Manitou Creek-Fish Lake Drain

Watershed-Based Plan




Acknowledgements

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Most of all we would like to recognize the project partners and watershed stakeholders whose interest in protecting, restoring, and enhancing the Manitou Creek-Fish Lake Drain watershed has been critical to the success of this plan. The following individuals and organizations participated in watershed planning meetings from March – December 2024:

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

COMMON ACRONYMS/ABBREVIATIONS USED IN CHAPTER

CMAP – Chicago Metropolitan Agency for Planning

HUC – Hydrologic Unit Codes

FIS – Flood Insurance Study

Illinois EPA – Illinois Environmental Protection Agency

LCFPD – Lake County Forest Preserve District

LCHD – Lake County Health Department

NPDES – National Pollutant Discharge Elimination System

SESC – Soil Erosion and Sediment Control

SMC – Lake County Stormwater Management Commission

TMDL – Total Maximum Daily Load

USACE – United States Army Corps of Engineers

USEPA – United States Environmental Protection Agency

USGS – United States Geological Survey

VLMP – Volunteer Lake Monitoring Program

WDO – Watershed Development Ordinance

1 INTRODUCTION

1.1 WHAT IS A WATERSHED?

A **watershed** is the area of land drained by a river, stream, or other body of water (Figure 1-1). Other common names given to watersheds include **drainage basins** and **catchments**.

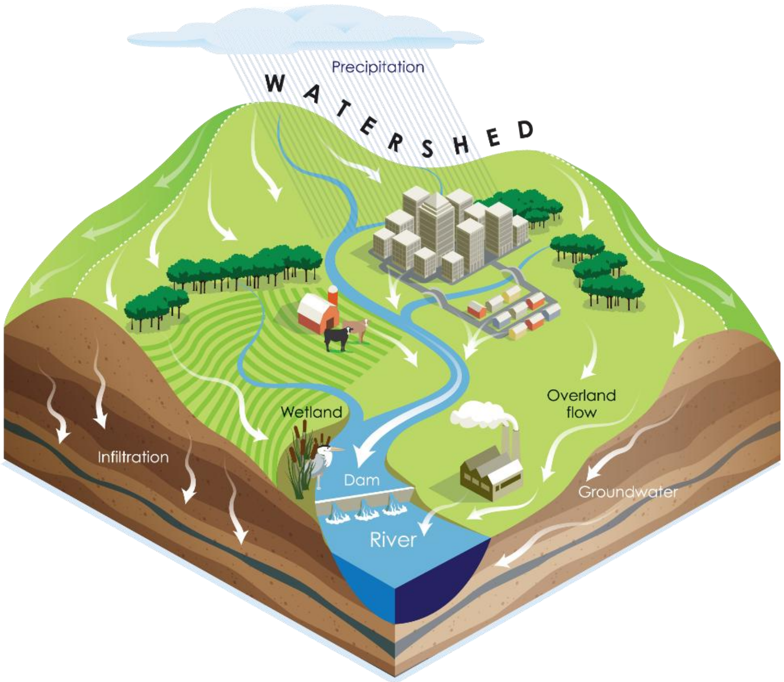

Figure 1-1: Diagram of a Watershed

As simple as the definition sounds, a watershed is actually a complex interaction between ground, climate, water, vegetation, and animals. In today's developed watersheds, other elements such as sewage, agricultural drainage, **impervious surfaces**, stormwater, and erosion can all be detrimental to the health of the watershed.

The health of a waterbody is a direct reflection of how the land in the watershed is used and managed. Some of the benefits of a healthy watershed are: improved water quality, fewer flooding problems, enhanced wildlife habitat, recreational opportunities, and better quality of life.

WATERSHED: Land area that drains water to a given point, usually a river, stream or lake. The land area above a given point on a waterbody (river, stream, lake, wetland) that contributes runoff to that point is considered the watershed.

DRAINAGE BASIN: Synonymous with "watershed," though often used to describe the watersheds of larger rivers or hydrologic systems (e.g., the "Mississippi River drainage basin" or "Great Lakes drainage basin").

CATCHMENTS: Small unit of a watershed or subwatershed that is delineated and used in watershed planning efforts because the effects of impervious cover are easily measured, there is less chance for confounding pollutant sources, boundaries have fewer political jurisdictions, and monitoring/mapping assessments can be done in a relatively short amount of time.

SUBWATERSHED: A smaller basin within a larger drainage area that all drains to a central point of the larger watershed. The Fish Lake Drain and Manitou Creek Subwatersheds are part of the Fox River Watershed.

IMPERVIOUS SURFACES: A surface that does not allow water to infiltrate to the soil layer, including pavement, rooftops, and roads.

1.1.1 Why A Watershed-Based Plan?

Water is elemental to our lives. Plants and animals, including humans, are largely composed of water, and generally require clean water to survive. Our communities, food systems, energy sources, and countless products that we consume everyday are dependent upon water. Despite this dependence, water is often taken for granted until it negatively affects us, usually due to short supply, inundation, or pollution.

This watershed-based plan specifically addresses water-related issues in communities within the watershed. Clean and abundant water, healthy streams and lakes, and safety from flooding are important to residents and business and play a significant role in the quality of life, health, and economic vitality of our communities. Lakes, rivers, and streams in the watershed provide recreational destinations for watershed residents as well as tourists and are a highly visible indicator of watershed health. These waterbodies support a diverse variety of water-dependent plants and animals and are critical to local ecosystems.

Water does not generally flow according to political boundaries. Consequently, we recognize the watershed as the appropriate scale to address most water resource issues, which often involves multiple political jurisdictions. The Manitou Creek-Fish Lake Drain Watershed planning process brought together numerous watershed stakeholders to provide input towards the management and enhancement of water resources in the watershed. During this planning process, critical data was obtained from a variety of sources. This watershed-based plan utilizes these sources of up-to-date information as well as historical data to provide a comprehensive summary of existing watershed conditions and trends. It recommends actions stakeholders can take to protect resources that are in good condition and restore those that have been degraded. As a resident, landowner, business, or community official, you make a difference.

1.2 MANITOU CREEK-FISH LAKE DRAIN WATERSHED

The Manitou Creek-Fish Lake Drain Watershed-Based Plan covers 49 square miles, which is 1.8% of the total land area of the 2,654 square mile Fox River Watershed. The planning area includes both the Manitou Creek* (40.2 square miles) and Fish Lake Drain (8.7 square miles) subwatersheds in northeastern Illinois. The Manitou Creek subwatershed consists of four subwatersheds: Eagle Creek, Long Lake, Round Lake Drain, and the Manitou Creek Mainstem. The Fish Lake Drain and Manitou Creek Subwatersheds are located within the larger Fox River Watershed. The Fox River begins in central Wisconsin and ends where it joins the Illinois River. The Illinois River then flows into the

Noteworthy: Hydrologic unit code (HUC)

A hydrologic unit can accept surface water directly from upstream drainage areas, and indirectly from associated surface areas such as remnant, noncontributing, and diversions to form a drainage area with single or multiple outlet points. Hydrologic units are only synonymous with classic watersheds when their boundaries include all the source area contributing surface water to a single defined outlet point. Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to twelve digits based on the six levels of classification:

- 2-digit HUC first-level (region)
- 4-digit HUC second-level (subregion)
- 6-digit HUC third-level (accounting unit)
- 8-digit HUC fourth-level (cataloguing unit)
- 10-digit HUC fifth-level (watershed)
- 12-digit HUC sixth-level (subwatershed)

*The U.S. Board on Geographic Names approved the name change to Manitou Creek in December 2021.

Mississippi River, which flows south to the Gulf of Mexico.

The Manitou Creek-Fish Lake Drain northernmost watershed boundary is in Lake Villa, Illinois and its southernmost boundary north of Hawthorn Woods, Illinois. The watershed is bound to the east by the Des Plaines River Watershed and to the west by the Lower Fox River Watershed. Streams in the watershed generally flow northwest and the mainstem of Manitou Creek joins the Fox River at Fox Lake. The watershed is in west-central Lake County, Illinois and includes portions of 14 municipalities and five townships (Figure 1-2), 39 miles of stream, 6,610 acres of wetland, and 25 lakes. Figure 1-3 depicts the size and location of the planning area. The watershed is comprised of two 12-digit **Hydraulic Unit Codes (HUC)** (Table 1-1).

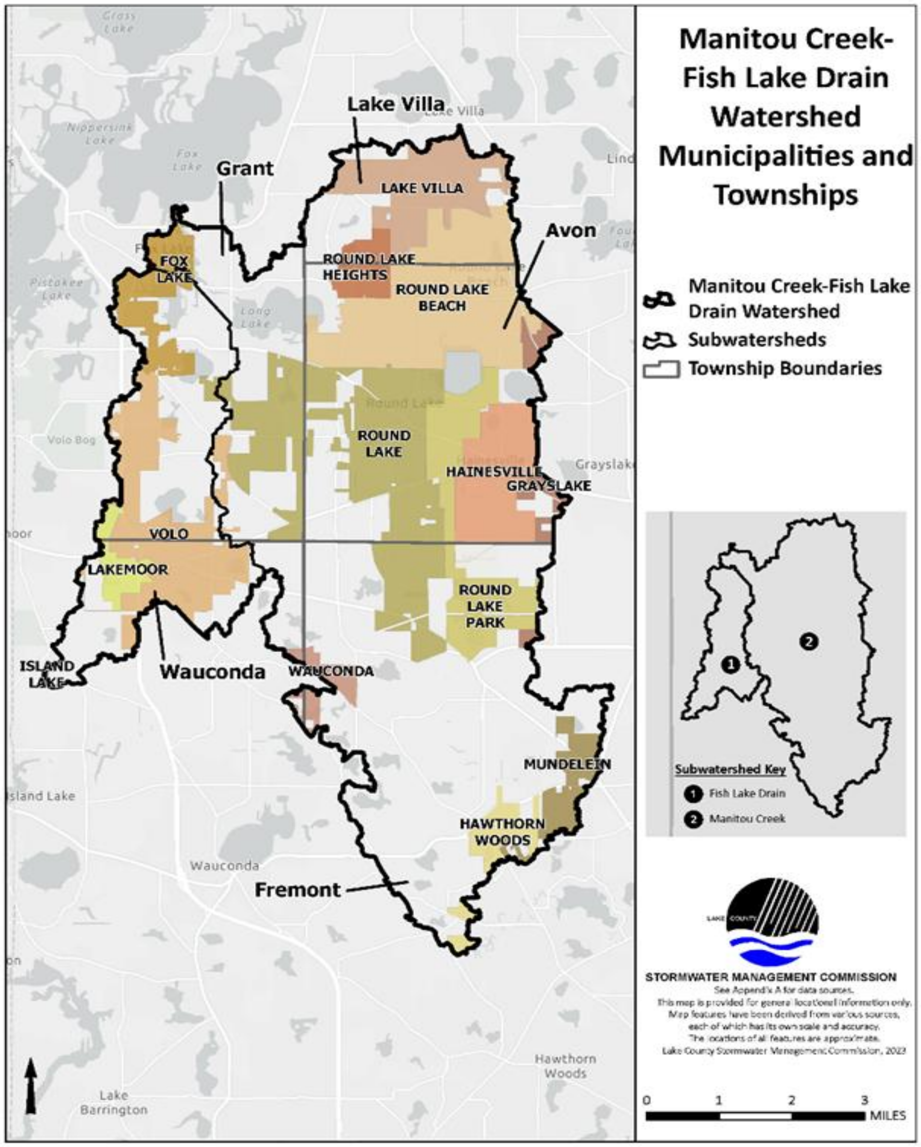

Figure 1-2: Municipalities and Townships

The Manitou Creek-Fish Lake Drain Watershed-Based Plan is an "umbrella" watershed-based plan because this plan updates and combines two previously completed watershed plans for the Fish Lake Drain Watershed (2008) and the Manitou Creek Watershed (2004).

Table 1-1: 12-Digit HUCs

12-Digit HUC	HUC Name
071200061008	Headwaters Manitou Creek
071200061007	Manitou Creek

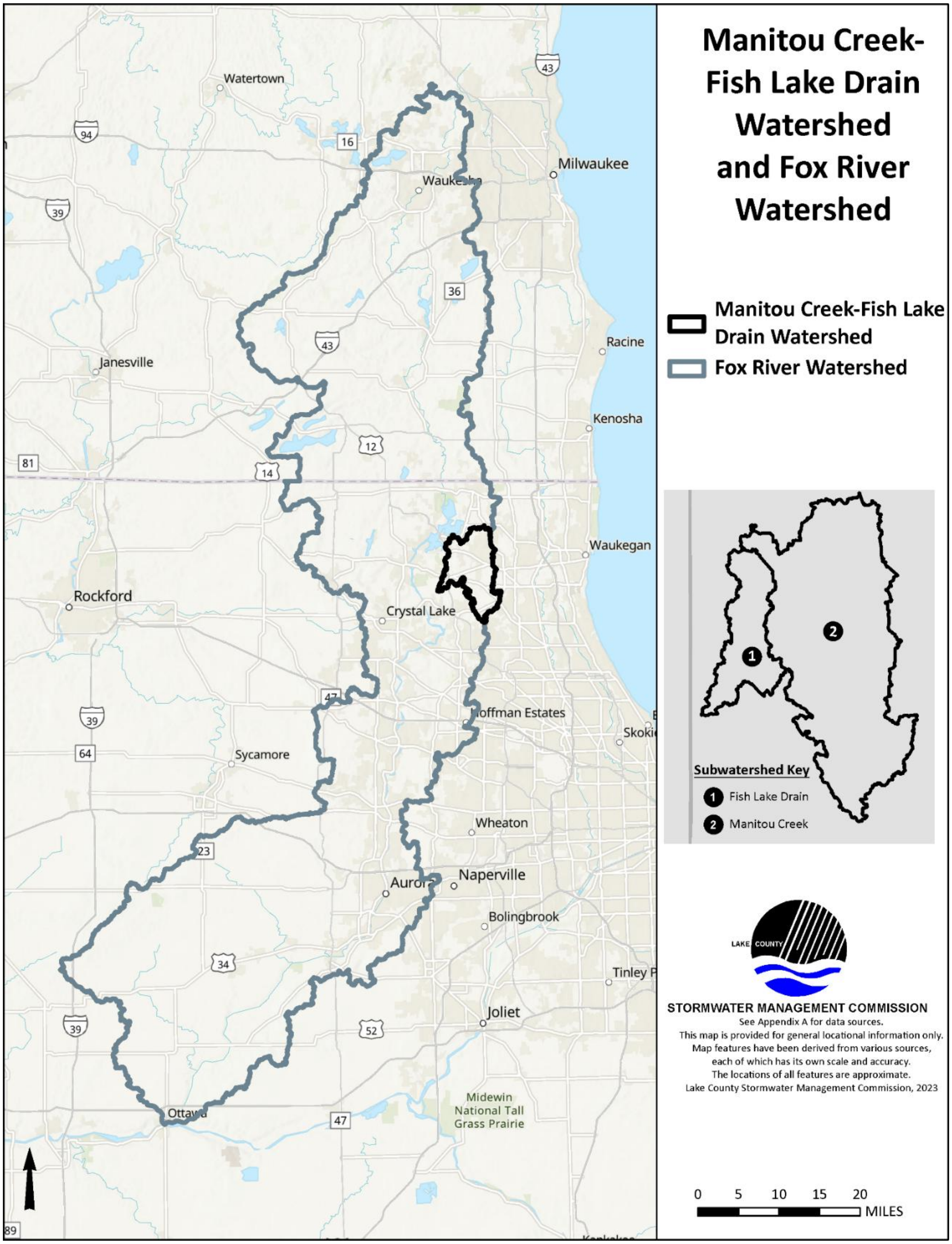

Figure 1-3: Manitou Creek-Fish Lake Drain Watershed Location Map

1.3 WATERSHED PLAN PURPOSE

The Lake County Stormwater Management Commission (SMC) took the lead in developing a watershed-based plan for the watershed. The purpose of this effort was to develop a plan to reduce the impacts of water pollution and flood damage; restore watershed lakes, streams, and wetlands to a healthy condition; and provide opportunities for watershed stakeholders to substantially participate in the process. This watershed-based plan does not address groundwater quality issues, focusing instead on stormwater and surface water runoff.

IMPAIRED WATERS: The Clean Water Act requires states to identify waters that do not or are not expected to meet applicable water quality standards with current pollution control technologies alone.

A broad representation of watershed stakeholders participated in the planning process and developed and supported this plan. A major objective of this planning effort and the implementation of the plan going forward is to return the 16 waterbodies in the watershed that are listed as **impaired** on the 2022 Illinois 303(d) list of impaired waters to conditions that fully support their designated uses (Figure 1-4) (Illinois EPA, 2022). This plan identified best management practices to remedy or mitigate water quality impairment, flood damages, and loss or degradation of natural resources.

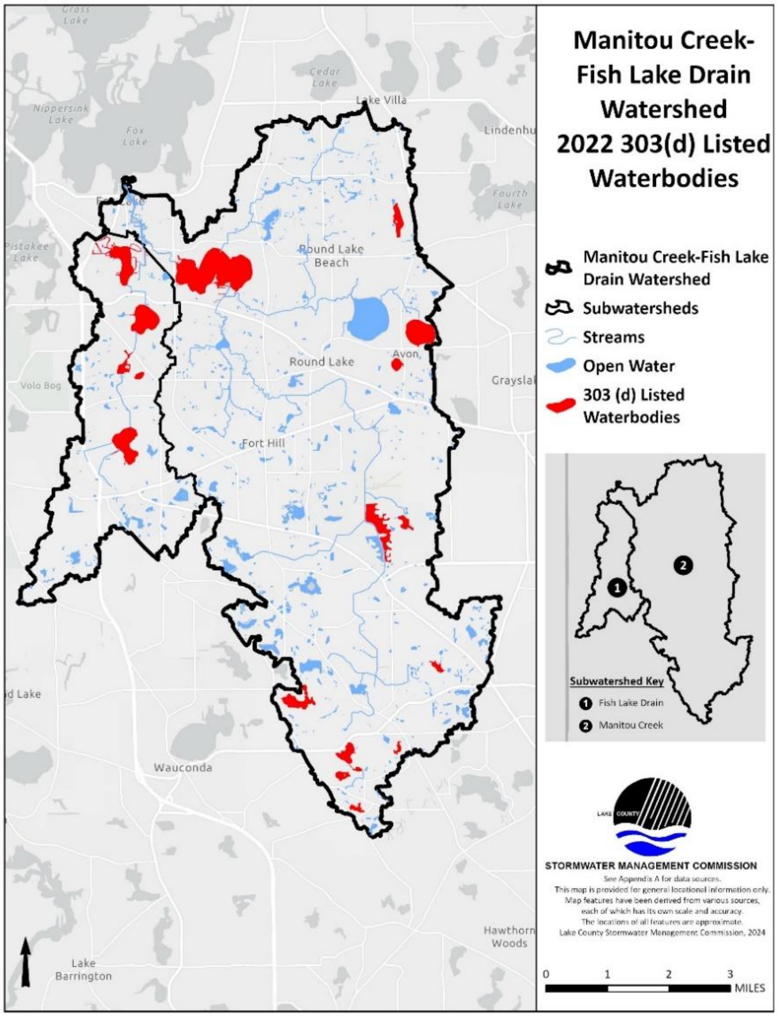

Figure 1-4: 2022 303(d) Impaired Waters

The plan also recommends watershed stakeholders implement actions to preserve, manage, and restore natural resources, and prevent actions that will cause or exacerbate unintended water quality and flood damage problems. Watersheds do not generally coincide with political boundaries, so watershed planning improves coordination and cooperation among communities and the land and water resources they share and impact.

1.4 WATERSHED PLAN REQUIREMENTS, PROCESS, AND ORGANIZATION

The primary scope of this watershed-based management plan is to identify actions to improve water quality and reduce flood risks. The planning approach was designed to help stakeholders from multiple jurisdictions and with various interests to better understand and become engaged in the watershed. The desired outcome is to spur implementation of watershed improvement projects and programs that will accomplish the goals and objectives established in this plan. SMC worked with numerous stakeholders, including public agencies, local units of government, landowners, environmental interest groups, volunteer lake and watershed organizations, and private sector professionals with interests in the watershed. SMC engaged Hey and Associates, Inc. to assist in developing this watershed-based plan.

The Manitou Creek-Fish Lake Drain Watershed-Based Plan serves as an update to the two older watershed-based plans (Fish Lake Drain and Manitou Creek) and satisfies the recommendations for periodic updates included in those watershed-based plans.

Development of the Manitou Creek-Fish Lake Drain Watershed-Based Plan was funded, in part, by the Illinois EPA through Section 319 of the Clean Water Act. Section 319 grants are also awarded to projects to protect water quality in Illinois. Projects must address water quality issues relating directly to nonpoint source pollution. Funds can also be used for the implementation of watershed management plans including the development of information programs and for the installation of best management practices. Section 319 funds give higher priority to projects that implement a site-specific action plan recommendation in an approved watershed-based plan or total maximum daily load (TMDL) implementation plan that meets the watershed-based plan requirements. A portion of the Section 319 funding is utilized for projects that aren't recommended in an approved watershed-based plan, but higher priority is allocated to projects within the watershed-based plans. The Manitou Creek-Fish Lake Drain Watershed-Based Plan follows Illinois EPA guidance and is designed to meet the nine elements required by the United States Environmental Protection Agency (USEPA) for a watershed-based plan.

Pursuant to its mission and authority for stormwater management and watershed planning (55 ILCS 5/5-1062), SMC develops watershed-based plans and follows the adoption process outlined below:

1. *Draft version of the watershed-based plan is submitted to the Illinois EPA, Illinois DNR-Office of Water Resources, and Chicago Metropolitan Agency for Planning (CMAP) for review*
2. *SMC Board approves a 30-day public comment through a public hearing and local publication*
3. *SMC revises the draft watershed-based plan based on comments received*
4. *Illinois EPA determines the plan meets the watershed-based planning guidance*
5. *The plan is brought before the Lake County Stormwater Management Commission & Lake County Board for approval in accordance with the Lake County Comprehensive Stormwater Management Plan.*
6. *SMC seeks community adoption of the watershed-based plan from the watershed entities.*

NOTEWORTHY – USEPA'S NINE ELEMENTS OF A WATERSHED –BASED PLAN

1. Identification of the causes and sources, or groups of similar sources, of pollution that will need to be controlled to achieve the pollutant load reductions estimated in the watershed-based plan;
2. Estimate of the pollutant load reductions expected following implementation of the management measures described under number 3 below;
3. Description of the nonpoint source management measures that will need to be implemented to achieve the load reductions estimated under number 2 above, and an identification of the critical areas in which those measures will be needed to implement the plan;
4. 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 plan;
5. Public information/education component that is designed to change social behavior;
6. Plan implementation schedule;
7. Description of interim, measurable milestones;
8. Set of criteria that can be used to determine whether pollutant loading reductions are being achieved over time;
9. Monitoring component to evaluate the effectiveness of the implementation efforts over time.

1.5 PREVIOUS AND RELATED STUDIES AND PLANS

Floodplain, biological, habitat, water quality, demographic, and geographic data for this plan were compiled from several previous and concurrent studies of the watershed. This information was collected, analyzed, summarizes, and supplemented with newly collected field data, and was then used to reach conclusions regarding the condition of the resources in the watershed. Field studies completed in association with this planning effort include detailed stream, lake shoreline, and detention basin inventories performed by SMC and biological and water quality monitoring by the Illinois Environmental Protection Agency and Lake County Health Department. References for previous reports and studies and summaries of field data collected and reports compiled specifically for this planning effort are listed below in Table 1-2.

The previous watershed plans for the Manitou Creek (2004) and Fish Lake Drain (2008) watersheds are listed in Table 1.2. Those plans included numerous action recommendations, many of which have been implemented in the years since the plans were completed. Below is a summary of implantation of the previous Manitou Creek and Fish Lake Drain watershed plans (Table 1-3). A full summary is included in Appendix K.

Table 1-2: Previous Studies and Plans

Previous & Related Studies/Plans	Year Completed	Author/Owner
Floodplain Studies	1977, 1978, 1979, 2013	FEMA
Lake County Wetland Restoration and Preservation Plan	2018	SMC
Lake County All-Natural Hazards Plan	2017	SMC
Lake County Green Infrastructure Model and Strategy	2016	LCFPD
Lake County Flood Problem Areas Inventory	2016	SMC
Lake County Lake Reports	2002, 2003, 2004, 2006, 2008, 2009, 2016, 2019	LCHD
Manitou Creek Section 206 Ecosystem Restoration Detailed Project Report	2006	USACE, SMC
The Village of Round Lake Comprehensive Plan	2016	Village of Round Lake
Upper Fox River/Chain O' Lakes Watershed TMDL Report	2020	Illinois EPA
Upper Fox River/Flint Creek Watershed TMDL Report	2020	Illinois EPA
Manitou Creek Watershed Management Plan	2004	Manitou Creek Watershed Planning Committee, SMC
Fish Lake Drain Watershed Management Plan	2008	Fish Lake Drain Watershed Planning Committee, SMC
Round Lake Beach Wetland Management Plan	2019	Village of Round Lake Beach

Table 1-3: Previous Watershed Plan Implementation Summary *See referenced plan for full action recommendation details

Plan	Action	Status
2004 Manitou Creek Watershed Plan	Round Lake Drain Flood Insurance Study (FIS) Restudy	Partially complete
	Eagle Creek FIS Restudy	Partially complete
	Round Lake Drain Flood Audit	Partially complete
	Evaluate Renwood Golf course for flood control	Complete
	Evaluate increased Round Lake Drain conveyance	Complete
	Evaluate mainstem storage sites Northbrook Sports Club	Wetland mitigation bank
	Identify structures for floodplain buyout	Partially complete, voluntary
	Update storm sewer data	Partially complete, ongoing
	GIS tile map base	Ongoing updates
	Attain full participation in Volunteer Lake Monitoring Program (VLMP)	Program suspended by State of Illinois
	Monitor lakes on a 5-year schedule	Complete
	Train and certify Soil Erosion and Sediment Control Program (SESC) inspectors	Complete (Lake County Designated Erosion Control Inspector Program)
	Increase Watershed Development Ordinance (WDO) and National Pollutant Discharge Elimination System (NPDES) review and inspection efforts	Ongoing per WDO
	Implement Stormwater NPDES Phase II: Road Salt Storage and Application	Ongoing
	Implement Stormwater NPDES Phase II: Herbicide and Fertilizer Storage and Application	Ongoing
	Implement Stormwater NPDES Phase II: Other Public Works Chemical Storage and Handling	Ongoing
	Implement Round Lake Drain COE 206 restoration projects	Mayfield Drive Basin project complete
	Continue implementation of existing WDO	Ongoing
	Encourage certification of floodplain managers	Ongoing
	Continue enforcement officer training	Ongoing
	Develop a coordinated flood warning and response plan	Complete
	Monitor Plan Progress	Ongoing
2009 Fish Lake Drain Watershed-Based Plan	Perform stream and lake monitoring using volunteers and professional staff	Partially complete
	Conduct floodproofing workshops	Partially complete
	Perform periodic updates to Flood Problem Area Inventory	Complete
	Increase level of enforcement of soil erosion and sediment control through certified inspector program or other measures	Complete
	Develop and distribute educational materials on source control and lot-level BMPs	Complete
	Adopt plan at municipal and county level. Obtain Illinois Environmental Protection Agency approval as a Watershed-Based Plan to ensure eligibility for grants, etc.	Complete
	Management Unit 1, Sub-Unit 1A, Reach 1B: Repair failing sheet pile wall	Complete
	Stabilize Duck Lake shoreline erosion	Partially complete
	Establish native buffer along Duck Lake shoreline	Partially complete
	Stabilize Wooster Lake shoreline erosion (plantings & weir replacement)	Complete
	Establish native buffer along Wooster Lake shoreline	Partially complete
	Management Unit 3, Sub-Unit 3A, Reach 4C: Perform modest bank regrading & establish native buffer along shoreline	Complete
	Management Unit 5: Protect lands identified in Green Infrastructure Plan	Partially complete

1.6 USING THE PLAN

1.6.1 Who Should Use This Plan?

This plan will be of limited use without the commitment of watershed stakeholders to improve, restore, manage, and steward watershed resources. Municipal and county agencies and elected officials, as the primary land use, development, and infrastructure authorities in the watershed, will have a significant amount of influence and responsibility for implementing this plan. These public agencies represent the interests of their constituents and are strongly influenced by every community resident or landowner. Therefore, each community member has the potential to influence the actions that occur in the watershed through active participation.

State and federal agencies, elected officials, and private organizations, such as lake associations, homeowner associations, and private conservation organizations, will also play an important role. State and federal agencies can support the implementation of this plan by approving projects in a timely fashion, supporting projects with funding, and providing technical information, tools, and resources to assist local authorities and watershed organizations in their efforts. Private associations and organizations have the ear and influence of their members and can provide significant contributions to land and water protection. Individual watershed residents and landowners must also accept responsibility for managing their own land and water resources responsibly and for working with others to implement this plan.

All jurisdictions, organizations, businesses and institutions, private landowners, and residents will have to work together to successfully protect and restore the watershed. The power of water is immense, as anyone who has experienced flooding can attest. The flow of water also does not respect property lines or jurisdictional boundaries; therefore, everyone needs to share the long-term stewardship responsibility and the costs and benefits of watershed improvements.

The success of plan implementation will also be determined by the ability of stakeholders to organize to coordinate, communicate, and manage activities in the watershed. Watershed organizations are generally formed from the organizations and/or individuals who participated in the watershed planning process. Watershed organizations often become the drivers of implementing the watershed plan and provide educational outreach to the community. A watershed organization will be the primary mechanism to engage the general public in watershed activities, to support the implementation of the watershed plan, and to voice their concerns and celebrate their successes in restoring watershed resources.

1.6.2 How To Use This Plan

For those unfamiliar with watershed planning, this document may appear overwhelming. There are pages of information to navigate, containing numerous tables and maps reporting the condition of the watershed, and many costly recommendations that a lone individual cannot likely implement. These recommendations are for public agencies to consider. But there are also several straightforward actions that individuals can take to improve the watershed. Every action, no matter how small, when undertaken by many or key landowners can have a positive impact on improving the watershed. For a general understanding of what this plan is about, please read the Executive Summary, which also includes a list of top priority actions for the next ten years. For additional details, browse the table of contents and advance to the section you are interested in.

To find out…

- What this plan is intended to accomplish, read about the watershed issues, opportunities, goals, and objectives for improving watershed health and improving water quality in **Chapter 2**.
- Detailed information about watershed resources and conditions, read the section(s) of interest in **Chapter 3**.
- What the problems are facing the watershed, **Chapter 4** includes a summary and analysis of watershed problems that need to be addressed by the action plan.
- Detailed information about flooding, including the flood events, flood problem inventory, and strategies for flood damage reduction, turn to **Chapter 5**.
- What kind of actions can be taken to improve the watershed? the action plan in **Chapter 6 and Appendix A** includes a watershed-wide programmatic action plan that includes general recommendations; and a site-specific action plan directed to critical areas of the watershed that identifies actions that can improve water quality in specific areas. A web application has been created that allows watershed stakeholders to access the site-specific action plan recommendations in the watershed through a mapping tool.
- What kind of funding may be available to provide cost share for implementing watershed improvement projects, refer to the funding sources in **Chapter 7**.
- What sort of outreach and education is needed so that watershed stakeholders understand the watershed problems, their role in the watershed, and have the capability to implement the Action Plan, refer to **Chapter 8**. SMC will continue to coordinate the stormwater activities in the watershed to improve water quality, reduce flood damage, and restore and enhance the natural drainage systems.

1.7 REFERENCES

Healy, R. W. 1979. River mileages and drainage areas for Illinois streams- Volume 1, Illinois except Illinois River Basin. U.S. Geological Survey, Water Resources Investigations 79-110.

Illinois Environmental Protection Agency Bureau of Water. "Illinois Integrated Water Quality Report and Section 303(D) List, 2020/2022." Clean Water Act Sections 303(d), 305(b), and 314 Water Resource Assessment Information and List of Impaired Waters, June 2022, https://epa.illinois.gov/content/dam/soi/en/web/epa/topics/water-quality/watershed-management/tmdls/documents/2020-2022-ir-final-6-01-22.pdf

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Susan Pribyl	Manitou Creek Watershed Alliance
Vince Mosca	Hey And Associates

CHAPTER TWO: WATERSHED ISSUES, OPPORTUNITIES, GOALS, AND OBJECTIVES

CONTENTS

ACRONYMS/ABBREVIATIONS USED IN CHAPTER 2

BMP – Best Management Practices

2 WATERSHED ISSUES, OPPORTUNITIES, GOALS, AND OBJECTIVES

2.1 WATERSHED GOALS AND OBJECTIVES

Goals from the previous 2004 Manitou Creek and the 2009 Fish Lake Drain Watershed-Based Plans were reviewed prior to the development of Goals and Objectives for this updated and combined Manitou Creek and Fish Lake Drain Watershed-Based Plan.

The Manitou Creek Watershed Plan identified five goals (SMC, 2004):

1. Reduce existing flood damage potential and prevent the creation of increased flood damage potential.
2. Improve water quality in the watershed's streams and lakes.
3. Preserve, protect, and enhance existing natural areas; and restore or create new, sustainable natural areas.
4. Develop and utilize tools for plan implementation.
5. Involve the public in the use and stewardship of the Manitou Creek watershed.

The Fish Lake Drain Watershed Plan identified five goals (SMC, 2009):

1. Improve water quality and stream, lake, and wetland resources.
2. Identify and mitigate existing watershed flooding problems.
3. Prevent negative impacts of new development on flooding and watershed resources.
4. Provide tools to implement watershed protection and enhancement measures.
5. Evaluate success in plan implementation.

These goals were considered along with current watershed conditions, watershed stakeholder priorities, expected watershed changes, and meet current and possible future funders' expectations to identify five (5) goals for the Manitou Creek-Fish Lake Drain Watershed Plan. The goals are central to the development of the watershed action plan (**Chapter 6**). Objectives that helped reach watershed goals were also identified. Measurable indicators were assigned to each goal to help measure future progress toward meeting each goal as the watershed action plan is implemented. The action plan includes:

- Programmatic actions that address stream, lake, and wetland systems; stormwater management and flooding; natural resources; water quality; education and information; and watershed coordination and partnerships; and
- Site-specific actions that recommend best management practices (BMP) for specific problem locations identified during inventories and assessments.

Chapter 7 Plan Implementation and Evaluation and **Appendix B Milestone Evaluation Scorecards** examine the watershed plan goals by looking at their performance and progress. These sections evaluate milestones related to measurable indicators for the watershed goals and objectives.

NOTEWORTHY: WHAT ARE GOALS VERSUS OBJECTIVES?

GOALS:

- Targets for the watershed plan.
- The desired change or outcome to achieve.
- Ideally are clear, concise, and measurable.

OBJECTIVES:

- Specific, more precise steps needed to attain goals.
- Position reached or purpose achieved by an activity by a specific time.
- Objective outcomes should be measurable, attainable, relevant, and time-based.
- There may be multiple objectives to achieve a goal(s).

2.2 WATERSHED GOAL #1: WATER QUALITY

GOAL: Improve impaired water quality and protect surface water quality from future impacts.

OBJECTIVES:

A. Develop and implement a watershed monitoring program to collect, assess, and report physical, chemical, and biological water quality data on streams and lakes on a regular basis.

Indicator A1: Implementation of watershed monitoring program.

Indicator A2: Regular reports on water quality monitoring to community and stakeholders.

B. Reduce the quantity of road salt needed for safe and cost-effective winter maintenance to reverse the current trend of rising chloride levels in water bodies.

Indicator B1: Winter Maintenance Program establishment including: policy and manual development, de-icing workshop attendance and certification.

Indicator B2: Monitoring data trends for chloride and specific conductivity.

C. Reduce internal and external phosphorus loading in eutrophic and hypereutrophic lakes.

Indicator C1: Implementation of BMP's and management practices that reduce internal or external phosphorus loading in lakes.

Indicator C2: Monitoring data trends for phosphorus.

D. Reduce nonpoint source pollution loading and erosion from existing development, re-development and construction sites by controlling inputs, installing green infrastructure and implementing BMPs.

Indicator D1: Monitoring data trends for common nonpoint source pollutants.

E. Reduce nonpoint source pollution loading and erosion from agricultural land uses.

Indicator E1: Number of agricultural BMPs implemented that reduce nonpoint source pollution.

Indicator E2: Monitoring data trends for common nonpoint source pollutants.

2.3 WATERSHED GOAL #2: STORMWATER MANAGEMENT, FLOOD RISK, AND FLOOD DAMAGE

GOAL: Reduce the risk of flood damage in the watershed, mitigate the effects of runoff, and enhance stormwater management systems.

OBJECTIVES:

A. Reduce or mitigate runoff volumes through installation of green infrastructure and nature-based solutions, including trees, bioretention, and other best management practices.

Indicator A1: Runoff volume reduction and mitigation measures implemented.

B. Reduce existing flood damage and number of flood problem areas through the implementation of flood mitigation projects.

Indicator B1: Number of flood problem areas positively affected by flood mitigation projects implemented.

Indicator B2: Number/value of claims filed each year per community in the watershed.

C. Enhance, maintain, and manage constructed and natural drainage systems to mitigate flood damage and improve resilience for changing precipitation patterns.

Indicator C1: Number of local drainage system improvement projects implemented.

D. Purchase and remove structures that are repetitively flooded or in danger of catastrophic damage from flooding through the voluntary buyout program.

Indicator D1: Number of Voluntary Floodplain/Hazard Mitigation Buyouts.

2.4 WATERSHED GOAL #3: NATURAL RESOURCE MANAGEMENT

GOAL: Preserve, restore, and enhance a system of terrestrial and aquatic ecosystems to provide beneficial functions for people, plants, and wildlife.

OBJECTIVES:

A. Preserve, enhance, restore, and create wetlands and wetland buffers wherever possible.

Indicator A1: Acres of wetlands enhanced and/or restored.

B. Identify and connect environmental corridors.

Indicator B1: Number of regional green infrastructure projects.

C. Preserve, manage, and restore rare or unique habitat and natural communities in protected natural areas.

Indicator C1: Acres of protected natural areas preserved, managed and/or restored.

D. Reduce presence of nuisance aquatic and terrestrial invasive species in the watershed.

Indicator D1: Acres of invasive species removal/management projects.
Indicator D2: Number of aquatic invasive education and outreach efforts.

E. Perform in-lake management measures to improve water quality and aquatic habitat of lakes in the watershed.

Indicator E1: Number of lakes with Lake Management or Aquatic Plant Management Plans.

F. Stabilize eroding streambanks, shorelines, and localized erosion related to infrastructure.

Indicator F1: Linear feet of stabilization projects implemented.

2.5 WATERSHED GOAL #4: WATERSHED EDUCATION AND OUTREACH

GOAL: Watershed stakeholders (residents, property owners, students, non-profit organizations and public agencies) have adequate knowledge, skills, resources, motivation and stewardship opportunities to implement the watershed plan and associated programs.

OBJECTIVES:

A. Conduct a watershed outreach campaign to inform and engage the public about watershed issues and solutions, landowner responsibilities, available resources, and the benefits of implementing the watershed plan recommendations.

Indicator A1: Number of people reached by watershed outreach campaign.

B. Utilize trainings, workshops, public meetings, personal site visits, newsletters, websites, media, campaigns, and stakeholder word of mouth to provide watershed stakeholders opportunities to participate in watershed programs and projects.

Indicator B1: Number of landowners that receive information about watershed programs and projects.
Indicator B2: Number of workshops.

2.6 WATERSHED GOAL #5: WATERSHED COORDINATION AND PARTNERSHIPS

GOAL: Improve coordination, engagement and decision-making between public, private and non-profit stakeholders to implement the watershed plan.

OBJECTIVES:

A. Watershed communities and stakeholder organizations adopt the Manitou Creek-Fish Lake Drain Watershed-Based Plan.

Indicator A1: Number of municipalities, counties, agencies and organizations that adopt the Manitou Creek-Fish Lake Drain Watershed-Based Plan.

B. Stakeholder groups actively engage in watershed plan implementation.

Indicator B1: Number of projects advanced/undertaken with the support of stakeholder groups.

C. Communities and organizations designate a representative and participate in watershed stakeholder initiatives.

Indicator C1: Number of communities and organizations that have designated a representative to participate in watershed stakeholder initiatives.

2.7 REFERENCES

Lake County Stormwater Management Commission (SMC), 2009. Fish Lake Drain Watershed Management Plan. https://www.lakecountyil.gov/DocumentCenter/View/10955/Fish-Lake-Drain-Watershed-Based-Plan-PDF?bidId=

Lake County Stormwater Management Commission (SMC), 2004. Manitou Creek Watershed Management Plan May, 2004. https://www.lakecountyil.gov/DocumentCenter/View/3961/Watershed-Management-Plan-2004-Manitou-Creek-Watershed

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS/ABBREVIATIONS USED IN CHAPTER 3

ADID – Advance Identification Study
ALK – Alkalinity
BMP – Best Management Practices
Cl^- – Chloride
CMAP – Chicago Metropolitan Agency for Planning
COND – Specific Conductivity
CyAN – Cyanobacteria Assessment Network
DO – Dissolved Oxygen
DST – Decision Support Tool
FLU – Future Land Use
FQI – Floristic Quality Index
GIMS – Green Infrastructure Model and Strategy
GIS – Geographic Information System
GPS – Global Positioning System
HQAR – High Quality Aquatic Resources
HSG – Hydrologic Soil Groups
HUC – Hydrologic Unit Code
IDNR – Illinois Department of Natural Resources
Illinois EPA – Illinois Environmental Protection Agency
INAI – Illinois Natural Areas Inventory
IWLC – Isolated Waters of Lake County
LCFPD – Lake County Forest Preserve District
LCHD-ES – Lake County Health Department – Ecological Services
LCWI – Lake County Wetland Inventory
LiDAR – Light Detection and Ranging
LRR – Lateral Recession Rate
LRS – Load Reduction Strategy
MGD – Millions Gallons Per Day
MS4 – Municipal Separate Storm Sewer System
NAVD88 – North American Vertical Datum of 1988
NH_3-N – Ammonia
NO_{3-} – Nitrate
NPDES – National Pollutant Discharge Elimination System
NRCS – Natural Resources Conservation Service
RAP-M – Rapid Assessment Point Method
s.u. – Standard Unit
SECCHI – Secchi Disk Depth
SLAM – Simplified Lake Assessment Model
SMC – Lake County Stormwater Management Commission
SRP – Soluble Reactive Phosphorus
TDS – Total Dissolved Solids
TKN – Total Kjeldahl Nitrogen
TMDL – Total Maximum Daily Load
TP – Total Phosphorus
TS – Total Solids
TSS – Total Suspended Solids
TVS – Total Volatile Solids
USACE – United States Army Corps of Engineers
USEPA – United States Environmental Protection Agency
USFWS – United States Fish and Wildlife Service
USGS – United States Geological Survey
WDO – Watershed Development Ordinance
WOUS – Waters of the United States
WRAPP – Wetland Restoration and Preservation Plan
WWTP – Wastewater Treatment Plant

3 WATERSHED CHARACTERISTICS ASSESSMENT

3.1 WATERSHED SETTING

This report focuses on the Manitou Creek-Fish Lake Drain watershed within Lake County. The planning area includes the Manitou Creek and Fish Lake Drain subwatersheds. All figures and tables focus only on this planning area within the Fox River watershed in Illinois, hereinafter referred to as the "watershed". The watershed area is approximately 49 square miles of the 2,654 square mile Fox River watershed. The entire Manitou Creek-Fish Lake Drain watershed is located within Lake County, Illinois.

Figure 3-1: Tributary Drainage Area to the Mississippi River Basin

The Fox River watershed originates as a small stream in Waukesha County, Wisconsin and flows through Illinois into the Illinois River, a major tributary to the Mississippi River, at Ottawa, Illinois (Figure 3-1). The Illinois River flows through the State of Illinois and joins the Mississippi at Grafton, about 25 miles north of St. Louis, Missouri. The Mississippi flows another 1,169 miles to the Gulf of Mexico.

3.1.1 GEOLOGY

The Manitou Creek-Fish Lake Drain watershed is shaped by surficial geology formed during the most recent glacial period known as the Wisconsin stage of the Pleistocene Era or "Ice Age" that began approximately 85,000 years ago and ended 10,000-14,000 years ago. During this time, 80% of Illinois was covered with one or more sheets of glacial ice (Neely and Heister 1987). Although the watershed was most likely glaciated repeatedly during the Ice Age, the retreat and re-advance of the Lake Michigan lobe of the North American ice sheet during the Wisconsin glaciation resulted in many of the underlying surficial geologic features present today (Figure-3-2) (Barnhardt et al., 2015). These features are composed of materials deposited less than 30,000 years ago and include **outwash valley deposits, post- and proglacial lake deposits** and **till**. Topographic features in the watershed are largely a result of the movement of the Lake Michigan lobe of the ice sheet, which extended as far south as Shelbyville, Illinois. Its retreat resulted in the deposition of

POST- AND PROGLACIAL LAKE DEPOSITS: Layers of silt and clay deposited on the beds of lakes that formed along the retreating face of the ice sheet or within landforms left by its retreat.

OUTWASH: Deposits of sand and gravel carried by running water from the melting ice of a glacier and laid down in stratified deposits.

TILL: Unsorted glacial sediment.

MORAINE: Low ridge formed by till deposited at the margin of a stagnant or retreating glacier.

HUMMOCKY: Extremely irregular surface.

MARL: A loose or crumbling earthy deposit that contains a substantial amount of calcium carbonate.

moraines and till plains. The recessional **moraines** that formed at the ice margin following stages of retreat and re-advance presently appear as concentric belts of low topographic ridges around southern Lake Michigan and the Chicago region and generally parallel to the modern Lake Michigan shoreline (Figure 3-3). Recessional moraines in the watershed are oriented along north-south axes, are generally parallel. The Valparaiso and Fox Lake moraines collectively cover the entire watershed and consist of unsorted till deposited by the glacier and ranges from relatively flat to **hummocky** and is pock-marked with depressions containing younger peat, muck, **marl**, and organic materials.

The bedrock of the watershed is composed primarily of dolomite, sandstone, and shale. The upper layers of bedrock were formed during the Silurian Period that began approximately 440 million years ago. Rock formed during this period is found at the surface only in the northern third of the state. Silurian dolomite forms the entire bedrock surface of the watershed and can be more than 300 feet thick. This bedrock aquifer provides moderate yields of groundwater, however higher yields can be obtained from the sandstone layers that lie beneath (Leetaru et al., 2003).

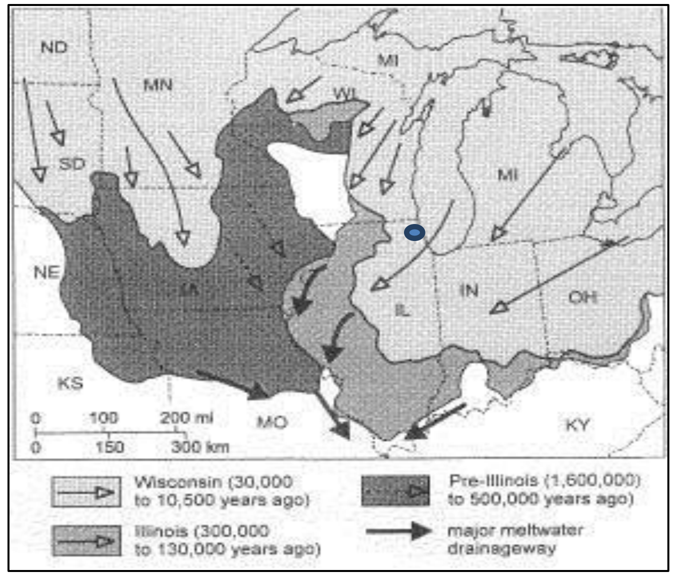


Figure 3-2: Geology of the Midwest. The blue circle represents the approximate location of the Manitou Creek-Fish Lake Drain Watershed.

3.1.2 THE WATERSHED OVER TIME

Following the most recent glacial retreat, the Manitou Creek-Fish Lake Drain watershed was shaped by a succession of flora, fauna, and human cultures. There is paleontological evidence of Pleistocene megafauna and archaeological evidence of prehistoric human occupation in the vicinity of the watershed shortly after deglaciation, supported by the discoveries of mammoth remains near Kenosha, Wisconsin and Wadsworth, Illinois. Marks on the bones, which date more than 13,000 years old, indicate butchering and provide an estimate of the temporal extent of human presence in the area. The landscape of the Manitou Creek-Fish Lake Drain watershed at the time of the Surveyor General Surveys in the early 1800's included numerous **natural communities** (e.g., **marsh**, oak **woodlands and prairies**), some of which were adapted to periodic disturbance by fire (Figures 3-4 and 3-5). There is a large body of literature on the fire ecology of some of these natural communities and it is likely that fires resulted from both

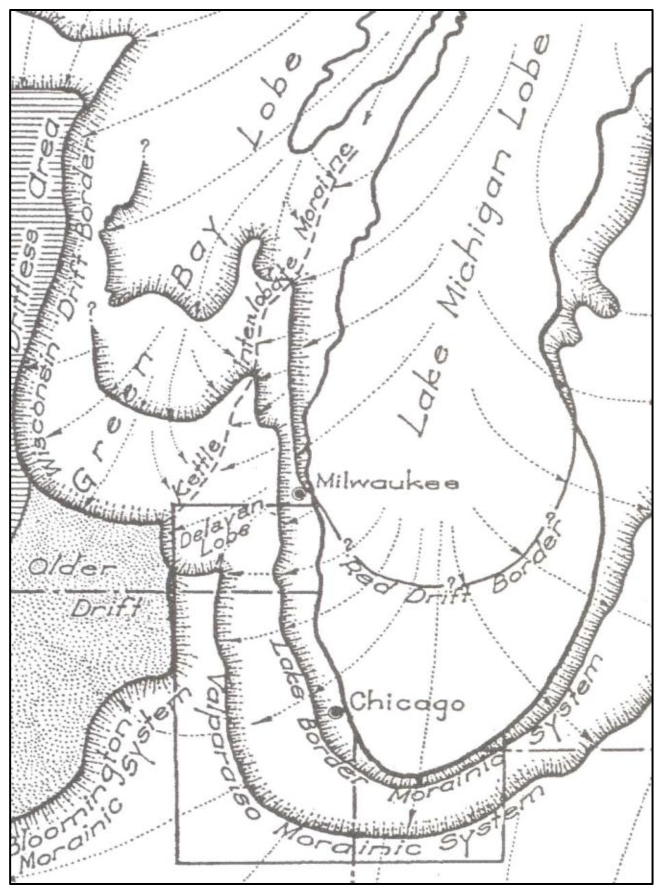


Figure 3-3: Moraine Deposits Developed from Advancing and Retreating Glaciers.

natural causes (lightning) as well as ignition by humans (Fahey et al., 2015).

Most of the watershed at that time was a landscape of predominantly savanna and prairie. Savanna dominated, with large sections of prairie interspersed throughout, particularly in the southeastern portion of the watershed. Oak Woodlands, Marshes, and other wetlands were interspersed throughout. These natural communities likely infiltrated precipitation, which minimized surface runoff leaving the watershed. The natural drainage system was largely composed of marsh/prairie, whose stream **channels** have enlarged as urban development has expanded in the watershed.

Following European settlement in the early 1800's, much of the watershed area was altered. After the initial conversion for agriculture, much of the north portion of the watershed was developed into suburbs. Portions of the central and southern parts of the watershed remain agricultural or open space, but much of the landscape has been converted to suburban (primarily residential) land use.

NATURAL COMMUNITY: An assemblage of plants and animals interacting with one another and their physical environment.

PRAIRIE: An extensive flat or rolling area dominated by grasses. Prairie grasslands once covered much of central North America.

SAVANNA: A type of woodland characterized by open spacing between trees and intervening grassland.

WETLAND: Low-lying land that is saturated or inundated with water to an extent that plants that are adapted to living in wet conditions grow there. Marshes, swamps, bogs, sloughs, wet prairie, rivers, streams, ponds and the edges of lakes are typically classified as wetlands.

MARSH: Low-lying land area that is usually saturated or inundated with surface or ground water that is dominated by herbaceous plants.

WOODLANDS: Land that is mostly covered with trees and shrubs.

CHANNEL: Any river, stream, creek, brook, ditch, gully, ravine, swale or wash, into which surface or groundwater flows, either perennially or intermittently.

Figure 3-4: Pre-European Settlement Landscape Examples

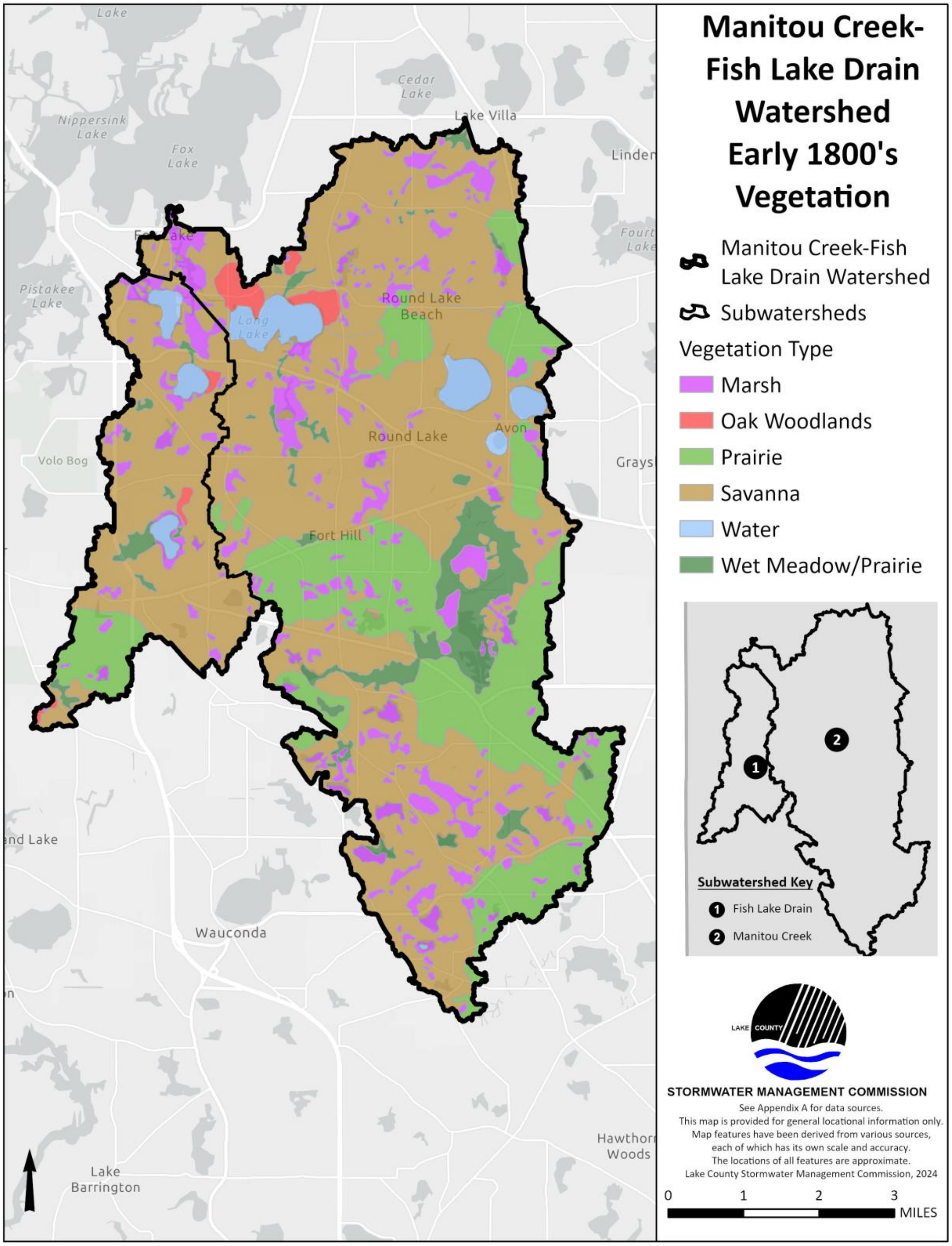


Figure 3-5: Early 1800's Plant Communities

3.1.3 Watershed Size and location

The Fox River watershed, in its entirety, covers 2,654 square miles in Illinois and Wisconsin. The Fox River watershed originates in Waukesha County, Wisconsin and ultimately discharges into the Illinois River in Ottawa, Illinois. The area included in this watershed plan covers approximately 49 square miles in Lake County, Illinois (Figure 3-6). The Manitou Creek-Fish Lake Drain watershed covers less than 2% of the total Fox River watershed land area.

The Manitou Creek-Fish Lake Drain Watershed generally drains in a northwestern direction where it discharges to the Fox River in Fox Lake. The watershed includes two subwatersheds in western Lake County, Illinois.

3.1.4 Geographic Boundaries

The boundaries of the Manitou Creek Fish Lake Drain watershed are primarily defined by topographic features formed by the retreat of the continental ice sheet during the Wisconsin glaciation and subsequent geologic processes (Figure 3-7).

Generally, the Manitou Creek-Fish Lake Drain watershed and subwatershed boundaries used in this report are similar to those used for previous watershed-based plans, however they are modified from the Lake County subwatershed boundaries delineated by the Lake County Stormwater Management Commission (SMC) in the early 1990s. This modification is the result of the availability of higher-resolution topographic data as well as additional stormsewer data, both of which yield more accurate hydrologic mapping. This data has resulted in some changes to watershed and sub-watershed boundaries relative to earlier mapping produced by SMC. The boundary of the watershed was derived from a Geographic Information System (GIS) based flow direction model as well as stormsewer data and

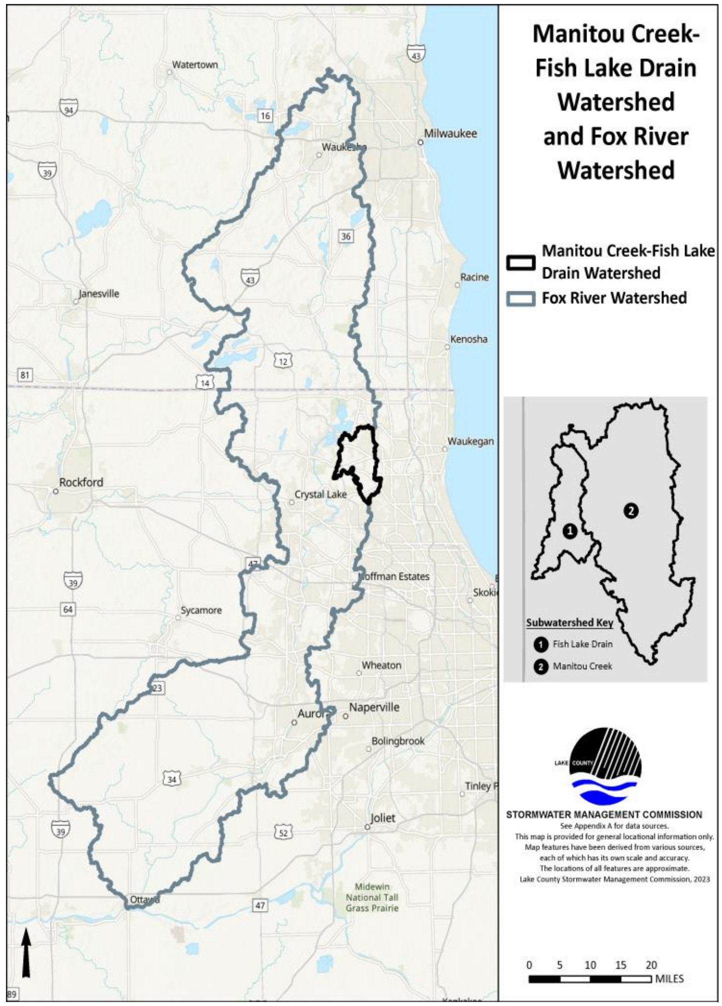


Figure 3-6: Manitou Creek-Fish Lake Drain and Fox River Watershed Locations

> **Noteworthy: Hydrologic unit code**
>
> A hydrologic unit can accept surface water directly from upstream drainage areas, and indirectly from associated surface areas such as remnant, noncontributing, and diversions to form a drainage area with single or multiple outlet points. Hydrologic units are only synonymous with classic watersheds when their boundaries include all the source area contributing surface water to a single defined outlet point. Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to twelve digits based on the six levels of classification:
>
> - 2-digit HUC first-level (region)
> - 4-digit HUC second-level (subregion)
> - 6-digit HUC third-level (accounting unit)
> - 8-digit HUC fourth-level (cataloguing unit)
> - 10-digit HUC fifth-level (watershed)
> - 12-digit HUC sixth-level (subwatershed)

therefore diverges from boundaries of previous watershed plans.

The United States Geological Survey (USGS) has developed a coding system for hydrologic systems that is used throughout the United States by numerous federal, state, and local agencies and organizations. Each watershed unit is assigned a Hydrologic Unit Code (HUC), with the number of digits in each code dependent upon watershed size and its relationship to larger watersheds to which it belongs (if any). Table 3-1 includes the applicable HUCs for the Manitou Creek-Fish Lake Drain watershed and Figure 3-8 shows the HUC 12 watersheds in the Manitou Creek-Fish Lake Drain watershed.

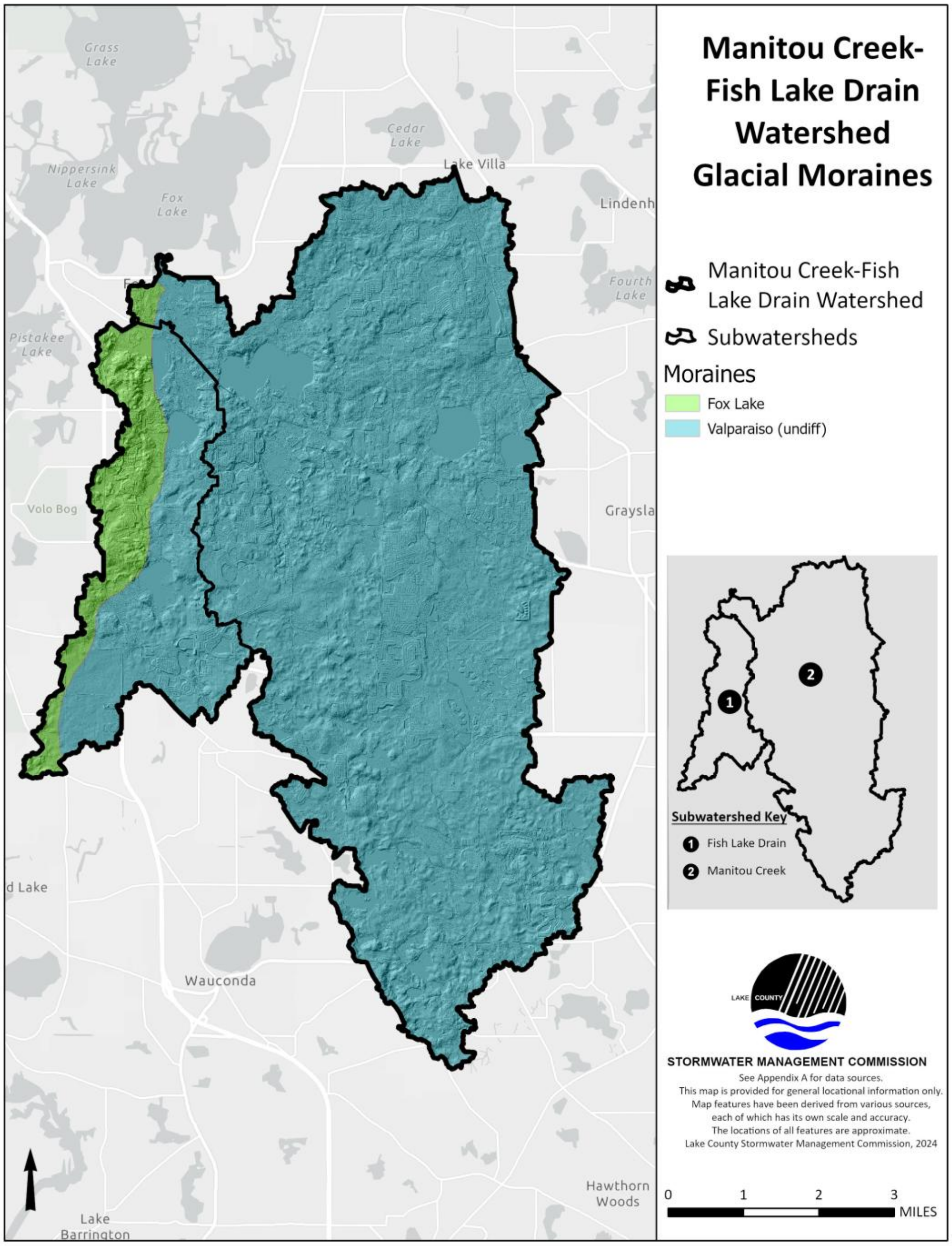


Figure 3-7: Glacial Moraines

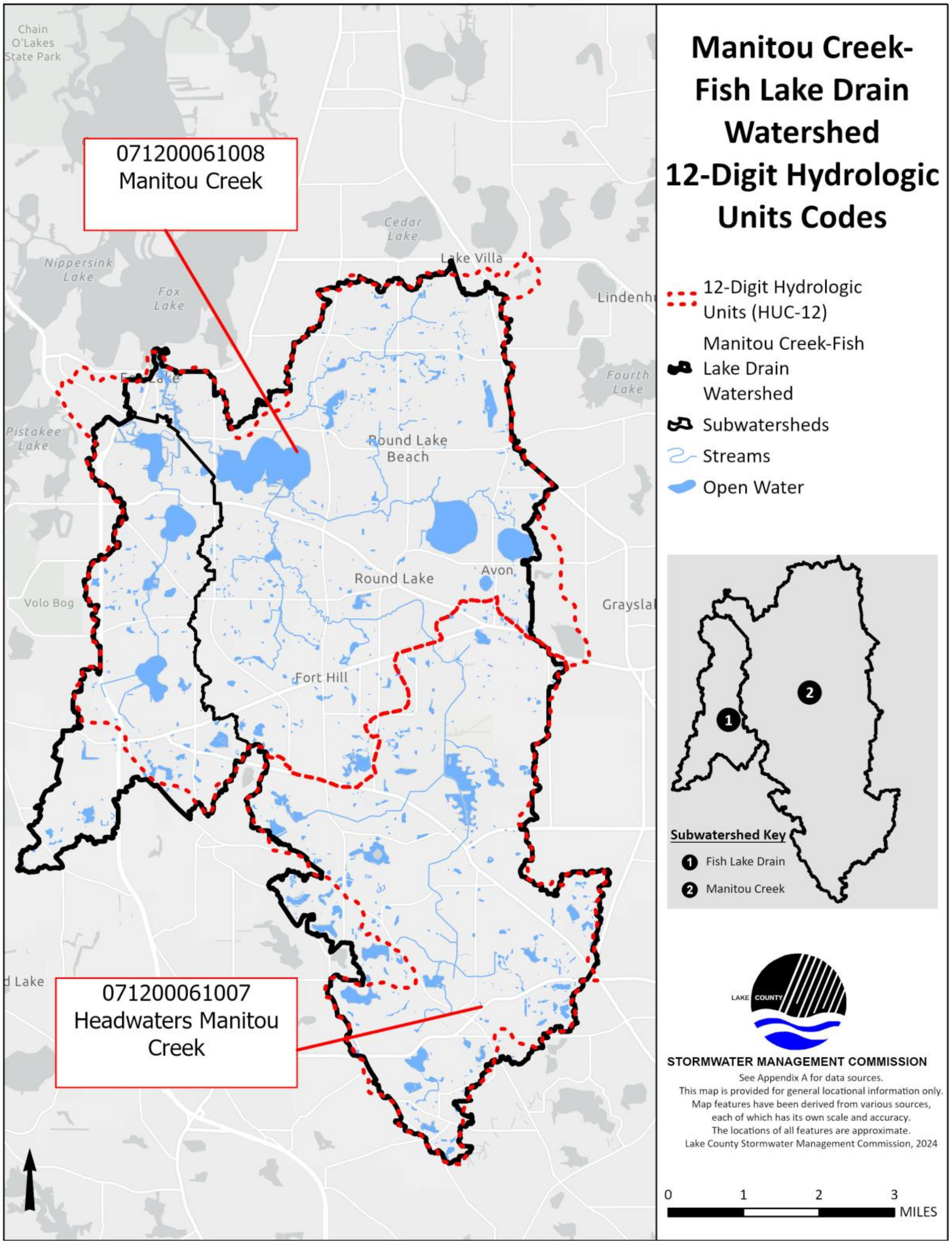


Figure 3-8: HUC 12 Watersheds

Table 3-1: Hydrologic Units and HUC Designations

HUC	HUC Name	HUC Level	Corresponding Subwatershed(s)
07	Upper Missisippi	HUC 2	All
0712	Upper Illinois	HUC 4	All
07120006	Upper Fox	HUC 8	All
0712000610	Manitou Creek-Fox River	HUC 10	All
071200061008	Manitou Creek	HUC 12	All
071200061007	Headwaters Manitou Creek	HUC 12	Manitou Creek

3.1.5 Climate and Precipitation

Climate Normals: 30-year averages of climatological variables including temperature and precipitation.

The Manitou Creek-Fish Lake Drain watershed is situated midway between the western Continental Divide and the Atlantic Ocean, and it is often underneath the polar jet-stream, which creates low pressure systems that bring clouds, wind, and precipitation to the region. The watershed's mid-latitude position results in seasonal variations in the regional solar energy input causing warm summers and cold winters. The watershed is classified as a humid continental climate, meaning the coldest month has an average temperature below freezing, the warmest month has an average temperature above 71.6 degrees Fahrenheit, and there is not a pronounced wet or dry season. The presence and density of buildings, roads, parking lots and industrial activities also influence the climate, often increasing the temperature (National Climatic Data Center, 2009).

The Illinois State Climatologist Office and the National Climatic Data Center track **climate normals** for numerous sites in Illinois. Only one reporting site, Mundelein 4WSW, is within the watershed. Additional sites located close to the perimeter of the watershed at Lake Villa, Gurnee (precipitation only) and McHenry are included here as they "frame" the watershed and provide some additional context. The monthly mean temperature and precipitation normals from 1981-2010 for these four sites are summarized in Tables 3-2 and 3-3, respectively.

Illinois exhibits wide variability in annual precipitation. Average annual precipitation varies by approximately two inches among sites in or near the Manitou Creek-Fish Lake Drain watershed and the mean of the 30-year normal is 35.9 inches. Despite the spatial variability of annual precipitation, seasonal variations in precipitation are similar between sites within or near the watershed, with relatively wetter summers and drier winters. Annual snowfall totals are typically higher than annual precipitation, due to the low density of snow compared to liquid water. The wetter summer months are the result of thunderstorm-derived precipitation. These storm events tend to distribute rainfall variably and it is not uncommon for heavy rainfall to occur in some parts of the watershed while other parts receive little to no precipitation.

The variety of climate and weather conditions creates diverse watershed conditions. For example, during winter months the watershed experiences precipitation in the form of snow, this precipitation may affect flooding if there is a sustained warm period following heavy snow accumulation. Likewise, rain on frozen ground or snow melt in spring combined with rain may also result in stream and localized flooding.

During spring, the watershed will usually experience warming temperatures and wet weather conditions. In contrast, during fall, the watershed experiences cooling temperatures and precipitation frequency decreases. There have been prolonged "wet" periods of above-average annual precipitation, most recently during the 1970s and 1980s and the late 2010s. There have also been major multi-year droughts in the 1930s and 1950s. Illinois has rainstorms which cause flash-floods annually, each with several inches of rainfall in a few hours, in localized areas. In July 2017, this type of rainstorm delivered up to 8 inches of rainfall in less than 24 hours in parts of Lake County, Illinois resulting in localized flash flooding.

Table 3-2: Mean Monthly Temperature Normals (Degrees Fahrenheit), 1981-2010. (Illinois State Climatologist's Office & National Climatic Data Center, 2010) Data provided by the Illinois State Climatologist's Office, a part of the Illinois State Water Survey (ISWS) located in Champaign and Peoria, Illinois, and on the web at www.isws.illinois.edu/atmos/statecli.

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann.
Lake Villa 2NE	22.2	25.9	36.0	47.5	58.0	67.8	72.6	71.2	63.3	51.2	39.0	26.2	48.5
McHenry-WG Stratton LD	20.1	24.5	35.1	47.2	57.7	67.3	71.4	70.1	62.3	49.7	38.0	24.6	47.4
Mundelein 4WSW	20.9	25.1	35.2	46.9	57.6	68.0	72.3	70.7	62.8	50.8	38.3	25.1	47.9

Table 3-3: Mean Monthly Precipitation Normals (Inches), 1981-2010. (Illinois State Climatologist's Office & National Climatic Data Center, 2010) Data provided by the Illinois State Climatologist's Office, a part of the Illinois State Water Survey (ISWS) located in Champaign and Peoria, Illinois, and on the web at www.isws.illinois.edu/atmos/statecli.

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann.
Gurnee Public Works	1.80	1.82	2.35	3.59	3.96	3.69	3.79	2.90	3.29	2.85	2.90	2.28	35.22
Lake Villa 2NE	1.99	1.76	2.55	3.79	3.88	3.86	4.03	3.65	3.21	2.83	2.83	2.39	36.77
McHenry-WG Stratton LD	1.39	1.43	2.03	3.26	4.09	4.10	3.90	4.16	3.07	2.93	2.66	1.87	34.89
Mundelein 4WSW	1.53	1.97	2.55	3.21	4.21	4.05	3.82	4.19	3.48	2.92	2.65	1.97	36.55

3.1.6 Spatial Relationship of Water Resources

Dendritic Stream Systems: In a dendritic system, there are many contributing streams (similar appearance to the branches of a tree), which are then joined together into the tributaries of the main river. They develop where the river channel follows the slope of the terrain.

Water resources in the Manitou Creek-Fish Lake Drain watershed tend to be spatially distributed by the underlying surface topography and anthropogenic influences. Where channelization hasn't occurred, the tributary stream systems of the watershed tend to be longer and **dendritic** (Figure 3-9). The relatively high to moderate amount of channelization in the watershed is an example of how anthropogenic activities can alter drainage. Wetlands are evenly distributed throughout the watershed; however, many wetlands have been drained or filled to allow for land development particularly in the northern portion of the watershed. Several lakes in the watershed are kettle lakes or glacial sloughs. These are naturally formed lakes, but the hydrology of these lakes and their hydrologic connection to other water resources has been modified by humans. Many lakes have adjustable or fixed spillways, dams, or culverts constructed at their outlets. Likewise, flow into the lakes has been modified by ditching, drainage projects, and stormsewer systems. Many of the natural lakes in the watershed have a surface or culvert connection to another waterbody. Long, Round, Wooster, and Fish Lakes are examples of glacial lakes in the watershed.

Several additional lakes in the watershed were created for purposes such as aesthetics, recreation, or stormwater management and flood control. These lakes were often constructed through a combination of excavation of low-lying areas near streams and wetlands and subsequent impoundment with construction of a dam or spillway. Examples of anthropogenic lakes in the watershed include Hidden Lake, Lake Christa, and Countryside Glen.

Wetlands cover approximately 4,313 acres of the Manitou Creek Fish Lake Drain watershed are interspersed throughout the watershed, except in locations where they have been drained, filled, or converted to another land cover type. While wetlands are typically lower in elevation than the immediately surrounding lands, they are found in a variety of topographic positions, ranging from isolated depressions on the crests of moraines to gently sloping drainageways across the landscape, to bottomlands in floodplains and along lake shores. Similarly, wetlands can be found throughout the hydrologic network of the watershed. Geographically isolated wetlands are located in depressions surrounded by uplands and do not have regular surface connections to other water bodies or wetlands. Headwater wetlands are located along the upper-most stream reaches, while larger wetland complexes often have larger tributary areas and may have more regular hydrologic connections to other water features. Rivers, streams, and lakes typically have wetlands of some form associated with them. Descriptions of more common wetland types can be found in Section 3.11.

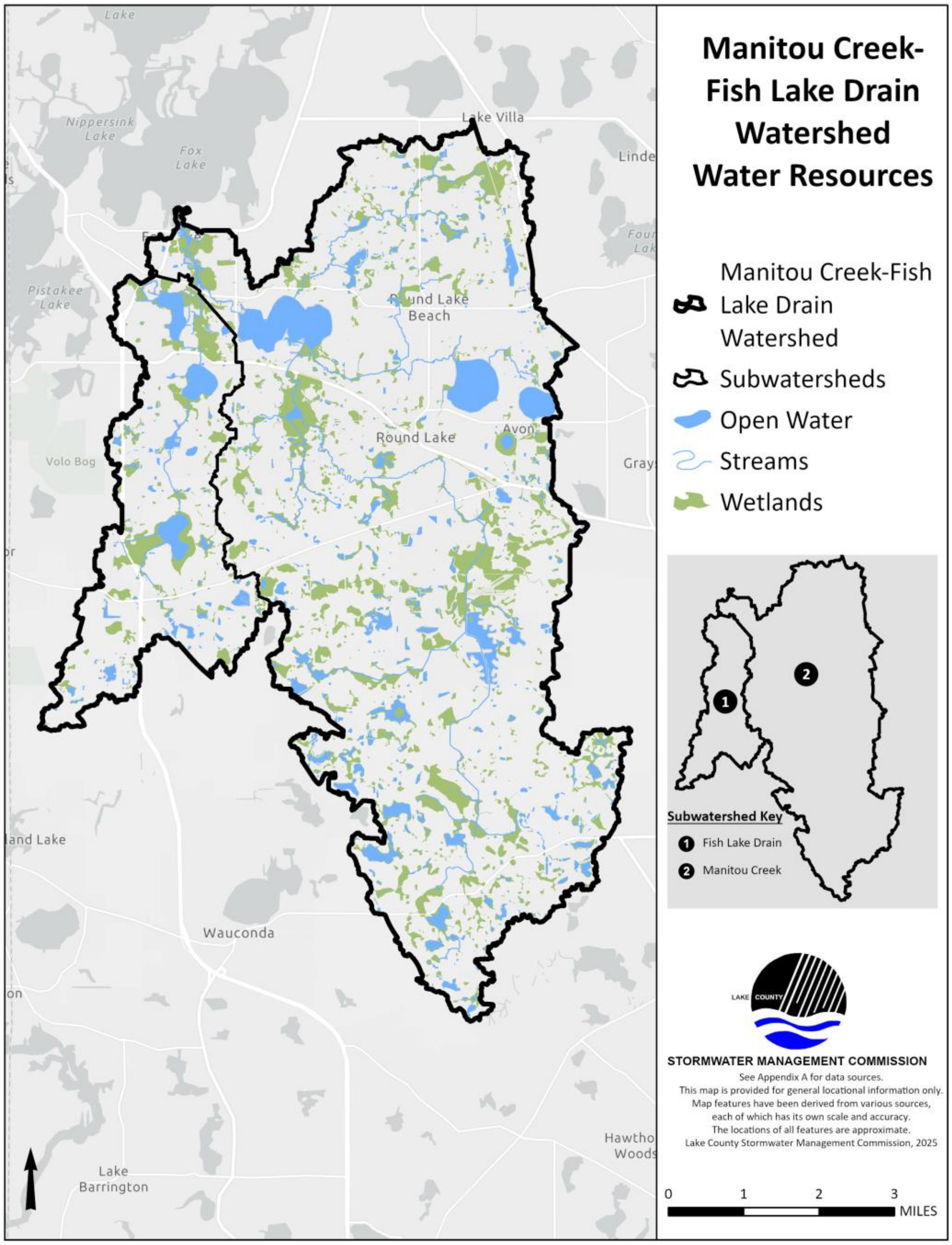


Figure 3-9: Water Resources

Ponds and detention basins are the most numerous constructed water features in the watershed and can be found throughout the landscape. Ponds have historically been constructed by excavation or impoundment for a variety of purposes including agriculture, borrow pits, wastewater treatment, wildlife management, fish/fishing, golf course features, and residential aesthetics. Constructed ponds are often associated with a natural source of hydrology such as a wetland or stream but may also be located in upland areas that would otherwise be dry. Detention basins, a specific type of pond, are associated with urban and suburban development beginning in the second half of the twentieth century. Detention basins can be wet (ponds), wetland-bottom, or dry and are specifically designed to reduce peak runoff discharges from developed sites. Prior to watershed development regulations, detention ponds were constructed in both upland and wetland locations. Regulations now discourage or prohibit the construction of stormwater detention facilities in wetlands, which are typically constructed in upland areas in more recent developments. Detention basins are a component of the designed drainage system and stormwater infrastructure, and typically have a direct or eventual hydrologic connection to rivers, streams, lakes, and wetlands through stormsewers, drainage ditches, and other detention basins. The stormsewer network and detention basin inventory are further described in sections 3.14 and 3.15, respectively.

3.2 TOPOGRAPHY

Topographic data is used to develop floodplain maps, water quality models, flood mitigation recommendations, catchments, digital terrain models, and regionally significant depressional storage areas. Figure 3-10 represents the Manitou Creek-Fish Lake Drain watershed topography. The lowest elevation in the watershed is 736 feet above mean sea level feet [North American Vertical Datum of 1988 (NAVD88)] and the highest elevation is 919 feet (NAVD88).

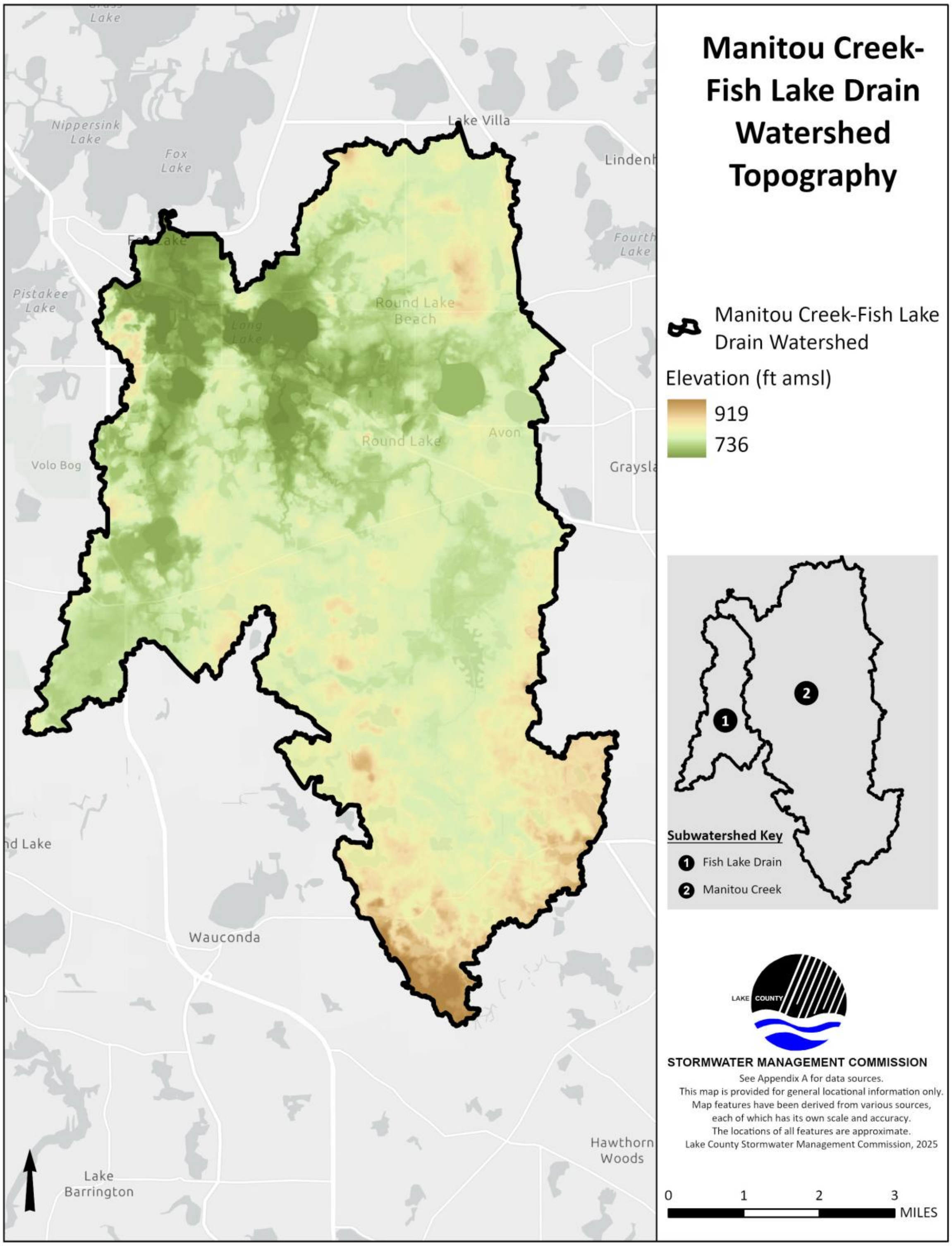


Figure 3-10: Topography

3.3 SOIL

Deposits left during and after the last glacial period are the raw materials of the Manitou-Fish Lake Drain watershed. A combination of physical, biological, and chemical variables have interacted over centuries to form the soils currently found in the watershed. These soils are identified by a name associated with each series or class of soils with similar characteristics. A soil series name generally is derived from a town or landmark in or near the area where the soil series was first recognized, although naming conventions vary by county.

INFILTRATION: That portion of rainfall or surface runoff that moves downward into the subsurface soil.

SOIL PHASE: A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Soils affect water-holding capacity, erosion potential, and **infiltration** capabilities of the land. Soil characteristics indicate the way soils in an area will interact with water in the environment. These soil characteristics can help guide where restoration or certain Best Management Practices (BMP) may be successful and where there may be constraints to project implementation.

The United States Department of Agriculture Natural Resources Conservation Service has produced detailed soil surveys for Lake County. These soil surveys contain information regarding the physical and chemical properties, as well as information regarding human use for each soil series and **soil phase**. The soil surveys were utilized for soil data in this watershed plan. Table 3-4 includes the major soil series (more than 3% of the watershed) present in the Manitou Creek-Fish Lake Drain watershed and the area occupied by each.

Table 3-4: Major Soil Types

Soil Series	Soil Series Name	Acres	Hydrologic Soil Group	Hydric Rating (Y/N/Partial)	% Of Watershed
530	Ozaukee	7,047	C	N	22.5%
103	Houghton	3,056	A/D	Y	9.7%
531	Markham	2,795	N	P	8.9%
232	Ashkum	2,416	C/D	Y	7.7%
298	Beecher	1,375	C	N	4.4%
696	Zurich	1,269	B	N	4.0%
153	Pella	1,238	B	Y	3.9%
840	Zurich and Ozaukee	1,224	C	N	3.9%
330	Peotone	1,128	C/D	Y	3.6%
978	Wauconda and Beecher	956	C/B	N	3.0%
979	Grays and Markham	944	B/C	N	3.0%
Total, Major Soil Types		*23,448*	--	--	*74.8%*
All Other Soil Types		*7,911*	--	--	*25.2%*

3.3.1 HYDRIC SOILS

HYDRIC SOILS: A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. These conditions alter the physical, biological and chemical characteristics of the soil, thereby influencing the species composition or growth, or both, of plants on those soils.

HYDROPHYTIC VEGETATION: Plants that tolerate or require saturated soil or standing water.

Hydric soils form in areas of the landscape that are seasonally or permanently saturated with water. These conditions are conducive to the growth of **hydrophytic vegetation**; therefore, the presence of hydric soils is indicative of present or historical wetland conditions. Areas with hydric soils and drained hydric soils that do not presently contain wetlands may be utilized for wetland restoration.

Figure 3-11 maps hydric soils in the Manitou Creek-Fish Lake Drain watershed. Hydric soils cover approximately 10,148 acres (32%), while non-hydric soils cover about 21,291 acres (68%) of the watershed. Hydric soils are mostly evenly distributed throughout the watershed along open water and in topographic depressions.

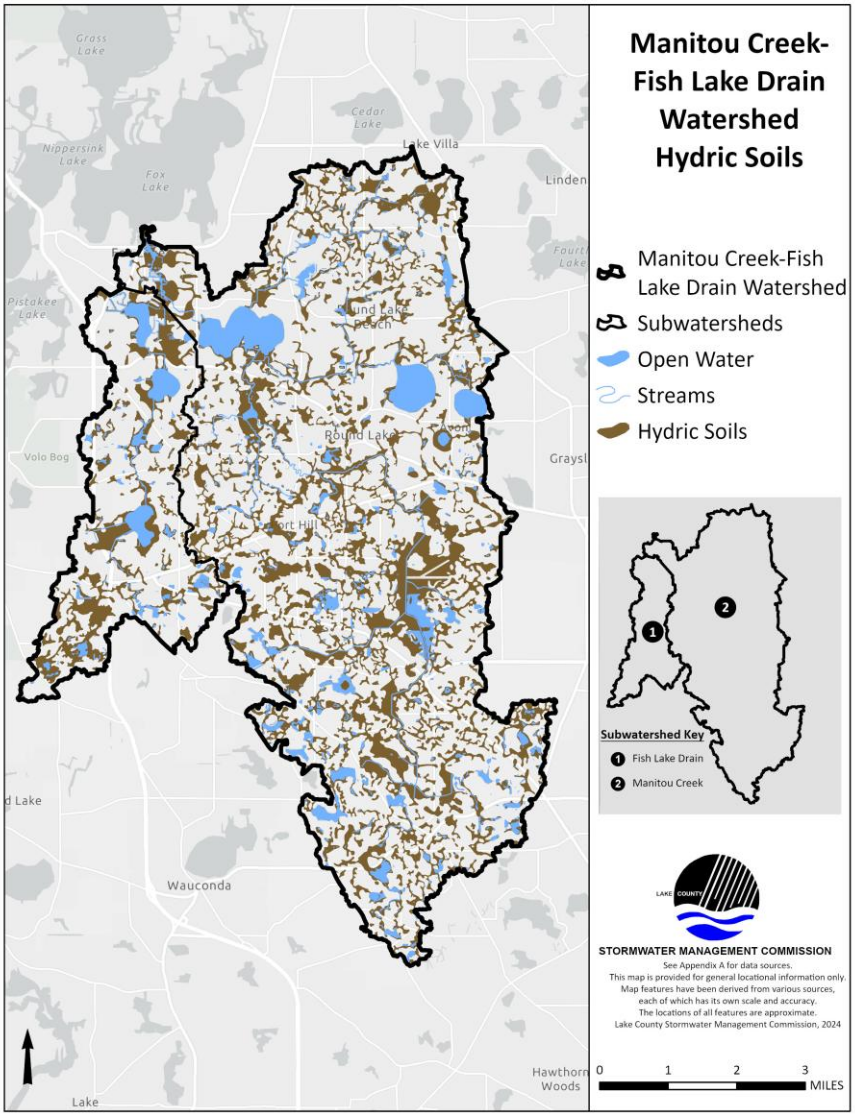


Figure 3-11: Hydric Soils

3.3.2 Soil Erodibility

Highly erodible soils in the watershed are highly susceptible to erosion by water due to a combination of slope, particle size, and cohesion, but they are not prone to erosion by wind. Highly erodible soils are considered in this plan because erosion from these soils can potentially end up in surface waters, contributing to high amounts of total suspended solids and sediment accumulation in streams and lakes. The movement or loss of soil resulting from erosion may also cause property damage as buildings and infrastructure are undermined.

In the Manitou Creek-Fish Lake Drain Watershed, 4,969 acres (16%) are classified by United Stated Department of Agriculture's Natural Resources Conservation Service (NRCS) as highly erodible soil. These soils are largely associated with topographic highs from glacial sediment deposits. Highly erodible soils do not include hydric soils. Erodible soils along lakeshores, stream channels, and disturbed land surfaces (e.g. active croplands and construction sites) are most susceptible to erosion (Figure 3-12). Stabilization practices near shorelines and stream channels could substantially reduce erosion. Additionally, land developers are required to follow the National Pollution Discharge Elimination System (NPDES) and the Lake County Watershed Development Ordinance regulations regarding soil erosion and sediment control measures during construction.

NOTEWORTHY: Soil Erodibility and Pollution

Soil characteristics, especially the tendency of soil particles to become detached and mobilized by water runoff, have considerable impact on water quality. For instance, sandy soils are more prone to erosion than clayey soils, although pollutants are more likely to be attached to clay particles.

It is important to map highly erodible soils because they represent areas that may contribute large amounts of total suspended solids (TSS) to streams and lakes. High TSS levels can result in stream degradation as a result of silt deposition and pollution. Some pollutants frequently attach to TSS particles and wash into lakes and streams, polluting the water and sediments and decreasing water clarity.

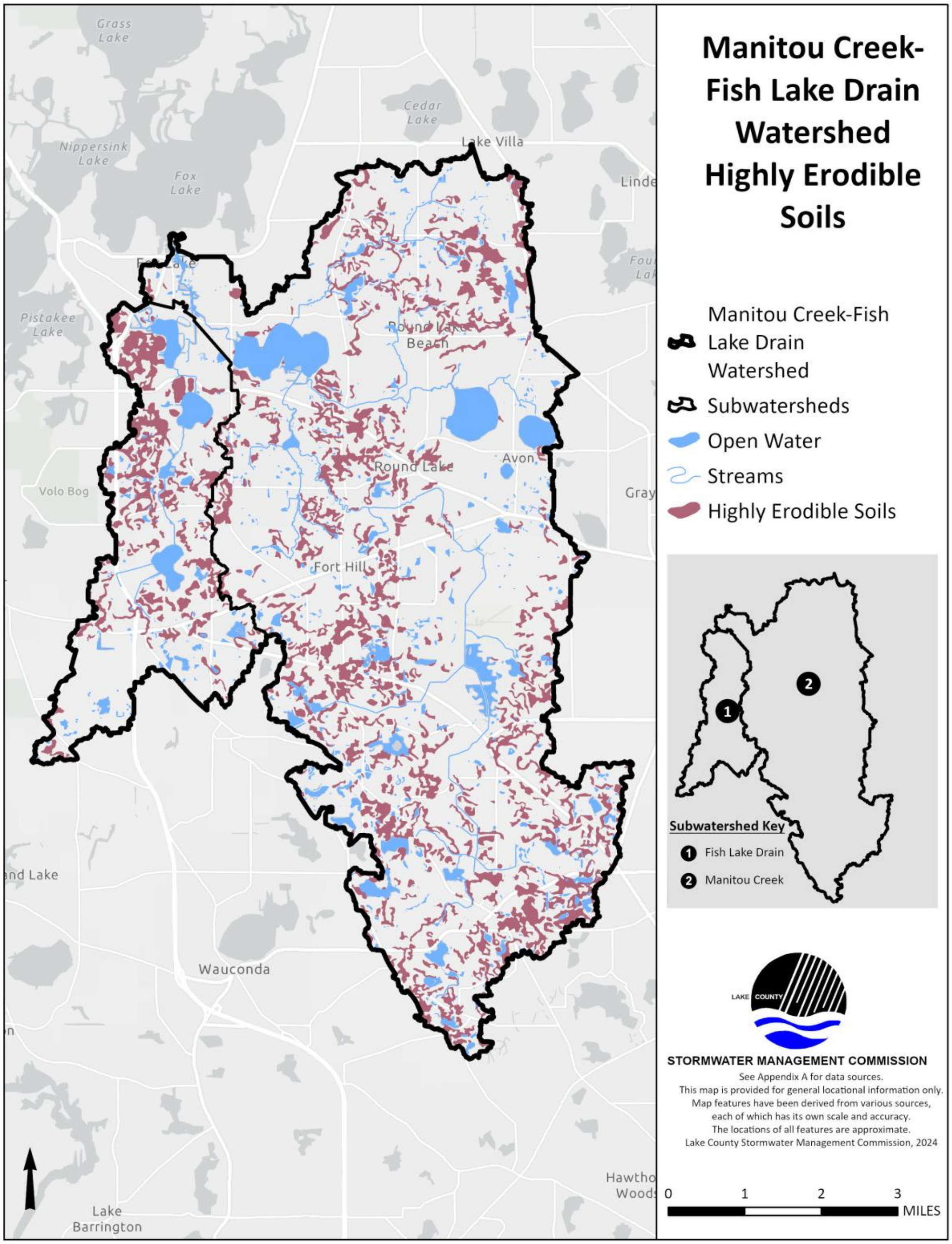


Figure 3-12: Highly Erodible Soils

3.3.3 Hydrologic Soil Groups

The NRCS broadly classifies soils based on their drainage characteristics into four different hydrologic soil groups (HSGs). The classification considers soil texture, drainage description, runoff potential, infiltration rate and transmission rate (permeability). Group A is comprised of the most permeable soil types (i.e., sandy soils) and has the least runoff potential while group D includes the most impermeable soil types (i.e. clay) and has the greatest runoff potential. HSGs should be considered when identifying potential stormwater best management practice and retrofit opportunities. The main HSGs are separated into four categories: A, B, C, and D; see Table 3-5 for HSG permeability and surface runoff characteristics and Figure 3-13.

Table 3-5: Hydrologic Soil Groups and Corresponding Attributes

HSG	Soil Texture	Drainage Description	Runoff Potential	Infiltration Rate	Transmission Rate	Acres	Percent of Watershed
A	Sands (and Gravels), Loamy Sand, or Sandy Loam	Well to Excessively Drained	Low	High	High (greater than 0.30 in/hour)	0	0
B	Silt Loam or Loam	Moderately Well to Well Drained	Moderate	Moderate	Moderate	5,593	18
C	Sandy Clay Loam	Somewhat Poorly Drained	High	Low	Low	16,274	52
D	Clay Loam, Silty Clay Loam, Sandy Clay Loam, Silty Clay, or Clay	Poorly Drained	High	Very Low	Very Low	1,939	6

There are also areas of the watershed with combined soil groups such as: HSG-A/D, HSG-B/D and HSG-C/D and N/A – water, landfills, urban areas, etc. (totaling 24% of the watershed). These combined soil groups are a combination of soil types and exhibit a combination of permeability and surface runoff characteristics. The soil characteristics can change depending on saturation, slope and time of year. If these soils can be adequately drained (with underground drain tiles or other techniques), then they are assigned to dual hydrologic soil groups based on their saturated hydraulic conductivity and the water table depth when drained. The first letter applies to the drained condition and the second to the undrained condition.

Runoff curve numbers classify the runoff potential of different soil types with different types of land cover. The curve numbers are a function of HSGs, land cover or usage and antecedent soil moisture conditions. The curve number ranges from 0 - 100. Lower runoff curve numbers indicate low runoff potential, while larger runoff curve numbers indicate increased runoff potential. Overall, soils in the watershed are somewhat poorly-drained to well-drained.

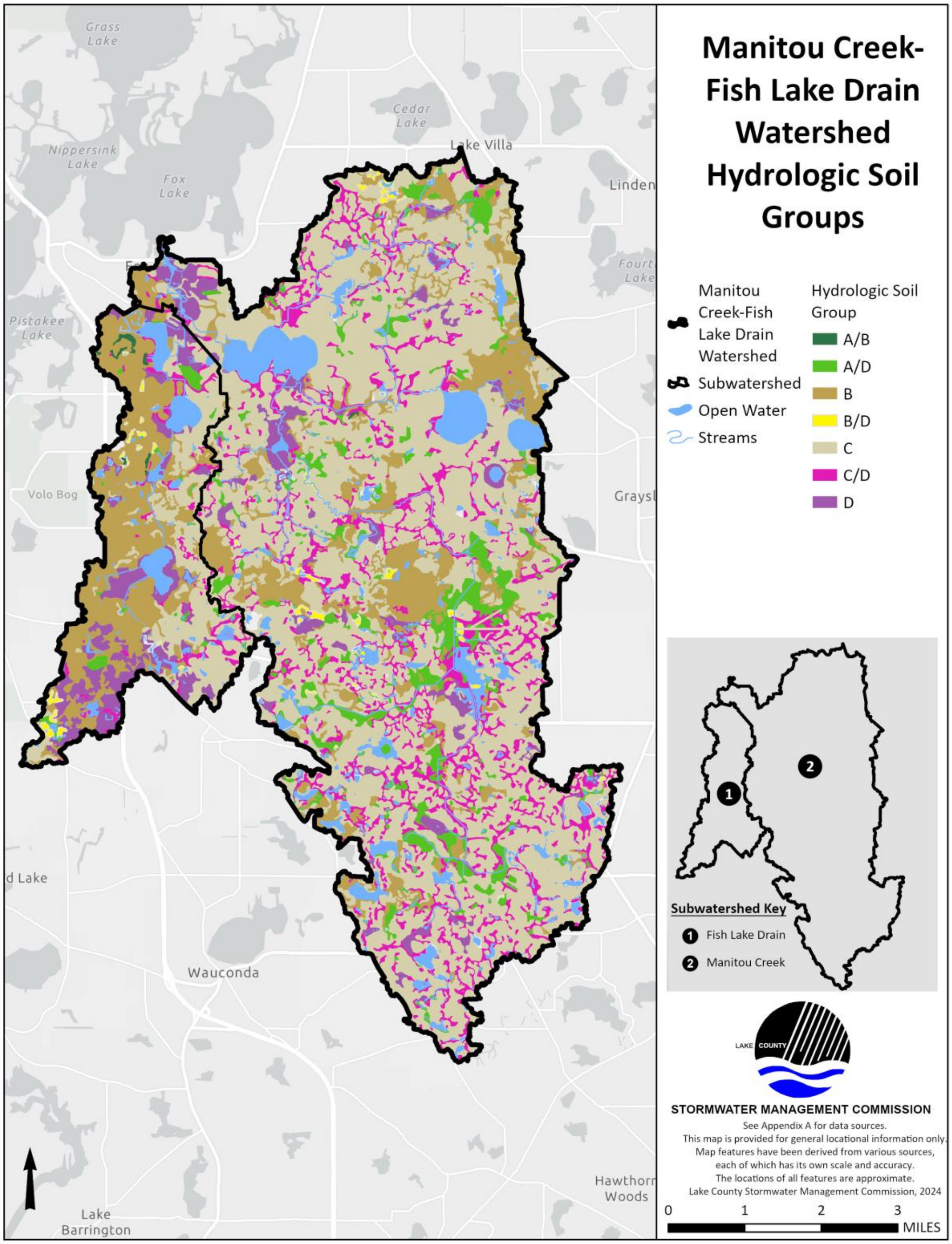


Figure 3-13: Hydrologic Soil Groups

3.4 WATERSHED HYDROLOGY

Hydrology is the study of the occurrence, circulation, distribution, and properties (e.g., quality) of water. Earth's water is constantly being cycled between oceans, the atmosphere, and land through different pathways at different rates. The movement of the earth's water through these various pathways is called the hydrologic cycle. Although the hydrologic cycle is inherently complex, one can gain a general understanding of how it works by envisioning the following process. Clouds form over the ocean due to the evaporation of water. Wind carries the clouds ashore where they produce rain. Excess rainfall (i.e., stormwater runoff) flows into lakes, rivers, wetlands, and groundwater. Over time, water stored in waterbodies either evaporates back into the atmosphere or flows back into the ocean, beginning the cycle anew.

Primarily, hydrology involves studying the flow of water through the various pathways that can be found within a geographical area. These pathways connect every component of the landscape and can generally be divided into surface and ground water hydrology. Surface water includes all hydrologic pathways at or above the earth's surface, including precipitation, evapotranspiration and surface water flow. Ground water includes all hydrologic pathways below the earth's surface including infiltration, interflow, and groundwater flow. Primary areas of study within the science of hydrology include developing methods for directly measuring flows through the various hydrologic pathways and developing and/or applying models for estimating flows through the various hydrologic pathways. When applied to a watershed, hydrology typically involves studying the flow of water between the surface water hydrologic pathways that connect the air, land, lakes, rivers, and wetlands found within the watershed.

Hydrology and hydraulics are terms used to describe the effects of precipitation including infiltration, runoff, and evaporation on land surfaces that drain to streams and lakes. Hydrologic studies of watersheds usually typically determine how topography and human modifications affect water volumes in watersheds, subwatersheds and smaller catchments. Hydraulics is the branch of science that deals with practical application of liquid in motion.

NOTEWORTHY: HYDROLOGIC CYCLE

The hydrologic cycle describes the continuous movement of water on, above, and below the surface of the earth. The total mass of water on earth remains relatively constant over time, but the amount of water in each of its three primary states, solid (ice), liquid (water), and gas (water vapor), is variable depending on a wide range of climate-related variables. Water moves from one state to another through various hydrologic pathways, such as evaporation, transpiration, condensation, precipitation, infiltration, surface water flow, and interflow (shallow groundwater flow). As water moves between states, energy is exchanged, which affects temperatures on the surface of the earth. For example, when water evaporates, energy is absorbed, and the surface of the earth is cooled through the process of evaporative cooling. When water condenses, energy is released, and the surface of the earth is warmed. These energy exchanges occur on a global scale, are powered by solar energy and have a significant influence on the earth's climate, as does water in its three primary states. For example, water vapor absorbs and emits energy back toward the surface of the earth; however, when water vapor forms into clouds, it reflects a significant amount of solar radiation back into space. Water and the hydrologic cycle are responsible for earth's mild climate and makes life possible on earth.

3.4.1 SUBWATERSHEDS

> **SUBWATERSHED:** The area within a larger watershed that drains to a single point, such as a tributary stream or lake. Large watersheds are comprised of smaller subwatersheds.

There are two subwatersheds in the Manitou Creek-Fish Lake Drain watershed (Figure 3-14). The Manitou Creek and Fish Lake Drain subwatersheds have a total land area of 40.2 square miles and 8.7 square miles, respectively.

The subwatersheds in the Manitou Creek-Fish Lake Drain watershed were originally derived from subwatershed boundaries delineated by Lake County in the late 1980s. These boundaries have been altered as more detailed data, such as remapping from floodplain studies and higher resolution topographic data, has become available.

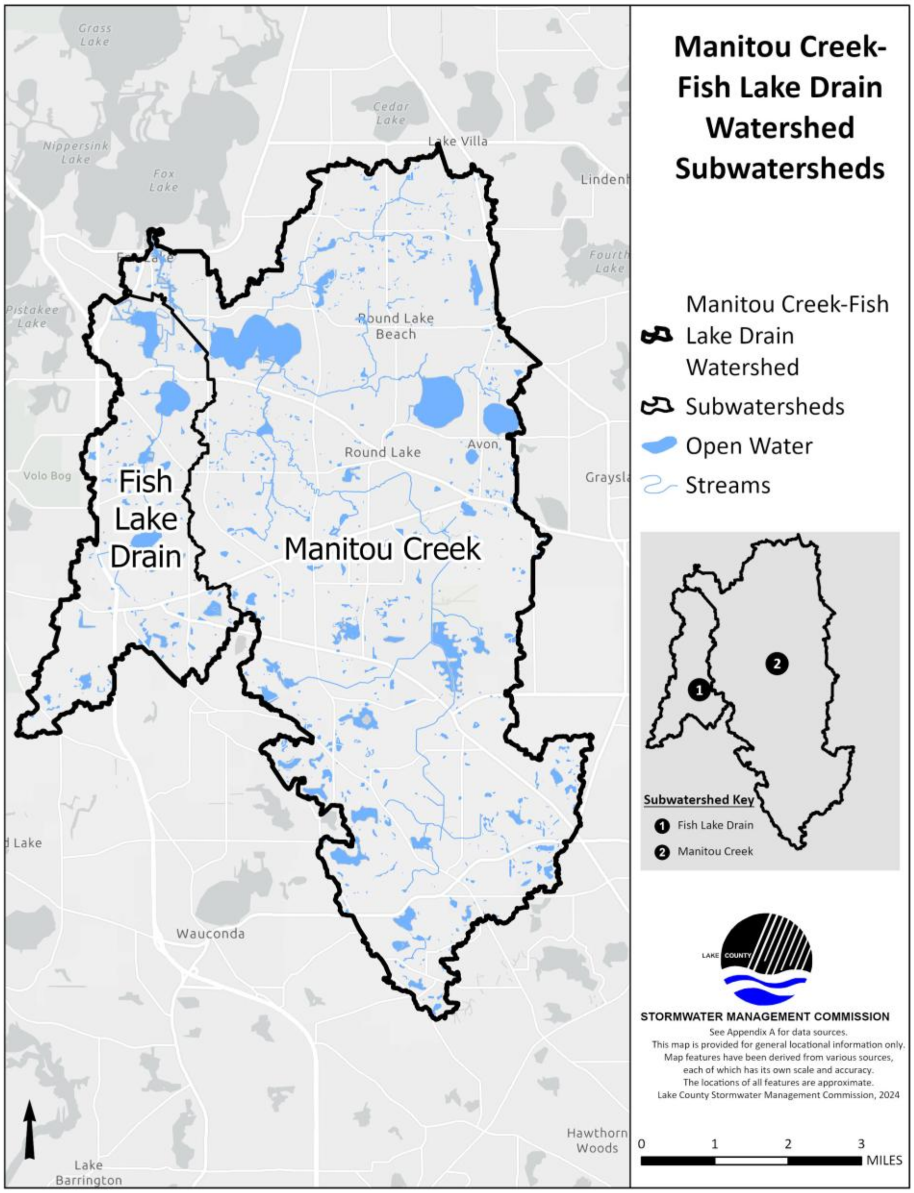


Figure 3-14: Subwatershed Map

3.4.2 Catchments

The Manitou Creek-Fish Lake Drain Watershed consists of 266 catchments ranging in size from 3 to 871 acres, with a mean size of 118 acres. As part of the watershed delineation discussed in Section 3.4.1, the Manitou Creek-Fish Lake Drain watershed was divided into catchments using 2017 LiDAR data from Lake County, IL. The LiDAR dataset was used to produce a seamless raster and basins were developed using models in ArcGIS. The boundaries developed in ArcGIS were further augmented and refined using the latest aerial photography as well as other datasets such as water, roads, and culverts. The catchments represent surface drainage but account for storm sewers where possible. Table 3-6 and Figure 3-16 summarize the delineated catchments by subwatershed.

Catchments: Small unit of a watershed or subwatershed that is delineated and used in watershed planning efforts because the effects of impervious cover are easily measured, there is less chance for confounding pollutant sources, boundaries have fewer political jurisdictions, and monitoring/mapping assessments can be done in a relatively short amount of time. See Figure 3-15.

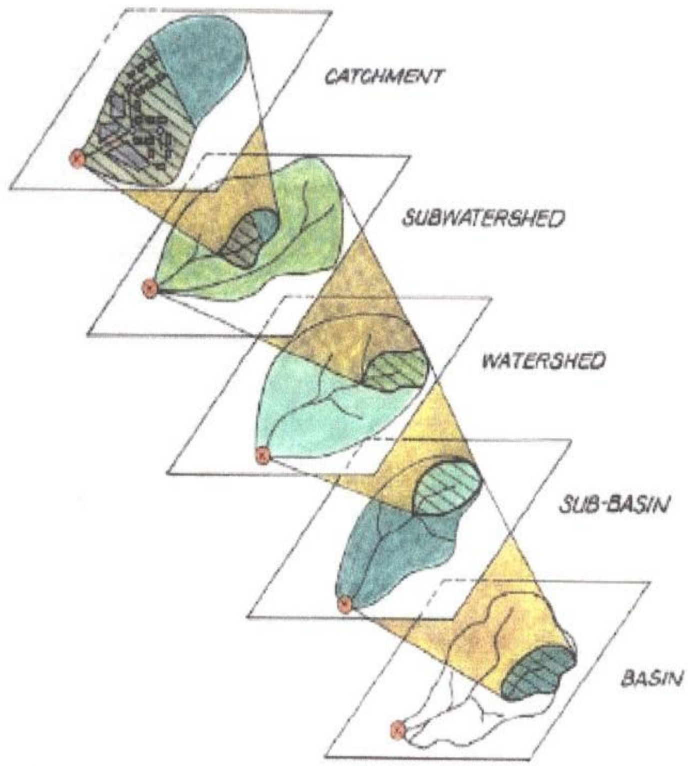


Figure 3-15: Defining Watershed Delineation Categories

Table 3-6: Subwatershed Catchment Compilation Data

Subwatersheds	Number Of Catchments	Total Acres	Mean Catchment Acres
Manitou Creek	185	25,809	140
Fish Lake Drain	81	5,550	69
Total:	**266**	**31,359**	**118**

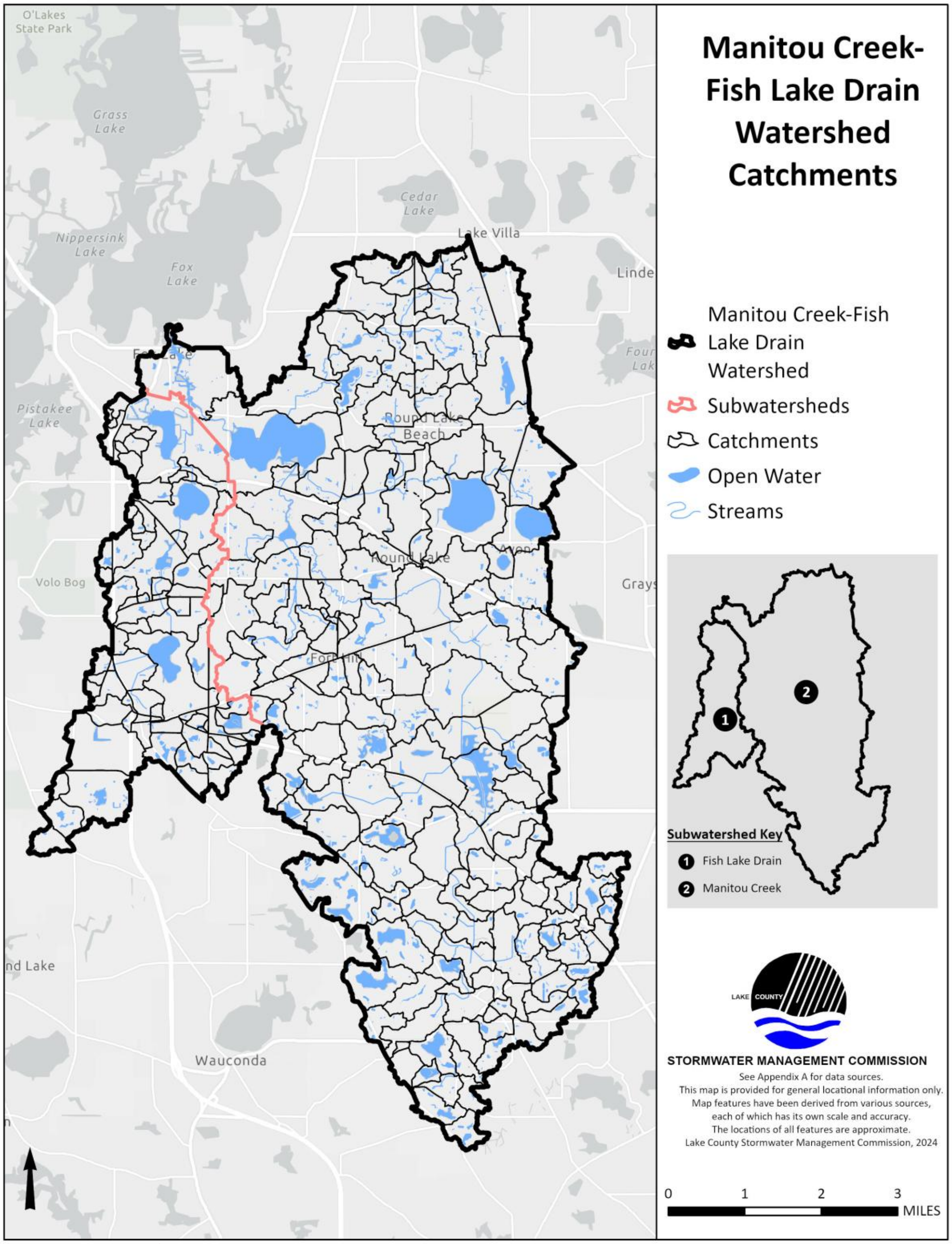


Figure 3-16: Catchments

3.4.3 STREAM HYDROLOGY

Discharge in the watershed is derived from three general sources of flow:

- Baseflow and Interflow: the discharge of groundwater and shallow subsurface flow to waterbodies.
- Overland Flow and Surface Runoff: discharge of water flowing over the ground surface as a result of direct precipitation, snowmelt, ground saturation, or other sources of water. Flow in streams, surface waters and wetlands is included in this category.
- Treated Effluent and Return Flow: discharge of water that has been used for some human activity such as treated wastewater from public water supplies or industrial uses, cooling and process water, and irrigation. Treated effluent and return flow are not significant sources of overall streamflow in the watershed.

Under pre-European settlement landscape conditions, discharge during much of the year in all streams within the watershed was driven by baseflow, interflow, and tributary flow (runoff) from smaller streams and wetlands. Runoff from precipitation had a less pronounced effect on stream discharge compared to present conditions. As the Manitou Creek-Fish Lake Drain watershed has been developed, baseflow and interflow has been reduced with surface runoff contributing a greater proportion of the volume of annual discharge (see Section 4.1). Tiling, channelization of streams, and ditching of wetlands and low-lying areas lowered shallow groundwater levels in some areas. Consequently, stream hydrology in the watershed has been extensively altered since European settlement.

The United States Geological Survey began monitoring discharge in the Manitou Creek in 1989 in the Village of Round Lake Near N MacGillis Drive. Monitoring occurred at this location until 2005. Discharge is not currently being monitored in the Manitou Creek-Fish Lake Drain watershed. Figure 3-17 displays the typical yearly discharge at this location. Streams in the Manitou Creek-Fish Lake Drain watershed have small tributary watersheds relative to the full Fox River watershed. Stream response in urbanized areas of the watershed is augmented by efficient surface drainage from impervious surfaces, curb and gutter systems on roadways, and stormsewer systems. These factors result in streams that respond quickly to precipitation runoff resulting in a more "flashy" hydrology than the larger Fox River watershed.

There are numerous **stream classification systems and characterization terms** in use by the community of engineers, watershed and natural resource managers, and researchers engaged in watershed planning. This plan recognizes the utility of these systems and terms but does not specify or apply them to streams in the watershed. In particular, the concepts of stream order and headwater streams are recognized as potentially significant to determining the feasibility of attaining certain water quality thresholds (such as indices of biotic integrity). The spatial position of streams, permanence of flow, and the effect of anthropogenic changes to watershed and stream hydrology will require additional scrutiny and agreement among watershed managers, policy-makers, and regulators if these types of classifications are intended to define future watershed goals.

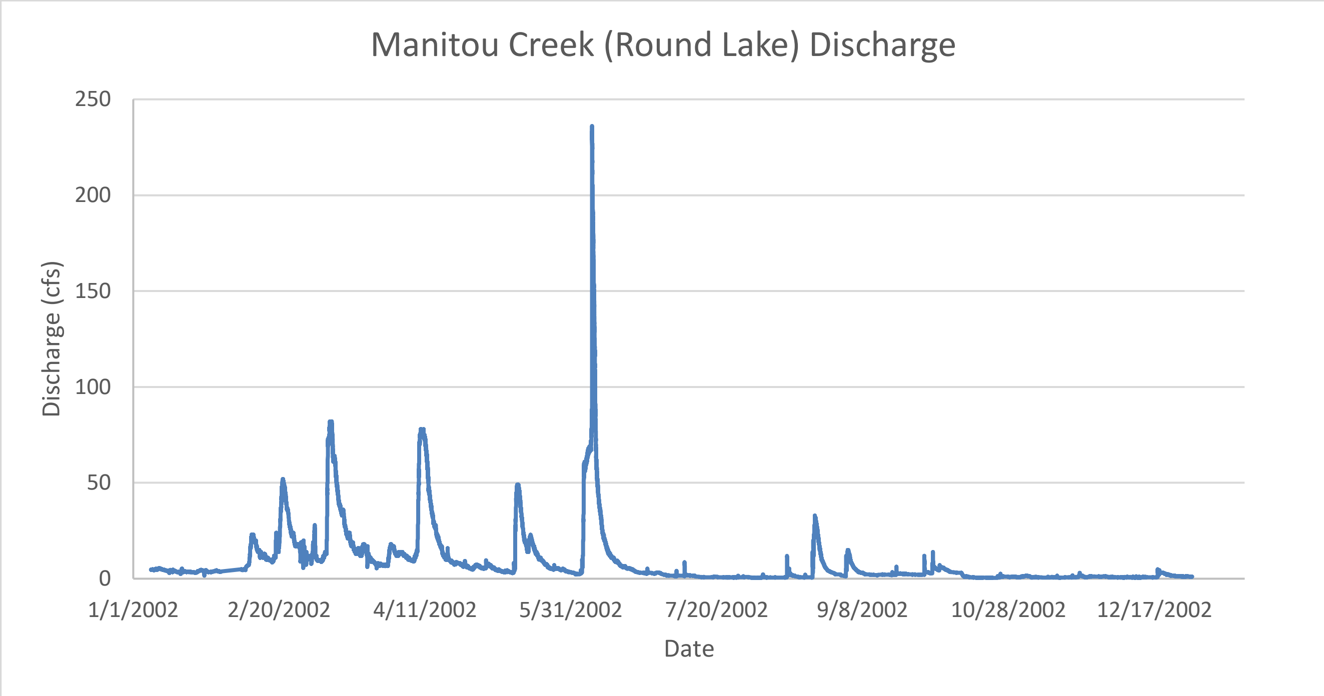


Figure 3-17: 2002 Hydrograph for Manitou Creek

NOTEWORTHY: STREAM CLASSIFICATION

Numerous classification systems and characterizations for streams exist and are generally based on drainage area size, stream network pattern, stream channel morphology, spatial relationship to other streams, and discharge characteristics.

Stream order is a common method used to classify streams (usually hierarchically) within a drainage network but is dependent on underlying cartography. Similarly, it is generally agreed by hydrologists, ecologists, and watershed managers that "headwater" streams are of significance, though there is not a universal definition. Fritz, Johnson, and Walters (2006) have summarized the issue of stream order and headwater characterization well:

> "Stream order is a measure of stream position within a drainage network system (Horton 1932, Strahler 1945, Shreve 1966). Headwater streams are typically considered to be first- and second-order streams (Gomi et al. 2002, Meyer and Wallace 2001), meaning streams that have no upstream tributaries (i.e., "branches") and those that have only first-order tributaries, respectively. Use of stream order to define headwater streams is problematic because stream-order designations vary depending upon the accuracy and resolution of the stream delineation (Mark 1983, Hansen 2001). Lack of agreement among maps with different mapping resolution is common when identifying headwater stream[s], determining stream order, and determining total stream [length]... The smallest headwater streams are not designated as channels on topographic maps and may be difficult to discern in aerial photographs. Thus, stream order designations based on maps are typically underestimated (Hughes and Omernik 1983), prompting some investigators to characterize such streams as zero-order streams (e.g., Brown et al. 1997). Most "blue line" designations on topographic maps are not based on field studies, but are "drawn to fit a rather personalized aesthetic" of the cartographer (Leopold 1994) or drawn with standards that exclude a proportion of headwater channels (Drummond 1974)."

3.5 WATERSHED JURISDICTIONS AND DEMOGRAPHICS

3.5.1 UNITS OF GOVERNMENT

The Manitou Creek-Fish Lake Drain watershed has numerous political jurisdictions, including municipal, township, and other local, state, and agency jurisdictions. The boundaries of these jurisdictions are seldom drawn to coincide with watershed boundaries. Fifty one percent of the Manitou Creek-Fish Lake Drain watershed is incorporated, within 14 municipalities (totaling 15,885 acres). The Village of Round Lake is the largest municipality within the watershed by area with 3,660 acres, or about 11.8% watershed coverage. The next largest municipality is Village of Round Lake Beach which occupies 2,933 acres, or about 9.4% of the watershed. Forty nine percent of the Manitou Creek-Fish Lake Drain watershed is unincorporated, made up of five townships (totaling 15,475 acres). Fremont Township is the largest township by area with 7,665 acres, or about 24.4% watershed coverage. A large portion of the Fremont Township is preserved as open space. The next largest township is Grant Township with 3,930 acres, or about 12.5% of the watershed. Municipalities and townships in the Manitou Creek-Fish Lake Drain watershed are shown in Figure 3-18 and Table 3-7.

Table 3-7: Municipalities and Townships

Name	Acres	Percent of the Watershed
Avon Township	1,730	5.5%
Fremont Township	7,665	24.4%
Grant Township	3,930	12.5%
Lake Villa Township	742	2.4%
Wauconda Township	1,408	4.5%
Village of Fox Lake	836	2.7%
Village of Grayslake	337	1.1%
Village of Hainesville	1,203	3.8%
Village of Hawthorn Woods	462	1.5%
Village of Island Lake	7	<0.1%
Village of Lake Villa	1,373	4.4%
Village of Lakemoor	329	1.0%
Village of Mundelein	519	1.7%
Village of Round Lake	3,692	11.8%
Village of Round Lake Beach	2,933	9.4%
Village of Round Lake Heights	404	1.3%
Village of Round Lake Park	1,407	4.5%
Village of Volo	2,082	6.6%
Village of Wauconda	301	1.0%
Total:	**31,359**	**100%**

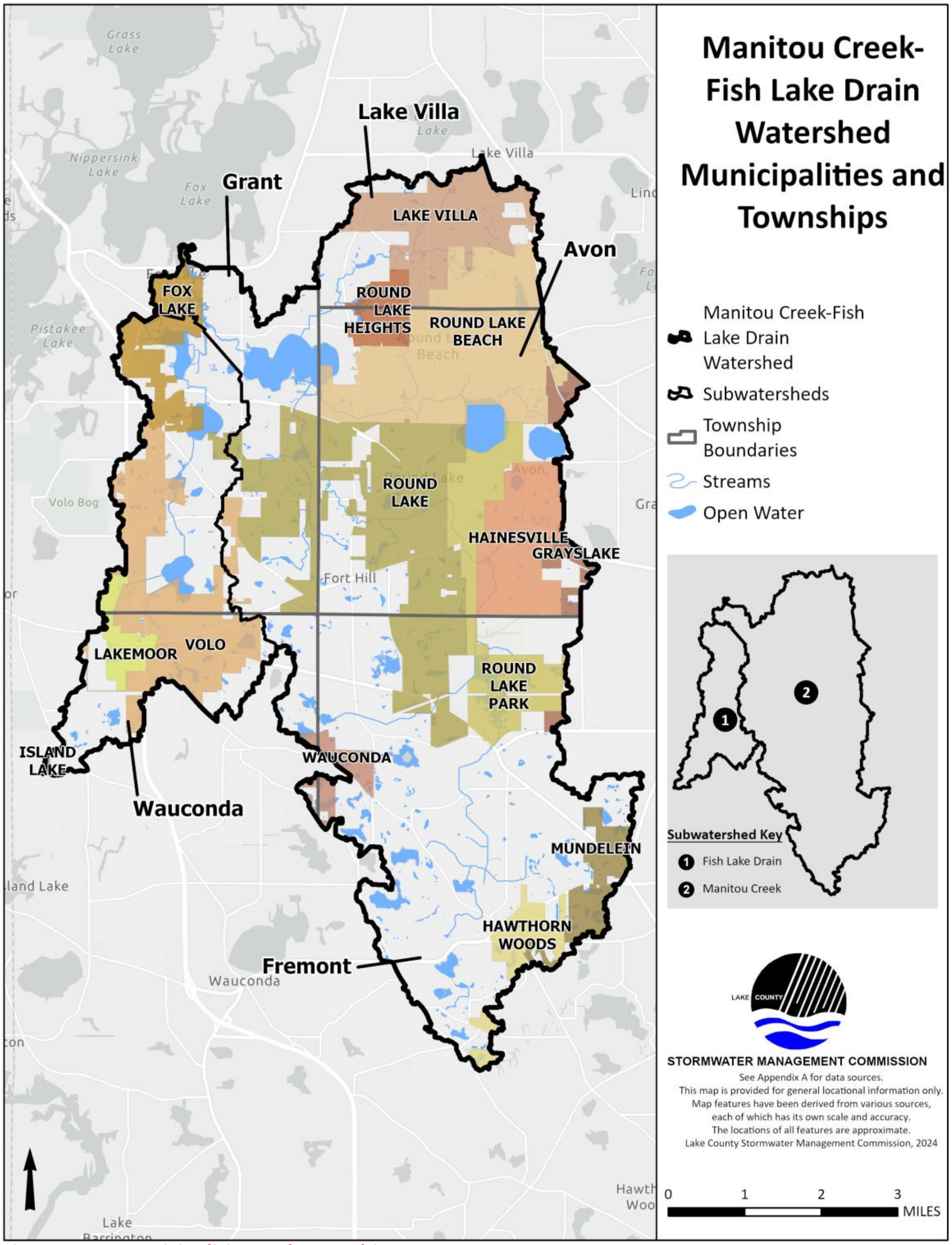


Figure 3-18: Municipalities and Townships

3.5.2 Roles and Responsibilities of Each Unit of Government

One of the challenges of creating and implementing watershed-based plans is that a watershed usually includes multiple jurisdictions that have varying interests, resources, and responsibilities. This variability can be beneficial if the jurisdictions actively work together to collaborate on policies, projects, and practices, but frequently it presents watershed coordination challenges for efficiently implementing BMP projects and for providing program, policy, and regulatory consistency. In some cases, independent actions by one community or jurisdiction can have a detrimental impact on watershed neighbors, or a good project may not be as effective as it could have been if resources had been pooled to expand the scope of the project to cover a broader area of the watershed, thereby providing economies of scale.

Watershed planning brings communities together to protect and improve the land and water resources that they share and impact. Watershed activities and projects offer many opportunities for communities and other government agencies to operate outside of their traditional "silos." Meeting regularly as a watershed group provides opportunities to share information and coordinate activities. For instance, when a community or agency develops or updates a comprehensive plan, disagreement and costly competition among agencies/jurisdictions can be averted if the watershed-based plan and the plans of neighboring communities and other agencies (such as parks departments or districts) are considered. This level of coordination benefits the watershed. As an example, a municipality may receive a development proposal for a land parcel that the local parks department has identified as environmentally sensitive and has included in their long-term conservation plan. Although the underlying zoning for the land may allow the proposed development, both the community and the developer are likely to face challenges from competing interests, and with land development standards so that it does not negatively impact the features that made it environmentally sensitive. Sharing information about the land during the comprehensive planning process can prevent these kinds of problems. See Table 3-8 for more jurisdiction roles and responsibilities.

Table 3-8: Jurisdiction Roles and Responsibilities

Type Of Jurisdictions	Roles & Responsibilities						
	Land Use Planning & Regulation	Stormwater Ordinance Administra-tion	Stormwater Infrastructu-re Management	BMP Manage-ment	Non-Point Source Pollution Manage-ment	Roadway Manage-ment	Wastewater Treatment & Sanitary Sewer Management
*County	X	X	X	X	X	X	X
*Municipalities	X	X	X	X	X	X	X
*State	X	X	X	X	X	X	
*Townships			X	X	X	X	
Drainage District			X	X	X		
Forest Preserve District			X	X	X		
Park Districts			X	X	X		
Water Reclamation & Sanitary Districts		X	X	X			X

**Street, Highway and Transportation Departments are included in these jurisdiction categories*

3.5.3 POPULATION, EMPLOYMENT, AND GROWTH FORECASTS

Based on the 2020 U.S. census estimate, the household population within the Manitou Creek-Fish Lake Drain watershed is approximately 85,180 (Figure 3-19). Household population is forecasted to increase from 85,180 to 108,989 (28%) by 2050 (Figure 3-20).

As of 2020, there were approximately 13,889 employed individuals in the Manitou Creek-Fish Lake Drain watershed (Figure 3-21). CMAP forecasts employment to increase by 35% by the year 2050 (Figure 3-22). The CMAP population and employment forecast is based on a model that accounts for local future development and land use plans, as well as other land use, demographic, and economic variables and trends. Due to the Manitou Creek-Fish Lake Drain watershed incorporating only a small portion of the entire CMAP population forecast area, the results should be considered as an example or indicator of how the watershed could develop over the next few decades. This plan does not draw conclusions or recommendations from any single evaluation unit (square) in the forecast map.

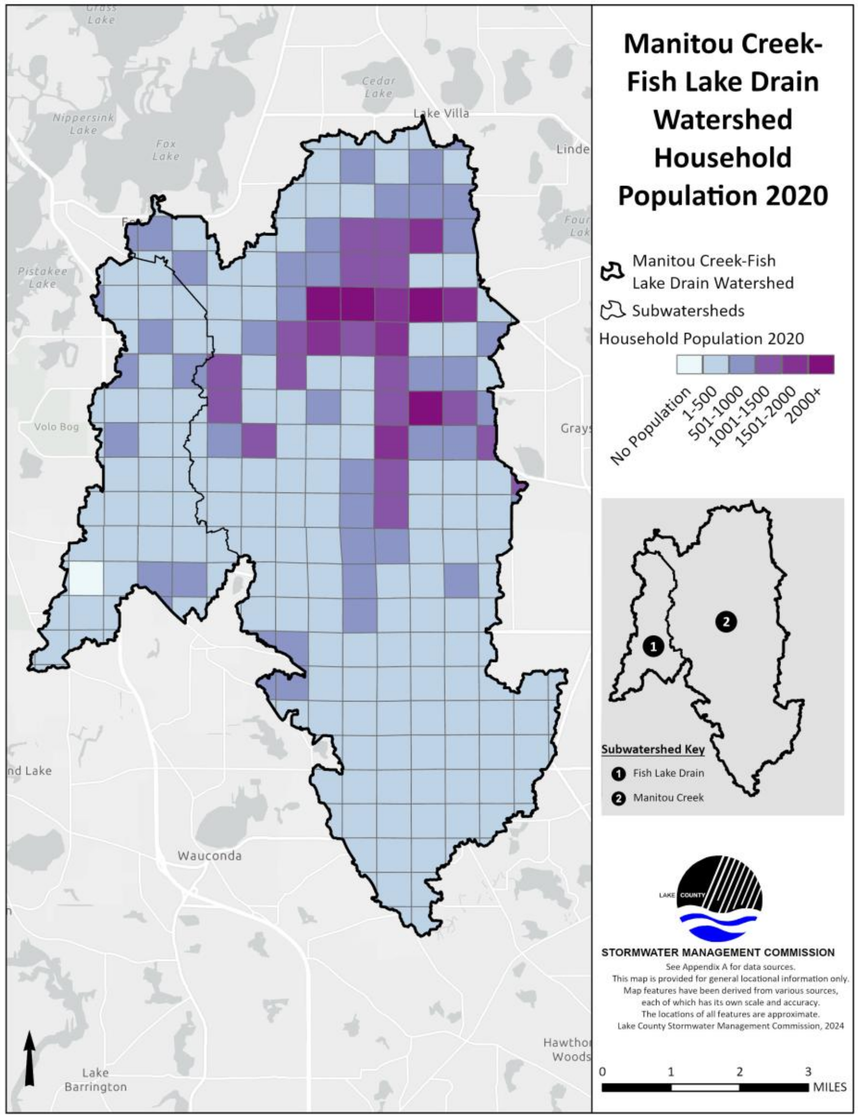


Figure 3-19: 2020 Household Population. Household population does not include individuals living in group quarters (college dorms, assisted living, etc.). Each "square" on the map represents a quarter section of the Public Land Survey System, or a 160-acre square, 0.5 miles per side.

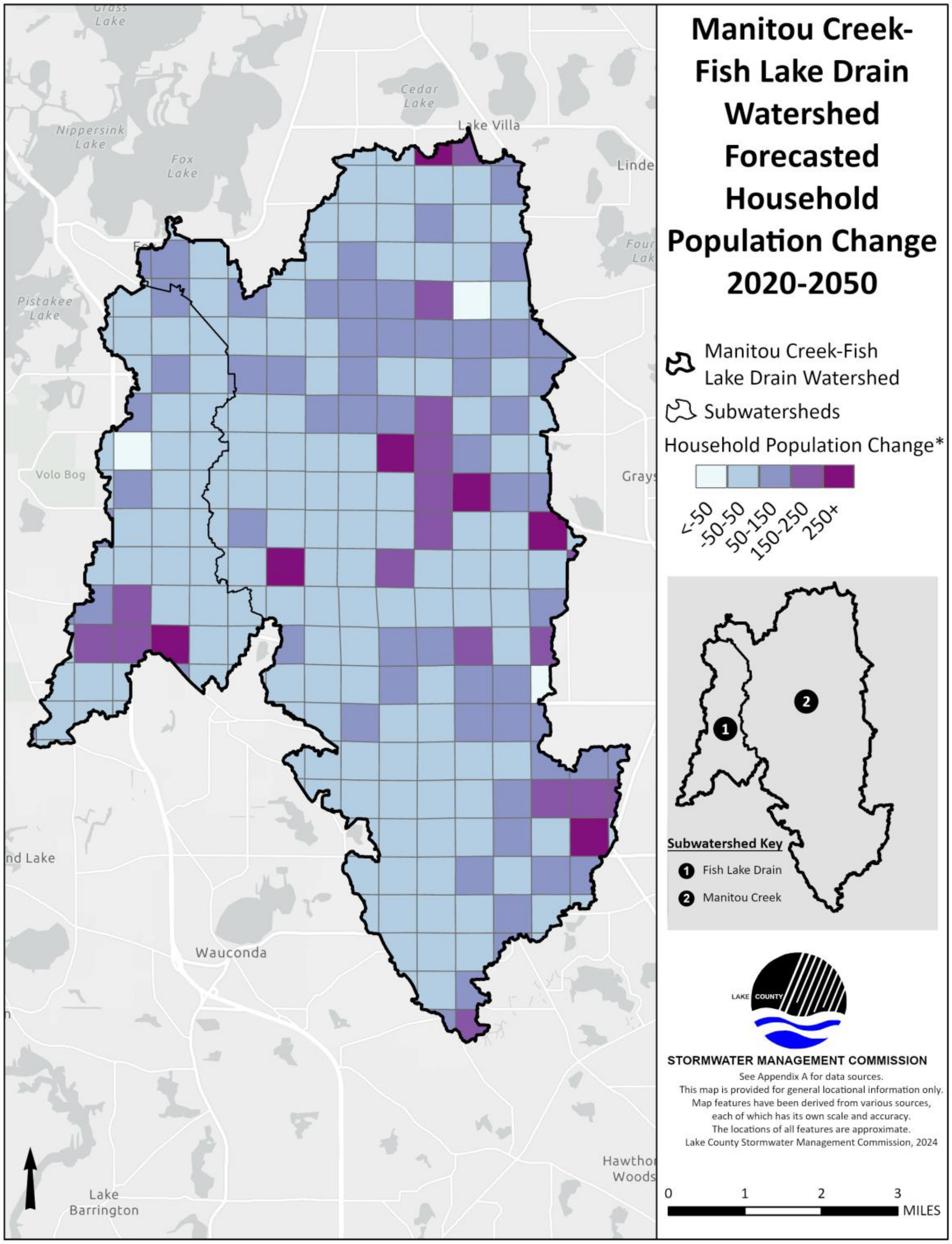


Figure 3-20: 2020-2050 Household Population Change. Household population does not include individuals living in group quarters (college dorms, assisted living, etc.). Each "square" on the map represents a quarter section of the Public Land Survey System, or a 160-acre square, 0.5 miles per side.

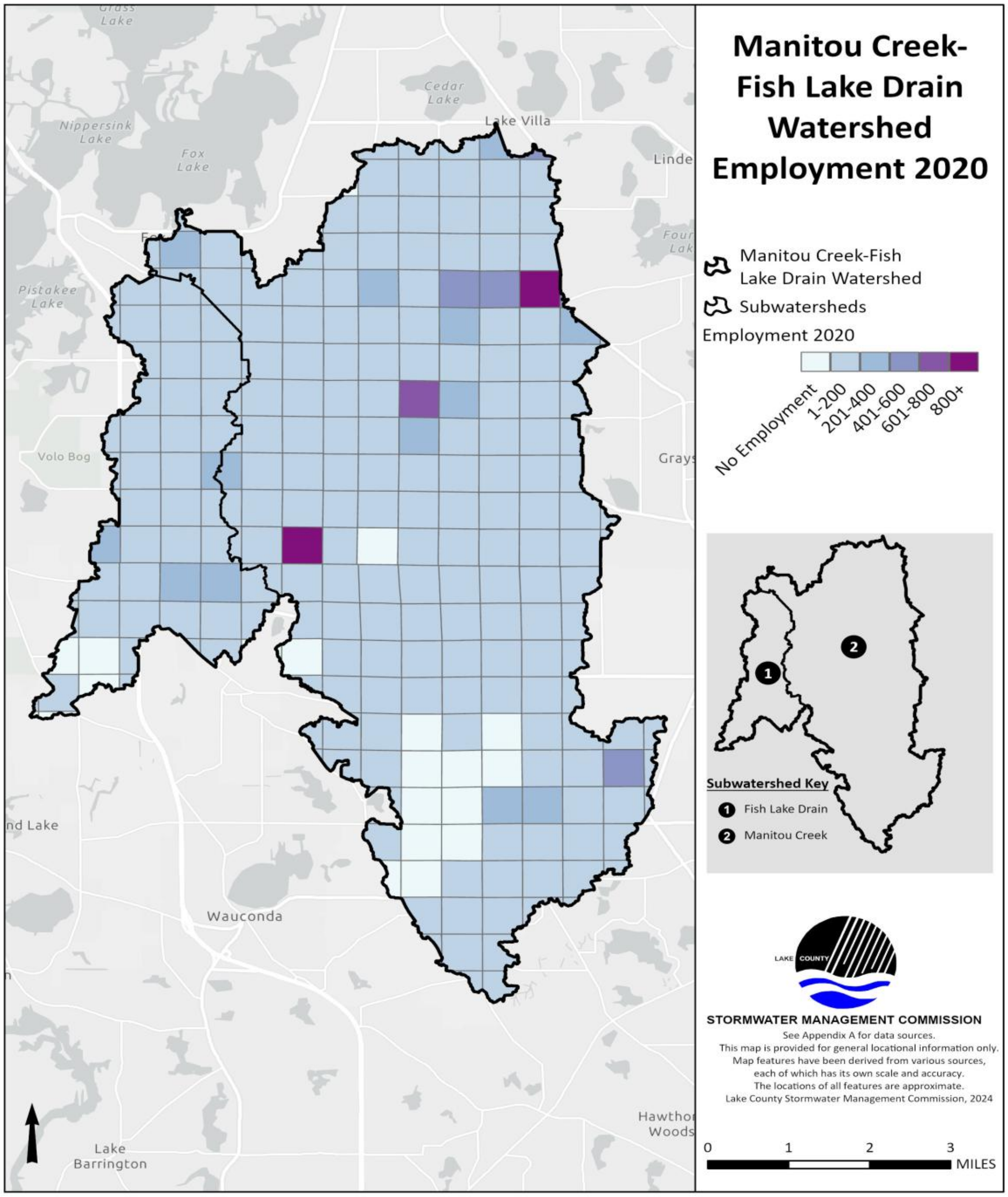


Figure 3-21: 2020 Employment. Each "square" on the map represents a quarter section of the Public Land Survey System, or a 160-acre square, 0.5 miles per side.

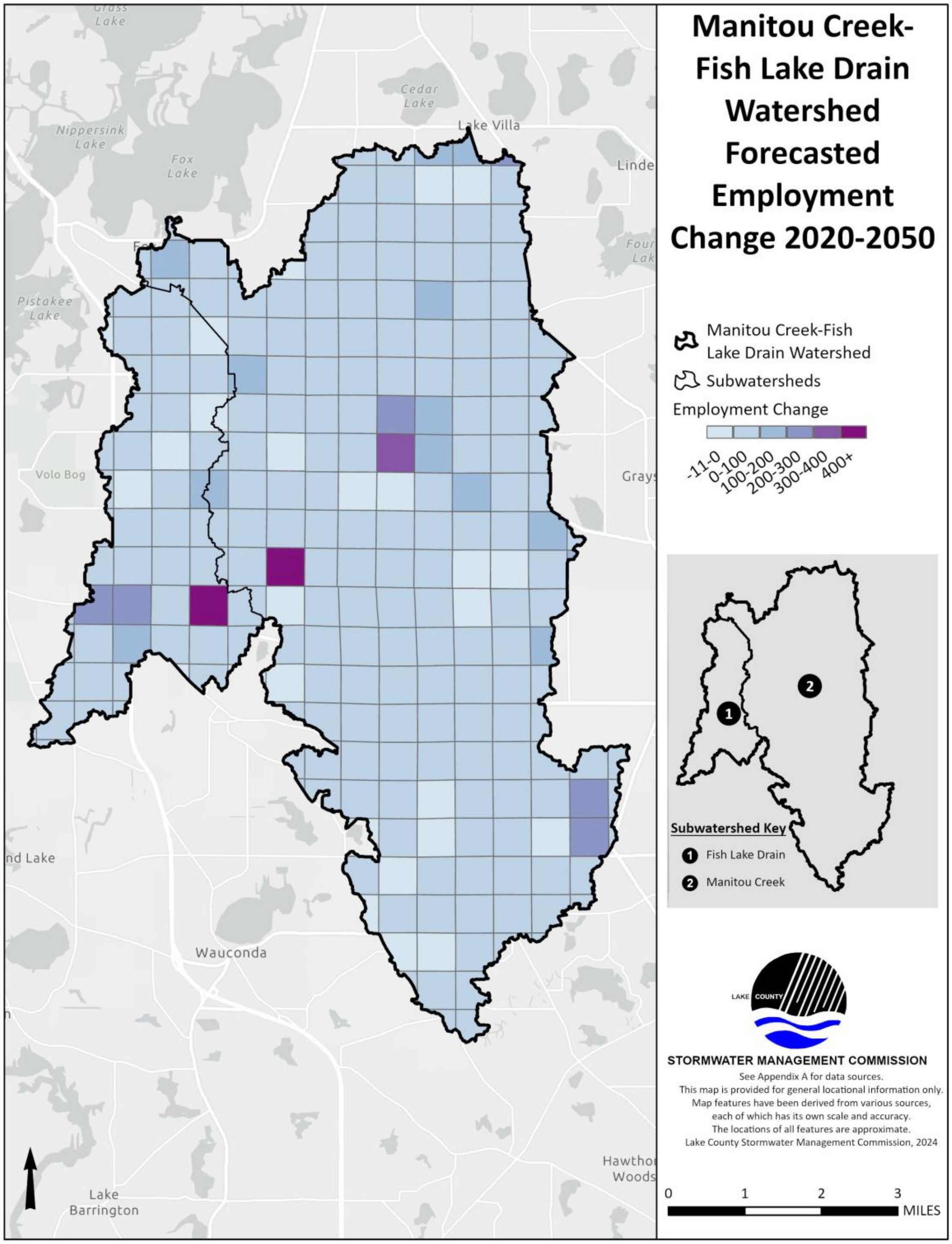


Figure 3-22: 2020 – 2050 Forecasted Employment Change. Note: Each "square" on the map represents a quarter section of the Public Land Survey System, or a 160-acre square, 0.5 miles per side

3.5.4 Median Age

Median age is a statistic that provides information on the age distribution of a population. The median age in the Manitou Creek - Fish Lake watershed in 2010 was 25.3, compared to the median age of 38.5 from the 2021 census data for the State of Illinois (2016-2021 American Community Survey 5-year estimates). Median census block age ranged from 1 to 84 in the Manitou Creek - Fish Lake watershed. The 2010 median age by census block is displayed in Figure 3-23.

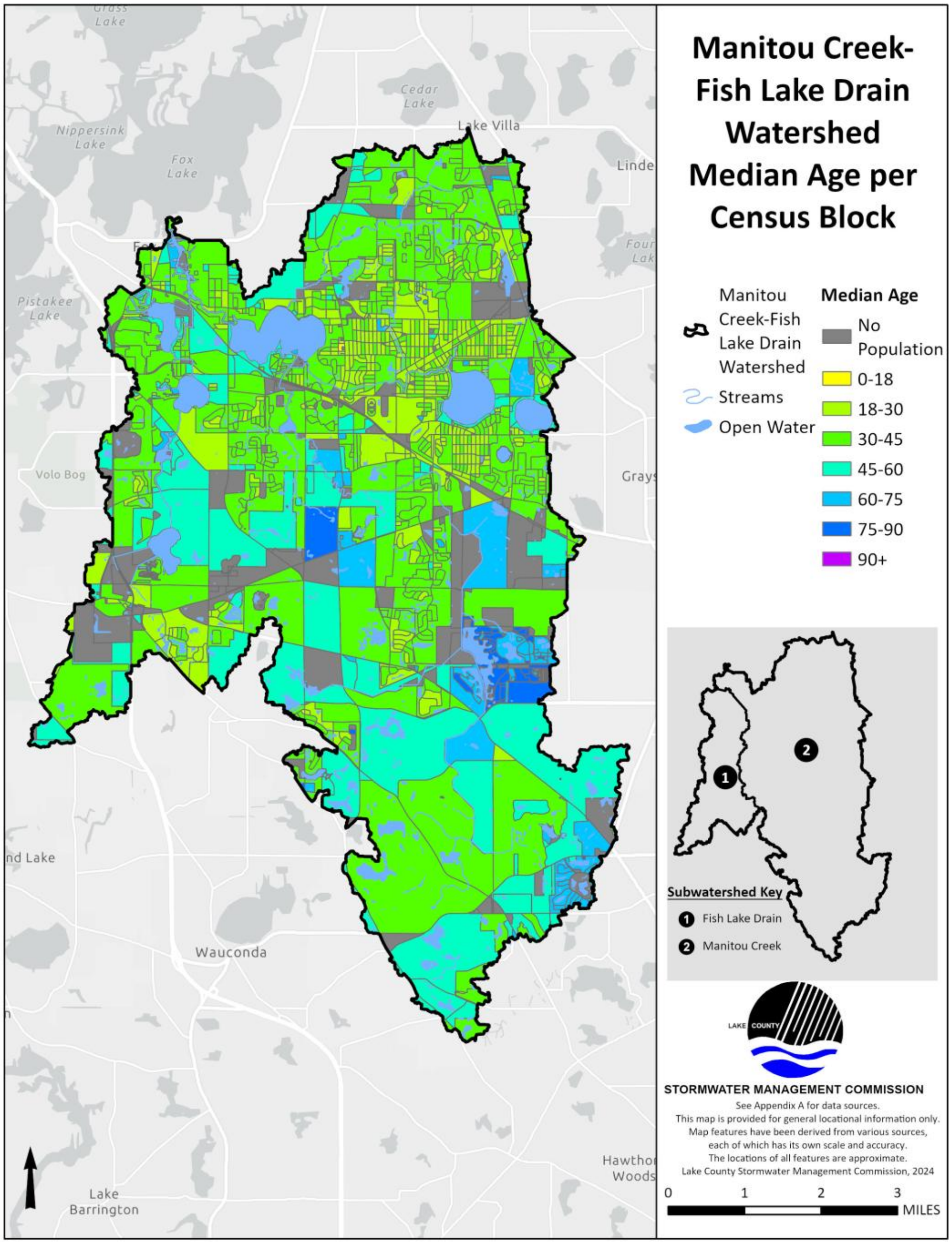


Figure 3-23: 2010 Median Age

3.5.5 MEDIAN INCOME

The median household income for the Manitou Creek - Fish Lake Drain watershed is $76,660 compared to $72,563 which was the median household income for the State of Illinois in 2021 (U.S. Census Bureau, 2021) (Figure 3-24). The U.S. Census Bureau includes incomes of people 15 or older in income calculations. Median incomes are used as measures because the values are less skewed by extremely high or low outliers.

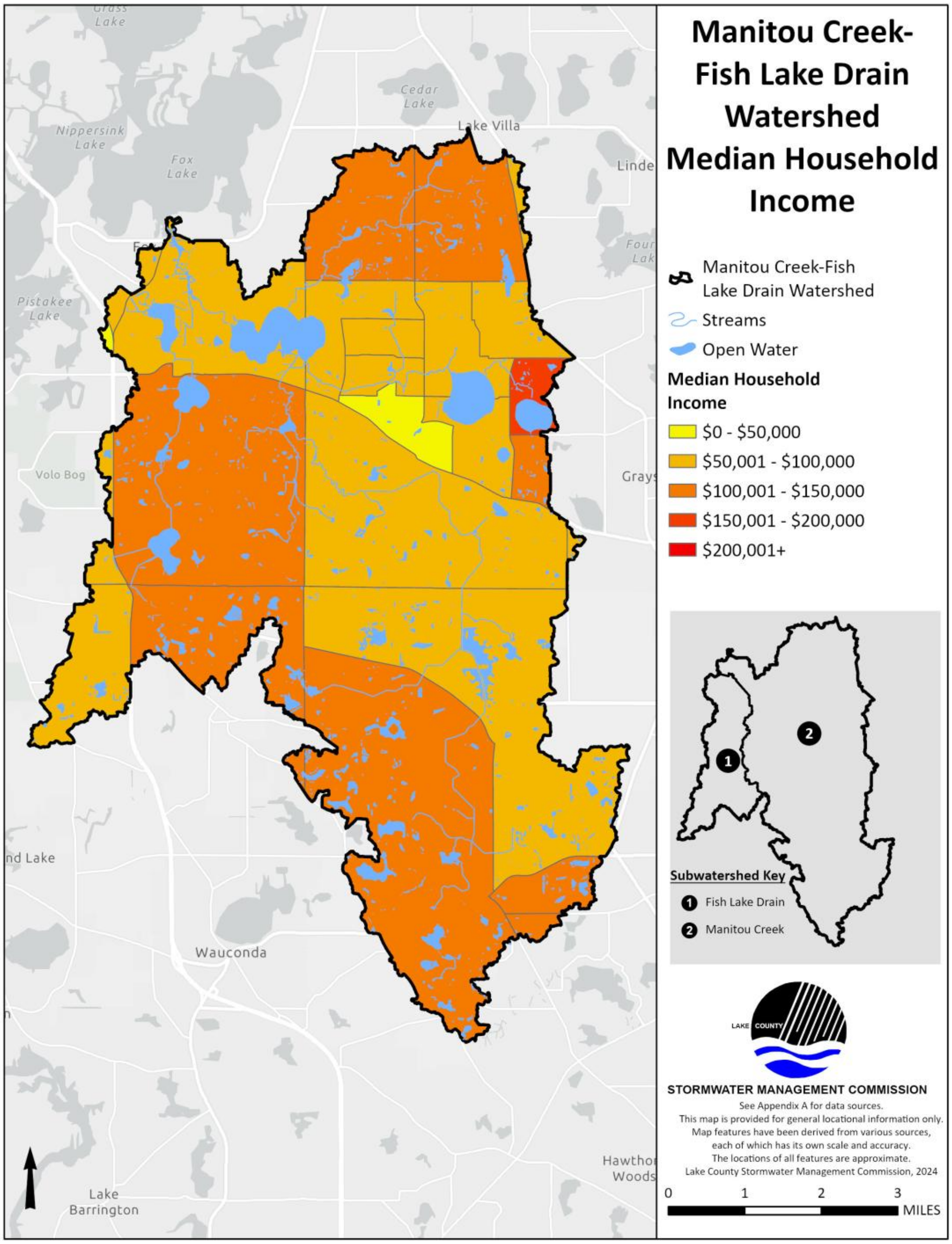


Figure 3-24: Median Household Income

3.6 LAND USE

3.6.1 EXISTING LAND USE

Existing land use of the Manitou Creek-Fish Lake Drain watershed was determined using land use data from Lake County GIS. To ensure land use and land cover represented the most recent watershed conditions, this layer was updated for lands classified as "vacant" by interpreting aerial imagery. Additionally, land use categories were simplified by grouping and re-naming similar land use codes and by extracting land cover designations from land use (i.e., woodlands, wetlands, grasslands, etc. are included in "open space"). Table 3-9 includes land use/cover categories, including acreage and overall percentage, and Figure 3-25 illustrates land use in map format.

Open space (including all public parks and preserves, private undeveloped land, forest, grassland, beach, wetland and lands classified as "vacant" with vegetated land cover) comprises 11,927 acres or 41.4% of the watershed. Residential (single-family and multi-family) lands comprise 6,490 acres (22.5% of the watershed). Agriculture lands comprise 5,521 acres (19.2% of the watershed). Total developed land, including residential, commercial/retail/mixed use, government/institutional, industrial, transportation, and utilities accounts for 11,389 acres or 40% of the watershed. While all land uses are distributed throughout the watershed, developed land is generally located in the northern portion of the watershed and undeveloped land (open space and agriculture) is generally located in the southern portion of the watershed.

Table 3-9: Land Use Summary. *Total watershed acres differ from previously stated values because open water was excluded in this analysis.

Land Use Type	Total Area (acre)	Percent of Watershed
Agriculture	5,521	19.2%
Government/Institutional	638	2.2%
Industrial	376	1.3%
Open Space	11,927	41.4%
Residential	6,490	22.5%
Retail/Commercial/Mixed Use	581	2.0%
Transportation/Utility/Waste Facility	3,304	11.5%
Total:	**28,836***	**100.0%**

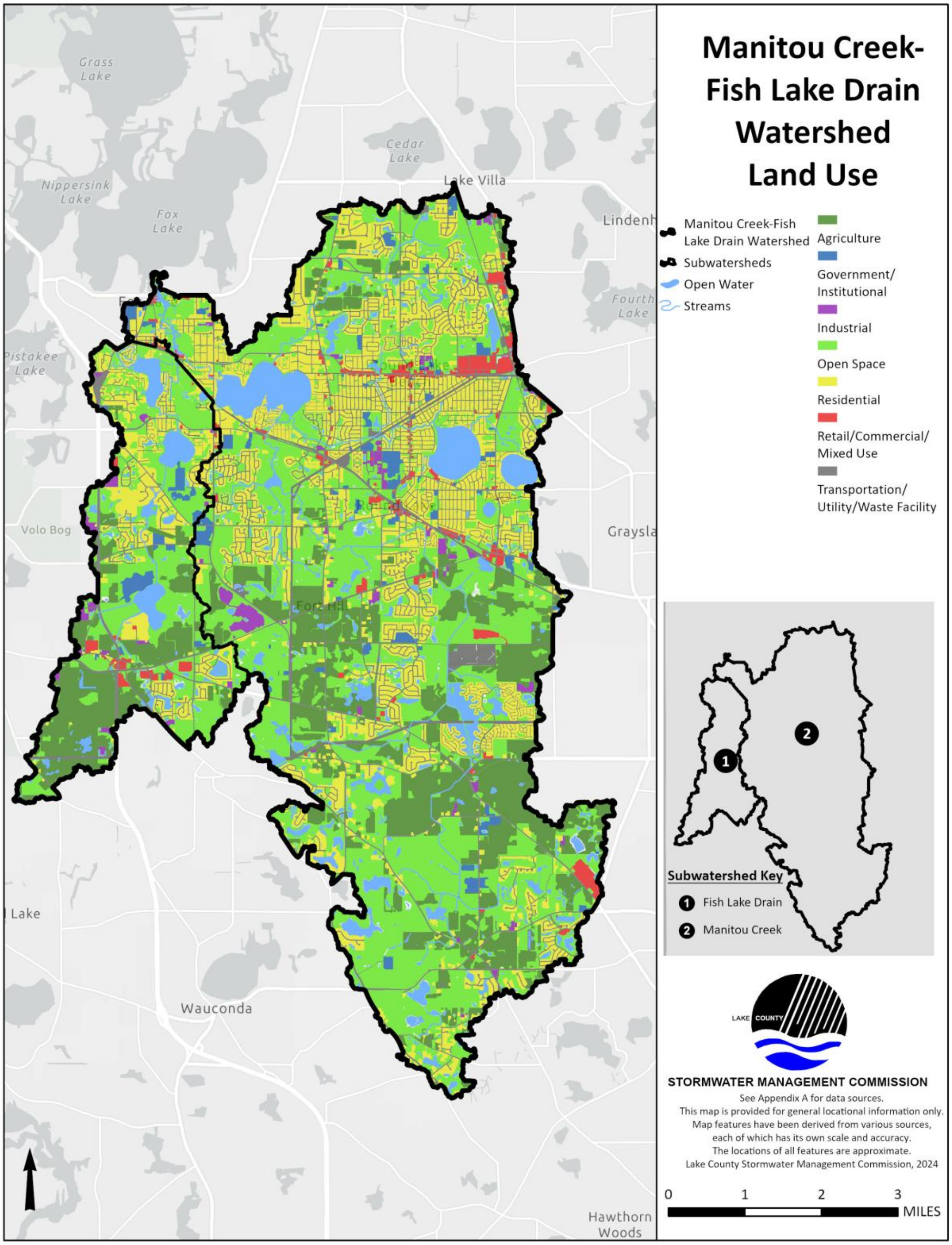


Figure 3-25 Current Land Use

3.6.2 Impervious Cover

Impervious cover is the direct result of altering a native soil's permeability by replacing natural surfaces with impermeable/impervious surfaces. Impervious surfaces such as buildings, roads, parking lots, sidewalks, and compacted open space, which are common in urban areas, prevent precipitation from infiltrating into the ground. This increases direct storm water runoff and **nonpoint source pollution** stressors into wetlands, ponds, streams, and rivers, thereby impacting local water quality (USEPA, 2017 a).

Nonpoint Source Pollution: The cumulative effect of rainfall runoff that flows over or through the land and collects pollutants and nutrients prior to entering waterways. The cumulative effect of this pollution throughout the watershed represents the contribution of nonpoint source pollution.

Analysis of impervious surface impacts in the Manitou Creek-Fish Lake Drain watershed was conducted using planimetric GIS datasets that were derived and interpreted using machine learning analysis of aerial imagery. These datasets delineated the measured area or constructed footprint of major contributors to impervious surfaces including buildings, roads, sidewalks, driveways, and parking lots. Impacts of construction and development that were not included in the planimetric datasets gravel surfaces (trails, parking lots, road shoulders), railroad right of ways and embankments, constructed features that are not buildings or paved surfaces, and compaction of soils. Planimetric data used in this analysis was developed by Nearmap. The results of the planimetric impervious cover analysis are summarized in Table 3-10 and displayed in Figure 3-26.

Table 3-10: Planimetric Impervious Area by Subwatershed. *% = Percent of Subwatershed

Subwatershed	Subwatershed Acres	Building Footprint		Pavement		Total Planimetric Impervious	
		Acres	%*	Acres	%*	Acres	%*
Fish Lake Drain	5,610	200	3.6	381	6.8	581	10.4
Manitou Creek	25,749	1,339	5.2	2,200	8.5	3,540	13.7
Total:	**31,359**	**1,539**	**4.9.**	**2,581**	**8.2**	**4,121**	**13.1**

Research conducted in many geographic areas, concentrating on many different variables, and employing widely different methods, has yielded a similar conclusion: stream degradation occurs at relatively low levels of imperviousness, with 10% imperviousness impacting water quality and greater than 30% imperviousness severely degrading water quality (Schueler, 1994).

The results of the impervious area analysis indicate that the Manitou Creek and Fish Lake Drain subwatersheds have similar percentages of land area that are covered by impervious surface. Both watersheds exhibit relatively higher amounts of impervious surfaces in the northern portions of the subwatersheds.

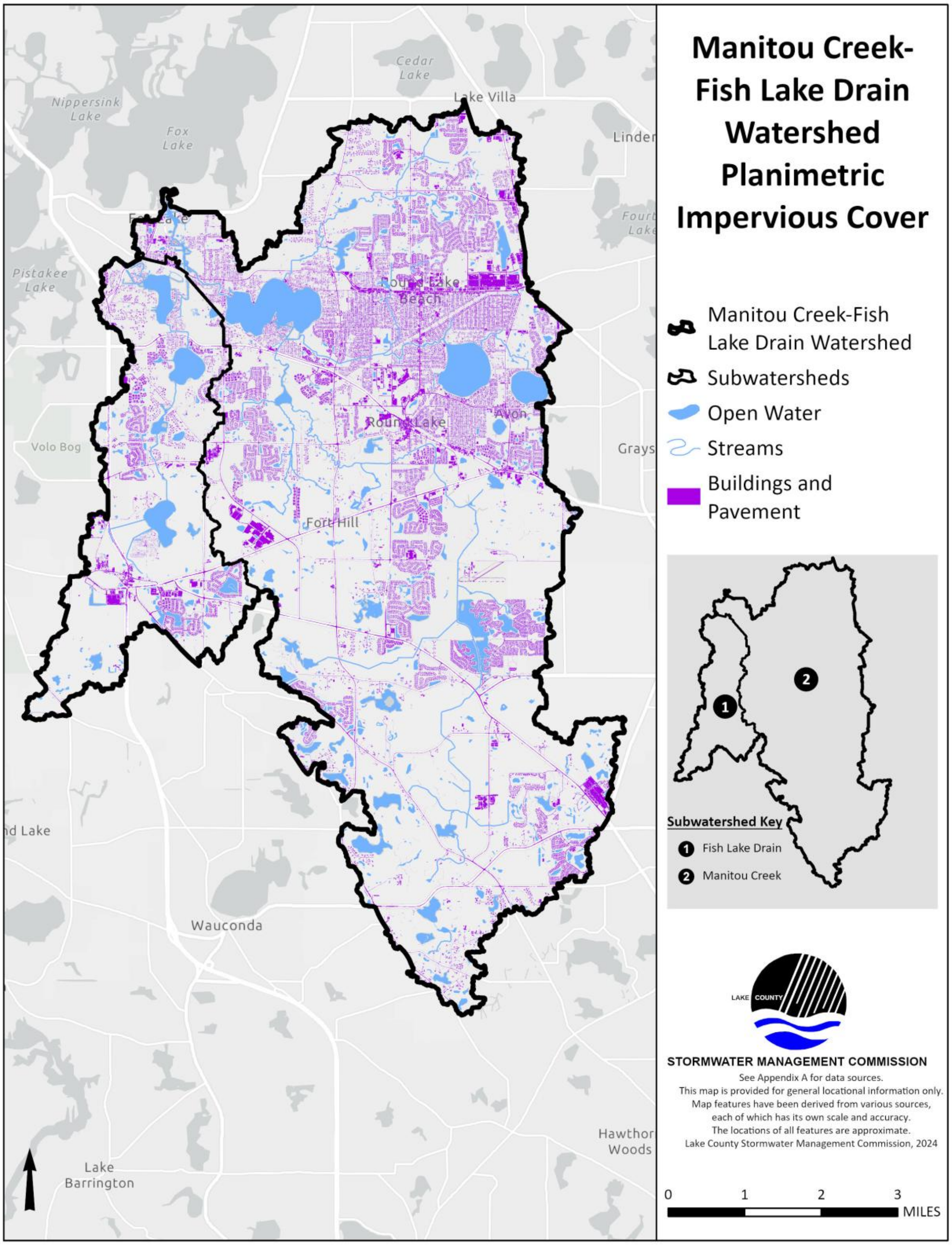


Figure 3-26: Planimetric Imperviousness

3.6.3 FUTURE LAND USE PROJECTIONS

Future land use (FLU) projections were based on a review of county FLU maps. FLU is of interest in watershed planning because changes in land use may result in additional impervious acres or may otherwise affect water resources. The FLU dataset consulted in this plan does not necessarily have a "date", i.e., there may not be an estimated year at which the planned use will be present. FLU data for Lake County is compiled by the Lake County Department of Planning, Building and Development from municipal County comprehensive land use plans and is not assigned a projected date. The most recent FLU update was 2010. SMC does not update FLU data during the watershed planning process.

Table 3-11 shows projected changes in land use by land use type and Figure 3-27 maps future land use predicted in the watershed. The data indicate decreases in Open Space while Residential, Industrial, Government/Institutional and Retail/Commercial/Mixed Use are expected to increase in area. In general, the projected changes in land use occur in the southern and western portions of the watershed. The projected decreases in Open Spaces are primarily accounted for by increases in Residential and Retail/Commercial/Mixed Use.

Some caveats are warranted in discussion of future land use data and mapping, specifically related to mapping scale. Existing land use is mapped at the parcel or sub-parcel scale. Future land use is mapped at a coarser scale and therefore results in shifts in land use types that are unlikely to occur. For example, the existing land use data identifies most wetlands as Open Space, however in the future land use data, the wetlands are subsumed into the surrounding dominant land use class (often Agricultural). This aggregation in the future land use categories accounts for some of the forecast gains and losses in categories such as Government/Institutional, Agriculture, and Transportation/Utility/Waste Facility.

Table 3-11: Projected Land Use Change by Type. *Total acreage not equal due to differences in open water delineations

Land Use Type	Current Acres*	Projected Future Acres*	Change From Current to Future	
			Acres	Percent
Agriculture	5,521	5,761	+240	+4
Government/Institutional	638	1,268	+630	+99
Industrial	376	1,036	+660	+175
Open Space	11,927	6,577	-5,350	-45
Residential	6,490	9,013	+2,523	+39
Retail/Commercial/Mixed Use	581	2,361	+1,780	+1,780
Transportation/Utility/Waste Facility	3,304	3,266	-38	-1

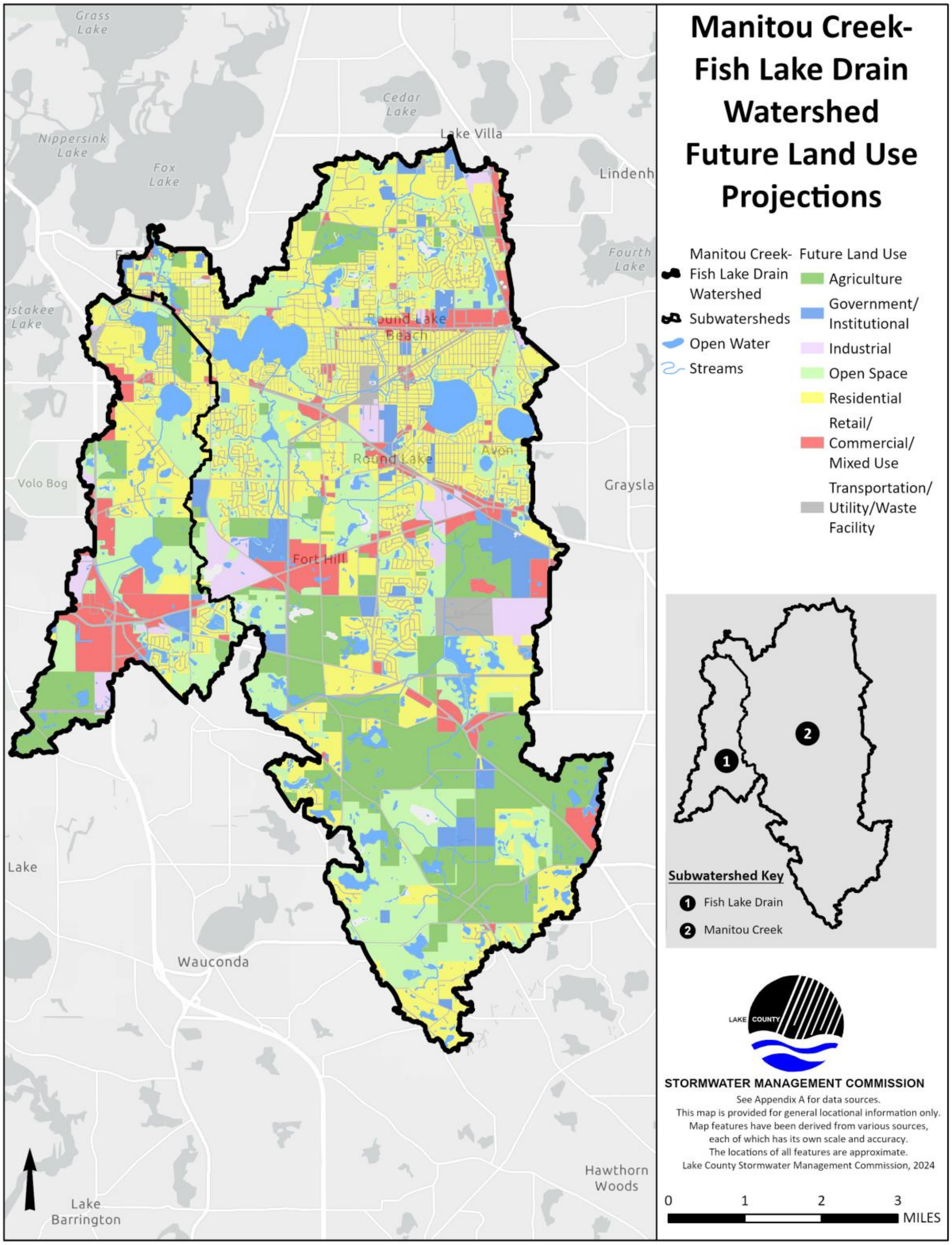


Figure 3-27: Future Land Use Projections

3.7 TRANSPORTATION

The Manitou Creek-Fish Lake Drain Watershed includes approximately 381.5 miles of roads, 67.9 miles of trails and 12.5 miles of railroads that make up the existing network of transportation corridors. Although not analyzed in detail in this section, other important components of the transportation network include the public bus transit system, parking lots, and rail stations.

3.7.1 Transportation and Nonpoint Source Pollution

Transportation corridors in the watershed connect residents to points within and outside of the watershed. "Car habitat"; the combined area of roads, parking lots, driveways and garages is prevalent in the watershed. Parking lots and roads are the largest components of car habitat and can have a significant influence on stormwater runoff and water quality. Studies have shown that streets are a major source of nonpoint source pollution in urban settings. Several factors contribute to high pollutant loading from streets. Streets are most often connected to the drainage system and tend to be the collector of stormwater runoff and pollution from sidewalks, driveways, lawns and rooftops as well as from emissions and leaks from vehicles, atmospheric deposition, and winter road maintenance practices. The design, construction, and maintenance of transportation infrastructure can have substantial beneficial and detrimental impacts on human and watershed health.

3.7.2 Transportation Infrastructure

3.7.2.1 Roads

Multiple local, county, and state entities manage approximately 381.5 miles of roadway within the watershed (Table 3-12, Figure 3-28). The roadway network includes local roads, township roads, county roads, state highways, and a U.S. highway. U.S. Highway 12 runs north-south and several major highways, inlcuding State Highways 60, 120, and 176, run roughly east-west. The largest stretch of existing major roadway in the watershed is Fairfield Road, which is 11.4 miles long.

Table 3-12: Roadway Classifications

Roadways	1- 1.5 Lanes (mile)	2- 3.5 Lane (mile)	4+ Lanes (mile)	Total Miles
U.S. Highway	0.0	7.0	0.4	7.4
State Highway	0.8	18.2	5.4	24.4
County Highway	0.2	40.3	6.8	47.3
Township Road	0.1	57.6	0.5	58.2
Local/Private Road	0.3	243.3	0.6	244.2
Total	**1.4**	**366.4**	**13.7**	**381.5**

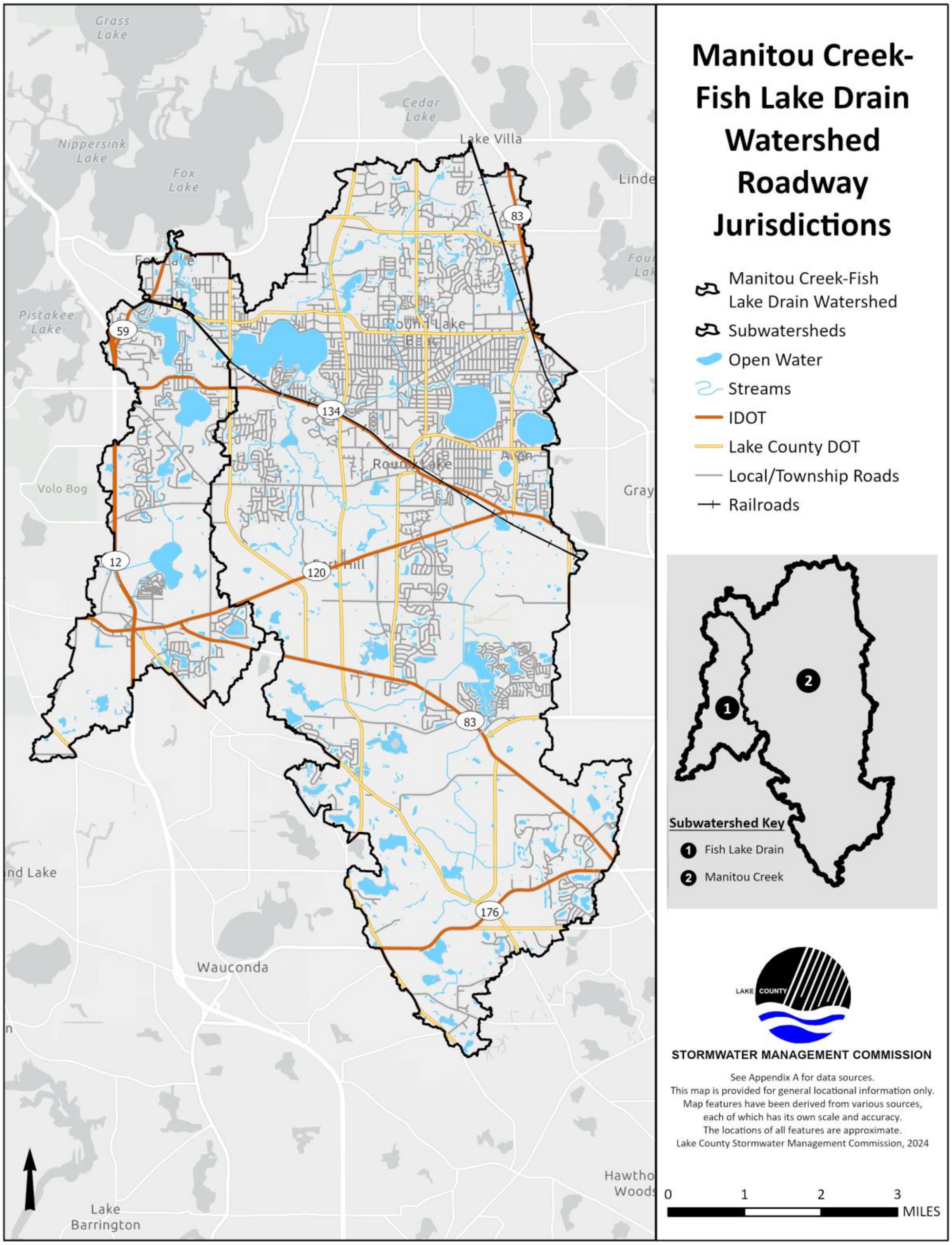


Figure 3-28: Roadway Jurisdictions

3.7.2.2 Trails

There are currently approximately 67.9 miles of mixed use trails in the Manitou Creek-Fish Lake Drain Watershed, including mowed footpaths, gravel, concrete, and asphalt trails (Figure 3-29). The largest existing trail system in the watershed is the Millenium Trail & Greenway. While the Millenium Trail & Greenway is 33 miles overall, 12 miles of the trail are within the Manitou Creek-Fish Lake Drain Watershed.

Several jurisdictions develop and manage trails in the watershed including the Forest Preserve Districts, Park Districts, Municipalities, Townships, Homeowner Associations, and Lake County Department of Transportation. Several villages and townships support trail systems along and across roadways within their jurisdiction. Park Districts also provide and maintain a trail network to connect people to parks and other community centers. The Forest Preserves provide a large trail network within forest preserves. Homeowner associations may provide neighborhood trails within the subdivision which connect to community trail systems and neighborhood parks.

3.7.2.3 Railroads

There are two major railroads that exist within the Manitou Creek-Fish Lake Drain watershed. Railroads in the watershed range from commuter rail lines to large freight rails transporting goods regionally and nationally. There is 12.5 miles of railway in the Manitou Creek-Fish Lake Drain watershed (Table 3-13).

Table 3-13: Miles of Railroad

Railroad Owner	Miles		
	Manitou Creek	Fish Lake Drain	Total Mileage
Canadian National Railway	5.2	0	5.2
Metra	6.4	0.9	7.3
Total	**11.6**	**0.9**	**12.5**

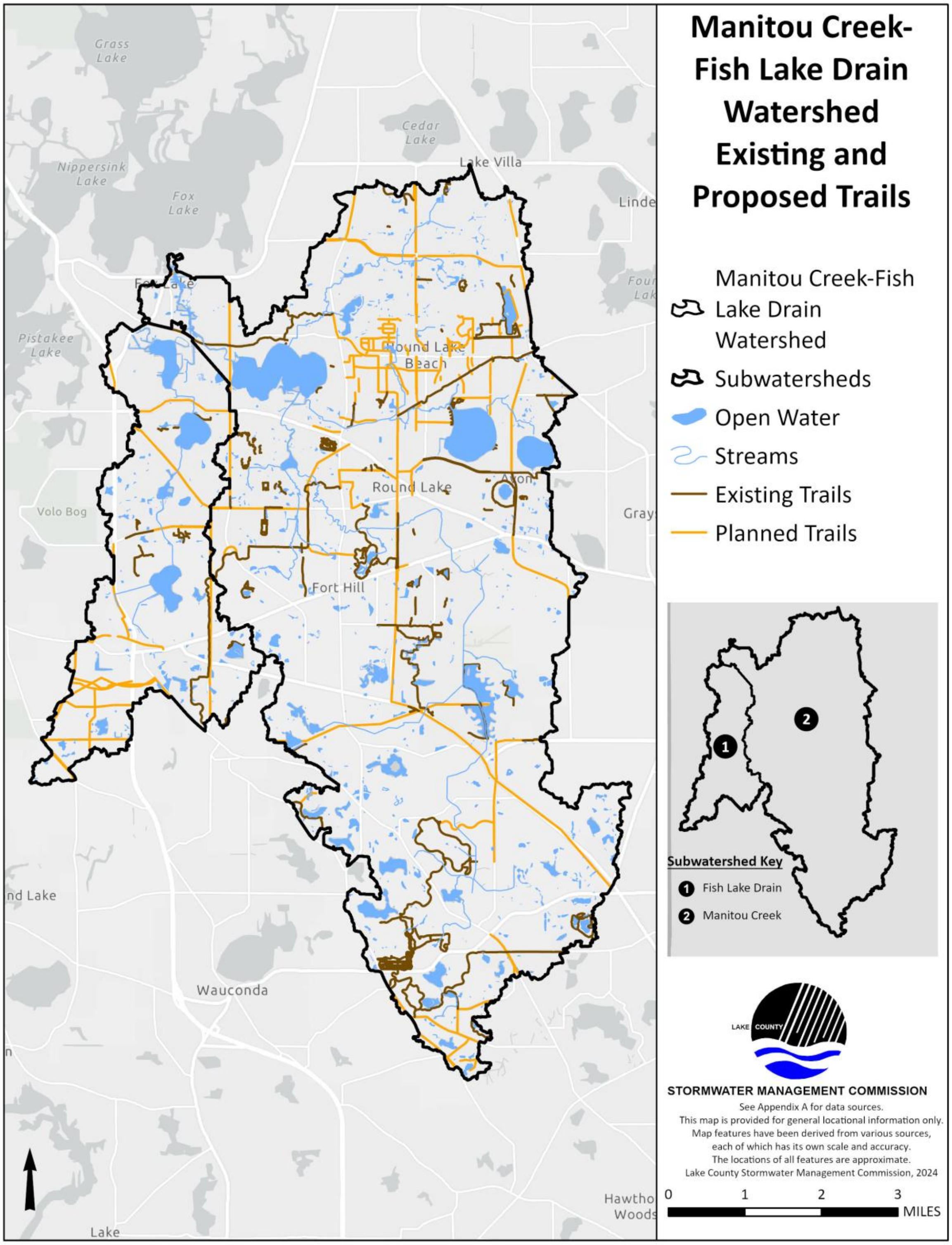


Figure 3-29: Existing and Proposed Trails

3.7.3 PLANNED TRANSPORTATION PROJECTS

The Transportation Goal is to "reduce congestion and improve transportation systems in Lake County". The strategic statement to meet this goal is to "promote development of State, County and municipal transportation systems that provide for efficient, flexible, and uncongested movement through an integrated network of road, rail, public transit, and non-motorized (bicycle, pedestrian) modes of travel.
Lake County Department of Transportation 2040 Transportation Plan (LCDOT, 2014)

Information about planned roadway improvements in the Manitou Creek-Fish Lake Drain watershed was gathered through local, regional, and state transportation contacts and from best available road planning reports. The compiled list of planned roadway improvements includes all major county, regional, and state planned projects; however, this is not an exhaustive list of all planned roadway projects in the watershed. There are likely additional local roadway improvement plans that were not captured in this analysis.

Planned roadway improvements that increase or impact the amount of existing impervious surfaces are shown in Figure 3-30. The design of rights-of-way has a substantial impact on the livability of communities' health, safety and welfare of residents, and the quality of aquatic resources. Transportation agencies face several challenges in addressing the volume of runoff from roadways and the pollutants typical in roadway runoff. A transportation jurisdiction frequently has limited control of the pollutants entering its right of way (including pollutants generated from atmospheric deposition, vehicle operation, litter, organic debris, and surrounding land uses).

3.7.3.1 Roads

There is 56.9 miles of proposed roadway, which includes roadway widening, route extensions, and roadway realignments. The largest stretch of proposed major roadway projects in the watershed are the Illinois Route 60 roadway widening (approximately 6.4 miles) and the Illinois Route 120 Bypass (Approximately 6.6 miles). Traffic congestion on the highways and roads in Lake County negatively impacts the local economy and quality of life.

The effects of impervious surface on water quantity and quality are discussed in Section 0. Road construction also increases the potential for soil erosion to nearby waters if erosion control measures are not implemented before, during, and after construction. Because runoff from transportation infrastructure may contain additional pollutants, collecting and minimizing the mobilization of this material on streets and highways is the goal of successful roadway runoff management. Common pollutants related to transportation infrastructure are listed in Table 3-14.

Table 3-14: Highway Runoff Constituents and Their Primary Sources. Source: US DOT, FHWA, Report No. FHWA/RD-84/057-060, June, 1987; USEPA 1993.

Constituents	Primary Sources
Particulates	Pavement wear, vehicles, atmosphere, maintenance
Nitrogen, Phosphorus	Atmosphere, roadside fertilizer application
Lead	Leaded gasoline (auto exhaust), tire wear (lead oxide filler material, lubricating oil and grease, bearing wear)
Zinc	Tire wear (filler material), motor oil (stabilizing additive), grease
Iron	Auto body rust, steel highway structures (guard rails etc.), moving engine parts
Copper	Metal plating, bearing and bushing wear, moving engine parts, brake lining wear, fungicides and insecticides
Cadmium	Tire wear (filler material), insecticide application
Chromium	Metal plating, moving engine parts, brake lining wear
Nickel	Diesel fuel and gasoline (exhaust), lubricating oil, metal plating, bushing wear, brake lining wear, asphalt paving
Manganese	Moving engine parts
Cyanide	Anti-cake compound (ferric ferrocyanide, sodium ferrocyanide, yellow prussiate of soda) used to keep deicing salt granular
Sodium, Calcium, Chloride	Deicing salts
Sulphate	Roadway beds, fuel, deicing salts
Petroleum	Spills, leaks or blow-by motor lubricants, antifreeze and hydraulic fluids, asphalt surface leachate
Polychlorinated Biphenyl	Spraying of highway rights-of-way, background atmospheric deposition, polychlorinated biphenyl catalyst in synthetic tires

3.7.3.2 Trails

There are 76.7 miles of proposed trail and bikeway systems in the watershed (Figure 3-29). If constructed, many of the proposed trails would connect the network of existing trails within and outside the watershed such as the Des Plaines River Trail and the Millennium Trail.

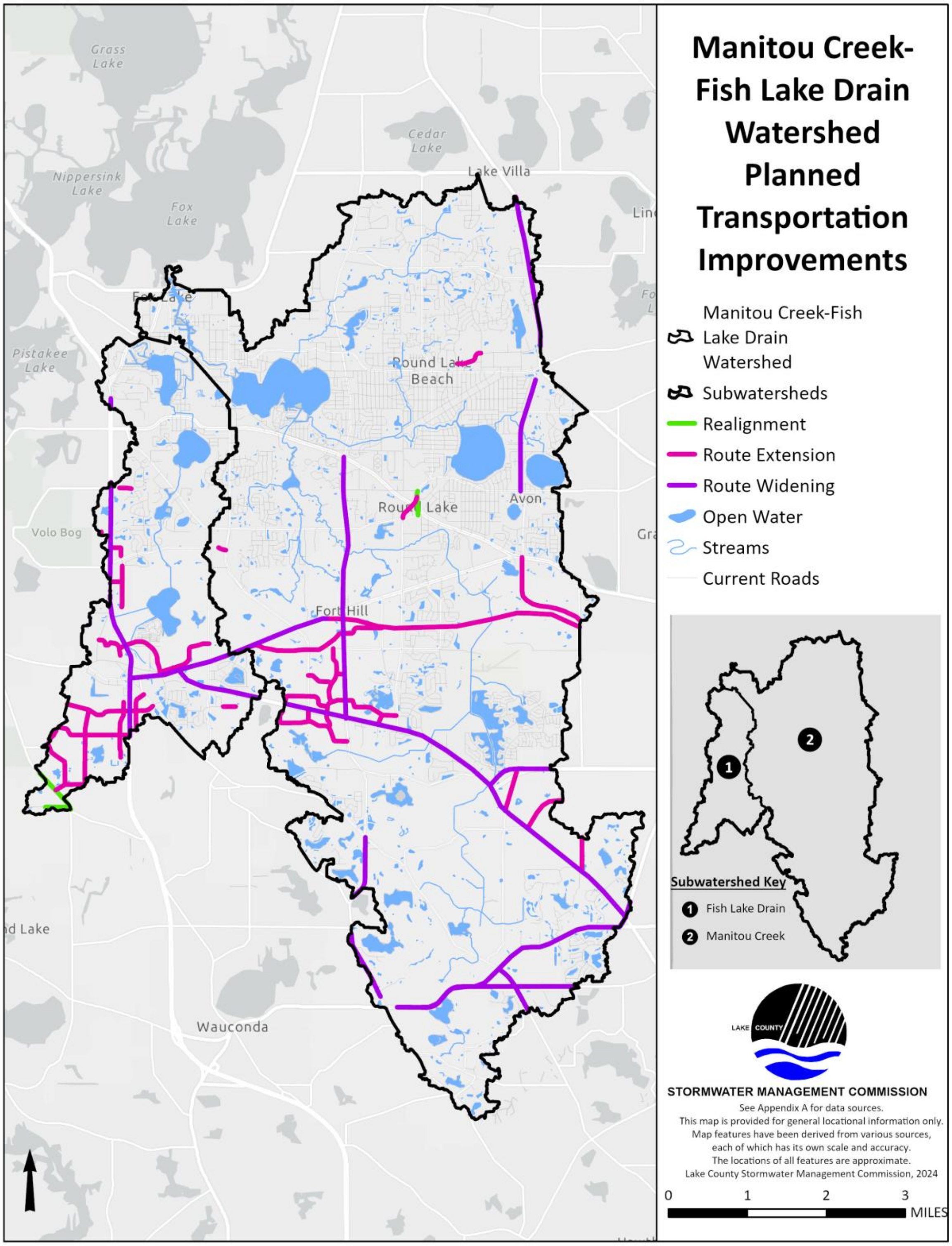


Figure 3-30: Planned Roadway Improvements

3.8 GREEN INFRASTRUCTURE

3.8.1 GREEN INFRASTRUCTURE MODEL AND STRATEGY

The Lake County Green Infrastructure Model and Strategy (GIMS) provides a more comprehensive assessment of the overall green infrastructure values in this plan. The following text is taken directly from the "project summary" (page 5) of the Lake County GIMS "Technical Report" (2017):

> *The Lake County GIMS builds on the previous efforts of the Chicago Wilderness Regional Green Infrastructure Vision through building a more refined infrastructure network model with higher resolution and more up-to-date GIS data. The GIMS also builds on the efforts of The Conservation Fund's (the Fund) support to the CMAP to access ecosystem service valuation in Lake and six other Illinois counties in its planning area. The Lake County GIMS provides a framework for identifying land conservation and restoration opportunities for the county's major native landscape types: woodland/forest. Prairie/grassland/savanna, wetlands, and freshwater aquatic systems. The primary products of the Lake County GIMS are derived GIS datasets and models, which describe and characterize the regional green infrastructure network, restoration opportunities, and ecosystem service values of this network. The derived GIS datasets include core areas, functional connections, restoration building blocks, and composite layers that combine the science-based, data driven ecological network with the inventory of protected and managed lands. Included in the functional connections are corridor linkages for woodland/forest, prairie/grassland/savanna, wetlands, and steam buffers, as well as functional connectivity within Lake County's trail network.*

For more information on the GIMS for Lake County, Illinois, please visit http://www.lcfpd.org /conservation/greenstrategy/. For more information on CMAP's Green Infrastructure Vision, please visit https://www.cmap.illinois.gov/programs/sustainability/open-space/green-infrastructure-vision.

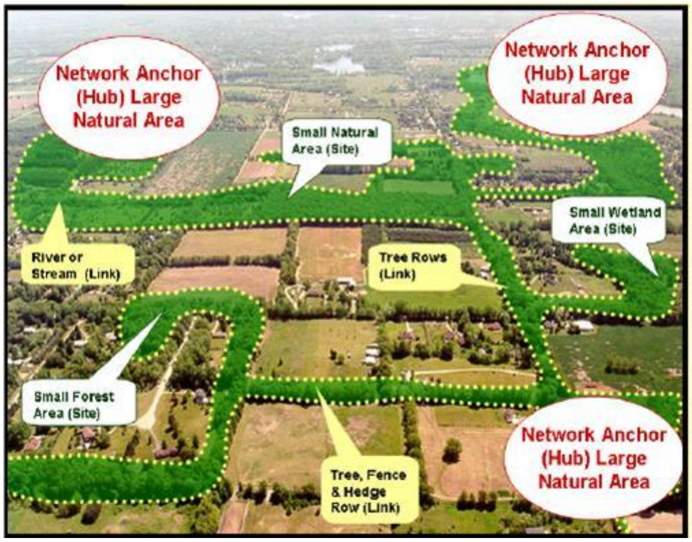
3.8.2 GREEN INFRASTRUCTURE

Green Infrastructure is a stormwater management approach that saves money, supports sustainability, and more efficiently uses limited financial and natural resources. It is achieved by capturing rain where it falls, reducing runoff volumes, and recharging groundwater supplies. By integrating natural processes into the built environment, green infrastructure provides stormwater management, flood mitigation, economic benefits, air quality improvements, and much more. Green infrastructure can be planned and implemented on local and regional scales:

- **Local scale:** Green infrastructure on a local scale consists of site-specific BMPs such as naturalized detention facilities, vegetated swales, porous pavement, rain gardens, and green roofs that are designed to maintain natural hydrologic functions by absorbing and infiltrating precipitation where it falls.

- **Regional Scale:** Green infrastructure at the regional scale consists of the interconnected network of open spaces and natural areas that mitigate stormwater runoff, naturally recharge aquifers, and improve water quality while providing recreational opportunities and wildlife habitat (Figure 3-31).

Regional scale green infrastructure aims to create an unbroken chain of natural areas and encourages planers to design interconnected hubs of natural space. This connection enhances the health of open spaces and promotes species diversity.



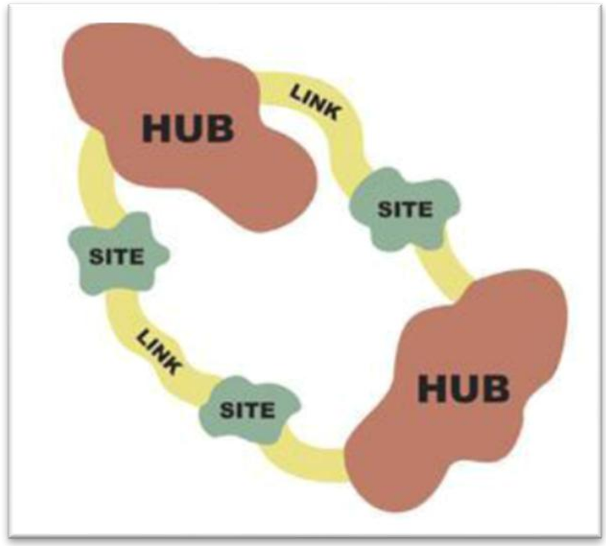


Figure 3-31: Diagram of Regional Scale Green Infrastructure

The Manitou Creek-Fish Lake Drain Watershed-Based Plan addresses quality of water resources and flood damage. Stormwater runoff is a major cause of water pollution and flooding in developed and semi-developed watersheds. Impervious surfaces such as rooftops, driveways, parking lots, and roads generate stormwater runoff that conveys pollutants to natural drainage or green infrastructure systems (ex. wetlands, lakes, and streams). Higher flows of stormwater can also cause erosion and flooding in urban streams, damaging habitat, property, and infrastructure. Since green infrastructure influences how water moves in and on the landscape, it is an important element in the Manitou Creek-Fish Lake Drain Watershed-Based Plan for assessing current and planning for future conditions. There are four goals that can be met by increasing the green infrastructure in the watershed. These summarized goals pertaining to green infrastructure are taken from Chapter 2.

1. Stream Restoration & Management: Stabilize eroding streams and address localized erosion related to infrastructure. Naturalize stream channels where possible to enhance the beneficial functions of the drainage system. Restore and manage riparian areas to enhance beneficial functions and protect property and infrastructure.
2. Flood Risk, Flood Damage & Stormwater Management: Installation of green infrastructure, including trees and bioretention, and other best management practices to lessen flooding and stream erosion. Expand, maintain, and manage constructed and natural drainage systems to mitigate flood damage and improve resilience for changing precipitation patterns.
3. Natural Resources and Habitat: Preserve, restore, and create wetlands and wetland buffers wherever possible. Identify and connect environmental corridors across community lines. Preserve, manage, and restore rare or unique habitat and natural communities in the Grants Woods, Kestrel Ridge, Kettle Grove, Lakewood, Marl Flats, Nippersink, Singing Hills, and Ray Lake Forest Preserves as well as the Gavin Bog and McLean Woods Nature Preserves. Preserve, manage, and restore rare or unique habitat and natural communities in other protected natural areas within the watershed. Protect

existing healthy trees, and plant and maintain a diversity of native trees in appropriate locations within natural and developed areas.

4. Water Quality: Installing green infrastructure and implementing BMPs to reduce nonpoint source pollution loading and erosion from existing development, re-development, and construction sites. Implementing BMPs and restoring the natural drainage system, including (where appropriate) removal, restoration or retrofitting of impoundments and piped or channelized segments in streams and reductions in impervious surfaces.

Local and regional scale green infrastructure work in concert to infiltrate and store precipitation, thereby reducing the amount of stormwater runoff and the need to treat the water. Green infrastructure also brings many other environmental, social, and economic benefits. These benefits promote livability by improving the environment and preserving open space, which supports sustainable communities.

3.8.3 Hubs & Functional Connections

The hubs and functional connection analysis for the Manitou Creek and Fish Lake Drain watersheds used existing data from GIMS.

There is approximately 12,254 acres (or 39% of the watershed) of hubs and functional connections in the watershed (Table 3-15). Many of the identified functional connections follow streams and lakes as well as trails systems and serve as natural riparian areas and greenway connections to hubs. Major roadways may act as barriers to functional connections between hubs.

Enhancing and protecting functional connections along riparian areas, especially those adjacent to unprotected stream sections, will improve water quality and help preserve and enhance biodiversity. Riparian functional connection buffers should be restored to widths that benefit not only water quality but also benefit aquatic and terrestrial life. Functional connections identified within open space can be restored to natural land cover types more easily. Furthermore, enhancing existing and restoring/creating wetlands within functional connections will mitigate impacts from stormwater, improve water quality, and provide critical habitat. Figure 3-32 shows locations of hubs and functional connections throughout the watershed.

Table 3-15: Hub and Functional Connection Total Area

Subwatershed	Area (acre)	Percent Of Subwatershed	Percent Of Watershed
Fish Lake Drain	1,801	32%	6%
Manitou Creek	10,453	41%	33%
Total	**12,254**	**-**	**39%**

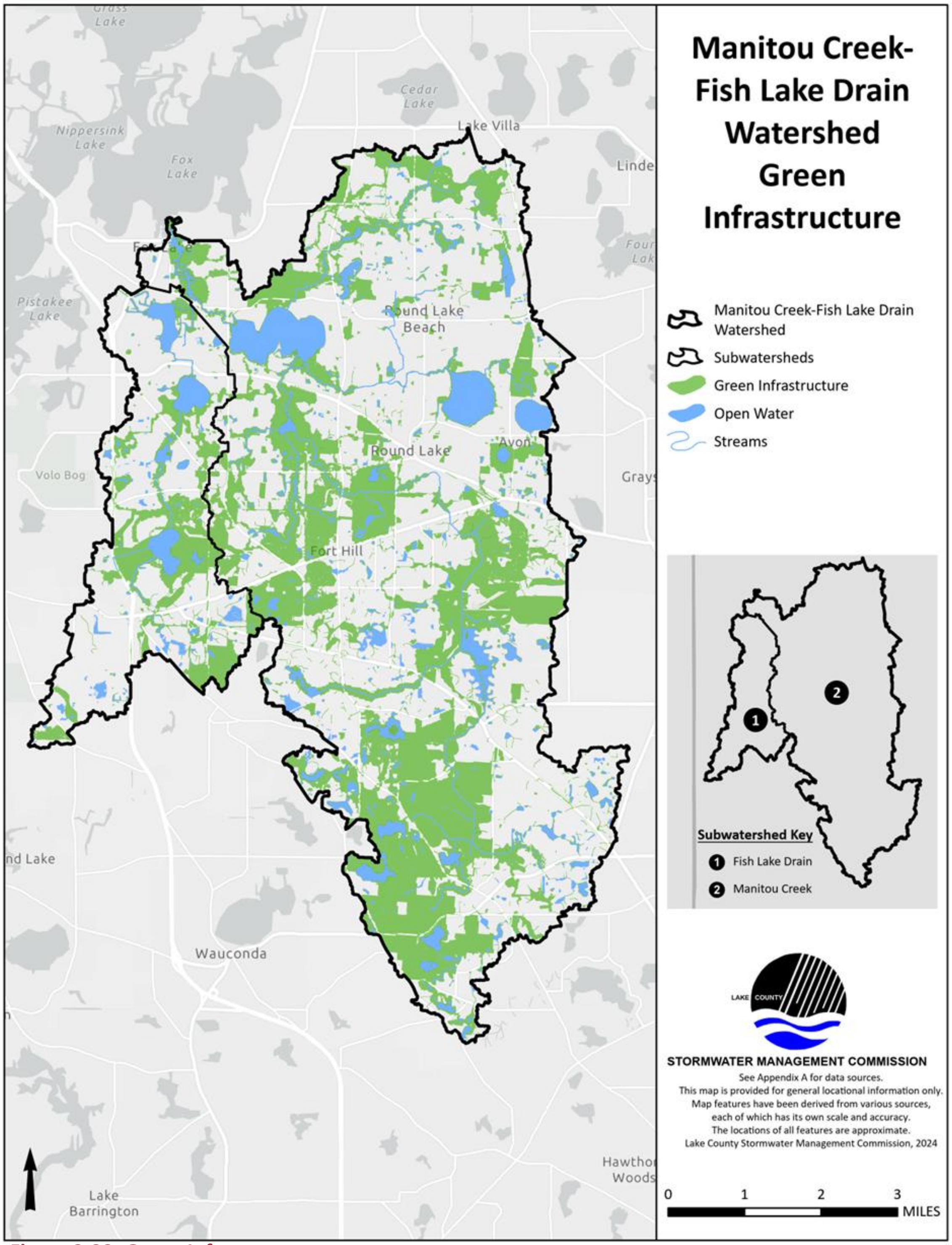


Figure 3-32: Green Infrastructure

3.8.4 Protection Status

Protected and managed land differs from unprotected land because it can't be utilized for developed land uses. The land is either permanently chartered as open land or in a permanent deed restriction such as a conservation easement. Publicly protected and managed lands include forest preserve districts, state nature preserves, and park districts. Privately protected and managed lands include homeowners/business association-owned land with deed restrictions or conservation easements, and land owned by land trusts and other conservation organizations. The conversion of open space to other uses reduces the watershed benefits provided by open land. Conversion of open space to traditionally developed land uses may increase runoff, water quality degradation, and loss of wildlife habitat area and connectivity.

This section identified Protected and Managed Lands using the following data sources:

1. Citizens for Conservation (Data Source: Prairie State Conservation Coalition)
2. Conserve Lake County (Data Source: Prairie State Conservation Coalition)
3. Illinois Department of Natural Resources (IDNR): Illinois Natural Area Inventory (INAI)
4. Lake County Forest Preserve District
5. National Conservation Easement Database
6. Protected Areas Database of the US - CBI Edition 2.1, 2016, (Data Source: USGS)
7. Municipal Parks

The following sources were also checked, but no data was found within the watershed planning boundary.

1. *IDNR: State Park*
2. *Illinois Department of Transportation Mitigation Banks*
3. *Regional In-Lieu Fee and Bank Information Tracking System.*

Table 3-16 represents the acres and percent of protected and managed lands in each of the two subwatersheds and Figure 3-33 represents the geographic distribution.

Table 3-16: Protection Status Summary

Subwatershed	Area (acre)	Percent of Subwatershed	Percent of Watershed
Fish Lake Drain	914	16%	3%
Manitou Creek	5,592	22%	18%
Total	**6,506**		**21%**

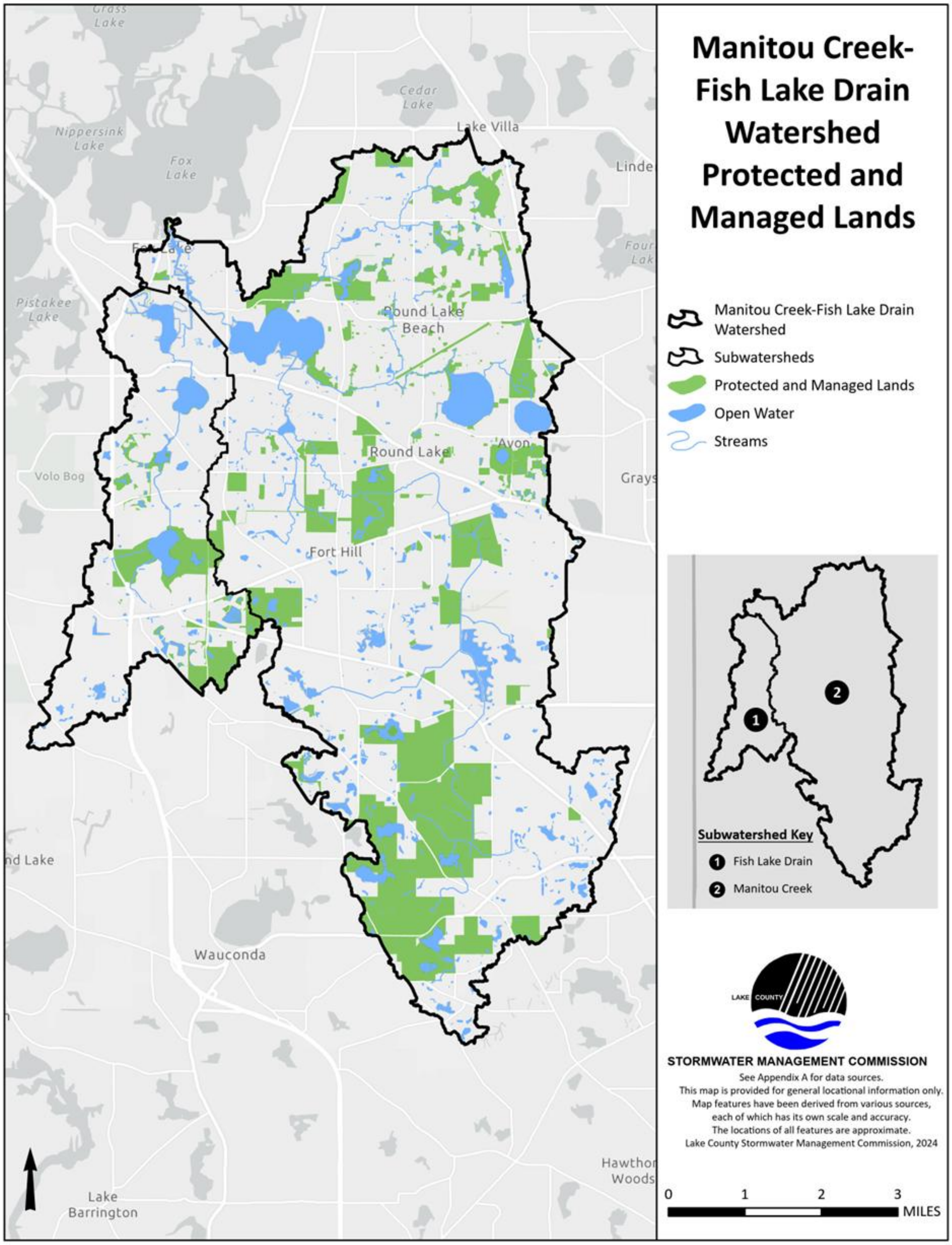


Figure 3-33: Protected and Managed Lands

3.8.5 Restoration Opportunities

The Lake County GIMS identifies “restoration building blocks” based on landscape type (Allen et al., 2016). Other areas of potential restoration can be gleaned from the 2008 Fish Lake Drain Watershed-Based Plan Update and the 2004 Manitou Creek Watershed Plan.

Green Infrastructure related recommendations represented in the 2008 Fish Lake Drain watershed-based plan update include the following five goals:

Goal 1: Improve Water Quality and Stream, Lake, and Wetland Resources.
Goal 2: Identify and Mitigate Existing Watershed Flooding Problems.
Goal 3: Prevent Negative Impacts of New Development on Flooding and Watershed Resources.
Goal 4: Provide Tools to Implement Watershed Protection and Enhance Measures.
Goal 5: Evaluate Success in Plan Implementation.

Green Infrastructure related recommendations represented in the 2004 Manitou Creek watershed plan include the following five goals:

Goal 1: Reduce existing flood damage potential and prevent the creation of increased flood damage potential.
Goal 2: Improve water quality in the watershed’s streams and lakes.
Goal 3: Preserve, protect, and enhance existing natural areas; and restore or create new, sustainable natural areas.
Goal 4: Develop and utilize tools for Plan implementation.
Goal 5: Involve the public in the use and stewardship of the Manitou Creek watershed.

Table 3-17 lists the restoration building block layers used in the GIMS. Figure 3-34 represents mapped restoration opportunities in the Manitou Creek and Fish Lake Drain watersheds.

Table 3-17: GIMS Restoration Building Blocks Data Layers

GIMS Restoration Building Block
Forest_Sites
Forest_Restoration
PGS_Restoration
Wetland_Sites
Wetland_Complexes
Water_AllBuffer*
Water_FreshWaterSystems

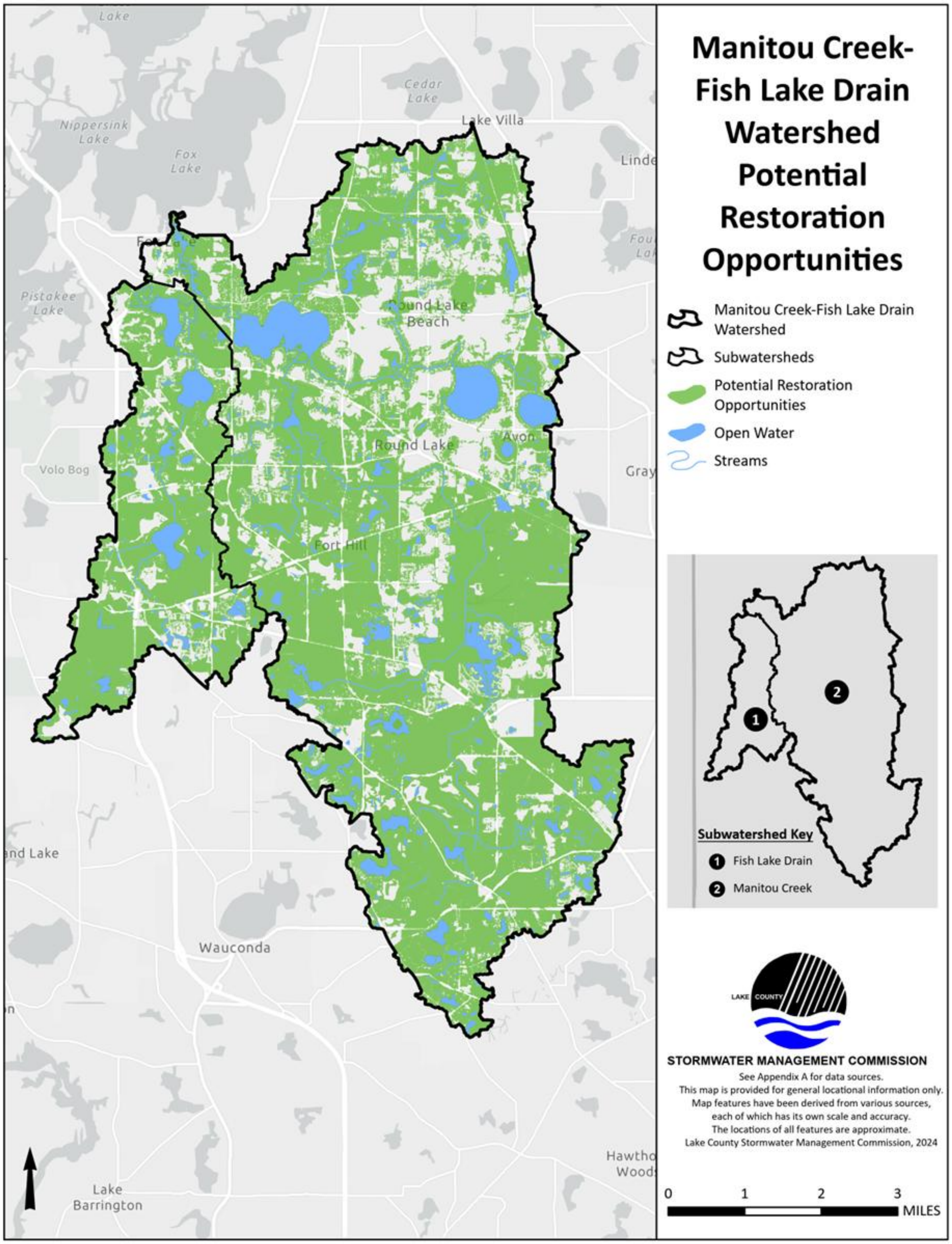


Figure 3-34: Restoration Opportunities

3.9 PARKS AND RECREATION

3.9.1 PARKS AND OPEN SPACE

One hundred and eight (108) parks totaling approximately 1,266 acres were identified within the Manitou Creek-Fish Lake Drain watershed. For the purposes of this plan, "parks" are defined as publicly owned open space not owned by a Forest Preserve District, including all open space owned by park districts, municipalities, townships, and the State of Illinois. Management, programming, and use of these lands is varied, and includes active and passive recreation, wildlife management, and fishing. This plan does not include golf courses in this definition (see Section 0). The average mean park size is approximately 11.7 acres. The number of parks per jurisdiction is presented in Table 3-18 and all park locations are displayed in Figure 3-35.

Table 3-18: Summary of Parks by Jurisdiction

Jurisdiction	Number Of Parks	Acres	Percent of the Watershed
Avon Township	2	3.4	0.01%
Fox Lake	4	4.2	0.01%
Grant Township	2	25.3	0.08%
Grayslake	6	19.1	0.06%
Hainesville	6	147.8	0.47%
Lake Villa	4	17.5	0.06%
Mundelein	1	1.0	<0.01%
Round Lake	22	194.7	0.62%
Round Lake Beach	34	404.9	1.29%
Round Lake Heights	7	126.8	0.40%
Round Lake Park	10	81.3	0.26%
Volo	7	224.0	0.71%
Wauconda	3	16.1	0.05%
Total	**108**	**1,266**	**4.04%**

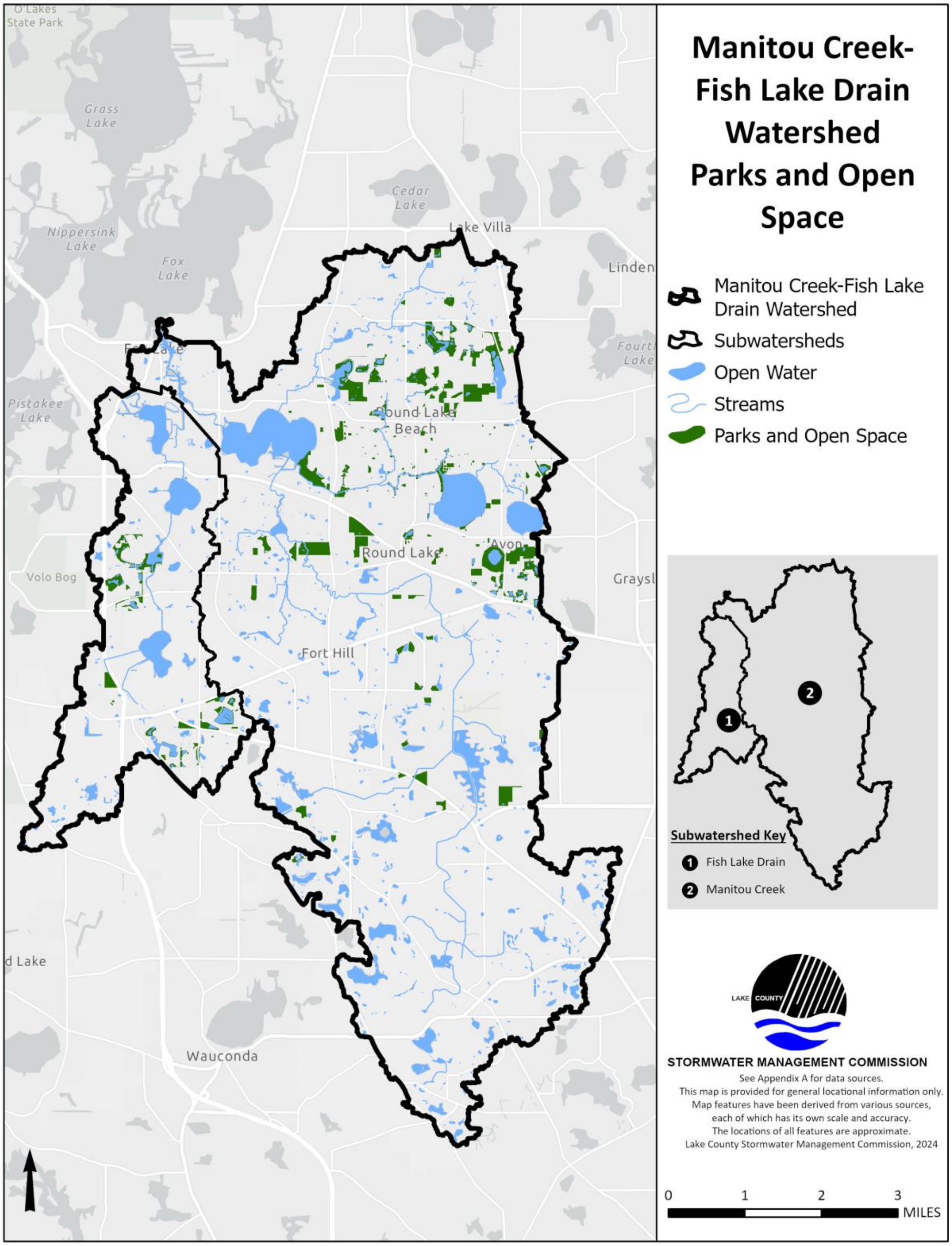


Figure 3-35: Parks and Open Space

3.9.2 GOLF COURSES

Six golf courses totaling approximately 661 acres are located within the Manitou Creek-Fish Lake Drain watershed (Table 3-19) (Figure 3-36). Stormwater runoff from many of these golf courses flows directly into the tributaries and open waters. Landscaping and maintenance practices at golf courses directly impact the watershed. While fertilizers and pesticides maximize productivity and performance of turf grass, the watershed may be at risk from spills of concentrated chemicals used to mix fertilizers and pesticides for application. Of the many nutrients applied to golf turf and the primary contaminants of concern in fertilizers are nitrogen and phosphorus, which contribute to algal growth and the impairment of water.

Pesticides may be toxic to aquatic and terrestrial systems depending on their solubility, toxicity, and chemical breakdown rate. Other potentially hazardous materials, such as fuels and paints that are used in everyday operation and maintenance, can contaminate water quality accidentally. Golf course BMPs should be followed for maintenance operations to prevent contamination from accidental releases. Another significant source of pollution from golf courses are waterfowl. Shallow ponds surrounded by mowed turf grass attract significant populations of waterfowl. Deposits of fecal matter by resident and migrating waterfowl (primarily Canada geese) may contribute to high levels of fecal coliform in the watershed.

Table 3-19: Summary of Golf Courses by Jurisdiction

Jurisdiction	Number of Golf Courses	Acres	Percent of the Watershed
Fremont Township	1	257.5	0.8%
Lake Villa Township	1	26.5	0.1%
Wauconda Township	1	176.5	0.6%
Village of Hawthorn Woods	1	27.2	0.1%
Village of Round Lake Beach	1	140.1	0.4%
Village of Mundelein	1	33.5	0.1%
Total	**6**	**661.3**	**2.1%**

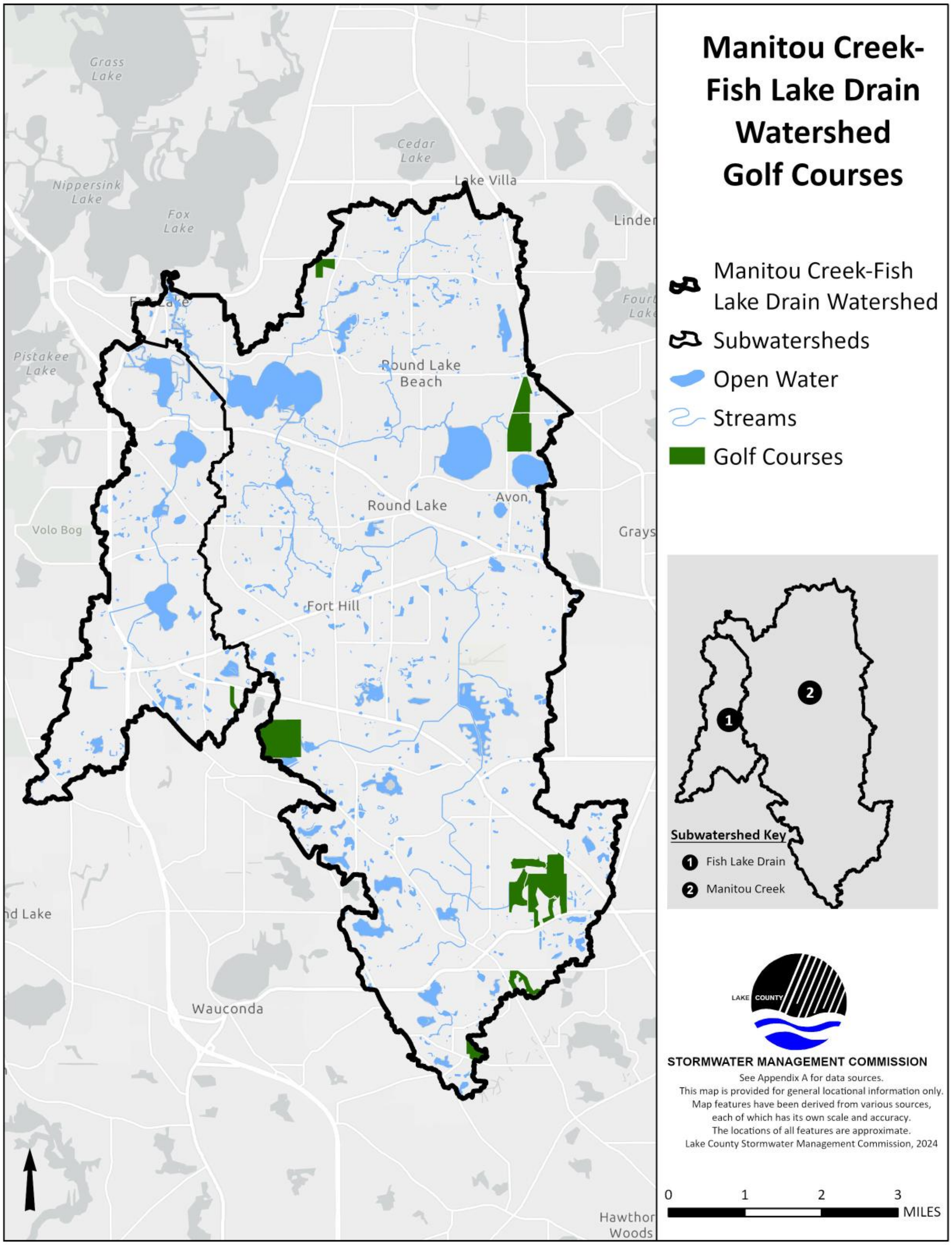


Figure 3-36: Golf Courses

Recommended BMPs for golf courses (Cornell University, 2014) include:

- *Maintain a 100-foot buffer around waterways for chemical storage and mixing. Storage areas should have a raised berm on all sides and an impervious surface for containment. Facilities should be equipped with "spill containment material".*
- *Grass clippings and debris removed from equipment should be disposed of properly and not released into waterways.*
- *Determine accurate supplemental nutrient needs based on soil chemical and physical analysis.*
- *Assess nutrient application efficiency through regular equipment calibration.*
- *Maintain turf with high shoot density to minimize runoff and maximize infiltration.*
- *Manage the surface accumulation of organic matter to maintain a permeable system that minimizes runoff and maximizes subsurface retention.*
- *Select turf that is well adapted to site conditions. Well adapted species require reduced amounts of fertilizer and pesticides, and if selected for drought tolerance, requires less water to survive and maintain playability.*
- *Minimize the amount of fertilizer and chemicals used during the establishment phase as establishing turf does not provide the needed uptake to prevent runoff and leaching.*
- *Implement methods such as core cultivation, deep slicing and water injection to alleviate soil compaction and remove organic material, resulting in increased infiltration and reduced runoff.*
- *Utilize proper topdressing material to maintain permeable turf.*
- *Utilize a combination of preventative and reactive strategies to manage pest problems. Select management options according to site conditions instead of the calendar.*
- *Establish wetland fringes around ponds to reduce populations of geese (geese prefer open water with closely mowed, visible banks so they can see predators approaching).*

3.10 NATURAL AREAS

3.10.1 Nature Preserves, Forest Preserves, and High-Quality Natural Areas

There are eight forest preserve and three nature preserve areas totaling 3,787 acres in the Manitou Creek-Fish Lake Drain watershed (Tables 3-20 and 3-21) (Figure 3-37). All three nature preserves are located in Lake County Forest Preserves. Forest and nature preserve areas are key components of the system of hubs and links creating the regional green infrastructure system that provides substantial flood damage reduction as well as water quality, habitat, and quality of life benefits in the Manitou Creek-Fish Lake Drain watershed.

Table 3-20: Forest Preserves

Site	Acres
Grant Woods Forest Preserve	345
Kestrel Ridge Forest Preserve	135
Kettle Grove Forest Preserve	236
Lakewood Forest Preserve	1,222
Marl Flat Forest Preserve	206
Nippersink Forest Preserve	324
Ray Lake Forest Preserve	1,158
Singing Hills Forest Preserve	163
Total:	3,787

Table 3-21: Nature Preserves

Site	Acres	Acres In Forest Preserve
Gavin Bog and Prairie Nature Preserve	48	48
McLean Woods and Wetlands Nature Preserve	435	435
Schreiber Lake Bog	355	355
Total:	838	838

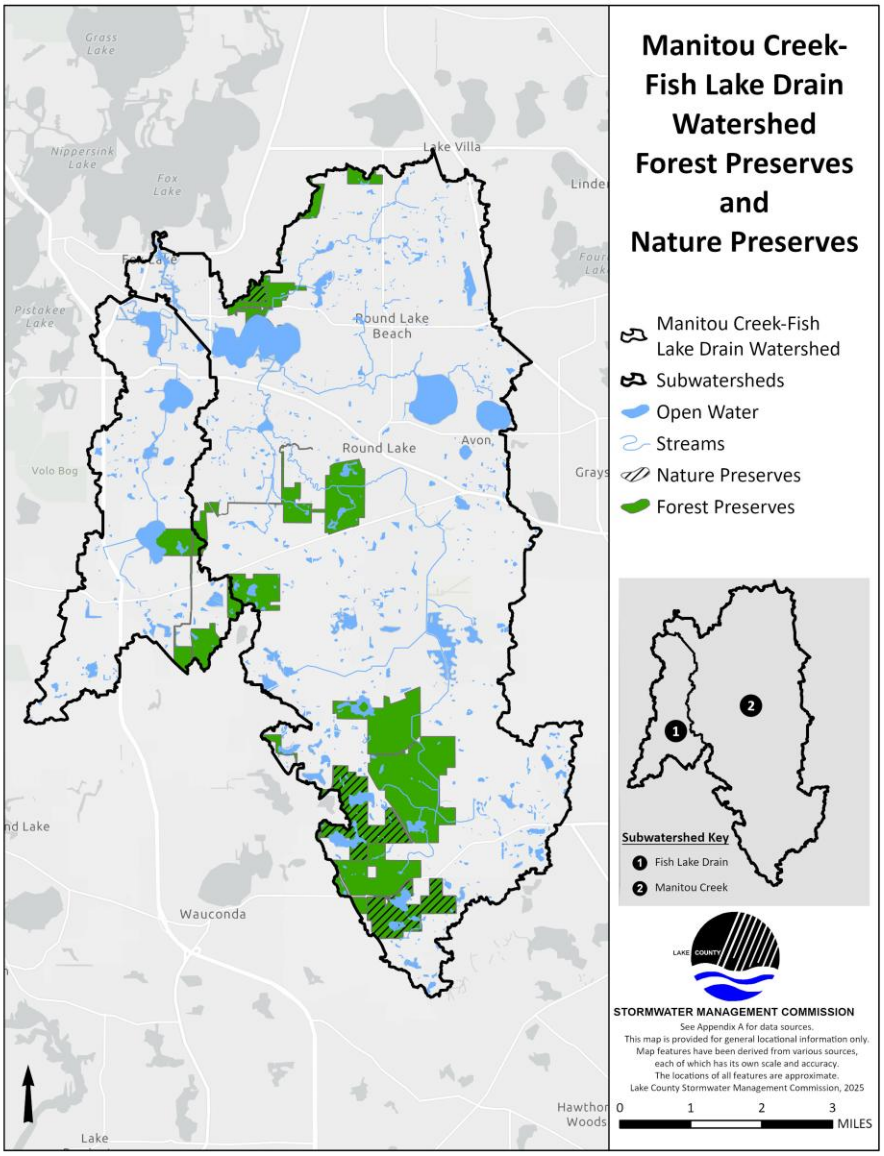


Figure 3-37: Forest and Nature Preserves

3.10.2 Threatened and Endangered Species

High quality natural resources in the Manitou Creek-Fish Lake Drain watershed include **threatened** and **endangered** species and communities, rare habitats, and important natural areas, including natural area inventory sites, forest preserves, nature preserves, and high quality **ADID** wetlands. There is one Federally endangered species (Rusty Patched Bumble Bee) that has been observed in the watershed.

Thirty-six (36) threatened and endangered species were listed in the watershed including 24 vascular plant species, 11 vertebrate animal species, and one invertebrate animal species (Table 3-22). There are six terrestrial communities and one animal assemblage within the watershed; no formal status is assigned to natural communities or assemblages.

Ecologically significant and protected areas provide habitat for threatened or endangered species and contain examples of high-quality natural communities. These areas include ADID (high quality) wetlands, INAI sites, forest preserves, and nature preserves.

ENDANGERED SPECIES: A species in danger of extinction throughout all or a substantial portion of its range.

THREATENED SPECIES: A species likely to become endangered soon.

ADID SITES: Aquatic sites that have been determined to provide biological value by the United States Army Corps of Engineers (USACE), Chicago District and the USEPA.

Noteworthy: Identifying High Quality Natural Resources

The Illinois Natural Heritage Database provides information on the presence of the state's threatened and endangered plants and animals, INAI sites, Illinois Nature Preserves, and Forest Preserve lands. The database's information was gathered from the INAI inventory (conducted in the mid 1970's), as well as by IDNR biologists, resource managers, and volunteers. Lake County threatened and endangered species information was also assembled during LCHD-ES water quality and plant sampling of the lakes, in addition to 20 years of threatened and endangered species data from the Lake County Forest Preserve District queried through the IDNR Element Occurrence Records reports.

Table 3-22: Illinois Listed Threatened and Endangered Species

Scientific Name	Common Name	Type	Status
Amelanchier interior	Shadbush	Vascular Plant	Threatened
Bombus affinis	Rusty Patched Bumble Bee	Invertebrate Animal	Endangered (Federal and State)
Calcareous floating mat	Calcareous floating mat	Terrestrial Community	--
Carex aurea	Golden Sedge	Vascular Plant	Threatened
Carex brunnescens	Brownish Sedge	Vascular Plant	Endangered
Carex chordorrhiza	Cordroot Sedge	Vascular Plant	Endangered
Carex crawfordii	Sedge	Vascular Plant	Endangered
Carex cryptolepis	Sedge	Vascular Plant	Threatened
Carex echinata	Sedge	Vascular Plant	Endangered
Carex trisperma	Three-seeded Sedge	Vascular Plant	Endangered
Carex viridula	Little Green Sedge	Vascular Plant	Threatened

Scientific Name	Common Name	Type	Status
Chamaedaphne calyculata	Leatherleaf	Vascular Plant	Threatened
Chlidonias niger	Black Tern	Vertebrate Animal	Endangered
Cypripedium parviflorum	Small Yellow Lady's Slipper	Vascular Plant	Endangered
Drosera rotundifolia	Round-leaved Sundew	Vascular Plant	Endangered
Elymus trachycaulus	Bearded Wheat Grass	Vascular Plant	Endangered
Emydoidea blandingii	Blanding's Turtle	Vertebrate Animal	Endangered
Fundulus dispar	Starhead Topminnow	Vertebrate Animal	Threatened
Gallinula galeata	Common Gallinule	Vertebrate Animal	Endangered
Graminoid bog	Graminoid bog	Terrestrial Community	--
Graminoid fen	Graminoid fen	Terrestrial Community	--
Ixobrychus exilis	Least Bittern	Vertebrate Animal	Threatened
Juncus alpinoarticulatus	Richardson's Rush	Vascular Plant	Threatened
Larix laricina	Tamarack	Vascular Plant	Endangered
Lathyrus ochroleucus	Pale Vetchling	Vascular Plant	Threatened
Mesic prairie	Mesic prairie	Terrestrial Community	--
Notropis heterodon	Blackchin Shiner	Vertebrate Animal	Threatened
Notropis heterolepis	Blacknose Shiner	Vertebrate Animal	Endangered
Nycticorax nycticorax	Black-crowned Night-Heron	Vertebrate Animal	Endangered
Pandion haliaetus	Osprey	Vertebrate Animal	Threatened
Potamogeton gramineus	Grass-leaved Pondweed	Vascular Plant	Threatened
Potamogeton praelongus	White-stemmed Pondweed	Vascular Plant	Endangered
Potamogeton robbinsii	Fern Pondweed	Vascular Plant	Endangered
Rhynchospora alba	Beaked Rush	Vascular Plant	Endangered
Rookery	Rookery	Animal Assemblage	--
Sterna hirundo	Common Tern	Vertebrate Animal	Endangered
Utricularia minor	Small Bladderwort	Vascular Plant	Endangered
Vaccinium macrocarpon	Large Cranberry	Vascular Plant	Endangered
Vaccinium oxycoccos	Small Cranberry	Vascular Plant	Endangered
Veronica scutellata	Marsh Speedwell	Vascular Plant	Threatened
Wet prairie	Wet prairie	Terrestrial Community	--
Wet-mesic prairie	Wet-mesic prairie	Terrestrial Community	--
Xanthocephalus xanthocephalus	Yellow-headed Blackbird	Vertebrate Animal	Endangered

3.11 WETLAND INVENTORY

European settlers to the region altered much of the Manitou Creek-Fish Lake Drain watershed's natural hydrology and wetland processes. They drained wet areas, channelized streams, plowed prairie land, and cleared forests. Even after these alterations, the underlying soil retains clues to its prior condition. Hydric soils (soils that remain wet for an extended period) can help identify the locations of pre-settlement wetlands.

Several wetland types exist in the watershed. These wetlands are characterized based on the location in the landscape, soil, vegetation, and hydrology. Marshes, often a mix of emergent vegetation and open water, are probably the most recognizable wetland type in the watershed and form in many different landscapes, including in isolated depressions and along stream corridors. Wet meadows (areas with saturated soil conditions for much of the year) were once a common wetland type in the watershed but have been reduced since the time of European settlement because of drainage and agriculture. Vernal pools (forested wetland pockets that hold standing water during spring and early summer) can be found in the woodlands.

The first comprehensive effort to inventory and map wetland resources in the watershed was the National Wetlands Inventory, undertaken by the U.S. Fish and Wildlife Service (USFWS) in the mid-1980s. National Wetland Inventory maps initially were developed by interpreting high-altitude aerial photographs using stereoscope, pen, and ink. Image interpretation for the National Wetland Inventory has evolved to now use geospatial software. In 1990 a countywide wetland mapping effort was undertaken. The

NOTEWORTHY: HIGH FUNCTIONALITY (ADID) WETLANDS

In 1992, Lake County implemented the ADID process to identify high functionality wetlands that should be protected. The ADID program is a USEPA program developed to shorten permit processing time and provide information to local governments to aid in zoning, permitting and land acquisition decisions. Three primary functions were used by the USEPA and USACE to evaluate wetlands during the ADID process: biological functions (i.e., threatened or endangered species, wildlife habitat, and plant species diversity), hydrologic functions (i.e., stormwater storage), and water quality mitigation functions (i.e., sediment and toxicant retention, shoreline/bank stabilization).

NOTEWORTHY: LAKE COUNTY WETLAND INVENTORY

The *Lake County Wetland Inventory (LCWI)* was originally developed in 1993 by a multi-agency team using a combination of information sources, including wetland inventory maps and the 1970 Soil Survey of Lake County by the United States Department of Agriculture-Soil Conservation Service, National Wetland Inventory maps by the USFWS, and various years of aerial photography. The LCWI was updated in 2002 using high resolution aerial photography and enhanced with Lake County GIS topographic information. The updated 2002 LCWI maps identify five different wetland types: *wetlands, farmed wetlands*, *artificial wetlands*, *converted wetlands*, and *Advance Identification wetlands*. The LCWI is intended to improve the understanding and management of the County's wetland resources.

NOTEWORTHY: WETLAND RESTORATION AND PRESERVATION PLAN

The WRAPP was adopted by SMC and the Lake County Board in 2020. Its dataset reflects enhancements of the 2002 LCWI maps using high resolution aerial photography and LiDAR collected since 2002, as well as existing information from the Lake County ADID study, soil surveys, and other available mapping products. Each WRAPP polygon was enhanced with descriptors associated with the National Wetlands Inventory classification system and *hydrogeomorphology*. Using this combined information, the WRAPP estimates the functions (services) of mapped wetland and water resources for both existing and pre-settlement conditions within Lake County. The WRAPP supports watershed-based assessments of wetland function, identifies locations of *potentially restorable wetlands,* and identifies opportunities for *wetland enhancement* and *preservation*. The WRAPP includes an on-line decision support tool (DST) to help users prioritize restoration and preservation opportunities based on acreage, wetland function or functional loss, allowing the user to make informed decisions on wetland restoration and preservation options targeted to user-specific goals and objectives.

Lake County Wetland Inventory (LCWI) was initially published in 1993, comprehensively updated in 2002, and the current version has a publication date of 2009.

While National Wetlands Inventory offers a classification of wetland areas based on vegetation and hydrology, in 1992, the USEPA completed an Advanced Identification (ADID) study of high-functioning wetlands in Lake County using the LCWI as a base. The ADID study identified about 200 wetland complexes in the county that were predicted to have high ecological stormwater management, and water quality enhancement functionality. Thirty-nine (39) wetland complexes totaling 2,208 acres have been identified as high-quality wetlands in the Manitou Creek-Fish Lake Drain watershed through the ADID process. The three primary functions evaluated were:

- Ecological value based on wildlife habitat quality and plant species diversity.
- Hydrologic functions such as stormwater storage value and/or shoreline/bank stabilization value.
- Water quality values such as sediment/toxicant retention and nutrient removal/transformation function.

The Lake County Wetland Restoration and Preservation Plan (WRAPP), which builds on these previous studies, provides the most current iteration of wetland resources and their functionality within the county. According to the WRAPP, approximately 4,313 acres or 48% of the pre-settlement wetlands remain in the watershed, along with 2,277 acres of streams, lakes and ponds. The estimated historic wetland loss in the watershed (52%) is less than the overall estimated wetland loss Lake County (55%). The Lake County WRAPP estimates that wetlands comprise approximately 14% of the total area of the watershed, which is similar to the percentage of wetlands relative to the total land area of Lake County (13%). Figure 3-38 depicts the location of wetlands in the watershed and Figure 3-39 depicts the location of potentially restorable wetlands in the watershed, as documented in the WRAPP.

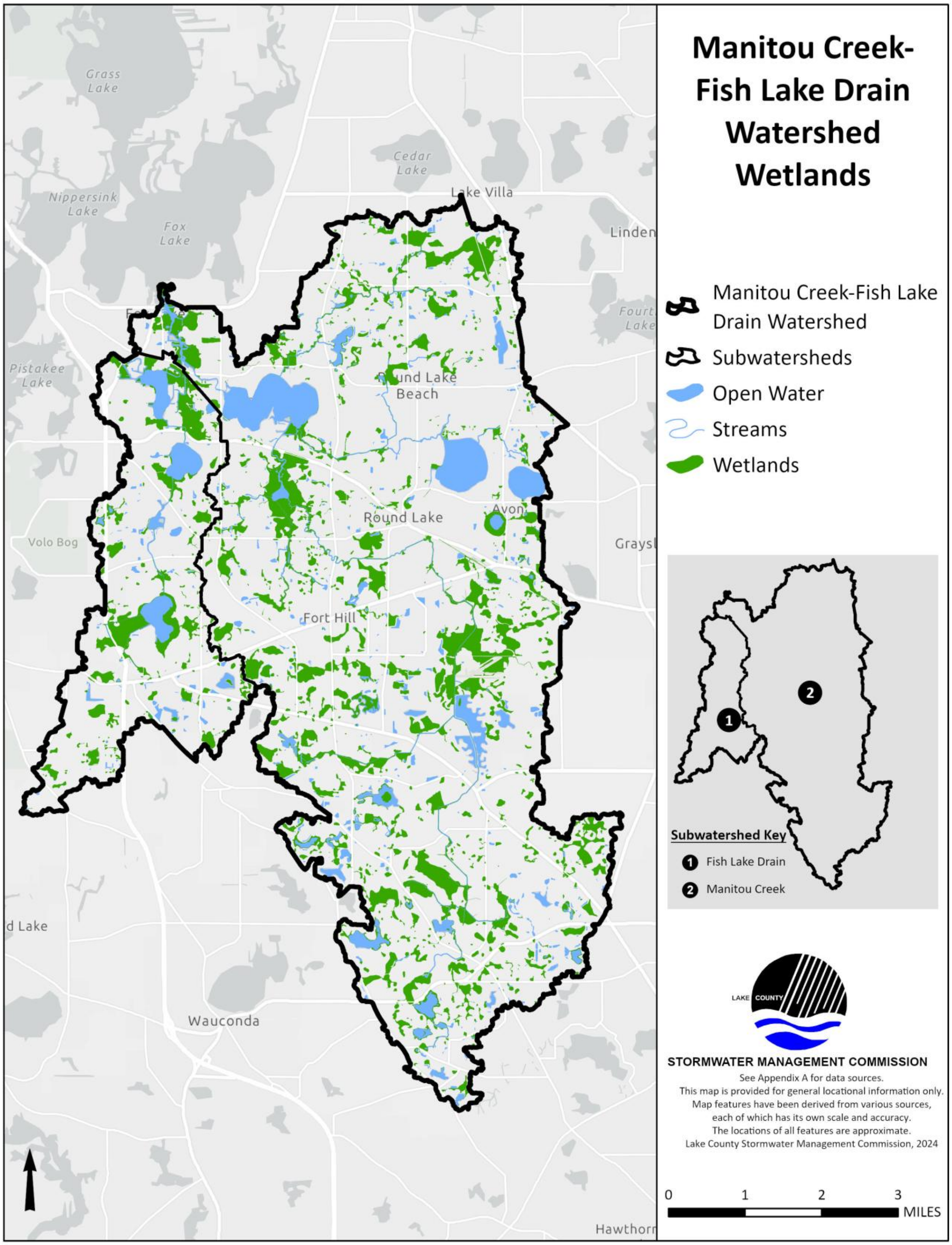


Figure 3-38: Existing Wetland Locations

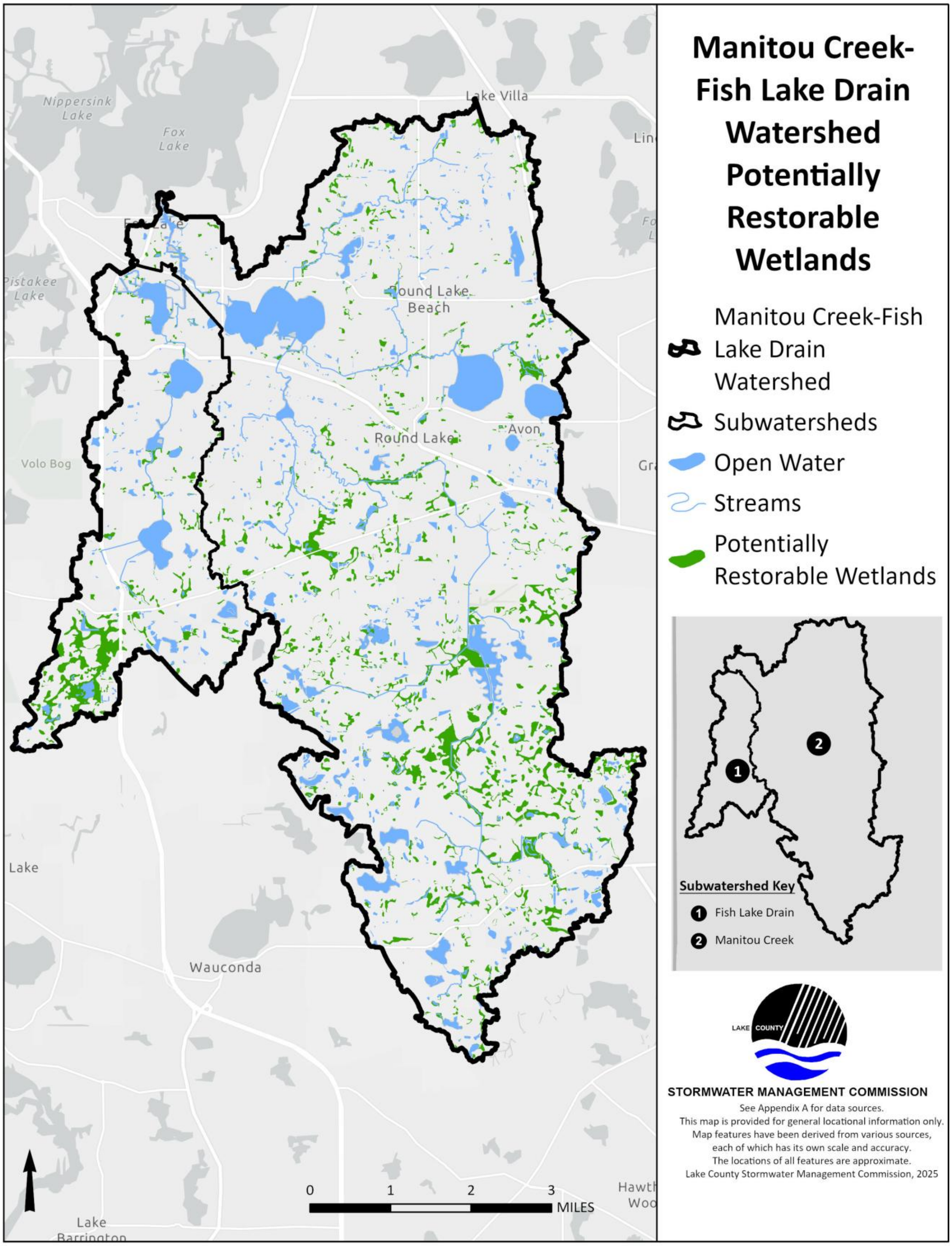


Figure 3-39: Potentially Restorable Wetlands

3.11.1 Wetland Function

Wetlands filter sediments and nutrients from runoff, provide wildlife habitat, reduce flooding, and help maintain water levels in streams. They also provide areas where groundwater is recharged by surface water. By performing these functions, wetlands improve the water quality and biological health of streams and lakes located downstream and protect public safety.

The WRAPP evaluated thirteen wetland functions, which fall under three general groups: hydrologic functions, biodiversity functions, and water quality functions. As indicated in Table 3-23, not all wetlands within the watershed perform all functions, and they also do not perform all functions equally well.

Table 3-23: Wetlands Functions and Acres of High Functional Significance

Category	Function	Acres of High Functional Significance
Hydrologic Functions	Flood Water Storage	6,284
	Stream Baseflow Maintenance	1,936
Biodiversity Functions	Native Fish Habitat	1,936
	Waterfowl Habitat	3,380
	Other Wetland-dependent Bird Habitat	3,060
	Woodland Amphibian Habitat	7
	Unique Wetland Resources	2,712
	Stream Shading	97
	Wildlife Movement Corridors	3,754
Water Quality Functions	Nutrient Transformation (P-focus)	407
	Sediment and Other Particulate Retention	2,835
	Shoreline/Stream Bank Stabilization	1,112
	Carbon Sequestration	1,883

3.11.2 Approaches to and Tools for Wetland Management

Within a watershed, wetlands are managed using multiple approaches and various tools, including planning efforts, regulations, and voluntary activities. Advanced planning efforts can help identify wetland needs and potential locations. Countywide planning efforts include the Wetland Restoration and Preservation Plan, the Lake County Wetland Inventory, and the Advanced Identification Program wetland studies previously described. Other efforts target specific areas of the county.

Regulation of wetland impacts by agencies and municipalities is arguably the most visible approach for wetland management. This typically involves permits and may require mitigation which can occur at the national (USACE), state, county, and local (municipal) level. At the county level, Lake County regulates wetlands through the Watershed Development Ordinance. The Watershed Development Ordinance establishes a no-net-loss policy for wetland impact, with a goal of net gain in function. The ordinance sets the minimum requirements for the county, including the need for a permit to approve wetland impacts and requirements for mitigation if impacts exceed the minimum threshold. Wetland impacts within Lake County are to be mitigated within the county on a watershed basis. Wetland mitigation can take the form of mitigation banking, or a site-specific mitigation project involving wetland restoration, enhancement or, in rare cases, preservation.

Voluntary wetland restoration and management efforts are performed not as a regulatory action but in response to a desire to restore or manage a target wetland for a specific purpose (e.g., duck habitat, flood water storage, etc.). Typical approaches include wetland preservation and wetland restoration or enhancement through on-the-ground activities that may include, but are not limited to, tile disablement, selective herbicide application, prescribed burning, on-line flow restriction, and water level control.

Wetland Restoration: The re-establishment of wetlands in areas where they previously existed and were altered by drainage activities or landscape modifications.

Wetland Enhancement: Augmenting wetland functions beyond the current conditions; enhancement of one function sometimes can occur at the expense of other functions.

Mitigation Banking: A system of credits and debits to offset environmental impacts associated with site development and achieve no net loss, typically accomplished via restoration, creation, enhancement, or preservation of similar wetland, stream, or natural habitats near the area of impact with the specific goal of compensating for unavoidable impacts to aquatic resources.

Wetland Preservation: Actions taken to maintain the size and functions of an existing wetland or water body.

NOTEWORTHY: WETLANDS PROTECTION IN LAKE COUNTY

Wetlands protection is provided under existing regulatory programs, including federal and state floodplain development restrictions, the USACE's Section 404 Clean Water Act wetland permit program, and the Watershed Development Ordinance (WDO).

A permit/approval is required for any development that will impact wetlands in Lake County. The USACE Chicago District issues permits for impacts to federal *Waters of the U.S.* (WOUS), while Lake County issues written approvals for impacts to *Isolated Waters of Lake County* (IWLC). The USACE-Chicago District normally issues regional permits for impacts to less than 1.0 acre of non-high quality WOUS and compensatory mitigation typically is required at a minimum 1.5:1 replacement ratio for impacts over 0.1 acre to these wetlands. An individual permit from the USACE usually is required for proposed impacts to federal ADID sites, as ADID sites are generally considered unsuitable for filling activities. The individual permit process requires permit applicants to identify and assess practicable alternatives for avoiding and minimizing impacts to the federal ADID sites. In cases where an IP is issued for impacts to federal ADID sites, the USACE usually requires mitigation at a 3:1 or higher ratio. Lake County issues written approvals for IWLC impacts as part of the Watershed Development Permit process, in accordance with the WDO regulations. Compensatory mitigation is required at a 1.5:1 ratio for impacts to 0.1 acre or more of non-high quality IWLC and 3:1 or higher for impacts to high quality IWLC. The USACE-Chicago District's regulatory program and the WDO also require buffers of native vegetation around preserved wetlands to provide a natural transition between wetlands and developed upland areas and help treat stormwater runoff by filtering sediments and pollutants before the runoff reaches the wetlands. Required buffer widths vary depending on the size, type (linear vs. water body), and quality of the wetlands. For *High Quality Aquatic Resources* (HQAR), which include ADID sites, a 100-foot-wide buffer is required under both the USACE-Chicago District's regulatory program and the WDO. A 30- to 50-foot-wide buffer typically is required around all other wetland areas, depending on wetland size and type.

3.12 STREAM INVENTORY

3.12.1 STREAM INVENTORY INTRODUCTION AND METHODS

SMC conducted stream inventories in 2021 for each of the subwatersheds of the Manitou Creek-Fish Lake Drain watershed (Table 3-24). These assessments recorded qualitative information on several easily observed and measured parameters that provide information on the baseline conditions of the stream channel and riparian area. The results provide a framework for prioritizing and implementing watershed management strategies in the watershed-based plan.

The stream assessment includes the geomorphic characterization of the channel, identifying erosion, evaluating discharge points and hydraulic structures, obstructions, areas of deficient buffer zones, and areas with significant detrimental impact on the stream. Visual observations include vegetation, water quality conditions, habitat assessments, and aquatic and terrestrial life. This allows for a more comprehensive assessment of the stream conditions. Information captured during the inventory process also includes notes and comments about the stream not represented in the other forms, such as specific restrictions to stream, restoration efforts or conversations with residents. A copy of the Stream Inventory Methodology is in **Appendix C.**

The watershed stream network is divided within each subwatershed into reaches; smaller geographically-defined stream segments, for which data is aggregated and evaluated (Figure 3-40). A team of two observers wade the entire length of each reach to collect data. At representative points within each reach, the observers measure the channel dimensions and relative velocity at the surface of the stream. The observers photograph and document all areas of moderate to severe ***erosion***, significant ***sediment deposition***, debris jams, ***hydraulic structures,*** and ***discharge points***. Equipment to collect photographs utilizes a ***GPS*** which provides geographic coordinates that translate point locations into GIS for analysis and mapping of data collected in the field. For determining bank erosion (lateral recession) additional measurements obtained include bank height, lateral recession rate, severity, and lateral recession characteristics. The stream inventory only assesses reaches which can be safely waded and have a ***defined channel***. Reaches excluded from assessments are: open-water ponds, lakes, impoundments, wetland complexes (without defined channel), roadside swales, small minor tributaries, or areas with restricted access or that create a hazard for the observer(s): depth of water, unstable substrate, or both.

EROSION: The process by which the surface of the earth is worn away by the action of water, glaciers, winds, waves

SEDIMENT DEPOSITION: The geological process in which sediments, soil and rocks are added to a landform or land mass.

HYDRAULIC STRUCTURES: Bridges, culverts, dams, weirs, or other structures spanning or crossing the stream channel.

DISCHARGE POINTS: The location where all sanitary, storm sewer and agricultural drainpipes surface or stormwater flows back into a lake or stream channel. Discharge points also include open channels, swales, gullies and other significant tributaries.

GLOBAL POSITIONING SYSTEM (GPS): A system of earth-orbiting satellites, transmitting signals continuously towards the earth that enables the position of a receiving device on or near the earth's surface to be accurately estimated from the difference in arrival times of the signals.

DEFINED CHANNEL: Clearly discernable bed and banks of a flowing watercourse

The following types of data were collected during the inventory and summarized in the following section:

- Channel conditions (dimensions of the banks and bed)
- Channelization
- Pool-Riffle Development
- Bank Erosion
- Sediment Accumulation and Debris Loading
- Hydraulic Structures (bridges, culverts, dams, etc.)
- Discharge Points (storm sewers, pipes and overland flow draining to the stream)
- Riparian Corridor (vegetated buffer along the stream)

3.12.2 Stream Network Description and Stream Reaches

The Manitou Creek-Fish Lake Drain stream network has 38.68 miles of flow path through streams, ravines, wetlands and lakes. Each of the subwatersheds in the Manitou Creek-Fish Lake Drain watershed are described below:

1. **Manitou Creek Subwatershed:** The Manitou Creek subwatershed encompasses 40.2 square miles of the western portion of Lake County. The subwatershed includes two tributary streams and a mainstem which discharges into Fox Lake.

2. **Fish Lake Drain Subwatershed:** The Fish Lake Drain subwatershed encompasses 8.7 square miles of the weststern portion of Lake County, Illinois. The subwatershed includes a mainstem that flows through Fish Lake, Fischer Lake, Wooster Lake, and Duck Lake and ultimately discharges into the Manitou Creek Mainstem near Fox Lake.

Table 3-24: Stream Inventory Reach Summary

Subwatershed	Number of Reaches	Assessed Miles
Manitou Creek	72	34.37
Fish Lake Drain	7	4.29
TOTAL	**79**	**38.66**

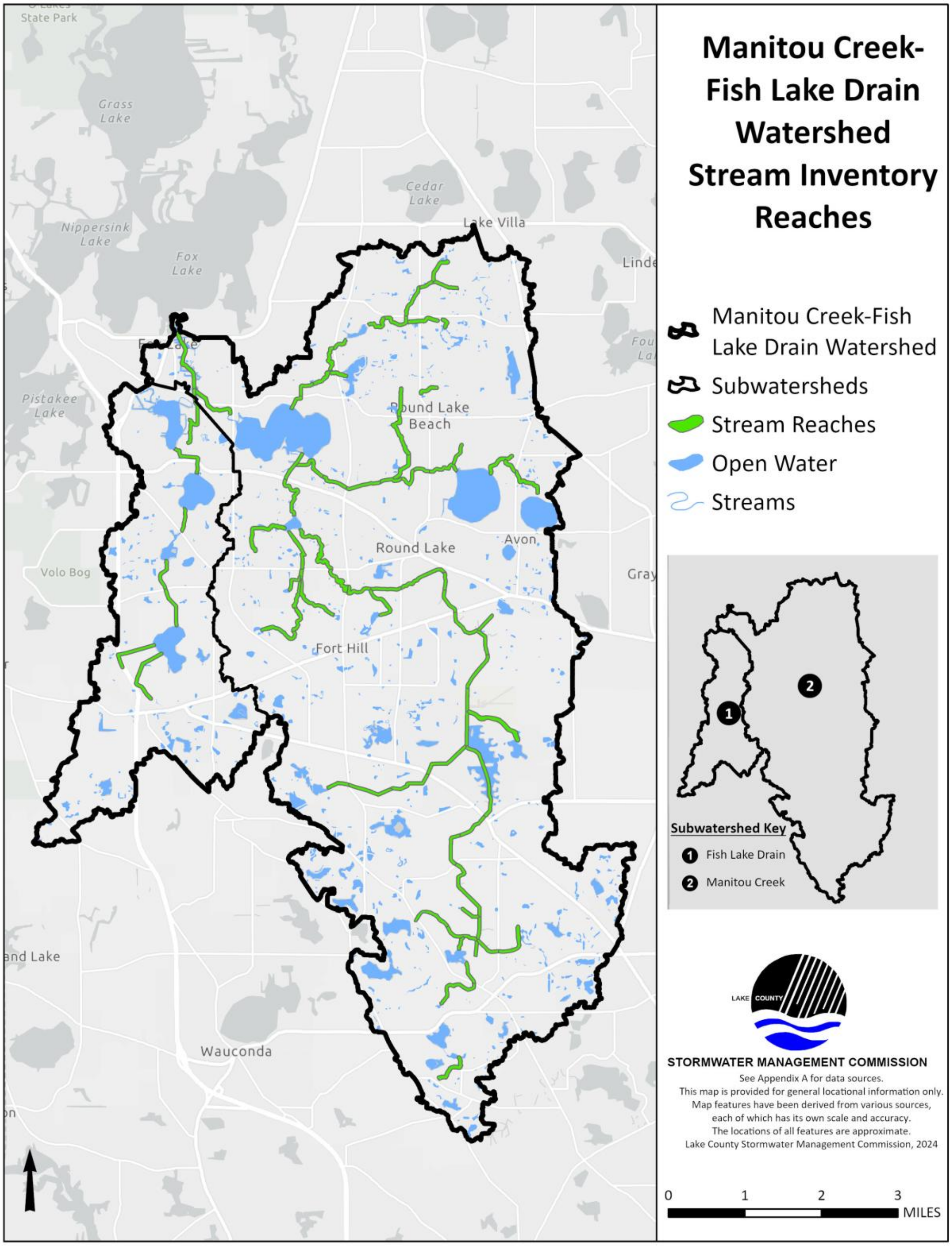


Figure 3-40: Stream Inventory Reaches

3.12.2.1 Channel Conditions

Measurements of the physical dimensions of the stream channel reflect the shape of the channel and the amount of water that it can transport under low or high flow conditions. A summary of channel conditions by subwatershed is shown in Table 3-25.

Table 3-25: Channel Condition Summary

Subwatershed	Bank Height (ft)		Channel Width Top (ft)		Channel Width Bottom (ft)	
	Min	Max	Min	Max	Min	Max
Manitou Creek	0	250	0	250	0	6
Fish Lake Drain	0	5	0	90	0	90

3.12.2.2 Channelization

Stream channelization describes any activity that moves, straightens, shortens, cuts off, diverts, or fills in a stream channel. These activities, which include widening, narrowing, or lining a stream channel, alter the discharge and increase the velocity of water flowing through the streams. In natural meandering streams, channelization decreases the length of the stream and increases the gradient of the channel. Because it is the nature of concentrated, flowing water to create meandering channels with overbank floodplains that dissipate the energy of the flowing water, channelized streams may be susceptible to bank instability and erosion. Modifications in one area of the watershed or stream channel affect other areas. Table 3-26 and Figure 3-41 illustrate the degree of channelization of assessed reaches in each subwatershed within the Manitou Creek-Fish Lake Drain watershed. The degree of channelization is ranked based on the percentage of channelization. Reaches with channelization of 1%-33% ranks “low”, 33%-66% ranks “moderate”, and >66% of a reach channelized ranks “high”. Reaches ranked as “None” have no indication of channelization. The majority of stream reaches assessed in the watershed had “moderate” or “high” channelization.

Table 3-26: Channelization Summary

Subwatershed	Degree (Number of Reaches)				
	None	Low	Moderate	High	Total
Fish Lake Drain	0	3	0	2	7
Manitou Creek	1	19	26	26	72
Total	**1**	**22**	**26**	**28**	**79**

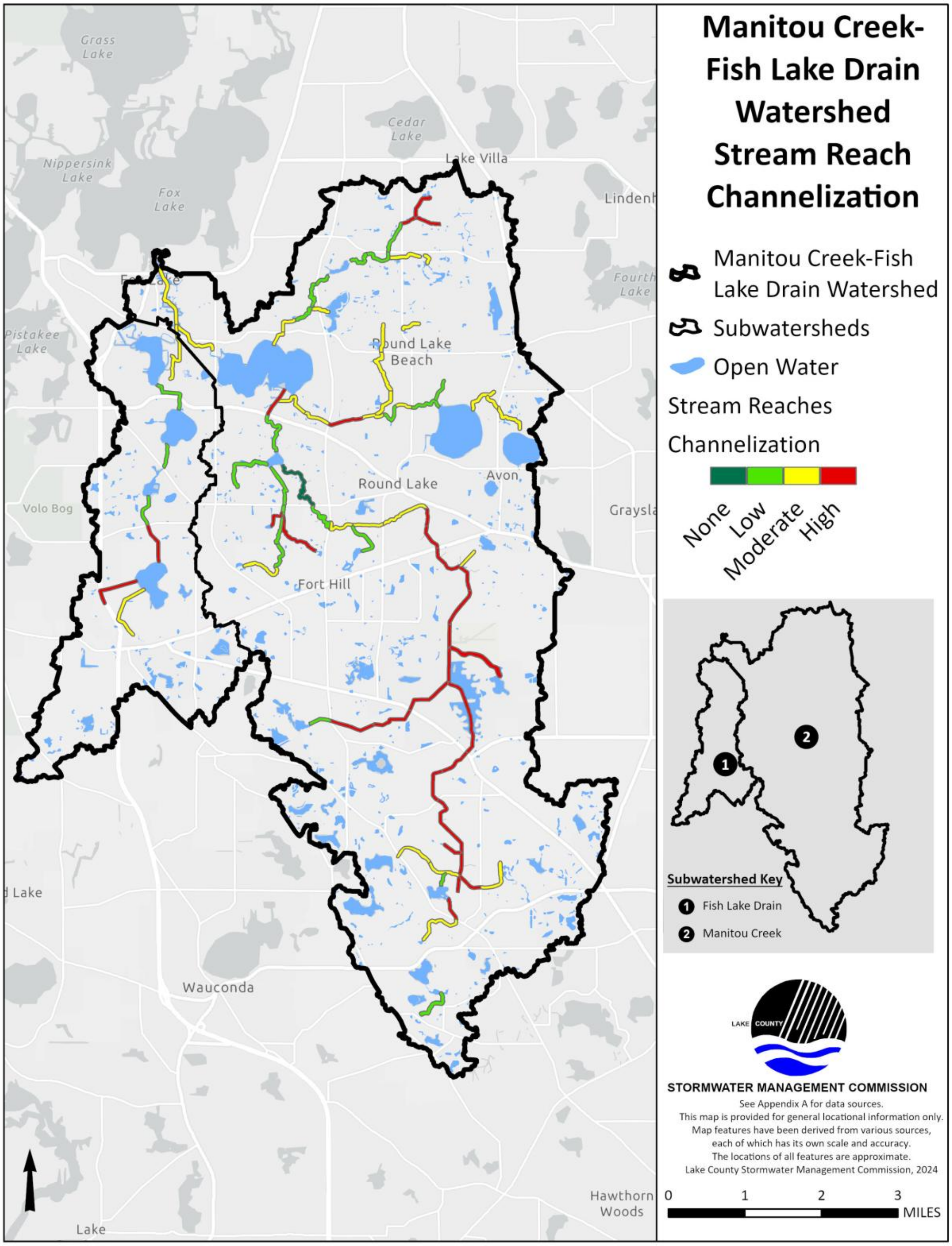


Figure 3-41: Channelization by Stream Reach

3.12.2.3 Pool-Riffle Development

Under baseflow conditions, pools are low-gradient areas of deeper water with slower velocity and riffles are high-gradient areas of shallow water with higher velocity. During baseflow conditions, sediment erodes from riffles and is deposited into pools. During bankfull conditions, the relationship of relative velocity in riffles and pools is reversed and sediments along with substrate material are scoured from pools and the channel bed and deposited on riffles or bars. During periods of elevated flow when the velocity in pools exceeds that over riffles, deposition and bar formation tend to occur in areas adjacent to pools (Figure 3-42).

THALWEG: the line of lowest elevation within a valley or watercourse.

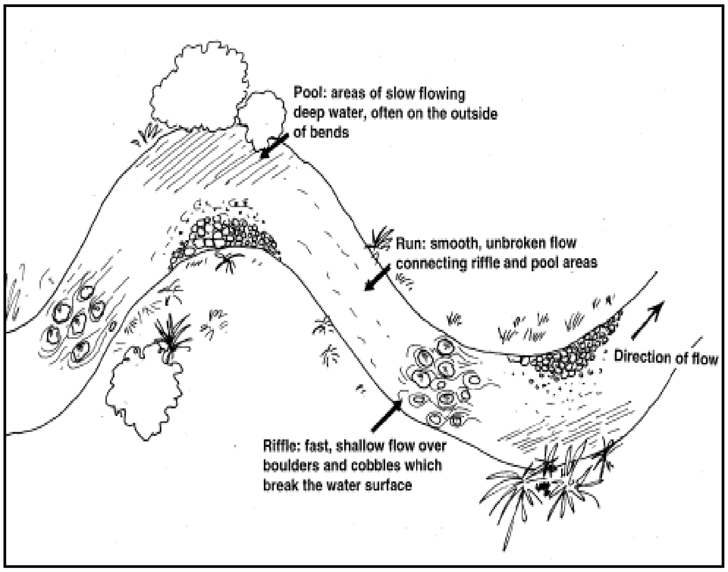


Figure 3-42: Pool/Riffle Sequence. Source: National Institute of Water and Atmospheric Research

In a single-**thalweg** meandering channel, pools are associated with the outer portions of meander bends while riffles are located above or below pools. Because pools and riffles have different physical conditions and are often adjacent to one another in the channel, they are important to the ecological health of the stream channel. Because of their shallow depth, increased gradient and sediment size, riffles cause turbulence in the water column which aerates the stream. Pools have slower velocities and increased depth, offering habitat to a wide range of aquatic species for a variety of uses. Channelization often reduces the extent of pool-riffle sequences in a stream. There was limited pool riffle development in the watershed Tables 3-27 and 3-28). These results may have been influenced by the moderate drought that was occurring while data was being collected. The high degree of channelization in the watershed also likely contributes to the lack of pool and riffle development.

Table 3-27: Number of Stream Reaches with Riffle Development

Subwatershed	0-10%	11-30%	31-50%	51-75%	76-100%
Fish Lake Drain	6	0	0	0	1
Manitou Creek	70	2	0	0	0
Total	**76**	**2**	**0**	**0**	**1**

Table 3-28: Number of Stream Reaches with Pool Development

Subwatershed	0-10%	11-30%	31-50%	51-75%	76-100%
Fish Lake Drain	7	0	0	0	0
Manitou Creek	71	1	0	0	0
Total	**78**	**1**	**0**	**0**	**0**

3.12.2.4 Streambank Erosion

Figure 3-43: Streambank Erosion Example

The Rapid Assessment Point Method (RAP-M) assesses lateral recession and provides the degree of streambank erosion (Windhorn, 2000). Lateral recession rates (LRR) evaluate streambanks for each assessed reach. Segments with LRR characteristics were photo documented and measurements of left and right bank height and length were collected. The combined analysis allows for an overall assessment regarding the severity of the entire reach, including review of photographs, and repeatable measurements taken in the field. The methodology for lateral recession can be found in Appendix C (Windhorn, 2000).

Streams are dynamic systems, in a perpetual state of flux, therefore, all banks exhibit some form of erosion (Figure 3-43). Substantial bank erosion was identified in both rural and urban streams in the watershed. Areas with severe erosion tended to be along the outside bank where streams turned sharply. Areas with lowest bank erosion tended to be in heavily armored areas or in wetlands.

The stream inventory assessed the degree of streambank erosion for each stream reach. The description of qualitative assessment criterion for streambank erosion is shown in Table 3-29 and the results of the streambank erosion assessment are summarized below in Table 3-30. The results of the stream inventory indicate that most stream reaches (54) were slightly eroded and 22 of the stream reaches were moderately eroded. In one reach, streambank erosion was severe, suggesting the stream channel is responding to changes in watershed hydrology.

Table 3-29: Bank Erosion Criteria

Category	Description
Slight	Some bare bank but active erosion not apparent. Some rills but no vegetative overhang. No exposed tree roots.
Moderate	Bank is predominantly bare, with some rills and vegetative overhang.
Severe	Bank is bare, with rills and severe vegetative overhang. Many exposed tree roots and some fallen trees and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross-section becomes more U-shaped as opposed to V-shaped.

Table 3-30: Number of Stream Reaches with Streambank Erosion

Extent Of Erosion	None (<1%)	Low (1-10%)	Moderate (11-33%)	Severe (34-66%)	Not Assessed
Fish Lake Drain	0	5	2	0	0
Manitou Creek	1	49	20	1	1
Total	**1**	**54**	**22**	**1**	**1**

3.12.2.5 Sediment Accumulation

Sediment erosion, transport, and deposition are naturally occurring processes in stream systems. Land use changes and other anthropogenic modifications within the watershed can amplify the magnitude of these processes.

Figure 3-44: Sediment Accumulation Example

Typically, a stream generates, suspends, and transports sediment through high gradient reaches and deposits sediment in low gradient reaches and/or in areas where velocity decreases (Figure 3-44). These low-velocity areas may be naturally occurring areas such as pools or sloughs. They may also occur behind debris jams or beaver dams or upstream of channel constrictions such as culverts or dams. Fluctuations in discharge rate results in a stepwise movement of deposition and storage of sediment within stream network. Increased sediment transported during storm events will increase sedimentation rates in downstream channels. Excessive sediment deposition affects fish and the benthic community in several ways including:

- Interfering with food gathering or filtering organisms.
- Decreasing light levels which impact productivity and reproduction.
- Sediment accumulation on the bottom of channels can bury organisms to the point of starvation or death.

Once sediment has entered waterways it is difficult and expensive to remove, requiring engineering solutions and heavy equipment. Preventative measures such as the revegetation of riparian areas and stream banks can help reduce sediment transport and bank erosion.

Most reaches in the watershed had “Low” or “Moderate” sediment accumulation (Table 3-31). Of the assessed reaches, 50% exhibited moderate sediment accumulation and 5% exhibited high sediment accumulation. The sediment accumulation is likely due to local and upstream increases in runoff and/or erosion, especially in areas with highly erodible soils.

Table 3-31: Number of Stream Reaches with Sediment Accumulation

Subwatersheds	Not Assessed	None (<1%)	Low (1-33%)	Moderate (34-66%)	High (67-100%)
Fish Lake Drain	0	0	3	4	0
Manitou Creek	1	1	31	35	4
Total	**1**	**1**	**34**	**39**	**4**

3.12.2.6 Debris Loading

In addition to sediment, most streams transport some debris. Because debris transport is a naturally occurring stream process, some debris can provide habitat and contribute to a diverse instream environment. However, too much debris can be problematic and may result in large debris jams, causing backwater flooding and sediment deposition (Figure 3-45). Debris jams can also cause erosion of the stream banks which can damage riparian lands and property.

Figure 3-45: Debris Jam in Fish Lake Drain

Reaches having a moderate or high debris load are considered to have the potential to be problematic. In some cases, these reaches may be in natural or open space areas and no action is needed or warranted. In other cases, moderate or high debris loads may be problematic and warrant removal. Tables 3-32 and 3-33 summarize the reaches instream and overbank debris loads, respectively. Most instream debris observed consisted of woody debris along stream banks. Overbank debris loads were generally higher than instream debris loads. Dumping of yard waste and construction waste was observed throughout the watershed, particularly in more developed areas.

Table 3-32: Reach Instream Debris Load

Subwatersheds	Instream Debris Load			
	None (<1%)	Low (1%-33%)	Moderate (34%-66%)	High (67%-100%)
Fish Lake Drain	0	3	4	0
Manitou Creek	4	47	12	8
Total	**4**	**50**	**16**	**8**

Table 3-33: Reach Overbank Debris Load

Subwatersheds	Overbank Debris Load			
	None (<1%)	Low (1%-33%)	Moderate (34%-66%)	High (67%-100%)
Fish Lake Drain	0	6	0	1
Manitou Creek	7	34	19	11
Total	**7**	**40**	**19**	**12**

3.12.2.7 Hydraulic Structures

Hydraulic structures are bridges, culverts, dams, weirs, or other structures spanning or crossing the stream channel. These structures modify or have the potential to modify the pattern or amount of flow in the stream channel and may act as constriction points under certain flow conditions, leading to backwater flooding. Additionally, dams and weirs can impede the movement of fish and other aquatic organisms within the stream network. Culverts may create temporary or permanent barriers if scour causes the bottom of the culvert to become elevated above the water level of the stream. Problem hydraulic structures include:

- Obstructed culverts and bridges, culverts that are undermined or collapsed.
- Bridges, culverts, dams and weirs that have been washed out.
- Beaver dams that are causing severe bank erosion or impounding a significant volume of water in a manner that impacts public safety.

Structures listed as problem structures were identified as needing further inspection; however, this designation is not a definitive determination that the structure is defective.

Modification of streams by channelization and the construction of hydraulic structures results in decreased quantity of pool-riffle complexes, increased sediment accumulation, increased debris loads, habitat alteration, and decreased biological productivity. Table 3-34 contains a summary of hydraulic structures in the watershed. Dams located on reaches not assessed were not included in the stream inventory. Problem Hydraulic Structures, defined as structures that may require further inspection or repair, are found in both the Manitou Creek and Fish Lake Drain subwatersheds. Figure 3-46 maps the problem hydraulic structures identified in the stream inventory.

Table 3-34: Summary of Hydraulic Structures

Subwatershed	Bridge	Culvert	Dam	Beaver Dam	Other	Total Structures	Problem Structures	Percent of Structures Identified as Problem Structures
Fish Lake Drain	2	18	2	3	28	53	3	6
Manitou Creek	42	128	11	21	70	272	3	1
Total	**44**	**146**	**13**	**24**	**98**	**325**	**6**	**2**

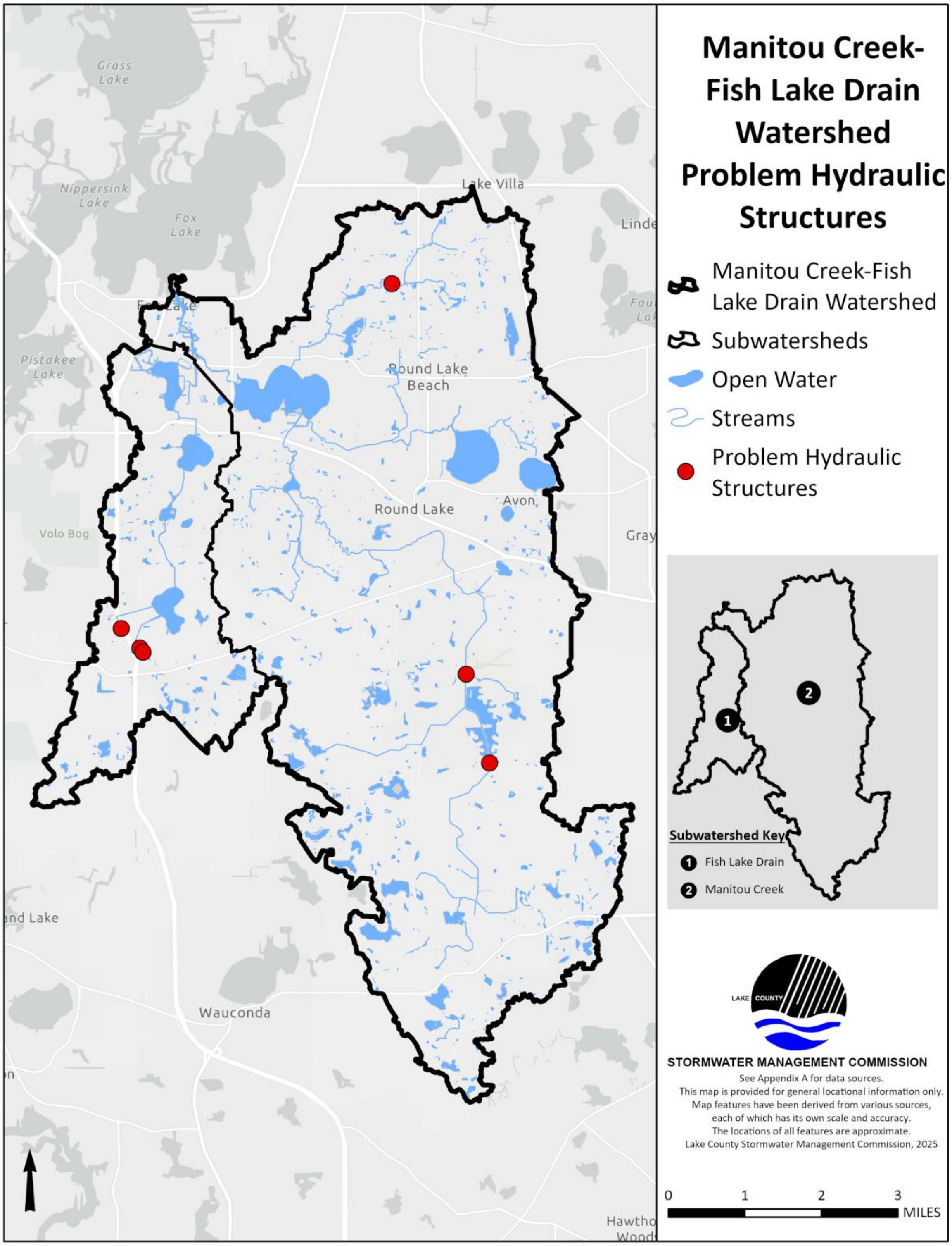


Figure 3-46: Problem Hydraulic Structures

3.12.2.8 Discharge Points

Discharge points are identified as outfalls that discharge into streams including "pipes" such as drain tile outlets, sump pump discharges, storm sewers and "open channel" discharges such as drainage swales, gullies, and small tributaries (Figure 3-47). The stream inventory documented 277 discharge points into the stream network.

Figure 3-47: Discharge Point Example

Problem discharge points in the watershed contribute to streambank erosion and the transport of excess sediment and associated nutrients to the stream channel. The location of these points is summarized in Table 3-35 and shown in Figure 3-48. Outfalls may cause localized erosion, resulting in a positive feedback loop of bank erosion near the outfall, which may result in pipe, end section, apron, or headwall failure. Gullies and other open channels can also result in bank erosion, as they deliver concentrated flow to the stream channel. Pipes that appeared to have discolored discharge, substances other than water, or substantial damage were noted in the inventory.

Table 3-35: Summary of Discharge Points

Discharge Points	Swales, Gullies, and Tributaries	Pipes, Storm Sewers, and Culverts	Total Discharge Points	Problem Discharge Points	Discharge Points Per Stream Mile
Fish Lake Drain	28	32	60	0	14
Manitou Creek	130	245	375	61	11
Total	**158**	**277**	**435**	**61**	**11**

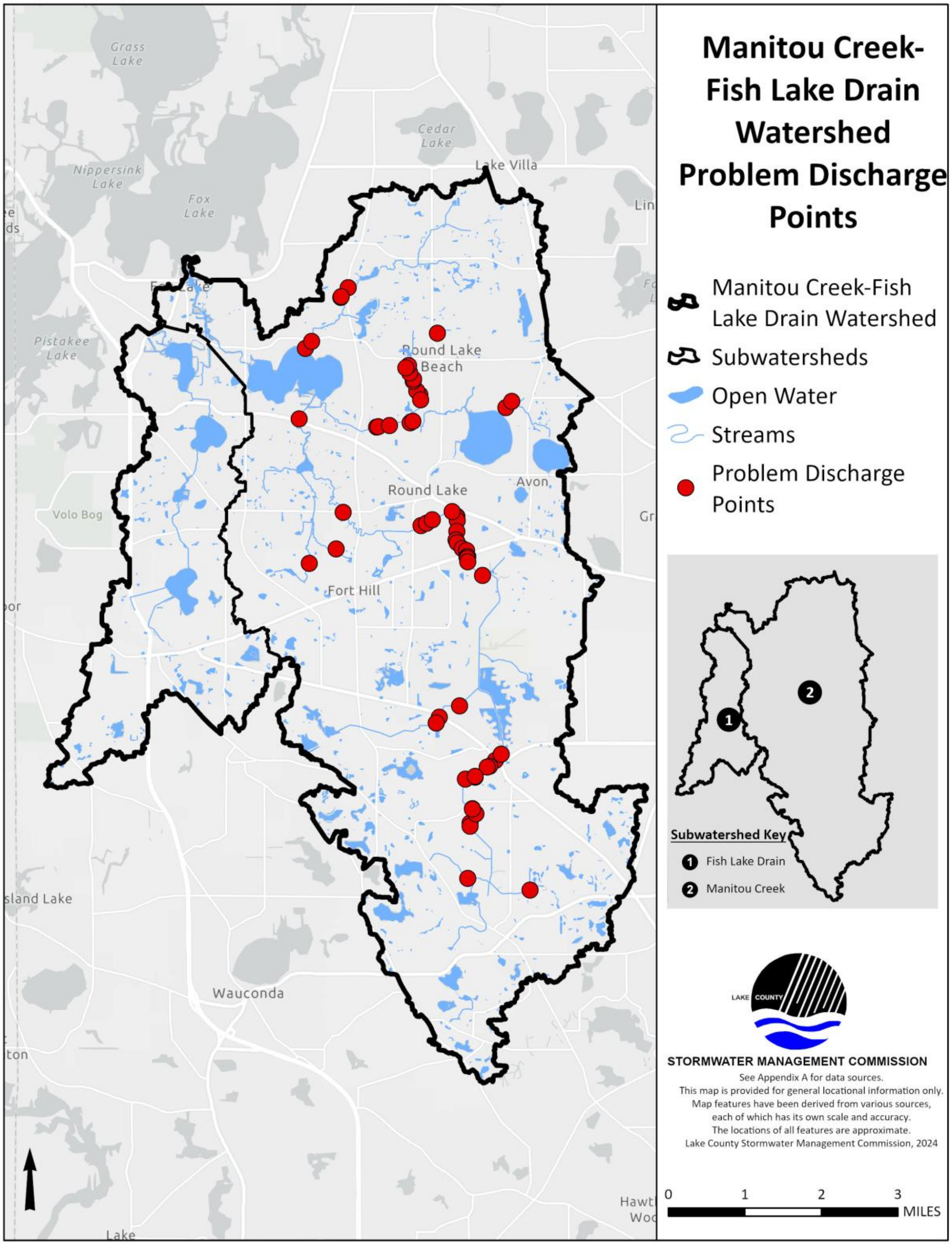


Figure 3-48: Problem Discharge Points

3.12.2.9 Riparian Buffers

The riparian zone is an area extending 100 feet from the left and right side of the stream channel (Figure 3-49). Vegetated riparian buffers are of interest because riparian vegetation can make streambanks more resistant to erosion, buffers act as filters for runoff and pollutants, and riparian areas offer habitat for wildlife and can be important links in the watershed green infrastructure network. Riparian vegetation also provides beneficial shading to streams and lakes which helps to avoid temperature stress on fish and aquatic organisms. The width and quality of vegetated riparian buffers were visually assessed while walking the stream channel throughout the inventory and checked with aerial imagery of the watershed for each reach.

Figure 3-49: Riparian Buffer Example

Table 3-36 summarizes the assessment criterion for buffer width, while Figure 3-50 maps the observed vegetated riparian buffer quality in 2021. Throughout the watershed, riparian buffer width was related to riparian land use, with wide riparian buffers ("High" buffer width) in locations where the stream flows through open space areas and narrow buffers ("Low" buffer width) in locations where the stream flows through developed and agricultural areas.

Table 3-36: Riparian Buffer Condition

Subwatershed	Stream Reach Riparian Buffer Condition			
	None (mile)	Low (mile)	Moderate (mile)	High (mile)
Fish Lake Drain	0.0	3.3	0.7	0.3
Manitou Creek	6.0	8.9	10.7	8.7
Total	**6.0**	**12.2**	**11.4**	**9.0**

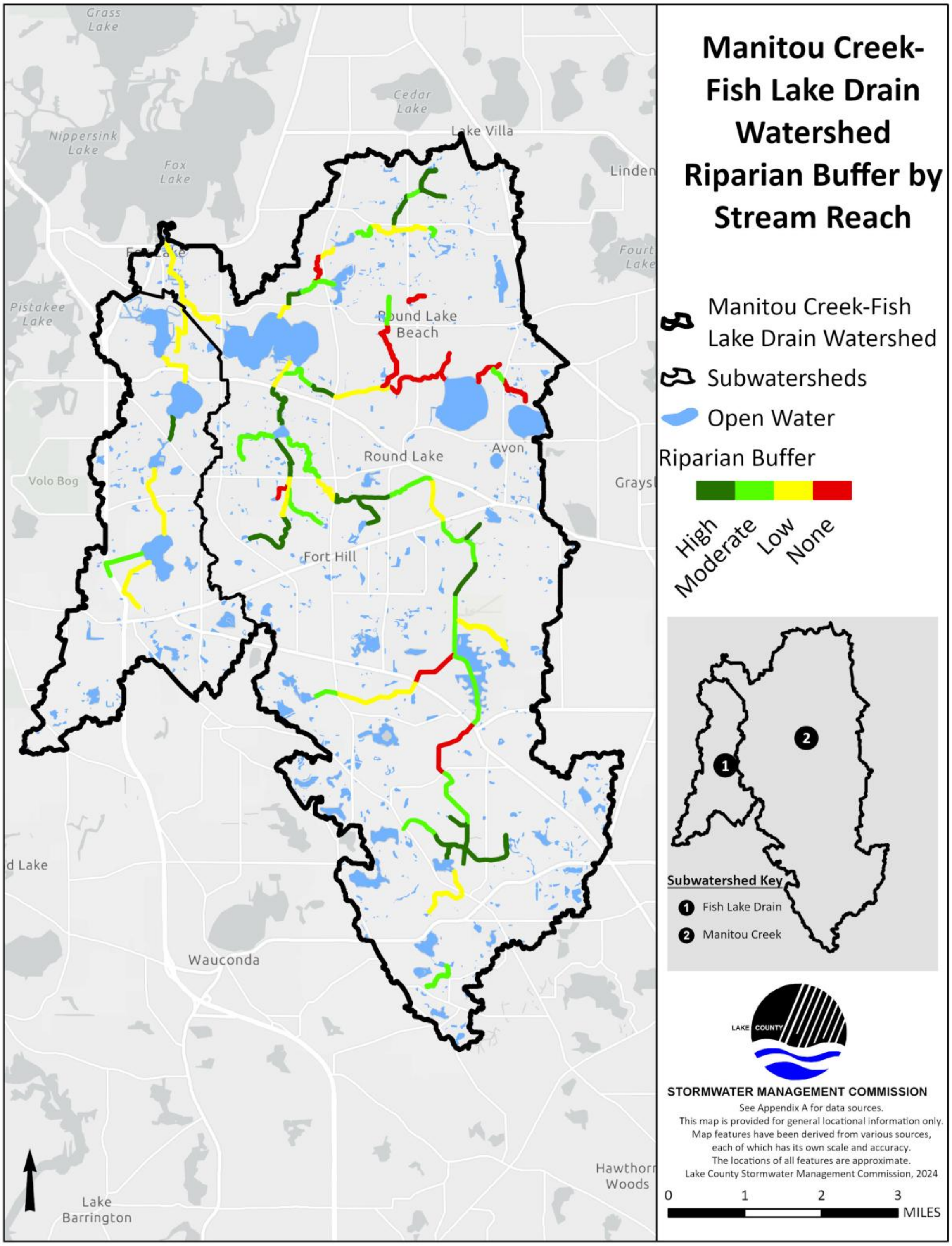


Figure 3-50: Riparian Buffers by Stream Reach

3.13 LAKE INVENTORY

3.13.1 Introduction and Methods

The Illinois Environmental Protection Agency (Illinois EPA) defines lakes as open bodies of water greater than 6 acres. Lake County defines lakes as open bodies of water greater than 20 acres. This assessment was conducted on all lakes greater than 20 acres and lakes less than 20 acres that the Illinois EPA lists as impaired. Using this criteria, 25 lakes were identified in the watershed (Figure 3-51).

A lake inventory was conducted to assess the health of lakes within the watershed and provide information on natural and anthropogenic impacts to lake systems. The lakes were assessed for number of aquatic plant species, floristic quality assessment, and water quality by the Lake County Health Department- Environmental Services. Fish assessments were conducted by the Illinois Department of Natural Resources. Shoreline erosion was assessed by the Lake County Stormwater Management Commission. Collectively this data provides essential information for watershed planning and management.

3.13.2 Shoreline Erosion

Shoreline erosion is a natural process which results in the loss of sediment from a shoreline. Shoreline erosion occurs gradually; however, anthropogenic influences such as clearing of vegetation or rocks and increased stormwater runoff can substantially accelerate this process. Sediments eroded from shorelines are transferred to the lake's water column, which increases turbidity and introduces nutrients and contaminants which are attached to the sediment. This sediment is mostly deposited on the lakebed, which can result in degraded habitat for fish and aquatic life.

Shoreline assessments were conducted in the watershed by boating the perimeter of the waterbody and assigning a categorical value (none, slight, moderate or severe) for each segment of shoreline erosion (Table 3-37) (Appendix D). Values were recorded in ESRI collector using an iPad and photographs were taken at each shoreline segment. Moderate or severe shoreline erosion was observed at 15 of the 22 (68%) assessed lakes. The lakes with visually identified moderate or severe shoreline erosion during this assessment would likely benefit from shoreline stabilization practives; however, further site investigation is needed to determine if remedial action is nessesary .

SHORELINE EROSION CATEGORICAL VALUES

NONE: No visible erosion. Includes purpose-built erosion control structures such as riprap and sea walls.

SLIGHT: Minimal observable erosion. Generally considered stable.

MODERATE: Obvious recession and/or eroded banks. Area may exhibit some exposed roots, fallen vegetation or minor slumping.

SEVERE: Recession is characterized by eroding of exposed soil on nearly vertical banks, exposed roots, fallen vegetation, extensive slumping of bank material, undercutting, washouts, or fence posts exhibiting realignment.

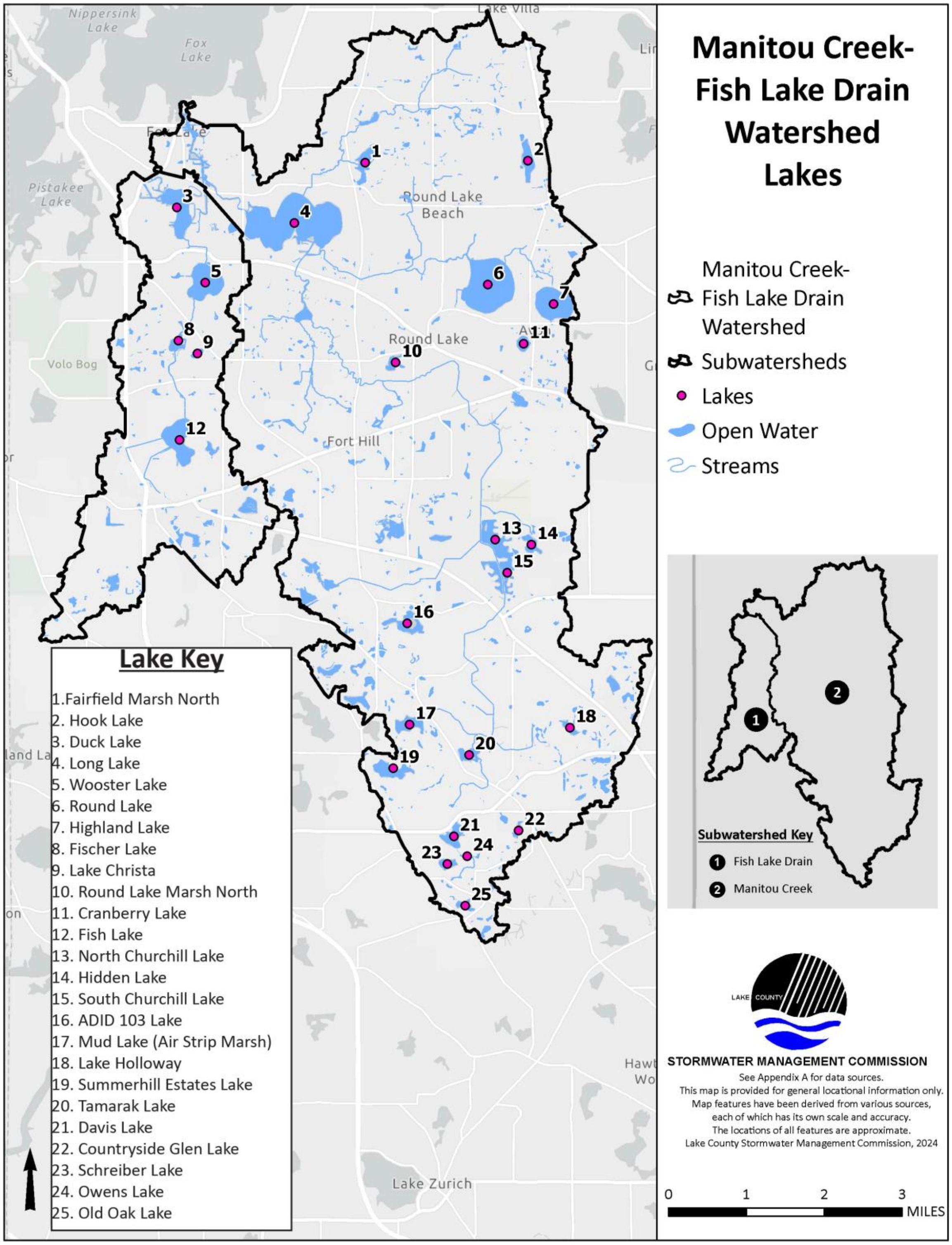


Figure 3-51: Lakes

Table 3-37: Lake Shoreline Erosion *Shoreline length was determined using GIS analysis without field verification. Shoreline length values in this table should be considered an approximation and may differ from other publications. **Percent of total shoreline length categorized as having None, Slight, Moderate, or Severe erosion ***Shoreline assessments were not conducted at ADID 103 Lake, Mud Lake, or Tamarack Lake because of access constraints

Lake Name	Shoreline Length (ft)*	Percent Shoreline Erosion**			
		None	Slight	Moderate	Severe
Countryside Glen Lake	3,951	42	58	0	0
Cranberry Lake	4,194	100	0	0	0
Davis Lake	7,292	99	1	<1	0
Duck Lake	40,164	43	53	3	1
Fairfield Marsh North	9,383	0	93	7	0
Fischer Lake	8,748	9	19	20	52
Fish Lake	12,633	41	59	0	0
Hidden Lake	4,875	0	74	14	12
Highland Lake	8,374	64	36	0	0
Hook Lake	7,564	90	10	0	0
Lake Christa	6,796	14	56	28	3
Lake Holloway	4,136	1	52	43	5
Long Lake	41,347	68	31	1	0
North Churchill Lake	12,910	47	20	23	10
Old Oak Lake	4,352	5	70	21	4
Owens Lake	2,238	51	45	5	0
Round Lake	20,621	36	50	14	1
Round Lake Marsh North	6,007	51	47	2	0
Schreiber	3,765	100	0	0	0
South Churchill Lake	9,289	9	21	23	47
Summer Hill Estates Lake	11,609	90	7	2	1
Wooster Lake	9,611	41	54	3	2

3.14 STORMSEWER NETWORK

The natural drainage system of the Manitou Creek-Fish Lake Drain watershed has changed where residential, commercial, and industrial land uses replaced open lands. These land use/cover changes limit the land's capacity to infiltrate and store precipitation and runoff. In these portions of the planning area, a Stormsewer network (or stormsewershed) collects runoff from developed landscapes and conveys it to a waterbody.

Stormsewersheds were delineated in the watershed by reviewing available stormsewer data from municipalities, counties, and other sources and analyzing aerial photography. The Manitou Creek-Fish Lake Drain watershed contains 11,803 acres of stormsewersheds, which comprise about 38% of the watershed (Table 3-38, Figure 3-52). This analysis is likely an underestimate due to the lack of stormsewer data for parts of the watershed. Stormsewersheds are associated with the urbanized portions of municipalities throughout the watershed and geographically correlate to impervious surface.

Table 3-38: Stormsewered Area Summary

Subwatershed	Subwatershed Acres	Acres of Sewered Area	Percent of Subwatershed Sewered
Fish Lake Drain	5,550	1,324	24%
Manitou Creek	25,809	10,479	41%
Total	**31,359**	**11,803**	**38%**

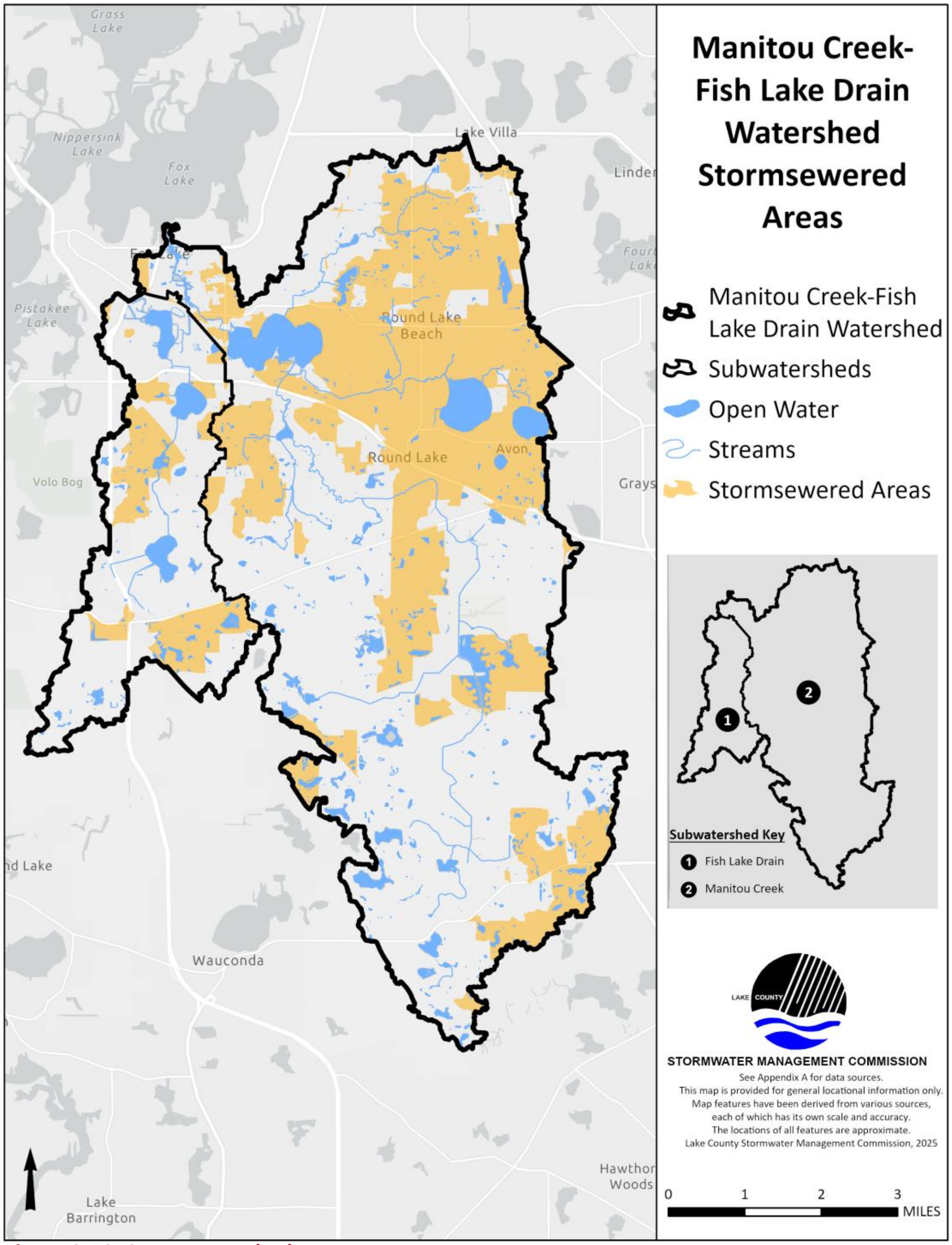


Figure 3-52: Stormsewersheds

3.15 DETENTION BASIN INVENTORY

In 2022 and 2023, SMC conducted a detention basin inventory for all known areas being used for detention in the watershed. Detention basins were identified using aerial imagery analysis. A field inspection was conducted at each basin identified. Additional permit and desktop (computer) reviews were utilized as needed to supplement field assessment data. Basins were assessed for location, design features, maintenance and design needs, potential safety problems, and retrofit opportunities. Assessments were conducted at 275 detention basins (Table 3-39 and Figure 3-53). Appendix E summarizes the detention basin inventory results.

WET DETENTION BASINS: A stormwater control structure that provides both retention and treatment of contaminated stormwater runoff. It contains a perennial pool of water, which holds runoff from one rainfall event until displaced by a new rainfall event.

DRY DETENTION BASINS: - Basins that temporarily stores water before discharging to river or lake and usually dry up following large rainstorms or snow melt events. Typically, not effective at removing pollutants.

3.15.1 Constructed Basins, Pre and Post 1992

In 1992, the Lake County Watershed Development Ordinance (WDO) restricted stormwater release rates for all new development within Lake County. The WDO was generally more restrictive than the municipal ordinances it superseded. The WDO limited release rates from the 2-year recurrence interval design storm to 0.04 cfs per acre of development area and limited release rates from the 100-year recurrence interval design storm to 0.15 cubic feet per second per development acre. Basins built after the adoption of the WDO are required to meet these discharge rates. Of the assessed basins, 23 were built before 1992 and 252 were built after 1992.

3.15.2 Basin Type, Location, and Maintenance/Retrofit Needs

Of the 275 basins assessed, 163 were classified as **wet**, 21 were classified as **dry,** and 91 were classified as **wetland**. The assessment identified 12 basins with preliminary retrofit opportunities. The most common retrofit opportunities included stabilization of erosion and inlet/outlet/restrictor maintenance and repair.

Table 3-39: Number and Type of Detention Basins Inventoried by Subwatershed

Subwatershed	Number of Basins	Number of Wet Basins	Number of Dry Basins	Number of Wetland Basins
Fish Lake Drain	42	31	0	11
Manitou Creek	233	132	21	80
Total	**275**	**163**	**21**	**91**

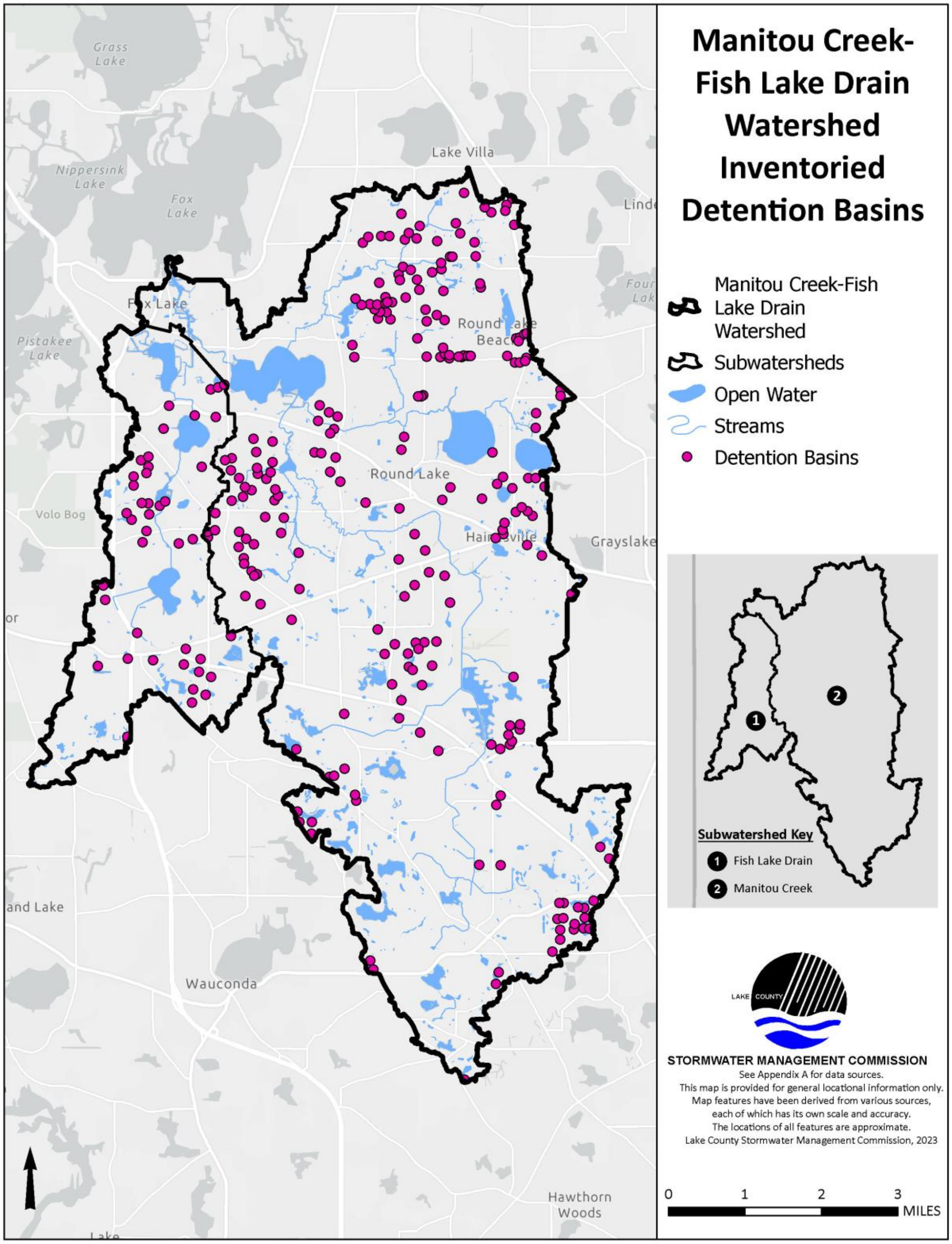


Figure 3-53: Inventoried Detention Basins

3.16 LAKE AND STREAM WATER QUALITY

Water quality refers to a waterbody's ability to support a variety of aquatic life, recreational, and aesthetic uses. Water pollution reduces the health of aquatic ecosystems and may be harmful to human health. Water quality is impacted by pollutants from multiple point and nonpoint sources. During storms, pollutants on the landscape are washed from the ground into storm sewers, roadside drainage ditches, natural drainageways and ultimately into the watershed's receiving streams and lakes.

Physical changes in the watershed, such as stream channelization and the loss of riparian vegetation and wetlands, reduce the ability of the natural drainage system to filter pollutants and infiltrate water into the ground, and contribute sediment and other pollutants to the stream and lakes, thereby reducing the quality of aquatic habitat. Water quality degradation is also caused by an increase in watershed impervious cover that has led to an increase in the volume and rate of runoff in the watershed. The increased quantity of runoff causes problems such as excessive stream bank erosion and the deepening of the stream channel.

3.16.1 Status of Designated Use Support

The Illinois EPA produces a biennial report on the water quality of surface waters and groundwater in Illinois. The "Integrated Water Quality Report and Section 303(d) List" ("Integrated Report") is based on federal guidance for meeting the requirements of Sections 305(b), 303(d) and 314 of the Clean Water Act. Discussion of the Integrated Report in this section is specifically related to surface water in the 2020/2022 Integrated Report. Assessment of water quality for an individual water body or stream segment is expressed in terms of support of "designated uses". Designated uses assessed in the 2020/2022 Integrated Report applicable to lakes and streams in the Manitou Creek-Fish Lake Drain watershed include Aquatic Life, Fish Consumption, Primary Contact, and Aesthetic Quality. These uses are determined to be fully supported, not supported, not assessed, or to have insufficient information to make a determination. Figure 3-54 shows the Manitou Creek-Fish Lake Drain watershed 2022 303(d) listed waterbodies.

Illinois EPA evaluates physical, biological, and chemical monitoring data to make assessments of designated use support. For some uses, monitoring data may indicate non-support or "impairment". For example, depauperate fish or invertebrate taxa may indicate impairment of the aquatic life designated use. In these cases, physical and/or chemical monitoring data are compared to numeric water quality standards to determine if pollutants are present in sufficient quantities to cause an impairment of one or more designated uses. In other cases, exceedance or violation of the water quality standard is enough to list the use as not supported and the water as "impaired". For example, exceedance of the fecal coliform standard results in non-support of the Primary Contact designated use, if it is an assessed use for a given water. Waters with one or more pollutants identified as the cause of impairment are added to the "303(d) list" of impaired waters and put onto a schedule for development of a Total Maximum Daily Load study for the pollutant(s) of concern. In some cases, "non-pollutants" are identified as the cause of non-support. Non-pollutants are typically non-chemical causes of impairment such as modification of flows in a stream by dams, alteration of habitat, or the presence of non-native invasive species. Once a surface water assessment is made, it typically remains unchanged in subsequent editions of the Integrated Report unless new data is obtained by Illinois EPA. Changes from previous editions are reported by Illinois EPA in an appendix to the integrated report.

3.16.1.1 Streams

The Illinois EPA identifies eight stream segments in the Manitou Creek-Fish Lake Drain watershed. None of these stream segments were assessed for any designated use.

3.16.1.2 Lakes

Twenty-one lakes in the watershed appear on the Illinois EPA list of assessed waters for 2022 (Table 3-40). Round Lake and Lake Fairfield fully support their respective designative uses. The remaining 19 lakes do not support the aesthetic quality designated use, making it the most common designated use impairment for lakes in the watershed. Three of the 21 lakes do not support the aquatic life designated use.

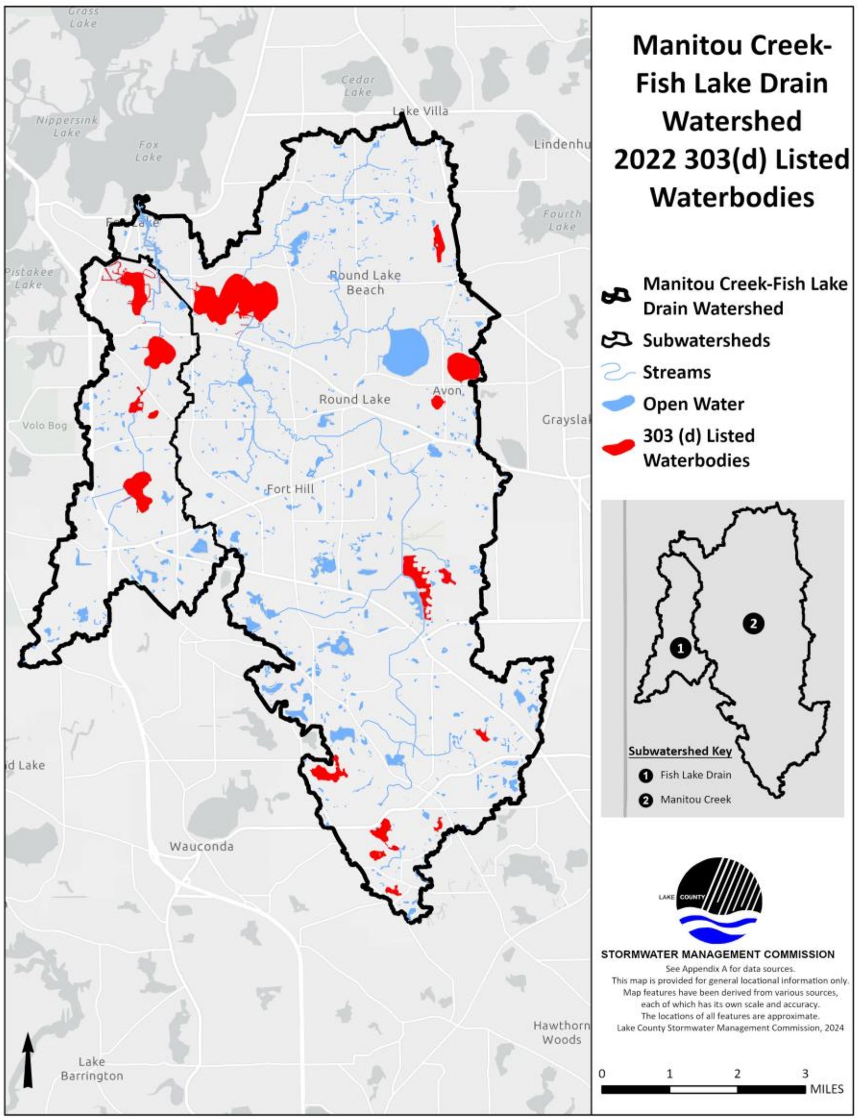


Figure 3-54: 2022 303(d) Listed Waterbodies

Table 3-40: Assessed Lakes and Causes of Impairment and Source of Pollution. Bold font indicates the Designated Use and cause(s) of impairment for which the water appears on the 303(d) list. Source: Illinois EPA

Lake	Illinois EPA Assessment Unit Id	Designated Use(s) And Level of Support	Cause(s)
Christa	IL_STU	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Phosphorus, Total** **Total Suspended Solids**
Davis Lake	IL_STQ	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Phosphorus, Total** **Total Suspended Solids**
Long (Lake)	IL_RTJ	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Phosphorus, Total**
Round	IL_RTH	Aquatic Life: Full Support Aesthetic Quality: Full Support Fish Consumption: Not Assessed Primary Contact: Full Support	n/a
Lake Fairfield	IL_UTE	Aquatic Life: Full Support Aesthetic Quality: Full Support Fish Consumption: Not Assessed Primary Contact: Not Assessed	n/a
Wooster	IL_RTZH	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Phosphorus, Total**
Summerhill Estate	IL_WTA	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Phosphorus, Total** **Total Suspended Solids**
Old Oak	IL_UTJ	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Cause Unknown**
Highland	IL_RTZP	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Phosphorus, Total**
Schreiber	IL_UTD	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Cause Unknown**
Owens	IL_VTZX	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Aquatic Plants** **Phosphorus, Total** **Total Suspended Solids**
Hidden Lake	IL_UTM	**Aquatic Life: Non-Support** **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed	**Dissolved Oxygen** **Non-Native Fish/Shellfish/Zooplankton** **pH**

Lake	Illinois EPA Assessment Unit Id	Designated Use(s) And Level of Support	Cause(s)
		Primary Contact: Not Assessed	**Phosphorus, Total** **Total Suspended Solids**
Hook Lake	IL_STW	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Aquatic Plants** **Phosphorus, Total** **Total Suspended Solids**
Duck	IL_RTZG	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Phosphorus, Total** **Total Suspended Solids**
Fish	IL_VTK	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed Primary Contact:	**Phosphorus, Total** **Total Suspended Solids**
Lake Holloway	IL_UTK	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Phosphorus, Total** **Total Suspended Solids**
Cranberry Lake	IL_UTL	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Aquatic Plants** **Phosphorus, Total**
Fischer Lake	IL_VTT	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Phosphorus, Total** **Total Suspended Solids**
North Churchill	IL_STR	**Aquatic Life: Non-Support** **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Phosphorus, Total** **Total Suspended Solids**
South Churchill	IL_STS	**Aquatic Life: Non-Support** **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Phosphorus, Total** **Total Suspended Solids**
Countryside Glen	IL_STX	Aquatic Life: Full Support **Aesthetic Quality: Non-Support** Fish Consumption: Not Assessed Primary Contact: Not Assessed	**Phosphorus, Total** **Total Suspended Solids**

3.16.2 Total Maximum Daily Loads

Section 303(d) of the Clean Water Act requires Illinois EPA to identify all waters that do not meet water quality standards. For waters impaired by pollutants, Section 303(d) requires the development of a total maximum daily load (TMDL). The Illinois EPA developed a total maximum daily load reports for phosphorus in the Upper Fox River/Chain O' Lakes watershed in 2020. Where applicable, actions identified in the TMDL reports were included in the programmatic and site-specific action plans (see Chapter 6).

Total Maximum Daily Load: An estimation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. It assesses contributing point and nonpoint sources and identifies pollution reductions necessary for designated use attainment.

The Upper Fox River/Chain O' Lakes watershed Total Maximum Daily Load Report assessed 10 impaired waterbodies in the Manitou-Fish Lake Drain watershed (Illinois EPA, 2020). The TMDL addresses Aesthetic Quality Use impairments caused by phosphorus for stream segments and lakes/reservoirs within the Manitou Creek-Fish Lake Drain watershed. The report also addresses Dissolved oxygen (DO) and pH impairments for Hidden Lake. The TMDL did not address the TSS impairments present in several of the lakes in the watershed; however, Load Reduction Strategies (LRS) were created to address these impairments.

Phosphorus pollution can come from nonpoint or point source pollution. Nonpoint sources of phosphorus pollution include internal loading, stormwater runoff, stream channelization, stream erosion, discharges from septic systems, wetlands, forests, and wildlife. Point sources of phosphorus pollution include individual permitted facilities and municipal separate storm sewer systems (MS4). The total maximum daily load report determined total respective phosphorus loads and reductions for each of the 10 impaired waterbodies needed to reach the target phosphorus concentration of 0.05 mg/L (Table 3-41). The total maximum daily load is distributed among permitted point sources as waste load allocations. The total maximum daily load is distributed among nonpoint sources as load allocations. A margin of safety is also included to account for uncertainty.

Table 3-41: TMDL Load Summary by Lake. Source: Illinois EPA 2020/2022

Name	Illinois EPA Assessment Unit ID	TMDL Pollutant	Current Load (lb/day)	Reduction Needed (lb/day)	Load Reduction Needed (percent)
Davis Lake	IL_STQ	Total Phosphorus	2.03	1.73	85%
Duck Lake	IL_RTZG	Total Phosphorus	3.46	0.48	14%
Fischer Lake	IL_VTT	Total Phosphorus	5.21	4.00	77%
Fish Lake	IL_VTK	Total Phosphorus	7.10	5.32	75%
Hidden Lake	IL_UTM	Total Phosphorus	0.49	0.38	79%
Long Lake	IL_RTJ	Total Phosphorus	38.60	25.20	66%

Name	Illinois EPA Assessment Unit ID	TMDL Pollutant	Current Load (lb/day)	Reduction Needed (lb/day)	Load Reduction Needed (percent)
North Churchill Lake	IL_STR	Total Phosphorus	1.25	0.74	59%
South Churchill Lake	IL_STS	Total Phosphorus	0.80	0.41	52%
Summerhill Estates Lake	IL_WTA	Total Phosphorus	1.01	0.81	80%
Wooster Lake	IL_RTZH	Total Phosphorus	6.12	2.43	40%

Modeling prepared for the Upper Fox River/Chain O' Lakes Watershed TMDL Report also includes a breakdown of total phosphorus loading into internal and external loads for each impaired lake (Table 3-42). Internal loading primarily consists of the release of phosphorus from the following sources in the lakes investigated:

- Lake sediments via physical disturbance from benthic fish (rough fish, e.g., carp).
- Wind mixing the water column.
- Seasonal temperature turnover mixing the water column.
- Decaying aquatic plant life, predominantly curly-leaf pondweed and Eurasian watermilfoil.

The following notes regarding this effort are included in the Total Maximum Daily Load Report:

- The Simplified Lake Assessment Model (SLAM) was used to model the impaired lakes.
- The relative proportion of the load reduction coming from internal or external sources can be modified and still result in compliance.
- Internal loading may be addressed by more aeration, addition of aluminum to inactivate phosphorus, and dredging.

Table 3-42: TMDL Summary: Load Reduction Needed by Lake. Source: Illinois EPA 2020/2022

Name	Illinois EPA Assessment Unit ID	Total Phosphorus Loading Source	Current Load (lb/day)	Reduction Needed (lb/day)	Load Reduction Needed (percent)
Davis Lake	IL_STQ	Internal	1.79	1.61	90%
		External	0.24	0.12	50%
Duck Lake	IL_RTZG	Internal	0.27	0	0%
		External	3.19	0.48	15%
Fischer Lake	IL_VTT	Internal	0.60	0.44	74%
		External	4.62	3.55	77%
Fish Lake	IL_VTK	Internal	1.72	1.29	75%
		External	5.38	4.03	75%
Hidden Lake	IL_UTM	Internal	0.26	0.21	82%
		External	0.23	0.17	75%
Long Lake	IL_RTJ	Internal	10.3	7.24	70%
		External	28.2	17.9	64%
	IL_STR	Internal	0.17	0.09	52%

Name	Illinois EPA Assessment Unit ID	Total Phosphorus Loading Source	Current Load (lb/day)	Reduction Needed (lb/day)	Load Reduction Needed (percent)
North Churchill Lake		External	1.08	0.65	60%
South Churchill Lake	IL_STS	Internal	0.62	0.32	52%
		External	0.18	0.09	50%
Summerhill Estates Lake	IL_WTA	Internal	0.65	0.54	83%
		External	0.37	0.28	75%
Wooster Lake	IL_RTZH	Internal	1.21	0.42	35%
		External	4.91	2.43	41%

3.16.3 Summary of Monitoring

Chemical, physical, and biological monitoring has been conducted by multiple agencies within the planning area (Table 3-43, Figure 3-55). Monitoring frequency and intensity varies considerably between waterbodies. Lake monitoring comprises most efforts in the area. Stream monitoring has been conducted at three locations on Manitou Creek. There is no known stream monitoring data for Fish Lake Drain. Due to the heavy focus on lake monitoring, results will be summarized by waterbody.

US EPA's *How's My Waterway?* Tool was used to identify monitoring efforts within the planning area. Current and past water monitoring conditions were queried from both the Manitou Creek (071200061008) and Headwaters Manitou Creek (071200061007) watersheds. Portions of the planning boundary that extend into Cotton Creek (071200061103) do not have any monitoring data. There are two currently active monitoring sites: a USGS station and a Cyanobacteria Assessment Network (CyAN) site, both at Long Lake. There are many past monitoring efforts included in this database, which are summarized below, focusing on the last 10 years of data collection. The database includes water quality samples from the EPA National Aquatic Resources Survey, Illinois EPA, Illinois RiverWatch Network, North American Lake Management Society, and the USGS Illinois Water Science Center. In addition to data recovered through US EPA, the Illinois EPA's Volunteer Lake Monitoring Program data and the Lake County Health Department's monitoring efforts are included in the subsections below.

Compiled data herein is only intended to summarize monitoring data on a watershed-wide scale and should not be used to compare individual lakes to on another. Complex lake-specific characteristics influence the fishery, aquatic plant composition, and water quality. For more individual lake assessments, Lake County Health Department Lake Reports provide smaller scale lake-specific assessments and can be accessed at: https://www.lakecountyil.gov/2400/Lake-Reports.

Table 3-43: Summary of Relevant Recent Monitoring Efforts

Station Location	Year	Investigator(s)	Notes
Countryside Glen Lake	2004	Lake County Health Department	Chemical/physical parameters, aquatic plants

Station Location	Year	Investigator(s)	Notes
Cranberry Lake	2000, 2005-2014	Lake County Health Department	Chemical/physical parameters, aquatic plants
Cranberry Lake	2014	Illinois EPA	Algae
Davis Lake	2000, 2009	Lake County Health Department	Chemical/physical parameters, aquatic plants
Duck Lake	1988, 1997, 2001, 2006, 2016	Lake County Health Department	Chemical/physical parameters, aquatic plants
Duck Lake	2003, 2008, 2009, 2016	Illinois EPA	Chemical/physical parameters, algae
Duck Lake	1994, 1995, 1997, 1999-2013, 2016-2018	Illinois EPA Volunteer Lake Monitoring Program	Physical parameters, aquatic plants
Duck Lake	1995-2007, 2018	North American Lake Management Society	Physical parameters
Duck Lake	2020	Illinois Department of Natural Resources	Fish
Fairfield Marsh	2003	Lake County Health Department	Chemical/physical parameters, aquatic plants
Fischer Lake	2001, 2006, 2016	Lake County Health Department	Chemical/physical parameters, aquatic plants
Fischer Lake	2007-2009, 2016	Illinois EPA	Chemical/physical parameters, aquatic plants, algae
Fischer Lake	2005-2013, 2015, 2016	Illinois EPA Volunteer Lake Monitoring Program	Physical parameters, aquatic plants
Fish Lake	1988, 1997, 2002, 2006, 2016	Lake County Health Department	Chemical/physical parameters, aquatic plants
Fish Lake	2014-2022	Illinois EPA	Algae
Fish Lake	2003-2011	Illinois EPA Volunteer Lake Monitoring Program	Physical parameters, aquatic plants
Fish Lake	2004	Illinois Department of Natural Resources	Fish
Hidden Lake	2002	Lake County Health Department	Chemical/physical parameters, aquatic plants
Highland Lake	2004, 2009	Lake County Health Department	Chemical/physical parameters, aquatic plants
Highland Lake	2019	Illinois EPA	Algae

Station Location	Year	Investigator(s)	Notes
Highland Lake	2008	North American Lake Management Society	Physical parameters
Highland Lake	2009	Illinois Department of Natural Resources	Fish
Hook Lake	1991, 1996, 2001, 2009, 2019	Lake County Health Department	Chemical/physical parameters, aquatic plants
Hook Lake	2001	Illinois Department of Natural Resources	Fish
Lake Christa	2004, 2006	Lake County Health Department	Chemical/physical parameters, aquatic plants
Lake Fairfield	2000	Lake County Health Department	Chemical/physical parameters, aquatic plants
Lake Helen	2009	Lake County Health Department	Chemical/physical parameters, aquatic plants
Lake Holloway	2002	Lake County Health Department	Chemical/physical parameters, aquatic plants
Long Lake	1982, 1991, 1996, 2001, 2005-2014	Lake County Health Department	Chemical/physical parameters, aquatic plants
Long Lake	2002, 2003, 2009, 2012, 2014, 2017-2022	Illinois EPA	Chemical/physical parameters, aquatic plants, algae
Long Lake	2012	Illinois EPA	Aquatic plant and fish habitat survey
Long Lake	2007	EPA National Aquatic Resources Survey	Chemical/physical parameters
Long Lake	2012	EPA National Aquatic Resources Survey	Chemical/physical parameters, algae
Long Lake	2015-2022	USGS	Algae
Long Lake	2022-2023	USGS	Chemical/physical parameters
Long Lake	1994, 1995, 1997, 1999, 2001, 2002, 2005, 2006, 2010-2018	Illinois EPA Volunteer Lake Monitoring Program	Physical parameters, aquatic plants
Long Lake	2020-2024	Cyanobacteria Assessment Network	Daily blue-green algae concentration estimates using satellite data
Long Lake	2019-2023	Long Lake Improvement and Sanitation Association (LLISA)	Chemical, Physical, water levels
Long Lake	2001-2002	Stanley Consultants	Chemical parameters

Station Location	Year	Investigator(s)	Notes
Long Lake	2016	Illinois Department of Natural Resources	Fish
Manitou Creek, in Fairfield Park	2015, 2016	RiverWatch Network	Habitat and biological survey
Manitou Creek, just upstream of Nippersink Lake, near Grand Ave	2014	Illinois EPA	Algae
Manitou Creek, just downstream of Long Lake, near Wilson Rd	2014	Illinois EPA	Algae
Manitou Creek	2019-2020	Manitou Creek Watershed Alliance	HAB, watershed monitoring
Nippersink Lake (LCFP)	2009, 2021	Lake County Health Department	Chemical/physical parameters, aquatic plants
Nippersink Lake (LCFP)	2008, 2022	Illinois Department of Natural Resources	Fish
North Churchill Lake	2003	Lake County Health Department	Chemical/physical parameters, aquatic plants
Old Oak Lake	2000, 2009	Lake County Health Department	Chemical/physical parameters, aquatic plants
Owens Lake	2000, 2009	Lake County Health Department	Chemical/physical parameters, aquatic plants
Patski Pond (Inlet)	2004	Lake County Health Department	Chemical/physical parameters, aquatic plants
Round Lake	2004	Lake County Health Department	Chemical/physical parameters, aquatic plants
Round Lake	2002, 2003, 2005, 2009, 2012, 2014, 2015, 2017, 2018, 2019, 2022	Illinois EPA	Chemical/physical parameters, aquatic plants, algae
Round Lake	2009	Illinois EPA	Aquatic plant and fish habitat survey
Round Lake	1994, 1996, 1999-2001, 2018	North American Lake Management Society	Physical parameters
Round Lake	2019	Illinois Department of Natural Resources	Fish
Round Lake Marsh North	2009, 2021	Lake County Health Department	Chemical/physical parameters, aquatic plants
Schreiber Lake	1999, 2003, 2009, 2023	Lake County Health Department	Chemical/physical parameters, aquatic plants

Station Location	Year	Investigator(s)	Notes
Schreiber Lake	2007	Illinois Department of Natural Resources	Fish
Summerhill Estates Lake	2004, 2009, 2016	Lake County Health Department	Chemical/physical parameters, aquatic plants
Wooster Lake	1989, 1995, 1999, 2003, 2005-2014, 2016	Lake County Health Department	Chemical/physical parameters, aquatic plants
Wooster Lake	2001, 2002, 2014-2017	Illinois EPA	Chemical/physical parameters, aquatic plants, algae
Wooster Lake	1995, 1997, 1999-2012	Illinois EPA Volunteer Lake Monitoring Program	Physical parameters, aquatic plants
Wooster Lake	1997, 2002	North American Lake Management Society	Physical parameters
Wooster Lake	2004	Illinois Department of Natural Resources	Fish

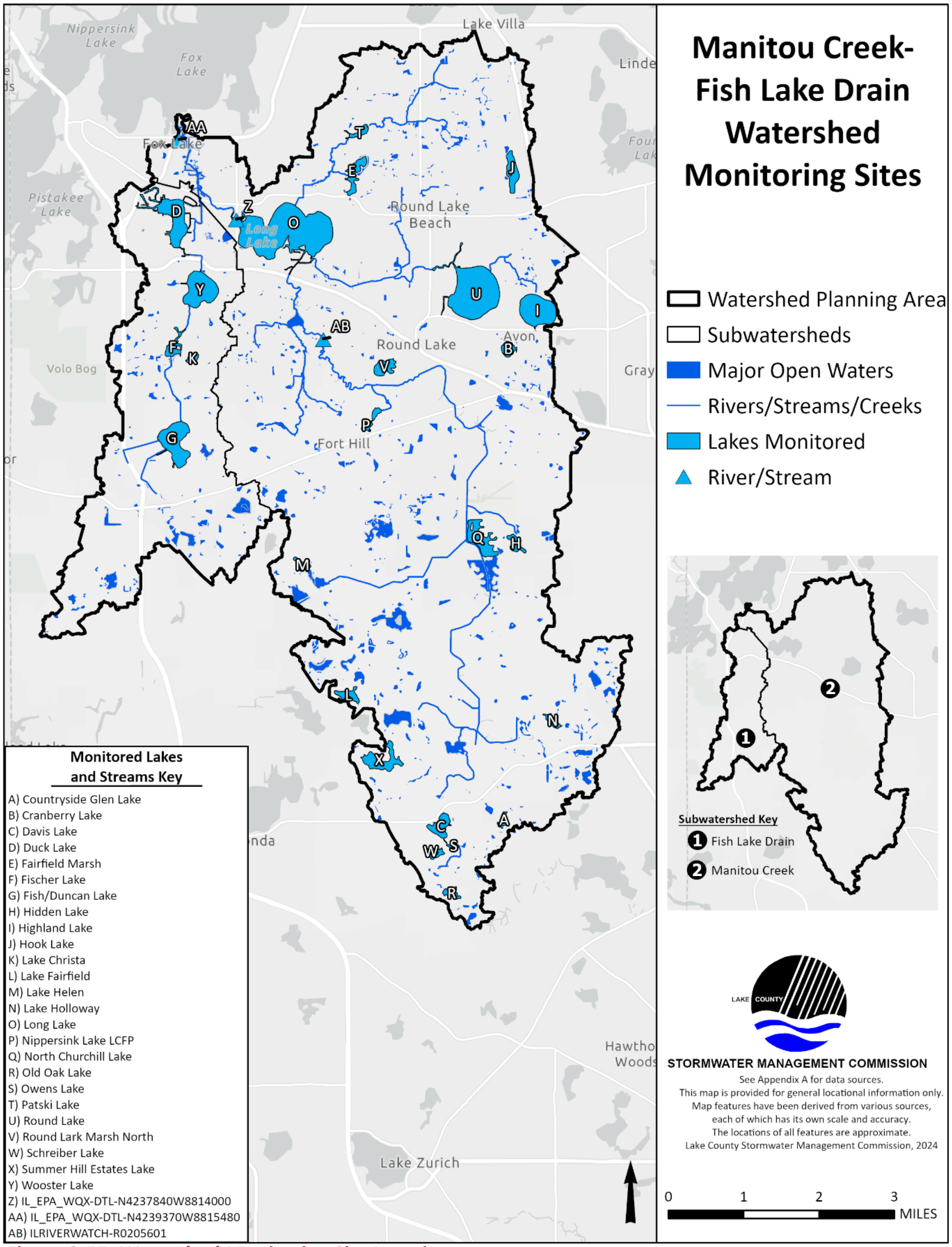


Figure 3-55: Watershed Monitoring Site Locations

Minimal monitoring has occurred on streams in the watershed in the last ten years. Two Microcystin samples were collected in Manitou Creek, one just downstream of Long Lake, near Wilson Rd., and one just upstream of Nippersink Lake, near Grand Ave. Both these samples were collected in September of 2015, likely associated with a potential harmful algal bloom in Long Lake. Microcystin concentrations were recorded at 852 and 626 µg/L, which are higher that the US EPA's established recommended water concentrations, at or below which protects public health, of 8 µg/L.

At the Illinois RiverWatch Network site, located on Manitou Creek, in the Village of Round Lake's Fairfield Park, the RiverWatch Assessment summarizes the historical trends as follows in Table 3-44.

Table 3-44: Illinois RiverWatch Network Summary

Metric	Assessment
Water Quality Score	Fair
Water Quality Trend	Declining
Last Sampled	April 16, 2023
Number of Years Sampled	7
Average Macroinvertebrates Collected	114.71
Average Taxa Richness	9.29
Average EPT Taxa Richness	2.71
Average Biotic Index	5.43
Public Water Quality Score	3

Metric	Assessment
Correl Taxa Richness	-0.39
Correl EPT Taxa Richness	-0.55
Correl MBI	0.52
Strength Taxa Richness	Declining
Strength EPT Taxa Richness	Declining
Strength MBI	Declining
Taxa Richness Score	Fair
EPT Taxa Richness Score	Fair
MBI Score	Fair

In 2015 and 2019, the Illinois Natural History Survey performed limited in-field water quality sampling in conjunction with freshwater mussel surveys (Table 3-45). These surveys were performed at the wetland complex along Rollins Road, at the confluence of Fish Lake Drain and Manitou Creek.

Table 3-45: Illinois Natural History Survey Water Quality Summary

Parameter	2015	2019
pH	7.7	7.49
Salinity (mg/L)	512.3	380
Conductivity (µS)	961.8	728
Total Dissolved Solids (mg/L)	674.3	517

A large Manitou Creek water quality monitoring effort was undertaken in the early 2000s and is references as the Baxter Report in the 2004 Manitou Creek Watershed Management Plan. The 2004 Manitou Creek Watershed Management Plan is the most current comprehensive assessment of water quality for Manitou Creek.

3.16.3.1 Fish and Native Plant Species

The Illinois Department of Natural Resources, Division of Fisheries surveyed nine lakes in the planning area for the number of native fish species present, and the Lake County Health Department – Ecological Services (LCHD-ES) surveyed 23 lakes for the number of native plant species (Table 3-46). Due to the limited fisheries data, the total number of species recorded is reported in lieu of the number of native species. Common carp was a non-native species that was commonly identified in survey reports. The number of fish species observed ranged from 6 - 21 and the number of native plant species observed ranged from 0 – 17. These counts can be utilized to identify lakes that would benefit from habitat restoration.

Table 3-46: Number of Fish and Native Plant Species Identified in Assessed Lakes

Lake Name	Subwatershed	Fish		Aquatic Plants	
		Last Assessed	Number of Species	Last Assessed	Number of Native Species
Countryside Glen Lake	Manitou Creek	-	-	2004	12
Cranberry Lake	Manitou Creek	-	-	-	-
Davis Lake	Manitou Creek	-	-	2009	10
Duck Lake	Fish Lake Drain	2020	21	2016	9
Fairfield Marsh	Manitou Creek	-	-	2003	4
Fischer Lake	Fish Lake Drain	-	-	2016	7
Fish Lake	Fish Lake Drain	2004	11	2016	3
Hidden Lake	Manitou Creek	-	-	2002	0
Highland Lake	Manitou Creek	2009	8	2019	9
Hook Lake	Manitou Creek	2001	6	2009	5
Lake Christa	Fish Lake Drain	-	-	2006	4
Lake Fairfield	Manitou Creek	-	-	-	-
Lake Helen	Manitou Creek	-	-	2009	8
Lake Holloway	Manitou Creek	-	-	2002	2
Long Lake	Manitou Creek	2016	15	-	-
Nippersink Lake (LCFP)	Manitou Creek	2022	6	2021	1
North Churchill Lake	Manitou Creek	-	-	2003	4
Old Oak Lake	Manitou Creek	-	-	2009	8
Owens Lake	Manitou Creek	-	-	2009	8
Patski Pond	Manitou Creek	-	-	2004	2
Round Lake	Manitou Creek	2009	15	2019	17
Round Lake Marsh North	Manitou Creek	-	-	2004	17
Schreiber Lake	Manitou Creek	2007	7	2009	12
South Churchill Lake	Manitou Creek	-	-	2003	2
Summerhill Estates Lake	Manitou Creek	-	-	2016	7
Wooster Lake	Fish Lake Drain	2004	14	2016	8

3.16.3.2 Floristic Quality Index

Floristic Quality Index (FQI) is a metric that evaluates how close the flora of an area is to undisturbed conditions. It can be used to identify natural areas, compare floristic quality between or within lakes, monitor long-term changes in floristic quality, or monitor habitat restoration efforts. To determine FQI, each floating and submerged plant species is assigned a number based on its sensitivity to disturbance, and the average of the assigned numbers is multiplied by the square root of the number of plant species found in the lake. FQI scores between 1 - 19 indicate low vegetative quality, scores between 20 - 35 indicate high vegetative quality, and scores >35 indicate undisturbed vegetative quality. The LCHD-ES surveyed 25 lakes in Lake County for FQI (Table 3-47). These assessments determined FQI scores both including (FQI Native) and excluding (FQI w/ Adventives) invasive species. Of the 25 lakes assessed for FQI Native, 16 had low vegetative quality and 9 had high vegetative quality. When invasive species were included in the FQI scores (FQI w/ Adventives), 19 lakes had low vegetative quality and six had high vegetative quality.

Table 3-47: FQI of Assessed Lakes Without and With Adventives

Lake Name	Last Assessed	Subwatershed	Floristic Quality Index: Native	Floristic Quality Index: Native with Adventives
Countryside Glen Lake	2004	Manitou Creek	22.8	21.9
Cranberry Lake	2013	Manitou Creek	29.7	29.7
Davis Lake	2009	Manitou Creek	21.4	21.4
Duck Lake	2016	Fish Lake Drain	19.0	18.0
Fairfield Marsh	2003	Manitou Creek	8.7	7.5
Fischer Lake	2016	Fish Lake Drain	14.7	13.6
Fish Lake	2016	Fish Lake Drain	10.9	9.6
Hidden Lake	2002	Manitou Creek	0	0
Highland Lake	2019	Manitou Creek	20.0	17.3
Hook Lake	2009	Manitou Creek	13.4	11.3
Lake Christa	2006	Fish Lake Drain	9.8	8.5
Lake Fairfield	2001	Manitou Creek	10.4	9.0
Lake Helen	2009	Manitou Creek	18.0	18.0
Lake Holloway	2002	Manitou Creek	10.6	10.6
Long Lake	2013	Manitou Creek	17.7	15.8
Nippersink Lake	2021	Manitou Creek	5.0	3.5
North Churchill Lake	2003	Manitou Creek	15.0	15.0
Old Oak Lake	2009	Manitou Creek	19.1	18.0
Owens Lake	2009	Manitou Creek	17.3	16.3
Patski Pond	2004	Manitou Creek	7.1	7.1
Round Lake	2019	Manitou Creek	27.6	24.9
Round Lake Marsh North	2004	Manitou Creek	29.9	29.1
Schreiber Lake	2009	Manitou Creek	24.8	23.9
South Churchill Lake	2003	Manitou Creek	8.5	8.5
Summerhill Estates Lake	2016	Manitou Creek	15.5	14.5
Wooster Lake	2016	Fish Lake Drain	20.0	18.0

3.16.3.3 Water Quality

The water quality of 25 lakes in the watershed was assessed utilizing multiple parameters including total phosphorus (TP), soluble reactive phosphorus (SRP), total Kjeldahl nitrogen (TKN), ammonia (NH_3-N), nitrate (NO_3^-), secchi disk depth (SECCHI), total solids (TS), total dissolved solids (TDS), total volatile solids (TVS), TSS, chloride (Cl^-), alkalinity (ALK), specific conductivity (COND), pH, and DO (Table 3-48).

The most recent year of epilimnion water quality data collected by the Lake County Health Department was used for each lake (ranged from 2001 – 2023). More recent data from other monitoring agencies or programs were included in addition to Health Department data. Water quality data that is older than 10 years may not be representative of the current lake conditions and should be interpreted carefully. For example, phosphorus fertilizer restrictions were implemented in Illinois in 2010. This likely reduced phosphorus pollution loading to lakes, but this reduction would not be shown in summaries using older water quality data. In-depth analysis and reports for individual lakes within Lake County can be accessed at http://www.lakecountyil.gov/2400/Lake-Reports.

Table 3-48: Water Quality in Lakes for Most Recent Year Assessed. Value for each parameter is the arithmetic mean of all samples for most recent assessment year. If most recent assessment was > 10 years before this lake inventory summary (2024), results may not be representative of the current lake conditions. ND = not detected above laboratory detection limits. NA= Not Analyzed

Lake Name	Last Assessed		TP (mg/L)	SRP (mg/L)	TKN (mg/L)	NH3-N (mg/L)	NO3-N (mg/L)	SECCHI (ft)	TS (mg/L)	TDS (mg/L)	TSS (mg/L)	TVS (mg/L)	ALK (mg/L CaCO3)	COND (mS/cm)	Cl- (mg/L)	pH (s.u.)
Manitou Creek																
Countryside Glen Lake	2004	LCHD ES	0.064	0.020	1.16	ND	0.06	3.6	460	420	6.7	119	151	0.760	NA	8.33
Cranberry Lake	2014	LCHD ES	0.027	ND	0.86	ND	ND	5.9	355	NA	2.9	88	128	0.559	104	7.64
Davis Lake	2009	LCHD ES	0.065	0.013	0.96	ND	ND	9.6	382	NA	2.6	104	160	0.631	89	8.44
Fairfield Marsh	2003	LCHD ES	0.326	0.016	5.31	0.64	0.05	0.8	759	652	81.6	218	175	1.109	NA	8.56
Hidden Lake	2002	LCHD ES	0.224	0.057	2.99	0.53	1.14	0.6	436	352	74.0	116	141	0.547	NA	8.48
Highland Lake	2019	LCHD ES	0.034	0.007	0.66	ND	0.05	7.4	374	NA	2.6	76	137	0.605	109	8.26
Hook Lake	2009	LCHD ES	0.041	ND	0.84	0.14	0.06	4.0	820	NA	6.5	98	119	1.469	366	8.50
Lake Fairfield	2000	LCHD ES	0.030	ND	1.16	0.17	0.32	5.9	405	386	5.1	136	161	0.627	NA	8.54
Lake Helen	2009	LCHD ES	0.072	0.013	1.41	ND	ND	6.4	319	NA	4.1	98	152	0.474	33	8.40
Lake Holloway	2002	LCHD ES	0.132	0.023	2.05	0.19	1.36	3.4	376	343	14.6	118	157	0.555	NA	8.74
Long Lake	2014	LCHD ES	0.107	0.031	1.66	0.12	0.51	3.0	649	NA	11.8	134	179	1.007	193	8.39
	2023	USGS	0.037	ND	0.74	NA	NA	10.2	NA	NA	NA	NA	NA	NA	164	8.20
Nippersink Lake	2021	LCHD ES	0.072	0.017	1.13	0.19	ND	3.5	499	619	12.1	123	152	0.781	147	8.28
North Churchill Lake	2003	LCHD ES	0.087	0.005	1.49	0.16	1.29	0.6	518	430	77.2	127	176	0.677	NA	8.37
Old Oak Lake	2009	LCHD ES	0.047	ND	0.90	ND	ND	5.1	460	NA	4.6	124	153	0.763	146	8.70
Owens Lake	2009	LCHD ES	0.058	0.026	0.92	ND	ND	5.3	387	NA	3.5	105	158	0.642	93	8.55
Patski Pond	2004	LCHD ES	0.113	0.050	1.04	ND	0.10	NA	463	422	13.9	92	182	0.748	NA	7.37
Round Lake	2019	LCHD ES	0.016	ND	0.53	ND	ND	10.8	445	NA	4.1	71	102	0.755	171	7.18
	2022	IEPA	0.031	NA	0.74	0.39	NA	NA	NA	NA	6.5	NA	151	NA	230	NA
Round Lake Marsh North	2004	LCHD ES	0.113	0.027	1.39	ND	ND	NA	373	341	20.2	105	143	0.609	NA	8.90
Schreiber Lake	2023	LCHD ES	0.034	ND	1.57	ND	ND	5.8	189	NA	4.0	60	156	0.282	ND	7.69
South Churchill Lake	2003	LCHD ES	0.090	ND	ND	ND	ND	0.7	ND	ND	43.6	ND	ND	0.691	ND	ND
Summerhill Estates Lake	2016	LCHD ES	0.051	0.007	1.01	0.15	ND	3.8	363	NA	4.7	98	137	0.576	102	8.91
Fish Lake Drain																
Duck Lake	2016	LCHD ES	0.061	0.008	1.99	0.26	ND	3.7	510	NA	9.2	148	191	0.753	120	8.32
	2018	NALMS	NA	NA	NA	NA	NA	1.8	NA	NA	NA	NA	NA	NA	NA	NA
Fischer Lake	2016	LCHD ES	0.138	0.009	1.99	0.11	0.09	2.7	526	NA	16.5	149	207	0.765	117	8.36
Fish Lake	2016	LCHD ES	0.073	0.008	1.64	0.15	ND	3.6	509	NA	12.3	130	203	0.781	123	8.38
Lake Christa	2006	LCHD ES	0.058	ND	1.79	ND	0.23	3.0	629	NA	10.7	192	170	0.913	134	8.32
Wooster Lake	2016	LCHD ES	0.043	0.005	1.83	0.10	ND	7.4	424	NA	15.0	120	155	0.705	100	8.52

3.16.3.4 Nutrients

Plants and algae require nutrients from their environment to grow. The primary nutrients necessary for plant and algal growth are nitrogen and phosphorus. Aquatic vegetative growth in lakes is typically phosphorus limited in the Manitou Creek-Fish Lake Drain watershed. This means that any contributions of phosphorus to the water column directly affects plant and algal growth. The LCHD-ES analyzed TP and SRP at lakes within the watershed.

TP is a measure of all organic and inorganic phosphorus in the water column. Lakes with TP concentrations greater than 0.05 mg/L are classified as impaired by the Illinois EPA, because they can support excessive algal growth. The most recent yearly epilimnion average of TP for the assessed lakes ranged from 0.016 – 0.326 mg/L (Figure 3-56). The yearly average epilimnion TP concentration exceeded Illinois EPA's 0.05 mg/L TP standard in 18 (69.2%) of the assessed lakes.

SRP is a measure of phosphorus in the dissolved form that is readily available for plant and algal growth. The most recent yearly average of SRP for the assessed lakes ranged from <0.005 – 0.472 mg/L (Figure 3-57). Nitrogen is also needed for plant and algal growth and is present in both organic and inorganic forms. The LCHD-ES analyzed TKN, NH_3-N, and NO_3^- at lakes in the watershed. TKN is a measure of organic nitrogen, which is typically bound by aquatic vegetation. The most recent yearly average epilimnion TKN concentration for the assessed lakes ranged from <0.500 – 5.341 mg/L (Figure 3-58). NH_3-N and NO_3^- are measures of inorganic nitrogen, which can support seasonal algal blooms if present in sufficient quantities. The most recent yearly average epilimnion NH_3-N concentration ranged from <0.100 – 0.636 mg/L (Figure 3-59). The most recent yearly average epilimnion $N0_3^-$ concentration ranged from <0.050 – 1.294 mg/L (Figure 3-60).

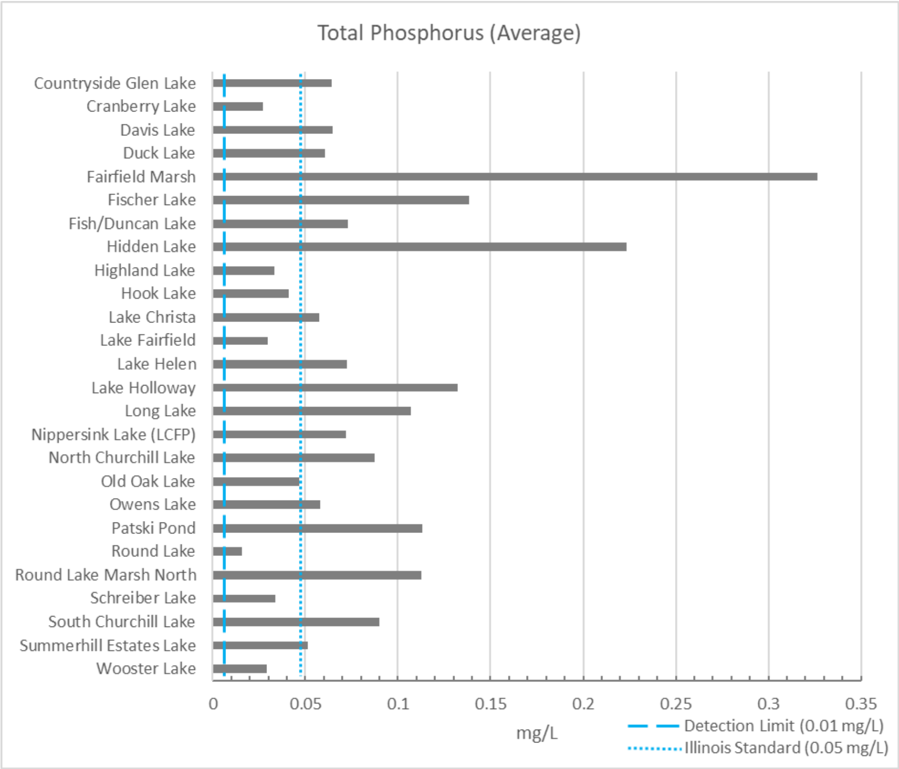


Figure 3-56: Mean Total Phosphorus by Lake. Most Recent Lake County Health Department Yearly Data. Lakes without monitoring data and lakes without monitoring data above detection limits for this parameter are not included in the

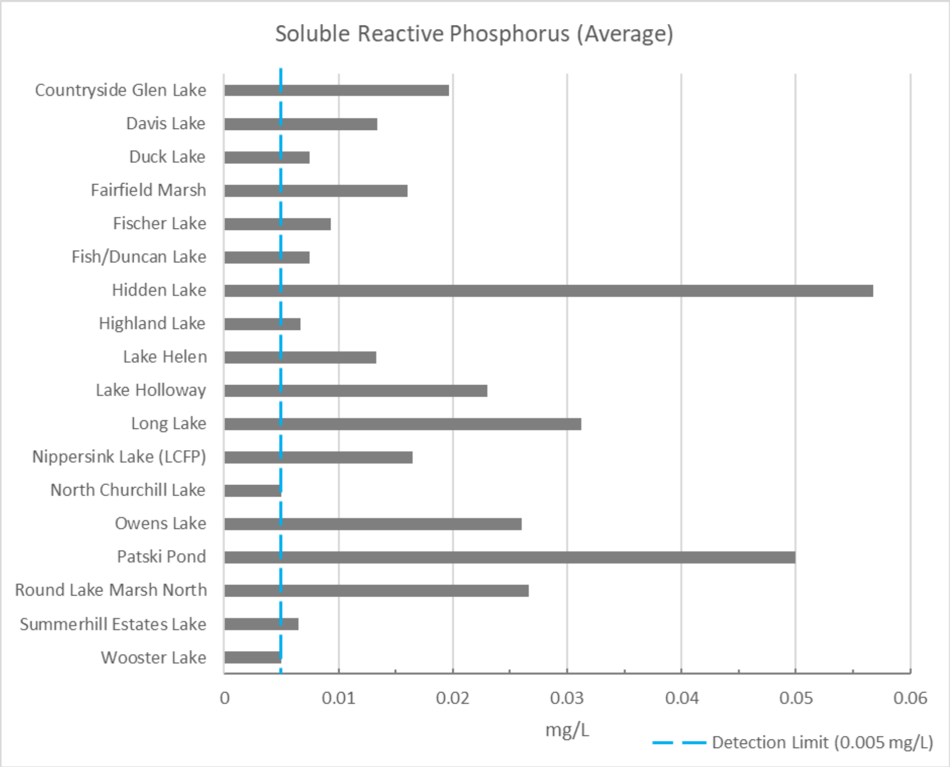


Figure 3-57: Mean Soluble Reactive Phosphorus by Lake. Most Recent Lake County Health Department Yearly Data. Lakes without monitoring data and lakes without monitoring data above detection limits for this parameter are not included in the figure.

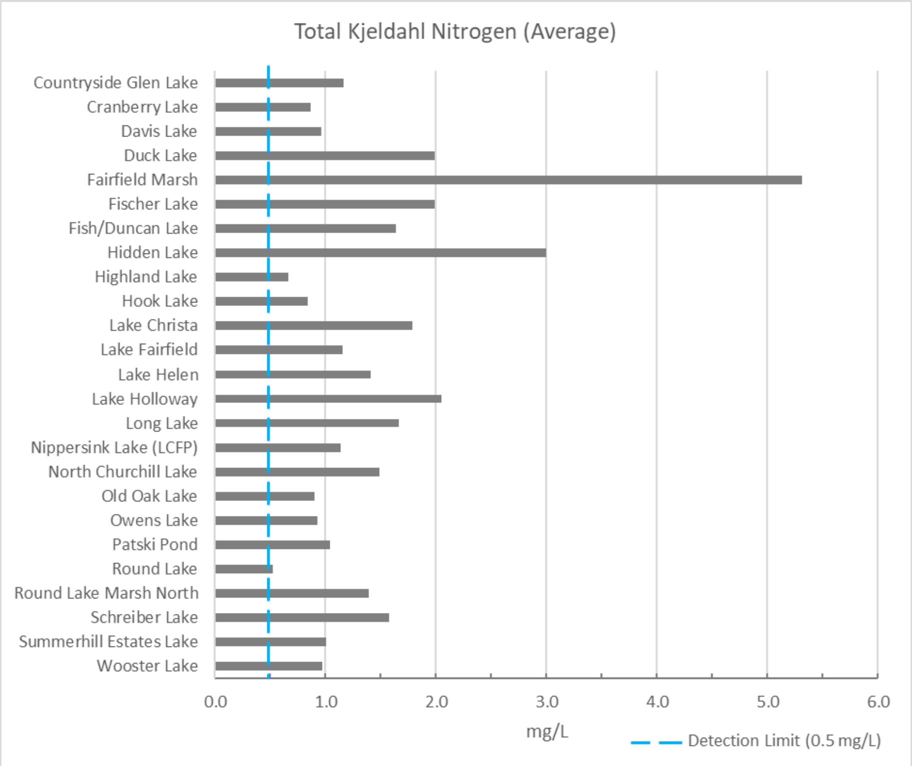


Figure 3-58: Mean Total Kjeldahl Nitrogen by Lake. Most Recent Lake County Health Department Yearly Data. Lakes without monitoring data and lakes without monitoring data above detection limits for this parameter are not included in the figure.

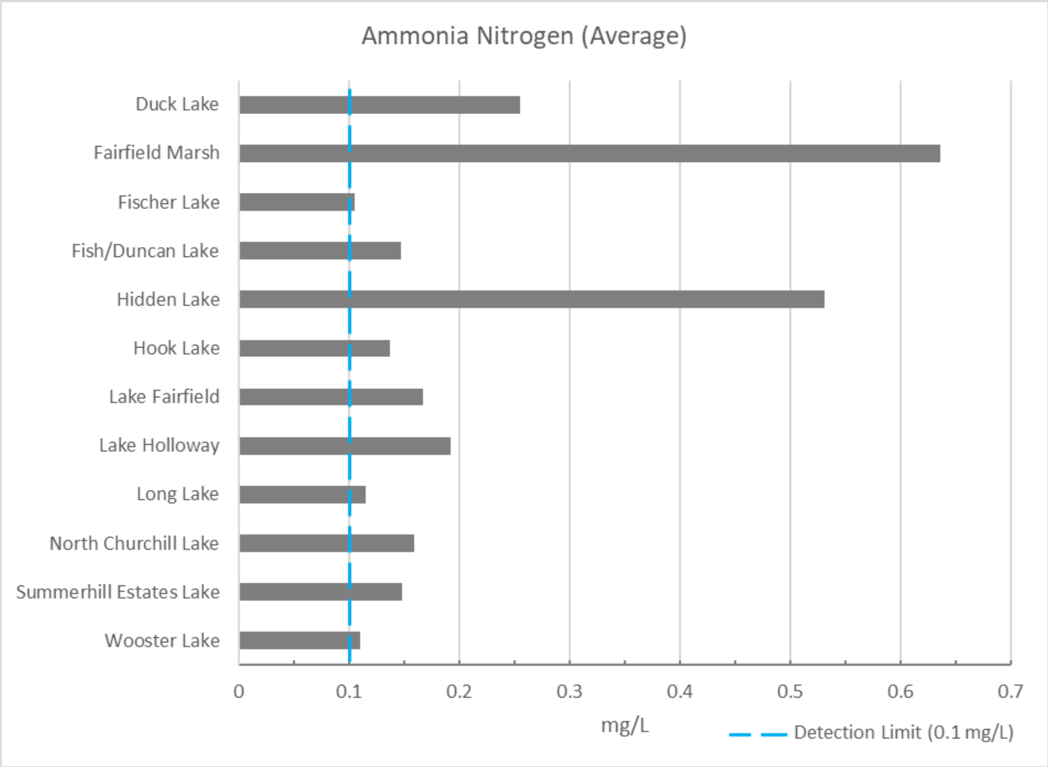


Figure 3-59: Mean Ammonia Nitrogen by Lake. Most Recent Lake County Health Department Yearly Data. Lakes without monitoring data and lakes without monitoring data above detection limits for this parameter are not included in the figure.

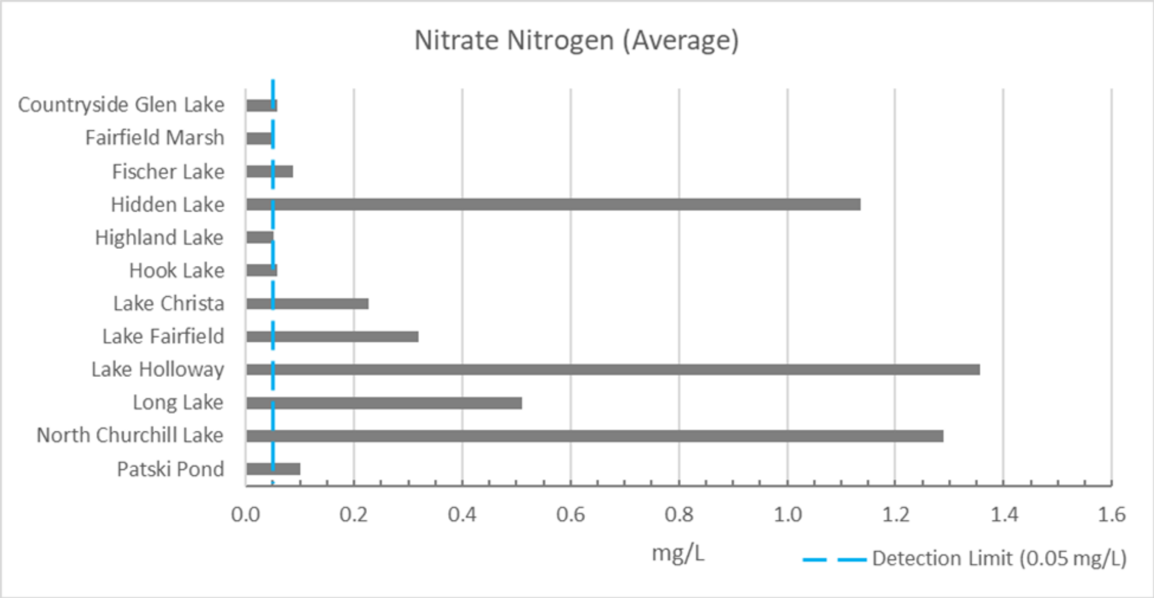


Figure 3-60: Mean Nitrate Nitrogen by Lake. Most Recent Lake County Health Department Yearly Data. Lakes without monitoring data and lakes without monitoring data above detection limits for this parameter are not included in the figure.

3.16.3.5 Water Clarity

Water clarity, or water transparency, is a measurement of the depth that light penetrates through the water column. A Secchi disk is typically utilized to measure this parameter. Briefly, a disk, with alternating black and white patterns, is lowered into the water column until it can't be seen by the observer. The depth at which this occurs is known as the Secchi depth. Secchi depth can be used as a proxy to estimate the amount of suspended and dissolved material in a lake such as algae, plankton, and sediment. Since suspended and dissolved material scatters light that enters the water column, increases in suspended sediments result in decreases in secchi depth. The most recent yearly average of secchi depth for the assessed lakes ranged from 0.6 – 10.8 feet (Figure 3-61).

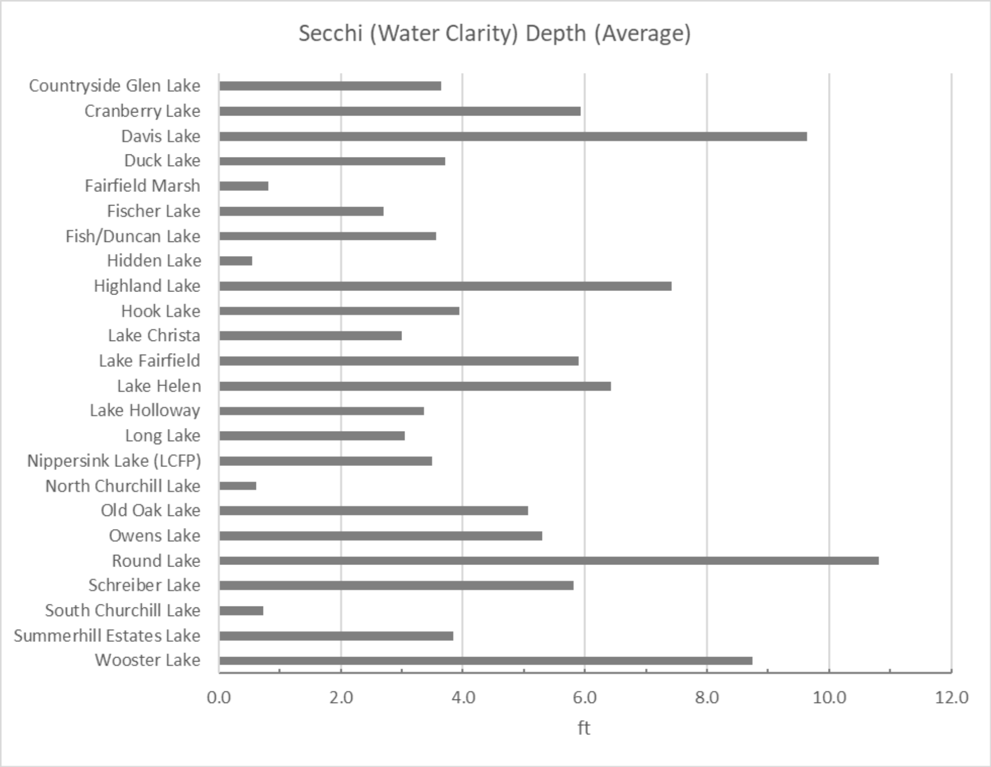


Figure 3-61: Mean Secchi Depth by Lake. Most Recent Lake County Health Department Yearly Data. Lakes without monitoring data for this parameter are not included in the figure.

3.16.3.6 Solids

Solids in the water column of a lake consist of suspended and dissolved material. TS is a measure of all suspended and dissolved solids in the water column. The most recent yearly average of TS for the assessed lakes ranged from 189-820 mg/L (Figure3-62). TDS is a measure of all the dissolved solids in a water column. The most recent yearly average of TDS for the assessed lakes ranged from 341-652 mg/L, (Figure 3-63). TSS is a measure of all organic and inorganic solids suspended in the water column including algae and sediment. High TSS concentrations can negatively impact many aspects of lake ecosystems and are typically associated with high phosphorus and low water clarity in the watershed lakes. The most recent yearly average of TSS for the assessed lakes ranged from 2.5-81.6 mg/L (Figure 3-64). TVS is a measure of organic solids in the water column, including algae, plant material, and zooplankton. Lakes with high TVS typically have large quantities of aquatic plants and algae. The most recent yearly average of TVS for the assessed lakes ranged from 60.4-217.8 mg/L (Figure 3-65).

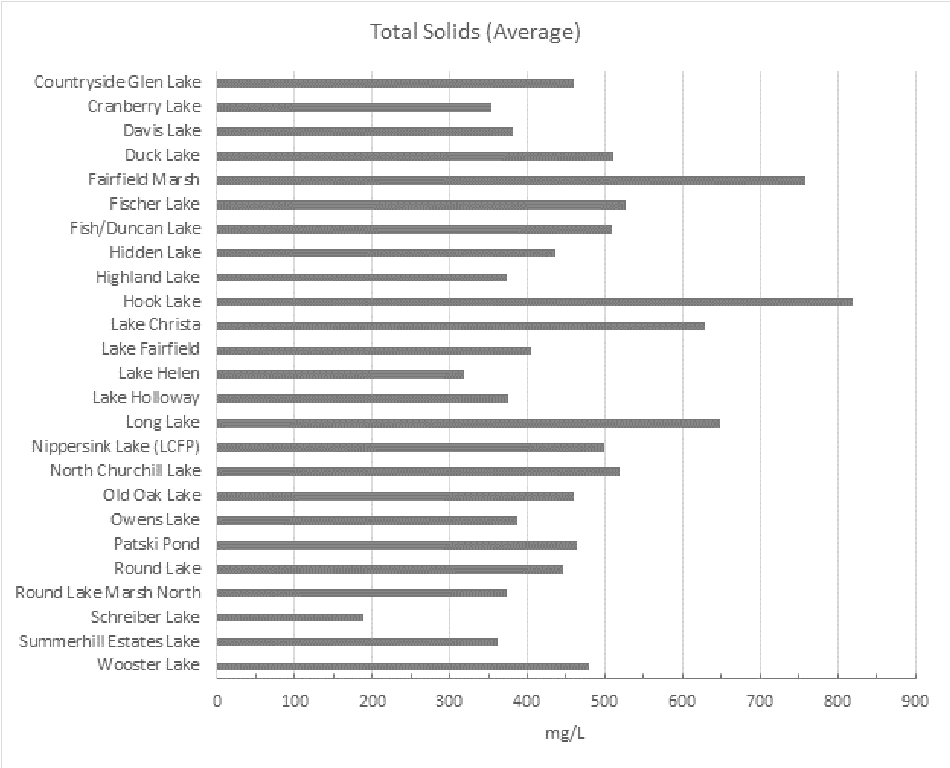


Figure 3-62: Mean Total Solids by Lake. Most Recent Lake County Health Department Yearly Data. Lakes without monitoring data for this parameter are not included in the figure.

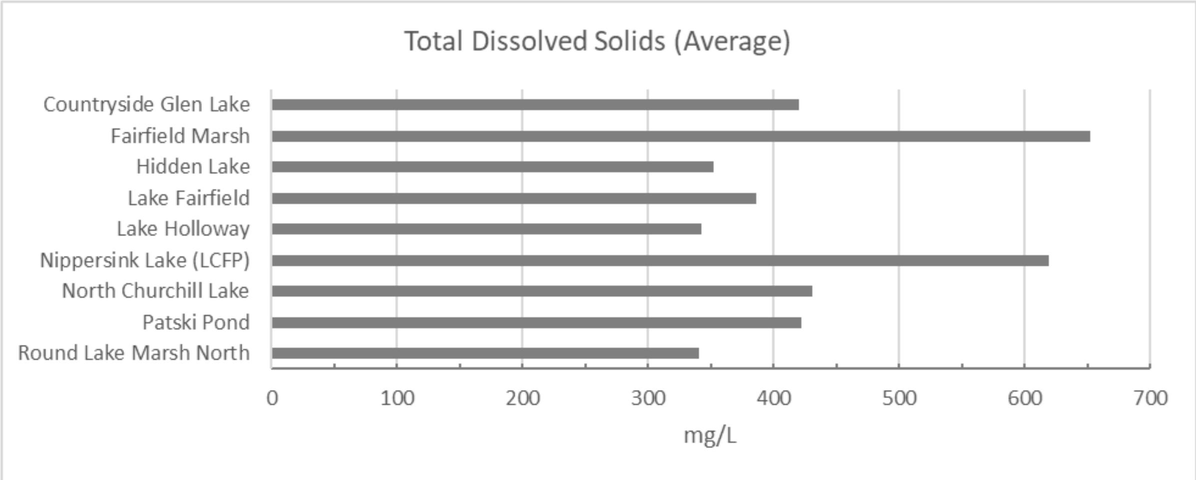


Figure 3-63. **Mean Total Dissolved Solids by Lake.** Most Recent Lake County Health Department Yearly Data. Lakes without monitoring data for this parameter are not included in the figure.

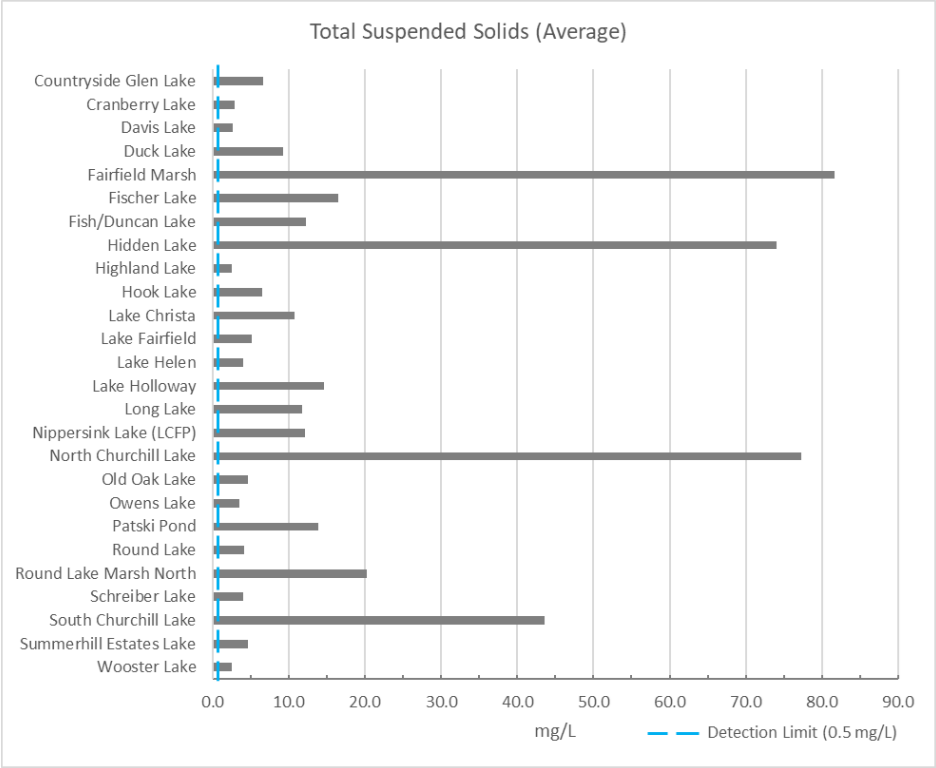


Figure 3-64: **Mean Total Suspended Solids by Lake.** Most Recent Lake County Health Department Yearly Data. Lakes without monitoring data and lakes without monitoring data above detection limits for this parameter are not included in the figure.

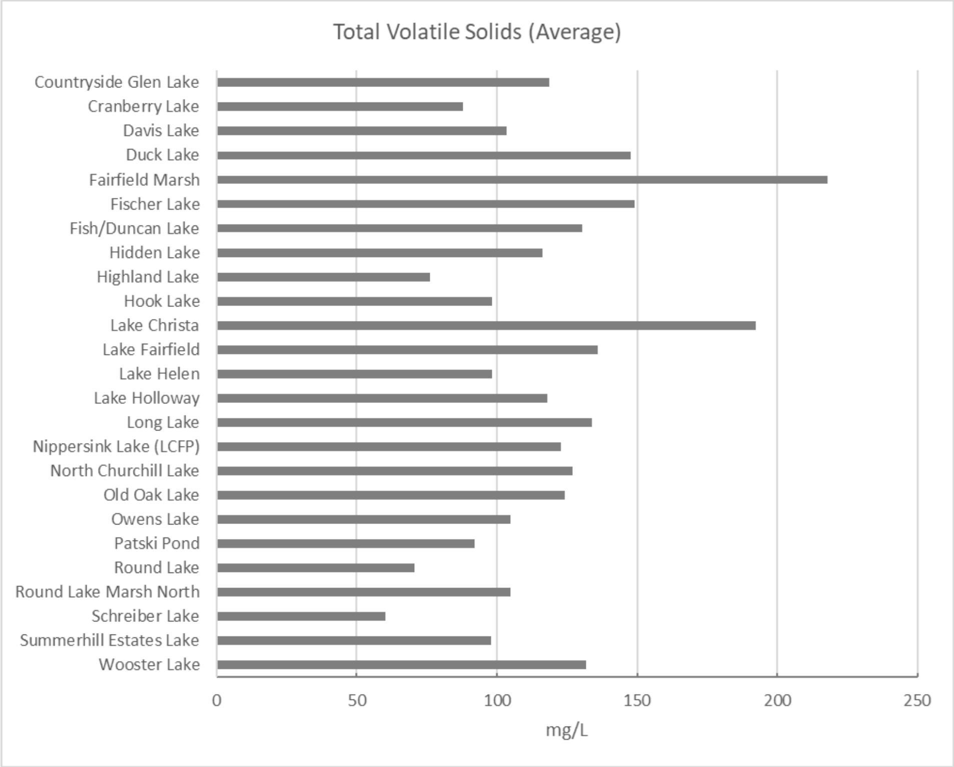


Figure 3-65: **Mean Total Volatile Solids by Lake.** Most Recent Lake County Health Department Yearly Data. Lakes without monitoring data for this parameter are not included in the figure.

3.16.3.7 Alkalinity, Specific Conductivity, and Chloride

Alkalinity is a measure of the buffering capacity of water, which is influenced by the minerals in surrounding sediment and bedrock. Lakes with high alkalinity have greater buffering capacities than lakes with lower alkalinity. The most recent yearly average for assessed lakes ranged from 120-214 mg/L (Figure 3-66). Specific conductivity is measured to approximate the quantity of dissolved ions in a solution. Specific conductivity is closely related to chloride concentrations and TDS in the watershed lakes. Yearly average specific conductivity values ranged from 0.282-1.496 mS/cm in the assessed watershed lakes (Figure 3-67). The concentration of chloride ions has been increasing in the watershed lakes over time. It is highly likely that this increase is caused by the utilization of road salt for deicing. Road salt applied to surfaces within the watershed is incorporated into stormwater runoff, which drains into lakes. Increased chloride concentrations can cause detrimental impacts to aquatic life. The USEPA recommended water criteria for chronic toxicity of chlorides is 230 mg/L. Yearly average chloride concentrations ranged from 33-366 mg/L in assessed watershed lakes (Figure 3-68). The yearly average chloride concentration exceeded Illinois EPA's 230 mg/L standard in 1 (3.8%) of the assessed lakes in the watershed. These epilimnion chloride monitoring was conducted between May and September. Chloride concentrations in the watershed lakes are likely higher during times when road salt is typically applied.

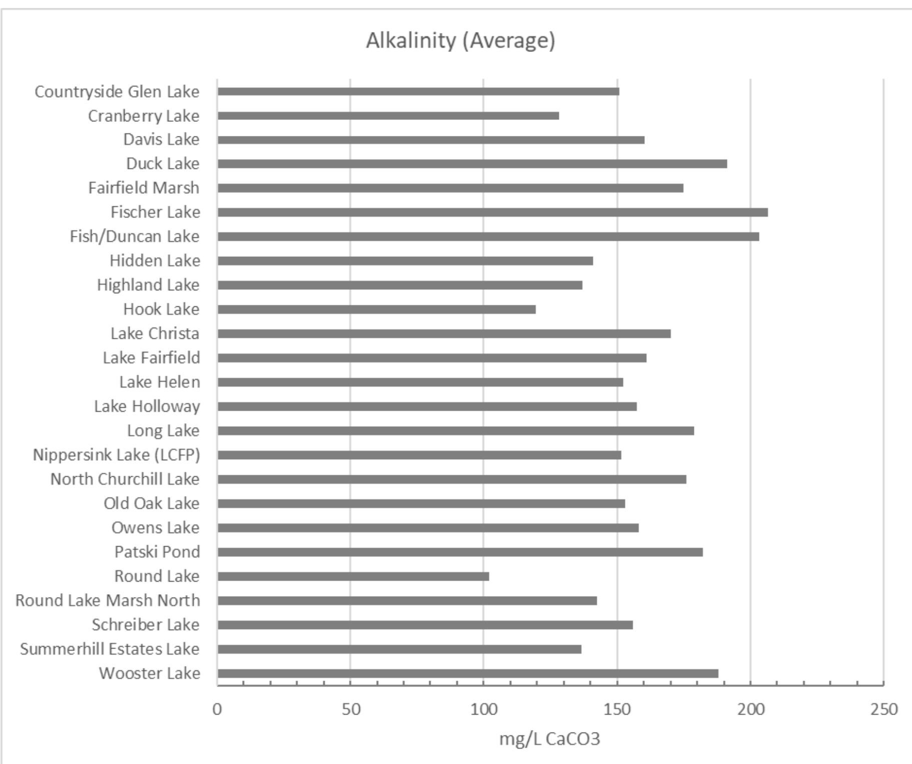


Figure 3-66: Mean Alkalinity by Lake. Most Recent Lake County Health Department Yearly Data. Lakes without monitoring data for this parameter are not included in the figure.

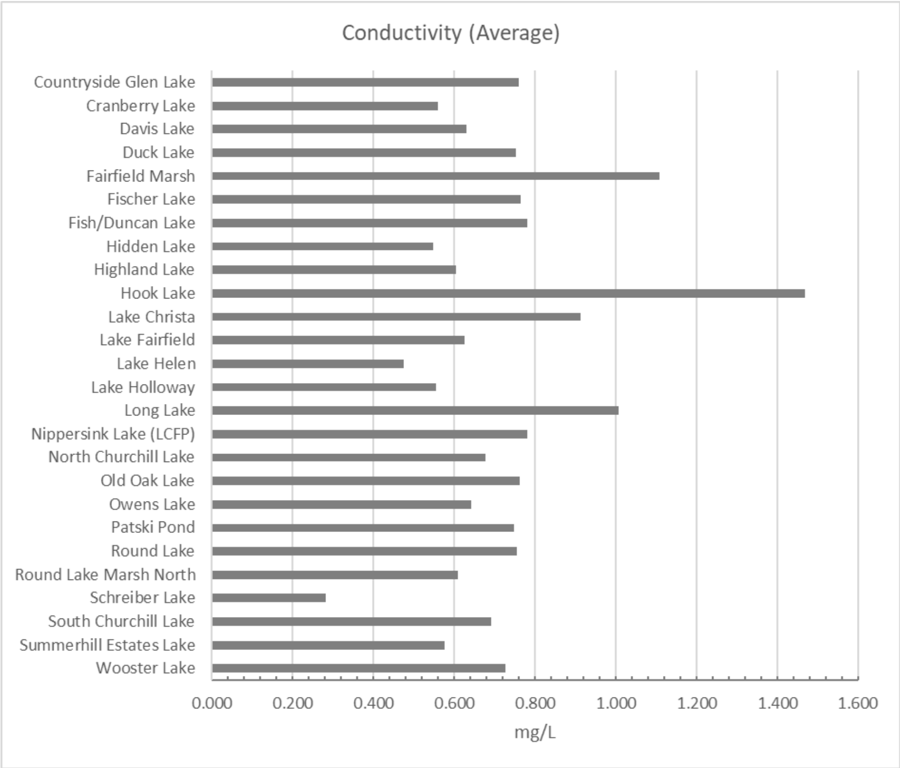


Figure 3-67: **Mean Specific Conductivity by Lake.** Most Recent Lake County Health Department Yearly Data. Lakes without monitoring data for this parameter are not included in the figure.

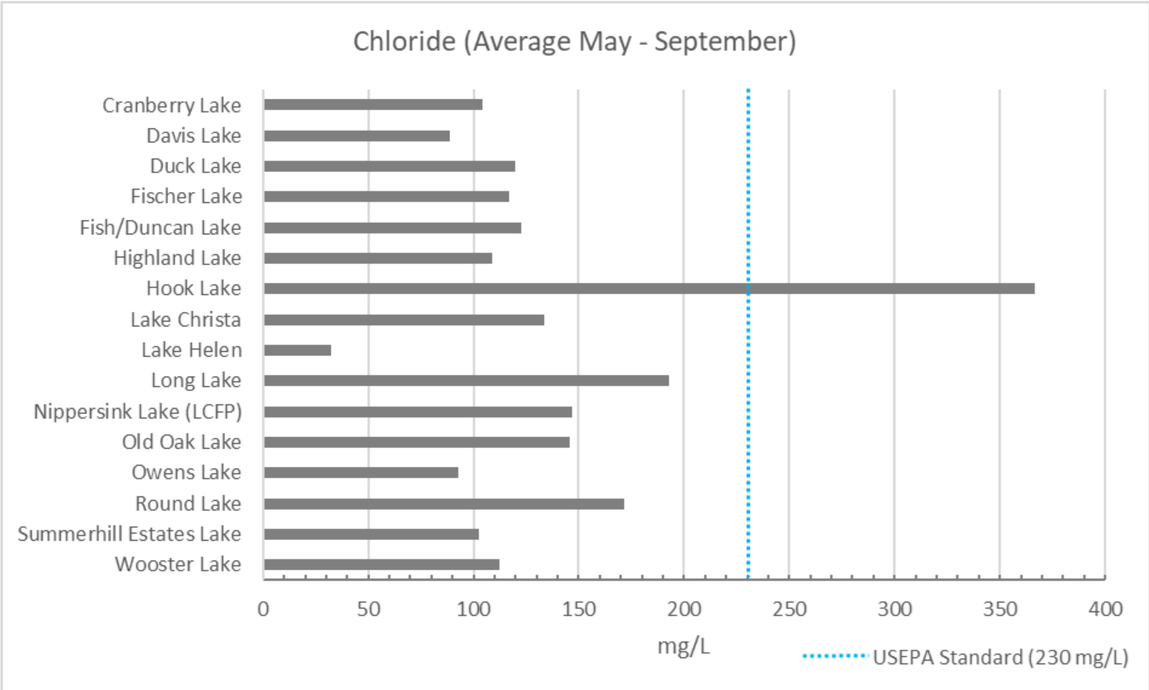


Figure 3-68: **Mean Chloride by Lake.** Most Recent Lake County Health Department Yearly Data. Lakes without monitoring data for this parameter are not included in the figure.

3.16.3.8 pH and Dissolved Oxygen

pH is a measure of the concentration of the hydrogen ion in water, which affects multiple chemical processes within a lake such as the carbonate equilibrium cycle. The range of pH that is supportive of aquatic life is 5 – 9 standard units (s.u.). Values outside of this range can be harmful to aquatic life. Yearly average epilimnion pH values ranged from 7.18-8.91 s.u. in assessed watershed lakes (Figure 3-69).

Dissolved oxygen is a measure of the concentration of gaseous oxygen in water. DO concentrations vary spatially and temporally on multiple scales. In stratified lakes, dissolved oxygen is generally higher in the epilimnion than the hypolimnion. DO concentrations fluctuate daily, with increases occurring during the day when photosynthesizing plants are releasing oxygen into the water columns, and decreases occurring at night when minimal photosynthesis is occurring. DO concentrations also vary seasonally because the solubility of oxygen in water decreases as water temperature increases. Additionally, lakes with substantial amounts of aquatic vegetation may experience sharp declines in DO, due to decaying plants and algae consuming oxygen. Fish may experience oxygen stress if DO concentrations are below 5 mg/L for prolonged periods of time. Lakes with large amounts of aquatic vegetation may have high DO concentrations during daylight, and experience sharp decreases in DO at night. Yearly average DO values ranged from 2.49-10.10 mg/L in assessed watershed lakes (Figure 3-70). Cranberry Lake, Highland Lake, and Schreiber Lake had a yearly average DO below concentrations recommended for aquatic life. DO measurements were conducted during daylight hours and likely represent the high end of growing season DO levels. Continuous overnight monitoring of DO in lakes is necessary to determine if diurnal fluctuations are sufficient to negatively impact aquatic life.

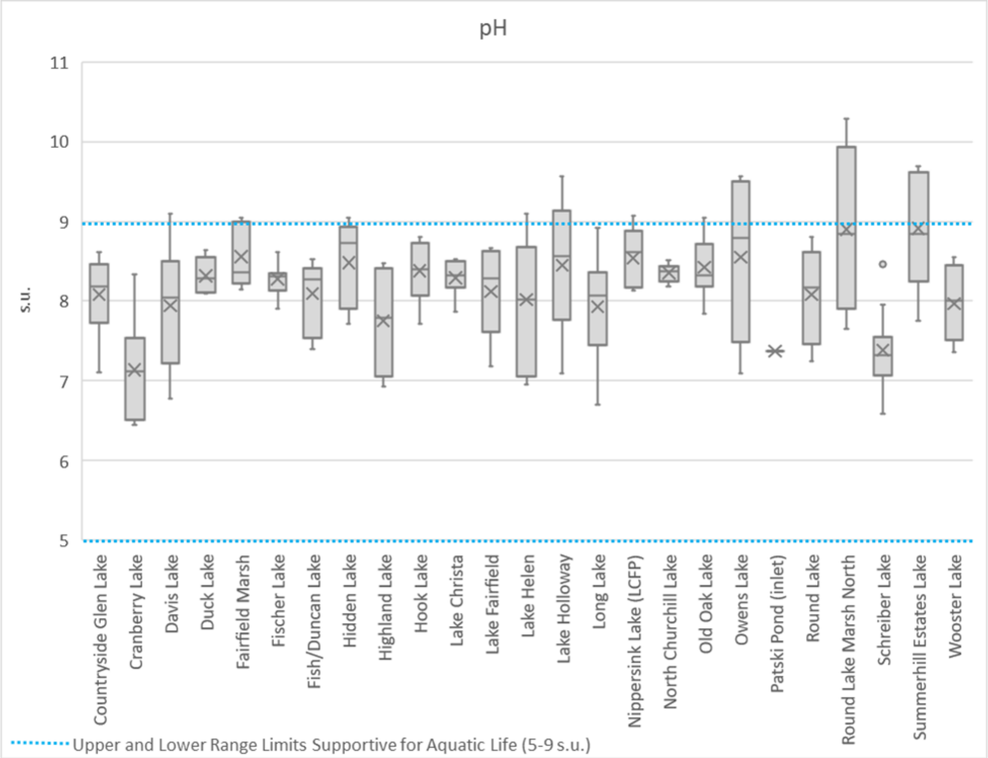


Figure 3-69: **Mean pH by Lake.** Most Recent Lake County Health Department Yearly Data. Lakes without monitoring data for this parameter are not included in the figure.

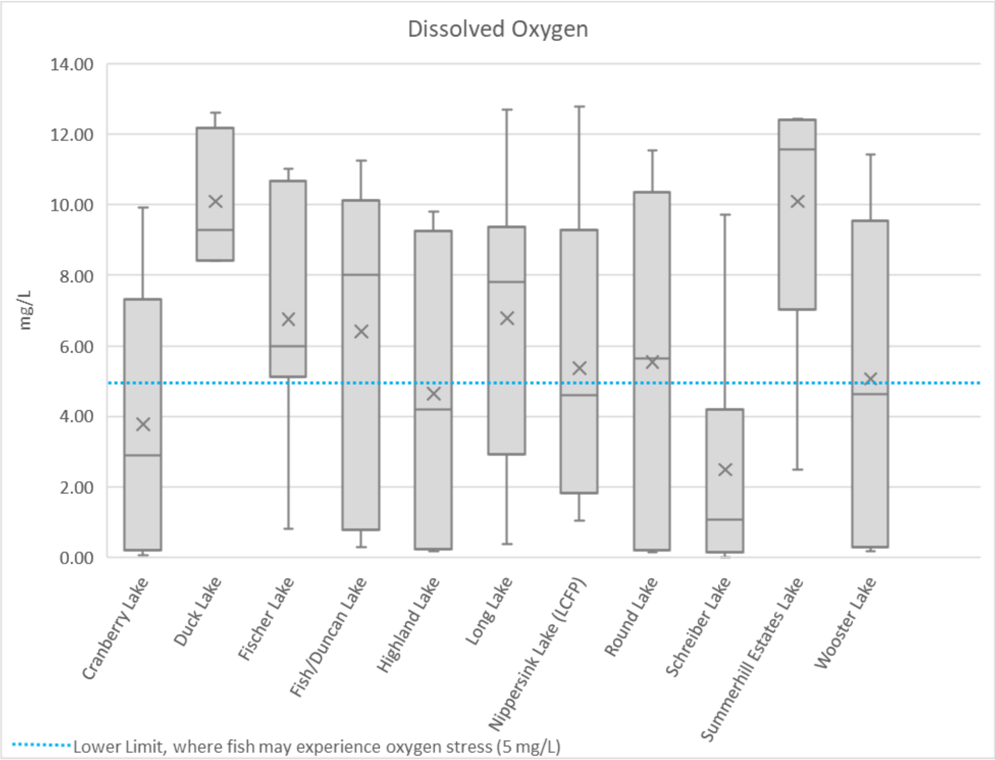


Figure 3-70: Mean Dissolved Oxygen by Lake. Most Recent Lake County Health Department Yearly Data. Lakes without monitoring data for this parameter are not included in the figure.

3.16.3.9 Microcystin Sampling

Microcystin are toxic substances released by cyanobacteria (blue-green algae) when they decay and degrade. The presence of these toxins are typically correlated with high levels of nutrients such as nitrogen and phosphorus in the waterway. Most waterways in the watershed are likely limited by phosphorus, so it is typically an influx of phosphorus that triggers these conditions. Exposure to cyanobacteria and these cyanotoxins can cause adverse health impacts in humans and other animals. Low dissolved oxygen levels due to the decomposition of algal blooms are likely to follow and continue to adversely impact the aquatic environment.

The USGS database includes Illinois EPA sample results for Microcystin from June 2014 to October 2022, which represent 127 sampling events during 110 sampling days (Table 3-49). Individual sites were occasionally sampled more than once on a given day and multiple sites were occasionally sampled on a given day.

Table 3-49: Microcystin Results in Assessed Lakes

Waterbody Name	Subwatershed	Number of Samples	Number of Positive Samples	Percent of Positive Samples	Maximum Concentration (µg/L)	Average Concentration (µg /L)
Fish Lake	Fish Lake Drain	54	41	76%	1,840	52.77
Long Lake	Manitou Creek	77	59	77%	20,000	709.55
Manitou Creek, just downstream of Long Lake, near Wilson Rd	Manitou Creek	1	1	100%	852	852.00
Manitou Creek, just upstream of Nippersink Lake, near Grand Ave	Manitou Creek	1	1	100%	626	626.00
Round Lake	Manitou Creek	20	15	75%	3,860	257.84
Wooster Lake	Fish Lake Drain	19	10	53%	4	0.90

The Cyanobacteria Assessment Network app uses satellite data to map the location of cyanobacterial blooms in fresh and coastal waters across the U.S. The data included for Long Lake spans from 1/1/2020 to 1/23/2024 (data retrieved) and indicates the following daily blue-green algae concentration estimates from satellite data included in Figure 3-71.

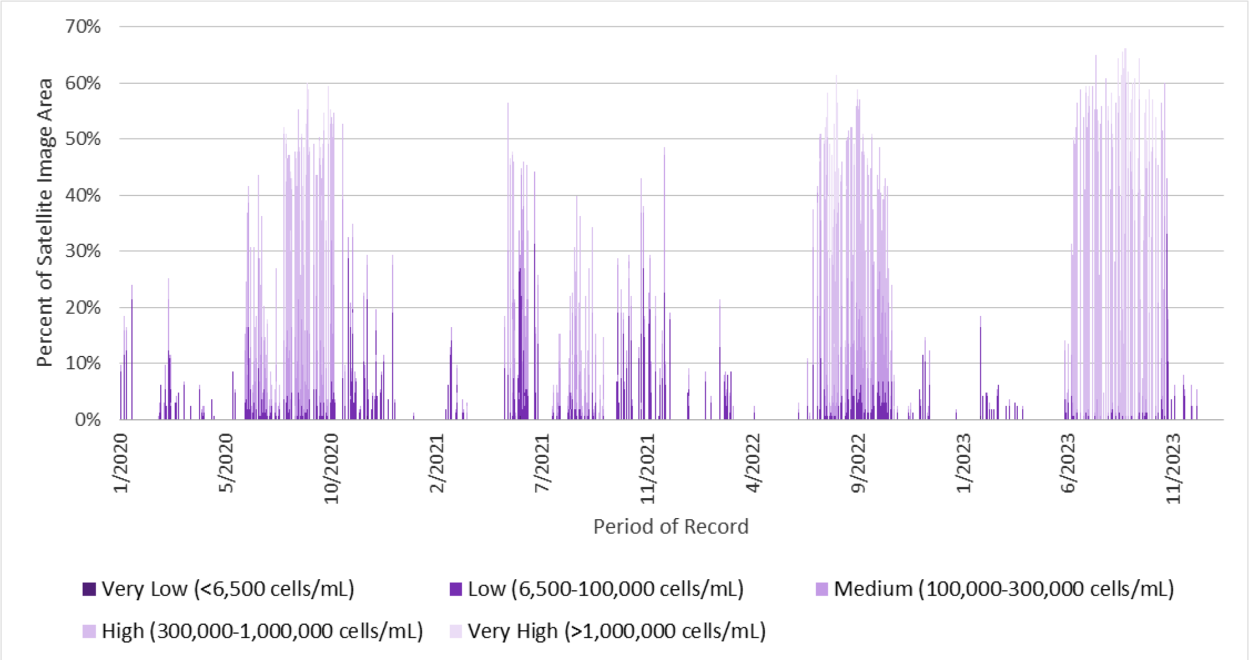


Figure 3-71: Daily Blue-Green Algae Estimates for Long Lake. January 2020- January 2024.

3.17 NPDES POINT SOURCE PERMITS

The USEPA under the Federal Water Pollution Control Act Amendments of 1972, regulates and monitors point source industrial and wastewater pollutant discharges into the nation's waterways (Public Law 92-500; 33 U.S.C. 1251 et seq.). Authorized under amendments made to the 1977 Clean Water Act in 1987 and implemented in 1990, the USEPA developed a two-phased NPDES permit program to address industrial and MS4s, serving populations of greater than 100,000, requiring a permit to discharge stormwater from their outfalls into waterways. NPDES Phase 2, enacted into law in 1999 and implemented in 2003, builds upon the existing Phase I program by regulating stormwater discharges from small MS4s located in urbanized areas (as defined by the latest decennial census) and construction sites that disturb one to five acres obtain a permit to discharge stormwater from their outfalls into waterways. Additional information regarding the NPDES program and specifically permit basics and definitions are available from USEPA NPDES website (USEPA WMPD, 2012; USEPA, 2017b).

Point sources are defined as discrete conveyances including but not limited to any pipe, ditch, channel, or conduit from which pollutants are or may be discharged into waterways. Point source regulation through NPDES includes wastewater treatment plants, industrial discharges, concentrated animal feeding operations, combined sewer overflows, sanitary sewer overflows, urban stormwater runoff and MS4 urban stormwater discharges. The NPDES program plays a key role in restoring water quality since it sets discharge limits, requires monitoring and reporting requirements, and limits discharge of specific pollutants including biological oxygen demand, total suspended solids, ammonia nitrogen, fecal coliform, dissolved oxygen, and phosphorus.

3.17.1 WASTEWATER TREATMENT PLANTS

Waste water treatment plans (WWTP) are vital to public health. Sewers collect wastewater from homes, businesses, and industries and deliver it to wastewater treatment facilities to remove pollutants from water impacted by human waste which can be either discharged to water bodies or land or reused.

Sewage treatment processes typically use a series of processes to treat wastewater prior to discharge. The typical series of unit processes includes:

- Preliminary treatment or screening to remove large solids.
- Primary clarification (or preliminary sedimentation) to remove floating and settleable solids.
- Biological treatment (also referred to as secondary treatment) to remove biodegradable organic pollutants and suspended solids.
- Disinfection to deactivate pathogens.

Some facilities also provide more advanced treatment which is designed to reduce constituents, such as nitrogen and phosphorus, that are not removed in any significant quantity by traditional biological treatment processes. Some municipalities currently experience high peak influent flows during periods of increased wet weather that exceed the treatment capacity of existing biological or advanced treatment units.

Under peak flow conditions some plant operators divert a portion of the flow around biological or advanced treatment units to prevent damage to the wastewater treatment plant. The diverted flow is then either recombined with flows from the biological treatment units or discharged directly into waterways" (USEPA, 2016).

Within the Manitou Creek-Fish Lake Drain watershed, there are four active WWTPs of varying capacity, function, and treatment capabilities based on the USEPA Facility Registry System database (Table 3-50) (Figure 3-72) (USEPA, 2023). Based on the available data from current NPDES permits, the WWTPs in the Manitou Creek-Fish Lake Drain Watershed contribute an actual average of 0.089 million gallons per day (MGD) of treated water into the Manitou Creek subwatershed. Table 3-51 lists direct discharges and violations by wastewater treatment plants in the watershed. These tables and values do not include land application of wastewater or onsite wastewater treatment systems (septic systems), although two land applications (one at Saddlebrook Farms and one at Ivanhoe Club) are permitted and operating within the planning area (Figure 3-72).

Table 3-50: Wastewater Treatment Plants

Permit No.	Wastewater Treatment Plant	Actual Average Facility Flow (MGD)	Facility Design Flow (MGD)	Site Function
IL0054615	Camp Henry Horner STP	0.014	0.035	Sporting And Recreational Camps
IL0046043	Camp Hickory STP	0.014	0.035	Amusement And Recreation
IL0050661	Dayspring Bible College	0.03	0.075	Residential Care
IL0034746	Fremont School District 79 - STP	0.01	0.04	Elementary & Secondary Schools

Table 3-51: Wastewater Treatment Plants Violations *A violation is noted as per the EPA Discharge Monitoring Report Pollutant Loading Tool as one or more exceedances of permit effluent limits for this pollutant sometime during the year recorded. Violation issue date range is January 2007 – September 2023

Permit No.	Wastewater Treatment Plant	Direct Discharges To	Violation Issues 2007-2023*
IL0054615	Camp Henry Horner STP	Wooster Lake	pH, Total Suspended Solids, Ammonia, Chlorine, Fecal Coliform, Biochemical Oxygen Demand
IL0046043	Camp Hickory STP	Unnamed Tributary to Manitou Creak	Ammonia, Total Suspended Solids, Biochemical Oxygen Demand
IL0050661	Dayspring Bible College	Unnamed Tributary to Manitou Creak	Ammonia
IL0034746	Fremont School District 79 - STP	Unnamed Tributary to Manitou Creak	Dissolved Oxygen, Total Suspended Solids, Ammonia, Biochemical Oxygen Demand

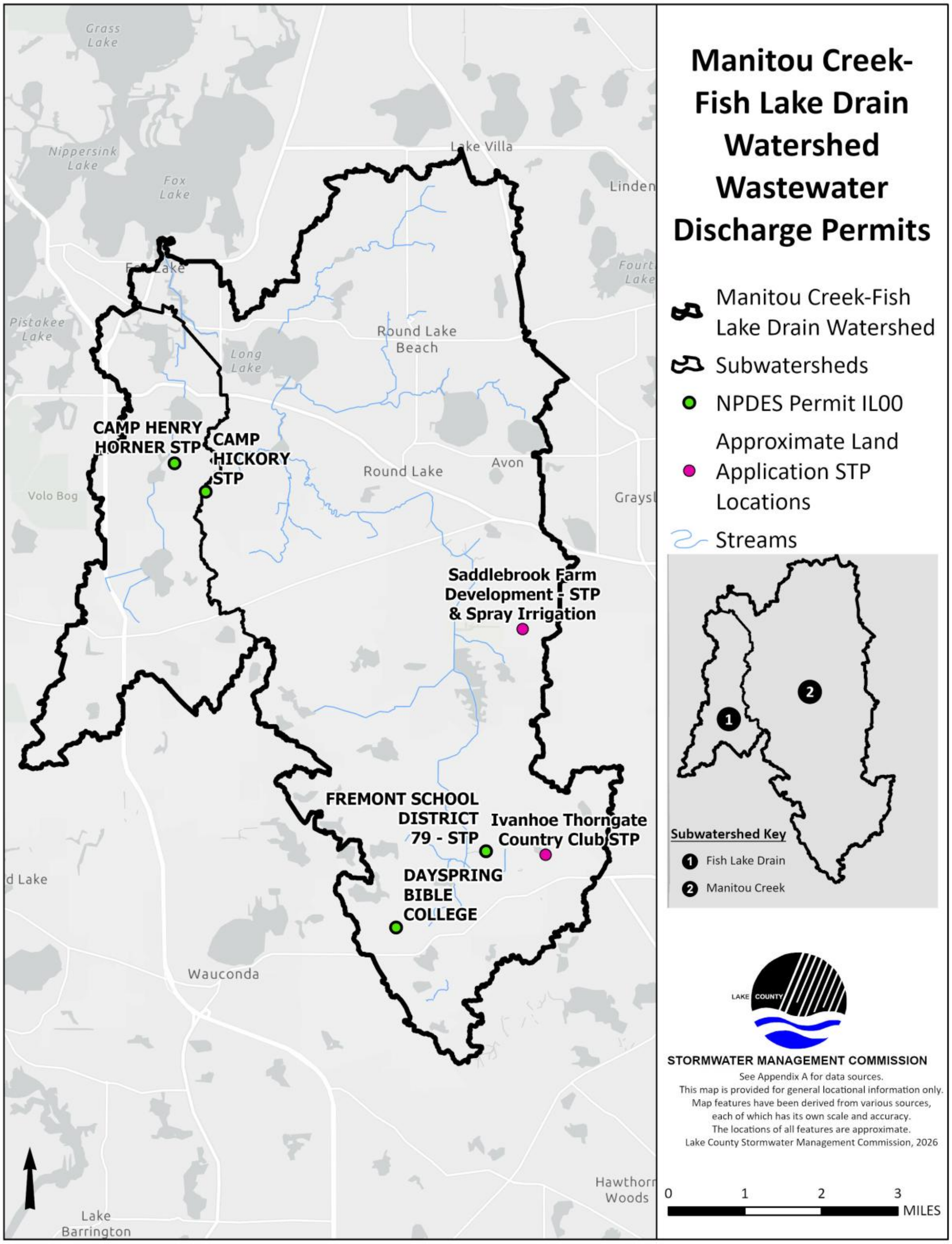


Figure 3-72: Wastewater Discharge Permits

3.17.2 Pesticide Point Source Discharge

Pesticide Application Point Source Discharges regulates point source discharges of biological pesticides and chemical pesticides that leave a residue over or into waters of the U.S. and requires a permit under the USEPA NPDES pesticides general permit (Illinois EPA, 2017c). The USEPA's pesticides general permit authorizes discharges to waters of the U.S. from the application of biological pesticides and chemical pesticides that leave a residue for mosquito and other flying insect pest control, aquatic weed and algae control, aquatic nuisance animal control and forest canopy pest control.

Agricultural runoff and/or irrigation return flows that contain pesticides are exempt from NPDES permitting requirements as authorized by Congress in 1987 with an amendment to the Clean Water Act for the exemption. In Illinois, the Pesticide Application Point Source Discharges permit is NPDES Permit No. ILG87.

There are five NPDES Pesticide Application Point Source Discharge permits in the watershed or within a municipality that comprises some percentage of the land jurisdiction within the watershed (USEPA, 2023) (Table 3-52) (Figure 3-73). There may be additional commercial organizations with NPDES pesticides general permits performing work on public and private property within the study area but are not included within this inventory as their activities cannot be determined at this time.

Table 3-52: ILG87 Permits Source: USEPA Facility Registry Service (FRS).

Permittee	NPDES Permit No.	Jurisdiction
Bar None Services, Inc.	ILG870869	Grant Township
Bird Dog Holdings Inc	ILG870828	Grant Township
Duck Lake Waterway Association	ILG870307	Grant Township
Hey And Associates Inc	ILG870029	Village of Volo
Village Of Fox Lake	ILG870399	Village Of Fox Lake

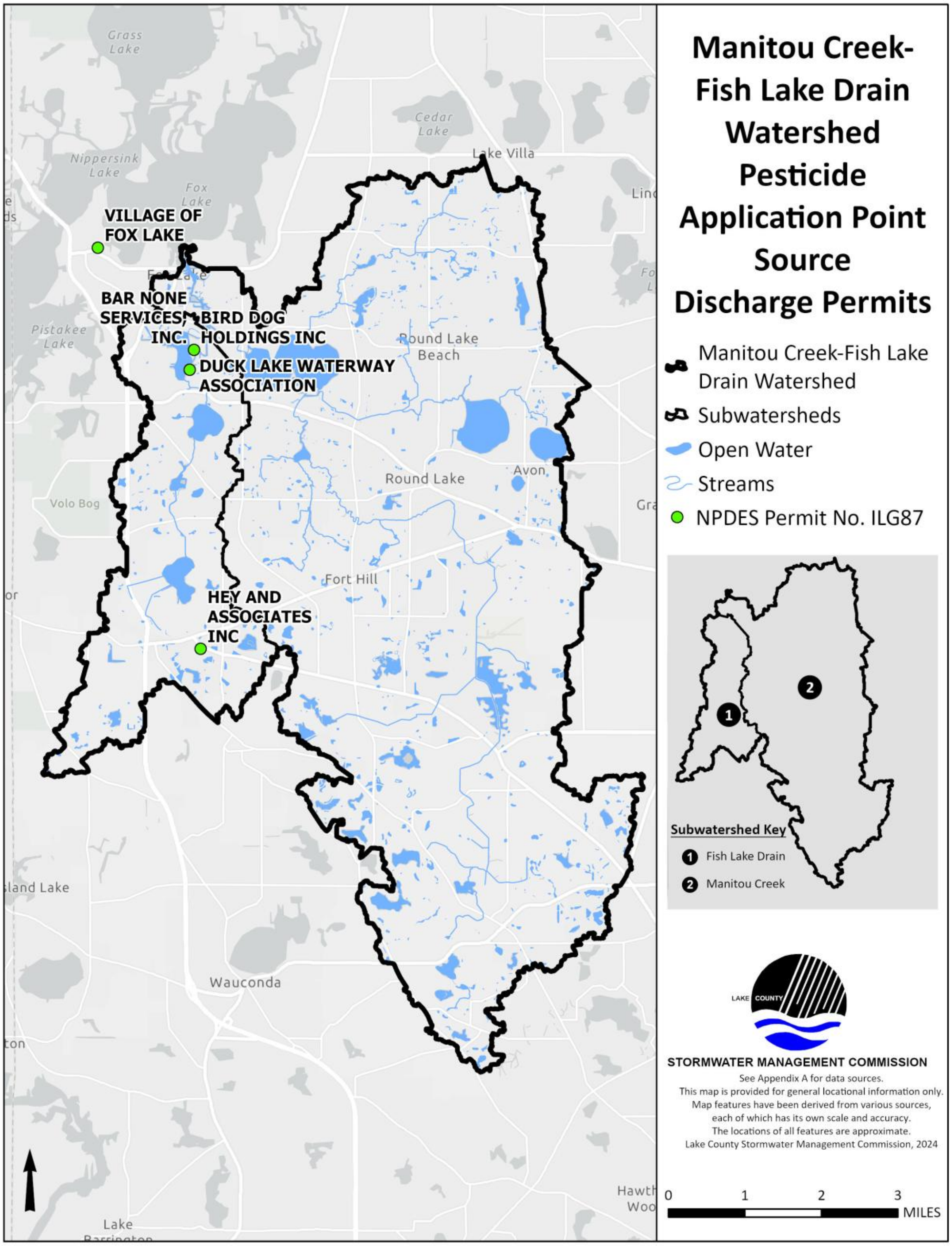


Figure 3-73: Pesticide Application Point Source Discharge Permit

3.18 NPDES PHASE II STORMWATER PERMITS

The NPDES Phase II Program regulates stormwater discharges from small MS4s, industrial, and construction site activities. Under the permitting requirements of the NPDES Phase II, permittees are required to implement certain practices that control pollution in stormwater runoff. They are required to prevent the contamination of stormwater runoff and develop a Stormwater Pollution Prevention Plan. NPDES Phase II, is intended to reduce negative impacts to water quality and aquatic habitats by preventing and controlling unregulated sources of storm water discharge, informing communities about water quality, and improving water quality.

Storm Water Discharges from Small MS4s into waters of the United States require a permit under the USEPA NPDES program as many units of government have distinct roles and responsibilities related to water quality and nonpoint source pollution control. Discharges from small MS4s in USEPA Region 5 states are regulated under each state’s general NPDES Permit. In Illinois, the Illinois EPA regulates MS4s through the NPDES No. ILR40 (USEPA, 2016).

The permit requires that MS4 operators develop, implement, and enforce a stormwater management program to reduce the discharge of pollutants. A permittee’s stormwater management program must include six minimum control measures:

1. Public education and outreach on storm water impacts.
2. Public involvement and participation.
3. Illicit discharge detection and elimination.
4. Construction site storm water runoff control.
5. Post construction storm water management in new development and redevelopment.
6. Pollution prevention / good housekeeping for municipal operations.

To define its storm water management program, a permittee must define BMPs and measurable goals for each of the six minimum control measures.

In the watershed, there are three units of township government and ten units of municipal government operating as MS4’s with distinct roles and responsibilities related to activities and water quality control. There are ten units of municipal government and three townships with a NPDES MS4 permit in the watershed (Table 3-53).

Table 3-53: ILR40 Permits

Jurisdiction Type	Permittee	Permit Number
Municipal	Village of Fox Lake	ILR400339
Municipal	Village of Hainesville	ILR400205
Municipal	Village of Hawthorn Woods	ILR400209
Municipal	Village of Mundelein	ILR400395
Municipal	Village of Round Lake Beach	ILR400439
Municipal	Village of Round Lake Heights	ILR400241
Municipal	Village of Round Lake Park	ILR400242
Municipal	Village of Round Lake	ILR400243
Municipal	Village of Volo	ILR400657
Municipal	Village of Grayslake	ILR400202
Township	Township of Avon Highway Department	ILR400006
Township	Grant Township	ILR400059
Township	Wauconda Township	ILR400147

3.19 REFERENCES

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS/ABBREVIATIONS USED IN CHAPTER 4

AC - Acre

BOD – 5-Day Biological Oxygen Demand

BMP – Best Management Practices

Cd - Cadmium

COD – 5-Day Chemical Oxygen Demand

Cu - Copper

CYAN - Cyanobacteria Assessment Network

DOT – Department/Division of Transportation

DP – Dissolved Phosphorus

EIG – Environmental Interest Groups

EMC - Event Mean Concentration

GIS- Geographic Information System

HAB – Harmful Algal Bloom

IC – Impervious Cover

IDNR – Illinois Department of Natural Resources

IDOT- Illinois Department of Transportation

IEMA – Illinois Emergency Management Agency

Illinois EPA – Illinois Environmental Protection Agency

INHS – Illinois Natural History Survey

ISGS- Illinois State Geological Survey

lb- Pounds

LCFPD- Lake County Forest Preserve District

LCHD-ES- Lake County Health Department- Ecological Services

LRR- Lateral Recession Rates

MS4- Municipal Separate Storm Sewer Systems

NPDES- National Pollutant Discharge Elimination System

PAH – Polycyclic Aromatic Hydrocarbons

Pb - Lead

SLAM - Simplified Lake Analysis Model

SMC – Lake County Stormwater Management Commission

SPU – Subwatershed Planning Unit

TKN – Total Kjeldahl Nitrogen

TMDL – Total Maximum Daily Load

TDS - Total Dissolved Solids

TN – Total Nitrogen

TP – Total Phosphorus

TSS – Total Suspended Solids

U of I Extension- University of Illinois Extension

USACE- United Stated Army Corps of Engineers

USEPA- United States Environmental Protection Agency

USGS – United States Geological Survey

WDO – Watershed Development Ordinance

Yr – Year

Zn - Zinc

4 WATERSHED PROBLEM ASSESSMENT

This chapter assesses in detail the problems identified in Chapter 3 Watershed Characteristics Assessment. The Watershed Problem Assessment describes the effect of land use and land cover change on water resources in the watershed; estimate the most prevalent causes and sources of waterbody pollution; estimate nonpoint source pollutant loading in the watershed; and identify critical areas where programmatic or site-specific actions are likely to result in nonpoint source pollutant reductions. This chapter also assesses how jurisdictional roles, including regulatory oversight, can be better coordinated to improve water resources.

4.1 LAND USE IMPACTS AND IMPERVIOUS COVER CHANGES

As discussed in Chapter 3, impervious cover (IC) is the result of altering or replacing native soil permeability because of land cover changes. Impervious cover causes an increase in direct storm water runoff and nonpoint source pollution stressors into waterbodies thereby impacting local water quality. Stressors increase pollutant loads in stormwater runoff, alter stream flow, decrease bank stability, increase water temperatures, and reduce wetland capacity and function. These impacts affect terrestrial and aquatic wildlife, plant establishment, habitat function, recreational opportunities, environmental health, and property use and value.

Research also shows that impervious cover impacts water quality at relatively low levels of development and land use (0-9% IC or **Low IC**). Symptoms of water quality impact from land use stressors have been observed at 10-29% impervious cover (or **Medium IC**) of a watershed, and research has quantified and observed degradation of natural water bodies when impervious cover is between 30-100% (**High IC**) of the watershed. Figure 4-1 visualizes percent imperviousness based on impacted land use. (Chabaeva, 2007).

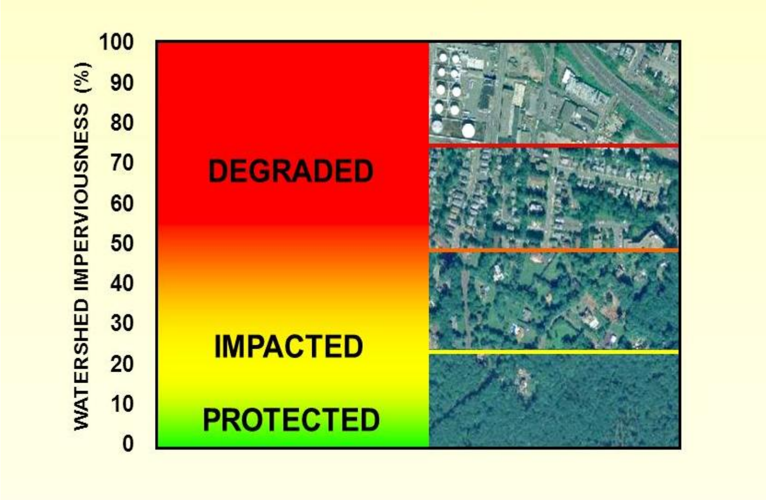

Figure 4-1: Comparison of Percent Imperviousness to Land Use

IMPERVIOUS COVER CLASSIFICATION:
Water quality is impacted at 10% and degradation of water quality is consistent at greater than 30% impervious cover. The impervious cover is analyzed by impacts:

Low IC – Land use changes increase impervious cover to 0-9% of the watershed with minimal impact to water quality.

Medium IC – Land use changes increase impervious cover to 10-29% of the watershed with water quality impacts noticeable.

High IC – Land use changes increase impervious cover to 30-100% of the watershed with water quality degradation expected.

4.1.1 EFFECTS OF LAND USE CHANGE ON WATER QUANTITY

Land disturbance associated with land use modification has a direct effect on stormwater quantity. Disturbance of a natural site alters hydrology due to impacts to the native soils and vegetation. Plowing, clearing, and tree removal eliminate vegetation that reduces stormwater runoff volumes through the hydrologic processes of interception, evaporation, and transpiration. Earthwork and grading disturb native soils and may remove or fill areas with natural depressions that collect, infiltrate, and retain rainfall and stormwater runoff onsite. Soil compaction resulting from the operation of heavy machinery over and across the site reduces the infiltration capacity of underlying soil. Land use changes that increase impervious surfaces, such as roads, parking lots, and rooftops, further reduce the infiltration capacity of an area and increase stormwater runoff volume and velocity.

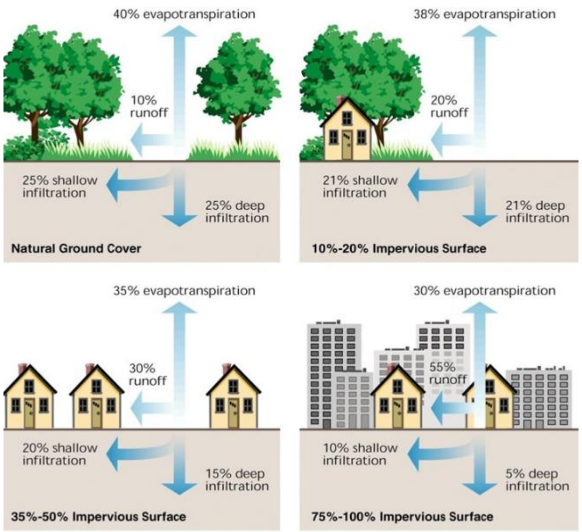

Figure 4-2: Influence of Impervious Surface on the Fate of Precipitation (FISRWG, 1998)

The installation of drainage improvements (e.g., channelization, dredging, or artificial drainage systems) further reduces a site's ability to retain rainfall. Collectively these impacts result in substantially increased stormwater runoff volumes and velocities (Figure 4-2) and reductions in groundwater recharge (Pitt, 1994; Shueler, 1987; Thompson, 2009). Increased stormwater runoff volumes and velocities result in increased peak discharge rates, which can be at least two to five times higher on developed sites than undeveloped sites, resulting in increased flooding risk (Figure 4-3). Reduced groundwater recharge decreases baseflow to aquatic resources, including streams and wetlands. In recently developed areas, these impacts are partially offset by modern stormwater-related land development regulations.

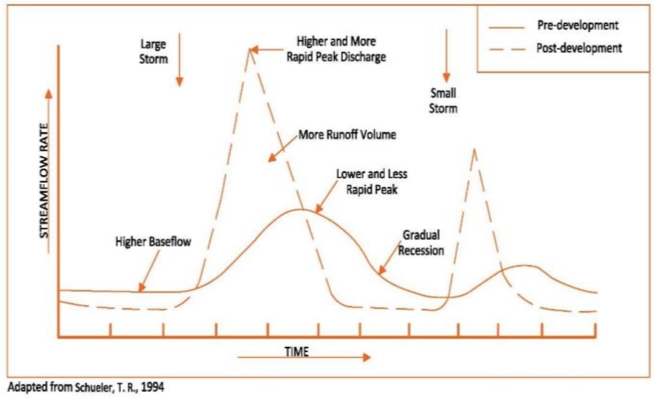

Figure 4-3: Impacts of Urbanization on Hydrology

4.1.2 EFFECTS OF LAND USE CHANGE ON WATER QUALITY

Land use change also affects stormwater quality. Impervious and compacted surfaces, such as parking lots, roads, lawns, parks, and athletic fields, accumulate pollutants during dry weather. These pollutants are quickly transported to receiving waterbodies during precipitation

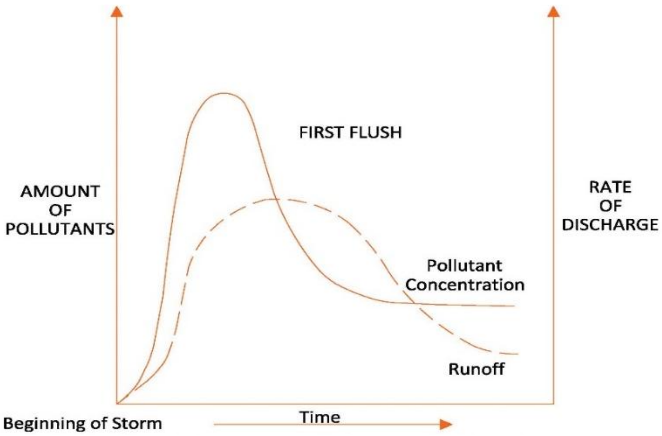

Figure 4-4: Influence of Impervious Surface on Fate of Pollutant Concentrations. Adapted from Florida Department of Regulation 1994

events, often through altered drainage systems, resulting in increased pollutant loads to aquatic resources (Figure 4-4).

Stormwater pollutants come from a variety of diffuse and scattered sources, many of which are a direct or indirect result of land use change. These nonpoint source pollutants include:

- Sediment: Sources of sediment to stormwater runoff include land disturbing activities, atmospheric deposition, and surface or streambank erosion. Sediment particles can adsorb other stormwater pollutants, such as nutrients, metals, hydrocarbons, and pesticides, and transport them into receiving streams, wetlands, and other aquatic resources.
- Nutrients: Sources of nutrients such as nitrogen and phosphorus to stormwater runoff include fertilizer, pet and animal waste, leaves, grass clippings, sanitary sewer overflows & illicit connections, septic system discharges, and atmospheric deposition.
- Bacteria: Sources of bacteria and pathogens to stormwater runoff include pet and animal waste, sanitary sewer overflows, and septic system discharges. Runoff impacted by these sources typically exceeds public health standards for recreational contact.
- Organic Matter: Sources of organic matter to stormwater runoff include leaves, grass clippings, pet and animal waste, sanitary sewer overflows, and septic system discharges. The decomposition of this organic matter can decrease dissolved oxygen to levels that are detrimental to aquatic life.
- Metals: Sources of heavy metals, such as lead, zinc, copper, and cadmium, to stormwater runoff include atmospheric deposition, vehicle wear, and commercial, industrial, and hazardous waste sites.
- Hydrocarbons: Sources of hydrocarbons (i.e., PAHs or coal tar sealants) to stormwater runoff include vehicle wear, chemical spills, restaurant grease traps, and improper handling and disposal of waste oil and grease.
- Pesticides: Sources of insecticides, herbicides, and other pesticides to stormwater runoff include farming activities, lawn care and maintenance activities, chemical spills, and atmospheric deposition.
- Chlorides: Sources of chlorides to stormwater runoff include winter sidewalk, driveway, roadway, and parking lot anti-icing and deicing activities, and water softeners.
- Chemicals: Sources of chemicals, such as chlorine, solvents, soaps and detergents, degreasers, drain cleaners, vehicular liquids and paint, to stormwater runoff include residential, commercial, industrial, and hazardous waste sites.
- Trash and Debris: Considerable quantities of trash and debris typically accumulate on impervious or compacted pervious surfaces and are transferred to receiving waters by stormwater runoff. This trash and debris can accumulate in stormwater conveyance systems, potentially causing clogging and nuisance flooding.

As outlined below, an extensive and ever-growing body of research shows that these nonpoint source pollutants have substantial negative impacts on streams, wetlands, and other aquatic resources. Negative impacts include impaired water quality, reduced dissolved oxygen levels, increased primary productivity (e.g., eutrophication, algal blooms), sediment contamination, degradation of habitat, and a general decline in the abundance and diversity of wildlife and aquatic animals.

4.1.3 Effects of Land Use Change on Stormwater Temperature

Land use changes also affect stormwater temperature. The compacted pervious and impervious surfaces resulting from land use change absorb and retain heat, especially when exposed to sunlight. The heating of these surfaces is exacerbated by reduced shade resulting from the clearing of vegetation. During precipitation events, these heated surfaces increase the temperature of stormwater runoff, resulting in increased water temperatures and decreased dissolved oxygen in receiving waters.

4.1.4 Impacts on Aquatic Resources

Changes in hydrology and stormwater runoff characteristics (e.g., increased stormwater runoff rates, volumes, and pollutant loads) resulting from changes in land use can have a wide range of negative impacts on the aquatic resources of watersheds. Additional information about these impacts is provided below.

4.1.4.1 Streams

Changes in stormwater quantity, quality, and temperature resulting from changes in land use can have multiple negative impacts on freshwater streams. These well-documented impacts (CWP, 2003) include:

- Increased Channel Forming Events: Increased stormwater runoff rates and volumes resulting from land use changes increase the frequency and duration of channel forming bankfull and near-bankfull events, resulting in changes in channel form, stream channel enlargement (e.g., stream down-cutting and widening), and streambank erosion.
- Increased Flooding: Increased stormwater runoff rates and volumes resulting from land use changes also increase the frequency, duration, and severity of overbank and extreme flooding events. These flooding events can cause property damage and endanger public health and safety.
- Decreased Baseflow: Increased stormwater runoff volumes resulting from land use changes reduce the amount of recharge to shallow groundwater aquifers which supply baseflow to streams and rivers.
- Stream Channel Enlargement: Stream channels enlarge (e.g., downcut and widen) to accommodate the increased peak discharges resulting from land use changes.
- Streambank Erosion: As stream channels enlarge to accommodate an increased frequency and duration of channel forming events and the increased peak discharges resulting from land use changes, streambanks are gradually undercut, scoured, and eroded away.
- Loss of Riparian Vegetation: As stream channels enlarge and streambanks are gradually eroded away, the roots of vegetation along the stream corridor may become exposed, undercut, uprooted, and conveyed downstream.
- Degradation of Habitat: Increased stormwater runoff rates and volumes resulting from land use changes scour stream beds and degrade aquatic habitat. The increased sediment loads that result from land use changes and erosion can also degrade aquatic habitat by filling in streambeds and destroying the important pool-riffle structure found in many streams.
- Increased Temperatures: Increased stormwater runoff temperatures resulting from land use changes can raise the temperature of freshwater streams. Since aquatic organisms can only survive within a specific temperature range (e.g., some darter fish species and other cool water species), increased stream temperatures can lead to a decline in wildlife abundance and diversity.

- Degradation of Water Quality: Increased stormwater pollutant loads resulting from land use changes reduce the overall water quality of freshwater streams. This water quality degradation negatively impacts many of the ecological functions that these important natural resources provide.
- Reduced Dissolved Oxygen Levels: Increased amounts of organic matter found in urban stormwater runoff, and increased stormwater runoff temperatures that result from land use changes, reduce the amount of dissolved oxygen found in freshwater streams. Fish kills and the loss of other aquatic organisms can occur if dissolved oxygen levels decrease enough. Low dissolved oxygen levels can also cause the release of harmful pollutants such as metals, nutrients, hydrocarbons, and pesticides that have accumulated within stream bottom sediment.
- Decline in Wildlife Abundance and Diversity: Increased stormwater runoff rates, volumes, and pollutant loads resulting from land use changes degrade habitat and water quality. This reduces the abundance and diversity of aquatic organisms found in freshwater streams. Sensitive keystone or indicator organisms that require high quality habitat may become stressed and be gradually replaced by organisms more tolerant of degraded conditions.
- Reduced Recreational and Aesthetic Value: Increased trash, debris, and pollutant loads found in stormwater runoff can accumulate in freshwater streams and detract from their natural beauty and recreational value.

4.1.4.2 Lakes and Wetlands

Impacts on aquatic lake resources within the watershed are characterized in sections 3.13.2 Shoreline Erosion and 3.16 Lake and Stream Water Quality. Impacts on aquatic wetland resources within the watershed are characterized in section 3.11 Wetland Inventory. Changes in stormwater quantity and quality resulting from changes in land use can have multiple negative impacts on lakes and wetlands.

The water quality of lakes is substantially negatively impacted by increased stormwater pollutant loads. Since lakes function as sinks within the landscape, incoming sediment, nutrient, bacteria, metals, hydrocarbons, pesticides, chlorides, and trash and debris can remain in a lake for a long time. The accumulation of these various pollutants can reduce overall water quality, contaminate sediments, increase primary productivity (e.g., increase algal growth), and negatively impact many of the important ecological functions that lakes provide.

As documented above, land use changes can have a wide range of impacts on the health of terrestrial and aquatic resources. These impacts, which range from additional runoff volume to degraded water quality to a decline in wildlife abundance and diversity, have been well documented by an extensive and ever-growing body of research. These impacts have been observed within the aquatic resources of the Manitou Creek-Fish Lake Drain Watershed, as described in Chapter 3 and can, in part, be linked to changes in hydrology and stormwater runoff characteristics (i.e., increased stormwater runoff rates, volumes, and pollutant loads) resulting from land use changes that have occurred in the watershed. Changes in stormwater quantity and quality resulting from changes in land use can have multiple negative impacts on lakes and wetlands. These well-documented impacts include:

- Increased Ponding: Increased stormwater runoff rates and volumes resulting from land use changes can cause increased ponding within wetlands. This can stress native wetland plant communities, especially in wetlands that did not previously receive large inputs of stormwater runoff.
- Increased Water Level Fluctuations: Increased stormwater runoff rates and volumes resulting from land use changes can cause increased water level fluctuations in wetlands. This can stress native wetland plant communities and reduce plant and wildlife abundance and diversity.
- Decreased Baseflow: Increased stormwater runoff volumes resulting from land use changes reduce the amount of precipitation available to recharge shallow groundwater aquifers and provide a steady supply of baseflow to wetlands, particularly during dry weather.
- Shoreline Erosion: Increased ponding and water level fluctuations and decreased baseflow resulting from land use changes can stress native wetland plant communities and leave portions of wetland shorelines unvegetated, making them vulnerable to undercutting, scour, and erosion.
- Degradation of Habitat: Increased ponding and water level fluctuations and decreased baseflow resulting from land use changes can stress native wetland plant communities and degrade wetland habitat. Increased sediment loads resulting from land use changes and surface and streambank erosion can also degrade wetland habitat.
- Degradation of Water Quality: Increased stormwater pollutant loads resulting from land use changes reduce the overall water quality of wetlands. This negatively impacts many of the ecological functions these important natural resources provide.
- Increased Primary Productivity: Increased nutrient loads in stormwater runoff increases the primary productivity of wetlands, promoting algal growth and forcing native wetland plant communities to compete for available nutrients. This competition can stress native wetland plant communities and reduce plant and wildlife abundance and diversity.
- Sediment Contamination: Metals, hydrocarbons, and pesticides in stormwater runoff can become attached to sediment particles and accumulate within wetlands. This can cause sediment contamination and expose aquatic and terrestrial organisms to the harmful effects of these pollutants.
- Decline in Wildlife Abundance and Diversity: When increased stormwater runoff rates, volumes, and pollutant loads resulting from land use changes degrade habitat and water quality, the abundance and diversity of plants, animals, and other organisms found in freshwater wetlands may be significantly reduced. In these situations, native wetland plant communities tend to be replaced by invasive species, and sensitive macroinvertebrate, amphibian, reptile, and bird populations become stressed and gradually replaced by populations that are more tolerant of the degraded conditions. This can result in the local extinction of native aquatic and terrestrial organisms.
- Reduced Aesthetic Value: Trash, debris, and pollutant loads in stormwater runoff can accumulate in wetlands, detracting from their natural beauty and aesthetic value.

4.1.5 Assessing the Impacts of Forecasted Land Use Changes

4.1.5.1 Impervious Cover by Catchment

Chapter 3 provides an overview of current land use, current impervious cover, and future land use projections. Assessing impacts of forecasted land use changes within the Manitou Creek-Fish Lake Drain watershed involves further analysis of current land use and impervious cover. The Existing Land Use and Impervious Cover data discussed in Chapter 3 were used to determine the average impervious cover by land use category in the Manitou Creek-Fish Lake Drain watershed (Figure 4-5). These percentages were applied to Future Land Use data to determine the expected change in impervious cover in the future within each catchment and subwatershed (Figure 4-6) (Tables 4-1 and 4-2).

More than 59% of the catchments in the Manitou Creek and Fish Lake Drain subwatersheds fall in the “Medium” impervious cover category. More than 37% of catchments in the Manitou Creek and Fish Lake Drain Subwatersheds fall in the “Low” impervious cover category. Both the Fish lake Drain and Manitou Creek subwatersheds have approximately 3% of catchments in the “High” impervious cover category.

4.1.5.2 Impervious Cover Changes Related to Future Land Use Mapping

As identified in Section 3.6.2, much of the watershed, particularly the southern portions, has low or medium impervious cover. Where land use is expected to change in the future, it is expected that impervious cover will increase. The number of catchments in the “Low” (0-9%) and “Medium” (10-29%) impervious cover categories is expected to decrease. Based on Future Land Use map conditions, it is expected that both subwatersheds within the watershed will have an increase in catchments with >30% in pervious cover in the future (Figure 4-7).

Table 4-1: Catchment Imperviousness by Subwatershed

Subwatershed	Catchment IC Percentage 0-9% (Low)		Catchment IC Percentage 10-29% (Medium)		Catchment IC Percentage 30-100% (High)	
	Acres	% Area	Acres	% Area	Acres	% Area
Fish Lake Drain	1,902.4	37.2 %	3,043.3	59.5%	168.7	3.3%
Manitou Creek	8,908.7	37.6%	14,079.1	59.3%	734.5	3.1%

Table 4-2: Estimated Watershed IC associated with Future Land Use

Subwatershed	Catchment IC Percentage 0-9% (Low)		Catchment IC Percentage 10-29% (Medium)		Catchment IC Percentage 30-100% (High)	
	Acres (Change)	% Area (Change)	Acres (Change)	% Area (Change)	Acres (Change)	% Area (Change)
Fish Lake Drain	797.4 (-1,105.0)	15.6% (-58.1%)	2,447.2 (-596.1)	47.8% (-19.7%)	1,869.9 (+1,701.2)	36.6% (+1,009.1%)
Manitou Creek	4,966.5 (-3,942.2)	20.9% (-44.4%)	14,544.9 (+465.8)	61.3% (+3.3%)	4,210.9 (+3,47634)	57.7% (+1,761.3%)
Watershed Total	5,763.9 (-5,047.2)	20.0% (-46.7%)	16,992.1 (-130.3)	58.9% (-0.8%)	23,367.98 (+5,177.6)	21.1% (+547.1%)

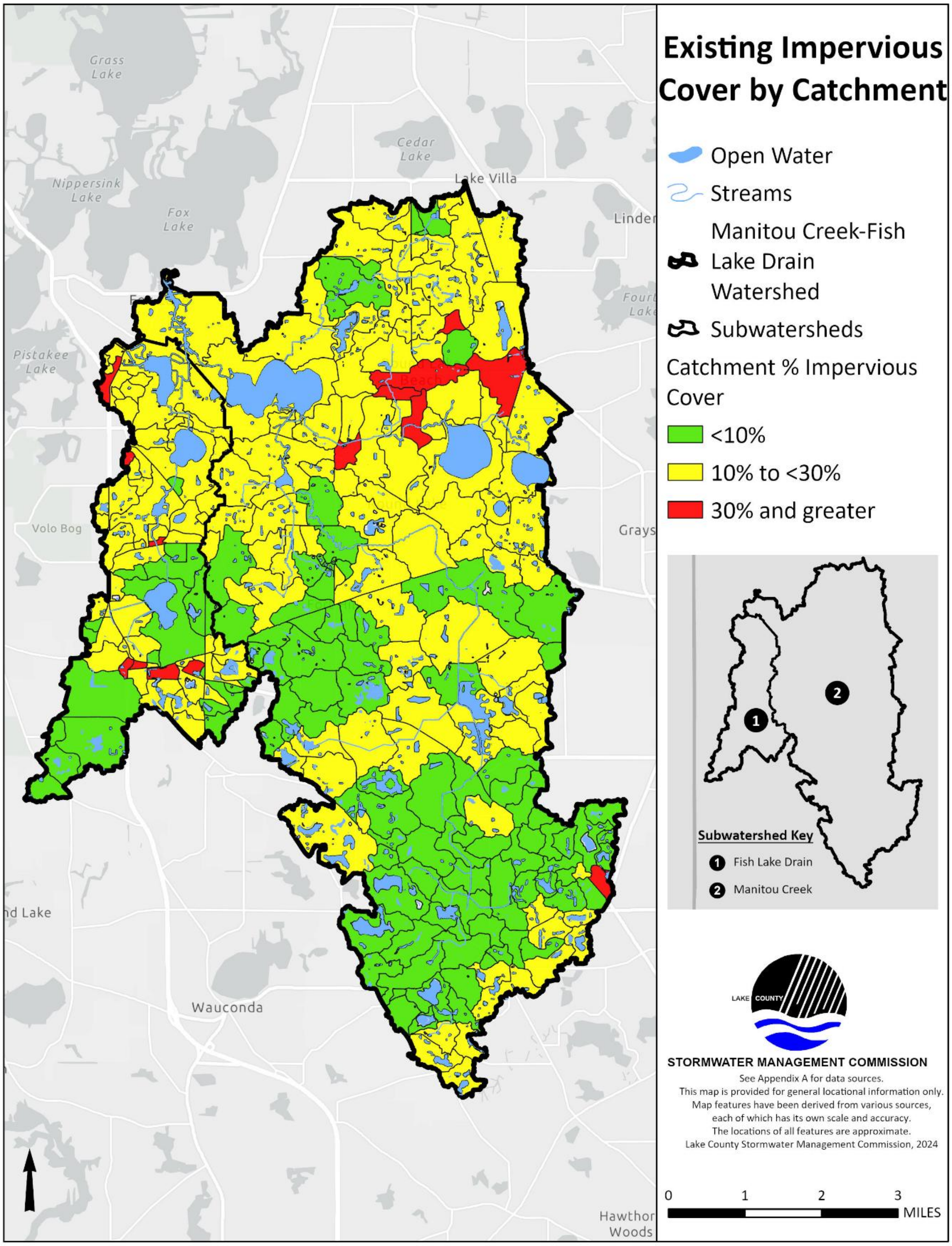

Figure 4-5: Impervious Cover by Catchment

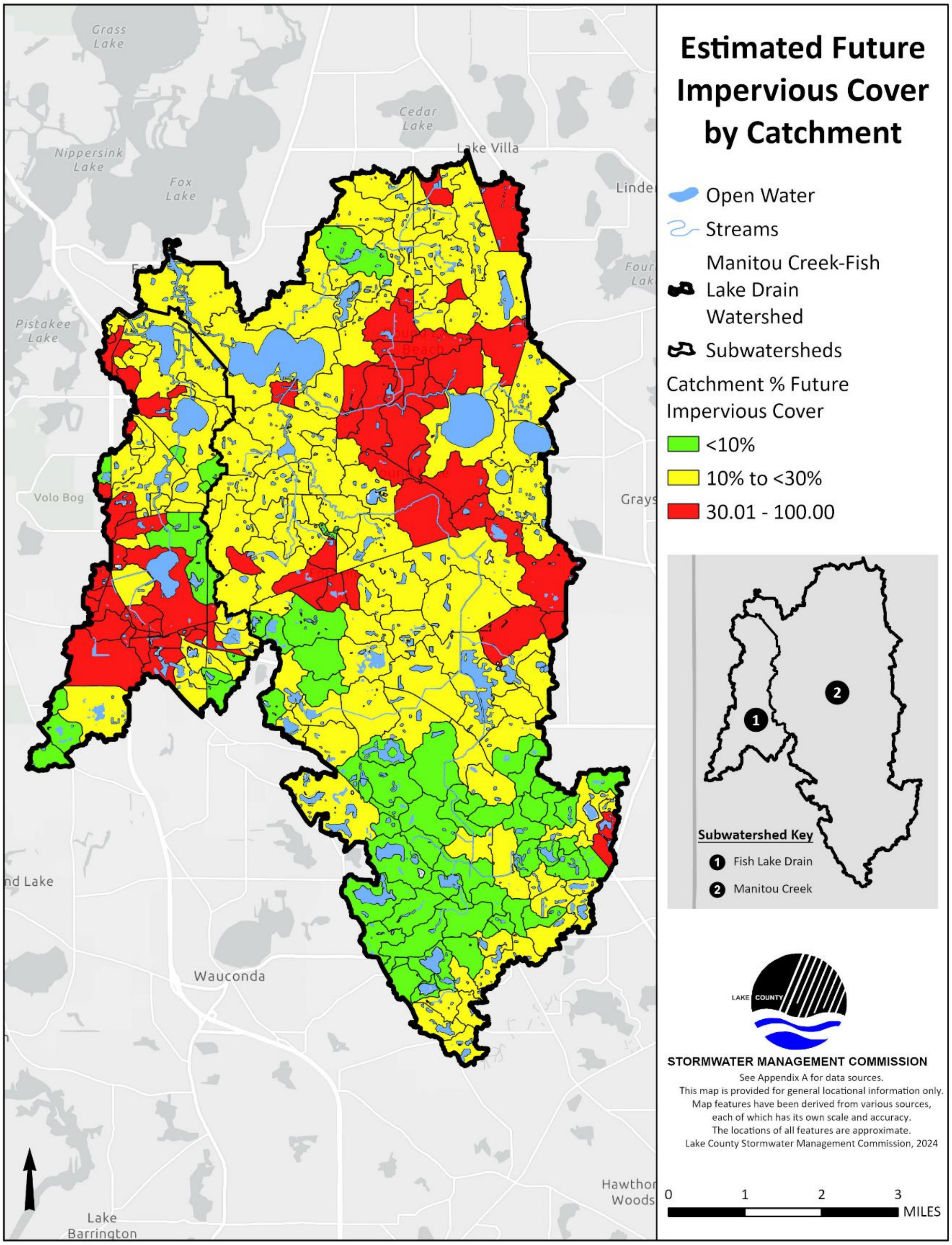

Figure 4-6: Estimated Impervious Cover by Catchment Based on Future Land Use Mapping

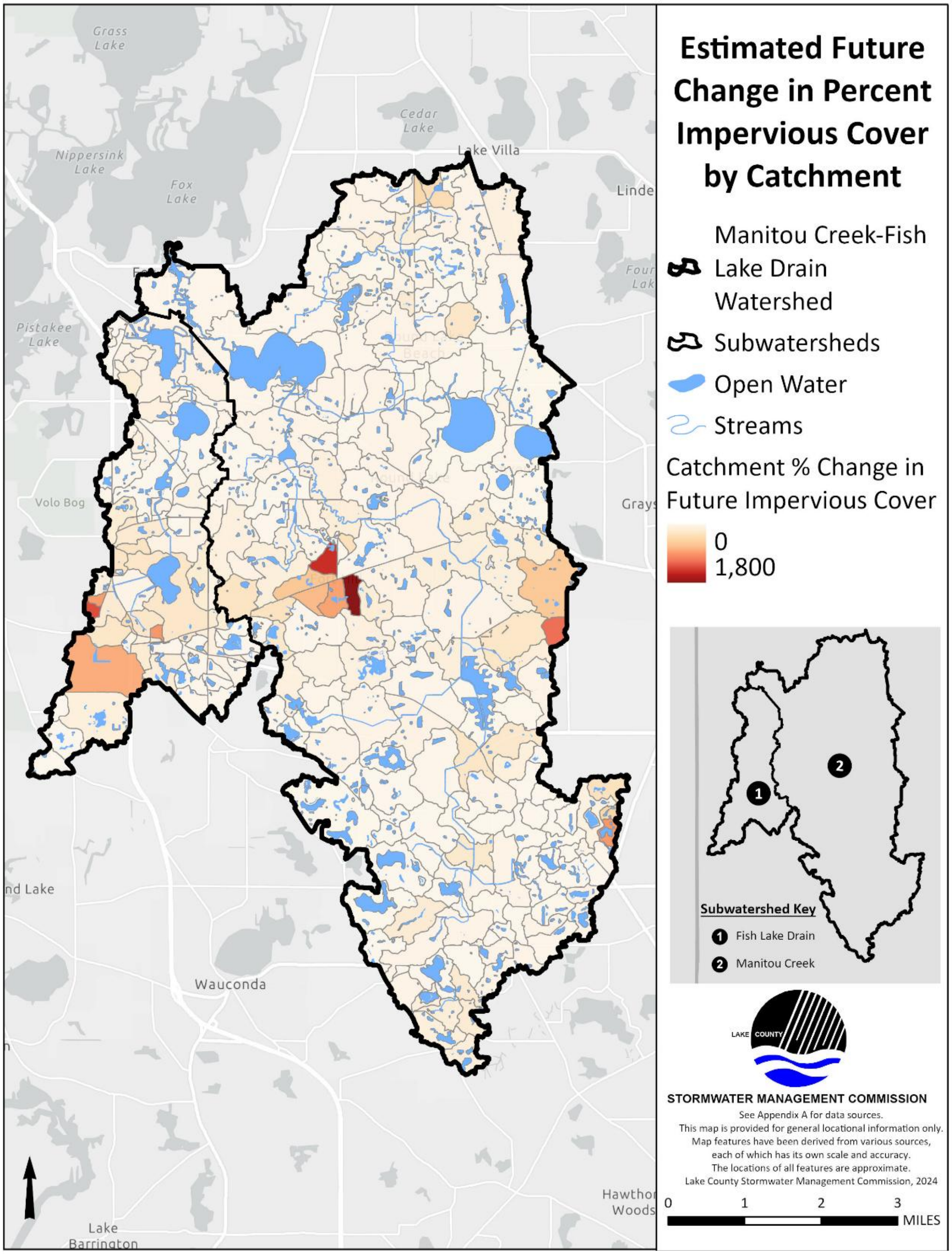

Figure 4-7: Estimated Percent Change in Catchment Impervious Cover Based on Future Land Use

4.1.6 Reducing Land Use Impacts Through Development Standards and Policy

FLOODPLAINS: Floodplains are lowlands, adjacent to rivers, streams and creeks that are subject to recurring floods. Mapped regulatory floodplains are defined as the area of land, which is inundated with water during 100-year flood events.

FLOODWAY: A "Regulatory Floodway" means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

The Manitou Creek-Fish Lake Drain Watershed-Based Plan recommends actions for protecting and restoring natural resources, improving water quality, and reducing and preventing flood damage in the watershed. These actions include both remedial and preventative measures for communities to support. Among the most significant and influential are preventative measures such as policies and regulatory programs, which are proactive practices rather than costly remedial measures after the problems become unavoidable.

This watershed-based plan does not recommend specific land uses or zoning; however, it does consider the health of watershed streams, waters and wetlands, which is a direct reflection of land use and land management. Therefore, consideration of land management and development impacts by local land use authorities is necessary for effective watershed planning. Resolution of water resource issues may be supported by review and modification of policies, standards, and practices guiding land development and land management.

It is anticipated that stormwater runoff volume and pollution will continue to increase as impervious cover increases within the Manitou Creek-Fish Lake Drain watershed. Municipalities and Lake County should review relevant ordinances to evaluate policies, standards, and regulations for new and retrofitted development, and for land management as it pertains to stormwater runoff volume, detention, water quality, **floodplains/floodways**, and wetlands. Both watershed development regulations and policies focused on stormwater management and local ordinances and policy that direct development practices that influence impervious cover and drainage should be reviewed based on their potential to positively influence watershed health by preventing negative land development impacts.

4.1.6.1 Stormwater Management

Current stormwater regulations are enforced locally and include development standards based on local ordinance and National Pollution Discharge Elimination System (NPDES) minimum requirements. Section 4.3 Watershed Jurisdictional Coordination identifies roles and jurisdictions of development programs. Section 3.18 NPDES Phase II Stormwater Permits identifies national stormwater requirements.

The current Lake County Watershed Development Ordinance (WDO) specifies watershed-specific release rates for new development standards. As of the date of this report, Manitou Creek Mainstem major tributary, including Fish Lake Drain, Round Lake Drain, and Eagle Creek Drain minor tributaries are the only specified watersheds in Lake County with release rates that are more stringent than the Ordinance's maximum allowable release rates. These rates are 0.090 cfs/acre and 0.020 cfs/acre, compared to 0.150 cfs/acre and 0.040 cfs/acre for the 100-year and 2-year storm events, respectively. According to the Ordinance, these values were derived from 11/3/1982 Flood Insurance Study flow rate analysis, which was adopted by the Lake County Stormwater Management Commission (SMC) on 8/1/1996.

The primary technical issues of concern related to stormwater management are:

- Hydrologic changes have resulted in stream channel changes and slope instability. Deepening and widening of the stream channel in some locations has created excessive erosion and sedimentation, property loss, debris loads and blockages, and aquatic habitat impairments.
- Historic urbanization of the watershed has caused hydrologic change.
- Further development will increase impervious cover in the watershed.
- Current impervious cover and land use vary within an individual catchment, impervious cover tends to be relatively low compared to other local watersheds. The highest impervious cover concentrations in the study area are in the Highland Lake Drain, Round Lake, and Round Lake Drain SPUs.
- Current drainage infrastructure varies within an individual catchment and with undersized, older, not maintained, or inadequate infrastructure which largely contributes to urban flooding.
- Nonpoint source pollution from urban and agricultural land uses, transportation infrastructure and maintenance practices, and urban runoff may contribute to impairment of waterways and wetlands.

The effects of increased runoff volume resulting from land use changes can be addressed in a variety of ways, including the following examples:

- Institute more effective and consistent runoff volume reduction practices as around 2,000 acres are projected to convert to land uses with comparable (redevelopment) or greater impervious cover.
- Review the detention volume/release rate requirements for the watershed and determine if unique conditions warrant additional adjustments or changes to storage and release regulations.
- Review and revise ordinance and policy language to ensure that the disconnection and minimization of impervious surfaces are allowed by right.
- Low impact development practices and the use of green infrastructure best practices (that maintain natural hydrology post-development) could be expanded by municipal and county ordinances for all new development and significant redevelopment.
- Mitigate unavoidable wetland loss within the watershed or subwatershed where the wetland impact/loss occurs and restore wetlands and runoff-reducing wetland function(s) where feasible.
- Utilize tree preservation ordinances that protect mature healthy native trees and stands of forest/savanna for stormwater reductions, habitat value and increased urban tree canopy coverage.

Water quality has been identified as a watershed issue and concern. Local community ordinances can be reviewed and revised to ensure that development codes do not preclude but rather encourage Best Management Practices (BMPs) to protect and improve water quality. Examples of such BMPs include:

- The use of native vegetation in home and business landscaping.
- Sustainable street designs, including alternative transportation opportunities and bio-swales or other vegetated conveyance systems for stormwater management instead of traditional curb and gutter.
- Infiltration for a significant portion of increased runoff volume due to land development. County stormwater management ordinances provide runoff volume reduction measures.
- Preservation of areas recognized as green infrastructure to reduce polluted runoff.
- Rainwater harvesting such as using rain barrels and cisterns.

Site-specific streambank erosion issues were identified as a concern. Many of these erosion issues can be addressed with the following:

- Requirements or incentives for stream corridor buffering and restoration for stream reaches located on new development sites could provide water quality, flood reduction, and habitat enhancement benefits. Currently stream corridor enhancements are not required with land development activities.
- Continued outreach and education to riparian landowners on proper maintenance and protections.
- Development and support for standardized long-term maintenance and monitoring protocols for naturalized stormwater drainage systems and natural areas. Development of a standardized protocol for monitoring and maintenance plans for new developments and required endowment funds for long-term implementation of the plans.
- Collective resolution (by landowners and others) to multi-property erosion problems.

4.1.6.2 Local Municipal and County Policies and Ordinances

Policy and regulatory changes regarding land use are the responsibility of the county and municipal planning and development departments. Those entities should consider developing and implementing sound environmental long-term planning goals in their guiding documents. Planning documents vary in function (e.g. comprehensive plans, overlay, or area-specific plans) but can seek balanced land use, land preservation, and development guidelines to protect water resources. Development guidelines may be the best avenue for incorporating watershed-specific development standards and practices that prevent flood damage and protect water quality. Because elected officials change, long-term planning guidelines support county and municipal staff in preserving watershed health through the available resources for enforcement and recommendations.

Planning and zoning guidance provides the next level of watershed protection. Most planning and zoning regulations are in the form of local comprehensive land use plans and development-related ordinances that regulate onsite land use practices to ensure adequate floodplain, wetland, stream, lake, pond, soil conservancy, and other natural resource protection. Zoning ordinances and overlay districts, define the allowed type of development and where it can be located relative to natural resources. Other examples of planning/zoning resource protection include riparian and wetland buffers, impervious area reduction, open space/greenway dedication, and conservation development.

An excellent source of information on model development principles and a sample code and ordinance review worksheet can be found in *Better Site Design: A Handbook for Changing Development Rules in Your Community* (CWP, 1998). In addition, the Center for Watershed Protection and United States Environmental Protection Agency (USEPA) have self-appraisal checklists that watershed communities may use to evaluate their existing codes and ordinances. Adopting watershed-friendly codes and ordinances will elevate protection and enhancement of watershed resources. Watershed communities should perform this self-appraisal and establish an action plan to revise ordinances and codes where needed.

Improved coordination and communication between county and local government would benefit water resource protection. Municipal stormwater officials, local planners, and zoning boards should be very familiar with watershed development regulations and should consider revising local ordinances that address watershed and site-specific water, natural resource, and flooding issues not covered by county, regional, or state program requirements.

Noteworthy: Community Programs and Regulations Influence Watershed Health

Many codes and ordinances influence the health and function of a watershed. The table below includes typical types of codes and ordinances to evaluate and potentially change or modify to help improve watershed conditions.

Code or Ordinance Types with Ties to Watershed Health

SUBJECT OF REGULATION	CODE/ORDINANCE/REGULATION
Erosion and Sediment Control	Zoning Ordinance, Stormwater Ordinance
Environmental Regulations (e.g., Buffers, Water Quality, Wetlands, Threatened/Endangered Species)	Subdivision Codes, Stormwater Ordinance, Planned Unit Development Agreements, Special Use Permits
Floodplain Regulations	Zoning Ordinance, Stormwater Ordinance, Subdivision Codes, Building Code
Stormwater Management and Drainage	Stormwater Ordinance, Subdivision Codes, Zoning Ordinance, Planned Unit Development Agreements, Street Standards and Road Design, Building Code, Fire Code
Tree Protection and Landscaping	Tree Protection Ordinance, Landscape Ordinance, Nuisance Ordinance, Planned Unit Development Agreements, Building Code, Fire Code
Parking Requirements	Zoning Ordinance; Planned Unit Development Agreements, Special Use Permit, Grading Ordinance

Noteworthy: Conservation Development and Low Impact Development

County and local governments can work together to develop incentives for conservation development and Low Impact Development. Some ways to incorporate conservation development into projects and provide incentives for developers include:

- Allow conservation development "by-right" (does not require variances)
- Establish a joint review department/agency application process that reduces review time
- Reduce fees for conservation development application review
- Require all developments have a certain percentage of preserved open space
- Develop native landscaping ordinances
- Reduce setback requirements between lots and encourage multi-level and clustered residential development to reduce land consumption
- Provide credit for combining natural buffers with recreational opportunities
- Require native plantings in all detention basins

Communities may incorporate conservation development and Low Impact Development using several methods and strategies. Conservation development zoning could be applied to rezoning. The conservation development zoning classification should outline the intent, design guidelines, density bonus, and the specific areas where conservation development zoning changes would be permitted. The areas that may be rezoned to a conservation development might include areas that are adjacent to ecologically significant lands or are identified in local green infrastructure plan. Rural residential districts or less productive agricultural areas may also be considered. Areas that are defined as rural residential could provide a transition from higher density residential to rural.

Design guidelines for conservation developments should include Low Impact Development practices, a detailed outline of the process used to define the environmentally sensitive areas on the site and identify areas on the site that are developable. Because each site will have different developable areas and sizes, design guidelines should be flexible and should consider different development characteristics, such as roadway length, width, and lot size. Density bonuses may be written into the zoning code and could include bonuses for the following: use of native vegetation throughout the development including individual lots, reduction in pavement or impervious surface, use of permeable pavements, increased percentages of open space, trail or sidewalk connections to other developments or regional trails, additional expanded buffering of natural areas and adjacent spaces, and creation of wildlife habitat.

4.2 WATERSHED RESOURCE PROBLEMS ASSESSMENT

This section assesses the problems and concerns identified in Chapter 2 and Chapter 3 in order to better understand them and guide informed and prioritized actions to address them. Many water resources in the watershed have water quality impairments which negatively affect aesthetic value, aquatic habitat, recreational value, and fish consumption uses.

The following subsections describe further analysis used to assess how watershed conditions are affecting the water quality, natural resources, and green infrastructure throughout the Manitou Creek-fish Lake Drain watershed.

4.2.1 LAKE IMPAIRMENTS

Based on the 2020/2022 Illinois Environmental Protection Agency (Illinois EPA) A 303(d) list, 19 of 25 inland lakes in the Manitou Creek-Fish Lake Drain Watershed have been assessed for beneficial uses and all have statutory impairments, as thoroughly detailed in Chapter 3. The impaired lakes and their respective sources of impairment include Lake Christa, Countryside Glen Lake, Cranberry Lake, Davis Lake, Duck Lake, Fischer Lake, Fish Lake, Hidden Lake, Highland Lake, Hook Lake, Lake Holloway, Long Lake, North Churchill Lake, Old Oak Lake, Owens Lake, Schreiber waterbody, South Churchill Lake, Summerhill Estates Lake, and Wooster Lake.

Of the 25 lakes in the Manitou Creek-Fish Lake Drain Watershed, 10 are listed as impaired for phosphorus, 12 for total suspended solids, and 1 for aquatic plants. All 25 of the lakes found in the watershed have a designated use of aesthetic quality, with 3 of these 25 also having the designated use of aquatic life.

All lakes mentioned above are impaired for aesthetic quality caused by total phosphorus, total suspended solids, or a combination of the two. Lakes with high nutrient concentrations and sediment can become vulnerable to a myriad of issues including low dissolved oxygen, an increase in invasive aquatic plant growth, and algae blooms, all of which negatively affect aesthetic value, habitat, and recreational use. In addition to nonpoint and point sources of sediment and phosphorus, internal lake processes contribute to nutrient and sediment issues.

Invasive species and excessive algae blooms decrease biological productivity and limit the diversity of native plants, fish, and macroinvertebrate species. Lake shoreline erosion is another consideration, as erosion can add sediment to the waterbody, decreasing overall water quality and contributing to the loss of shoreline and property. A lake shoreline erosion inventory was completed for most lakes in the watershed and based on the findings (see section 3.13.2) shoreline erosion is not currently a significant issue of concern compared to other contributing sources of pollution.

4.2.2 HARMFUL ALGAL BLOOMS

Environmental conditions including warm water, elevated nutrients, stagnant water, and high sunlight can create ideal conditions for cyanobacteria growth causing harmful algal blooms (US EPA-OWR, 2019). Cyanobacteria cells can produce toxic compounds, including microcystins and cylindrospermopsin, that are harmful to human and animal health (US EPA-OWR, 2019). These toxins can be present in levels dangerous to human health before, during, and after a visible harmful algal bloom (HAB) has occurred (US EPA-OWR, 2019).

The Illinois EPA collects water samples to test for Harmful Algal Blooms during routine monitoring and HAB event response (Illinois EPA, 2024). Additionally, the Lake County Health Department conducts routine monitoring approximately every two weeks between May and September at Fish Lake. Fish Lake, Long Lake, Round Lake, Wooster Lake, and Manitou Creek have been sampled multiple times and tested positive for various toxins associated with harmful algal blooms: microcystin, cylindrospermopsin, anatoxin-a, and saxitoxin. Of particular concern is Long Lake, where residents and lake organizations have raised concerns about harmful algal blooms. Efforts to identify a potential bloom, collect samples, transport samples to a laboratory, perform the tests, and report the results collectively create a response lag in which exposure can occur. To mitigate exposure, better early detection and response mechanisms are in development to identify harmful algal blooms.

Tools for accurately identifying harmful algal blooms in real time are still a work in progress. Various types of visual sensors have been used to identify algal blooms, including those associated with satellite imagery as part of the Cyanobacteria Assessment Network (CYAN) project discussed in Chapter 3. Another tool is United States Geological Survey's (USGS) water quality sensors in Long Lake that pair with satellite imagery and multi-spectral cameras to remotely identify harmful algal blooms; however, preliminary results find that the sensors were not only indicative of harmful algal blooms but also general aquatic plants. Best tools and practices for calibration, pairing sensors with other data sources, placing sensors in appropriate locations, and managing bloom migration are in development or are subjects for future study.

Even though real-time prediction tools are still in development, we can leverage our current understanding of what causes harmful algal blooms to better prevent them from occurring. Individual factors such as increased nutrient loads, food web alterations, introduced species, water flow modifications and climate change contribute to HABs (NOAA, 2016). How these individual factors interact to cause HABs is not well understood (NOAA, 2016).

Elevated levels of nutrients, predominantly phosphorus, are likely major drivers of harmful algal blooms in the watershed, based off the Illinois EPA impairment status and Total Maximum Daily Load (TMDL) reporting. Some of these other factors, like water flow modifications can be partially addressed through restoration but will be impacted perpetually due to watershed urbanization. Food web alterations, likely most predominantly due to aquatic invasive species, can be improved through invasive species management and prevention measures, like waterway user education. Climate change, impacting temperatures, seasonality, and other growing conditions are not localized or acute, but still impact the in-lake ecosystem and nutrient cycling.

4.2.2.1 The Role of Phosphorus

Most waterbodies in the watershed, including Long Lake, are phosphorus limited. This means when phosphorus concentrations increase in the water column aquatic plants and algae can flourish. Decreased abundance of or absence of algae can lead to abrupt and rapid aquatic plant growth. Likewise, decreased abundance of or absence of aquatic plants can lead to abrupt and rapid algae growth.

Phosphorus comes from both internal and external sources. Internal sources are within the waterbody itself, while external sources include both point and nonpoint sources. Point sources include individual permitted facilities and Municipal Separate Storm Sewer Systems (MS4s), while nonpoint sources are associated with watershed activities and land uses.

Since phosphorus sorbs to soil particles, increased phosphorus concentrations can result from increased suspended solids concentrations. Large precipitation events are primary avenues of sediment transport, as they mobilize soils in the upper watershed via stormwater runoff and erosion. Soils naturally contain phosphorus, but they can carry increased concentrations due to legacy fertilizer application, predominantly on lawns, agricultural fields, and manure application practices. Other nonpoint sources of phosphorus include stream channelization and erosion, discharges from septic systems or unsewered communities, wetlands, forests, and wildlife.

Legacy phosphorus also accumulates within lakes through the deposition of sediment and decaying aquatic plants. These internal loads can be reintroduced to the water column through physical disturbance such as wind and wave action, seasonal lake turnover, benthic fish activity (particularly carp), and recreational boating (particularly in shallow areas).

4.2.2.2 Harmful Algal Bloom Reduction Strategies

Decreasing phosphorus concentrations will likely help to limit harmful algal blooms. Understanding the relative contribution of phosphorus from internal and external sources can help inform phosphorus reduction strategies. Since much of internal phosphorus loading associated with sediment is a result of historical external loading, one of the most sustainable, long-term, and cost-effective strategies to limit loading is to reduce external loading. Internal loading can be addressed by in-lake methods discussed in more detail later in this section but will need to be regularly applied if excess external loading persists.

An analogy for this relationship between internal and external load reductions is associated with a sinking boat. Repairing the leak in the hull represents external load reductions, while bailing the water out represents internal load reductions. Bailing will need to be sustained indefinitely unless the leak in the hull is repaired. Likewise, repairing the leak will not reduce the water already in the hull. If only one person is in the boat (limited resources), the most effective approach would be to start repairing the leak before bailing the water.

As part of the TMDL, the Simplified Lake Analysis Model (SLAM) was used to determine the breakdown of phosphorus loading from internal and external sources. Table 4-3 shows the SLAM results for the studied lakes in the watershed. Based on the relative actual loads and percent reductions needed, addressing external and internal loading is recommended for all lakes, except for Duck Lake, in which no internal loading reduction is needed. Note that loads from MS4 communities are included as external nonpoint sources.

External phosphorus reduction strategies are covered in Chapter 6. Some internal phosphorus reduction strategies, like carp removal and appropriate aquatic plant management, are recommended as lake actions in Chapter 6. Additional tools available to limit internal phosphorus loading are presented below. Each tool may not be appropriate or effective for every waterbody, and therefore should be evaluated in more detail on a lake-specific basis.

In-lake treatments are chemical, physical, or biological in nature. Appropriate selection is dependent on many factors, including lake morphology, hydrology, water chemistry, impact to aquatic ecosystem, duration of result, stakeholder preferences, legality, and budget. Comprehensive impacts of these tools and treatments to the lake ecology varies between lakes and is sometimes not well understood. Careful selection and monitoring will ultimately assess efficacy and will inform adaptive management of internal phosphorus loads.

Table 4-3 TMDL SLAM Results

Name	Total Phosphorus Loading Source		Actual Load (lbs/yr)	Allowable Load (lbs/yr)	Percent Reduction Needed
Davis Lake	Internal	Internal	655	66	90%
	External	Nonpoint	87	44	50%
		Point	0	0	0%
	Total		742	109	85%
Duck Lake	Internal	Internal	97	97	0%
	External	Nonpoint	1,166	991	15%
		Point	0	0	0%
	Total		1,263	1,089	14%
Fischer Lake	Internal	Internal	217	57	74%
	External	Nonpoint	1,685	388	77%
		Point	0	0	0%
	Total		1,902	444	77%
Fish Lake	Internal	Internal	627	157	75%
	External	Nonpoint	1,963	491	75%
		Point	0	0	0%
	Total		2,590	647	75%
Hidden Lake	Internal	Internal	95	17	82%
	External	Nonpoint	84	21	75%
		Point	0	0	0%
	Total		178	38	79%
Long Lake	Internal	Internal	3,773	1,132	70%
	External	Nonpoint	9,487	2,846	70%
		Point	822	822	0%
	Total		14,082	4,800	66%
North Churchill Lake	Internal	Internal	226	108	52%
	External	Nonpoint	67	33	50%
		Point	0	0	0%
	Total		293	142	52%
South Churchill Lake	Internal	Internal	63	30	52%
	External	Nonpoint	394	157	60%
		Point	0	0	0%
	Total		456	187	59%
Summerhill Estates Lake	Internal	Internal	236	40	83%
	External	Nonpoint	134	34	75%
		Point	0	0	0%
	Total		370	74	80%
Wooster Lake	Internal	Internal	443	288	35%
	External	Nonpoint	1,627	895	45%
		Point	165	165	0%
	Total		2,235	1,347	40%

Chemical tools can be used to inactivate or impede phosphorus release from sediment. This process decreases the amount of mobile phosphorus available for uptake by plants, algae, and photosynthetic bacteria. Depending on the treatment, varying sizes of spot treatments may be appropriate, as well as the instillation of filters at lake inlets. Aluminum additions, iron filings, ferric chloride, and lanthanum are examples of chemical treatments (NALM, 2004).

Physical methods for phosphorus management include dredging, drawdown, dilution, oxygen injection, hypolimnetic withdrawal, hypolimnetic aeration, circulation, and aeration (Pam et al., 2020). Some of these tools approach phosphorus reduction by removing phosphorus-laden sediments, while others alter dissolved oxygen conditions to prevent the release of phosphorus in anoxic conditions.

Biological methods involve removing phosphorus by removing vegetation and fish that contain phosphorus (Pam et al., 2020). Vegetation removal strategies should be controlled and consider lake-specific targets for vegetation densities and distributions. Excessive vegetation removal could lead to nutrient imbalances that could trigger algae production. Fish removal is typically limited to carp, as they are both introduced species and disturb bottom sediments that mobilize phosphorus in the water column. Care must be taken to maintain and not overly disrupt the in-lake ecosystem. For example, removing too many aquatic plants may allow algae and bacteria to flourish.

Individual lake factors, like thermal stratification, pH, and bathymetry, will inform selection of appropriate strategies for internal loading reduction. Tools designed to limit anoxic conditions, like aeration, or anoxic release of phosphorus due to stratification, like alum treatment, are typically more effective in deeper lakes. Other tools, like dredging phosphorus-laden sediments and carp removal, are better suited for shallower lakes with larger littoral zones.

Since each of these methods include careful consideration and further study, recommendations of internal phosphorus reduction methods have not been included for each lake.

4.2.2.3 Phosphorus in Long Lake

The TMDL SLAM results indicate that most of the total phosphorus load in Long Lake comes from external loading from non-point sources (67%). Internal loading accounts for 27% of Long Lake's total phosphorus load (Figure 4-8). A 70% reduction in both internal and external loads is needed to meet the water quality standard of 0.05 mg/L. External loading reductions are best achieved through non-point source phosphorus BMPs.

To inform potential watershed-level project prioritization approaches, the TMDL provides an estimate of contributing drainage area and phosphorus loading by subwatershed (Figure 4-8). The TMDL modeling suggests Eagle Creek's relative contribution of phosphorus is larger than its relative drainage area contribution (Figure 4-8). Based on this information, targeting non-point source phosphorus reduction efforts in the contributing areas of the Eagle Creek subwatershed is recommended.

To assess the internal load reduction needed, further in-lake research should be conducted. The previously prepared TMDL SLAM model could be employed to assess potential in-lake phosphorus reduction tools. Additional monitoring could be helpful for refining the SLAM model, as the availability of site-specific data was identified as a model limitation. As identified in the TMDL report:

Because the lake is relatively shallow and has relatively high concentrations of suspended sediment; wind, precipitation, and waterbody uses likely result in increased resuspension of sediment year-round. Furthermore, a review of historical DO levels recorded at depths near the lake bottom suggests the potential for sediment loading of phosphorus as a result of anoxic conditions near the lake bottom.

Monitoring of stratification and resulting anoxic conditions near the lake bottom will help inform internal phosphorus reduction strategies. The Lake County Health Department Reports suggest that Long Lake stratifies some years and may not stratify in others. In 2005, the lake was strongly stratified through September while in 2008, the lake weakly stratified from June through August and turned over in September. Additional dissolved oxygen profiles could provide more data about stratification and turnover that could better inform internal phosphorus reduction strategies.

Based on the TMDL and watershed characteristics, residence time in Long Lake fluctuates throughout the year. Installing gauges or performing low flow and storm flow measurements would improve our understanding of residence time fluctuations in Long Lake. A better understanding of Long Lake's residence time would better inform internal phosphorus reduction strategies. For example, understanding how long a chemical treatment may remain in the water column in Long Lake will impact the timing of the treatment and practicality of the treatment method.

Additional data collection, assessment, and discussion with stakeholders and regulators is needed prior to prescribing internal phosphorus loading reduction strategies at Long Lake. Carp removal has historically been deployed as a management tool, which helps to reduce biomass and to reduce sediment re-suspension. Periodic winter draw down of lake water level may also be an effective means to manage aquatic plant communities given the presence of a functional sluice gate on the downstream controlling dam structure. Drawdown in conjunction with dredging can be a cost-effective approach to dredge accumulated soft sediment from the littoral zone. Based on the confined inlet locations of the main tributaries, installation and regular maintenance of iron filing filters or sediment traps may be localized measures to collect and remove phosphorus and sediment. Alum treatments, that flocculate, inactivate, and settle sediment-laden particles out of the water column are also growing in popularity.

Detailed feasibility studies should further investigate these options before one or multiple are selected. As stated previously, source management in the contributing watershed should be pursued, as in-lake treatments alone can prove to be ineffective and costly. Managing expectations, outcomes, and longevity of these treatments are important considerations in weighing different treatment strategies. In each case, repeated treatment, maintenance planning, and adaptive management are critical components of the comprehensive planning process.

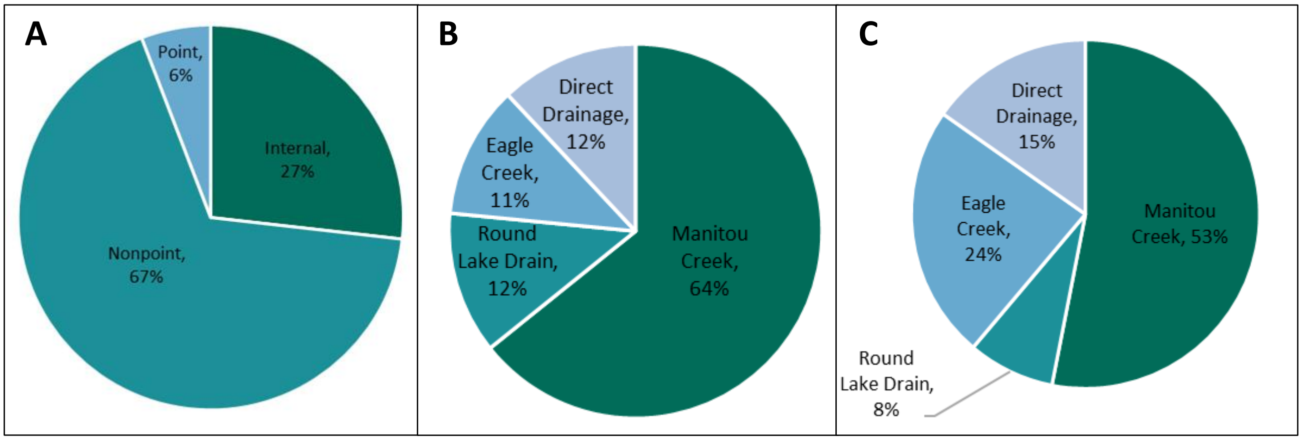

Figure 4-8: Long Lake Phosphorus Loading and Contributing Drainage Area Summary A. Percent Actual Loads to Long Lake from Phosphorus Loading Sources, B. Estimated Percent of Contributing Drainage Area from Each Subbasin, C. Estimated Percent of Phosphorus Load Emanating from Each Subbasin

4.2.3 Stream Impairments

Throughout the Manitou Creek-Fish Lake Drain watershed, there are two primary rivers, creeks, or streams that flow through the watershed. They are Manitou Creek (IL_DTL-02) and Eagle Creek (IL_DTLA-01). Both streams are listed as "not assessed" in the Illinois EPA 2020/2022 section 303(d) list.

It is in the best interest of the Manitou Creek-Fish Lake Drain watershed to implement and expand stream monitoring efforts. These programs are vital in providing data that are beneficial to thoroughly characterizing a watershed and understanding the issues that affect aquatic life and overall health and function of the watershed. A streambank erosion inventory was completed for most reaches of rivers, creeks, and streams in the watershed and based on the findings (see section 3.12.2.4) streambank erosion is not currently a substantial issue of concern compared to other contributing sources of pollution.

4.2.4 Causes

Chapter 3 introduced and identified problems and impairments in the Manitou Creek-Fish Lake Drain watershed, this section considers that assessment and prioritizes the level to which causes and sources of water quality impairment are addressed in this plan. Various sources of quantitative and qualitative were analyzed with the goal of identifying the causes and sources of impairment that will need to be managed to achieve the goals and objectives of this plan.

The combined efforts outlined in the inventory presented in Chapter 3, the Illinois EPA 2020/2022 Total Maximum Daily Load report for the Upper Fox River/Chain O' Lakes Watershed report, and the Illinois EPA 303(d) list provide data to assess the water quality impairments and better understand the causes and sources. Table 4-4 provides a planning level inventory of impairments, causes, and sources based on the characteristics and inventory of the Manitou Creek-Fish Lake Drain watershed. This table serves as a summary to document the issues and provides a baseline to further characterize them in a sufficient manner to recommend priority areas and specific actions.

Table 4-4: Summary of Causes of Pollution and Impairments

Impaired Use	Causes	Sources	Priority	Highest Priority Waters
Aquatic Life and Aesthetic Quality	Total Phosphorus	- Urban Runoff/Storm Sewers	Medium	Highland Lake, Lake Christa, Hook Lake, Countryside Glen Lake, Lake Holloway
	Total Suspended Solids (TSS)	- Bank Erosion - Altered Hydrology - Urban Runoff - Streambank Modifications/Destabilization	Medium	Lake Christa, Hook Lake, Countryside Glen Lake, Lake Holloway, Owens Lake
	Aquatic Plants	- Unknown	Unknown	Davis Lake

4.2.5 Pollution Loading and Nonpoint Sources

Pollutant loading from a watershed is the sum of point sources and nonpoint sources. Nonpoint source pollution is a primary concern related to water quality in the Manitou Creek-Fish Lake Drain based on the watershed characterization. Based on the data available, the watershed plan identifies priority impairments and problems to address in this watershed-based plan.

Point sources are also potential contributors to the overall watershed pollutant loads, specifically phosphorus and total suspended sediments. Existing regulatory permit processes and enforcement address point source pollution; however, some parameters are not regulated and contribute to watershed problems and stakeholder concerns. The NPDES-permitted point source facilities within the Manitou Creek-Fish Lake Drain include four wastewater treatment treatment plants as well as numerous private onsite treatment systems, including land application systems. These permitted facilities are subject to regulatory monitoring and reporting requirements, which are public records.

4.2.5.1 Nonpoint Source Pollution Load Model

A GIS model was developed to estimate nonpoint source pollutant loads for thirteen (13) parameters: total suspended solids (TSS), total dissolved solids (TDS), total phosphorus (TP), dissolved phosphorus (DP), total nitrogen (TN), total Kjeldahl (TKN), 5-day chemical oxygen demand (COD), 5-day biological oxygen demand (BOD), cadmium (Cd), lead (Pb), copper (Cu), zinc (Zn), and fecal coliforms. The output illustrates and quantifies the estimated spatial distribution of nonpoint source loading in the Manitou Creek-Fish Lake Drain by Subwatershed Planning Unit (SPU).

EVENT MEAN CONCENTRATION (EMC): Method for characterizing pollutant concentrations in stormwater runoff. The pollutant concentrations are measured in studies and on-going research that collects and analyzes runoff from various land-use practices in different geographic and climatic regions. The values are determined by compositing (in proportion to flow rate) a set of samples, taken at various points in time during a runoff event, into a single sample for analysis.

The model used to estimate pollutant loads incorporates the land use described in Chapter 3. Runoff volumes are based on the impervious area associated with a given land use and annual rainfall. Event mean concentrations (EMCs) were applied to the runoff volumes based on land use mapping. The EMCs are established based on literature sources, water quality studies and professional experience (Appendix F). Formulas and EMCs incorporated into the model are derived from Unit Area Pollutant

Load Estimates for Lake County, Illinois Lake Michigan Watersheds (NIPC, 1993) as modified and applied in the Dead River and Kellogg Creek watershed plans (SMC, 2008a; SMC, 2008b).

4.2.5.2 Nonpoint Source Loading, Current Conditions

Figures 4-9 through 4-21 illustrate the spatial distribution of nonpoint source loading for total suspended solids, total dissolved solids, total phosphorus, dissolved phosphorus, total nitrogen, total Kjeldahl, 5-day chemical oxygen demand, 5-day biological oxygen demand, cadmium, lead, copper, zinc, and fecal coliforms, respectively. Tables 4-5 and 4-6 display the total pollutant loading estimates and loading rates, respectively, throughout the Manitou Creek-Fish Lake Drain watershed. Total load estimates indicate which SPUs are estimated to contribute the greatest amount of a pollutant annually. Loading rate estimates indicate which SPUs contribute greater amounts of a pollutant per acre. A larger SPU may contribute to a high pollutant load as a function of its size while a SPU with a high loading rate might be characterized as a “hot spot” because it contributes a higher pollutant load per unit area.

Several SPUs are estimated to contribute higher loads for all pollutants. Because the pollutant load estimates are based on land use, it is not surprising that the same SPUs are predicted to have high loads for all pollutants. At the SPU scale, Cranberry Lake has the lowest estimated annual load for most of the parameters, likely due to its smaller area. The Tamarack Lake Drain SPU has the lowest loading rate (load per acre) of the twenty-three SPUs due to the relative amount of open space land remaining in the SPU.

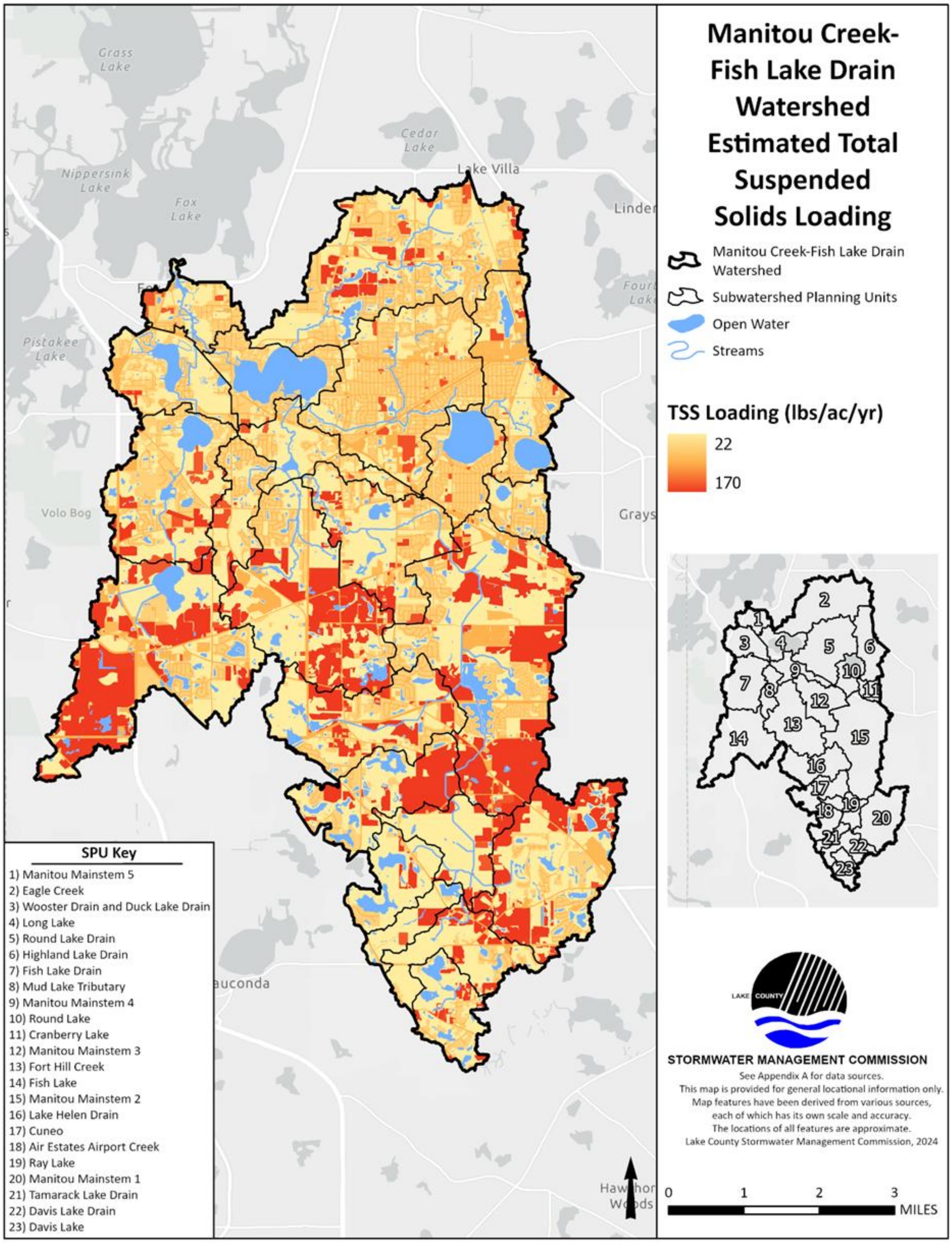

Figure 4-9: Estimated Annual Nonpoint Source Total Suspended Solids Loading

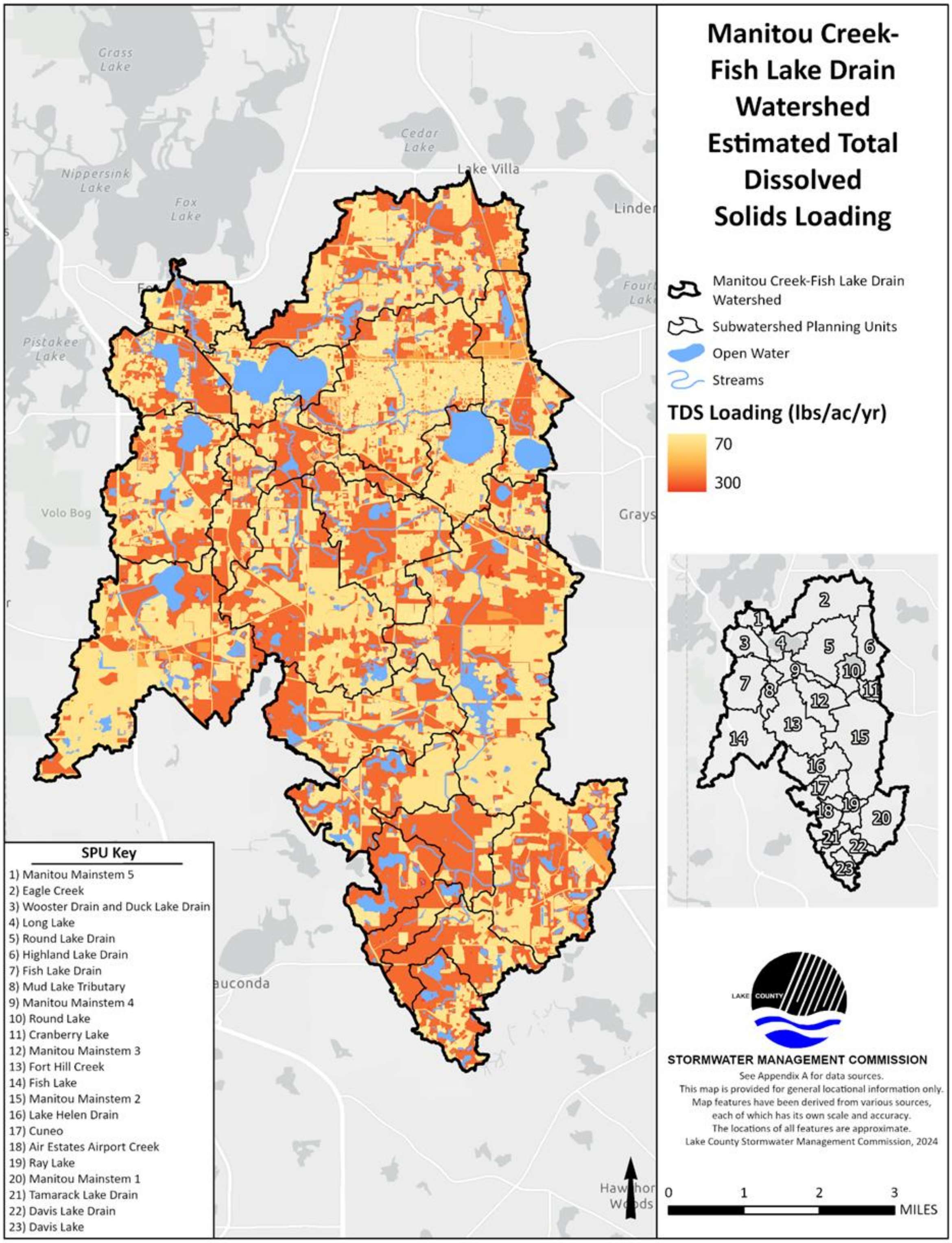

Figure 4-10: Estimated Annual Nonpoint Source Total Dissolved Solids Loading

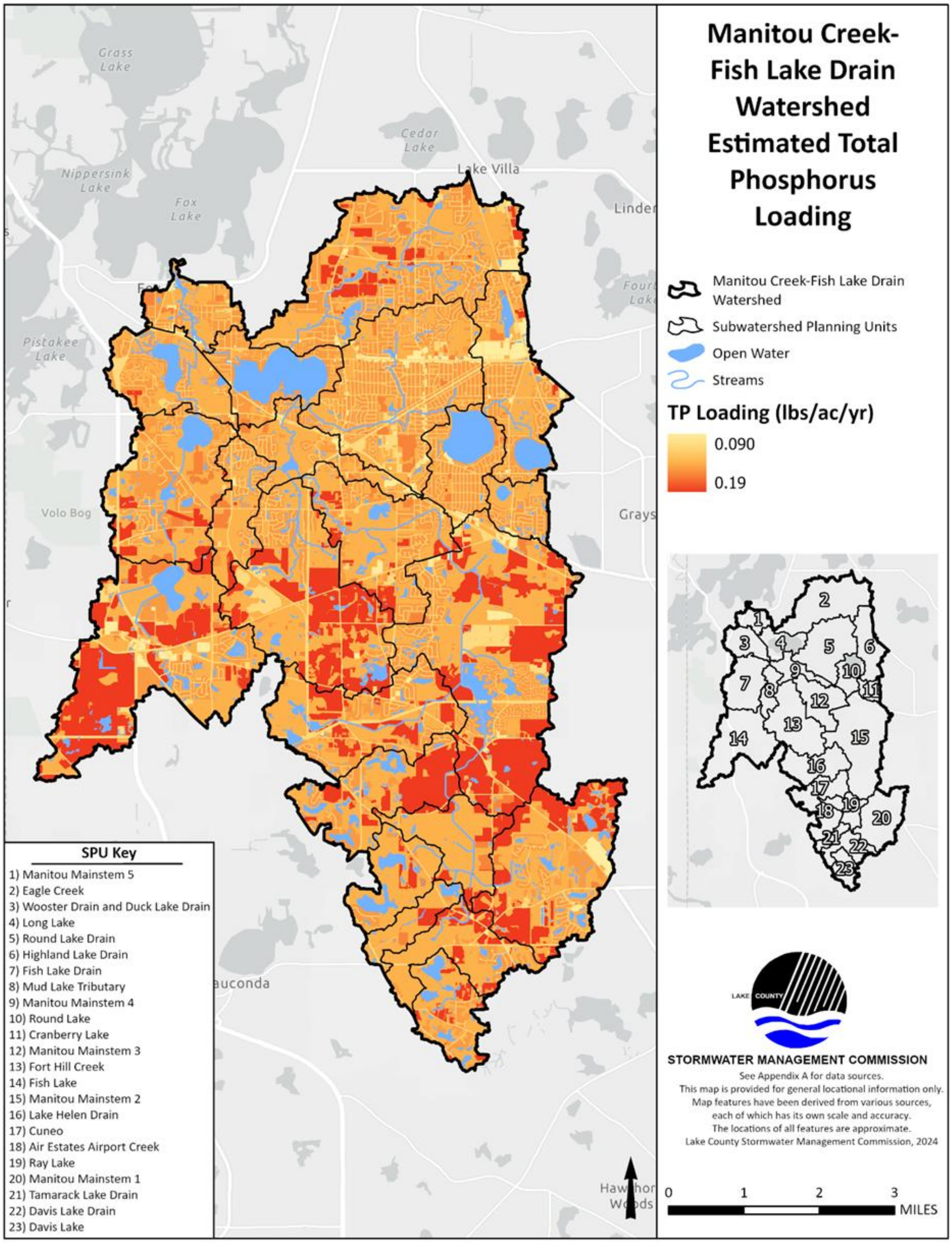

Figure 4-11: Estimated Annual Nonpoint Source Total Phosphorus Loading

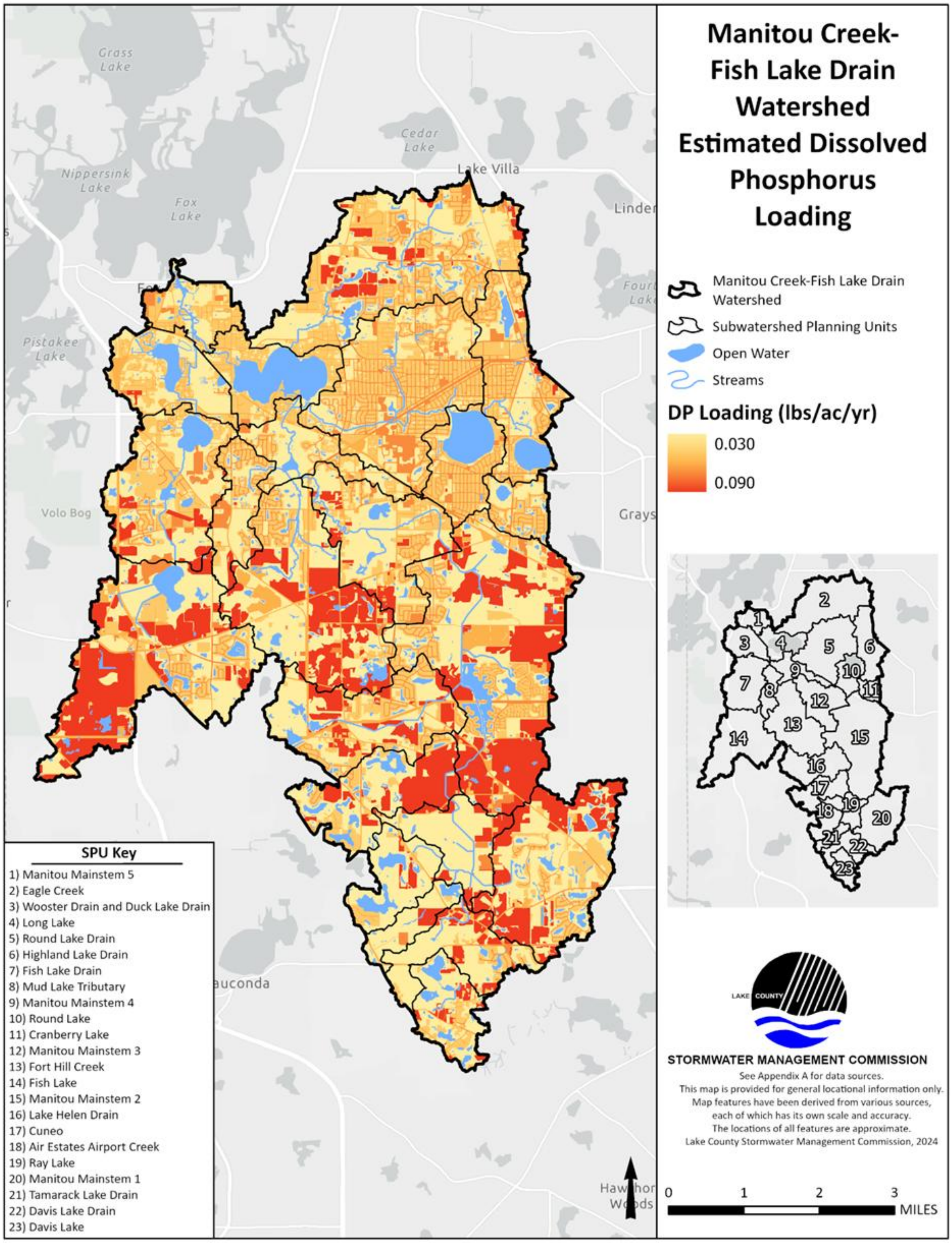

Figure 4-12: Estimated Annual Nonpoint Source Dissolved Phosphorus Loading

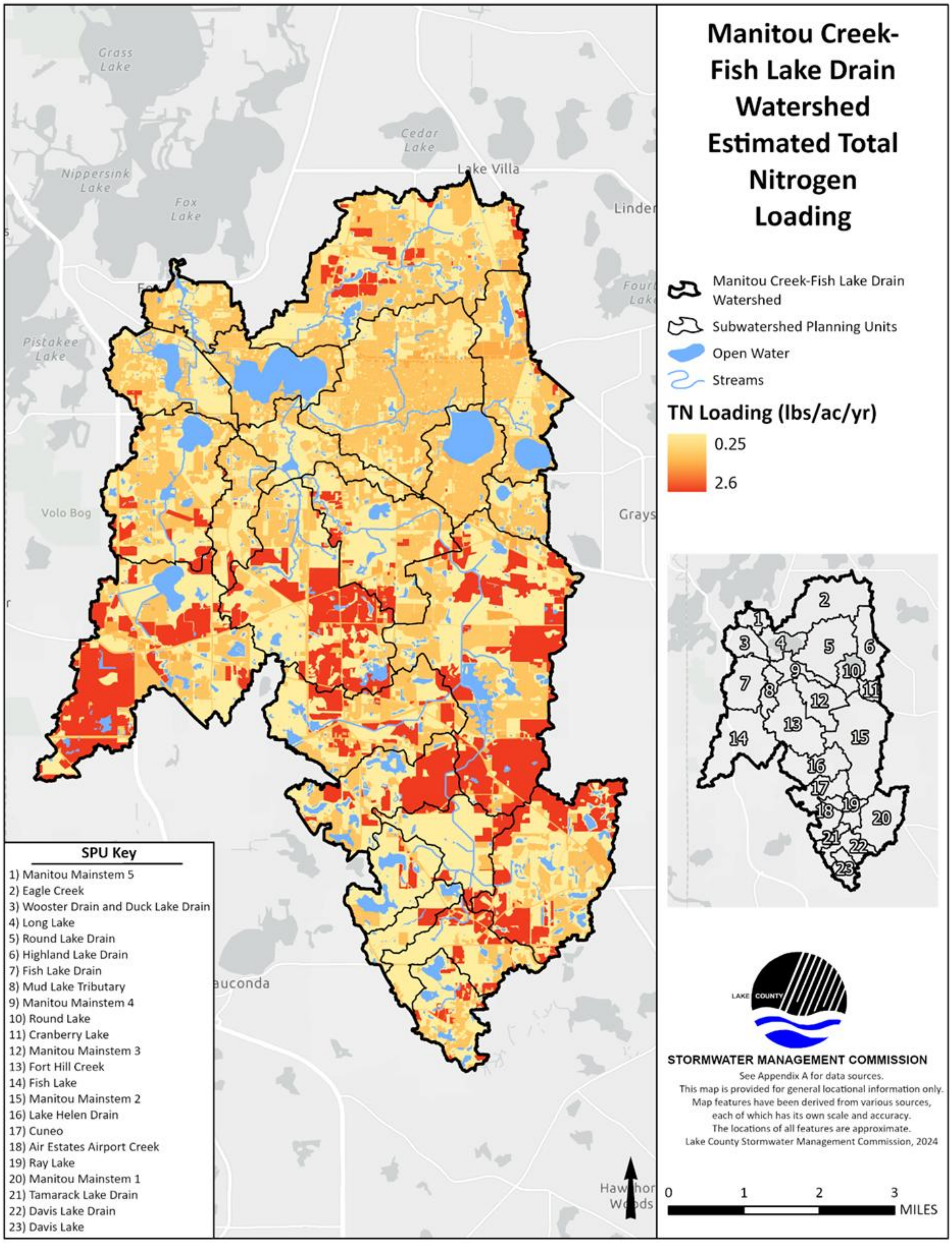

Figure 4-13: Estimated Annual Nonpoint Source Total Nitrogen Loading

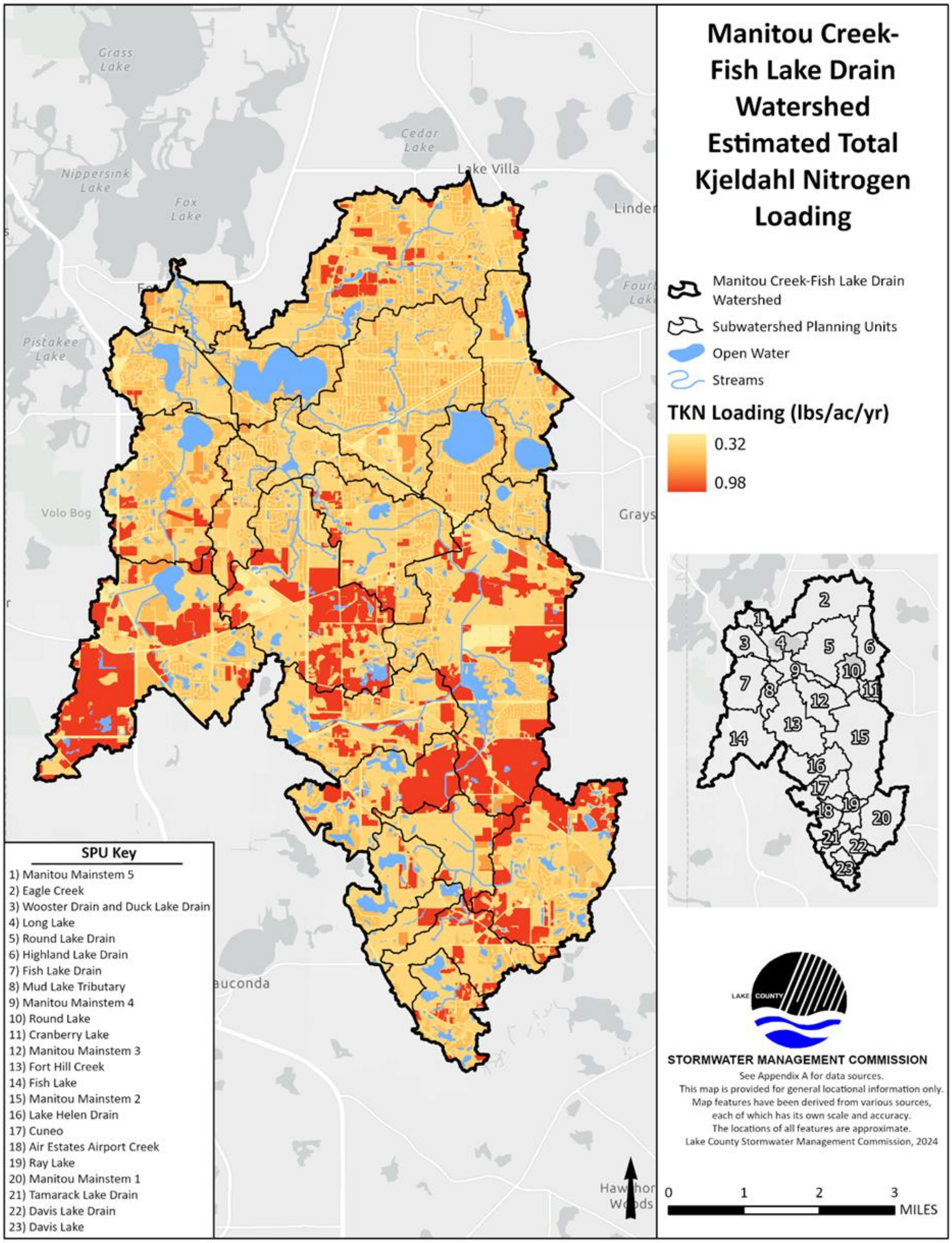

Figure 4-14: Estimated Annual Nonpoint Source Total Kjeldahl Nitrogen Loading

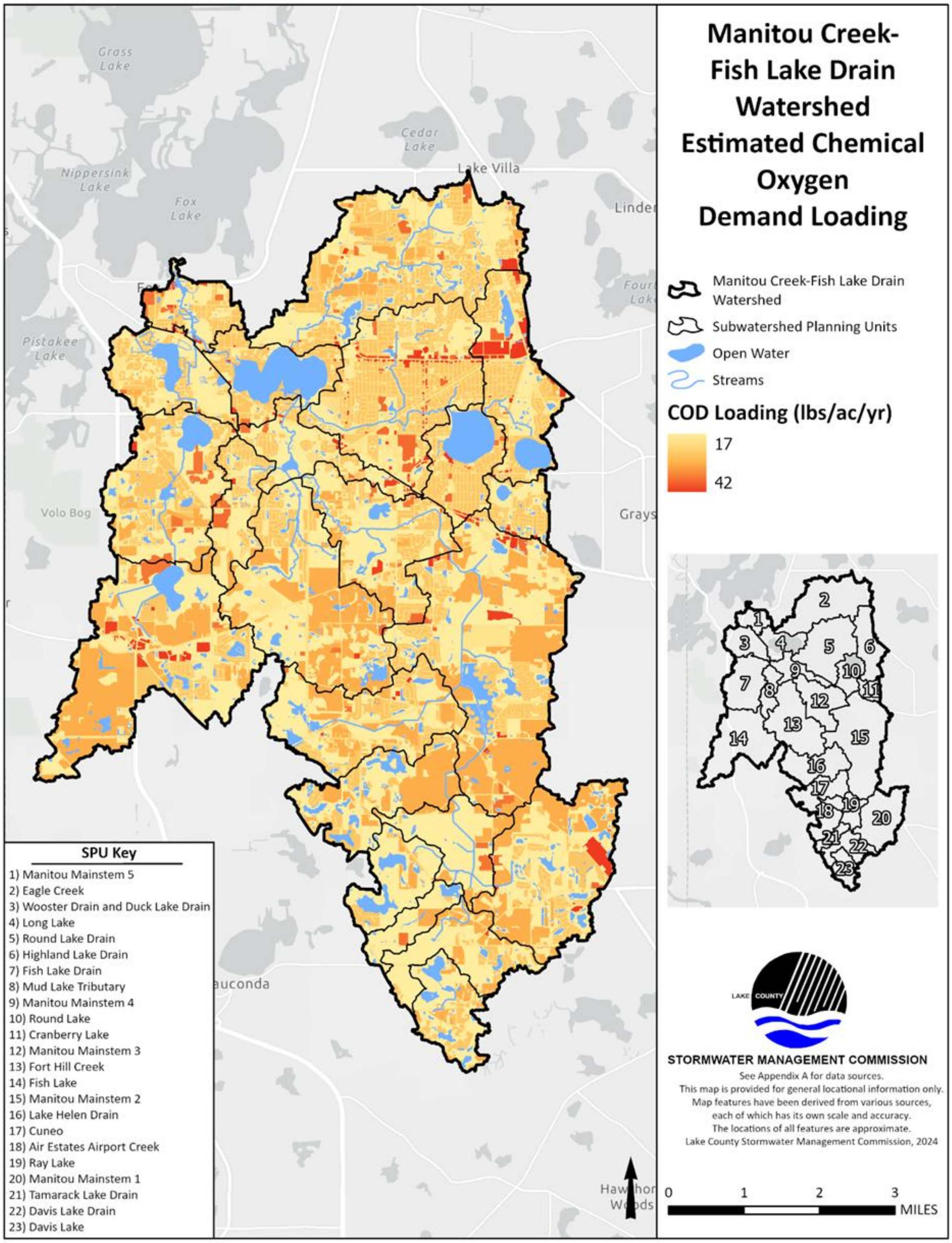

Figure 4-15: Estimated Annual Nonpoint Source Chemical Oxygen Demand Loading

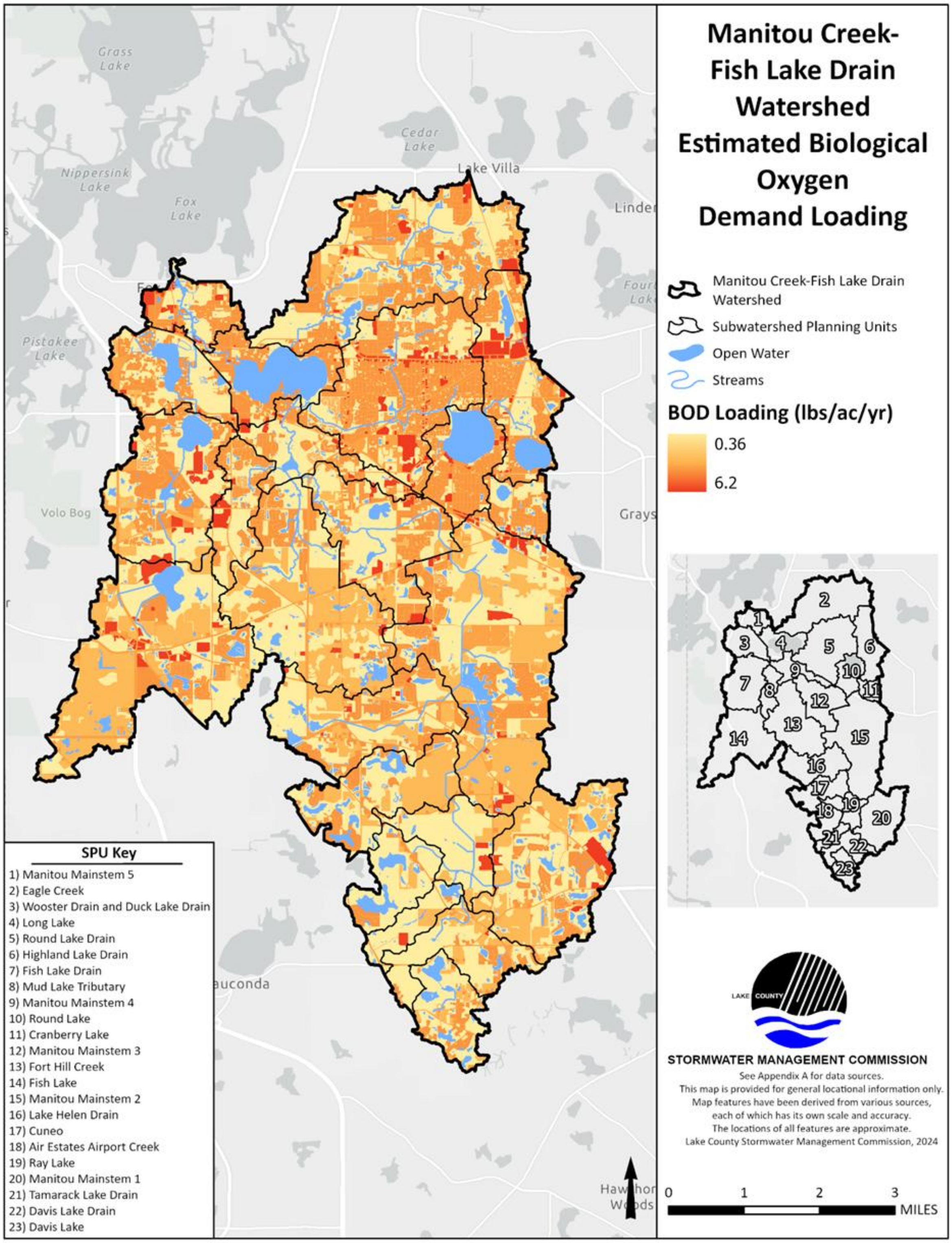

Figure 4-16: Estimated Annual Nonpoint Source Biological Oxygen Demand Loading

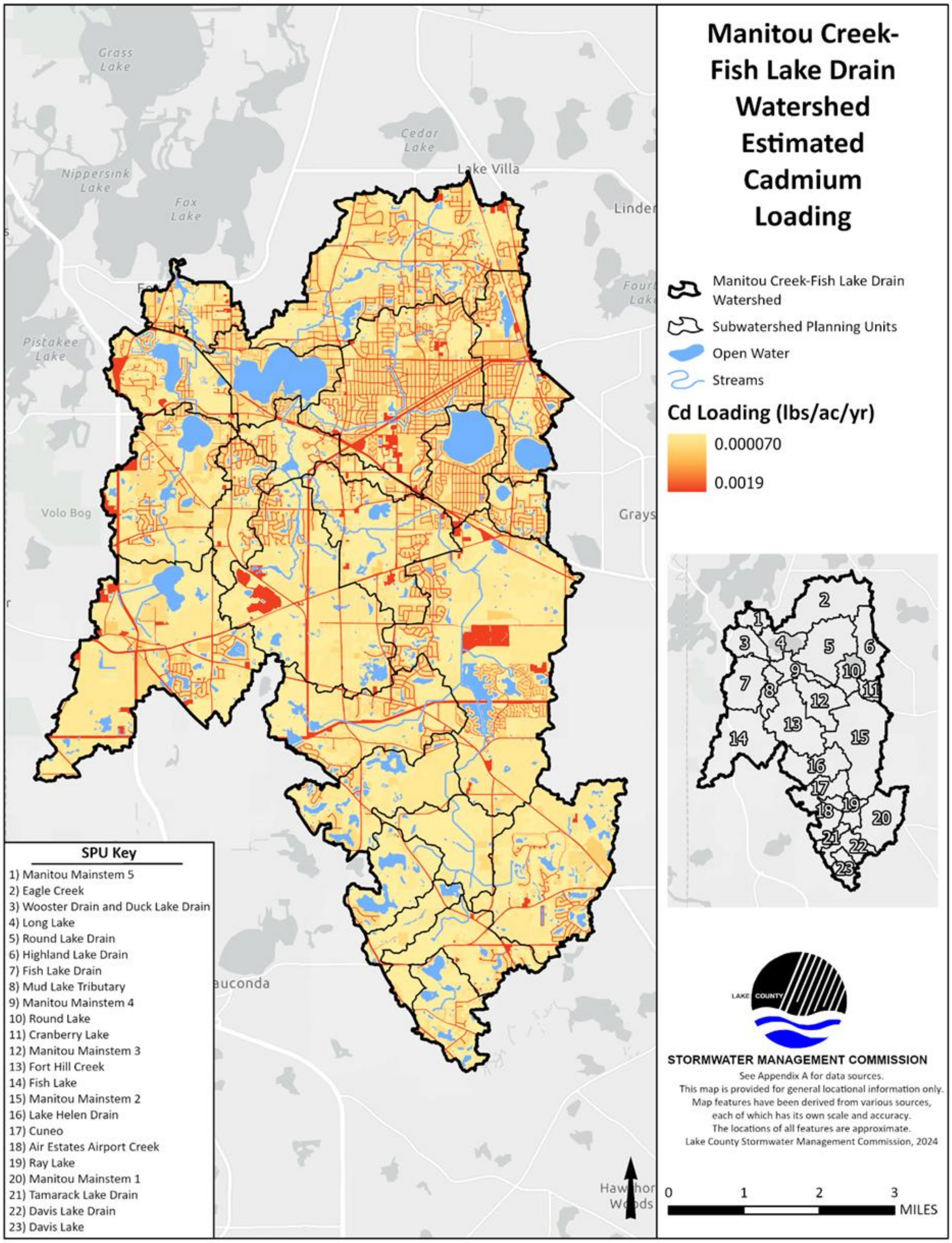

Figure 4-17: Estimated Annual Nonpoint Source Cadmium Loading

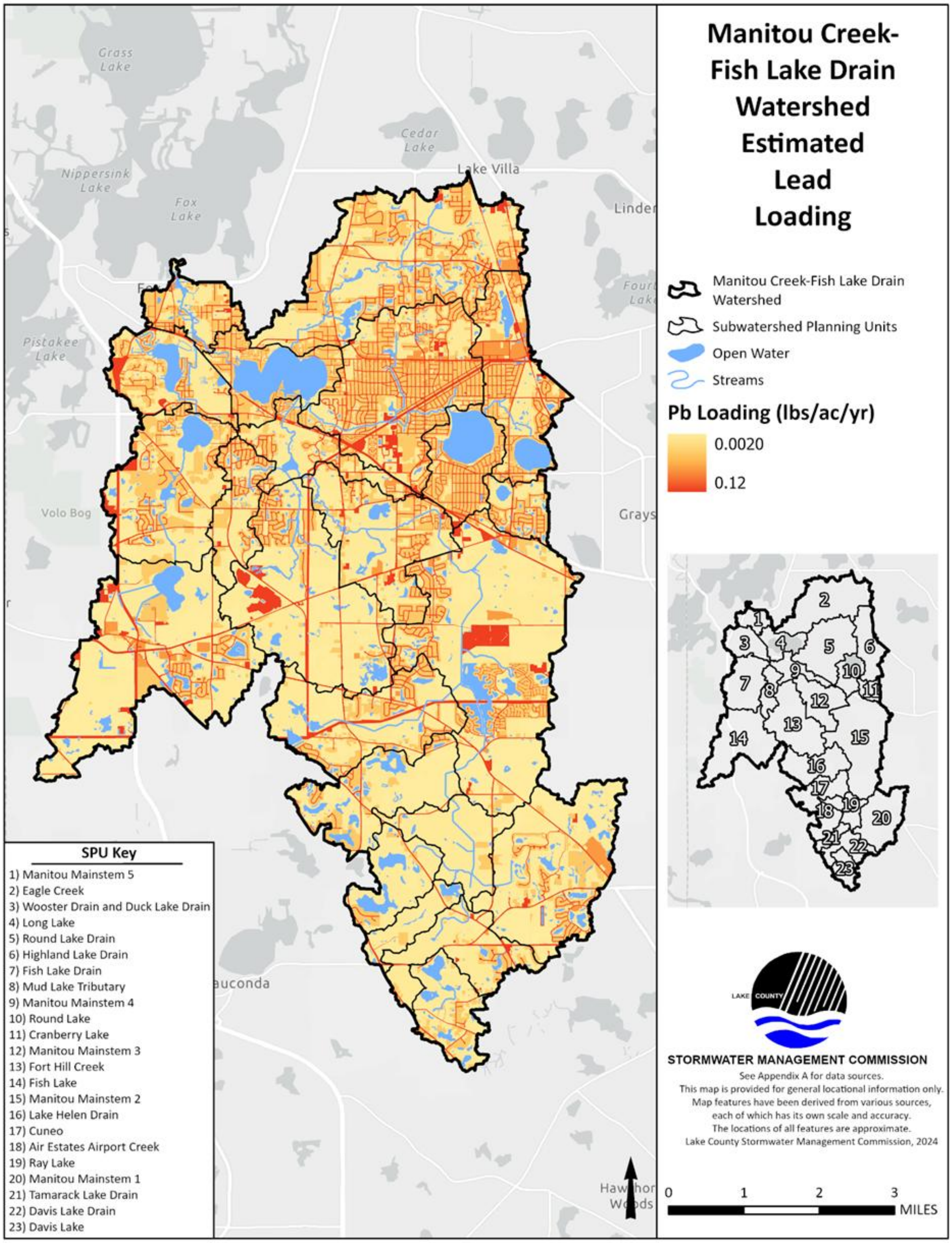

Figure 4-18: Estimated Annual Nonpoint Source Lead Loading

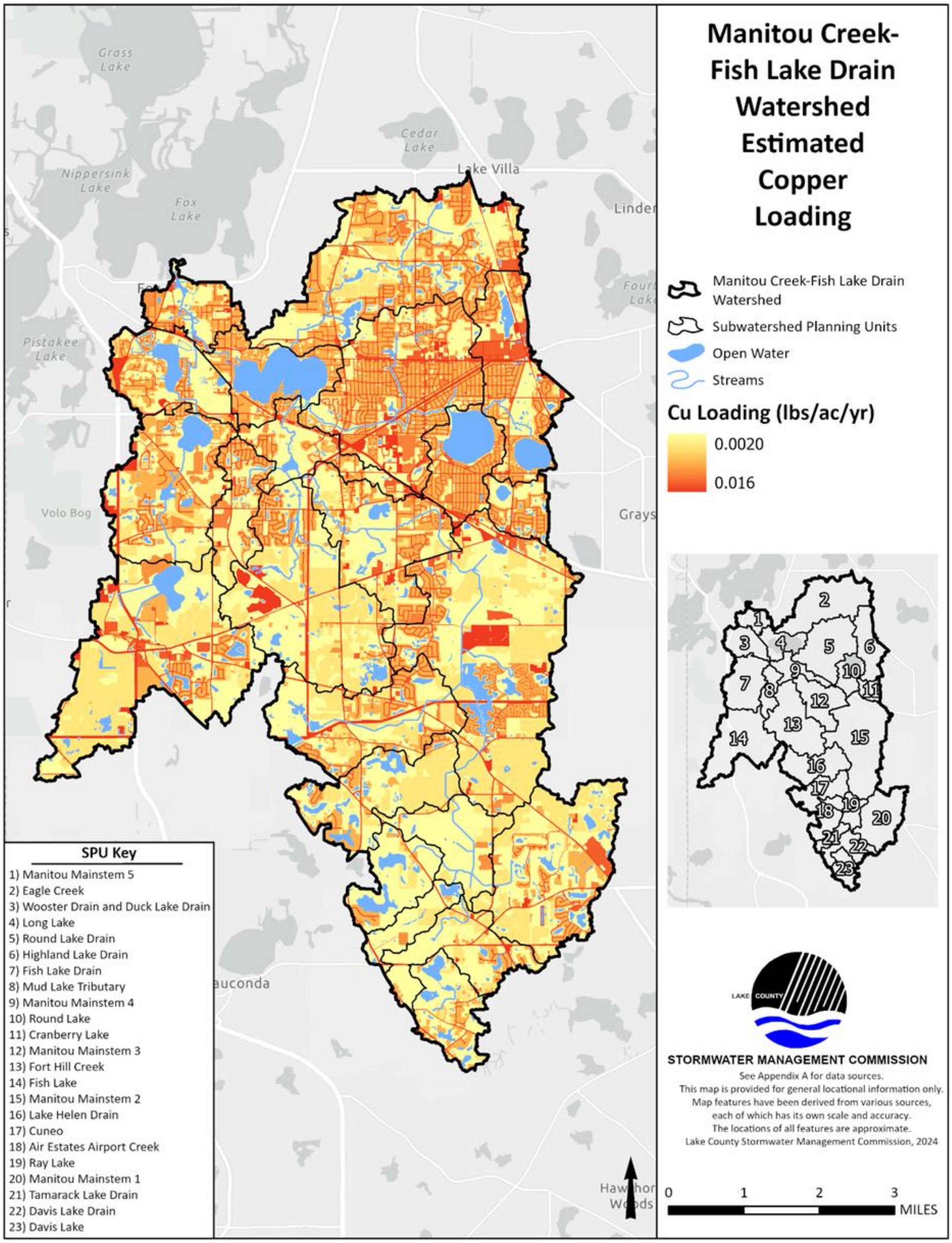

Figure 4-19: Estimated Annual Nonpoint Source Copper Loading

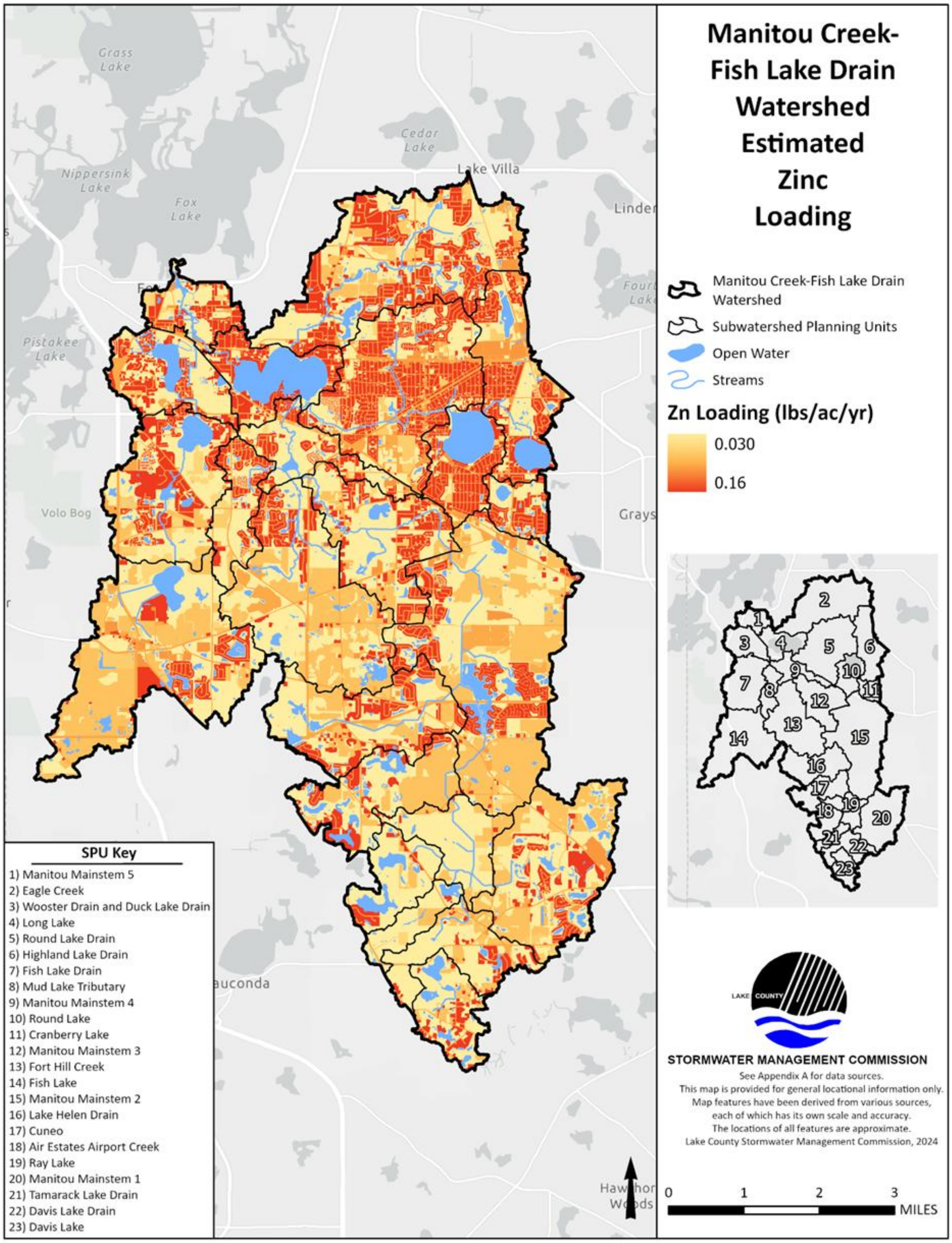

Figure 4-20: Estimated Annual Nonpoint Source Zinc Loading

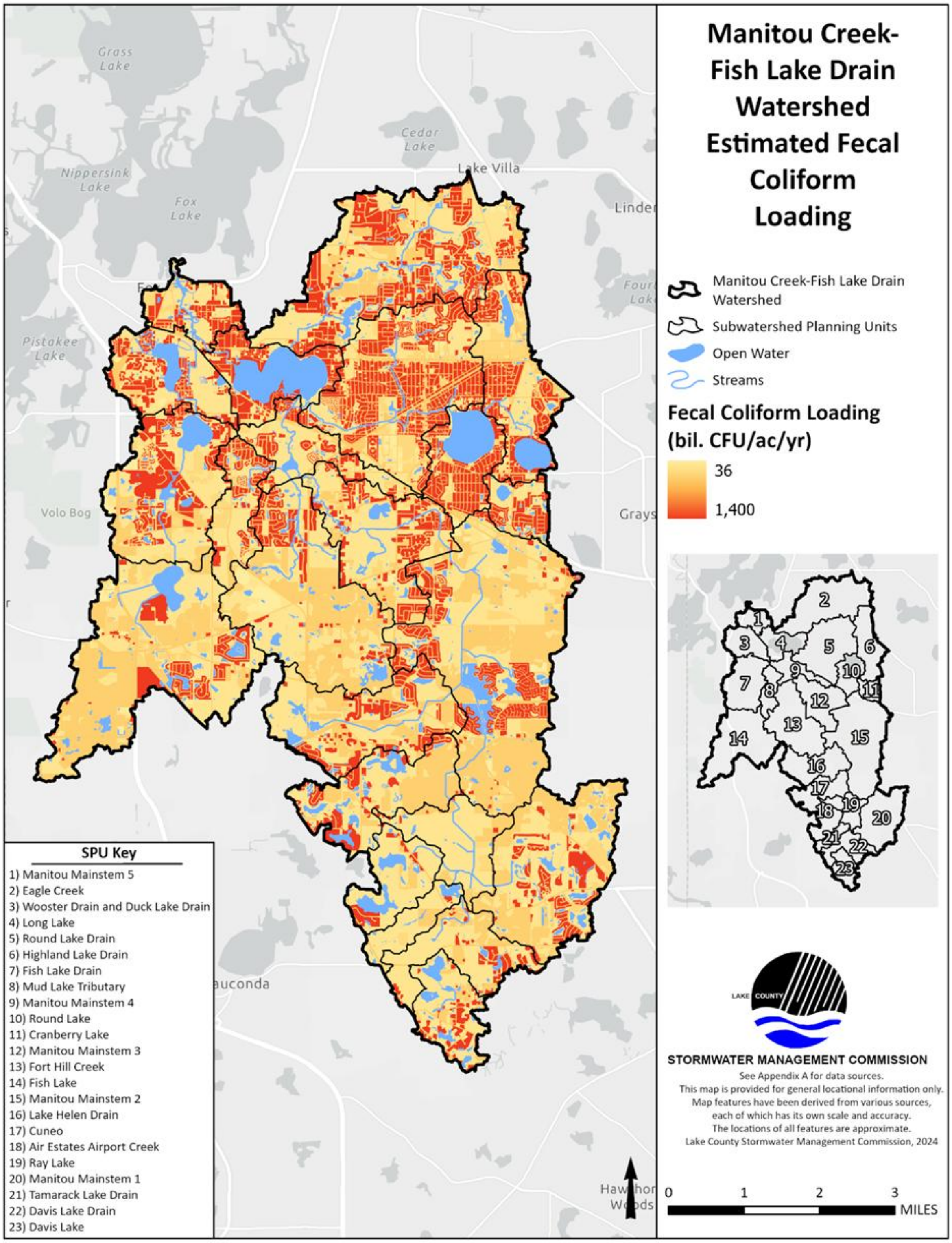

Figure 4-21: Estimated Annual Nonpoint Source Fecal Coliform Loading

Table 4-5: Annual Nonpoint Source Loading Estimates by SPU

Pollutant Load (lb/year)	Total Suspended Solids	Total Dissolved Solids	Total Phosphorus	Dissolved Phosphorus	Total Nitrogen	Total Kjeldahl Nitrogen	Chemical Oxygen Demand	Biological Oxygen Demand	Cadmium	Lead	Copper	Zinc	Fecal Coliform (Billion CFU)
Manitou Mainstem 5	29,816	94,256	77	24	413	283	12,427	1,420	0.3	20	4	47	315,340
Eagle Creek	158,921	475,228	408	128	2,417	1,527	61,253	6,451	1.2	91	18	243	1,699,277
Wooster Drain and Duck Lake Drain	42,301	179,933	134	39	623	473	19,290	1,849	0.4	32	6	75	500,200
Long Lake	36,887	176,555	130	35	564	463	18,652	1,718	0.3	25	5	72	471,678
Round Lake Drain	139,758	329,199	315	110	2,039	1,154	52,992	7,084	1.5	118	21	242	1,662,941
Highland Lake Drain	73,437	222,715	179	59	1,102	661	30,503	3,633	0.7	58	11	122	779,461
Fish Lake Drain	100,770	292,513	249	78	1,444	939	37,422	3,868	0.7	51	11	136	905,836
Mud Lake Tributary	40,798	129,685	91	25	487	400	16,632	1,462	0.3	26	6	59	327,497
Manitou Mainstem 4	32,168	132,996	97	28	451	344	14,510	1,428	0.3	24	4	53	347,811
Round Lake	39,056	130,251	110	34	591	396	16,939	1,936	0.4	30	6	73	495,040
Cranberry Lake	18,008	63,467	53	16	280	189	8,059	907	0.2	15	3	35	252,436
Manitou Mainstem 3	80,416	257,565	208	65	1,178	779	30,586	2,956	0.5	41	8	109	731,320
Fort Hill Creek	195,676	403,788	373	134	2,889	1,521	53,852	4,841	0.9	55	13	163	946,307
Fish Lake	269,308	471,020	468	176	4,014	1,979	71,150	6,856	1.0	67	17	213	1,233,812
Manitou Mainstem 2	315,745	588,162	573	211	4,693	2,375	86,167	8,393	1.4	92	22	271	1,629,548
Lake Helen Drain	102,885	266,494	232	77	1,541	900	33,696	3,203	0.6	42	9	117	773,940
Cuneo	93,547	197,815	188	65	1,445	776	27,088	2,406	0.3	20	6	87	564,239
Air Estates Airport Creek	23,130	154,712	96	23	320	338	12,223	613	0.1	8	2	30	181,936
Ray Lake	40,261	159,408	111	31	547	421	14,744	868	0.1	7	3	32	179,800
Manitou Mainstem 1	150,786	331,242	299	104	2,287	1,230	44,790	4,086	0.6	39	10	137	844,685
Tamarack Lake Drain	16,775	79,595	52	14	217	190	6,827	383	0.1	5	1	15	77,968
Davis Lake Drain	45,655	163,462	122	37	668	460	16,701	1,246	0.2	16	4	49	311,032
Davis Lake	31,025	133,446	97	27	463	356	13,096	963	0.2	12	3	41	267,875

Table 4-6: Annual Nonpoint Source Loading Rate by SPU

Pollutant Load (lb/acre/year)	Total Suspended Solids	Total Dissolved Solids	Total Phosphorus	Dissolved Phosphorus	Total Nitrogen	Total Kjeldahl Nitrogen	Chemical Oxygen Demand	Biological Oxygen Demand	Cadmium	Lead	Copper	Zinc	Fecal Coliform (Billions Colony Forming Units/Year)
Manitou Mainstem 5	53.84	170.20	0.14	0.04	0.75	0.51	22.44	2.56	0.0004	0.04	0.007	0.09	569
Eagle Creek	56.19	168.04	0.14	0.05	0.85	0.54	21.66	2.28	0.0004	0.03	0.006	0.09	601
Wooster Drain and Duck Lake Drain	44.39	188.80	0.14	0.04	0.65	0.50	20.24	1.94	0.0004	0.03	0.006	0.08	525
Long Lake	42.38	202.86	0.15	0.04	0.65	0.53	21.43	1.97	0.0003	0.03	0.006	0.08	542
Round Lake Drain	60.18	141.76	0.14	0.05	0.88	0.50	22.82	3.05	0.0007	0.05	0.009	0.10	716
Highland Lake Drain	56.20	170.43	0.14	0.05	0.84	0.51	23.34	2.78	0.0005	0.05	0.008	0.09	596
Fish Lake Drain	59.35	172.28	0.15	0.05	0.85	0.55	22.04	2.28	0.0004	0.03	0.006	0.08	534
Mud Lake Tributary	65.28	207.52	0.15	0.04	0.78	0.64	26.61	2.34	0.0004	0.04	0.009	0.10	524
Manitou Mainstem 4	45.65	188.75	0.14	0.04	0.64	0.49	20.59	2.03	0.0004	0.03	0.006	0.08	494
Round Lake	51.65	172.26	0.15	0.04	0.78	0.52	22.40	2.56	0.0005	0.04	0.007	0.10	655
Cranberry Lake	47.99	169.12	0.14	0.04	0.75	0.50	21.47	2.42	0.0005	0.04	0.007	0.09	673
Manitou Mainstem 3	55.79	178.69	0.14	0.04	0.82	0.54	21.22	2.05	0.0004	0.03	0.006	0.08	507
Fort Hill Creek	81.30	167.77	0.15	0.06	1.20	0.63	22.37	2.01	0.0004	0.02	0.005	0.07	393
Fish Lake	90.99	159.14	0.16	0.06	1.36	0.67	24.04	2.32	0.0004	0.02	0.006	0.07	417
Manitou Mainstem 2	85.86	159.94	0.16	0.06	1.28	0.65	23.43	2.28	0.0004	0.03	0.006	0.07	443
Lake Helen Drain	66.18	171.42	0.15	0.50	0.99	0.58	21.67	2.06	0.0004	0.03	0.006	0.08	498
Cuneo	79.47	168.05	0.16	0.06	1.23	0.66	23.01	2.04	0.0003	0.02	0.005	0.07	479
Air Estates Airport Creek	35.19	235.36	0.15	0.04	0.49	0.51	18.59	0.93	0.0002	0.01	0.003	0.05	277
Ray Lake	54.40	215.37	0.15	0.04	0.74	0.57	19.92	1.17	0.0002	0.01	0.003	0.04	243
Manitou Mainstem 1	78.39	172.21	0.16	0.05	1.19	0.64	23.29	2.12	0.0003	0.02	0.005	0.07	439
Tamarack Lake Drain	47.43	225.06	0.15	0.04	0.61	0.54	19.30	1.08	0.0002	0.01	0.004	0.04	220
Davis Lake Drain	55.24	197.78	0.15	0.04	0.81	0.56	20.21	1.51	0.0003	0.02	0.005	0.06	376
Davis Lake	47.85	205.81	0.15	0.04	0.71	0.55	20.20	1.49	0.0002	0.02	0.004	0.06	413

4.2.5.3 Sediment Source Analysis

The nonpoint source model does not directly account for sources of lakeshore, streambank, and gully erosion. These erosion estimates were made based on information gathered during stream and lakeshore inventories in 2022-2024. Data was collected in the field and remotely by SMC and a consultant. There may be other sources of erosion throughout the watershed, but the model only captured what was assessed and analyzed using spatial data. It is estimated that nonpoint sources load 1,039 tons/yr and lakeshore, streambank, and gully erosion load 677 tons/yr.

4.2.5.4 Streambank Erosion

Lakeshore, streambank, and gully erosion were estimated using lateral recession rate (LRR) and eroding bank height (EBH) data collected by SMC (Table 4-7). Pollutant load estimates were calculated using the Pollutant Load Estimation Tool model developed by USEPA Region 5 and Illinois EPA. It is estimated that at least 677 tons of sediment are delivered to waterways annually as the result of lakeshore, streambank, and gully erosion sources in the watershed. Areas of significant erosion were included in the site-specific action plan.

Table 4-7: Lakeshore, Streambank, and Gully Pollutant Loading Estimates

Subwatershed Planning Unit	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)	Total Sediment (Ton/yr)
Manitou Mainstem 5	11	4	8
Eagle Creek	71	27	52
Wooster Drain and Duck Lake Drain	70	27	51
Long Lake	6	2	4
Round Lake Drain	61	24	45
Highland Lake Drain	6	2	5
Fish Lake Drain	93	36	69
Mud Lake Tributary	11	4	8
Manitou Mainstem 4	8	3	6
Round Lake	1	0	0
Cranberry Lake	0	0	0
Manitou Mainstem 3	209	80	154
Fort Hill Creek	40	15	29
Fish Lake	25	10	18
Manitou Mainstem 2	171	66	125
Lake Helen Drain	14	5	10
Cuneo	17	7	13
Air Estates Airport Creek	7	3	5
Ray Lake	30	11	22
Manitou Mainstem 1	22	8	16
Tamarack Lake Drain	22	8	16
Davis Lake Drain	11	4	8
Davis Lake	16	6	12

4.2.5.5 Pollution Loading Hotspots

The 2020/2022 Illinois EPA 303(d) list did not assess any streams in the Manitou Creek-Fish Lake Drain but did assess 19 of 25 inland lakes in for beneficial uses and all have statutory impairments. Of these 19 assessed lakes, 10 lakes are listed as impaired for phosphorus, 12 for total suspended solids, and 1 for aquatic plants.

Section 303(d) requires the development of a TMDL for impaired waters. The Illinois EPA developed a total maximum daily load for phosphorus in the Upper Fox River/Chain O' Lakes watershed in 2020. A Total Maximum Daily Load for total suspended solids was not created for the Fox River/Chain O' Lakes TMDL.

Based on these listed impairments, for the purposes of this effort, pollution loading hotspots focus on phosphorus and total suspended solids. Since phosphorus sorbs to sediment particles, it is transported to waterways via suspended sediment. Therefore, hotspots were defined as the areas with the highest estimated annual total suspended solid load contributions. A summary of these hotspots is shown in Table 4-8 and Figure 4-22. Overall, 17% of the watershed consists of areas identified as pollutant loading hotspots.

Table 4-8: Hotspot Areas for Nonpoint Source Pollution Loading by SPU

SPU	Total Acreage Of SPU	Total Hotspot Acres Of Spu	% Of Total SPU	% Of Total Watershed
Manitou Mainstem 5	554	0	0%	0%
Eagle Creek	2,828	241	9%	0.8%
Wooster Drain and Duck Lake Drain	953	11	1%	0.04%
Long Lake	870	0	0%	0%
Round Lake Drain	2,322	0	0%	0%
Highland Lake Drain	1,307	20	2%	0.1%
Fish Lake Drain	1,698	156	9%	0.5%
Mud Lake Tributary	625	33	5%	0.1%
Manitou Mainstem 4	705	0	0%	0%
Round Lake	756	1	0.1%	0.003%
Cranberry Lake	375	0	0%	0%
Manitou Mainstem 3	1,441	141	10%	0.4%
Fort Hill Creek	2,407	775	32%	2.5%
Fish Lake	2,960	1,112	38%	3.5%
Manitou Mainstem 2	3,677	1,220	33%	3.9%
Lake Helen Drain	1,555	300	19%	1.0%
Cuneo	1,177	389	33%	1.2%
Air Estates Airport Creek	657	35	5%	0.1%
Ray Lake	740	132	18%	0.4%
Manitou Mainstem 1	1,924	583	30%	1.9%
Tamarack Lake Drain	354	42	12%	0.1%
Davis Lake Drain	827	134	16%	0.4%
Davis Lake	648	70	11%	0.2%

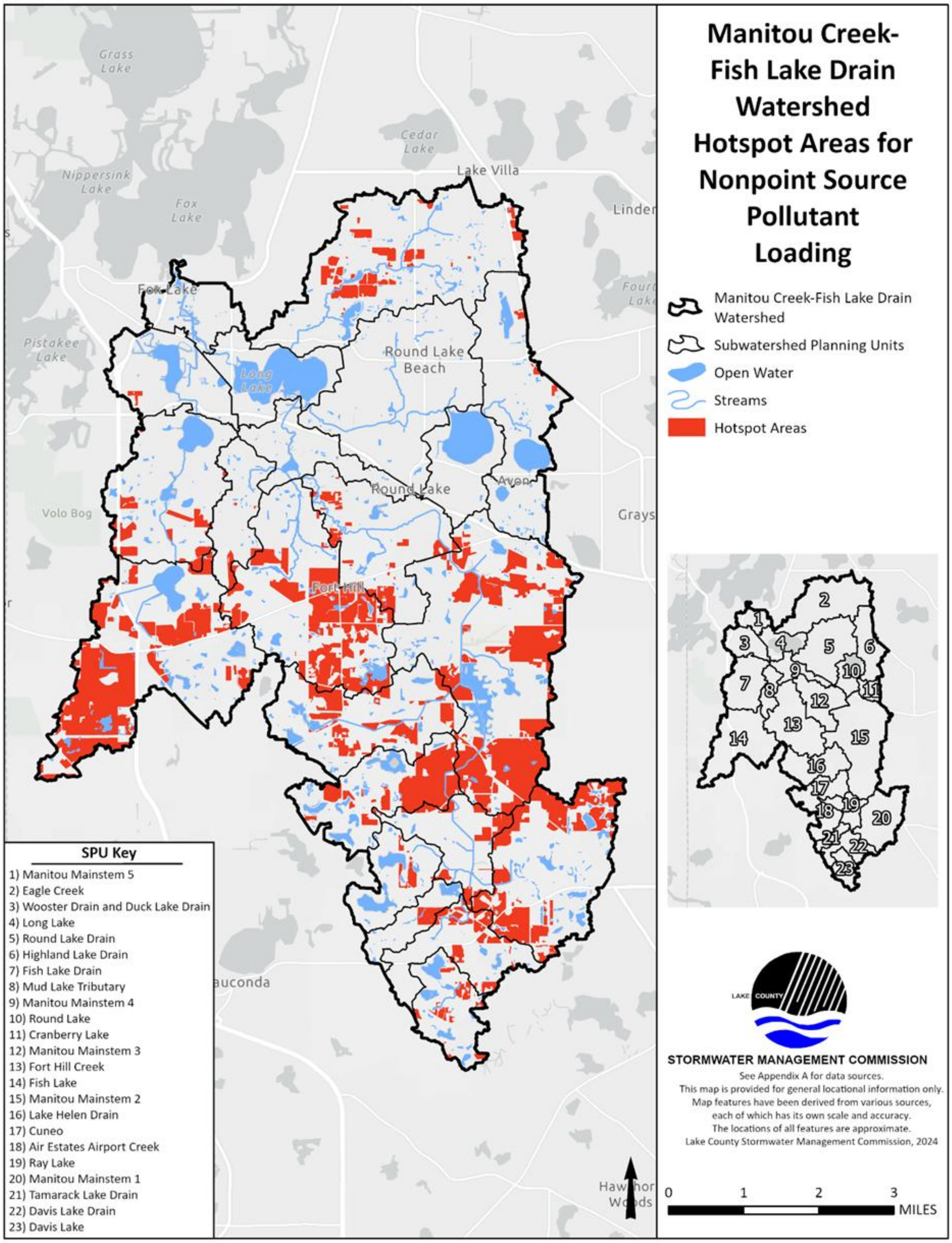

Figure 4-22: Hotspot Areas for Nonpoint Source Pollution Loading

4.2.6 Critical Areas Analysis

Critical areas are defined as areas in the watershed best suited to focus implementation efforts to help achieve the goals and objectives of the watershed-based plan. Critical areas represent areas that are likely to contribute to identified 303(d) list water quality impairments compared to other areas and present opportunities where project implementation would provide the greatest value and benefit. Critical areas are defined on a regional or linear basis, and generally meet one of 2 criteria:

1. Pollutant loading critical areas
2. Lakeshore or streambank erosion critical reaches

Many of the hotspots are areas in which future land use changes are either in progress or likely to occur in a manner that would reduce the annual total suspended solid load contributions. Planned restoration and enhancement efforts on Forest Preserve property will result in the conversion of agricultural lands to wetlands and planned development will result in the conversion of agricultural lands to residential and commercial uses. Both land use changes will decrease modeled total suspended solid load contributions.

Gullies identified during the pollutant loading modeling phase were not included in the critical area analysis, as nearly all the gullies are contained within the areas identified as high annual total suspended solid load contributions.

4.2.6.1 Pollutant Loading Critical Areas

Pollutant loading critical areas are the pollutant loading hotspot areas identified in Section 4.2.5.5, but do not include areas that are currently under land use change. Total suspended solids loading associated with these areas is assumed to be addressed as part of land use. These rank highly for total suspended solid load contributions, which is identified as causes of water quality impairment and serves as a proxy for phosphorus, also a cause of water quality impairment. These critical areas represent about 17% of the watershed acreage. Figure 4-23 shows the pollutant loading critical areas. Chapter 6 outlines recommended actions for the critical areas.

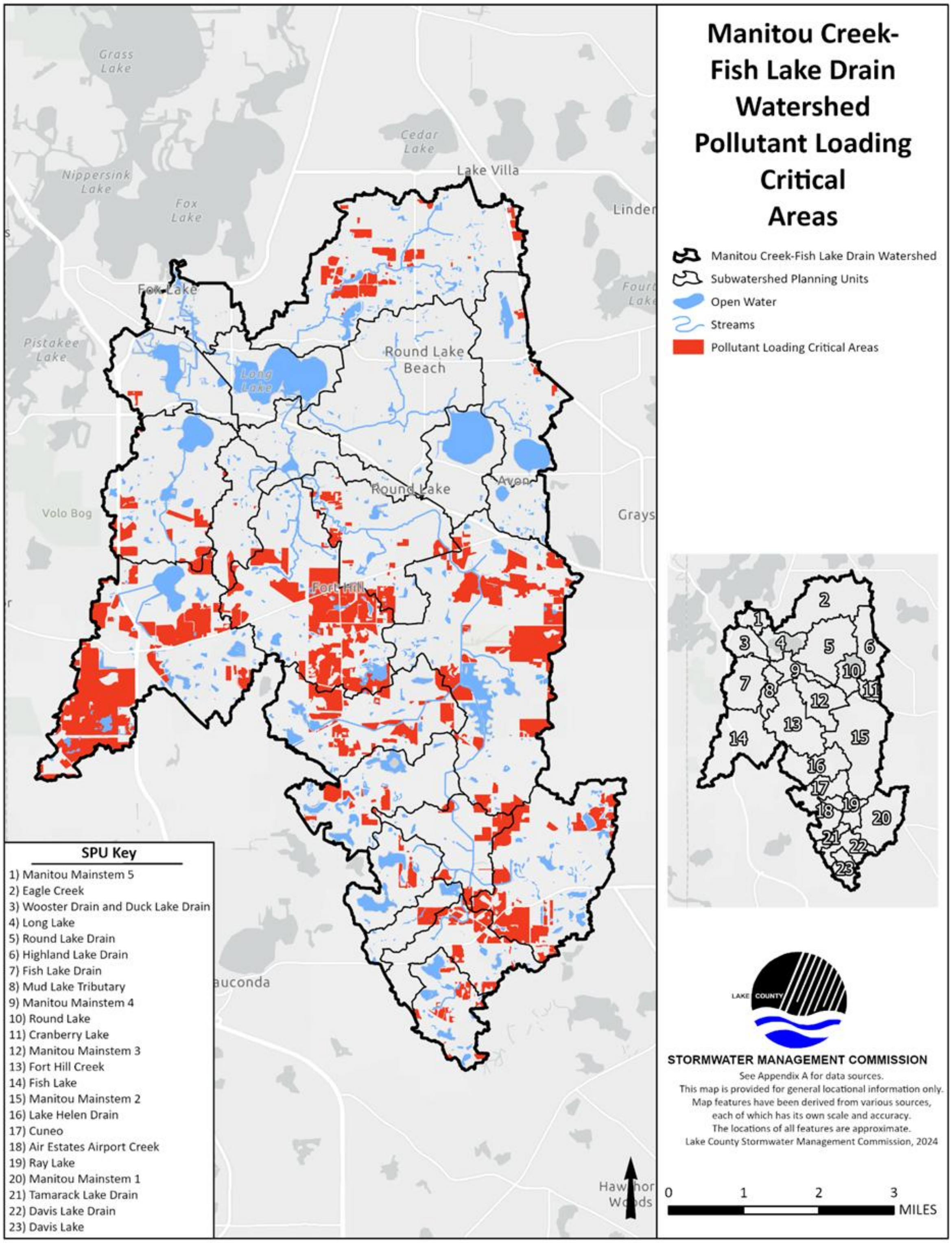

Figure 4-23: Pollutant Loading Critical Areas

4.2.6.2 Lakeshore and Streambank Erosion Critical Areas

Lakeshore and streambank erosion critical areas are banks exhibiting high rates of failure as well as those best suited for stabilization efforts to reduce sediment and nutrient loading. Streambank erosion was discussed previously in Chapter 3 and quantified in section 4.2.5.4. To define critical areas, reaches with moderate and high erosion rates were identified. Combined reaches representing contiguous erosional areas over 500 linear feet were identified as critical areas. This length was selected because it is the threshold for the US Army Corps of Engineers to issue a permit under Nationwide Permit 13 – Bank Stabilization. Bank treatment of more than 500 linear feet will likely require pursuit of an Individual Permit.

Gullies were omitted from this critical area quantification because they are assumed to be confined to agricultural areas, which were identified as pollutant loading critical areas.

A total of 21 miles of streambanks and shoreline were selected as critical areas, comprised of segments from seven streams or creeks, as well as from seven different lakes (Figure 4-24). These critical areas account for 19% of the total Manitou Creek-Fish Lake Drain watershed sediment load from streambank and lakeshore erosion (Tables 4-9 and 4-10). The highest loading occurs in the Manitou Mainstem 2 SPU, followed by Fish Lake Drain. The Fish Lake Drain SPU has the highest ratio of total sediment loading to total critical area length. The longest total length occurs in the Manitou Mainstem 2, followed by the Fish Lake Drain SPU.

Table 4-9: Streambank Erosion Critical Areas Sediment Loading by Subwatershed

Stream	Total Length by Stream Sides (Linear Ft)	Sediment Load By Stream (Ton/yr)
Manitou Creek	71,346	44
Fish Lake Drain	11,726	267

Table 4-10: Lakeshore Erosion Critical Areas Sediment Loading by Subwatershed Planning Unit

Subwatershed Planning Unit	Total Length by Shoreline (Linear Ft)	Sediment Load By Shoreline (Ton/yr)
Fish Lake Drain	7,636	56
Manitou Mainstem 1	2,280	7
Manitou Mainstem 2	12,544	79
Tamarack Lake Drain	5,333	16
Davis Lake	682	2

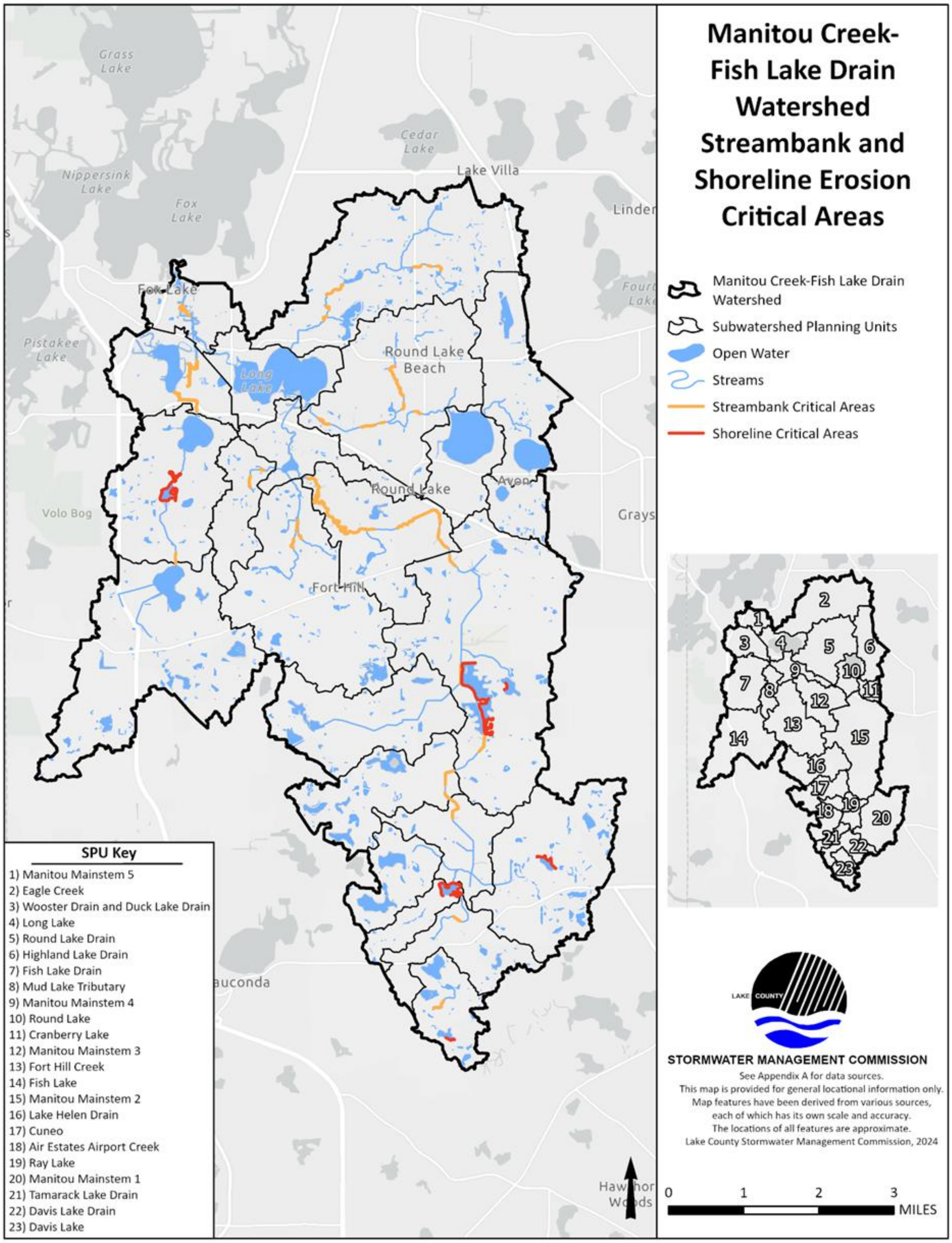

Figure 4-24: Streambank and Shoreline Erosion Critical Areas

4.3 WATERSHED JURISDICTIONAL COORDINATION

Watershed protection, which is a shared responsibility of multiple jurisdictions in the Manitou Creek-Fish Lake Drain watershed, may be problematic because the jurisdictions operate with different policies, practices, and regulations, that is, management practices and development requirements related to land and water resources may vary from place to place. Requirements for and application of BMPs also vary based on local policies, standards, requirements, and incentives. Coordination and consistency of watershed management efforts by the multiple authorities and jurisdictions could be improved.

While public policies and regulations can significantly influence the prevention of further watershed degradation, private efforts need to be combined with public initiatives to address current watershed issues, such as concentrated areas of flood damage, poor water quality and degraded stream conditions. Private landowners and homeowner groups should voluntarily incorporate BMPs in the landscapes they manage to resolve existing watershed problems and improve conditions. Education and outreach can substantially influence voluntary participation in watershed improvement activities and improve the general public's understanding of the need for jurisdictional projects and programs. For more information on education and outreach strategies and tools, see Chapter 8 Education and Outreach Strategy and Tools.

Because the Manitou Creek-Fish Lake Drain watershed comprises multiple jurisdictions, lack of coordination is a primary limitation in adopting consistent preventative practices. The ability to coordinate also presents challenges in completing BMP projects or instituting programs and policies that may provide broad watershed benefits. The following section describes watershed jurisdictional coordination roles and responsibilities.

4.3.1 Issues to be Addressed by Coordinated Jurisdictional Effort

The watershed planning process identified multiple issues that could be effectively addressed at the watershed level through a coordinated effort of watershed jurisdictions, with the support of private stakeholders. Table 4-11 includes a summary of the issues identified in the watershed planning process that would be best addressed through coordinated partnership efforts.

Table 4-11: Issues to be Addressed with Watershed-Level Coordination

Issue	Strategies to Address Issue	Potential Actions	Responsibility
Lack of Water Quality Data	Establish coordinated monitoring program	Watershed stakeholders collaborate on developing coordinated monitoring program	IDNR , SMC, LCHD-ES, USGS, ISGS, INHS, Municipalities, EIGs
	Participate in coordinated monitoring program	Each NPDES community/agency participates	Municipalities, Townships, County
	Determine if there are new or emerging pollutants of concern in the watershed (e.g., PAH, PFAS)	Identify and monitor subject pollutants within coordinated monitoring program	IDNR, SMC, LCHD-ES, USGS, ISGS, INHS, Municipalities, EIGs
Stormwater Runoff Volume	Enhanced runoff volume reduction standards in watershed	Review regulations and update as needed.	Municipalities, County, SMC
	Wetland mitigation in the watershed	Future potential watershed-specific policy.	SMC, USACE, Certified Communities

Issue	Strategies to Address Issue	Potential Actions	Responsibility
	Preserving/restoring landscape scale green infrastructure beneficial to reducing or mitigating runoff	Identify and implement potential restoration/preservation projects	Municipalities, County, LCFPD, Park Districts, EIGs
Water Quality Impairment	Utilization of coordinated monitoring program data	Implement targeted projects and programs based on data to reduce the number of water quality impairments	SMC, Municipalities, County, DOTs, Park Districts, LCFPD, IDNR
	Phosphorus ban	Adopt ban(s).	Municipalities, County
	Reduce sodium chloride application with alternative practices and chemicals	Form buying consortium to share equipment and reduce cost of alternative products.	Municipalities, County, Townships
	Calibrate salt application equipment	Document calibration	All applicators
	Consistent snow removal policies and application rates	Determine model policy and application rates as a base from which jurisdictions develop or modify individual policies.	Municipalities, County DOT, IDOT, Townships
	Coordinate geography-based plow routes among jurisdictions for efficiency and reduced travel, equipment and materials storage costs.	Optimize route efficiency recommendations and maintain coordinated effort/standards via Memorandum of Understanding.	County DOT, IDOT, Municipalities, Townships
	Applicator certification/ registration	State requirement. Phase in as a requirement via municipal ordinance, County Township.	Illinois EPA, IDOT, Municipalities, Townships, County DOT
Habitat Quality	Invasive species management in sensitive natural areas	Develop/continue funding and operation of invasive species strike team	Municipalities, County, Park Districts, LCFPD, IDNR, EIGs
Flood damage and Stormwater Infrastructure	Evaluating Stormwater Infrastructure	Clear, repair, or replace blocked, damaged, and failing stormwater infrastructure to maintain or improve conveyance.	SMC, Municipalities, Townships, County, IDOT, County DOT
	Flood Mitigation Projects	Utilizing local and regional partnerships to fund and implement flood mitigation projects such as buy-outs	SMC, Municipalities, Townships, County, IDNR, IEMA

4.3.2 Watershed Roles and Responsibilities

Watershed management in the Manitou Creek-Fish Lake Drain watershed is a shared responsibility of both public and private interests. Watershed protection provided by jurisdictional entities and private stakeholders comes in several forms: policy, regulation, planning, zoning, development and land management standards/incentives, education, outreach, and in-the-ground BMP projects.

Municipal and county governments share the greatest responsibility for watershed protection because they influence and oversee development impacts to the watershed through land use planning, land management and development policies, and regulatory oversight. Transportation infrastructure improvements are necessary to accommodate business and population growth. The operation, maintenance, and construction of roadways can substantially influence water resources. Roadways are constructed and maintained by multiple stakeholders including townships, municipalities, Lake County Division of Transportation, and the Illinois Department of Transportation.

Other agencies and private entities with jurisdictional or potential coordination roles include the Illinois Department of Natural Resources, the Lake County Forest Preserve District, park districts, and University of Illinois (U of I) Extension Service. The forest preserves and park districts provide important recreation opportunities and protect natural resources such as rare or high-quality habitat and threatened or endangered species. They protect and manage land that often contains wetlands, lakes, ponds, and streams. Soil and water conservation districts provide technical resource assistance to the public and other regulatory agencies including soil erosion and sediment control inspections. The U of I Extension Service may provide technical assistance and educational outreach programs to watershed stakeholders.

4.3.2.1 Watershed Development

Development practices that affect water resources (rivers, streams, lakes, isolated wetlands, and floodplains) are largely regulated by the Watershed Development Ordinance in Lake County, along with county and municipal ordinances and land use plans. In addition to local regulations, the United States Army Corps of Engineers regulates discharge of “fill” material into Waters of the United States (including adjacent and connected wetlands), and the Illinois Department of Natural Resources has floodplain/floodway regulatory and oversight authority. The Illinois Department of Transportation designs and constructs roadways in the Manitou Creek-Fish Lake Drain watershed. State and federal projects are not required to meet local regulatory requirements but are governed by state and federal policies and regulations.

The Watershed Development Ordinance is administered and enforced by the Lake County Stormwater Management Commission or a Certified Community. A community can be fully certified with authority to review and enforce both the standard stormwater and the isolated wetland provisions of the Watershed Development Ordinance, or partially certified with delegation to review and enforce one aspect of the ordinance (either the standard or isolated wetland provisions). The Lake County Stormwater Management Commission retains certain review authorities for all communities, primarily for several specific floodplain and floodway provisions of the Watershed Development Ordinance. Development practices within unincorporated areas are guided by the Lake County Framework Plan and must meet the requirements of the Unified Development Ordinance. The County Board oversees decisions made by county departments and, therefore, can affect policies and regulations for unincorporated Lake County. Authority for local land use planning and development regulation within municipalities (incorporated areas) within Lake County rests with the municipality and its municipal codes and regulations. For all development in Lake County, municipalities must meet the minimum standards set forth by the Watershed Development Ordinance (many municipalities are certified to administer Watershed Development Ordinance standards). The Illinois Department of Natural Resources has floodplain/floodway regulatory and oversight authority. The Illinois Department of Natural Resources has delegated floodplain/floodway review authority for Lake County to the Lake County Stormwater Management Commission.

4.3.2.2 In-the-Ground Watershed Projects

In-the-ground projects to manage and improve conditions of water resources are encouraged and incentivized when local units of government throughout the county adopt a watershed management plan. Plan adoption should be followed by close coordination and development of funding mechanisms, timelines, and shared responsibilities for implementing the projects prioritized by watershed planning efforts. Implementation of projects identified within the watershed-based plan requires partnerships between stakeholder groups, including homeowner associations, nonprofit organizations, businesses, schools, and community agencies, who must coordinate, fundraise, secure grants, and oversee project implementation. The experience and success that partnerships often gain from working together on a watershed project can improve regulatory efficiency and increase cooperation among policymakers.

The watershed action plan (Chapter 6 and **Appendix A**) identifies lead and support roles for multiple units of government to assist private landowners and watershed groups. Specific types of aid that governments can provide to private landowners can include Best Management Practice project cost-share funding or technical assistance, particularly for studies or plans. Private entities as partners can also provide cost-share for design, consulting, and construction work for projects, and in-kind Best Management Practice services, such as seeding, planting, restoration work, trail construction, and interpretive education. Watershed projects benefit from partnerships that share design, permitting, material, and labor costs. Public/private partnerships are also important for securing state or federal funding for in-the-ground projects. Projects with shared costs and benefits often result in more successful project outcomes because of the relationships built among partners who share a vested interest in the success of their projects. Partnership on a first project may establish an institutional relationship that results in implementing projects in the future.

4.3.2.3 Post-Construction Monitoring and Maintenance

Opportunities should also be identified for establishing partnerships to improve the effectiveness and efficiency of monitoring and maintenance. Partnerships could share responsibility for stream monitoring and maintenance, stormwater monitoring, road and parking lot deicing, detention basin monitoring and maintenance, and invasive plant management. Additionally, partnerships may be established to share technical expertise; develop maintenance guidelines or standards; share services, equipment, or storage locations; or combine contracts with neighboring jurisdictions for similar activities, such as winter road maintenance and invasive plant management.

Information on work responsibilities for each organization/jurisdiction should be available online to all watershed partners and residents to increase transparency and information availability. Interjurisdictional coordination may entail doing business in a new or different way; however, it results in watershed goals being achieved in a more efficient, effective, and sustainable manner.

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

COMMON ACRONYMS/ABBREVIATIONS USED IN CHAPTER 5

ANHMP - All-Natural Hazards Mitigation Plan

BFE – Base Flood Elevation

DMA 2000 - Disaster Mitigation Act of 2000

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

FIS – Flood Insurance Study

FPA – Flood Problem Area

FPAI – Flood Problem Areas Inventory

GIS – Geographic Information System

HMPC - Hazard Mitigation Planning Committee

Illinois EPA – Illinois Environmental Protection Agency

LiDAR - Light Detection and Ranging

LOMR – Letter of Map Revision

NFIP – National Flood Insurance Program

RVR – Runoff Volume Reduction

SFHA – Special Flood Hazard Areas

SMC – Lake County Stormwater Management Commission

USACE – United States Army Corps of Engineers

WDO - Lake County Watershed Development Ordinance

WRAPP – Wetland Restoration and Preservation Plan

5 FLOOD PROBLEM ASSESSMENT

Floodplains and floodways along stream corridors perform a variety of benefits. Some of these benefits include aesthetic value, flood storage, water quality, and habitat. The capacity of the floodplain to hold water during runoff events to minimize flood damage is of primary interest for this discussion. Upland areas outside of floodplains and floodways can experience urban or depressional flooding, which is common in older sections of communities where older storm sewers may not be designed to present-day standards (modern stormwater and floodplain regulations). Urbanization has increased runoff and climate is trending to more frequent and intense storm events (IDNR, 2015; Angel et al., 2020). The historical increase in stormwater runoff, in combination with areas with inadequate and poorly maintained stormwater infrastructure, lead to flash flooding in these urbanized areas.

5.1 FLOOD EVENTS

Flooding is a problem many Manitou Creek – Fish Lake Drain watershed residents have experienced, whether at home, in their yard, in their neighborhood, at work, or on area roadways. As the Lake County Stormwater Management Commission (SMC) compiled the Manitou Creek – Fish Lake Drain Watershed-Based plan, more information was needed about when and where flooding that impacts residents in the watershed occurs. As part of the watershed planning process, SMC identified structures in the watershed that are at risk of flooding so that the watershed plan can include targeted solutions to reduce flood damage in a cost-effective manner. Throughout the watershed, overbank riverine flooding largely occurs where structures and infrastructure are located within floodplains. Due to their relatively small size these streams have no gage record. In cases where gages have been installed, the record is typically short, and therefore it is difficult to assess the relative magnitudes of historic flood events. The description of floods below was obtained primarily through hydrologic atlases, flood hazard mitigation plans and reports, and archived contemporaneous media accounts.

5.1.1 1930s

The July 1938 flood was one of the first notable floods that was recorded in numerous northeastern Illinois watersheds. The flood resulted from as much as 7 inches of rain falling between the evening of June 30 and July 2. This flood was thought to have resulted in about $1 million worth of property damages across Lake County. Flooding occurred throughout the watershed including Eagle Creek, Manitou Creek, Long Lake, Fish Lake, and Fish Lake Drain (upstream of Molider Rd.) (Noehre et al., 1966; Allen, 1966). Flooding likely occurred throughout the watershed; however, data on the extent of this flood is limited (Allen, 1966). The 1938 flood was reported to be the highest since at least 1900 (Noehre et al., 1966).

5.1.2 1960s

The floods of April 1960 resulted from snowmelt followed by heavy rains. Flooding was widespread in northeastern Illinois and record flood crests occurred on the Fox and Des Plaines Rivers. Flooding occurred at Manitou Creek, Duck Lake, Long Lake, Wooster Lake, and Fish Lake Drain (downstream of Molidor Rd.) (Allen, 1966; May et al., 1967; Noehre et al., 1965). While the 1960 flood set records at the time in other parts of northeastern Illinois, it did not surpass the floods 1938 in Manitou Creek (May et al., 1967). The 1960 flood spurred the first floodplain mapping effort in northeastern Illinois, undertaken by the Northeastern Illinois Planning Commission (now Chicago Metropolitan Agency for Planning). A flooding event occurred on Manitou Creek and Long Lake in March 1962 (May et al., 1967; Noehre et al., 1965). Another flood event occurred in April 1965 on Manitou and Eagle Creek (May et al., 1967; Noehre et al., 1966).

5.1.3 1986

The 1986 flood influenced how stormwater management is addressed in Northeastern Illinois. The flood event was triggered by widespread regional rainfall with varying intensity and duration which had been preceded by two weeks of nearly continuous rain falling across northern regions of the Des Plaines River, North Branch of the Chicago River and Fox River watersheds. As a result, flooding occurred in rivers and streams across Lake, McHenry, and northern Cook County (Juhl, n.d.). Northeastern Illinois received almost one inch of rain daily from September 21 through October 4; on some days, as much as three inches of rain fell. A federal disaster declaration was declared by President Ronald Reagan for the region.

The storms of October 2-3, 1986, and August 13-14, 1987, in Illinois, though of contrasting types, both caused record floods and stream discharges. The 1986 floods were scattered throughout northeastern Illinois and were most severe in Lake and Cook Counties in Illinois. The floods of 1987 were localized and confined to the Des Plaines River basin. Flood damages were extensive, leaving many residents and motoring public stranded and without access to services. The 1986 and 1987 floods generated enough public awareness of the continued problems of drainage and flooding for the Illinois General Assembly to pass legislation authorizing the formation of countywide stormwater management programs. Such programs, in conjunction with state and federal programs, are providing stormwater management planning, watershed planning, regulation of construction within floodplain areas, and new sources of funding to manage local drainage and flooding problems.

5.1.4 2008

In 2008, multiple storm events associated with the remnants of Hurricane Ike led to 51 consecutive hours of precipitation in Northeastern Illinois. The largest rainfall accumulations occurred south of Lake County but resulted in a disaster declaration for Lake and other surrounding counties for these storms and flooding.

5.1.5 2013

In 2013, a massive rainstorm on April 17-18, 2013 delivered between 4-7 inches of rainfall to Northern Illinois (NOAA National Weather Service, 2014). The late snow melt and heavy rains in early April combined with the two-day rain event on April 17-18th, 2013 resulted in extended, widespread riverine flooding in the Fox and nearby watersheds and flash flooding and urban flooding in the Manitou Creek – Fish Lake Drain watershed including overwhelmed storm sewers, sanitary sewer backups, localized flooding, and road closures. In response to widespread flooding and severe storms, a presidential disaster declaration was made for the State of Illinois. This declaration made federal disaster assistance available for individuals and public assistance. In Lake County, 1,159 individuals and/or households received upwards of $2.7 million in federal disaster assistance.

5.1.6 2017

Figure 5-1: Roadway Flooding in Fox Lake, July 2017.

Torrential rounds of heavy rain began late on the night of July 11th, 2017 and continued into the morning of July 12th 2017. Multiple rounds of rain continued over the same locations produced 3-7 inches of rain which brought flash flooding by daybreak and continued throughout the entire day and into the next night (Figure 5-1). Flooding occurred, and at times very rapidly, affecting flood-prone areas as well as locations that had not experienced this type of flooding before. The heavy rain overwhelmed stormwater infrastructure and led to widespread flooding. Major roads were closed and hundreds of homes and properties reported flooding, more than a third of which were reports of basement flooding, including sewer backup. Outside the watershed, record crests were recorded for the Des Plaines and North Branch Chicago Rivers at multiple stream gage locations. Three Illinois counties including Lake County were proclaimed disaster areas by Governor Bruce Rauner, however federal assistance for a major disaster declaration was denied because the total amount of flood damages did not meet the state threshold for federal assistance.

5.1.7 2018-2020

Several intense rainfall events since July 2017 (e.g., May 2018, June 2018, September 2019) have also resulted in urban flooding of streets and basements and flash flooding of urban streams.

5.1.8 June 2015 Illinois Urban Flooding Awareness Act Final Report

In August 2014, the Illinois General Assembly through PA98-0858 tasked the Illinois Department of Natural Resources to prepare a report on the extent, cost, prevalence, and policies related to urban flooding (Illinois Urban Flooding Awareness Act, 2015). In addition, Illinois Department of Natural Resources was tasked to identify resources and technology that may lead to mitigating the impacts of urban flooding. Flooding in urban areas has received increasing attention in the last decade, with at least $2.319 billion in documented damages between 2007 and 2014, of which $1.240 billion were private claims that typically represent basement flooding and sewer backup (Illinois Urban Flooding Awareness Act, 2015). The Urban Flooding Awareness Act requires the Federal Emergency Management Agency (FEMA) to direct a study to quantify these facts and develop recommendations to assist federal, state, and local governments in their efforts to prevent and provide relief from urban flooding to homeowners and businesses across the country. The Urban Flooding Awareness Act specifically identifies the following nine topics to be addressed in the report:

1. Prevalence and costs associated with urban flooding events across the state and the trends in frequency and severity over the past two decades.
2. Apparent impact of global climate change on urban flooding.

3. The impact of county stormwater programs on urban flooding over the past two decades, including a list of projects and programs and the flood damages avoided.
4. An evaluation of policies such as using the 100-year storm as the standard for designing urban stormwater detention infrastructure and the 10-year storm for the design of stormwater conveyance systems.
5. Review of technology to evaluate the risk of property damage from urban flooding and whether a property is in or adjacent to a 1% (100-year) floodplain or not, including Ligh Detection and Ranging (LiDAR) and Geographic Information System (GIS).
6. Strategies for minimizing damage to property from urban flooding, with a focus on rapid, low-cost approaches such as nonstructural and natural infrastructure, and methods for financing them.
7. The consistency of the criteria for state funding of flood control projects between Illinois Department of Natural Resources, Illinois Emergency Management Agency, and Illinois Department of Commerce and Economic Opportunity.
8. Strategies for increasing participation in the National Flood Insurance Program and Community Rating System.
9. Strategies and practices to increase the availability, affordability, and effectiveness of flood insurance and basement backup insurance.

5.1.9 Summary of Flooding History

The flooding history of the watershed points to a few important trends. Riverine flooding associated with floodplains along waterways is a major cause of flooding, particularly in the lower reaches of the watershed near the Fox River Chain O' Lakes and along the Round Lake Drain. Flooding is also problematic in the many depressional floodplains in the watershed. Flood problems in depressional areas may be exacerbated by inadequately sized or lack of infrastructure, or failure of farm tile systems that comprise the primary drainage system for these areas. Both urban development in the watershed and rainfall intensity have increased during the past several decades. As a result, urban flooding in areas not associated with riverine floodplains has also become more common.

Flood Problem Area (FPA): One or more structures in a geographical area that are damaged by the same primary source or cause of flooding. Structures include transportation, utility infrastructure, buildings, and well and septic failure caused by flooding. Areas also include locations where road flooding results in damage to infrastructure, loss of critical access, or threatens safety.

SMC conducted the countywide **Flood Problem Areas** Inventory (FPAI) in 1995-1996 and updated it in 2002. The FPAI, and a flood risk assessment based on mapped floodplains, identified structures that have been or may be damaged by flood events that are less than the 100-year event. The flood problem area inventory is used to locate flood damage problem areas based on reports of flood damage by residents or communities. The inventory identifies the primary cause of flood damage for each area and is used to recommend flood mitigation priorities. The flood risk assessment identifies additional locations where structures occur in mapped floodplain areas and are likely at risk of flood damage. The purpose was to identify those structures that are at risk of flooding so that the plan can recommend ways to reduce flood damage.

As part of the watershed planning process, SMC updated the inventory of local flood problem areas to identify the sources of flooding, improve opportunities for reducing flood damage, aid decision-makers about determining adequate downstream capacity when issuing development permits in proximity to flood problem areas, and reduce flood damage at existing sites from nearby development projects. In 2023, SMC contacted the watershed municipalities, townships, and large jurisdictions and invited them to revise the current flood problem area map and information for their jurisdiction with updated or new flood problem information. The flood problem area inventory information was collected and summarized throughout 2024; six jurisdictions responded to this inventory update with updated and new information.

Before starting the Manitou Creek-Fish Lake Drain watershed planning process, 75 flood problem areas were identified in the watershed. As a result of this FPAI update, SMC added eight new flood problem areas to the inventory. Currently, there are 83 known flood problem areas in the Manitou Creek-Fish Lake Drain watershed (Figure 5-2); this number does not include data collected from the July 2017 flood event. Because the flood problem area inventory includes many areas affected by storms less than the 100-year event, the July 2017 flood event data is excluded given the larger magnitude of that particular storm.

5.1.9.1 July 2017 Flood Event FPAs

From July 11-12, 2017 a major precipitation event resulted in rainfall amounts between 3.4 - 7.2 inches in Lake and Cook Counties causing substantial flooding. SMC, Lake County Planning Building and Development, and local municipalities surveyed impacted areas to identify FPAs, impacted properties, and impacted critical facilities using data from resident self-reporting and the Illinois Emergency Management Agency. SMC defined FPAs as areas that experienced flooding during the event. FPAs varied in size, with some impacting one property and others impacting over 100 properties (countywide). Critical facilities are areas that may require a special response because of human needs or potential environmental impacts, including daycares, schools, gas stations, nursing homes, long term care facilities, and similar facilities. SMC identified 131 FPAs that impacted 1,182 properties within the Manitou Creek-Fish Lake Drain Watershed (Figure 5-2). The FPAs identified for the July 2017 flood event overlapped with approximately 53 existing FPAs in the watershed.

During the survey, structure damage from flooding and multiple forms of flooding were observed, including sewer backups; street, yard, and driveway flooding; and structure flooding. Table 5-1 summarizes the number of FPAs and impacted properties for each type of flooding. This flood impacted multiple municipalities within the Manitou-Fish Lake Drain watershed, with the Village of Round Lake Beach having the largest number (Table 5-2). From this event, the Illinois Emergency Management Agency received over 3,500 flood damage assessment form entries, and an estimated 9,553 structures were adversely affected by the storm events in Lake County, Illinois.

5.1.9.2 Four Corners Basin Flood Problem Area

The Four Corners Basin is a somewhat unique type of flood problem area in Lake County. The basin is mainly located in a triangular area bounded by Illinois Routes 120 and 60 and Cedar Lake Road and includes the point at which the boundaries of Avon, Fremont, Grant, and Wauconda Townships touch, from which the "Four Corners" name is derived (Figure 5-3). The basin is a natural topographic depression encompassing approximately 1,000 acres and is believed to be the largest depressional area in Lake County drained solely by farm tiles. In recent years, storm sewer systems have been installed to augment the tile drainage system. Water ponding in the basin would reach a depth of approximately 10 feet before reaching the natural overland flow route out of the depression. Flood problems in the basin are caused by the occasional failure of drain tiles and more recently, obstructions in storm sewers. The resultant flooding affects several homes and several major roads. In 2007, SMC determined that the basin lacked “adequate downstream stormwater capacity” to receive additional runoff from new development and requested that new developments in this area direct or divert additional runoff away from the basin. While several improvements have been made to the drainage system in recent years, obstructions and tile failures still occur and occasionally result in flooding in the basin.

Table 5-1: July 2017 FPAs

Type of Flooding	Number of July 2017 FPAs	Number of Impacted Properties
Sewer Backup	3	3
Street/Yard/Driveway Flooding	22	22
Structure Flooding	102	1,152
Structural Damage from Flooding	4	5
Total	**131**	**1,182**

Table 5-2: July 2017 FPAs by Municipality

Municipality	Number of July 2017 FPAs	Number of Impacted Properties
Avon Township	6	10
Fremont Township	3	4
Grant Township	30	200
Lake Villa Township	7	17
Wauconda Township	0	0
Village of Fox Lake	7	25
Village of Grayslake	8	150
Village of Hainesville	3	10
Village of Hawthorn Woods	0	0
Village of Island Lake	0	0
Village of Lake Villa	11	25
Village of Lakemoor	0	0
Village of Mundelein	0	0
Village of Round Lake	25	38
Village of Round Lake Beach	20	558
Village of Round Lake Heights	4	12
Village of Round Lake Park	7	133
Village of Volo	0	0
Village of Wauconda	0	0
Total	**131**	**1,182**

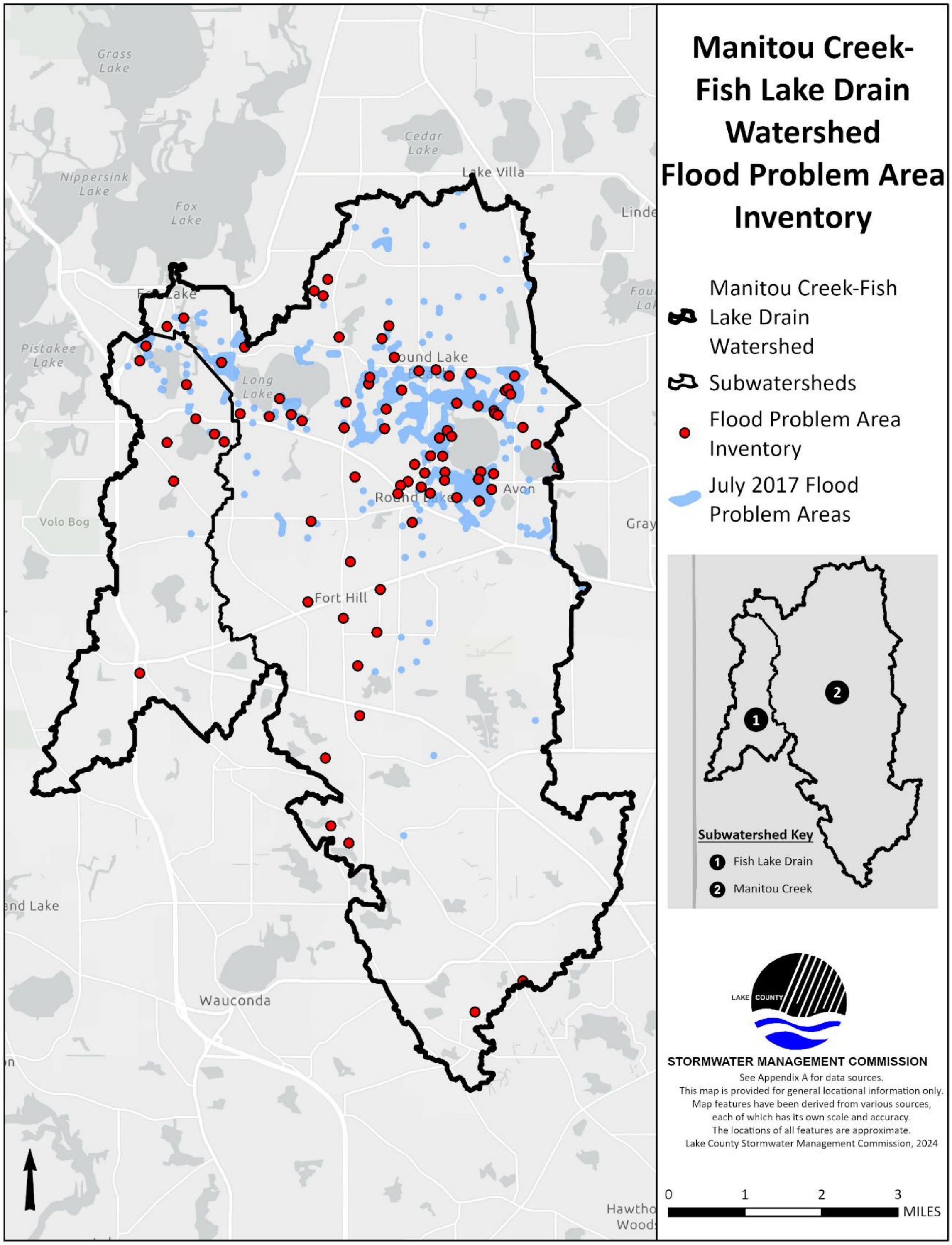

Figure 5-2: Flood Problem Areas

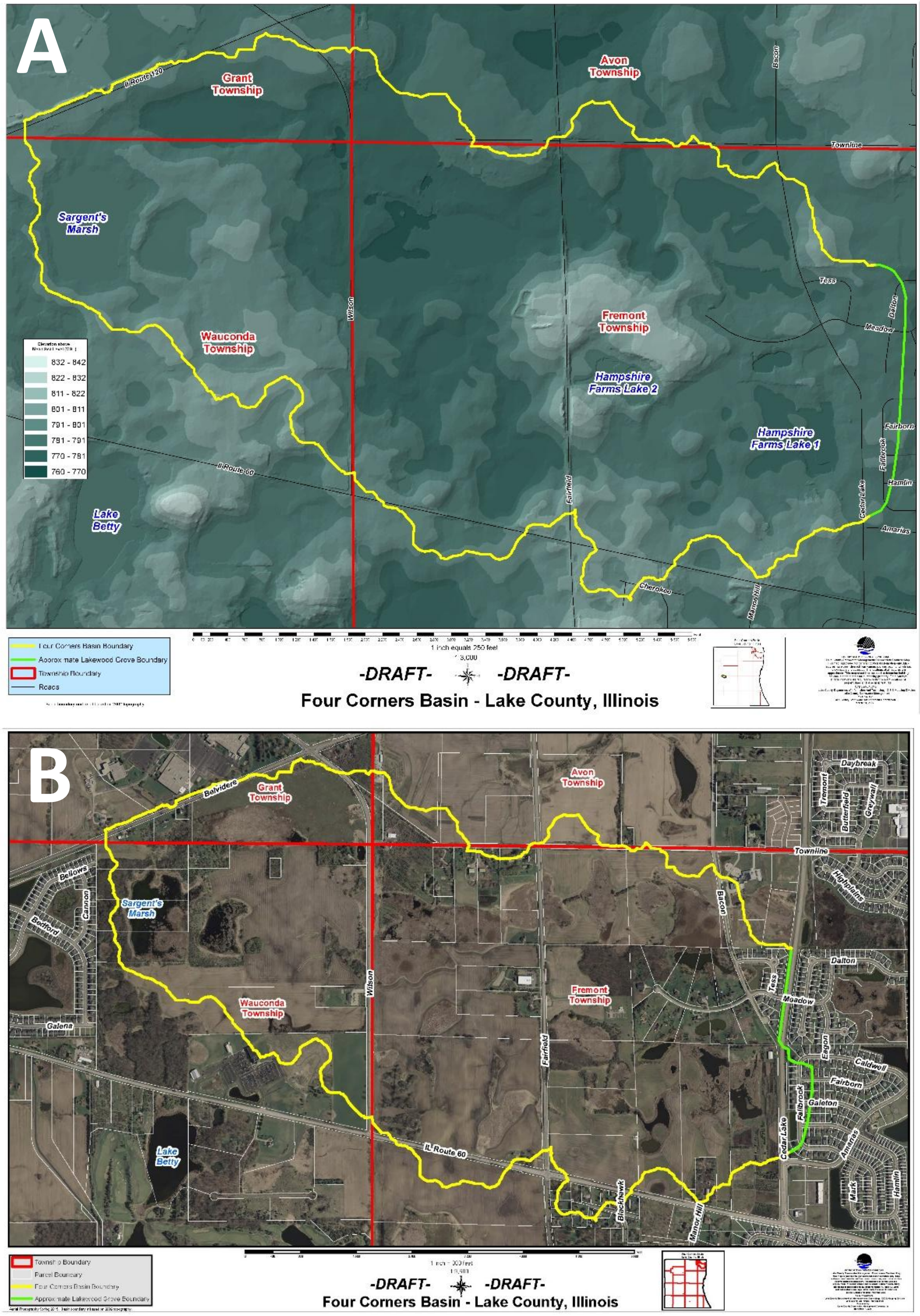

Figure 5-3: Four Corners Basin Flood Problem Area A. Digital Elevation Model. B. Aerial Imagery

5.2 FLOOD RISK ASSESSMENT – STRUCTURES IN THE FLOODPLAIN

Flood risk areas are Special Flood Hazard Areas (SFHA) where structures have been identified as being at risk for flood damage because they are located in the 1% annual chance floodplain. SMC compared the FEMA Flood Insurance Rate Maps (FIRM) with Nearmap machine learning planimetric data to locate structures in the SFHA. All structures greater than 500 square feet within the mapped Special Flood Hazard Areas are shown in Figure 5-4. Many of the identified structures are in or near potential FPAs. It should also be noted that structures within the mapped SFHA may have an associated letter of map revision (LOMR), which substantiates that a structure is protected from the 1% annual chance flood. 1,002 structures (municipal buildings; businesses; and residences, including garages, sheds, and boathouses), are mapped in the SFHA. There are 943 tax parcels associated with the structures mapped in the SFHA. The lower number of individual parcels compared to structures suggests that some of the structures mapped in the SFHA are accessory buildings such as garages and sheds.

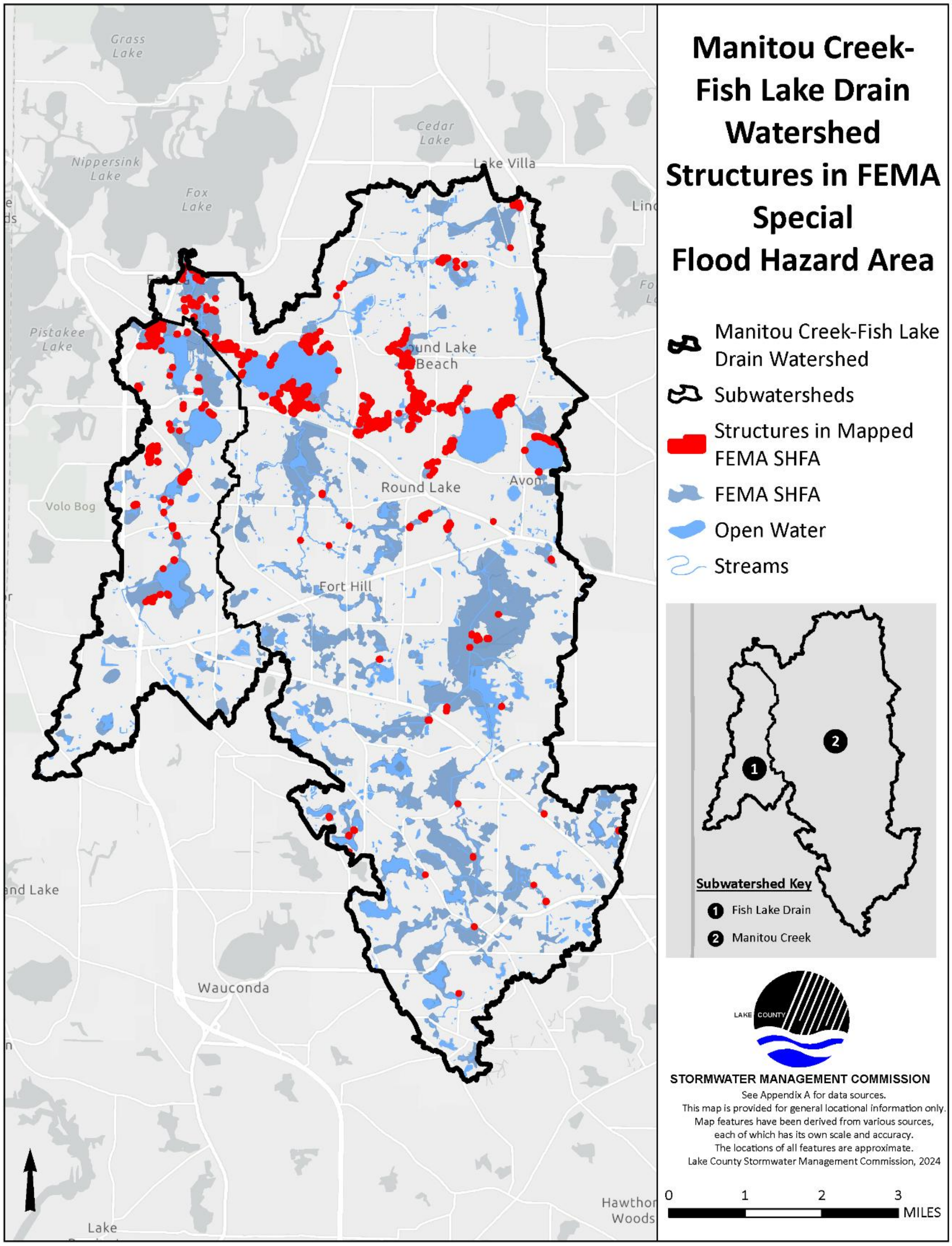

Figure 5-4: Structures in the FEMA Special Flood Hazard Area

5.3 FLOODPLAIN STUDY SUMMARY

Hydrologists assign statistical probabilities to different size floods to characterize common, less likely, and severe floods for individual streams. For example, a 2-year flood event has a 50% probability of occurring in any year, and a 100-year flood has a 1% chance of being equaled or exceeded in any year. The 1% annual chance flood event ("100-year flood"), also referred to as the "base flood," is the standard used by the National Flood Insurance Program to determine the need for flood insurance. The 1% annual chance flood has become the accepted national standard for floodplain regulatory purposes and was developed in part to guide floodplain development that lessens the damaging effects of floods. The 1% annual chance floodplain may also include a designated floodway. The floodway is the portion of the stream or river channel that must be reserved to discharge the base flood without increasing the water surface elevation more than 0.1-foot. A graphic representation of a typical floodplain and floodway is shown in Figure 5-5.

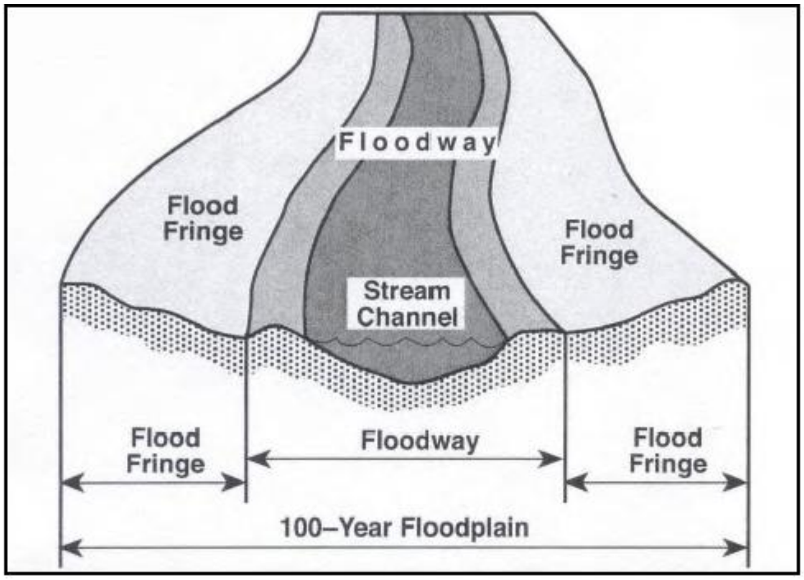

Figure 5-5: Graphical Representation of the Typical Floodplain and Floodway

FEMA has conducted **Flood Insurance Studies** (FIS) that assess a watershed's **hydrology**, land use, and drainage characteristics to identify areas that have the highest probability of flooding. FIS are used to produce **Flood Insurance Rate Maps**. These maps depict the probable extent of flooding during a 1% annual chance ("100-year") flood. These areas are collectively termed Special Flood Hazard Areas (SFHAs) and are divided into different zones depending on the type of hazard as well as the level of study and modeling employed to map the area. The FIRM are used to determine flood insurance requirements and calculate insurance costs. The maps are also used in concert with local, state, and federal ordinances to regulate development and building protection requirements within and adjacent to floodplain areas. The Manitou Creek-Fish Lake Drain watershed covers 31,359 acres, of which 6,762 acres are mapped within the SFHA. Figure 5-6 reflects the regulatory floodplain boundary based on the effective FIRMs.

FLOOD INSURANCE STUDY (FIS): Studies conducted by FEMA to determine areas that have the highest probability for flooding.

HYDROLOGY: Hydrology is the study of the occurrence, circulation, distribution, and properties (e.g., quality) of Earth's water.

HYDRAULICS: Hydraulics is the study of how water flows over the land surface. This includes flows within sewers, culverts, stream channels, wetlands, lakes, impoundments, etc.

FLOOD INSURANCE RATE MAP (FIRM): A map prepared by FEMA that depicts the SFHA within a community. The FIRM includes zones for the 100-year and 500-year floodplains and may or may not depict Regulatory Floodways.

BASE FLOOD ELEVATION (BFE): The elevation of surface water resulting from the flood having a one percent (1%) probability of being equaled or exceeded in any given year.

Floodplain studies have been completed for several areas in the watershed, dating to the late 1970s. Table 5-3 is an excerpt of data published as part of the current FIS for Lake County. This table summarizes the methods, and age of floodplain studies in the Manitou Creek-Fish Lake Drain watershed.

Floodplain studies of sufficient detail to produce base flood elevations (BFE) have been used to map SFHAs. There are approximately 32.7 miles of streams in the Manitou Creek-Fish Lake Drain watershed which have been studied in sufficient detail to develop BFEs mapped on effective or preliminary FEMA FIRMs. Additional portions of the watershed are mapped as Zone A and Zone AE ponding flood hazard areas and lack BFE determinations. Numerous Letters of Map Revision exist in these areas as well and may provide additional data on localized flood elevations.

Table 5-3: Floodplain Studies

Floodplain Study	Hydrologic Model or Method	Hydraulic Model or Method	Date Analyses Completed	Flood Zones on Firm
Air Estates Airport Creek	HEC-1; Bulletin 70	HEC-RAS	07/01/2013	AE w/Floodway
Davis Lake Drain	HEC-1; Bulletin 70	HEC-RAS	07/01/2013	AE w/Floodway
Eagle Creek	TR-20	WSP-2	09/01/1979	AE w/Floodway
East Branch of Eagle Creek	TR-20	WSP-2	09/01/1979	AE w/Floodway
Fort Hill Creek	HEC-1; Bulletin 70	HEC-RAS	07/01/2013	AE w/Floodway
Kestrel Ridge Tributary	HEC-1; Bulletin 70	HEC-RAS	07/01/2013	AE
Lake Helen Drain	HEC-1; Bulletin 70	HEC-RAS	07/01/2013	AE w/Floodway
Manitou Creek (Upstream end of Long Lake)	HEC-1; Bulletin 70	HEC-RAS	07/01/2013	AE w/Floodway
Manitou Creek (Confluence with Fox Lake)	TR-20	USGS E431	06/01/1977	AE w/Floodway
Manitou Creek (~785 ft upstream of Rollins Rd.)	TR-20	WSP-2	11/01/1979	AE w/Floodway
Manitou Creek (Zone AE ponding areas)	HEC-1; Bulletin 70	N/A	07/01/2013	AE
Manitou Creek (Zone A ponding areas)	HEC-1; Bulletin 70	N/A	07/01/2013	A
Mud Lake Tributary	HEC-1; Bulletin 70	HEC-RAS	07/01/2013	AE w/Floodway
North Branch Eagle Creek	TR-20	WSP-2	9/1/1979	AE w/Floodway
Rays Lake Drain	HEC-1; Bulletin 70	HEC-RAS	07/01/2013	AE
Round Lake	TR-20	Normal Depth Analysis	05/01/1978	AE w/Floodway
Round Lake Drain (mouth of Long Lake)	TR-20	WSP-2	11/01/1979	AE w/Floodway
Round Lake Drain (~3,650 ft above mouth of Long Lake)	TR-20	WSP-2	05/01/1978	AE w/Floodway
Round Lake Drain Tributary	TR-20	WSP-2	05/01/1978	AE w/Floodway
Round Lake Marsh South	HEC-1; Bulletin 70	HEC-RAS	07/01/2013	AE
Saddlebrook Farms Drain	HEC-1; Bulletin 70	HEC-RAS	07/01/2013	AE
Tamarack Lake Drain	HEC-1; Bulletin 70	HEC-RAS	07/01/2013	AE w/Floodway

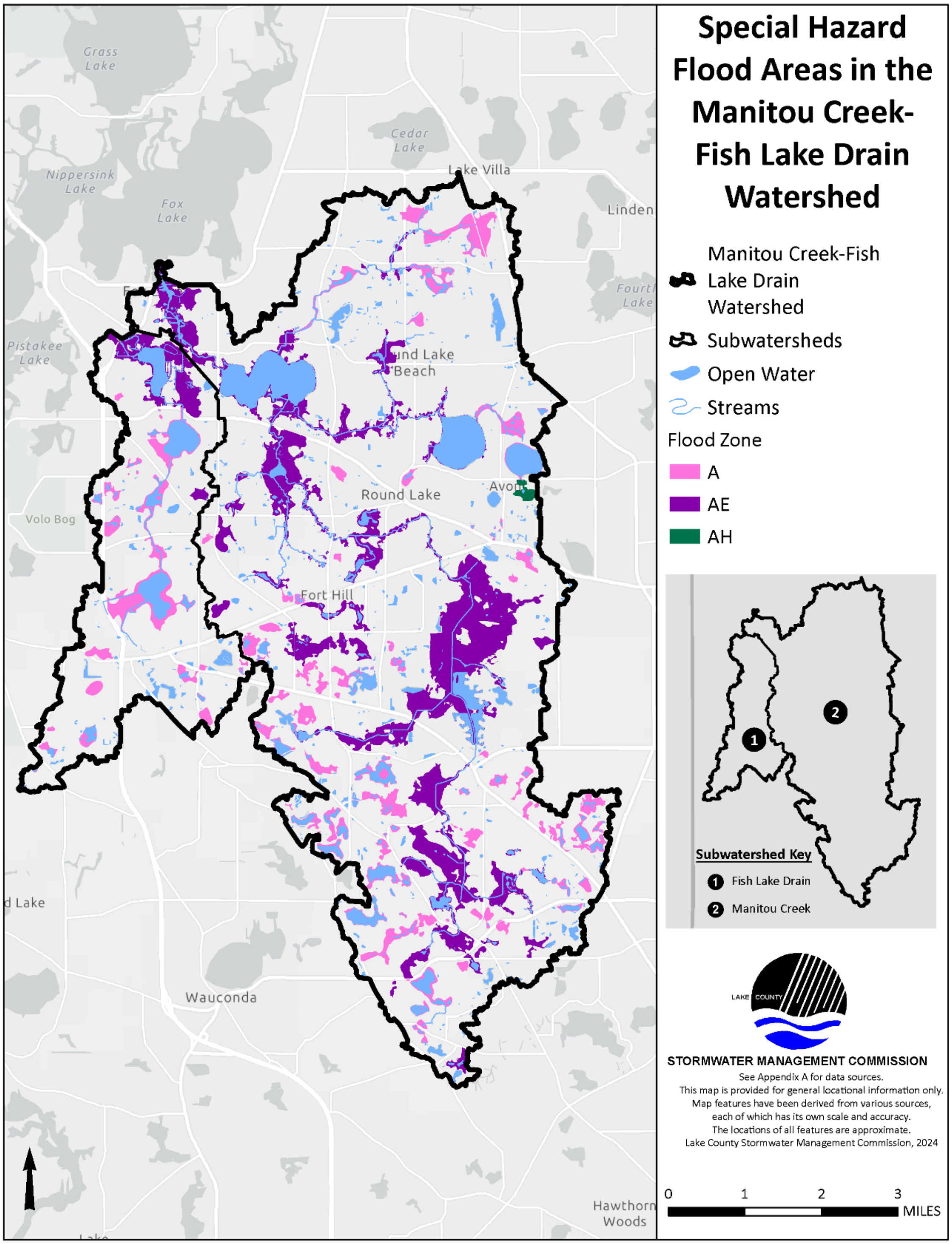

Figure 5-6: Special Flood Hazard Area Types and Boundaries

5.4 FLOOD DAMAGE REDUCTION

Flooding is an issue in the Manitou Creek-Fish Lake Drain watershed because of urban development and topographic depressional areas. Urban development has increased impervious surfaces and modified or built in natural storage and floodplain areas, resulting in increased stormwater runoff volumes and rates. Protection of the existing flood storage capacity of the landscape, including depressional areas, wetlands, and floodplains, is necessary to prevent increased flood risks in the region. Flood damage reduction is necessary to reduce the extent, frequency, and impact of flooding where development has already occurred. Flood damage reduction can be accomplished utilizing preventative or remedial measures.

5.4.1 Preventative Measures

Flood prevention techniques, including zoning, regulation, land acquisition, and runoff reduction, seek to prevent flooding problems before they occur. Zoning and floodplain regulations seek to prevent flood damages by limiting development in areas where flooding is most likely to occur. Land acquisition maintains open space, preserving rainfall infiltration and natural storage areas. Runoff reduction techniques reduce flood damage potential at the source by decreasing the amount of runoff from a developed site. This is accomplished by reducing on-site drainage, minimizing impervious surfaces, and implementing natural drainage measures.

5.4.1.1 Floodplain Zoning

Zoning ordinances regulate development by dividing the community into zones or districts and setting development criteria for each district. Zoning can prevent increased flood risks by controlling where new development or redevelopment occur. Zoning ordinances can establish separate zoning districts or overlay zoning. Separate districts designate floodplains as a special zoning districts that only allow development that is not susceptible to flood damage, such as some recreational uses, conservation, or agriculture. Overlay zoning adds special development limitations to the underlying zoning (i.e., residential, commercial, industrial, etc.) in areas subject to flooding. Special development limitations can include local, state or federal building requirements related to flood safety and can restrict the types of development occurring in overlay zoning districts or require additional permitting or oversight in these districts.

5.4.1.2 Floodplain Regulations

Regulations that restrict construction in floodplains are usually found in one or more of the following documents: subdivision ordinances, building codes, and separate stand-alone floodplain ordinances such as the Lake County Watershed Development Ordinance (WDO). If the zoning for a site allows a structure to be built, then the applicable subdivision and building regulations impose construction standards to protect buildings from flood damage and will require compensatory storage to prevent the development from aggravating the flooding problem. Subdivision ordinances specifically govern how land will be subdivided into lots and regulate standards for infrastructure provided by the developer, including roads, sidewalks, utilities, stormwater detention, storm sewers, and drainage ways. Both building codes and the countywide and local ordinances establish flood protection standards for all structures. Individual communities can adopt floodplain regulations that are more restrictive than the minimum WDO or National Flood Insurance program (NFIP) requirements.

All development in Lake County floodplains requires a WDO permit. The WDO restricts development in mapped floodways and limits development in the 100-year floodplain. Lowest floor elevations (including basements) must be a minimum of 2 feet above the BFE for residential structures constructed in the floodplain. Nonresidential structures must also meet these lowest floor elevation requirements or be dry-flood-proofed to two feet above the BFE, and compensatory storage must be provided for water storage lost due to floodplain fill at a ratio of 1.2:1 for riverine floodplain and 1:1 for depressional floodplain (SMC, 2020).

All local floodplain ordinances must meet the minimum requirements of the NFIP. Floodplain ordinances are adopted at the local level in the same manner as any other ordinance. Enforcement of the floodplain regulations is the responsibility of local officials. For most communities, the responsible official is the Zoning Administrator. Every community that participates in the NFIP must have the FIRMs and FIS available for the public. Communities that do not adequately enforce the local floodplain ordinance can be penalized by FEMA through probation or suspension from the NFIP.

5.4.1.3 Runoff Volume Reduction

Runoff volume reduction can be accomplished utilizing techniques that improve infiltration, site design, or stormwater regulation. Improved infiltration techniques include natural landscaping with deep-rooted plants, permeable pavers or porous pavement, and bio infiltration devices. Improved site design techniques include preserving natural drainage systems, impervious surface reduction, alternative streetscapes that reduce and infiltrate runoff, alternative parking lot designs, and green roofs. Examples of runoff volume reduction best management practices can be found here: http://www.lakecountyil.gov/2261/Stormwater-Best-Practices.

Stormwater regulations can also reduce the quantity of runoff from developments. Due to a trend of increasing Runoff Volume Reduction (RVR) requirements of the Illinois Environmental Protection Agency (Illinois EPA), the WDO has adopted both qualitative and quantitative RVR provisions. The WDO is a credit-based system designed to capture a percent of the annual rainfall event to the maximum extent practicable. This decreases the volume and flow rate of stormwater that is discharged off a site thereby preventing future flood damage.

5.4.2 Remedial Measures

Flooding problems are reduced or eliminated by both structural and non-structural means. Structural flood mitigation measures focus on reducing the probability of flooding (i.e. removing or reducing the ability of flood waters to reach a property or structure) while nonstructural flood mitigation measures focus on reducing the consequences of flooding (i.e., flood-proofing a structure located in the floodplain). Several common types of structural and nonstructural mitigation measures are described below. Due to the nature of flood problems and the types of flooding associated with them, some of these measures may have limited applicability in the Manitou Creek-Fish Lake Drain Watershed but are included here to be more comprehensive.

5.4.2.1 Structural Flood Mitigation Measures

Structural measures control or contain water and are designed to prevent floodwaters from reaching buildings or property. Structural alternatives include reservoirs, levees and floodwalls, diversions, stream channel conveyance improvements, and drainage and storm sewer improvements. Improved conveyance practices should be designed to ensure that adjacent and downstream properties and waterways will not be negatively impacted by increased flows. Large or complex structural flood mitigation alternative projects are often costly to implement, so local agencies and private landowners often request help from state or federal agencies such as the Illinois Department of Natural Resources Division of Water Resources Management, the United States Army Corps of Engineers, and the United States Department of Agriculture Natural Resources Conservation Service.

Structural flood control is generally the most expensive type of mitigation measure because of installation time and costs, maintenance requirements, and environmental impacts. Thorough assessment of alternatives prior to selecting a structural flood control measure can minimize costs and impacts. The advantages and disadvantages of structural flood control techniques are discussed in Table 5-4(Association of State Floodplain Managers, 2007).

Table 5-4: Benefits and Drawbacks to Structural Flood Control Measures

Advantages	Shortcomings
May provide the greatest amount of protection for land area used.	They disturb the land and disrupt natural water flow, often destroying wildlife habitat.
Due of potential land limitations, may be the only practical solution in some circumstances.	They require regular maintenance, which if neglected, can have disastrous consequences.
Can incorporate other benefits into structural project design such as water supply and recreational uses.	They are built to a certain flood protection level that can be exceeded by larger floods, causing extensive damage.
Regional detention may be more cost efficient and effective than requiring numerous small detention basins.	Although it may be unintended, in many circumstances they promote more intensive land use and development in the floodplain.
	They can create a false sense of security, as people protected by a project often believe the structure eliminates any flooding risk.
	They can create new flooding problems if improperly designed or built.
	Levees and reservoirs can significantly degrade riparian and aquatic habitat and water quality.

5.4.2.1.1 Reservoirs and Regional Detention

Reservoirs and regional detention are large structures that control flooding by holding water behind dams or in storage basins. After a flood peaks, water is released or pumped out slowly at a rate that is equal to or less than the capacity of the downstream channel. Reservoirs that maintain a normal water level may be used for water supply or to provide water-based recreational benefits. Additionally, wet or dry detention basins can serve multiple uses by doubling as parks or other open space uses.

The amount of land needed, coupled with the expense of construction, management, and maintenance, limit the use of reservoirs. Additionally, reservoirs may fail to prevent floods that exceed their design levels, eliminate the natural and beneficial functions of the floodplain, and negatively impact water quality and aquatic habitat.

5.4.2.1.2 Detention Basins

Some localized flooding problems can be minimized by enlarging or adjusting flows through existing detention basins or by constructing new basins. Detention basins are effective at flood reduction in watersheds of up to

30 square miles. While regional detention is generally more cost-effective than constructing numerous small detention facilities, in some cases there may not be sufficient land available for regional detention. Smaller detention basins may be the most cost-effective solution for localized flood problems. Slowing release rates from new and existing detention basins can reduce the downstream flood risk and impacts of short duration-high-velocity events on the stream channel. Retrofitting older detention basins to improve functionality or storage volume or constructing new detention basins are often viable flood mitigation alternatives, especially for smaller tributary areas (less than 100 acres).

5.4.2.1.3 Levees and Floodwalls

Earthen levees or concrete floodwalls are constructed between rivers and at-risk properties to mitigate overbank flooding. Levees and floodwalls confine water to the stream channel by artificially raising the bank. Regulatory levees must meet very strict and onerous design and permitting requirements. A serious concern with levees is that they frequently offer a false sense of security. In some cases, land use behind a levee can change to high intensity, high-value occupation under the false assumption that all future floods will be controlled by the levee, when in reality, large floods may overtop or breach the levee creating more flood damage than would have occurred. Problems also arise when the present runoff volume in the channel exceeds the design capacity of older levees that were constructed for lower flow conditions.

Levees and floodwalls have other limitations, levees and floodwalls are placed along the river or stream edge, where they degrade riparian and aquatic habitat. Levees are expensive to construct, require considerable land and maintenance, and are more likely to push floodwater onto other properties upstream or downstream. In some cases, it may be necessary to include expensive and noisy pumping operations for internal drainage. Levees also act as barriers to river access, block views, and disrupt local drainage patterns.

5.4.2.1.4 Barriers

Constructing barriers such as nonregulatory low floodwalls and berms around an individual property can keep floodwaters from reaching the structure. Berms are commonly used in areas subject to shallow flooding; see Figure 5-7 for a diagram of a backyard berm. Not considered engineered structures, berms are made by regrading or filling an area. Low floodwalls may be built around stairwells to protect the basements and lower floors of structures. By keeping water away from the structure walls, the problems of seepage and hydrostatic pressure are reduced. Barriers are commonly referred to as nonregulatory since a barrier typically cannot be used to remove a structure or property from the regulatory floodplain.

As with levees, the use of low floodwalls and berms must also include a plan to install drainpipes or sump pumps to handle leaks and water seepage through or under the barrier, and to remove water that may collect within the barrier. Care must be taken in the design, location, and installation of low floodwalls or berms to ensure that flood waters are not inadvertently pushed onto adjacent properties.

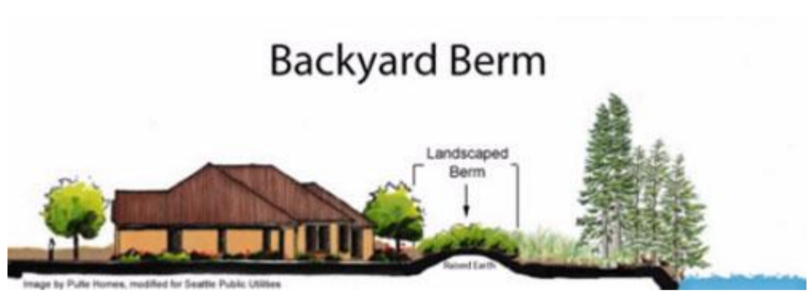

Figure 5-7: Example of a Backyard Berm
Diagram Courtesy of Seattle Public Utilities (Seattle.gov)

5.4.2.1.5 Improved Channel Conveyance

Channel conveyance improvements alter channels to increase drainage rate and volume. Improvements include making channels wider, deeper, smoother, or straighter. Some channels in urban areas have also been lined with concrete or put in underground pipes. Straightening, deepening, or widening a stream or river channel, commonly referred to as channelization, has been traditionally utilized to reduce riverine overbank flooding problems. Channelized rivers and streams drain water faster from areas adjacent to and upstream of the channel but can increase or create new flooding problems downstream as larger volumes of water are transported at a faster rate. Channelized waterways tend to be less stable and more susceptible to streambank erosion; therefore, the need for periodic reconstruction, streambank stabilization, and silt removal becomes cyclic, making stream and channel maintenance extremely expensive. Dredging is another type of conveyance improvement; however, it is frequently cost prohibitive due to dredged material disposal costs. Additionally, dredged areas typically fill in relatively quickly if upstream erosion is not reduced. Channel conveyance improvements (such as channelization and dredging) are environmentally destructive with respect to habitat and water quality and require regular, routine maintenance in perpetuity if the improvements are to be sustainable.

5.4.2.1.6 Drainage Improvements

Drainage improvements can include open ditches, swales, or storm sewers. Man-made ditches and storm sewers help drain areas where surface drainage is inadequate or where underground drainageways may be safer or more practical. Drainage and storm sewer improvements can be a quick and relatively cost-effective way to safely convey runoff for a wide range of smaller storm events. Storm sewer improvements may include the installation of new sewer lines or inlets, modifications to existing sewer inlets, installation of larger pipes, construction of better defined or more effective overland flow routes, and the use of mechanical measures, such as pumps or backflow preventers. Since drainage improvements typically result in runoff being more efficiently conveyed to a downstream location, these mitigation measures should only be used when the receiving waterway has sufficient capacity to handle the additional volume and flow of water. To prevent cumulative downstream flood impacts, drainage improvements are often combined with other storage volume creation or runoff reduction measures.

Performing regular maintenance on stormwater infrastructure for drainage improvements, such as channel clearing, dredging, storm sewer cleaning, or clogged debris removal, can be the most cost-effective measure in reducing future larger, more expensive infrastructure problems. “All stormwater management systems, whether gray or green, require maintenance. Appropriate operation and maintenance activities ensure that green (and gray) infrastructure will continue to function properly and yield expected water quality and environmental benefits, protect public safety, meet legal standards, and protect communities’ financial investment.” (U.S. Environmental Protection Agency - Office of Water, 2013).

5.4.2.2 Nonstructural Flood Mitigation Measures

Flooding problems can also be addressed using nonstructural measures. Nonstructural flood control techniques include flood-proofing, and elevation or relocation of a structure. More communities and county-wide agencies could get involved in nonstructural programs such as acquisition by helping to identify repetitively flooded properties. Runoff reduction techniques may also be used by individual homeowners or neighborhood associations in retrofit projects to lessen flooding problems. Nonstructural mitigation alternatives include practices such as acquisition or relocation of flood-prone structures, flood-proofing, or implementation of ordinances and codes.

5.4.2.2.1 Buyouts and Acquisitions

Acquisition ensures that structures in a flood-prone area will cease to be subject to flood damage. The major difference is that acquisition is undertaken by a government agency, so the cost is not borne by the property owner, and the land is converted to an appropriate permanent public use such as a park. Acquiring and clearing structures from the floodplain is the best long-term flood protection measure, one which converts a flood problem area into a community asset that can provide environmental and recreational benefits. To achieve maximum benefits from this type of public investment, acquisition and land reuse should be a component of a community's redevelopment plan, and be incorporated as a strategy in park, greenways, and capital improvement plans.

5.4.2.2.2 Structure Relocation

Moving a structure to higher ground is an extremely effective way to protect it from flooding. In many cases structure relocation is cost prohibitive because of the size, condition, and type of structure and the cost of acquiring a relocation site. Structure relocation can be cost effective where flooding is relatively severe or frequent. Structures that have suffered damage or contamination from frequent or long duration flooding should not be considered for relocation. Structure relocations have high initial costs, but they may be more cost-efficient than paying for repetitive flood damages or high flood insurance premiums. Relocation is typically the responsibility of the structure owner; however, government-sponsored loans or grants may be available for cost-share.

5.4.2.2.3 Structure Elevation

Raising a structure above the floodplain elevation is the best way to protect a structure that cannot be removed from the floodplain. The structure is elevated on a foundation or piers so that the lowest floor is above the BFE. When flooding occurs, water levels stay below the main floor, causing minimal damage to the structure or its contents. Raising a structure above the flood level is less expensive than moving it and can be less disruptive to a neighborhood. Commonly practiced in flood-prone areas nationwide, this protection technique is required by law for new and substantially damaged residences located in a 100-year floodplain.

Although flood damages can be reduced or eliminated through structure elevation, remaining in a flood-prone location has some limitations. While the structure itself is sufficiently elevated to be protected from flood damage, flooding may isolate the building and make it inaccessible. Flood waters surrounding the structure can also result in a loss of utility service or septic use, making the structure uninhabitable. Additionally, pollutant contamination in flood waters may present health and safety concerns.

5.4.2.2.4 Flood Proofing

Flood-proofing measures include dry flood-proofing or wet flood-proofing. In areas where there is shallow flooding, dry flood-proofing measures can be used to prevent water from entering at-risk structures. Dry flood-proofing is a combination of practices that are used to make a building watertight, so flood waters do not enter the structure, including the basement or crawl space. Various FEMA and the United States Army Corps of Engineers (USACE) publications highlight the range of practices that can be used to dry flood-proof a structure. Figure 5-8 shows an example of dry flood proofing practices.

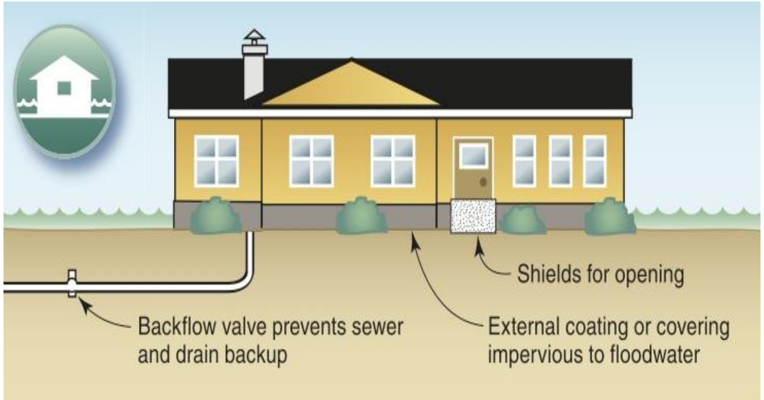

Figure 5-8: Dry Flood-Proofing

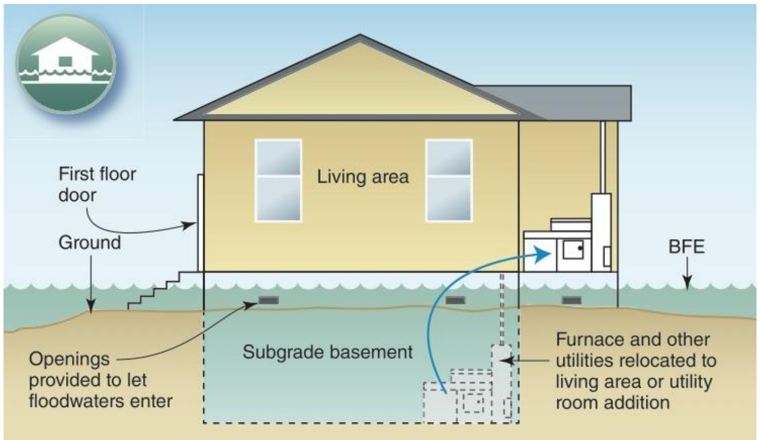

Figure 5-9: Wet Flood-Proofing

As defined by FEMA, wet flood-proofing includes permanent or contingent measures applied to a structure or its contents that prevent or provide resistance to damage from flooding while allowing flood waters to enter the structure or area. Wet flood-proofing allows water to enter the structure but minimizes the damage to the structure and its contents. Wet flood-proofing includes some of the least expensive and easiest mitigation practices to install. Generally, this includes properly anchoring the structure, using flood resistant materials below the BFE, protecting mechanical and utility equipment, and using openings or breakaway walls. Several low-cost steps can be taken to wet floodproof a structure. For example, simply moving furniture and electrical appliances out of the flood-prone portions of the structure can prevent thousands of dollars in damages. One strong advantage of wet flood-proofing is that flood damage can be reduced through some common sense, low or no-cost practices. Figure 5-9 shows an example of wet flood proofing practices.

5.4.2.2.5 Runoff Volume Reduction

Examples of runoff volume reduction techniques include the use of natural landscaping, permeable pavement, rain gardens and green roofs. Implementing these runoff reduction retrofits is generally the responsibility of individual property owners. These techniques typically do not have a substantial impact when applied on a single site; however, the cumulative effect of runoff reduction techniques at numerous sites throughout the watershed can result in substantial flood reduction benefits. The large scale of individual implementation required to achieve measurable flood reduction benefits makes this flood mitigation measure a long-term complementary mitigation measure rather than an immediate flood mitigation alternative.

5.4.3 All-Natural Hazards Mitigation Plan Recommendations

The Manitou Creek-Fish Lake Drain watershed is subject to natural hazards that potentially threaten life and property. Flooding, severe summer and winter storms, extreme cold and heat, and tornadoes are the most significant natural hazards that affect the watershed.

To prepare for and mitigate the effects of natural hazards, Lake County has developed hazard mitigation plans. FEMA, through the Disaster Mitigation Act of 2000 (DMA 2000) and the Stafford Act, requires that each community develop and adopt a FEMA-approved All-Natural Hazards Mitigation Plan (ANHMP) to be eligible for hazard mitigation grant funds. DMA 2000 and the Stafford Act require that the mitigation ANHMP be updated and readopted every five years to maintain grant eligibility. An ANHMP assesses the natural hazards that affect counties, sets mitigation goals, considers mitigation efforts currently being implemented, evaluates additional mitigation strategies, and recommends mitigation actions to be implemented over the next five years. The mitigation actions are designed to utilize both public and private sectors to protect the people and assets of the counties. Implementation of all action items is contingent on the availability of staff and funding.

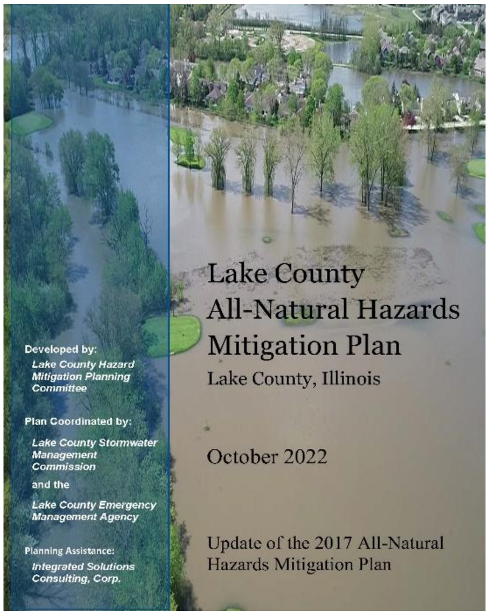

Figure 5-10: Lake County ANHMP

Lake County and the hazard mitigation planning committee (HMPC) developed and adopted the Lake County Countywide ANHMP in 2006 as a multi-jurisdictional plan; the plan was updated in 2012, 2017 and 2022 (see Figure 5-10). The2022 update to the ANHMP was developed by the Lake County HMPC as a multi-jurisdictional ANHMP to meet federal mitigation planning requirements. The 2022 ANHMP is adopted by resolution by the County and each participating municipality. The 2022 ANHMP will be implemented and maintained through both countywide and individual initiatives, as funding and resources become available.


Figure 5-11: Wetland with High Flood Storage

5.5 FLOOD STORAGE

5.5.1 Existing Flood Storage

Existing flood storage is defined as depressional areas and floodplains that are presently storing, or potentially could store, stormwater runoff to decrease flooding in the watershed. Besides flood protection, flood storage areas can be used for the mitigation of wetland losses (wetland restoration), channel protection, and water quality protection. Creating or enhancing storage would provide many benefits including reducing runoff to streams and minimizing channel erosion. Storage areas that are created through wetland restoration would improve water quality and habitat and increase groundwater recharge (Figure 5-11). The criteria used to identify existing storage locations in were:

- Mapped FEMA 100-year Special Flood Hazard Areas (SFHAs) and USGS Flood of Record outside of SFHAs (Lake County only).
- Wetlands with high flood storage function as identified in the Lake County Wetland Restoration and Preservation Plan (WRAPP).
- Stream corridors are included.
- Lakes are included.
- Detention Basins as identified in the WRAPP.
- Reservoirs are not included, as none are mapped in the watershed.

The existing flood storage totals and locations are identified in Table 5-5 and Figure 5-12, respectively**.** These locations range from 1 - 8,962 acre-feet of storage with a mean storage of 75 acre-feet. A total of 568 storage areas encompass 8,789 acres (28% of the Manitou Creek-Fish Lake Drain Watershed) with an estimated potential to store a total of 42,867 acre-feet of water.

Table 5-5: Existing Flood Storage by Subwatershed

Subwatershed	Acre Feet of Existing Storage
Fish Lake Drain	10,113
Manitou Creek	32,754
Total	**42,867**

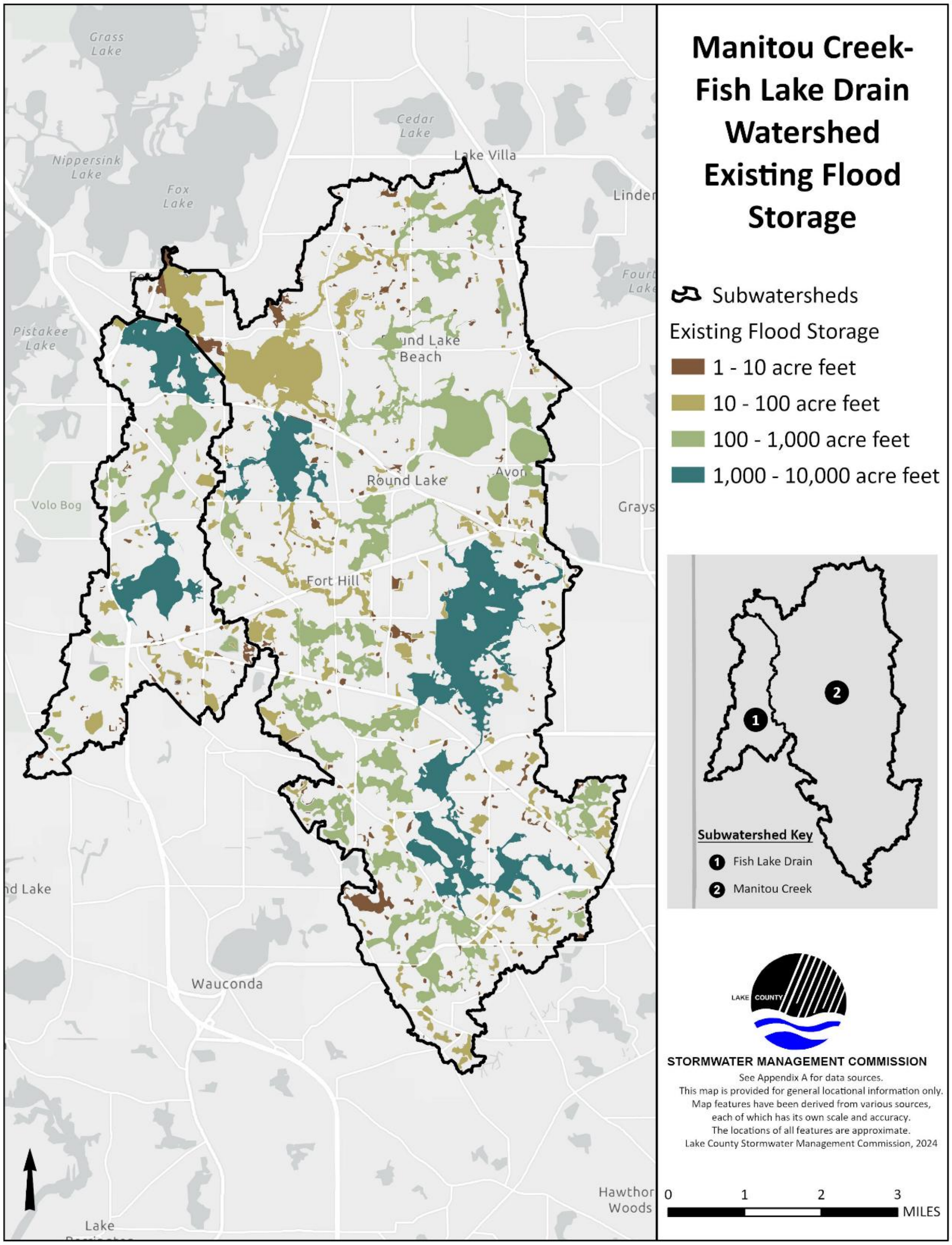

Figure 5-12: Existing Flood Storage

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS/ABBREVIATIONS USED IN CHAPTER 6

AG - Agricultural Producers
BMP – Best Management Practices
CBL - Corporate and Business Landowners
CMAP - Chicago Metropolitan Agency for Planning
DH - Developers and Homebuilders
DLWA – Duck Lake Waterway Association
DOT - Departments/Divisions of Transportation
EIG - Environmental Interest Groups
EM - State Emergency Management Agencies
EO - Elected Officials
EXT - County Extension Services
FEMA - Federal Emergency Management Agency
FPD - Forest Preserve Districts
GIS – Geographic Information System
HOA - Homeowners Associations
IDNR - Illinois Department of Natural Resources
I-LAST – Illinois – Livable and Sustainable Transportation Rating System
Illinois EPA - Illinois Environmental Protection Agency
ISD - LC Health Department Individual Sewage Disposal Program
ISGS - Illinois State Geological Survey
ISWS - Illinois State Water Survey
LA – Lake Association
LCFPD – Lake County Forest Preserve District
LCHD - Lake County Health Department
LCPW - Lake County Public Works Department
LLISA – Long Lake Improvement and Sanitation Association
M - Municipalities
N/L - Nursery and Landscaping Business
NRCS - Natural Resources Conservation Service
OL - Open Lands Project
PAH – Polycyclic Aromatic Hydrocarbons
PB&D - County Planning, Building, and Development
PC - Snow Removal and Deicing Private Contractors and Consultants
PD - Parks and Recreation Districts
SI - Schools and Institutions
SMC - Lake County Stormwater Management Commission
SWALCO - Solid Waste Agency of Lake County
SWCD - Soil and Water Conservation District
T - Townships
TMDL – Total Maximum Daily Load
USACE - U.S. Army Corps of Engineers
USFWS - U.S. Fish and Wildlife Service
USGS - United States Geological Survey
UT - Utilities
WDO – Watershed Development Ordinance
WLWA – Wooster Lake Waterway Agency
WPC - Watershed Planning Committee(s)
WRAPP – Wetlands Restoration and Preservation Plan
WWTP - Wastewater Treatment Plants

6 PRIORITIZED ACTION PLAN SUMMARY

NOTEWORTHY – ACTION PLAN RECOMMENDATIONS

The action plan recommendations in this Prioritized Action Plan Summary are to be interpreted as guidance recommendations (projects) for watershed stakeholders and not a regulatory document.

A variety of Best Management Practices (BMP) and programs are discussed in this plan as potential options for the mitigation of watershed issues in the Manitou Creek-Fish Lake Drain watershed. In this chapter, specific ***recommendations*** are made to meet the goals of the watershed plan and previously approved (sub)watershed-based plans, including the identification of specific locations for Best Management Practices in the watershed. This chapter presents specific recommended action items developed jointly by watershed stakeholders and the Lake County Stormwater Management Commission planning team to meet the goals of this watershed-based plan. Due to the size of the planning area and sheer number of site-specific action recommendations developed during the planning process, readers of the plan are encouraged to use the ***online mapping application*** (https://lakecountyil.maps.arcgis.com/apps/webappviewer/index.html?id=b134b3429e934ec28fb80a1146021ca7). The individual recommendations are also listed in tables, organized by jurisdiction, in **Appendix A**. The critical implementation partners for the watershed are identified in Section 6.1.

There are two primary types of action plan recommendations presented in this chapter: 1) programmatic actions and 2) site-specific project actions including critical area (pollutant load "hotspot") actions. The action plan recommendations identify specific locations for projects and activities recommended for implementation at the watershed-scale.

1. "Programmatic Actions" represent program, policy, regulatory, and project actions that are applicable throughout the watershed. The actions are based on achieving the goals and objectives of the watershed-based plan as outlined in **Chapter 2**.
2. "Site-Specific Actions" address site-specific project opportunities or issues that have been identified throughout the Manitou Creek-Fish Lake Drain watershed. Site-specific projects were identified through the stream, lake shoreline and detention basin inventories, local stakeholders and agency staff, and the planning team. Some of the site-specific practices were identified using existing map data and have not been field verified; however, they do represent actual locations where recommended Best Management Practices are applicable. Overall, these site-specific actions are the result of watershed assessment activities, a detailed analysis of existing watershed data, and stakeholder input.

SITE-SPECIFIC ACTION PLAN ONLINE MAPPING APPLICATION

An online mapping application was developed for stakeholders to view the action recommendations from this plan. Because the planning area covers 49 square miles and there are multiple individual action recommendations across numerous jurisdictions, it is likely easier for plan users to navigate to their individual areas of interest or browse areas they are familiar with for certain types of project recommendations. The mapping application can be accessed at: https://lakecountyil.maps.arcgis.com/apps/webappviewer/index.html?id=b134b3429e934ec28fb80a1146021ca7
or via the Manitou Creek-Fish Lake Drain page on the Lake County Stormwater Management Commission website (www.lakecountyil.gov/stormwater).

3. "Critical Area Actions" identify critical catchments, streambanks and shoreline areas based on the "Pollutant Load Hotspot Analysis" to focus actions. These areas include hotspot catchments identified in **Chapter 4**. Actions implemented in these critical areas will provide added value and benefit to the watershed.

For each of the watershed goals identified in **Chapter 2**, there is an action table that describes each recommended action including its 1) priority, 2) cost estimate (if applicable), 3) lead partners and support partners (if applicable) and 4) recommended implementation timeframe.

1. Priority was assigned to each of the recommended actions and classified as H (high), M (medium), or L (low). Priority was based on multiple factors including lead partners, land ownership, cost, and technical requirements based on circumstances and conditions observed at the time the plan was written. These circumstances and conditions will likely change over time resulting in changes to the priority of projects. This watershed-based plan is considered a living document that can be updated and adapted as conditions and priorities change.
2. Cost estimates are provided only for those watershed improvement actions that involve remedial projects, such as planting native vegetation, retrofitting detention basins, etc. Cost estimates are not provided for preventative measures such as education and regulatory action. Cost estimates should not be considered price quotes but used as a way to compare the relative costs of proposed treatments. Furthermore, Best Management Practice implementation projects vary drastically by specific technique employed, size of area, access to location, property values, and other factors.
3. Lead and support partners are those organizations or agencies that have the greatest potential to implement each recommended action.
4. Timeframe refers to the period of time in which the recommended action could be implemented. Timeframe is classified into three categories including:
   - S (Short = 1-5 years)
   - M (Medium = 6-10 years)
   - L (Long = 10+ years)

Chapter 7 outlines an implementation and evaluation strategy for the action plan, and **Chapter 8** identifies outreach and education strategies and tools that will provide watershed stakeholders with the knowledge and skills necessary to implement the watershed-based plan.

6.1 IMPLEMENTATION PARTNERS

Throughout the prioritized action plan tables and narrative, responsible parties are suggested for taking the lead partner role or providing a supporting partner role in plan implementation. This section presents the responsible parties as well as a brief description of their role. Table 6-1 provides a concise reference or key of implementation partners for reviewing the programmatic and site-specific action plan tables that follow. Implementation partners do not necessarily have the resources to complete a recommendation, but these recommendations can be implemented through coordination with other partners, grant funding, and more.

LEAD PARTNERS: Identify the lead public or private landowner, agency or other stakeholder with the greatest potential to implement the action.

SUPPORT PARTNERS: Include parties that could be involved in assisting in the action implementation related to regulation, permitting, coordination, technical needs and funding assistance.

Table 6-1: Plan Implementation Partners

Acronym	Implementation Partner	Implementation Role/Activity
AG	Agricultural Producers	Management and operation of cropped and other agricultural lands.
C	Counties	Land use and development, technical and financial support, and drainage system management.
CBL	Corporate and Business Landowners	Grounds management and maintenance. Implementation and maintenance of stormwater BMPs.
CMAP	Chicago Metropolitan Agency for Planning	Technical, planning, training, and funding assistance.
DD	Drainage District	Maintain conveyance, stability, and function of drainage ways within district boundaries.
DH	Developers and Homebuilders	Land development, stormwater management system design and construction.
DOT	Departments/Divisions of Transportation	Maintain, design, and construct transportation infrastructure in the watershed including stream, lake, and wetland crossings. *Includes State, Illinois Tollway, County, Municipal and Township Highway and Streets Departments.
EIG	Environmental Interest Groups	Advocate group positions on topics including environmental and land management.
EM	State Emergency Management Agencies	Flood and disaster planning, emergency response, and hazard mitigation.
EO	Elected Officials	Decision-making authority for county policies and ordinances [including the Watershed Development Ordinance (WDO) and Unified Development Ordinance (UDO)].
EXT	County Extension Services	Provides education and technical support.
FB	Farm Bureaus	Promotes farming practices that promote environmental stewardship.

Acronym	Implementation Partner	Implementation Role/Activity
FEMA	Federal Emergency Management Agency	National Flood Insurance Program, floodplain mapping and enforcement, and mitigation funding.
GC	Golf Course	Manage and maintain golf courses and associated natural areas.
LCFPD	Lake County Forest Preserve District	Manage and maintain green infrastructure, natural areas, and open space.
HOA	Homeowners Associations	Management of common areas and natural and constructed drainage systems.
IDNR	Illinois Department of Natural Resources	Natural area preservation and management, research, technical, and financial assistance.
Illinois EPA	Illinois Environmental Protection Agency	Water resource monitoring, pollution regulation and control, technical assistance and project funding.
ISD	LC Health Department Individual Sewage Disposal Program	Regulates the use of septic systems in incorporated and unincorporated areas of Lake County where sanitary sewer systems are not yet available. Regulation involves inspecting, planning, and installing septic systems.
ISGS/USGS	Illinois State Geological Survey & United States Geological Survey	Gather and manage geologic and water quality data.
ISWS	Illinois State Water Survey	Flood risk modeling and floodplain mapping
LCHD	Lake County Health Department	Monitor, manage, and provide technical support for water resources. Includes environmental services unit.
LCPW	Lake County Public Works Department	Manages water and wastewater facilities in Lake County.
LM	Lake Manager(s)	Management of lakes and common/natural areas under the lake managers authority.
M	Municipalities	Land use and development, technical and financial support, and drainage system management.
NRCS/SWCD	Natural Resources Conservation Service Soil and Water Conservation District	Provide technical and financial assistance for natural resource management.
N/L	Nursery and Landscaping Business	Grow and maintain landscaping plant materials. This includes irrigation or watering and storage of equipment and materials.
OL	Open Lands	Provide technical assistance for land acquisition and preservation
PB&D	County Planning, Building, and Development	Land use planning and permitting for unincorporated areas, natural resources and system management.

Acronym	Implementation Partner	Implementation Role/Activity
PC	Snow Removal and Deicing Private Contractors & Consultants	Land and pavement management and maintenance for snow removal and deicing.
PD	Parks and Recreation Districts	Management and maintenance of parks and open space.
PO	Property Owner	The owner of record for a particular tax parcel. Provide access, permission, and implementation of recommended actions. Likely contribute financially to implementation.
RR	Railroad	Land Management in railroad right of way.
SI	Schools and Institutions	Schools and institutions with large properties or campus settings.
SMC	Lake County Stormwater Management Commission	Technical and financial assistance for flooding, watershed planning, and water quality. Administers the Watershed Development Ordinance in Lake County.
SWALCO	Solid Waste Agency of Lake County	Implements the Lake County Solid Waste Management Plan.
T	Townships	Road maintenance and support for watershed improvement projects.
USACE	U.S. Army Corps of Engineers	Wetland protection and regulation and restoration funding.
US EPA	United States Environmental Protection Agency	Water resource monitoring, pollution regulation and control, technical assistance and project funding.
USFWS	U.S. Fish and Wildlife Service	Threatened and endangered species protection, technical and financial assistance for habitat restoration.
UT	Utilities	Land Management in utility right of way
WPC	Watershed Planning Committee	Coordinate watershed plan implementation, education, and outreach. Planning and support for watershed improvement projects.
WWTP	Wastewater Treatment Plants	Maintain wastewater treatment regulatory standards. *Includes privately and publicly owned treatment works

6.2 PROGRAMMATIC ACTION PLAN (BASIN-WIDE)

6.2.1 GOAL #1: WATER QUALITY

GOAL: Improve impaired water quality and protect surface water quality from future impacts (Table 6-2).

Table 6-2: Actions for Goal #1

Action #	Action	Priority	Lead Partners	Supporting Partners	Time Frame
1	Develop and implement a watershed monitoring program to collect, assess and report physical, chemical, and biological water quality data on streams and lakes on a regular basis.	H	WPC, M, T, LCHD, ISWS, USGS	Illinois EPA, FPD, IDNR, SMC	S
2	Reduce the quantity of road salt (sodium chloride) needed for safe and cost-effective winter maintenance to address rising chloride levels in local water bodies.	H	DOT, M, CBL, N/L, EO, PO, PC, HOA, PD	SMC, LCHD, T, Illinois EPA	S
3	Prepare pollution prevention plans to address emergency response for potential catastrophic environmental events such as pipeline leaks and flooding.	H	SMC, PB&D, M, PO, CBL	FEMA, EM	S
4	Reestablish and support Lake County Health Department and Illinois EPA's Volunteer Lake Monitoring Programs and encourage participation in the watershed.	H	LCHD, IDNR, Illinois EPA, FPD, WPC	SMC, M, SI, CMAP	S
5	Encourage participation in and training for IDNR's Harmful Algal Bloom Event Response Program	H	LCHD, IDNR, Illinois EPA	SMC, M, SI, CMAP	S
6	Implement projects to remediate sites with legacy contaminants/pollutants and to stop migration of those substances beyond their current extent.	H	USEPA, Illinois EPA, PO	M, C, IDNR, USACE	L
7	Use Stormwater Treatment Train concepts (sequenced best management practices) wherever possible to infiltrate and clean stormwater runoff.	M	PO, M, PB&D, CBL, DOT, DH, HOA	SMC, Illinois EPA, DD, NRCS/SWCD	S
8	Identify opportunities for wetland protection and enhancement on high priority parcels identified to maintain or improve water quality.	M	M, T, FPD, PD, SMC, PO, IDNR	USACE, Illinois EPA, WPC, DD	S

Action #	Action	Priority	Lead Partners	Supporting Partners	Time Frame
9	Implement effective leaf cleanup and composting programs.	M	M, T, EO, C, DOT, HOA, SWALCO	PB&D, PO, CBL, CMAP, SMC, LCHD	S
10	Reduce or ban the use and direct discharge of substances known to be sources of PAHs, including coal tar sealants.	M	PO, M, T, C, CBL, PD, AG, HOA	WPC, SMC, LCHD, Illinois EPA	S
11	Pass ordinances that restrict the use of lawn fertilizer with phosphorus.	M	M, T, C, EO, HOA	PB&D, CBL, Illinois EPA, CMAP, LCHD, SMC	S
12	Install stormwater green infrastructure BMPs in new or existing developments.	M	DH, CBL, M, C, T, HOA, SI	SMC, WPC, PB&D,	M
13	Implement projects identified by monitoring and studies that reduce or remove causes of impairment and/or help to attain the aquatic life use standard for impaired waters.	M	PO	Illinois EPA, IDNR, USEPA, SMC, M, T, C	M
14	Evaluate existing data to identify areas that are impacted by toxic sediment. If toxic sediment is found, identify contaminants of concern, human and ecological health risks and potential responsible parties. Pursue investigation and remediation if human or ecological risks are likely.	M	LCHD, Illinois EPA	ISWS, ISGS/USGS, PO	M
15	Continue to conduct intensive basin surveys for Illinois Integrated Water Quality Report on five-year rotational basis.	M	Illinois EPA, IDNR	LCHD, SMC, WPC	M
16	Maintain golf courses using BMPs that minimize nutrient loads and impacts to water quality.	M	GC, M, PD, FPD	SMC, EIG	M
17	Minimize runoff volumes, velocities, and pollution to waterways by creating/restoring wetlands, natural landscapes, and stormwater best management practices such as infiltration and pollutant filtration systems.	M	AG, PO, PD, FPD, WPC, M, T	NRCS/SWCD, Illinois EPA, USACE, SMC, CMAP	M
18	Where feasible, retrofit existing swales and open drainage-ways to infiltrate runoff with natural landscaping.	M	PO, HOA, CBL, DOT, AG, PD	SMC, Illinois EPA, NRCS/SWCD	M
19	Install bioretention BMPs to capture rooftop runoff.	M	DH, CBL, C, M, SI, T, PO	SMC, PB&D, Illinois EPA	M
20	Reduce phosphorus loads by using conservation practices on agricultural fields to reduce soil loss.	M	AG, NRCS/SWCD, PO	SMC, Illinois EPA	M

Action #	Action	Priority	Lead Partners	Supporting Partners	Time Frame
21	Relocate and/or place storm drain inlets away from areas with potential land use impacts to water quality (direct or indirect discharge).	M	PO, DH, M, C, PB&D, DOT, CBL, HOA	SMC	M
22	Monitor detention basins for Harmful Algal Blooms (HABs) and perform remedial actions to reduce the occurrence of HABs.	M	PO	EIG, LCHD, IDNR, ISGS/USGS, M, PD	L
23	Address re-suspension of phosphorus in lakes where feasible.	M	PO	LCHD, Illinois EPA, LCHD, SMC	L
24	Install riparian buffers and grassed waterways in agricultural areas where appropriate and feasible.	M	PO, FB, AG	DD, Illinois EPA, SMC, NRCS/SWCD,	L
22	Implement BMPs that reduce pollutants with a TMDL.	M	C, CBL, FPD, PD, HOA, M, PO, T	CMAP, DH, DOT, IDNR, Illinois EPA, LCHD, LCPW, NRCS/SWCD, PB&D, SI, SMC, WPC, DD	L
23	Monitor for and minimize use of Per- and Polyfluoroalkyl Substances (PFAS), including in aqueous film-forming foam fire suppression system when minimization of use is in the best interest of public safety and allowable by law.	M	M, IDNR, Illinois EPA	WPC	L
24	Disable drain tiles to restore wetland hydrology.	M	AG, PO, PD, FPD, M, T	USACE, NRCS/SWCD, PB&D, SMC	L
25	Create and enforce ordinances requiring proper cleanup and disposal of pet waste.	L	M, C, EO, FPD, PD	SMC, WPC, PB&D, LCHD, Illinois EPA	M
26	Conduct routine well and septic evaluations and repairs.	L	PO, AG, HOA	ISD, LCHD	M
27	Initiate sanitary surveys at beaches impaired for fecal coliforms and implement projects and management plans to reduce the impact of sources of contamination.	L	PO, PD, M	Illinois EPA, LCHD	M
28	Establish and publish watershed-wide recommended guidance for winter de-icing BMPs including road salt application rates and alternatives.	L	DOT, LCHD, M, T, SMC	Illinois EPA, WPC, IDNR, PB&D, CMAp	M

6.2.2 Goal #2: Stormwater Management, Flood Risk, and Flood Damage

GOAL: Reduce the risk of flood damage in the watershed, mitigate the effects of runoff, and enhance stormwater management systems (Table 6-3).

Table 6-3: Actions for Goal #2

Action #	Action	Priority	Lead Partners	Supporting Partners	Time Frame
1	Implement projects to reduce damages or mitigate urban flooding.	H	M, C, T, SMC, FEMA, IDNR	PB&D, CMAP	S
2	Implement floodproofing measures or elevate at-risk structures.	H	PO, M, C, SMC, PB&D, CBL	FEMA, EM, DOT, IDNR,	M
3	Purchase and remove structures that are chronically flood damaged through the voluntary buyout program.	H	PO, SMC, M	EM, IDNR, FPD, FEMA, PB&D	L
4	Increase native tree installation for stormwater benefits (ex. reduced erosion and runoff).	M	PO, M, C, T, HOA, PD, DH, SI, FPD, DOT	NRCS/ SWCD, SMC, EIG, CMAP	S
5	Identify or install overland flow routes for all detention facilities and flood prone depressional areas where needed.	M	SMC, M, C, T, FPD, PD, PO	FEMA, EM, USACE	S
6	Develop and implement a stream inspection and maintenance program throughout the watershed. Remove excessive debris loads and garbage in channels to maintain conveyance and reduce streambank erosion.	M	M, C, PB&D, FPD, P0, PD, DD, SMC	DOT, WPC, LCPW, IDNR, Illinois EPA, T, CMAP, USACE,	S
7	Design and install stormwater BMPs to capture and treat stormwater runoff from roads, parking lots, and other transportation infrastructure.	M	CBL, DOT, M, C, T, DH, SI	SMC, Illinois EPA	M
8	Identify and increase additional flood storage at regional wetland restoration or flood storage sites.	M	SMC, IDNR, FPD, M, T, PD, PO	LCHD, CMAP, PB&D	M
9	Communities adopt and implement "no adverse impact" floodplain management standards.	M	M, C, T, EO, CMAP, SMC, PB&D	FEMA, EIG, Illinois EPA, USACE, EM,	M
10	Support flood hazard map updates, including the FEMA Flood Insurance Study, to accurately identify current flood hazard areas and streams of high concern.	M	FEMA, ISWS, CMAP M, C, T, SMC	PB&D, USACE, IDNR, EM	M
11	Develop flood inundation maps to show varying depths of flooding and respective area of inundation using updated rainfall rates and topography data, in coordination with the Lake County All Natural Hazards Mitigation Plan.	M	SMC, M, CMAP, C, PB&D	FEMA, EM	M

Action #	Action	Priority	Lead Partners	Supporting Partners	Time Frame
12	Create a GIS database of storm sewer, drain tile, and drainage map information.	H	SMC, M, C, FPD, DOT	DD, PO, FB, NRCS/SWCD	M
13	National Flood Insurance Program (NFIP) communities participate in the Community Rating System (CRS) program to mitigate flood damage and reduce flood insurance rates for residents.	M	M, C, PB&D, FEMA	SMC	M
14	Maintain infiltration functionality of areas with high infiltration soil types by designating them as undisturbed open space features in developing/ redeveloping sites.	M	M, C, PO, DH, T, HOA	SMC	M
15	Encourage wet or wetland detention basins for new development and retrofit existing dry basins to these types, where feasible.	M	SMC, PB&D, M, C, T, CBL, HOA, DOT	CMAP, DH	M
16	Create storage to benefit Flood Problem Area Inventory sites where feasible and cost effective.	M	SMC, M, C, T, FPD, PD	FEMA, EM, USACE	M
17	Develop a flood warning and response plan for residents along the Round Lake Drain.	M	M	EM, FEMA, ISWS	M
18	Develop standards/guidelines for use of green infrastructure for stormwater management in site planning and design including strategically connecting to off-site green infrastructure.	M	PB&D, SMC, CMAP, M	WPC, Illinois EPA	M
19	Install porous or permeable surfaces in parking areas.	M	PO, CBL, SI, M, PD, DH, DOT	SMC, PB&D	M
20	Reduce the rate and volume of stormwater runoff from existing or new development by minimizing impervious cover and implementing green infrastructure practices.	M	PO, DH, CBL, M, PB&D, HOA, SI, DOT	SMC, CMAP	M
21	Maintain and increase local drainage system capacity to improve resiliency for changing precipitation patterns.	M	M, C, T, PD, FPD, DOT, DD	SMC	L
22	Evaluate, preserve, and enhance the flood storage functions of existing depressional, floodplain, and riparian areas in open and undeveloped parcels.	M	M, C, T, SMC, PD, FPD, PO, DOT	IDNR, WPC, PB&D, CMAP, FEMA, EM, DD	L
23	Use infiltration and evapotranspiration provided by green infrastructure to reduce volume of runoff and mitigate flood damage.	M	PO, M, C, DH, SMC, HOA, PD, T, DOT	FEMA, EM, DOT, CBL, IDNR, USACE, FPD, PB&D, DD	L

Action #	Action	Priority	Lead Partners	Supporting Partners	Time Frame
24	Expand funding opportunities including alternative funding mechanisms, technical assistance, and maintenance resources for improving stormwater green infrastructure and best management practices.	M	CMAP, IDNR, USFWS, Illinois EPA, FEMA	FPD, PD, WPC, SMC, EIG	L
25	Develop and implement a monitoring and maintenance plan for stormwater detention facilities, storm drains, drainageways, and catch basins, that identifies agency responsibilities, a maintenance schedule, budget, and funding source.	L	PO, DH, CBL, HOA, M, T, C	IDNR, SMC, FPD, WPC, DD	S
26	Restore and enhance under-utilized space at commercial, industrial, and residential developments with stormwater green infrastructure practices.	L	DH, PO, HOA, CBL, SI	Illinois EPA, PB&D, SMC, CMAP, WPC	L

6.2.3 GOAL #3: NATURAL RESOURCE MANAGEMENT

GOAL: Preserve, restore, and enhance a system of terrestrial and aquatic ecosystems to provide beneficial functions for people, plants, and wildlife (Table 6-4).

Table 6-4: Actions for Goal #3

Action #	Action	Priority	Lead Partners	Supporting Partners	Time Frame
1	Maintain, expand, or restore high quality native plant buffers along river, streams, lakes, and wetlands.	H	PO, CBL, HOA, SMC, FPD, IDNR, PD AG, DD	USACE, NRCS/SWCD, CMAP, USFWS	S
2	Reduce streambank, shoreline, and construction-related erosion.	H	M, PO, PD, FPD, HOA, DD	Illinois EPA, SMC, IDNR, DOT, PB&D, USACE, NRCS/SWCD	M
3	Replace or restore failed hydraulic structures and discharge pipes.	H	PO, DOT, HOA, T, M	FEMA, EM, SMC, USACE, DD	M
4	Modify, retrofit, or eliminate constructed hydraulic restrictions along the stream corridors to promote natural stream morphology.	H	M, C, PO, FPD, DOT, HOA, DD	USACE, IDNR, SMC, NRCS/SWCD,	L
5	Preserve, restore, and create wetlands wherever feasible.	H	SMC, PB&D, Illinois EPA, M, T, IDNR, USACE	EO, CMAP	L
6	Restore and manage riparian areas (including vegetation and buffers) to enhance beneficial functions and protect property and infrastructure.	M	PO, FPD, PD, IDNR, DD	M, SMC, USACE, Illinois EPA, USFWS, EIG	S
7	Develop a stream restoration plan and cost estimate for moderately and severely eroded stream reaches.	M	SMC, FPD, USACE, DD	IDNR, Illinois EPA, NRCS/SWCD, CMAP, PB&D	S
8	Avoid development in and installation of gray infrastructure through high priority green infrastructure system parcels wherever possible.	M	M, C, DOT, T, DH, LCPW	CMAP, SMC, EIG	S

Action #	Action	Priority	Lead Partners	Supporting Partners	Time Frame
9	Restore degraded terrestrial and aquatic resources (lakes, wetlands and streams) using BMPs to improve habitat. This includes in-stream habitat features, such as natural channel substrates and pools and riffles to improve water quality and aquatic biodiversity.	M	PO, FPD, PD, IDNR	USACE, M, SMC, NRCS/SWCD, Illinois EPA, PB&D, DD	M
10	Protect existing healthy trees and plant and maintain a diversity of tree species in both natural and developed areas	M	FPD, M, C, T, PD, PO, EIG, OL	WPC, PB&D	M
11	Maximize in-stream habitat in conjunction with installation of structures (bridges, culverts, etc.) to minimize negative impacts to streams and aquatic life.	M	DOT, M, PD, T, RR	SMC, Illinois EPA, IDNR, USACE, PB&D	M
12	Maximize in-stream habitat in conjunction with streambank stabilization projects.	M	DD, PO, HOA, M, PD	SMC, Illinois EPA, IDNR, USACE, NRCS/SWCD	M
13	Eliminate yard waste dumping along shorelines, streambanks, drainage paths (including ditches), and roadways.	M	PO, CBL, HOA, SI	M, PB&D, SMC, FPD, WPC, DD	M
14	Develop resource conservation and management plans, especially for ADID wetlands and other biodiversity sites.	M	SMC, FPD, IDNR, PD, AG, M, T	USACE, NRCS/SWCD, CMAP, USFWS, DD	M
15	Address localized erosion related to infrastructure	M	M, T, PO	USACE, SMC	M
16	Where appropriate, remove or retrofit impoundments, dams, piped stream conveyance, and weirs in streams to support fish passage and migration, hydraulic connectivity.	M	IDNR, USFWS, M, T, PD, PO, FPD, USACE	SMC, WPC, Illinois EPA, NRCS/SWCD, LCHD, DD	M
17	Develop green infrastructure protection strategies for natural communities, using acquisition, conservation easements, and other techniques.	M	M, C, T, IDNR, WPC, FPD, AG	CMAP, USFWS	M
18	Identify high quality areas for protection, acquisition, wetland protection, and habitat enhancement.	M	PO, FPD, PD, PB&D, IDNR	USACE, M, C, SMC NRCS/SWCD Illinois EPA	M
19	Maximize buffers, habitat and natural areas in golf courses.	M	GC, M, PD, FPD	SMC, EIG	M
20	Increase the enrollment of farms in soil erosion programs.	M	NRCS/SWCD, FB, PO, AG	DD, EIG, IDNR, Illinois EPA	M

Action #	Action	Priority	Lead Partners	Supporting Partners	Time Frame
21	Develop an aquatic plant management plan for lakes and streams that targets the reduction of invasive species, promotes native plant diversity and recreational use.	M	IDNR, LCHD	Illinois EPA, FPD, USACE, USFWS, IDNR, WPC	M
22	Identify and restore degraded stream banks and beds where possible.	M	SMC, PO, M, T, DD	USACE, IDNR, CMAP	L
23	Incorporate naturalized stream restoration as part of new developments where applicable.	M	DH, HOA	SMC, CMAP, M, C, PB&D, EO	L
25	Identify potential wetland mitigation banking sites in the watershed and encourage private and/or public investment for in-watershed mitigation.	M	SMC, FPD, USACE, PB&D	PD, M, C, T, CMAP, IDNR	L
26	Reintroduce extirpated native species as water resources or ecosystem improve (such as Blanding's turtle)	M	USFWS, IDNR, FPD	Illinois EPA, WPC, PD	L
27	Remove invasive species.	M	PO, FPD, IDNR, PD, CBL, DOT, EIG, HOA, PC, SI, EIG	SMC, CMAP, WPC, Illinois EPA, DD	L
28	Identify, map and restore environmental corridors across community lines, and trail connections between new and existing parks and forest preserves where appropriate.	L	FPD, PD, M, T, PB&D, CMAP	HOA, IDNR, SMC, WPC	M
29	Restore historical floodplain function along channelized stream reaches.	L	PO, T, C, M, FPD	NRCS/SWCD, USACE, SMC, DD	M
30	Conduct beaver management as needed for public safety in accordance with landowner and community preference.	L	PO	DD	L
31	Consider ecological, habitat, and water quality impacts before performing stream management.	H	PO, T, C, M, FPD, DD	SMC	L

6.2.4 GOAL #4: WATERSHED EDUCATION AND OUTREACH

GOAL: Watershed stakeholders (residents, property owners, students, non-profit organizations and public agencies) have adequate knowledge, skills, resources, motivation and stewardship opportunities to implement the watershed plan and associated programs (Table 6-5).

Table 6-5: Actions for Goal #4

Action #	Action	Priority	Lead Partners	Supporting Partners	Time Frame
1	Continue to inform local municipalities, landowners, and public works staff about road salt alternatives and application BMPs to minimize the use of road salt.	H	SMC, LCHD, LCPW, DOT	Illinois EPA, M, C, T, WPC	S
2	Provide outreach and workshops for the public affected by flood damage to inform them about the causes of flooding, flood mitigation practices, and ways to prevent local and regional flood damage.	H	SMC, PB&D	IDNR, EM, FEMA, LCPW	S
3	Complete a physical map revision to update Manitou Creek name on FEMA maps.	H	ISWS, FEMA	WPC	S
4	Conduct a watershed outreach campaign to inform and engage the public about watershed issues, landowner responsibilities, available resources and the benefits of implementing the watershed plan.	M	WPC	SMC, CMAP, LCHD, HOA, M, C, T, EIG, DD	S
5	Inform the public and distribute educational materials on the importance of watershed health (water quality, flood prevention/mitigation, soil conservation and agricultural production, green infrastructure, water-based recreation) to the economy of watershed communities.	M	WPC	LCHD, M, C, T, SI, HOA, IDNR, EIG, CMAP, SMC, EXT, FPD	S
6	Inform developers, municipalities, and residents about the negative impacts that untreated or unmitigated impervious surface coverage has on water resources.	M	WPC	SMC, LCHD, M, T, PB&D	S
7	Promote invasive species awareness at public boat launches regarding boat transport, live-well water, and use of live bait.	M	IDNR, LCHD	M, PD, FPD, HOA, WPC, EIG	S
8	Provide information and training to riparian landowners on best practices for stream and lake shoreline restoration and maintenance that will reduce erosion and increase water quality.	M	SMC, WPC, NRCS/SWCD, LCHD, HOA, DD	M, C, T, PD, CMAP	S
9	Inform communities about the benefits of adopting the “no adverse impact standard” and maintaining floodplain as open space in reducing flood damage.	M	SMC, PB&D	IDNR, EM, FEMA, EIG	M

Action #	Action	Priority	Lead Partners	Supporting Partners	Time Frame
10	Encourage public and private landowners to utilize trees as a stormwater management BMP. Outreach efforts should partner with established initiatives such as the Chicago Region Trees Initiative and Conservation@Home when practical.	M	FPD, M, C, T, PD, PO, EIG	WPC, PB&D	M
11	Inform landowners/landscaping professionals about the negative impacts of yard waste dumping in waterways, drainage paths (including ditches), and roadways; and the potential illegality of dumping trash in stream channels and lakes.	M	WPC	SMC, M, C, T, EIG, DD	M
12	Offer and provide technical assistance to the public and local government for funding and cost-share opportunities and support with project development to implement the watershed plan.	M	WPC, SMC, NRCS/SWCD WPC, CMAP,	LCHD, M, Illinois EPA, T, C	M
13	Support and promote programs such as Conservation@Home and Rain Ready to reduce stormwater runoff, protect their property from flooding, and protect natural resources.	M	WPC, FPD, NRCS/SWCD, EIG	SMC	M
14	Facilitate public training and engage the public, schools, youth groups, and HOAs to volunteer for stream, lake, and natural area stewardship and maintenance.	M	WPC, HOA, LCHD, SI, CMAP	SMC, Illinois EPA	M
15	Continue to support rain barrel distribution and sale programs within the watershed.	M	SWALCO	SMC, FPD, SWCD	L
16	Inform municipalities, businesses, and homeowner associations about detention basin and stormwater inlet maintenance practices that improve water quality and reduce flooding.	L	LCHD, WPC, LCPW, SMC	HOA	S
17	Incorporate watershed signage and information at public properties such as forest preserves, public parks, and public lake boating areas.	L	M, C, T	SMC, PD, FPD, LCHD	S
18	Encourage schools to participate in volunteer monitoring programs.	L	SI, WPC	SMC	M
19	Include stream name signs at all stream crossings.	L	DOT, T, PD, FPD, M, WPC	SMC, PD	M
20	Promote the removal of invasive plants by providing trainings aimed at species identification/control (species such as: phragmites, teasel, garlic mustard, buckthorn).	L	OL, SI, EXT, EIG, HOA	LCHD, SMC, CMAP, N/L, WPC, FPD, PD	S

6.2.5 Goal #5: Watershed Coordination and Partnerships

GOAL: Improve coordination, engagement and decision-making between public, private and non-profit stakeholders to implement the watershed plan (Table 6-6).

Table 6-6: Actions for Goal #5

Action #	Action	Priority	Lead Partners	Supporting Partners	Time Frame
1	Watershed communities adopt the Manitou Creek-Fish Lake Drain Watershed Based Plan.	H	SMC, M, C, WPC, EO	T, PB&D, FPD, CMAP, Illinois EPA, PD, SI, DD	S
2	Establish a watershed organization or committee with funding and support to guide watershed plan implementation, provide technical assistance to watershed stakeholders and coordinate multi-partner projects, and determine the roles of existing watershed communities, councils, organizations, and groups.	H	WPC	Illinois EPA, LCHD, SMC, M, T, C, PB&D, FPD, CMAP, PD, IDNR, DD	S
3	Watershed committee annually assesses progress on plan implementation and updates the watershed-based plan no less frequently than every 10 years.	H	WPC	Illinois EPA, WPC Members	M
4	Incorporate watershed plan recommendations or green infrastructure protection into community and county comprehensive land use plans.	M	M, C, PB&D, CMAP, FPD, T	SMC, WPC, IDNR	M
5	Develop a strategy for storing and sharing watershed data.	M	WPC	DD, SMC, FPD, Illinois EPA, M, T	M
6	Municipalities and County review development standards and policies and adopt changes as needed to implement the watershed-based plan and preserve and protect healthy aquatic life and good water quality.	M	M, C, PO, PD, FPD	USACE, Illinois EPA, SMC, IDNR, DOT, PB&D, NRCS/SWCD	M
7	Land use planning jurisdictions consider Manitou Creek-Fish Lake Drain Watershed-Based plan recommendations when developing local comprehensive plans and making land use decisions.	M	WPC, PB&D, M, C, T, FPD	CMAP, SI	M
8	Identify a watershed champion in each subwatershed or local area to promote and coordinate water resource management.	L	WPC	M, C, T, PD, FPD, EIG, SMC	S

Action #	Action	Priority	Lead Partners	Supporting Partners	Time Frame
9	Develop a model or template for an intergovernmental agreement for participation in cooperative watershed projects.	L	SMC, WPC, M, C, CMAP	FPD, DOT, HOA, CBL	M
10	Coordinate municipal and county policies on sewerage and water reclamation expansion with the recommendations in the Manitou Creek Watershed Plan.	L	C, M, EO, WWTP	EIG, Illinois EPA, PB&D	L

6.2.6 Regulatory and Policy Programmatic Actions

This watershed-based plan does not include land use recommendations because land use planning and development decisions are the right and responsibility of watershed municipalities and counties. This plan does consider the health of Manitou Creek-Fish Lake Drain watershed lakes, streams and wetlands, which is a direct reflection of land use and management. Therefore, municipal and county consideration of land management and development impacts is necessary for effective watershed planning. Modifications and changes to local regulations and policy can have a significant influence on improving the ecological, environmental, safety and economic conditions of the watershed. Design standards, ordinances, codes and other regulatory tools are key mechanisms for implementing a vision for the watershed that will prevail into the future. The way that many codes and ordinances are written may encourage or require design approaches that unintentionally neglect preserving and enhancing watershed health. Local regulating entities are encouraged to provide incentives for design approaches, development and redevelopment standards, codes and ordinances that allow innovative watershed development that reduces flood damage, improves water quality and preserves or includes green infrastructure.

An excellent source of information on model development principles and a sample code and ordinance review worksheet can be found in *Better Site Design: A Handbook for Changing Development Rules in Your Community* (Center for Watershed Protection, 1998).

Recommended opportunities for policy and regulatory review and modification are based on stakeholder input during watershed planning meetings and specific watershed issues identified through the watershed assessment process. Issues to be addressed and opportunities include:

6.2.6.1 Development and Stormwater Runoff

Local land development standards should:

1. Allow, incentivize, and/or credit Low Impact Development standards/practices, infiltration Best Management Practices, and maintaining pre-development hydrology.
2. Offset the impact of future impervious cover to ensure that additional impervious cover does not degrade catchments
3. Reduce the rate and volume of stormwater runoff from areas that are already developed.

6.2.6.2 Pollution Prevention

1. Reduce the quantity of road salt (sodium chloride) needed for safe and cost-effective winter maintenance to reverse the current trend of rising chloride levels in water bodies. Adopt standards for the use of deicing chemicals/practices.
2. Regulate and limit the use of lawn chemicals, such as fertilizers and pesticides, and tar for seal coating asphalt surfaces.
3. Reduce phosphorus loads by watershed municipalities and the county by passing an ordinance that bans the use of fertilizer with phosphorus unless a soil test indicates it is needed.

6.2.6.3 Monitoring and Stream Maintenance

1. Develop and implement a watershed monitoring program to collect and monitor water quality and biological data on a regular basis.
2. Establish institutional stream maintenance program and standards using the American Fisheries Society standards as guidelines.

6.2.6.4 Wetlands and Floodplains

1. Maintain riparian and depressional floodplain and wetlands to maximize flood storage and conveyance.
2. Restore and create wetlands where feasible with a minimum target of 10% wetland per subwatershed.

6.2.6.5 Green Infrastructure

1. Identify and preserve open space as green infrastructure or greenways to promote flood damage reduction, water quality improvement, natural resource protection and wetland restoration.

6.2.6.6 Transportation Sustainability Practices

1. Use the Illinois Livable and Sustainable Transportation Rating System (I-LAST) Scoring System for all new roadway expansion and extension projects.
2. Use practices that reduce and treat runoff volumes from roads and parking lots (reduce pavement extent, use porous pavement where appropriate, infiltrate runoff where appropriate).
3. Transportation design should consider wildlife crossings and avoid waters and wetlands where possible.
4. Include environmentally friendly stream crossings that protect aquatic habitat.
5. Monitor and maintain Best Management Practices post-construction.
6. Conduct street sweeping and inlet cleaning.

Table 6-7: Regulatory/Policy Action Recommendations

ID	Action	Priority	Lead Partners	Supporting Partners
RP-1	Review and modify land and transportation development standards, practices, codes and ordinances for new development and redevelopment to allow and incentivize low impact development design and green infrastructure practices to reduce runoff volumes and rates and mitigate water quality impacts.	M	M, PB&D, DOT	SMC, Illinois EPA
RP-2	Encourage the use of stormwater green infrastructure BMPs for detention credit.	M	M, PB&D	SMC, Illinois EPA
RP-3	Require downspout and sump pump discharges be disconnected from the storm sewer system and be directed to rain gardens, lawns, drywells or other practices for infiltration.	M	M, PB&D	HOA, SMC, CMAP
RP-4	Regulatory agencies and units of government determine if current enforcement supports existing regulations	M	M, PB&D, DOT, SMC, Illinois EPA, IDNR, USACE	EO
RP-5	Jurisdictions with transportation maintenance authority should have an adopted winter maintenance/snow and ice removal policy that includes snow removal priorities, practices and products used. Municipalities should be encouraged to require that all chemical applicators whether public or private must be registered with the jurisdiction and have appropriate training.	H	M, DOT, T, FPD	SMC, LCHD, Illinois EPA, LCPW
RP-6	Ban the use of fertilizer with phosphorus unless a soil test indicates it is needed.	H	M, PB&D	LCHD
RP-7	Ban the use of coal tar seal-coating products.	H	M, PB&D	LCHD
RP-8	Investigate limiting or banning the use of lawn pesticides known to runoff and pollute waters.	M	M, PB&D	LCHD
RP-10	Participate in a coordinated watershed monitoring program to collect and monitor water quality and biological data on a regular basis.	H	M, C	SMC, LCHD, T, PD, Illinois EPA
RP-11	Cooperatively establish, adopt and implement stream maintenance standards in conformance with American Fishery Society guidelines.	M	SMC, M, IDNR	LCHD, FPD
RP-13	Require in-watershed mitigation for all floodplain wetland impacts.	H	SMC, USACE, IDNR	M, PB&D

ID	Action	Priority	Lead Partners	Supporting Partners
RP-14	Consider local funding alternatives for Long Lake rehabilitation measures	H	PO, LA	SMC, M
RP-15	Develop and implement roadway design standards that include environmentally friendly stream crossings that protect aquatic habitat, route roadways away from sensitive waters and wetlands where possible and consider and incorporate wildlife crossings.	M	M, DOT, T	IDNR, SMC
RP-16	Implement street-sweeping and inlet clearing programs, particularly during autumn months	M	DOT, M, T	LCHD
RP-17	Consider impervious surface coverage regulations at appropriate scales such as parcels or catchments to reduce runoff volumes new development and redevelopment.	M	M, PB&D, SMC, CMAP	USACE, IDNR, Illinois EPA, EIG, OL
RP-18	Require that developers demonstrate measures taken to minimize impervious surfaces (i.e. parking ratios, multi-level parking, permeable surface parking, reduced street widths, and sidewalks on one side of street, etc.).	M	CBL, DOT, M, T, SI, EO	SMC, Illinois EPA
RP-19	Identify, repair, or disconnect all illegal discharges (illicit storm drain and/or sump pump hookups).	H	M, T, PO, CBL, HOA, ISD	SMC, LCHD, Illinois EPA
RP-20	Expand opportunities to reduce vehicular traffic and increase alternative modes of transportation.	M	M, T, DOT	SI

6.3 SITE-SPECIFIC ACTION PLAN

Project or site-specific action items and recommendations are tied to a particular location or locations in the watershed. As with the programmatic actions, these site-specific recommendations were developed to address watershed problems, to improve watershed resources and to achieve goals and objectives. Due to the size of the planning area and sheer number of site-specific action recommendations developed during the planning process, readers of the plan are encouraged to use the ***online mapping application***. The individual recommendations are also listed in tables, organized by jurisdiction, in **Appendix A**.

During development of the watershed-based plan, many methods were used to identify specific project sites, which are outlined below:

- Direct stakeholder input.
- Detention basin inventory.
- Stream inventory and assessment.
- Lake shoreline inventory and assessment.
- Flood problem area inventory.
- Lake County Wetland Restoration & Preservation Plan (WRAPP).
- GIS analysis and water quality monitoring data.
- Previously planned projects.

NOTEWORTHY: SITE-SPECIFIC ACTIONS VS. BASIN-WIDE SITE-SPECIFIC ACTIONS

SITE-SPECIFIC ACTIONS:
Recommendations for a specific geographic location in the planning area. Sites may be represented by single points, linear features (such as stream banks), or polygons (specific areas, such as a wetland).

BASIN-WIDE SITE-SPECIFIC ACTIONS:
Recommendations that can be applied to a specific geographic location but which are generally identified across the planning area based on land use/land cover or some other "mappable" geographic characteristic. Opportunities for runoff volume reduction are an example of basin-wide site-specific actions.

The identification of specific sites suited for watershed improvement projects has been ongoing during past planning efforts in subwatersheds of the Manitou Creek-Fish Lake Drain watershed. The Manitou Creek and Fish Lake Drain watershed-based plans should be considered jointly with this regional plan. This chapter is not a comprehensive inventory of all possible projects in the Manitou Creek-Fish Lake Drain watershed; it is only intended to provide guidance on where to "kick start" implementation.

For the purposes of this plan, wetland enhancement includes only existing wetlands and restoring their natural function, efficiency and biodiversity whereas wetland restoration includes creating wetlands where they do not currently exist. Opportunity sites for flood mitigation and regionally significant storage site action recommendations are also highlighted.

This section outlines and summarizes **site-specific actions** and **basin-wide site-specific actions**. Where applicable, the action recommendations are coded by jurisdictions and project type category (Table 6-8). Individual site-specific actions and their attributes and details are available through the online web application hosted by SMC and in detailed jurisdictional tables located in **Appendix A**. Chapter 7 includes overall cost estimates, pollutant load reductions, and implementation strategies. There are over 6,000 site-specific and basin-wide site-specific action recommendations. These actions are summarized in Tables 6-9 through 6-19. If implemented, the actions would benefit about 16,500 acres and more than 27 miles of streambank and lake shoreline.

Table 6-8: Site-Specific Action Categories

Project Specific Action Category	Description
Agricultural BMPs	Actions related to improving water quality on agricultural fields by reducing nutrient inputs and reducing soil loss.
Beach Management	Actions related to improving water quality, access, and public safety at bathing beaches. Actions include local beach management plans and input from local beach managers.
Debris Jam	Debris jams are any notable issues that impede the conveyance and function of the waterway. These locations were identified by SMC staff during the stream inventories.
Detention Basin Retrofit	Detention basin retrofit recommendations are based on a basin survey completed by SMC. These projects include maintenance and actions to improve basin function.
Flood Risk Reduction	Actions that reduce probability of flooding in a specific area.
Golf Course Management	Actions that reduce water quality impacts at golf courses.
Green Infrastructure	Actions that preserve stormwater green infrastructure benefits and wetlands within open space areas.
Road Salt Management	De-icing practices that reduce water quality impacts while maintaining transportation safety.
Runoff Volume Reduction	Recommendations for installation of runoff volume reduction BMPs such as rain barrels, rain gardens, green roofs, curb and gutter cuts, permanent vegetation cover, bioswales and tree installation practices.
Stabilization	Site-specific erosion control recommendations, including severely eroding streambanks and shorelines identified from inventories.
Stakeholder Identified Projects	Actions submitted by watershed stakeholders.
Stream Restoration	Actions that improve the condition of streams such as erosion control, habitat improvements, remeandering, floodplain reconnection, and riparian vegetative restoration.
Water Infrastructure	Recommendations for non-critical infrastructure that conveys, restricts, treats, or stores water. Does not include detention basin recommendations. These locations were identified by SMC staff during various stream inventories.
Water Quality Investigation	Recommendations to identify causes of impacted water quality.
Wetland Enhancement	Recommendations to enhance existing wetlands.
Wetland Restoration	Recommendations to create new wetlands.

Table 6-9: Summary of Site-Specific Actions by Priority. ac = acre, ea = each, lf = linear feet, ln mi = linear mile, cy= cubic yards

BMP Type	Number of Projects				Units of Practice			
	H	M	L	Total	H	M	L	Total
Agricultural BMPs	9	0	0	9	309.5 ac, 2.8 ln mi	0	0	309.5 ac, 2.8 ln mi
Debris Jam	5	5	0	10	5 ea	5 ea	0	10 ea
Detention Basin Retrofit	4	8	0	12	4 ea	8 ea	0	12 ea
Flood Risk Reduction	14	2	0	16	380.8 ac, 9,260 cy, 1.6 ln mi 9 ea	2 ea	0	380.8 ac, 9,260 cy, 1.6 ln mi 11 ea
Green Infrastructure	2	0	0	2	136.3 ac	0	0	136.3 ac
Road Salt Management	72	0	0	72	180.3 ac	0	0	180.3 ac
Runoff Volume Reduction	324	0	0	324	788 ac	0	0	788 ac
Stabilization	2	81	11	94	0.4 ln mi	16.0 ln mi	3.1 ln mi	19.4 ln mi
Stakeholder Identified Projects	2	1	0	3	2 ea	1 ea	0	3 ea
Stream Restoration	2	0	2	4	1.1 ln mi	0	4.0 ln mi	5.0 ln mi
Water Infrastructure	2	11	11	24	2 ea	20 lf, 9 ea	60 lf, 7 ea	80 lf, 18 ea
Water Quality Investigation	0	1	0	1	0	1 ea	0	1 ea
Wetland Restoration	31	123	0	154	200.5 ac	217.0 ac	0	417.4 ac
Totals	**469**	**241**	**24**	**754**	**1,995.3 ac, 5.9 ln mi, 9,260 cy, 22 ea**	**217 ac, 16 ln mi, 26 ea**	**7.1 ln mi, 7 ea**	**2,212.3 ac, 29 ln mi, 55 ea, 9,260 cy**

Table 6-10: Acres of Basin-Wide Site-Specific Actions by Priority

BMP Type	Acres of Practice			
	High Priority	Medium Priority	Low Priority	Total
Agricultural BMPs	478	1,812	1,766	4,057
Beach Management	0	0	15	15
Golf Course Management	0	644	0	644
Green Infrastructure	195	799	0	994
Road Salt Management	0	3,322	0	3,322
Runoff Volume Reduction	0	352	3,435	3,787
Wetland Enhancement	298	1,659	2,289	4,246
Wetland Restoration	0	380	1,137	1,516
Total	**971**	**8,968**	**8,642**	**18,581**

6.3.1 Critical Area Actions

Critical areas are defined in Chapter 4. Actions addressing these critical areas will have added value and benefit to the Manitou Creek/Fish Lake Drain watershed. Table 6-11 summarizes the critical area categories, relevant jurisdictions, and relevant actions. Jurisdictions can reference this table to review which critical areas are relevant to them. Figure 6-1 illustrates the critical areas in map format with jurisdictional boundaries. Site specific actions that fall within critical areas are considered high priority and are attributed with this information in the online mapping system and in Appendix A.

Table 6-11: Critical Areas Summary

Critical Area Category	Jurisdictions	General Relevant Actions
Critical Areas (Pollutant Hotspot)	**Townships:** Avon, Fremont, Grant, Lake Villa, Wauconda **Municipalities:** Grayslake, Hainesville, Hawthorn Woods, Island Lake, Lakemoor, Lake Villa, Mundelein, Round Lake, Round Lake Beach, Round Lake Park, Volo **State/Forest Preserve:** Ray Lake Forest Preserve	Urban BMPs, enhance and expand green infrastructure, wetland restoration and enhancement, maintain infiltration and hydrology of catchment, stream maintenance, detention basin retrofits, monitoring
Critical Areas (Lakeshore Erosion)	**Townships:** Fremont, Grant **Municipalities:** Round Lake Park, Volo **State/Forest Preserve:** Ray Lake Forest Preserve	Stabilize eroding lake shorelines
Critical Areas (Streambank Erosion)	**Townships:** Avon, Fremont, Grant, Lake Villa **Municipalities:** Fox Lake, Lake Villa, Round Lake, Round Lake Beach, Round Lake Park **State/Forest Preserve:** Grant Woods Forest Preserve, Kestrel Ridge Forest Preserve, Lakewood Forest Preserve, Nippersink Forest Preserve, Ray Lake Forest Preserve	Stream restoration and bank/channel stabilization

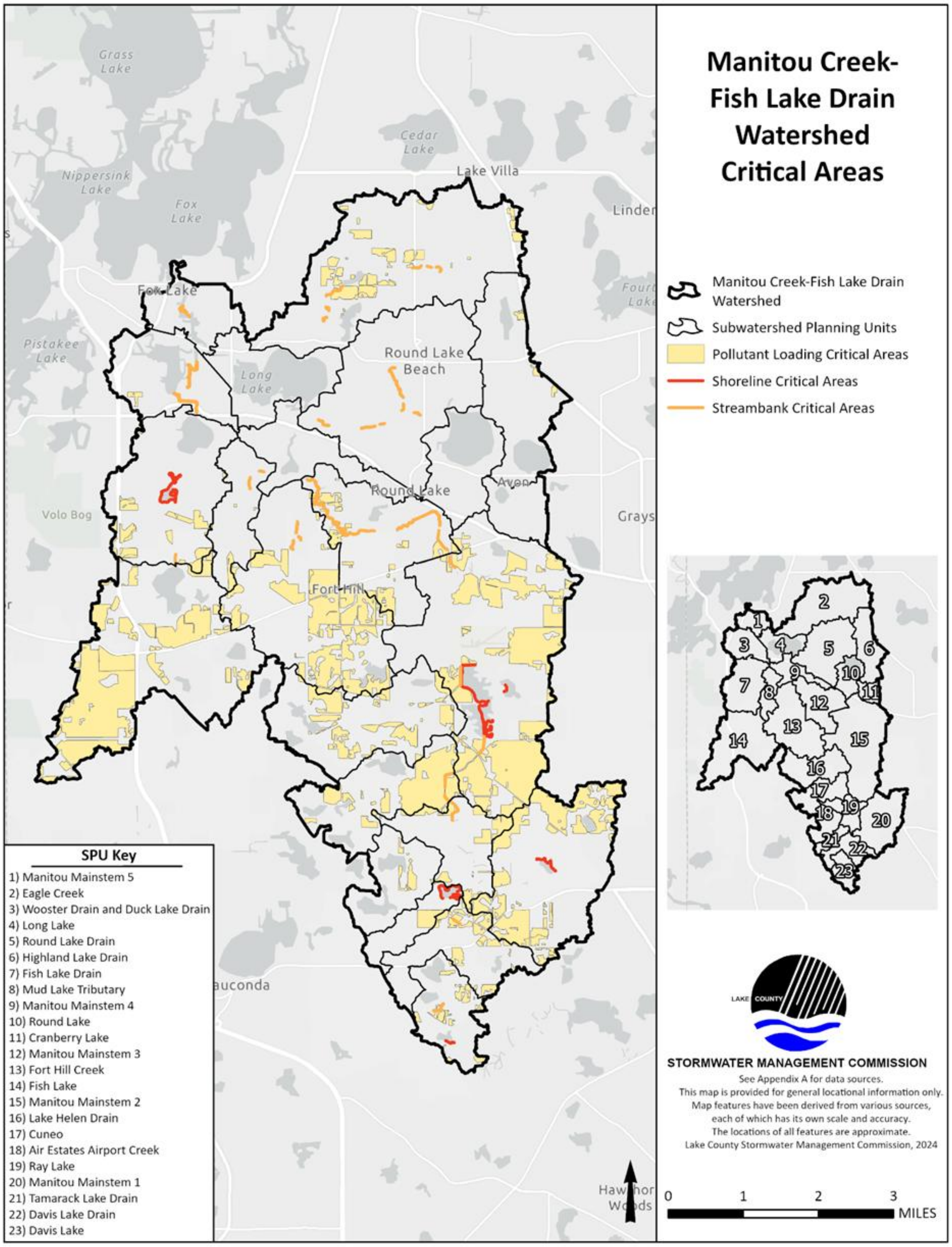

Figure 6-1: Critical Areas

6.3.2 Flood Problem Area Mitigation Actions

The Lake County Stormwater Management Commission has advanced progress towards flood mitigation efforts by inventorying and maintaining a database of flood problem areas as reported by watershed residents and stakeholders. Maps of and summary information on flood problem areas are included in **Chapter 5**. This chapter intends to guide direct actions to address flood problems. There are 83 known flood problem areas in the watershed and 131 locations were identified as impacted by the July 2017 flood event (Table 6-12). It is not within the scope or objectives of this plan to assess each individual problem and propose specific mitigation actions, however it is important to enable jurisdictions and stakeholders to better understand the problems to address and prioritize actions. The flood problem area data was reviewed, and a planning-level GIS analysis was applied to guide and focus actions.

The action recommendations and priorities were developed primarily from discussions with municipalities and other stakeholders. In some cases, concept plans and budget estimates have been developed for these actions by stakeholders. Based on the number of flood problem area inventory sites and the number of locations affected by other storm/flood events, there are clearly additional remedial actions needed in the planning area.

Table 6-12: Flood Problems and Flood Risk Reduction Actions by Priority

Subwatershed	Flood Problem Area Inventory Sites	July 2017 Flood Incidents	Number of Actions		
			H	M	L
Fish Lake Drain	9	18	0	0	0
Manitou Creek	74	113	14	2	0
Total:	**83**	**131**	**14**	**2**	**0**

6.3.2.1 Approach to Flood Mitigation Actions

Field reconnaissance is necessary to first evaluate sites; this would be followed by a detailed flood study or drainage analysis in combination with some level of engineering design and property owner(s) input to define alternatives and the most feasible mitigation measures for a specific problem area.

Flood problems are often complex and require specialized expertise; numerical modeling is sometimes necessary to adequately understand and diagnose the problem and design solutions. Flood mitigation activities also require a comprehensive understanding of regulations, local ordinances, and floodplain management. Professional engineers, certified floodplain managers, and stormwater managers need to be engaged in addressing flooding problems and the design of mitigation solutions.

An important action recommendation is to avoid a strict focus of directly addressing flood problems alone; a more holistic approach should be adopted to consider the flood problem locations and integrating these issues into all planning, permitting, development, and infrastructure processes so that the issues can potentially be addressed, and precautions can be taken so the problems do not worsen. It is also important to consider the toolbox of programmatic recommendations, preventative mitigation strategies and industry standard structural and non-structural flood mitigation best practices which are discussed in Chapter 5.

Section 6.3.4 defines actions based on jurisdictions, and **Appendix A** includes supporting details for each of the sites.

6.3.3 Potential Wetland Enhancement and Restoration Sites

As described in Chapter 3, the WRAPP identified specific opportunities for the enhancement of existing wetlands and the restoration of wetlands or those that are potentially restorable. These wetlands were evaluated, based on priority and developed into site-specific and basin-wide site-specific actions; the WRAPP provided scoring totals from which to select high priority sites. Existing wetlands, suitable for enhancement are summarized below based on their priority. As with restoration, the WRAPP dataset provided scoring totals from which to select high priority enhancement sites.

6.3.3.1 Wetland Enhancement

Wetland enhancement can be described as those existing wetlands that could benefit from remedial actions that enhance their extent or function. The WRAPP identifies 4,246 acres of existing wetland in the watershed. In general, for the purposes of this study, wetland restoration was considered a higher priority within the plan than wetland enhancement. Therefore, wetland enhancement areas were generally categorized as medium or low priority, leaving high priority areas to wetland restoration and some wetlands enhancements in key areas.

While nearly all wetlands in the watershed would likely benefit from some enhancement or management activity, 298 acres can be considered high priority for enhancement; this represents 7% of the total acreage. Wetlands located within proposed restoration areas are considered high priority for enhancements and restorations. Medium priority was assigned to wetlands located in other forest preserves and open spaces, near creeks or streams, and to other large contiguous wetlands. Wetlands not located in these critical areas were classified as low priority. The wetland enhancement recommendations within the watershed are summarized in Table 6-13 and mapped in Figure 6-2.

Table 6-13: Wetland Enhancement Actions by Priority

Subwatershed	Acres of Wetland Enhancement Recommendations			
	High Priority	Med. Priority	Low Priority	Total
Fish Lake Drain	0	418	315	733
Manitou Creek	298	1,241	1,974	3,513
Total	**298**	**1,659**	**2,289**	**4,246**

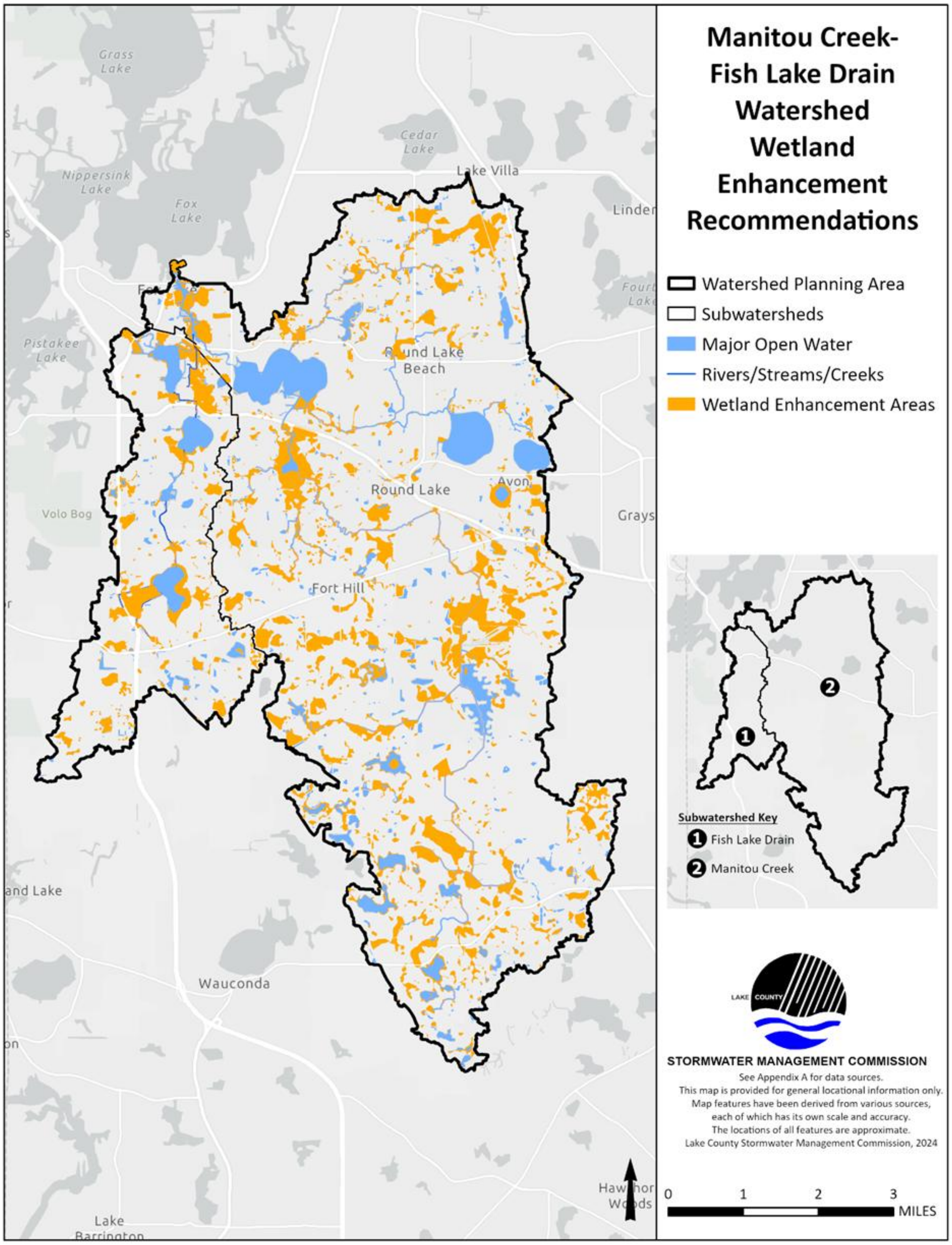

Figure 6-2: Wetland Enhancement Recommendations

6.3.3.2 Wetland Restoration

Wetland restoration locations are predictors of the best places to attempt wetland restoration based on historic wetland conditions and existing land use/land cover, although not necessarily specific land management practices or behaviors. Expected annual load reductions were generated for the footprint of each location.

The watershed contains a total of 1,934 acres of potentially restorable wetlands. Prioritization was determined by weighing the estimated functional significance ratings for each wetland. The weighting criteria are enumerated in Appendix G. Approximately 79% of wetland restoration opportunities are in the Manitou Creek subwatershed, a result of the difference in the density of urban development and agriculture in the subwatershed and the overall scale of the subwatershed itself. All high priority wetland restoration recommendations are in the Manitou Creek subwatershed. High priority was assigned to wetland restoration projects located in proposed forest preserve restoration areas and part of large wetland complexes. Medium priority was assigned to potential projects located within or near floodway and floodplain boundaries. Table 6-14 and Figure 6-3 show the distribution of potential wetland restoration sites.

Potential wetland restoration sites are also distributed within critical area catchments. A total of 1,292 acres of potential wetland restoration are in critical area catchments; representing 67% of total potential restoration acres. The Manitou Creek subwatershed has the most acreage of potential wetland restoration in critical catchments (Table 6-15).

Table 6-14: Acres of Wetland Restoration Actions by Priority

Subwatershed	Acres of Wetland Restoration Recommendations			
	High Priority	Med. Priority	Low Priority	Total
Fish Lake Drain	0	276	134	410
Manitou Creek	200	320	1,003	1,524
Total	**200**	**597**	**1,137**	**1,934**

Table 6-15: Acres of Wetland Restoration Actions in Critical Areas

Subwatershed	Acres of Critical Area Wetland Restoration Recommendations
Fish Lake Drain	342
Manitou Creek	950
Total	**1,292**

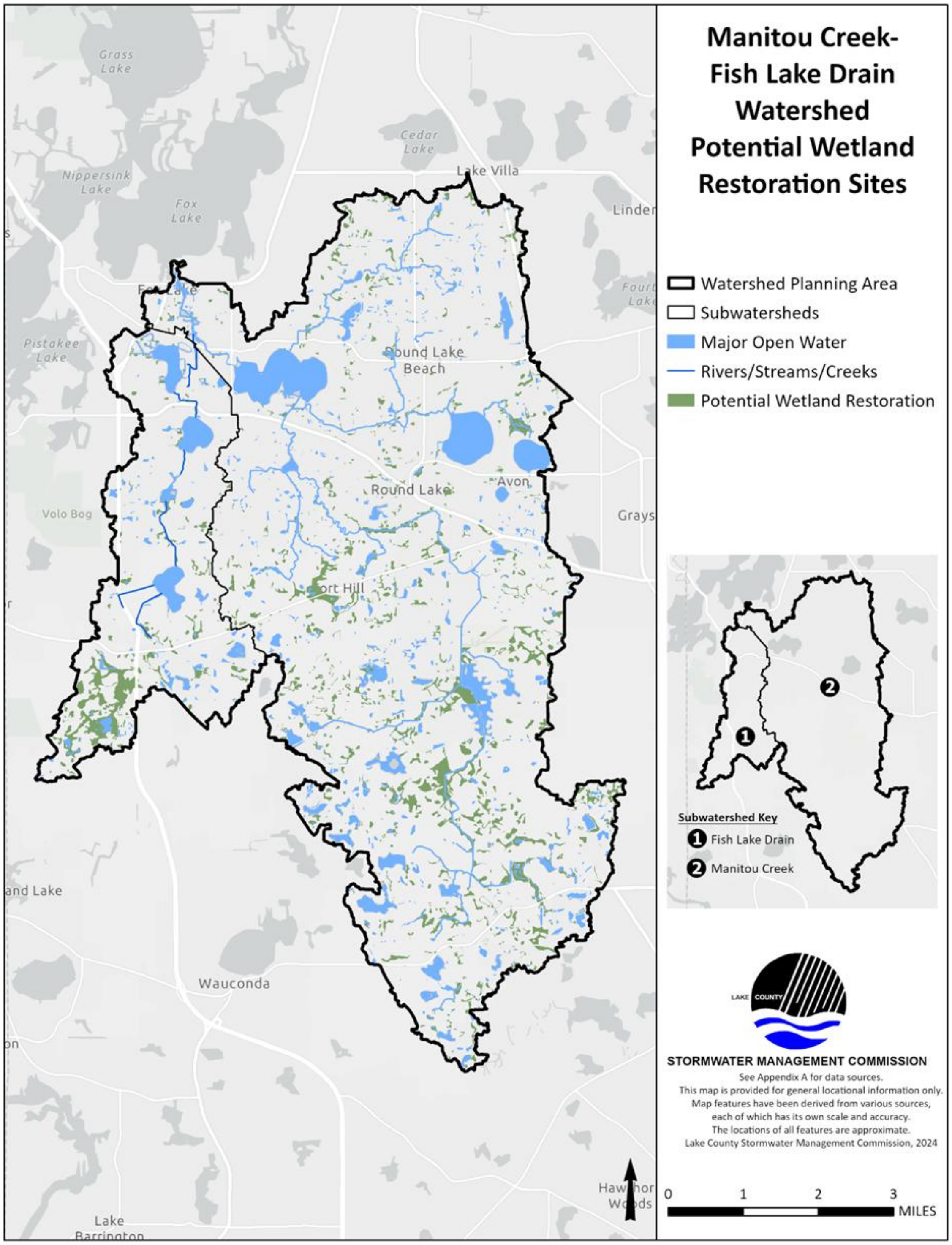

Figure 6-3: Wetland Restoration Recommendations

6.4 ACTIONS BY JURISDICTION

The following section summarizes site-specific actions and basin-wide site-specific action recommendations for each jurisdictional area within the watershed. Due to the large number of practices, specific details on individual actions are included in Appendix A and available through the Lake County Stormwater Management Commission (SMC) web application. Appendix A includes tables containing specific actions by jurisdiction and include unique action item codes, BMP type, description, subwatershed, quantities and units, cost estimates (if applicable), implementation priority and timeline, critical catchment status, plan goals addressed, lead and supporting partners and load reductions, if applicable.

6.4.1 Site-Specific Actions

Site-specific actions are comprised of project recommendations and are based on lake and stream inventories and coordination with stakeholders. The practice applies to a single specific geographic location. This section also includes stakeholder recommendations tied to a physical location. Table 6-16 summarizes all actions by jurisdiction. Figure 6-4 shows the location of all site-specific practices.

Table 6-16: Number of Site-Specific Actions by Jurisdiction. Site-Specific Actions that Span Multiple Jurisdictions are Included in Project Counts for Each Jurisdiction in Project Area

Jurisdiction	Agricultural BMPs	Debris Jam	Detention Basin Retrofit	Flood Risk Reduction	Green Infrastructure	Road Salt Management	Runoff Volume Reduction	Stabilization	Stakeholder Identified Action	Stream Restoration	Water Infrastructure	Water Quality Investigation	Wetland Restoration
Avon Township	1	2	--	2	--	--	--	8	--	1	1	--	11
Fremont Township	4	1	--	1	2	4	--	12	1	2	6	--	79
Grant Township	--	1	--	1	--	2	15	15	--	1	2	--	5
Lake Villa Township	--	--	--	--	--	--	--	5	--	1	--	--	6
Wauconda Township	--	--	--	--	--	2	--	--	--	--	--	--	9
Village of Fox Lake	--	--	--	--	--	--	10	2	--	--	--	--	--
Village of Grayslake	1	--	--	--	--	--	2	--	--	--	--	--	--
Village of Hainesville	4	--	--	--	--	--	11	1	--	--	--		--
Village of Hawthorn Woods	--	--	1	--	--	--	--	--	--	--	--	--	--
Village of Island Lake	--	--	--	--	--	--	--	--	--	--	--	--	--
Village of Lake Villa	--	--	1	--	--	2	13	5	--	--	--	--	4
Village of Lakemoor	--	--	--	--	--	13	3	--	--	--	--	--	--
Village of Mundelein	--	--	--	--	--	9	13	--	--	--	--	--	--
Village of Round Lake	--	2	4	3	--	1	81	15	1	1	2	1	25
Village of Round Lake Beach	--	3	1	8	--	23	123	22	--	--	1	--	5
Village of Round Lake Heights	--	--	2	1	--	--	20	--	--	--	--	--	1
Village of Round Lake Park	3	--	--	2	--	--	15	14	1	--	10	--	1
Village of Volo	--	1	3	--	--	16	18	2	--	--	2	--	12
Village of Wauconda	--	--	--	--	--	--	--	--	--	--	--	--	--

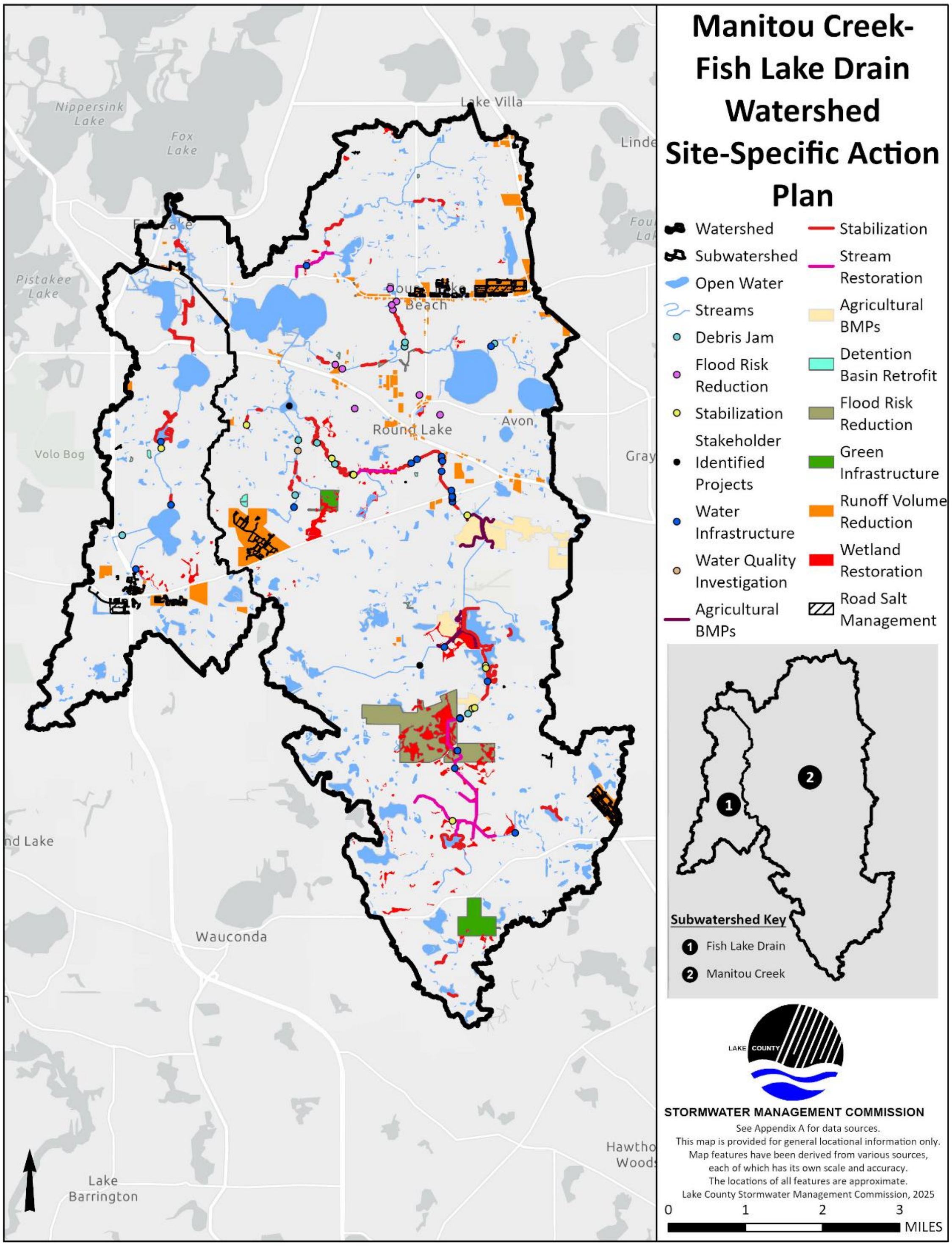

Figure 6-4: Site-Specific Recommendations

6.4.2 Basin-Wide Site-Specific Actions

Basin-wide site-specific actions are comprised of project recommendations that are generally identified across the planning area based on land use/land cover or some other mapped geography. Thus, the recommended practice applies to any site within the mapped geography. Table 6-17 summarizes basin-wide site-specific actions by jurisdiction. A detailed table of each individual action item is in Appendix A. Figure 6-5 shows the location of all basin-wide site-specific action recommendations.

Table 6-17: Acres of Basin-Wide Site-Specific BMPs by Jurisdiction Actions that span multiple jurisdictions are included in project summaries for each jurisdiction in project area.

Jurisdiction	Agricultural BMPs	Beach Management	Golf Course Management	Green Infrastructure	Road Salt Management	Runoff Volume Reduction	Wetland Enhancement	Wetland Restoration
Avon Township	442	--	--	3	415	273	111	99
Fremont Township	1,676	--	254	29	500	296	1,235	530
Grant Township	333	6	--	5	505	353	667	108
Lake Villa Township	150	--	26	--	34	58	70	43
Wauconda Township	721	--	163	0.2	64	25	169	293
Village of Fox Lake	--	4	--	--	56	139	100	18
Village of Grayslake	92	--	--	19	6	50	16	38
Village of Hainesville	63	--	--	135	21	128	384	35
Village of Hawthorn Woods	247	--	27	--	0.1	38	60	67
Village of Island Lake	4	--	--	--	--	0.2	--	--
Village of Lake Villa	81	--	--	78	209	208	246	49
Village of Lakemoor	521	--	--	--	7	53	39	122
Village of Mundelein	--	--	33	--	9	95	82	14
Village of Round Lake	128	1	--	195	421	563	590	143
Village of Round Lake Beach	15	1	140	267	558	735	232	93
Village of Round Lake Heights	--	--	--	78	70	85	40	12
Village of Round Lake Park	318	2	--	30	171	326	47	39
Village of Volo	919	1	--	139	275	298	152	284
Village of Wauconda	--	--	--	16	1	67	47	17

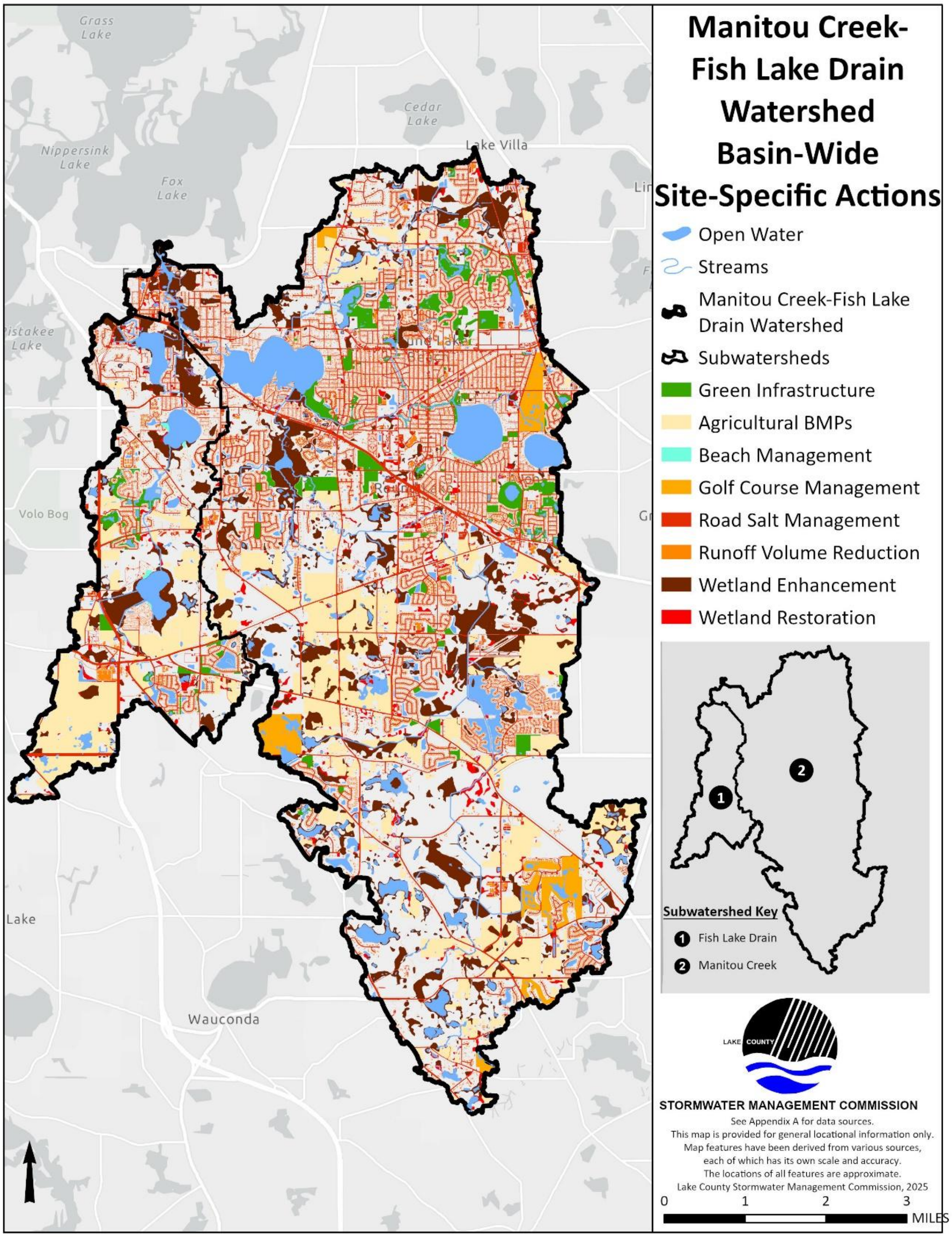

Figure 6-5: Basin-Wide Site-Specific Recommendations

6.5 LAKE ACTIONS

Lake-specific actions include programmatic, planning, and BMP recommendations (Table 6-18). Similar to the other types of action recommendations in this plan, lake actions have been given a unique ID, priority, time frame for implementation, lead partners are identified, and estimated cost is provided. Lakes with site-specific action recommendations are shown in Figure 6-6 and site-specific actions are listed in Table 6-19. Lake action recommendations are also included in the online mapping application for the Manitou Creek-Fish Lake Drain Watershed-Based Plan. This section identifies actions planning area lakes and is largely based on data and recommendations identified in Lake County Health Department Lake Reports.

Table 6-18: Summary of Site-Specific Lake Action Recommendations

Priority	Number of Actions	Estimated Cost
High	77	$11,403,067
Medium	42	$140,000
Low	27	$54,700
Total	**146**	**$11,597,767**

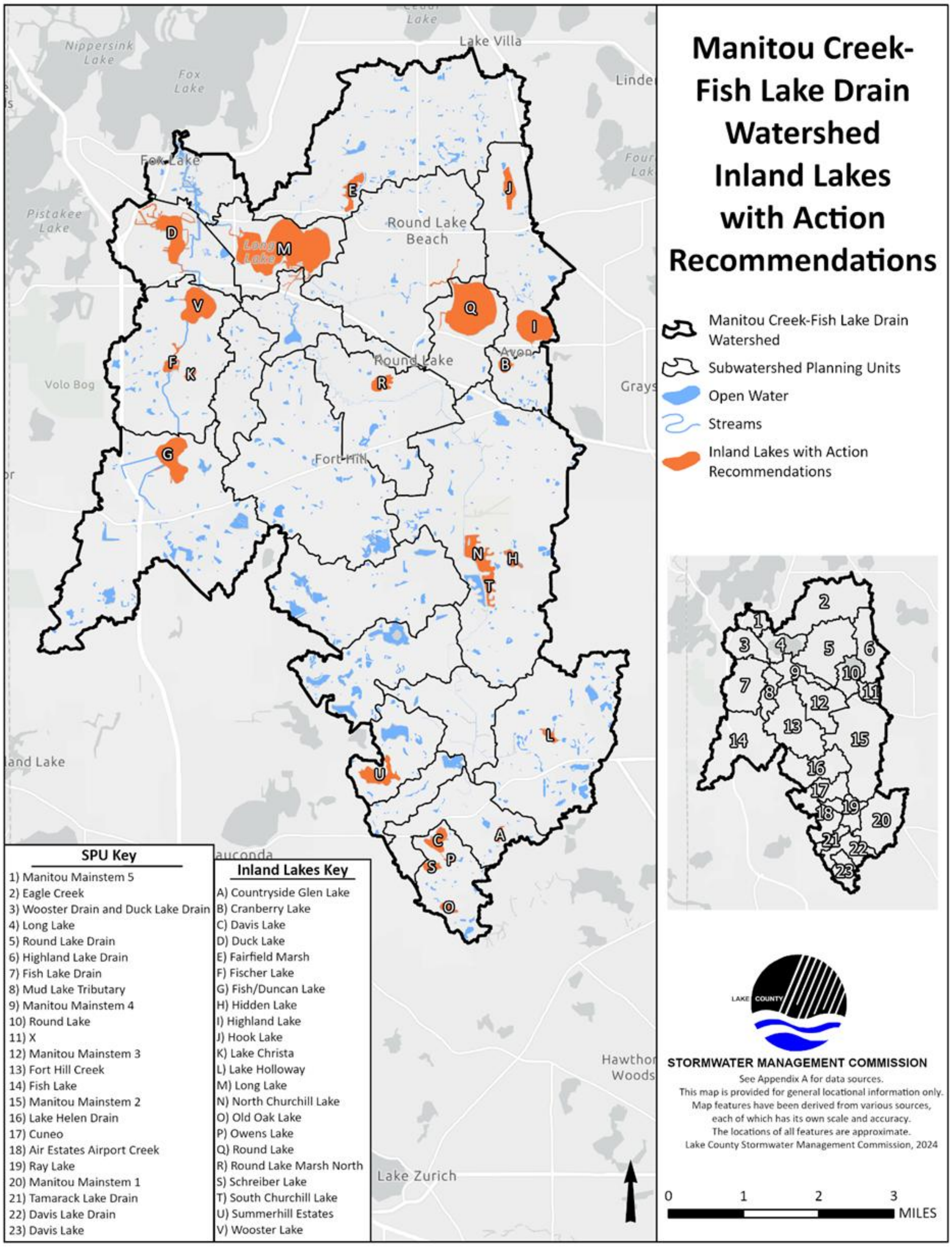

Figure 6-6: Lakes with Recommended Actions

Table 6-19: Recommended Lake Actions

Lake Name	Plan ID	Recommended Actions	Priority	Time Frame	Lead Partner(s)	Cost
Countryside Glen Lake	LK1	Update Lake Report and monitoring data (Most recent report is >10 years old).	H	M	LCHD	N/A
Countryside Glen Lake	LK2	Install staff gage or water level logger and monitor regularly.	M	M	HOA, LCFPD	$500
Countryside Glen Lake	LK3	Reduce turf grass fertilizer use in surrounding areas.	M	M	HOA, LCFPD	N/A
Countryside Glen Lake	LK4	Create a bathymetric map.	L	L	HOA, LCFPD	$2,000 - $5,000
Countryside Glen Lake	LK5	Reduce road salt use in the lake's watershed.	M	M	HOA, LCFPD	N/A
Countryside Glen Lake	LK6	Stabilize shoreline erosion using naturalized buffer strips or other soft stabilization BMP's where it is feasible and targeted hard stabilization BMP's where needed.	H	M	HOA, LCFPD	$150 - $400 per linear foot
Countryside Glen Lake	LK7	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	HOA, LCFPD	$200
Cranberry Lake	LK8	Update Lake Report and monitoring data (Most recent report is >10 years old).	H	M	LCHD	N/A
Cranberry Lake	LK9	Reduce road salt use in the lake's watershed.	M	M	M	N/A
Cranberry Lake	LK10	Minimize fertilizer use in the watershed.	M	M	M	N/A
Davis Lake	LK11	Update Lake Report and monitoring data (Most recent report is >10 years old).	H	M	LCHD	N/A
Davis Lake	LK12	Reduce road salt use in the lake's watershed.	M	M	LCFPD, PO	N/A
Davis Lake	LK13	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	LCFPD, PO	$200
Davis Lake	LK14	Reduce fertilizer use in surrounding areas.	M	M	PO	N/A
Davis Lake	LK15	Remove invasive vegetation from riparian buffer.	H	S	LCFPD, PO	$1,200 - $4,000 per acre
Davis Lake	LK16	Implement sediment reduction BMPs within the watershed.	M	L	LCFPD, PO	N/A

Lake Name	Plan ID	Recommended Actions	Priority	Time Frame	Lead Partner(s)	Cost
Duck Lake	LK17	Reduce carp populations.	M	M	DLWA, PO	$6,000 - $10,000
Duck Lake	LK18	Install staff gage.	M	M	DLWA, PO	$500
Duck Lake	LK19	Develop and implement an aquatic plant management plan.	H	M	DLWA, PO	$15,000 - $30,000
Duck Lake	LK20	Develop and implement a lake management plan.	H	M	DLWA, PO	$15,000 - $30,000
Duck Lake	LK21	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	DLWA, PO	$200
Duck Lake	LK22	Install signs to raise awareness of ways to reduce the spread of aquatic invasive species.	L	L	DLWA, PO	$300
Duck Lake	LK23	Reduce road salt use in the lake's watershed.	M	M	DLWA, PO	N/A
Duck Lake	LK24	Monitor lake for harmful algal blooms (HAB) and notify LCHD when HABs are identified.	H	M	DLWA, PO	N/A
Duck Lake	LK25	Increase riparian buffer width to at least 25 feet where feasible.	H	S	DLWA, PO	$1,200 - $4,000 per acre
Duck Lake	LK26	Conduct fish survey.	L	L	DLWA, PO, IDNR	$3,000 - $5,000
Fairfield Marsh	LK27	Develop and implement an aquatic and terrestrial plant management plan.	M	M	M, PD, PO	$15,000 - $30,000
Fairfield Marsh	LK28	Update Lake Report and monitoring data (Most recent report is >10 years old).	H	M	LCHD	N/A
Fairfield Marsh	LK29	Reduce carp populations.	M	M	M, PD, PO	$6,000 - $10,000
Fischer Lake	LK30	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	M, PO	$200
Fischer Lake	LK31	Create a bathymetric map.	L	L	M, PO	$2,000 - $5,000
Fischer Lake	LK32	Reduce road salt use in the lake's watershed.	M	M	M, PO	N/A
Fischer Lake	LK33	Develop and implement an aquatic plant management plan.	H	M	M, PO	$15,000 - $30,000
Fischer Lake	LK34	Conduct fish survey.	L	L	M, PO, IDNR	$3,000 - $5,000

Lake Name	Plan ID	Recommended Actions	Priority	Time Frame	Lead Partner(s)	Cost
Fischer Lake	LK35	Increase riparian buffer width to at least 25 feet where feasible.	H	S	M, PO	$1,200 - $4,000 per acre
Fischer Lake	LK36	Develop and implement a lake management plan.	H	M	M, PO	$15,000 - $30,000
Fischer Lake	LK37	Install "No Feeding Waterfowl" signs.	L	L	M, PO	$300
Fish Lake	LK38	Reduce carp populations.	M	M	LCFPD, PO	$6,000 - $10,000
Fish Lake	LK39	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	LCFPD, PO	$200
Fish Lake	LK40	Install signs to raise awareness of ways to reduce the spread of aquatic invasive species.	L	L	LCFPD, PO	$300
Fish Lake	LK41	Reduce road salt use in the lake's watershed.	M	M	LCFPD, PO	N/A
Fish Lake	LK42	Install staff gage.	M	M	LCFPD, PO	$500
Fish Lake	LK43	Monitor lake for harmful algal blooms (HAB) and notify LCHD when HABs are identified.	H	M	LCFPD, PO	N/A
Fish Lake	LK44	Develop and implement a lake management plan.	H	M	LCFPD, PO	$15,000 - $30,000
Fish Lake	LK45	Develop and implement an aquatic plant management plan.	H	M	LCFPD, PO	$15,000 - $30,000
Fish Lake	LK46	Conduct fish survey.	L	L	LCFPD, PO, IDNR	$3,000 - $5,000
Hidden Lake	LK47	Update Lake Report and monitoring data (Most recent report is >10 years old).	H	M	LCHD	N/A
Hidden Lake	LK48	Develop and implement an aquatic plant management plan.	H	M	HOA	$15,000 - $30,000
Hidden Lake	LK49	Reduce carp populations.	M	M	HOA	$6,000 - $10,000
Hidden Lake	LK50	Stabilize shoreline erosion using naturalized buffer strips or other soft stabilization BMP's where it is feasible and targeted hard stabilization BMP's where needed.	H	M	HOA	$150 - $400 per linear foot
Hidden Lake	LK51	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	HOA	$200

Lake Name	Plan ID	Recommended Actions	Priority	Time Frame	Lead Partner(s)	Cost
Hidden Lake	LK52	Update bathymetric map.	L	L	HOA	$2,000 - $5,000
Hidden Lake	LK53	Increase wildlife habitat.	L	L	HOA	$500-$3,000
Hidden Lake	LK54	Develop and implement a nutrient management plan.	H	M	HOA	$15,000 - $30,000
Hidden Lake	LK55	Remove invasive vegetation from riparian buffer.	H	S	HOA	$1,200 - $4,000 per acre
Highland Lake	LK56	Develop and implement a lake and aquatic plant management plan.	H	M	HOA, PO	$15,000 - $30,000
Highland Lake	LK57	Install 25 ft buffer strips where feasible.	H	S	HOA, PO	$1,200 - $4,000 per acre
Highland Lake	LK58	Update fish survey and stocking recommendations.	M	L	IDNR, HOA, PO	$7,000 - $10,000
Highland Lake	LK59	Continue zebra mussel monitoring and participation in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	HOA, PO	$50 - $1,400
Highland Lake	LK60	Update bathymetric map.	L	L	HOA, PO	$2,000 - $5,000
Highland Lake	LK61	Keep accurate records of management activities and lake observations.	L	S	HOA	N/A
Highland Lake	LK62	Increase wildlife habitat.	L	L	HOA, PO	$500-$3,000
Hook Lake	LK63	Update Lake Report and monitoring data (Most recent report is >10 years old).	H	M	LCHD	N/A
Hook Lake	LK64	Reduce road salt use in the lake's watershed.	M	M	PD, M	N/A
Hook Lake	LK65	Create a bathymetric map.	L	L	PD, M	$2,000 - $5,000
Hook Lake	LK66	Develop and implement an aquatic plant management plan.	H	M	PD, M	$15,000 - $30,000
Hook Lake	LK67	Develop and implement a fisheries management plan.	M	L	IDNR, PD, M	$7,000 - $10,000
Hook Lake	LK68	Consider management methods that discourage geese from congregating around the lake.	M	S	PD, M	$500-$3,000

Lake Name	Plan ID	Recommended Actions	Priority	Time Frame	Lead Partner(s)	Cost
Hook Lake	LK69	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	PD, M	$200
Lake Christa	LK70	Update Lake Report and monitoring data (Most recent report is >10 years old).	H	M	LCHD	N/A
Lake Christa	LK71	Minimize fertilizer use in the watershed.	M	M	PO	N/A
Lake Christa	LK72	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	PO	$200
Lake Christa	LK73	Develop and implement an aquatic and terrestrial plant management plan.	M	M	PO	$15,000 - $30,000
Lake Christa	LK74	Create a bathymetric map.	L	L	PO	$2,000 - $5,000
Lake Christa	LK75	Stabilize shoreline erosion using naturalized buffer strips or other soft stabilization BMP's where it is feasible and targeted hard stabilization BMP's where needed.	H	M	PO	$150 - $400 per linear foot
Lake Christa	LK76	Increase wildlife habitat.	L	L	PO	$500-$3,000
Lake Holloway	LK77	Update Lake Report and monitoring data (Most recent report is >10 years old).	H	M	LCHD	N/A
Lake Holloway	LK78	Develop and implement an aquatic plant management plan.	H	M	PO	$15,000 - $30,000
Lake Holloway	LK79	Create a bathymetric map.	L	L	PO	$2,000 - $5,000
Lake Holloway	LK80	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	PO	$200
Lake Holloway	LK81	Stabilize shoreline erosion using naturalized buffer strips or other soft stabilization BMP's where it is feasible and targeted hard stabilization BMP's where needed.	H	M	PO	$150 - $400 per linear foot
Lake Holloway	LK82	Remove invasive vegetation from riparian buffer.	H	S	PO	$1,200 - $4,000 per acre

Lake Name	Plan ID	Recommended Actions	Priority	Time Frame	Lead Partner(s)	Cost
Long Lake	LK83	Increase frequency of Lake Report and monitoring data updates.	H	M	LCHD	N/A
Long Lake	LK84	Minimize fertilizer use in the watershed.	M	M	LLISA, PD, IDNR, LCFPD, HOA, PO	N/A
Long Lake	LK85	Reduce road salt use in the lake's watershed.	M	M	LLISA, PD, IDNR, LCFPD, HOA, PO	N/A
Long Lake	LK86	License beaches that are servicing 5 or more households.	H	S	LLISA, PD, IDNR, LCFPD, HOA, PO	N/A
Long Lake	LK87	Develop and implement an aquatic plant management plan.	H	M	LLISA, PD, IDNR, LCFPD, HOA, PO	$15,000 - $30,000
Long Lake	LK150	Develop, implement, and update a fisheries management plan including stocking or removal recommendations (including carp removal) if appropriate.	M	M	LLISA, PO	N/A
Long Lake	LK151	Develop and implement a nutrient management plan that identifies the most effective and feasible BMPs to reduce nutrient loading, nutrient cycling, and the occurrence of harmful algal blooms and excessive algal growth. Sediment sampling is recommended as part of the plan development process. Plan development should include local stakeholder outreach to ensure locally preferred BMPs are included in the BMP assessment process.	M	M	LLISA, PO	N/A
Long Lake	LK152	Consider alternatives to steel seawalls that reduce wave energy and turbidity.	L	L	LLISA, PO	N/A
Long Lake	LK900	Install flow meters on Manitou, Eagle, and Round Lake creeks to understand flow through the watershed into Long Lake and mitigate flood impacts.	H	M	LLISA, PO	N/A
North Churchill Lake	LK88	Develop and implement a nutrient management plan.	H	M	HOA	$15,000 - $30,000

Lake Name	Plan ID	Recommended Actions	Priority	Time Frame	Lead Partner(s)	Cost
North Churchill Lake	LK89	Update Lake Report and monitoring data (Most recent report is >10 years old).	H	M	HOA	N/A
North Churchill Lake	LK90	Update fish survey and stocking recommendations.	M	L	IDNR, HOA	$7,000 - $10,000
North Churchill Lake	LK91	Install 25 ft buffer strips where feasible.	H	S	HOA	$1,200 - $4,000 per acre
North Churchill Lake	LK92	Create a bathymetric map.	L	L	HOA	$2,000 - $5,000
North Churchill Lake	LK93	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	HOA	$200
North Churchill Lake	LK94	Stabilize shoreline erosion using naturalized buffer strips or other soft stabilization BMP's where it is feasible and targeted hard stabilization BMP's where needed.	H	M	HOA	$150 - $400 per linear foot
North Churchill Lake	LK95	Develop and implement an aquatic plant management plan.	H	M	HOA	$15,000 - $30,000
North Churchill Lake	LK96	Reduce carp populations.	M	M	HOA	$6,000 - $10,000
Old Oak Lake	LK97	Update Lake Report and monitoring data (Most recent report is >10 years old).	H	M	LCHD	N/A
Old Oak Lake	LK98	Create a bathymetric map.	L	L	PO	$2,000 - $5,000
Old Oak Lake	LK99	Develop and implement an aquatic plant management plan.	H	M	PO	$15,000 - $30,000
Old Oak Lake	LK100	Reduce carp populations.	M	M	PO	$6,000 - $10,000
Old Oak Lake	LK101	Remove invasive vegetation from riparian buffer.	H	S	PO	$1,200 - $4,000 per acre
Old Oak Lake	LK102	Conduct fish survey.	L	L	IDNR, PO	$3,000 - $5,000
Old Oak Lake	LK103	Increase wildlife habitat.	L	L	PO	$500-$3,000

Lake Name	Plan ID	Recommended Actions	Priority	Time Frame	Lead Partner(s)	Cost
Old Oak Lake	LK104	Reduce road salt use in the lake's watershed.	M	M	PO	N/A
Old Oak Lake	LK105	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	PO	$200
Owens Lake	LK106	Update Lake Report and monitoring data (Most recent report is >10 years old).	H	M	LCHD	N/A
Owens Lake	LK107	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	LCFPD	$200
Owens Lake	LK108	Minimize fertilizer use in the watershed.	M	M	LCFPD	N/A
Owens Lake	LK109	Reduce road salt use in the lake's watershed.	M	M	LCFPD	N/A
Owens Lake	LK110	Encourage regular septic system maintenance within the watershed.	M	S	LCFPD	$1,500
Owens Lake	LK111	Create a bathymetric map.	L	L	LCFPD	$2,000 - $5,000
Owens Lake	LK112	Implement sediment reduction BMPs within the watershed.	M	L	LCFPD	N/A
Round Lake	LK113	Develop and implement a lake and aquatic plant management plan.	H	M	M, HOA, PO	$15,000 - $30,000
Round Lake	LK114	Encourage homeowners to incorporate native plants in their landscaping through rain gardens or riparian buffers.	M	S	M, HOA, PO	$1,500
Round Lake	LK115	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	M, HOA, PO	$200
Round Lake	LK153	Develop, implement, and update a fisheries management plan including stocking or removal recommendations (including carp removal) if appropriate	M	M	PO	N/A
Round Lake Marsh North	LK116	Update Lake Report and monitoring data (Most recent report is >10 years old).	H	M	LCHD	N/A

Lake Name	Plan ID	Recommended Actions	Priority	Time Frame	Lead Partner(s)	Cost
Round Lake Marsh North	LK117	Determine if recreational designated use and impairment is appropriate for shallow marsh environment in Round Lake Marsh North.	H	L	Illinois EPA, IDNR, LCHD	N/A
Round Lake Marsh North	LK118	Remove invasive vegetation from riparian buffer.	H	S	LCFPD	$1,200 - $4,000 per acre
Schreiber Lake	LK119	Update Lake Report and monitoring data (Most recent report is >10 years old).	H	M	LCHD	N/A
Schreiber Lake	LK120	Determine if recreational impairment is appropriate for this lake. According to lake report impairment is based on plant coverage which is beneficial for this lake.	H	L	Illinois EPA, IDNR, LCHD	N/A
Schreiber Lake	LK121	Monitor and manage Eurasian Watermilfoil in the lake. Care should be taken to ensure management actions do not negatively impact the high quality aquatic vegetation in the lake.	H	M	LCFPD	$3,200 - $10,000 annually
South Churchill Lake	LK122	Update Lake Report and monitoring data (Most recent report is >10 years old).	H	M	HOA, UT	N/A
South Churchill Lake	LK123	Develop and implement a nutrient management plan.	H	M	HOA, UT	$15,000 - $30,000
South Churchill Lake	LK124	Update fish survey and stocking recommendations.	M	L	IDNR, HOA, UT	$7,000 - $10,000
South Churchill Lake	LK125	Establish native buffer.	H	S	HOA, UT	$1,200 - $4,000 per acre
South Churchill Lake	LK126	Create a bathymetric map.	L	L	HOA, UT	$2,000 - $5,000
South Churchill Lake	LK127	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	HOA, UT	$200

Lake Name	Plan ID	Recommended Actions	Priority	Time Frame	Lead Partner(s)	Cost
South Churchill Lake	LK128	Stabilize shoreline erosion using naturalized buffer strips or other soft stabilization BMP's where it is feasible and targeted hard stabilization BMP's where needed.	H	M	HOA, UT	$150 - $400 per linear foot
South Churchill Lake	LK129	Develop and implement an aquatic plant management plan.	H	M	HOA, UT	$15,000 - $30,000
South Churchill Lake	LK130	Reduce carp populations.	M	M	HOA, UT	$6,000 - $10,000
Summerhill Estates	LK131	Develop and implement a lake and aquatic plant management plan.	H	M	LCFPD, PO	$15,000 - $30,000
Summerhill Estates	LK132	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	LCFPD, PO	$200
Summerhill Estates	LK133	Conduct fish survey.	L	L	LCFPD, PO	$3,000 - $5,000
Summerhill Estates	LK134	Install a riparian buffer (minimum width of 25 ft) on residential properties where feasible along the lake.	H	S	LCFPD, PO	$1,200 - $4,000 per acre
Wooster Lake	LK135	Participate in the Illinois EPA Volunteer Lake Monitoring Program.	H	S	WLWA, PO, HOA, LA	$200
Wooster Lake	LK136	Install signs to raise awareness of ways to reduce the spread of aquatic invasive species.	L	L	WLWA, PO, HOA, LA	$300
Wooster Lake	LK137	Reduce road salt use in the lake's watershed.	M	M	WLWA, PO, HOA, LA	N/A
Wooster Lake	LK138	Install staff gage.	M	M	WLWA, PO, HOA, LA	$500
Wooster Lake	LK139	Develop and implement a lake and aquatic plant management plan.	H	M	WLWA, PO, HOA, LA	$15,000 - $30,000
Wooster Lake	LK140	Monitor the Eurasian Watermilfoil and Curlyleaf populations. Hand rake or manually remove these species to keep the populations from expanding.	H	M	WLWA, PO, HOA, LA	$3,200 - $10,000 annually

Lake Name	Plan ID	Recommended Actions	Priority	Time Frame	Lead Partner(s)	Cost
Wooster Lake	LK141	Widen riparian buffer to at least 25 feet where feasible.	H	S	WLWA, PO, HOA, LA	$1,200 - $4,000 per acre
Wooster Lake	LK142	Conduct fish survey.	L	L	WLWA, PO, HOA, LA	$3,000 - $5,000

Table 6-20: Recommended Programmatic Lake Actions

Action #	Action	Priority	Lead Partners	Supporting Partners	Time Frame
1	Update Lake County Health Department lake reports and monitoring data including aquatic plant surveys.	H	LCHD	HOA, EIG, LCFPD, Illinois EPA, ISGS/USGS, M, PO	L
2	If needed, develop, implement, and periodically update a lake management plan including an aquatic plant management plan if appropriate and aquatic wildlife habitat improvement plans where needed.	L	PO, HOA	EIG, M, SMC, IDNR, Illinois EPA, PD	M
3	Conduct fish survey.	L	PO, HOA	IDNR	L
4	Develop, implement, and update a fisheries management plan including stocking or removal recommendations (including carp removal) where appropriate.	L	PO, HOA	IDNR	L
5	Manage lake buffer vegetation to enhance biodiversity and reduce populations of destructive species.	M	PO, HOA	Illinois EPA, PD, M	M
6	Encourage riparian landowners to incorporate regionally appropriate vegetation to their landscapes through the installation of riparian buffers and rain gardens.	M	WPC, EIG, HOA	M, C, SMC	L
7	Organize periodic litter clean up days.	M	PO, HOA	EIG, M, C	M
8	Monitor lakes for Harmful Algal Blooms and test for toxins. Develop a community notification process for unhealthy conditions. Notify LCHD when HABs are identified.	H	LM, PO, HOA	LCHD, US EPA, ISGS/USGS, EIG	S
9	Install signs to raise awareness of ways to reduce the spread of ecologically destructive species.	L	PO, HOA	EIG, M, WPC	L
10	Establish/maintain a voluntary lake monitoring program.	M	WPC, EIG	Illinois EPA	L
11	Stabilize shoreline erosion using soft stabilization where feasible and hard stabilization where necessary.	M	PO, HOA	Illinois EPA, PD, M	M
12	Develop aquatic invasive species monitoring plan that includes plants, mussels, fish, and other species of concern.	M	IDNR	USFWS, EIG, PO, LCHD	L

Action #	Action	Priority	Lead Partners	Supporting Partners	Time Frame
13	Develop an inventory of all public and private outfalls and identify BMP improvement options where applicable for each lake.	L	PO, LM, HOA, M, DOT, T	SMC, LCHD, EIG	L
14	Periodically update bathymetric map to assist with lake management.	L	PO, LM, LCHD	EIG	L
15	Reduce the quantity of road salt (sodium chloride) needed for safe and cost-effective winter maintenance to address rising chloride levels in local water bodies.	H	DOT, M, CBL, N/L, EO, PO, PC, HOA, PD	SMC, LCHD, T, Illinois EPA	S

CONTENTS

LIST OF TABLES

ACRONYMS/ABBREVIATIONS USED IN CHAPTER 7

BMP – Best Management Practices

CFU – Colony Forming Unit

DRWW – Des Plaines River Watershed Workgroup

fIBI – Fish Index of Biotic Integrity

Illinois EPA – Illinois Environmental Protection Agency

INLRS – Illinois Nutrient Loss Reduction Strategy

LCHD – Lake County Health Department

LMU – Lakes Management Unit

mIBI – Macroinvertebrate Index of Biotic Integrity

NGRREC – National Great Rivers Research and Education Center

SMC – Lake County Stormwater Management Commission

SSAP – Site Specific Action Plan

TMDL – Total Maximum Daily Load

US EPA – United States Environmental Protection Agency

USGS – United States Geological Survey

VLMP – Illinois Volunteer Lake Monitoring Program

7 PLAN IMPLEMENTATION AND EVALUATION

This chapter identifies a strategy and provides guidance to support transition from planning to implementation and to evaluate the effectiveness of implementation toward the goals and objectives of the plan. The primary components of this chapter include:

- Pollution load reduction estimates of action recommendations
- Estimated costs of plan implementation
- Leaders and supporters for plan implementation
- Initial steps for plan implementation
- Funding resources and opportunities
- Implementation schedule
- Evaluating plan performance
- Indicator and milestone grading system
- Water quality monitoring strategy
- Updating the watershed plan

How readily this plan is used and implemented by Manitou Creek-Fish Lake Drain stakeholders is a major indicator of its success and is easily measured by tracking the actions taken. Improvement in watershed resources or water quality are other indicators of success achieved through monitoring. Successful plan implementation will require significant cooperation and coordination among lead and support partners to secure and allocate resources and apply them to actions in the watershed. The watershed-based plan can be considered a living document and has the flexibility for stakeholders to make revisions over time that reflect shifts in local priorities or watershed conditions.

7.1 ESTIMATE OF POLLUTANT LOAD REDUCTIONS AND TARGETS

Pollution load estimates were made using the nonpoint source model described in Chapter 4. The purpose of estimating pollutant load reductions and targets in the Manitou Creek-Fish Lake Drain watershed is to present a general idea of Best Management Practice implementation benefits and to outline the practices that result in the greatest benefit to the watershed and achieve plan goals.

Load reduction estimates were not performed for all actions identified in Chapter 6; estimates were made for projects with specific on-the-ground locations, where project information was collected and reduction efficiencies are available in literature sources. Many actions presented in Chapter 6 are planning level actions, and do not have the detail of information at this time to support load reduction estimates; estimates are calculated for individual implementation projects during the design stage of the project as site information is generated. Table 7-1 includes the categories of projects for which load reduction estimates are made and Table 7-2 outlines the average expected reduction efficiencies that were applied.

Table 7-1: Project Categories Inclusive of Load Reduction Estimates [1]Load reductions are not calculated for action recommendations that lack sufficient information to calculate load reductions or may not result in directly measurable reductions. These practices can include education, planning, invasive species removal, general flooding issues etc.

Project Specific Action Category	Included in Load Reduction Estimates?
Agricultural BMPs	Yes[1]
Beach Management	Yes[1]
Debris Jam	No
Detention Basin Retrofit	Yes
Flood Risk Reduction	No
Golf Course Management	No
Green Infrastructure BWSS	No
Green Infrastructure SSAP	Yes
Road Salt Management	Yes
Runoff Volume Reduction	Yes[1]
Stabilization	Yes
Stream Restoration	Yes[1]
Water Infrastructure	Yes[1]
Water Quality Investigation	No
Wetland Enhancement	No
Wetland Restoration	Yes

Table 7-2: Best Management Practice Average Expected Load Reduction Efficiencies

Best Management Practice	Nitrogen Reduction	Phosphorus Reduction	Bod Reduction	Sediment Reduction	Bacteria Reduction	Chloride Reduction
Grassed Buffer/Filter Strip	34%	44%	0%	53%	0%	0%
Cover Crops, other best-fit BMPs	20%	15%	0%	20%	0%	0%
Green Infrastructure (SSAP), Prairie Restoration	90%	81%	0%	95%	0%	0%
Wetland Restoration	20%	44%	63%	78%	14%	0%
Detention Basin Retrofit	20%	44%	63%	78%	14%	0%
Stabilization	100%	100%	0%	100%	0%	0%
Bioswale, other best-fit vegetated filtration and infiltration BMPs	8%	18%	0%	48%	14%	0%
Riparian Buffer and In-channel Enhancement	100%	100%	0%	100%	0%	0%
Runoff Volume Reduction	45%	52%	57%	77%	36%	0%
De-icing BMPs	0%	0%	0%	0%	0%	25%

7.1.1 Reduction Estimates for Site Specific Actions

Load reduction estimates are provided for most project/site-specific recommendations throughout the watershed that are summarized in the action plan (Chapter 6) and detailed in Appendix N. Load reductions also include basin-wide site-specific BMPs and stabilization BMPs. Table 7-3 summarizes the annual load reduction estimates by project type for all new BMPs identified for the watershed during the planning process. This inventory includes projects throughout the entire Manitou Creek/Fish Lake Drain watershed. Estimates also do not account for load reductions from programmatic, education and outreach, and policy and regulatory actions since direct impacts are not easily determined at this stage of the planning process.

Based on the review of reduction estimates, project/site-specific actions identified in the watershed-based plan are effective for addressing water quality problems and impairments in the watershed such as sediment, nitrogen, and phosphorus. Those actions are moderately effective in addressing bacteria and chloride, and programmatic and regulatory actions will be more effective at addressing these pollutants throughout the watershed.

Table 7-3: Estimated Annual BMP Load Reductions. Table only includes actions with pollutant load reduction estimates.

BMP	Quantity (Area / Number / Length)	Nitrogen Reduction (lb/yr)	Phosphorus Reduction (lb/yr)	Sediment Reduction (lb/yr)	Chloride Reduction (lb/yr)	Bacteria Reduction (Billion CFU/yr)	BOD (lb/yr)
Agricultural BMPs	4,366.6 ac, 2.8 ln mi	3,011.5	233.4	256.4	0.0	0.0	0.0
Beach Management	15.3 ac	0.1	0.0	0.0	0.0	115.8	0.0
Detention Basin Retrofit	12 ea	0.4	0.5	0.1	0.0	200.6	2.0
Flood Risk Reduction	380.8 ac	655.8	45.2	44.5	0.0	0.0	0.0
Green Infrastructure	1,130.4 ac	319.0	22.0	21.6	0.0	0.0	0.0
Road Salt Management	3,502.3 ac	0.0	0.0	0.0	101,460.2	0.0	0.0
Runoff Volume Reduction	4,575.2 ac	213.8	26.0	37.1	0.0	41,630.6	1,095.7
Stabilization	19.4 ln mi	819.4	307.3	580.8	0.0	0.0	0.0
Stream Restoration	5.0 ln mi	158.8	79.4	150.1	0.0	0.0	0.0
Water Infrastructure	80 lf, 18 ea	0.8	0.2	0.5	0.0	0.0	0.0
Wetland Restoration	1,934.1 ac	1,005.8	154.7	249.7	0.0	115,565.0	3,539.5
Total Reduction Estimates		**6,185**	**869**	**1,341**	**101,460**	**157,512**	**4,637**

7.1.2 Load Reduction Targets

Water quality targets were established based on review of the Upper Fox River/Chain O' Lakes Total Maximum Daily Load (TMDL) report, review of targets from watershed-based plans in other regional watersheds, the Illinois Nutrient Loss Reduction Strategy (INLRS), and coordination with Manitou Creek/Fish Lake Drain planning area stakeholders. Pollutant load reduction targets for nitrogen, phosphorus, sediment, chloride, and bacteria are shown in Table 7-4. Load reductions based on BMPs for which expected load reductions were estimated are included in Table 7-5.

Table 7-4: Nonpoint and Point Source Load Reduction Targets

Pollutant	Reduction Target	Notes
Nitrogen (lb/yr)	**45%**	Based on the INLRS.
Phosphorus (lb/yr)	**50%**, except for lakes that have specific TMDL targets that apply	Based on regional watershed plans and the INLRS. See Section 3.16.2 for TMDL reduction targets for specific lakes.
Sediment (tons/yr)	**50%**	Based on the INLRS target for phosphorus and desire to reduce streambank and lakeshore erosion.
Chloride (lb/yr)	**50%**	Based on regional watershed plans.
Bacteria (billion CFU)	**50%**	Based on regional watershed plans.

Table 7-5: Estimated Nonpoint Source (NPS) Pollutant Load Reductions from BMPs.

Pollutant	Total Estimated Annual NPS Pollutant Loading	Tota Estimated Annual NPS Pollutant Load Reductions	Estimated Annual NPS Load Reductions
Nitrogen (lb/yr)	30,673	6,185	20%
Phosphorus (lb/yr)	4,662	869	19%
Sediment (tons/yr)	3,755	1,341	36%
Bacteria (billion CFU)	15,499,979	157,512	1%
BOD (lb/yr)	68,570	4,638	7%

7.2 COST ESTIMATES

Actions recommended in this plan will be implemented by numerous lead and supporting partners (as indicated in Chapter 6 and Appendix N) and the estimated costs of plan implementation are spread across various watershed stakeholders. The summary of cost estimates that follows is intended to provide a general idea of the scope of all projects considered in the plan but is not to be construed as a single "project cost" to be borne by a lone watershed entity. The cost estimates are for direct implementation projects and not the administrative, project management, and watershed coordinator costs. For all BMPs, an additional 20% should be considered to account for engineering/permitting and annual maintenance.

Cost estimates are generated from a combination of technical experience, previous subwatershed plans, and the United States Department of Agriculture's average practice cost list. Cost estimates are generalized for watershed-scale planning purposes and these estimates should not be used to calculate costs for individual projects, as costs may range significantly depending on site conditions. Appendix K includes criteria and assumptions used to develop the cost estimates listed in Table 7-6. Potential funding sources are included in Appendix L.

The total estimated cost among all stakeholders to implement site-specific action recommendations in this plan is approximately $86 - $201 million. It is important to consider that there are many complementary benefits in addition to water quality improvements that are not necessarily quantified in this estimate. When evaluating implementation strategies, it is important to consider the benefits such as green infrastructure enhancement, improved habitat, increased recreational value, and reduced flooding issues.

Table 7-6: Cost Estimates for Site-Specific Action Recommendations

Type	Units of Practice	Number of Projects/Actions	Estimated Total Cost
Agricultural BMPs	346.3 ac, 2.8 ln mi	9	$46,000 - $141,000
Debris Jam	10 ea	10	$150,000 - $1,100,000
Detention Basin Retrofit	12 ea	12	$104,000 - $1,730,000
Flood Risk Reduction	380.8 ac, 1.6 ln mi, 9,260 cu yd	16	$13,530,076
Golf Course Management	644.5 ac	6	Not Estimated
Green Infrastructure	136.3 ac	2	$149,000 - $446,000
Stabilization	19.4 ln mi	94	$15,369,000 - $40,971,000
Stream Restoration	5.0 ln mi	4	$13,235,000 - $26,471,000
Road Salt Management	180.3 ln mi	72	Not Estimated
Runoff Volume Reduction	788.0 ac	324	$13,725,000 - $68,650,000
Water Infrastructure	80 lf, 18 ea	24	$305,000 - $1,850,000
Water Quality Investigation	1 ea	1	Not Estimated
Wetland Restoration	417.4 ac	154	$29,222,000 - $45,919,000
Total		**728**	**$85,835,076 - $200,808,076**

7.3 NEXT STEPS FOR PLAN IMPLEMENTATION

Often, the greatest challenge of any watershed management process is its coordinated implementation. Successful implementation requires widespread coordination, effective partnerships and support, local leadership, financial and technical resources, time, and a genuine willingness to translate planning to action on-the-ground. The Manitou Creek-Fish Lake Drain watershed includes many implementation partners and supporters that will have to coordinate efforts to implement the recommendations in the action plan. No single partner has the financial or technical resources to accomplish the plan goals and objectives; partners working together are necessary to achieve meaningful results. Responsible entities are defined as jurisdictions; these entities have primary responsibility over actions or practices within their boundaries. Jurisdictions include municipalities, townships, counties, forest preserve districts, and the State of Illinois. Supporting partners are described in Section 6.1 Implementation Partners. Responsible entities or lead jurisdictions as well as supporting partners are further detailed in the individual action item tables located in Appendix A.

Combining and coordinating resources, funding, effort, and leadership will be the most efficient and effective means of maintaining watershed health. Implementation of this plan will also require the development of partnerships with local, state, and federal organizations for implementation, technical assistance, and funding. These efforts require the investment of a significant amount of time and resources.

Table 7-7 below shows five immediate, year-one priorities. The following subsections describe the key components of successful and sustainable plan implementation.

Table 7-7: Year One Plan Implementation Priorities

Recommended Action/Priority
1. Work with watershed stakeholders to determine specific year-1 implementation actions and short-term monitoring priorities and develop a Watershed Planning Committee.
2. Research funding and technical assistance to implement recommendations identified in the action plan.
3. Submit grant applications, if applicable, and secure additional funding sources for plan implementation.
4. Coordinate available programs, policy changes, and other local initiatives and programs where private landowners are responsible for participation or implementation.
5. Promote and adopt the plan; prioritize and incorporate plan recommendations into existing programs, activities, and budgets.

7.3.1 Plan Adoption

Support of the goals, objectives and recommendations of the Manitou Creek-Fish Lake Drain Watershed-Based plan should be formalized through its adoption by primary implementation entities (jurisdictions) and lead and support partners. Jurisdictions should adopt the watershed-based plan so that there is a basis for the incorporation of plan recommendations into the operations and procedures of the organization and its pursuit of project funding and implementation relevant to the watershed.

Chapter 6 outlines the Manitou Creek-Fish Lake Drain watershed jurisdictions and lead and support partners responsible for implementing the action recommendations of the watershed-based plan.

7.3.2 Establish, Support, and Maintain a Watershed Planning Committee

One important step for plan implementation will be continued support for existing watershed organizations to lead, organize, and coordinate plan actions. Active stakeholder groups have coalesced around Fox River watershed issues in multiple subwatersheds pre-dating the development of this plan and will continue to be active in the future. It is likely that watershed-based planning will be completed for the entire Fox River watershed in Lake County within the next ten years. Watershed stakeholder groups should coordinate with local units of government to form a Watershed Planning Committee for the Fox River watershed. This does not preclude the creation of a Manitou Creek-Fish Lake Drain Watershed Planning Committee; however, multiple planning committees within the Fox River Watershed may result in reduced capacity for stakeholders to participate.

A Watershed Planning Committee can define its planning boundary, hold regular meetings, take a lead in facilitating plan recommendations, organize watershed field trips, host educational workshops and forums, and bring watershed stakeholders and multiple units of government together to discuss issues and opportunities. Responsibilities of the committee include administration, coordination of stakeholders to support individual watershed projects, and working with regulatory partners on recommended policies and programs. The supporting partners can consider whether staff positions are needed or merging with existing collaborative organizations would be beneficial in the future.

7.3.3 Stakeholder Participation and Engagement

There are tangible benefits to stakeholder participation in watershed activities, from positive media attention to improved quality of life for residents. Increased involvement also can yield and leverage significant local, state, and federal funding opportunities to help share the cost of project implementation. Some actions can be added to existing capital improvement and maintenance plans, budgets, and schedules. This is a fairly quick and easy approach to implementing recommendations within the purview of specific jurisdictions. In other cases, an action recommendation will require the involvement of multiple stakeholders, such as residents, a municipality, and a county, state, or federal agency to provide financial and technical support. Some actions require interjurisdictional coordination for issues; for example, establishing a green infrastructure corridor along a stream channel, or natural area preservation and restoration often require interjurisdictional cooperation and may require a longer time frame for implementation. Other actions will require the cooperation of individual or groups of landowners, whether they are residents, homeowners' associations, businesses, or institutions.

7.3.4 Identify Implementation Champions

Implementation actions require a leader or a single champion for the project, to organize resources and keep the project(s) moving forward. This champion may be a watershed organization, or a single entity such as a landowner, a subwatershed group, or a municipality. In some cases, actions recommend the adoption of new policies, plans, or standards that modify the form, intensity, or type of development or redevelopment in the watershed in a way that better protects resources. These actions will require some effort on the part of municipalities to understand how plans and policies can be modified and to discuss and adopt new, or modify existing, policies, plans, and standards.

7.3.5 Resources and Funding

Funding implementation and watershed coordination actions is a priority. Securing sources of funding engages contract-level accountability and performance requirements that stakeholders are often more responsive to. There are numerous sources of funds available to help support projects or provide cost-share to match other sources of funds. A list of numerous local, regional, state, and federal funding sources is identified in Appendix I. Most of the programs require a local match of funds or in-kind services. Although these funding sources can provide a good source of revenue, significant local investment of time and money will be required to move this plan forward. These soft costs must be evaluated and incorporated into the operating strategies of the individual partners.

Many federal, state, local, and private programs are available. There are numerous sources of funding available to support projects or provide cost-share to match other sources of funds. Appendix I outlines the most common and available potential sources of funding for the technical assistance and actions identified in the plan; most Best Management Practices recommended **are** eligible for some form of funding. Information regarding potential funding sources is readily available online and applicants should research available programs ahead of time to understand the funding cycles, conditions, and terms. Most grant programs require financial or labor match, thus applications that leverage multiple sources also have the highest probability of being successful.

7.3.6 Implementation Partners

Parties who are key potential partners whose support will lead to the realization of identified goals for the Manitou Creek-Fish Lake Drain watershed are listed in Chapter 6 and in the detailed action plan tables in Appendix A as implementation partners. These organizations are listed as such because they are expected to fulfill one or more of the following functions:

- Oversee or implement watershed protection, restoration, and remediation strategies
- Acquire funding for watershed plan implementation
- Organize or participate in data collection
- Provide regulatory or technical guidance and issue permits
- Monitor the success of the watershed plan
- Acquire land for green infrastructure restoration or protection purposes
- Develop education strategies

Because implementation of the watershed-based plan will largely rest with local units of government, it is critical that they be involved from the beginning. They usually have the most to gain by participating and the most up-to-date information on the structure, needs, and available resources of the community.

In addition, some of the most powerful tools for implementation, such as planning, controlling development standards, and zoning reside at the local, jurisdictional level.

7.4 EVALUATING PLAN PERFORMANCE

An important component of any watershed planning initiative is the ability to monitor performance towards goals and objectives. This section focuses on the administrative-based monitoring that tracks the activities of stakeholders and the range of actions that are implemented. Section 7.5 discusses direct monitoring of quantitative criteria such as water quality and aquatic health that indicate the effectiveness of implementation actions.

7.4.1 EVALUATING PLAN IMPLEMENTATION PERFORMANCE

It is necessary to monitor the progress towards achieving the goals of this watershed-based plan outlined in Chapter 2. Tracking progress relevant to these requires an organized system in each jurisdiction to keep track of what is happening in their portion of the watershed. Communicating and reporting progress towards goals is equally as important as tracking them.

The following recommendations are included to help track progress and achieve the goals with plan implementation.

- The plan should be evaluated every five years to assess the progress made as well as to revise the plan, if appropriate, based on the progress achieved. The plan should also have a comprehensive review and update after 10 years (section 7.7). Amendments and changes may be made more frequently as laws change or new information becomes available that will assist in providing a better outlook for the watershed. As goals are accomplished and additional information is gathered, efforts may need to be shifted to issues of higher priority.
- The watershed stakeholders should request each major jurisdiction and project partner in the watershed to provide periodic updates, which could be in the form of a scorecard that tracks progress towards goal objectives via measurable milestones. The scorecard system is presented in section 7.4.2 and Appendix B. It is an easy and effective way to compile and track progress in a measurable way and evaluate the effectiveness of achieving short, medium, and long-term goals. Scorecards are an effective way to identify what needs attention and what stakeholders should focus on in the next year.
- Other opportunities for evaluating the status of plan implementation include the completion of project reports or group meeting minutes. Since this plan is a flexible tool, changes/modifications are anticipated based on usability and changes in priority throughout implementation.

7.4.2 MEASUREABLE MILESTONES AND SCORECARD SYSTEM

Interim measurable milestones are directly tied to the Manitou Creek-Fish Lake Drain watershed performance indicators. Milestones are essential when determining if management measures are being implemented and how effective they are at achieving plan goals and objectives over given time periods. This allows for periodic plan updates and changes that can be made if milestones are not being met.

Watersheds are complex systems with varying degrees of interaction and interconnection between physical, chemical, biological, hydrological, habitat, and social characteristics. Indicators that reflect these characteristics may be used as a measure of watershed health. Goals and objectives in the plan determine which indicators should be monitored to assess success. Physical indicators could include amount of sediment entering a steam reach or presence or lack of adequate stream buffers, whereas chemical and biological indicators could include nitrogen loads or macroinvertebrate health. Social indicators can be measured using demographic data or, for example, the number of landowners adopting conservation practices.

Manitou Creek/Fish Lake Drain planning area scorecards were developed for each of the watershed-based plan goals and are located in Appendix M. Table 7-8 provides an example indicator and associated milestones for each goal as taken from the complete scorecards in Appendix B.

This scorecard system should serve as an organizational monitoring plan and a tool for tracking progress toward meeting plan goals and specific recommendations and action items. Realistic short, medium, and long-term milestones are included for each indicator in the scorecards. Each milestone is a specific action recommendation and is intended to fulfill plan objectives if executed. Indicators are to be used as measurement tools when determining if each milestone has or has not been met. If the measurement of each indicator becomes problematic, the watershed planning committee should revisit and adjust where needed. It is up to local stakeholders to determine the priority of each milestone based on their ability to follow through with them. Scorecard evaluation on an annual basis is an effective way to identify priorities and what stakeholders should focus on in the next planning year.

Milestones in the scorecards can be graded based on the following criteria: A = Met or exceeded milestone(s); B = Milestone(s) 75% achieved; C = Milestone(s) 50% achieved; D = Milestone(s) 25% achieved; F = Milestone(s) not achieved

7.4.3 Plan Implementation Schedule

Implementing actions should occur immediately where specific projects and willing stakeholders have been identified. A general implementation schedule is presented in Table 7-9. Short (1-5 years), medium (5-10 years) and long-term (10+ years) timeframes are included in Appendix N for each site-specific action.

Table 7-8: Example Indicators and Milestones for Each Goal

Goal	Example Indicator	Short Term Milestone (1-5 Years)	Medium Term Milestone (6-10 Years)	Long Term Milestone (10+ Years)
1. Water Quality	Implementation of watershed monitoring program.	Develop monitoring program	Implement program	Continued implementation and adoption of program
2. Stormwater Management, Flood Risk, and Flood Damage	Number of flood problem areas positively affected by flood mitigation projects implemented.	2	5	10
3. Natural Resource Management	Acres of wetlands enhanced and/or restored.	10	50	100
4. Watershed Education and Communication	Number of people reached by watershed outreach campaign.	Establish outreach campaign	5,000	10,000
5. Watershed Coordination and Partnerships	Number of municipalities, counties, agencies and organizations that adopt the Manitou Creek-Fish Lake Drain Watershed-Based Plan.	20 Agencies	All Agencies	All Agencies

Table 7-9: General Implementation Schedule. Assuming Year is 2026, then Year 4 (2030) will be a key year to submit Section 319 grant applications because the Illinois EPA's Upper Fox Watershed implementation priority years is FY2031.

Task	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Promote and adopt the plan.	X									
Determine specific year-1-5 implementation actions; establish short term monitoring priorities.	X	X								
Research funding and technical assistance to implement priority recommendations identified in the action plan.	X	X	X	X						
Submit grant applications if applicable and secure additional funding sources for plan implementation.	X	X	X	X	X	**X**	X	X		
Coordinate available programs, policy changes and other local initiatives and those programs where private landowners are responsible for signing up.	X	X	X	X	X	X	X	X	X	
Project planning, site surveys and project design and budget development.		X	X	X	X	X	X	X	X	
Prioritize and incorporate plan recommendations into existing programs, activities, and budgets.	X	X	X	X	X	X	X	X	X	X
Implementation and construction of projects.			X	X	X	X	X	X	X	X
Report and monitor progress.	X	X	X	X	X	X	X	X	X	X
Communicate success stories.		X	X	X	X	X	X	X	X	X
Evaluate accomplishments.			X			X				X
Update Watershed-Based Plan.										X

7.5 WATER QUALITY MONITORING STRATEGY

The need for additional water quality monitoring has clearly been defined and communicated by stakeholders and is suggested as part of the TMDL report. A monitoring effort should be established and financed to support further characterization of problems and to monitor conditions and health of the watershed through time. Watershed monitoring will support a quantitative means to assess the effectiveness of plan implementation and the cumulative contribution towards goals and objectives.

Section 3.16.3 identifies the location of monitoring sites that provided data utilized in this plan. Water quality monitoring data has proven valuable throughout the planning process to characterize the watershed and prioritize actions. The feedback and recommendations summarized below are the result of analyzing the data identifying data gaps:

1. A scientific and use case analysis of this data should be performed to determine what type of environmental monitoring should be continued. Indicator parameters could also be evaluated and considered.
2. Pairing flow data with physical, chemical, and biological data is important and paired stations should be identified, established, and maintained.
3. Installing staff gages at or near the monitoring sites should be considered and stage readings recorded during sampling events. This will allow flow to be attributed to sampling events in the future with a stage/discharge relationship and to help quantify seasonal flows and residence time for lakes to aid in guiding internal phosphorus load reduction approaches.
4. From a watershed planning standpoint, the important parameters to monitor are:
    a. Nitrogen, Kjeldahl, Total
    b. Nitrogen, Ammonia
    c. Nitrate, Total
    d. Nitrite, Total
    e. Phosphorus, Total
    f. Chloride, Total
    g. Total Suspended Solids
    h. E. Coli
    i. Total Dissolved Solids
    j. Conductivity
    k. pH
    l. Diel Dissolved Oxygen
    m. Temperature
    n. Polycyclic aromatic hydrocarbons
    o. Fish Community, Fish Index of Biotic Integrity (fIBI)
    p. Aquatic macroinvertebrate Community, Macroinvertebrate Index of Biotic Integrity (mIBI)
5. Future monitoring should consider additional sediment sample collection methods to collect a more representative sample for estimating sediment yields.
6. In-lake sampling should be expanded to better characterize stratification and turnover to aid in guiding internal phosphorus load reduction approaches.

Section 7.4 tracks progress through achievement of actions, while this section outlines a strategy to directly monitor the effectiveness of the actions from a water quality perspective. Table 7-10 summarizes the proposed monitoring categories and associated recommendations.

Table 7-10: Summary of Proposed Monitoring Categories and Recommendations

<table>
<tr><th>Monitoring Category</th><th>Summary Of Recommendations</th></tr>
<tr><td>Streamflow</td><td>Establish/develop baseline hydrographs and continue streamflow measurements.</td></tr>
<tr><td>Ambient water quality (streams)</td><td>Develop and implement a robust, regular ambient water quality monitoring program.</td></tr>
<tr><td>Physical and biologic assessment (streams)</td><td>Include physical and biological assessments in baseline reporting for ambient water quality monitoring.</td></tr>
<tr><td>BMP effectiveness</td><td>Monitoring BMP effectiveness of specific practices or clusters of practices.</td></tr>
<tr><td>RiverWatch program</td><td>Partner with National Great Rivers Research and Education Center to enhance the volunteer monitoring program in the watershed.</td></tr>
<tr><td>Lake County Health Department Lake monitoring</td><td rowspan="3">• Coordinate with other agencies and organizations collecting data to use compatible procedures, identify and fill gaps in monitoring, and assess data together.
• Incorporate monitoring for algal toxins and coordinate with agencies that are collecting samples (USGS, Illinois EPA).
• Sample and assess lakes in a more frequent annual rotation and expand the monitoring period to capture stratification and turnover events.
• Collect base and storm flow water quality samples from lake inlets as part of program; install staff gages.</td></tr>
<tr><td>Illinois Volunteer Lake Monitoring Program</td></tr>
<tr><td>Local Lake and Watershed Organizations, Other Stakeholder Groups</td></tr>
<tr><td>Storm event runoff monitoring</td><td>Need additional data on wet weather flows of pollutants due to rapid hydrologic response of many streams in the planning area.</td></tr>
</table>

7.5.1 Best Management Practice Effectiveness Monitoring

As funding allows, Best Management Practice effectiveness monitoring should be performed on projects to assess if actions are achieving the watershed-based plan goals and objectives. It is recommended to incorporate monitoring into the budget of Best Management Practice projects. Monitoring should be conducted by environmental consultants or independent agency staff experienced in sampling and monitoring methods.

Monitoring can be used to determine the overall effectiveness of individual or multiple spatially clustered Best Management Practices on achieving the watershed-based plan goals. It is usually necessary to collect and analyze water quality and perform bioassessment sampling if the Best Management Practice is directly addressing a stream reach. This can be accomplished by monitoring prior to the practice (inflow) and downstream of the practice (outflow) or monitoring baseline and post-implementation conditions. It is also important to monitor the hydraulic performance and channel changes. Urbanized areas typically increase the total volume and rate of stormwater runoff that enters receiving streams and storm sewer systems. This causes changes in both hydrology and morphology. A goal of Best Management Practices is usually to attenuate these flows and morphological impacts.

Table 7-11 includes minimum parameters that can be used as guidelines in designing and evaluating a monitoring program to evaluate Best Management Practice effectiveness. Benchmark indicators are based on water quality criteria and standards or expert examination of water quality conditions to identify values representative of conditions that support designated uses and biological integrity and quality. The monitoring strategies of local watershed workgroups should also be referenced prior to initiating a monitoring program in order to maintain consistency.

Evaluation of the progress toward meeting targets indicates whether implemented Best Management Practices are effective. If implemented Best Management Practices are determined to be ineffective, the approach should be reconsidered or changed altogether.

Table 7-11: Baseline Water Quality Analysis Parameters

Parameters	Benchmark Indicators
Total Phosphorus	0.05 mg/L for lakes (Illinois criteria) / 0.072 mg/L (regional reference non-effect benchmark; DRWW report)
Total Suspended Solids	28 mg/L (regional reference non-effect benchmark; DRWW Report)
Total Dissolved Solids	296 mg/L (regional reference non-effect benchmark; DRWW report)
Ammonia-N	15 mg/L (Illinois general use criteria)
Total Kjeldahl Nitrogen	0.7 mg/L (regional reference non-effect benchmark; DRWW Report)
Nitrate-N	10 mg/L (Illinois drinking water standard)
Chloride	500 mg/L (Illinois criteria) / 230 mg/L (USEPA Standard)
Fecal Coliform Bacteria	126 cfu/100 ml (US EPA geometric mean criteria; recreational use standard)
Dissolved Oxygen	No less than 5.0 mg/L (Illinois criteria)
Temperature	Less than 90° F (Illinois criteria)
pH	Between 6.5 – 9.0 (Illinois criteria)
Conductance, Specific	751 µS/cm (regional reference non-effect benchmark; DRWW report)
Flow	--
Fish	Fish Index of Biotic Integrity (fIBI) 41 or greater
Aquatic Macroinvertebrates	Macroinvertebrate Index of Biotic Integrity (mIBI) 41.8 or greater

7.5.2 RiverWatch Volunteer Program

The National Great Rivers Research and Education Center (NGRREC) administers the RiverWatch program, which educates and trains volunteers to collect data from Illinois streams. The NGRREC holds open labs and workshops throughout the state to train volunteers. The RiverWatch program was previously called EcoWatch and was administered by the Illinois Department of Natural Resources.

While the RiverWatch monitoring program collects basic information about macroinvertebrates and aquatic habitat, it provides a real opportunity to engage stakeholders and volunteers to actively participate in the watershed in a meaningful way. A continuous and consistent monitoring program under RiverWatch would be a valuable tool to supplement the monitoring program, evaluate the evolving condition of the watershed, and monitor the effectiveness of watershed-based plan implementation. A RiverWatch program, however, is not a replacement for physical and biologic assessments performed under the water quality monitoring strategy outlined in previous sections.

It is recommended that the watershed planning committee work with regulatory agencies to select several designated RiverWatch stream reaches in the watershed. The reaches are typically 200-300 feet in length, depending on the type of macroinvertebrate habitat. The designated reaches should either be on public land or private lands with landowner permission. Stream reaches within Forest Preserve District and park district properties should be evaluated. The designated reaches should be communicated to the NGRREC so that volunteers in the area are focused to the designated stream reaches.

The watershed planning committee may want to consider a public relations program to educate the public regarding the RiverWatch program and enlist volunteers. Funding opportunities should be considered to reimburse travel expenses for volunteers to attend the necessary training provided by NGRREC.

7.5.3 Lake Monitoring

There are numerous lakes in the Manitou Creek/Fish Lake Drain planning area that are characterized as part of Chapter 3. The lakes are a tremendous resource for recreation and watershed health and function, and many are publicly accessible. Lake monitoring should be considered a priority to maintain and manage the lake systems and their value as an ecological and recreational resource. Currently the Illinois Environmental Protection Agency (Illinois EPA), Lake County Health Department (LCHD), and Lake and Watershed Organizations administer lake monitoring programs in the Manitou Creek/Fish Lake Drain planning area. Lakes are also periodically monitored by the United States Geological Survey (USGS), North American Lake Management Society, Illinois EPA, RiverWatch Network, and the Illinois Department of Natural Resources. These programs should be supported and enhanced by the watershed stakeholders and implementation partners.

7.5.3.1 LCHD Lake Monitoring

The Lakes Management Unit (LMU) of the LCHD has been collecting water quality data on Lake County lakes since the late 1960s. Starting in 1999, approximately 32 lakes per year are monitored, equating to about a 5-year period between lake monitoring for major lakes in the County. Smaller lakes are monitored less frequently. Data collection includes temperature, dissolved oxygen, phosphorus, nitrogen, suspended solids, pH, alkalinity, conductivity, water clarity, plant community, and shoreline characteristics. Detailed reports are written for each lake and include data analyses, a list of problems specific to each lake, and recommendations on how to reduce or eliminate those problems. Reports are available online, although the information is not readily available in a database format. It is recommended that the watershed planning committee continue to support this existing lake monitoring program and track the results of each of the monitored lakes in the watershed to monitor the effectiveness of plan implementation. Some of the lakes in the Manitou Creek/Fish Lake Drain planning area have not been monitored in more than 10 years and therefore should be monitored in the first 5 years following completion of this plan.

7.5.3.2 Illinois Volunteer Lake Monitoring Program

The Illinois EPA established the Volunteer Lake Monitoring Program (VLMP) in 1981 to engage and educate the public about lake health and lake management while developing a means to collect data and observations about lakes throughout Illinois. The program funds volunteer training programs, technical and administrative support to volunteers, and laboratory analysis costs. As volunteers gain experience, they can graduate to higher tiers of data collection and lake assessment as shown in Table 7-12.

The LCHD LMU works directly with the Illinois EPA and the VLMP volunteers relative to Lake County. The VLMP program does not include quantity or spatial-based monitoring of aquatic invasive species, although the volunteers are free to provide narrative descriptions about aquatic invasive species.

All three tiers of the VLMP were suspended in 2019 and will remain suspended until the Agency determines if the program can be reinstated.

Table 7-12: Monitoring Tiers of the Illinois Volunteer Lake Monitoring Program

Tier Level	Description Of Volunteer Lake Monitoring Program Monitoring Tiers
Tier 1	Volunteers perform Secchi disk transparency monitoring and field observations only. Monitoring is conducted twice per month from May - October, typically at 3 in-lake sites. Field observations include the presence of invasive species including installation and monthly observations of zebra mussel plate installed near boat launch.
Tier 2	In addition to the tasks of Tier 1, volunteers collect water samples for nutrient and suspended solid analysis at the representative lake site (site 1). Water quality samples are taken only once per month, May - August, and October in conjunction with one Secchi transparency monitoring trip.
Tier 3	In addition to tasks of Tier 1 and 2, volunteers collect water samples at up to three sites on their lake. Their samples are analyzed for nutrients and suspended solids. They also collect and filter their own chlorophyll samples. Dissolved oxygen and temperature profiles may also be performed, depending on equipment availability. Data collected in Tier 3 is used in the category 5 Integrated Report and is subject for use in designating state impaired waters.

7.5.3.3 Lake Monitoring Recommendations

In addition to efforts currently being performed by LCHD, the following recommendations should be considered to enhance current monitoring activity, as resources allow:

1. Coordinate with volunteer monitors to identify and fill gaps in monitoring and assess data together.
2. Consider monitoring for algal toxins and coordinate with agencies that are collecting samples (USGS, IEPA).
3. Sample and assess lakes within a 10-year rotation (or shorter).
4. Expand the monitoring period to capture stratification and turnover events.
5. Install staff gages.
6. Collect base and storm flow water quality samples from lake inlets as part of program.

7.6 PLAN IMPLEMENTATION MILESTONES

This section includes goals, objectives, indicators, and milestones, consistent with implementation scorecards found in Appendix M. Table 7-13 through Table 7-17 list all milestones established for the watershed plan. The “Objective ID” columns in Table 7-13 through Table 7-17 references Chapter 2, Section 2.4 goals (number) and objectives (letter).

7.6.1 Watershed Goal #1 Milestones: Water Quality

Improve impaired water quality and protect surface water quality from future impacts. Timeframe: Short (S): 1-5 years, Medium (M): 6-10 years, Long (L): 10+ years.

Table 7-13: Water Quality Milestones

Objective ID	Indicator	Timeframe	Milestone
1A	A1. Implementation of watershed monitoring program.	S	Develop monitoring program
		M	Implement program
		L	Continued implementation and adaptation of program
	A2. Regular reports on water quality monitoring to community and stakeholders.	S	Develop monitoring program
		M	Collect data, baseline report
		L	Subsequent reporting
1B	B1. Winter Maintenance Program establishment including: policy and manual development, de-icing workshop attendance and certification.	S	20% of municipal programs
		M	40% of municipal programs
		L	100% of municipal programs
	B2. Monitoring data trends for chloride and specific conductivity.	S	Develop monitoring program
		M	Collect data, baseline report
		L	Nonpoint source pollutant trends decreasing
1C	C1. Implementation of BMPs and management practices that reduce internal or external phosphorus loading in lakes.	S	3
		M	5
		L	10
	C2. Monitoring data trends for phosphorus.	S	Develop monitoring program
		M	Collect data, baseline report
		L	Nonpoint source pollutant trends decreasing
1D	D1. Monitoring data trends for common nonpoint source pollutants.	S	Develop monitoring program
		M	Collect data, baseline report
		L	Nonpoint source pollutant trends decreasing
1E	E1. Number of agricultural BMPs implemented that reduce nonpoint source pollution.	S	3
		M	5
		L	10

Objective ID	Indicator	Timeframe	Milestone
	E2. Monitoring data trends for common nonpoint source pollutants.	**S**	Develop monitoring program
		M	Collect data, baseline report
		L	Nonpoint source pollutant trends decreasing

7.6.2 Watershed Goal #2 Milestones: Stormwater Management, Flood Risk, and Flood Damage

Reduce the risk of flood damage in the watershed, mitigate the effects of runoff, and enhance stormwater management systems. Timeframe: Short (S): 1-5 years, Medium (M): 6-10 years, Long (L): 10+ years.

Table 7-14: Stormwater Management, Flood Risk, and Flood Damage

Objective ID	Indicator	Timeframe	Milestone
2A	A1. Runoff volume reduction and mitigation measures implemented.	**S**	Increase 2% from baseline (2024)
		M	Increase 5%
		L	Increase 10%
2B	B1. Number of flood problem areas positively affected by flood mitigation projects implemented.	**S**	2
		M	5
		L	10
	B2. Number/value of claims filed each year per community in the watershed.	**S**	Reduce by 5%
		M	Reduce by 10%
		L	Reduce by 25%
2C	C1. Number of local drainage system improvement projects implemented.	**S**	5
		M	10
		L	25
2D	D1. Number of Voluntary Floodplain/Hazard Mitigation Buyouts.	**S**	5
		M	10
		L	25

7.6.3 Watershed Goal #3 Milestones: Natural Resource Management

Preserve, restore, and enhance a system of terrestrial and aquatic ecosystem to provide beneficial functions for people, plants, and wildlife. Timeframe: Short (S): 1-5 years, Medium (M): 6-10 years, Long (L): 10+ years.

Table 7-15: Natural Resource Management Milestones

Objective ID	Indicator	Timeframe	Milestone
3A	A1. Acres of wetlands enhanced and/or restored.	**S**	10
		M	50
		L	100
3B	B1. Number of regional (based on SMC's Regional Green Infrastructure definition) green infrastructure projects.	**S**	1
		M	2
		L	3
3C	C1. Acres of protected natural areas preserved, managed and/or restored.	**S**	500
		M	1,500
		L	4,000
3D	D1. Acres of invasive species removal/management projects.	**S**	500
		M	1,000
		L	2,500
	D2. Number of aquatic invasive education and outreach efforts.	**S**	10
		M	20
		L	30
3E	E1. Number of lakes with Lake Management or Aquatic Plant Management Plans.	**S**	3
		M	5
		L	10
3F	F1. Linear feet of stabilization projects implemented.	**S**	5,000
		M	10,000
		L	25,000

7.6.4 Watershed Goal #4 Milestones: Watershed Education and Communication

Watershed stakeholders (residents, property owners, students, non-profit organizations and public agencies) have adequate knowledge, skills, resources, motivation and stewardship opportunities to implement the watershed plan and associated programs. Timeframe: Short (S): 1-5 years, Medium (M): 6-10 years, Long (L): 10+ years.

Table 7-16: Watershed Education and Communication Milestones

Objective ID	Indicator	Timeframe	Milestone
4A	A1. Number of people reached by watershed outreach campaign.	**S**	Establish outreach campaign
		M	5,000
		L	10,000
4B	B1. Number of landowners that receive information about watershed programs and projects.	**S**	2,000
		M	5,000
		L	10,000
	B2. Number of workshops.	**S**	10
		M	20
		L	30

7.6.5 Watershed Goal #5 Milestones: Watershed Coordination And Partnerships

Improve coordination, engagement and decision-making between public, private and non-profit stakeholders to implement the watershed plan. Timeframe: Short (S): 1-5 years, Medium (M): 6-10 years, Long (L): 10+ years.

Table 7-17: Watershed Coordination and Partnerships Milestones

Objective ID	Indicator	Timeframe	Milestone
5A	A1. Number of municipalities, counties, agencies and organizations that adopt the Manitou Creek-Fish Lake Drain Watershed-Based Plan.	**S**	20 Agencies
		M	All Agencies
		L	All Agencies
5B	B1. Number of projects advanced/undertaken with the support of stakeholder groups.	**S**	25 recommendations/projects
		M	100 recommendations/projects
		L	250 recommendations/projects
5C	C1. Number of communities and organizations that have designated a representative to participate in watershed stakeholder initiatives.	**S**	10 communities/organizations
		M	15 communities/organizations
		L	All communities

7.7 UPDATING THE WATERSHED-BASED PLAN

Watershed-based plans are required by the Illinois EPA to be updated every 10 years. Furthermore, the watershed-based plan should be revised, as necessary, as new information is received, and progress is made. For example, as additional data becomes available, it can be used to revise loading estimates and determine if implementation efforts are achieving stated goals, milestones, and reduction targets. Plan updates do not require an entire rewrite; typical elements that will likely require a major update or revision are summarized in Table 7-18.

Table 7-18: Plan Update Elements and Responsibilities

Major Plan Element Requiring Update	Element Component Requiring Update	Lead Partners	Primary Supporting Partners
Watershed Characterization	• Land use information • Water quality data/analysis • Stream/lake impairments • Climate • Demographics • Jurisdictions • Pollution loading • Ravine Inventory	Lake County SMC	• Jurisdictions (Chapter 6) • Watershed Planning Stakeholders
Action and Implementation Plan Components	• Project recommendations • Expected load reductions • Milestones, timeframes, and priorities • Responsible parties and support partners • Monitoring plan	Lake County SMC	• Jurisdictions (Chapter 6) • Watershed Planning Stakeholders

CHAPTER EIGHT: EDUCATION & COMMUNICATION STRATEGY & TOOLS

CONTENTS

LIST OF TABLES

COMMON ACRONYMS/ABBREVIATIONS USED IN CHAPTER 8

BMP – Best Management Practices

C – County

CMAP – Chicago Metropolitan Agency for Planning

DD – Drainage District

EIG – Environmental Interest Groups

LCFPD – Lake County Forest Preserve District

Illinois EPA – Illinois Environmental Protection Agency

M – Municipality

PD – Park Districts

SMC – Lake County Stormwater Management Commission

8 EDUCATION AND COMMUNICATION STRATEGY AND TOOLS

This chapter provides a strategy for all watershed stakeholders for information, education, and public involvement to address watershed topics and issues. The education and communication strategy provides messaging and motivation for each target audience (Section 8.4) to help achieve watershed goals and objectives to ultimately realize the goals and objectives for the Manitou Creek-Fish Lake Drain Watershed.

8.1 WATERSHED INFORMATION AND EDUCATION NEEDS

Community engagement, outreach, and education are essential components of the Manitou Creek-Fish Lake Drain Watershed-Based Plan. The education and communication strategy is designed to:

- Raise public awareness about watershed issues and foster support for solutions.
- Provide engaged stakeholders with the knowledge and skills they need to become watershed stewards and implement the watershed action plan.

8.2 EDUCATION AND COMMUNICATION OBJECTIVES

The education and communication objectives for this plan will support the watershed education and communication goal identified in Chapter 2: Watershed stakeholders (residents, property owners, students, non-profit organizations and public agencies) have adequate knowledge, skills, resources, motivation and stewardship opportunities to implement the watershed plan and associated programs.

OUTCOME: *Stakeholders have adequate information, knowledge and opportunity to implement the watershed plan.*

OBJECTIVES:

a) Conduct a watershed outreach campaign to inform and engage the public about watershed issues and solutions, landowner responsibilities and opportunities, available resources and the benefits of implementing the watershed plan recommendations.

b) Inform local government officials and agencies, consultants and contractors working in the watershed, landscapers and nurseries, property managers and landowners on road salt alternatives and application Best Management Practices (BMP) to minimize the use or impact of road salt by public and private snow removal providers.

c) Inform local government officials and agencies, consultants and contractors working in the watershed, landscapers and nurseries, and landowners on best practices related to lake, stream, and wetland maintenance/management.

d) Educate property owners and caretakers through outreach programs such as Conservation@Home or Rain Ready on ways to improve the quality and quantity of water leaving their property, protect their property from flooding, protect rare or high-quality natural resources that might exist on their property, and contribute to resilient ecosystems.

e) Utilize trainings, workshops, public meetings, personal site visits, newsletters, websites, media, campaigns, and stakeholder word of mouth to provide watershed stakeholders opportunities to participate in watershed programs and projects.

f) Facilitate and engage the public, schools and youth groups (students), and homeowner associations to volunteer for stream and natural area stewardship and maintenance.

8.3 EDUCATION AND COMMUNICATION PRIORITIES

The Manitou Creek-Fish Lake Drain Watershed-Based Plan project team and stakeholder group identified three priority topic areas for education and communication efforts during the implementation phase of the plan. Potential message topics that support these priorities are identified in bold typeface in Table 8-3 later in this chapter. The priority topic areas are:

1) Harmful algal blooms and nutrient cycling/dynamics in lakes
2) Ways to reduce the impact of impervious surfaces and reduce flooding
3) Roles and responsibility for drainage concerns among units of government and landowners

8.4 TARGET AUDIENCES

The audiences for specific education and communication activities and topics include public and private organizations, watershed residents and landowners, the general public, and professionals within the watershed community. These audiences have a wide range of understanding of watershed issues and needs for further education and communication. Education and communication aim to be responsive to existing partners, attract stakeholders that have not previously participated in watershed improvement activities, and align messages with audience knowledge levels and motivations. Education and communication partners include the entities listed and discussed below.

8.4.1 Local Government Officials and Agencies

Continued support from local governments and public landowners will be critical to implementing the education and communication strategy. These officials and agencies develop policies and regulations and manage the land and projects within the watershed. They will need to commit to projects on public lands and communicate with and encourage residents to participate in watershed improvements. The local government target audience includes:

- Municipalities
- Townships
- County agencies
- Elected officials and policy makers
- Drainage districts

- Park districts
- Forest preserve districts
- Public works agencies
- Farm Bureau
- Transportation agencies (including Highway Commissioners)

8.4.2 Residents and Businesses

Numerous residents and landowners in the watershed have participated in one or more watershed plan meetings or subwatershed committee meetings. The target audience includes the following groups or residents:

- All residents and landowners
- Not-for-profit and environmental interest groups
- Businesses and institutions (i.e., golf courses, shopping centers, churches and chambers of commerce)

8.4.2.1 Riparian and Lakeshore Landowners

Riparian landowners may have a disproportionate impact on stream, lakeshore, and wetland areas, and often have a vested interest in improving watershed conditions to protect their property, comply with regulations, or enhance property values. These areas are critical locations because they contribute to watershed problems or hold the key to solutions. Therefore, this subset of property owners should be targeted for special attention in the education and communication strategy. The target audience includes the following groups of landowners:

- Homeowner associations
- Single family residences
- Commercial and multifamily residential properties
- Owners of undeveloped land
- Railroads
- Utility companies located in floodplains or along streams, lakes, and wetlands
- Golf courses
- Public landowners

8.4.3 Schools and Youth Groups

Communication and education programs and messages are targeted towards students in schools and youth groups which are needed to set a foundation to achieve long-term sustainable improvements. Youth involvement in activities such as stream clean-ups and habitat restoration days or even smaller tasks such as not littering and recycling is an effective way to engage groups in learning about and acting to improve watershed conditions. The student target audience includes the following schools and youth groups:

- Primary and secondary schools
- Colleges and universities
- Youth groups (e.g., Boy Scouts, Girl Scouts)

8.4.4 Developers & Homebuilders

The land development process has the potential to adversely affect watershed conditions, but development interests can be balanced with watershed goals if identified prior to or early in the design and development process. Developers and homebuilders should adopt a variety of best development standards and comply with regulations, codes, and ordinances to protect watershed resources.

8.4.5 Consultants and Contractors Working in the Watershed

Several engineering, environmental, and other consultants have participated in stakeholder meetings and provided their expertise towards the watershed planning process. The watershed-based plan provides consultants and contractors with resources to share with their clients and support for prioritization of future projects. Consultants and contractors can communicate messages to their clients to motivate BMP adoption for watershed improvements. The target audience of consultants and contractors includes:

- Engineering, landscape architectural, and environmental consulting firms
- Restoration contractors
- Legal counsel
- Insurance companies
- Winter maintenance product/equipment suppliers
- Winter maintenance (snow removal) contractors

8.4.6 Landscapers and Nurseries

Landscapers, lawn and garden centers, nurseries, hardware stores, large retail establishments, and snow removal contractors can make a huge impact by learning and following watershed-friendly lawn care and winter maintenance practices, especially by reducing their use of pollutants such as chloride and phosphorus. Communities can support education by maintaining registries for lawn care, nurseries, and winter maintenance providers.

- Landscapers and property managers/caretakers
- Lawn and garden centers

8.5 PARTNER ORGANIZATIONS

Organizations that will be responsible for implementing the watershed plan recommendations can assist in education and communication and can also be one of the targeted audiences. Each partner should couple plan implementation efforts with parallel efforts to inform and educate. Several educational programs are currently being implemented by other organizations that watershed stakeholders may take advantage of. See Table 8-1 below for a list of potential partner organizations for implementing the watershed plan recommendations.

Table 8-1: Partner Organizations

Partner Organizations	
Businesses and Institutions	Natural Resources Conservation Service/Soil and Water Conservation Districts
Chicago Metropolitan Agency for Planning	Park Districts
Environmental Interest Groups	Schools and Colleges/Universities
Homeowner Associations	Lake County Stormwater Management Commission
Illinois Department of Natural Resources	Townships
Illinois Environmental Protection Agency	Transportation Departments
Illinois Lakes Management Association	United States Environmental Protection Agency
Lake County (including Planning, Bldg. & Development)	United States Geological Survey
Lake County Forest Preserve District	Watershed Groups/Coalitions
Lake County Health Department	Watershed Residents & Landowners
Manitou Creek Drainage District	Wastewater Treatment Plants
Master Gardeners, Garden Clubs	Youth Conservation Corps
Municipalities (including Public Works Depts.)	Youth Groups

8.6 GUIDANCE FOR IMPLEMENTATION

The following list provides general guidance for implementing the education and communication strategy. More detailed recommendations for addressing specific watershed issues are included in Table 8-3.

- Use words that the general public can understand and speak to their existing values and priorities.
  - Basic watershed science education (e.g., biology, the water cycle, and stream ecology) may be needed when the audience has little knowledge about streams, lakes, wetlands, or watersheds.
  - Identify and provide for different levels of understanding and the needs of various audience groups. When interacting with a group, stress the dimensions of the project that apply most to them. For example, when interacting with homeowners, focus on items such as rain gardens, lawn care, pollution prevention and restoration, and management of riparian areas/ravines. Develop a similarly targeted menu of topics and look for opportunities to "cross train" target audiences.
  - Inform the audience about actions they can take and behaviors they can change to help address watershed problems and issues.
- Develop multiple messages and update existing messages as needed; use one broad message for the general public and a series of more specifically targeted messages for specific audiences (e.g., landowners, business owners, and municipalities).
  - Keep the message simple and straightforward with only two or three take-home points at a time, use graphics and photos to illustrate the message, and repeat it frequently. Keep messages positive.
  - Emphasize the connections between the message and watershed stakeholder issues. For example, connect the message to lakes, storms, streams, land management, the urban landscape, and streets.
- Coordinate the education and communication strategy with partner organizations to combine efforts, achieve economies of scale, tap into one another's networks, share costs, and ensure consistent messages.

- Use websites and other social media, as well as public places, such as libraries and village halls, to post and promote your message.
  - All materials and messages should promote the local watershed groups, with contact information and information on how to get involved.
  - Develop materials and messages that anyone can use.

8.7 MESSAGE FORMATS AND DELIVERY MECHANISMS

Numerous existing programs, tools, and materials are available that can be used or customized to accelerate education and communication efforts. See Table 8-2 below for examples of education and communication through print, electronic, visual and personal contact communication efforts.

Table 8-2: Examples of Education & Outreach Efforts

Print	Electronic	Visuals	Personal Contact
Brochures	Social Media	Displays/Exhibits	Demonstrations, field trips, watershed tours
Fact sheets	Websites/Interactive Maps	Signage	Presentations (meetings, seminars, etc…)
Newsletters	E-News/Emails	Posters/ Bulletin boards	Interviews
News releases	Videos/local cable channel	Presentations	Surveys
Manuals or plans; Technical resources	Public Service Announcements		Targeted/one-on-one discussions and technical assistance
Inserts/Utility bills	Bulletin Boards		
Flyers	Surveys		
Direct mail			
Feature articles			
Media kit			
Curricula			

8.8 EVALUATING PLAN OUTREACH

Watershed plan evaluation provides a feedback mechanism for ongoing improvement of a communication effort and for assessing whether the effort is successful support for further activities and funding. It also builds support for further funding. The entity or persons responsible for implementing the education and information campaign should customize the following ideas.

For a number of these evaluation strategies, collect baseline information or survey current knowledge before the activities begin and check periodically throughout the campaign to help measure progress and effectiveness. Evaluations conducted early in the effort will help determine which programs are working and which ones are not. Based on this information, money and time can be saved by focusing on the programs that work and discarding those that do not. Indicators to evaluate, monitor, and provide a timeframe for each watershed goal are listed in **Chapter 7 & Appendix B Evaluation Scorecards**.

8.9 WATERSHED INFORMATION AND EDUCATION RESOURCES

Watershed education and outreach is not new. There are many resources already available that include effective education and outreach messages, delivery techniques, watershed management planning, media relations, and strategies to assist with developing an outreach campaign. Although larger educational activities, such as training workshops and demonstration projects, may require public or private grant sources, many of the Lake County Stormwater Management Commission Stormwater BMPs (http://www.lakecountyil.gov/2261/Stormwater-Best-Practices) can be established into partner work activities, projects, and education programs.

Table 8-3 provides educational messages, outreach vehicles and methods, target audiences, and partner leads to implement the watershed education and communication strategy. It is important to note that it is based on the Manitou Creek-Fish Lake Drain Watershed-Based Plan issues, opportunities, goals, and objectives (see Chapter 2). The vehicles and methods, partner leads, and messages columns listed below are not comprehensive, but are noted most effective means of disseminating education and outreach topics to that target audience. This table (and Chapter 8) were created to act as an education and outreach strategy and roadmap for watershed stakeholders and to help guide partner leads (identified below) for their own education and outreach strategies and activities. Although partner leads are identified below, there could be other appropriate partner and support leads not listed.

Table 8-3: Educational Topics, Messages, and Partners. Potential message topics that support priority topic areas identified during stakeholder outreach efforts are identified in bold typeface.

Target Audience (Section 8.3)	Watershed Goals	Vehicle/ Method	Partner Leads	Messages (Topics/Actions)
8.3.1 Local Government Officials & Agencies	1, 2, 3, 4	Emails, newsletters, websites, social media, targeted/one-on-one discussions and technical assistance, manuals or plans, technical resources	CMAP, LCFPD, SMC, DD, Illinois EPA	Adoption and implementation of the Manitou Creek-Fish Lake Drain Watershed-Based Plan
				Road salt application BMPs and alternatives
				Impact of impervious surfaces and soil compaction and benefits of green infrastructure
				Implement best practices related to the management/maintenance of recreational bodies of water, lakes, streams, and riparian areas**, including the reduction of harmful algal blooms**
				Responsibility/jurisdiction for drainage concerns and maintenance.
8.3.2 Residents & Businesses	1, 2, 3, 4, 5	Social media, brochures, newsletters, factsheets, inserts/utility bills, education signage at demonstration sites	SMC, C, M	**Economic/Quality of Life benefits of water quality improvement and flood mitigation** **Role and responsibilities of landowners and public agencies for drainage concerns** **Yard waste management.** **Septic system maintenance.**
		Social media, brochures, newsletters, factsheets, demonstrations and trainings	SMC, C, M, EIG	**Role and Responsibility of landowners and best management practices related to runoff reduction; shoreline and riparian management; nutrient reduction and protection from flooding**
		Targeted discussions & technical assistance, outreach programs (e.g. Conservation@Home, RainReady), social media, brochures, newsletters, factsheets	EIG	**Have a beneficial impact on runoff quantity/quality, protect property from flooding**, protect natural resources

Target Audience (Section 8.3)	Watershed Goals	Vehicle/ Method	Partner Leads	Messages (Topics/Actions)
		Social media, brochures, newsletters, factsheets	M, C, LCFPD, EIG	Participate in stream, beach, and natural area stewardship and maintenance opportunities
8.3.3 Schools and Youth Groups	1, 3, 4	Social media, emails, newsletters, education signage at demonstration sites, targeted/one-on-one discussions	Schools, CMAP, LCFPD, EIG	Participate in stream, lake, and natural area stewardship and maintenance opportunities
8.3.4 Developers & Homebuilders	1, 2, 3	Manuals or plans, technical assistance and resources, development planning and permitting process	C, M, SMC	**Implement designs that reduce impervious areas and include green infrastructure and BMPs to reduce runoff beyond current development requirements**
8.3.5 Consultants and Contractors Working in the Watershed	1, 2, 3, 5	Presentations (meetings), emails, newsletters, websites, targeted/one-on-one discussions	Illinois EPA, SMC, M	**Advocate for and implement best practices related to the management/maintenance of lake shorelines, reducing impervious surface, and green infrastructure and BMPs to reduce runoff and nutrients** Participation in Watershed Planning Committee and/or public meeting forums Road salt application BMPs and alternatives
		Manuals or plans, technical assistance and resources	SMC, CMAP, EIG, M	Implement watershed-based plan action recommendations
8.3.6 Landscapers & Nurseries	1, 2, 3, 5	Brochures, newsletters, social media, websites, education signage at demonstration sites, targeted/one-on-one discussions	Master Gardeners, FLCFPD, PD, SMC, CMAP, EIG	Best practices related to shoreline, and stream maintenance and management **Best practices related to nutrient reduction** Road salt application BMPs and alternatives

APPENDIX A:
SITE-SPECIFIC ACTION PLAN

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
Ag_4	Avon Township	Agricultural BMPs	Implement use of cover crops or other best fit agricultural BMPs	173.5	Acres	H	S	1, 2, 3, 5	AG	DOA, FB, M, DD, Illinois EPA, NRCS/SWCD	$17,000	$52,000	90.19	5.20	5.74	0.00	0.00	0.00	Manitou Creek	Y	N
DJ_4	Avon Township	Debris Jam	Remove debris obstructing flow using American Fisheries Society guidelines.	1	Each	H	S	2	PO	T, SMC	$15,000	$110,000	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	Y	N
DJ_6	Avon Township	Debris Jam	Remove debris obstructing flow using American Fisheries Society guidelines.	1	Each	H	S	2	PO	T, DD, SMC	$15,000	$110,000	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	Y	N
FRR_11	Avon Township	Flood Risk Reduction	Design and construct storm sewer upgrades and drainage system enhancements to lower the risk of flooding of adjacent residential properties and roads.	1	Each	H	M	2	M, T	DOT, SMC, PO, DCEO	$600,000	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	Y	N
FRR_04	Avon Township	Flood Risk Reduction	Install storm sewer improvements to reduce depressional flooding at Norelius Drive and the surrounding neighborhood.	1	Each	H	M	2	T	DCEO, SMC, DOT	$614,721	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
SS_77	Avon Township	Stabilization	Stabilize streambank erosion.	4,806	Linear Feet	M	M	1, 2, 5	PD, PO	AG, DOA, FB, LCFPD, UT, M, DD, Illinois EPA, SMC, HOA, USACE, DOT	$721,000	$1,922,000	38.45	14.42	27.25	0.00	0.00	0.00	Manitou Creek	N	N
SS_78	Avon Township	Stabilization	Stabilize streambank erosion.	4,704	Linear Feet	M	M	1, 2, 5	PD, PO	LCFPD, UT, M, DD, Illinois EPA, SMC, USACE, DOT	$706,000	$1,882,000	37.63	14.11	26.67	0.00	0.00	0.00	Manitou Creek	N	N
SS_80	Avon Township	Stabilization	Stabilize streambank erosion.	3,009	Linear Feet	M	M	1, 2, 5	PO	M, DD, Illinois EPA, SMC, USACE, DOT	$451,000	$1,204,000	24.07	9.03	17.06	0.00	0.00	0.00	Manitou Creek	N	N
SS_79	Avon Township	Stabilization	Stabilize streambank erosion.	2,990	Linear Feet	M	M	1, 2, 5	PO	M, DD, Illinois EPA, SMC, USACE, DOT	$449,000	$1,196,000	23.92	8.97	16.95	0.00	0.00	0.00	Manitou Creek	N	N
SS_76	Avon Township	Stabilization	Stabilize streambank erosion.	1,281	Linear Feet	M	M	1, 2, 5	PO	T, PB&D, DD, Illinois EPA, SMC, USACE, DOT	$192,000	$512,000	10.25	3.84	7.26	0.00	0.00	0.00	Manitou Creek	N	N
SS_75	Avon Township	Stabilization	Stabilize streambank erosion.	1,271	Linear Feet	M	M	1, 2, 5	PO	T, PB&D, DD, Illinois EPA, SMC, USACE, DOT	$191,000	$508,000	10.17	3.81	7.21	0.00	0.00	0.00	Manitou Creek	N	N
SS_11	Avon Township	Stabilization	Stabilize erosion.	30	Linear Feet	M	M	1,3	PO	T, PB&D, DD, Illinois EPA, SMC, USACE	$4,000	$12,000	0.24	0.09	0.17	0.00	0.00	0.00	Manitou Creek	N	N
SS_12	Avon Township	Stabilization	Stabilize erosion.	30	Linear Feet	M	M	1,3	PO	T, PB&D, DD, Illinois EPA, SMC, USACE	$4,000	$12,000	0.24	0.09	0.17	0.00	0.00	0.00	Manitou Creek	N	N
SR_3	Avon Township	Stream Restoration	Establish or enhance riparian buffers, including invasive species management and floodplain connectivity enhancements, and install In-channel enhancements such as riffles, root wads, and other habitat features.	4,177	Linear Feet	L	L	1, 2, 3, 5	LCFPD	M, Illinois EPA, SMC, USACE, DOT	$2,088,000	$4,177,000	25.06	12.53	23.68	0.00	0.00	0.00	Manitou Creek	N	N
WI_24	Avon Township	Water Infrastructure	Assess dam removal feasibility.	1	Each	L	L	2	LCFPD	T, PB&D, SMC	$15,000	$100,000	0.01	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
WR_52	Avon Township	Wetland Restoration	Create new wetland.	1.1	Acres	H	S	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$74,000	$116,000	0.55	0.08	0.14	0.00	62.87	1.93	Manitou Creek	N	N
WR_49	Avon Township	Wetland Restoration	Create new wetland.	0.8	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$54,000	$86,000	0.40	0.06	0.10	0.00	46.48	1.42	Manitou Creek	Y	N
WR_63	Avon Township	Wetland Restoration	Create new wetland.	0.7	Acres	H	S	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$50,000	$79,000	0.37	0.06	0.09	0.00	42.75	1.31	Manitou Creek	N	N
WR_138	Avon Township	Wetland Restoration	Create new wetland.	0.2	Acres	H	S	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$16,000	$26,000	0.12	0.02	0.03	0.00	13.91	0.43	Manitou Creek	N	N
WR_88	Avon Township	Wetland Restoration	Create new wetland.	5.8	Acres	M	M	1, 2, 3, 5	PD	M, USACE, USFWS, SMC, Illinois EPA	$409,000	$642,000	3.04	0.47	0.75	0.00	348.85	10.68	Manitou Creek	N	N
WR_87	Avon Township	Wetland Restoration	Create new wetland.	3.1	Acres	M	M	1, 2, 3, 5	AG, LCFPD, PD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$216,000	$339,000	1.60	0.25	0.40	0.00	183.95	5.63	Manitou Creek	Y	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
WR_7	Avon Township	Wetland Restoration	Create new wetland.	2.6	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$184,000	$289,000	1.37	0.21	0.34	0.00	157.04	4.81	Manitou Creek	N	N
WR_11	Avon Township	Wetland Restoration	Create new wetland.	1.6	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$111,000	$174,000	0.82	0.13	0.20	0.00	94.38	2.89	Manitou Creek	N	N
WR_12	Avon Township	Wetland Restoration	Create new wetland.	0.7	Acres	M	M	1, 2, 3, 5	PO	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$47,000	$74,000	0.35	0.05	0.09	0.00	40.06	1.23	Manitou Creek	N	N
WR_46	Avon Township	Wetland Restoration	Create new wetland.	0.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$16,000	$26,000	0.12	0.02	0.03	0.00	13.89	0.43	Manitou Creek	N	N
WR_141	Avon Township	Wetland Restoration	Create new wetland.	0.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$14,000	$22,000	0.10	0.02	0.03	0.00	11.82	0.36	Manitou Creek	N	N
Ag_3	Fremont Township	Agricultural BMPs	Implement use of cover crops or other best fit agricultural BMPs	47.3	Acres	H	S	1, 2, 3, 5	AG	DOA, FB, T, PB&D, DD, Illinois EPA, NRCS/SWCD	$6,000	$18,000	24.58	1.42	1.57	0.00	0.00	0.00	Manitou Creek	Y	N
Ag_6	Fremont Township	Agricultural BMPs	Install grassed buffer/filter strip (35 feet wide).	4,153	Linear Feet	H	S	1, 2, 3, 5	AG	DOA, FB, T, PB&D, DD	$3,000	$10,000	2.94	0.27	0.29	0.00	0.00	0.00	Manitou Creek	Y	N
Ag_2	Fremont Township	Agricultural BMPs	Implement use of cover crops or other best fit agricultural BMPs	5.2	Acres	H	S	1, 2, 3, 5	AG	DOA, FB, M, DD, Illinois EPA, NRCS/SWCD	$3,000	$9,000	2.68	0.15	0.17	0.00	0.00	0.00	Manitou Creek	Y	N
Ag_1	Fremont Township	Agricultural BMPs	Nutrient management plan, erosion control measures, control of run-off to Manitou Creek.	24.0	Acres	H	S	1, 2, 3, 5	AG	DOA, FB, M, DD, Illinois EPA, NRCS/SWCD	$2,000	$7,000	12.47	0.72	0.79	0.00	0.00	0.00	Manitou Creek	Y	N
DJ_7	Fremont Township	Debris Jam	Remove debris obstructing flow using American Fisheries Society guidelines.	1	Each	M	M	2	PO	T, SMC	$15,000	$110,000	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
FRR_13	Fremont Township	Flood Risk Reduction	Perform hydraulic restoration of former agricultural landscape including re-meandering Manitou Creek, channel conveyance improvements, channel stabilization, drain tile disabling, off-site stormwater redirection, and vegetation enhancement. If feasible ,modify impoundment east of Fairfield Rd. and south of N Imperial Ct. to provide flood relief.	380.8	Acres	H	M	1, 2, 3, 5	LCFPD	T, PB&D, DD, USFWS, SMC, DCEO	$2,750,000	-	655.78	45.23	44.45	0.00	0.00	0.00	Manitou Creek	Y	N
Res_3	Fremont Township	Green Infrastructure	Restore habitat by disabling drain tiles, restoring wetland function, and removing invasive species.	105.7	Acres	H	S	1, 2, 3, 5	LCFPD	HOA, Illinois EPA, USACE, USFWS, SMC	$107,000	$321,000	248.01	17.10	16.81	0.00	0.00	0.00	Manitou Creek	Y	N
Res_2	Fremont Township	Green Infrastructure	Perform site restoration of former agricultural landscape. Create trail connection between Nippersink Forest Preserve and the Millenium Trail.	30.6	Acres	H	S	1, 2, 3, 5	LCFPD	UT, T, PB&D, USFWS	$42,000	$125,000	71.03	4.90	4.81	0.00	0.00	0.00	Manitou Creek	Y	N
RSM_1	Fremont Township	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.5	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	14.32	0.00	0.00	Manitou Creek	Y	N
RSM_2	Fremont Township	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.9	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	26.75	0.00	0.00	Manitou Creek	Y	N
RSM_4	Fremont Township	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.4	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	12.99	0.00	0.00	Manitou Creek	N	N
RSM_13	Fremont Township	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.2	Acres	H	S	2, 5	M, PC		-	-	0.00	0.00	0.00	6.00	0.00	0.00	Manitou Creek	Y	N
SIP_1	Fremont Township	Stakeholder Identified Projects	Replace bridge and increase culvert capacity.	1	Each	H	S	2	DD	PO	-	-	-	-	-	-	-	-	Manitou Creek	N	N
SS_94	Fremont Township	Stabilization	Stabilize streambank erosion.	1,022	Linear Feet	H	S	1, 2, 5	PO	AG, DOA, FB, LCFPD, T, PB&D,	$153,000	$409,000	8.18	3.07	5.80	0.00	0.00	0.00	Manitou Creek	Y	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
										DD, Illinois EPA, SMC, USACE											
SS_93	Fremont Township	Stabilization	Stabilize streambank erosion.	999	Linear Feet	H	S	1, 2, 5	PO	AG, DOA, FB, LCFPD, T, PB&D, DD, Illinois EPA, SMC, USACE	$150,000	$400,000	8.00	3.00	5.67	0.00	0.00	0.00	Manitou Creek	Y	N
SS_91	Fremont Township	Stabilization	Stabilize streambank erosion.	621	Linear Feet	M	M	1, 2, 5	PO	T, PB&D, DD, Illinois EPA, SMC, USACE	$93,000	$248,000	4.97	1.86	3.52	0.00	0.00	0.00	Manitou Creek	N	N
SS_92	Fremont Township	Stabilization	Stabilize streambank erosion.	562	Linear Feet	M	M	1, 2, 5	PO	T, PB&D, DD, Illinois EPA, SMC, USACE	$84,000	$225,000	4.50	1.69	3.19	0.00	0.00	0.00	Manitou Creek	N	N
SS_18	Fremont Township	Stabilization	Stabilize shoreline erosion.	5,344	Linear Feet	L	L	1, 2, 5	LCFPD	T, PB&D, DD, Illinois EPA, SMC, USACE	$802,000	$2,138,000	42.75	16.03	30.30	0.00	0.00	0.00	Manitou Creek	N	N
SS_16	Fremont Township	Stabilization	Stabilize shoreline erosion.	2,280	Linear Feet	L	L	1, 2, 5	GC	T, PB&D, Illinois EPA, SMC, USACE	$342,000	$912,000	18.24	6.84	12.93	0.00	0.00	0.00	Manitou Creek	N	N
SS_17	Fremont Township	Stabilization	Stabilize shoreline erosion.	682	Linear Feet	L	L	1, 2, 5	PO	T, PB&D, Illinois EPA, SMC, USACE	$102,000	$273,000	5.45	2.05	3.87	0.00	0.00	0.00	Manitou Creek	N	N
SS_3	Fremont Township	Stabilization	Stabilize erosion.	20	Linear Feet	L	L	1,3	LCFPD	T, PB&D, DD, Illinois EPA, SMC, USACE	$3,000	$8,000	0.16	0.06	0.11	0.00	0.00	0.00	Manitou Creek	N	N
SS_4	Fremont Township	Stabilization	Multiple exposed drain tiles discharge to creek, resulting in erosion. Stabilize erosion.	20	Linear Feet	L	L	1,3	AG	T, PB&D, DD, Illinois EPA, SMC, USACE	$3,000	$8,000	0.16	0.06	0.11	0.00	0.00	0.00	Manitou Creek	N	N
SS_5	Fremont Township	Stabilization	Stabilize erosion.	20	Linear Feet	L	L	1,3	LCFPD	T, PB&D, DD, Illinois EPA, SMC, USACE	$3,000	$8,000	0.16	0.06	0.11	0.00	0.00	0.00	Manitou Creek	N	N
SS_6	Fremont Township	Stabilization	Stabilize erosion.	20	Linear Feet	L	L	1,3	PO	T, PB&D, DD, Illinois EPA, SMC, USACE	$3,000	$8,000	0.16	0.06	0.11	0.00	0.00	0.00	Manitou Creek	N	N
SS_7	Fremont Township	Stabilization	Stabilize erosion.	20	Linear Feet	L	L	1,3	PO	T, PB&D, DD, Illinois EPA, SMC, USACE	$3,000	$8,000	0.16	0.06	0.11	0.00	0.00	0.00	Manitou Creek	N	N
SR_1	Fremont Township	Stream Restoration	Remeander/naturalize channel and reconnect to the floodplain.	2,562	Linear Feet	H	M	1, 2, 3, 5	LCFPD	T, PB&D, DD, Illinois EPA, SMC, USACE, DOT, DCEO	$1,281,000	$2,562,000	15.37	7.69	14.53	0.00	0.00	0.00	Manitou Creek	N	N
SR_4	Fremont Township	Stream Restoration	Establish or enhance riparian buffers, including invasive species management and floodplain connectivity enhancements, and install In-channel enhancements such as riffles, root wads, and other habitat features.	16,733	Linear Feet	L	L	1, 2, 3, 5	LCFPD	T, PB&D, DD, Illinois EPA, SMC, USACE, DOT	$8,367,000	$16,733,000	100.40	50.20	94.88	0.00	0.00	0.00	Manitou Creek	N	N
WI_6	Fremont Township	Water Infrastructure	1. Stabilize erosion. 2. Extend discharge point to base water level and/or install appropriate energy dissipation.	1	Each	M	M	2	LCFPD	T, PB&D, DD, SMC	$15,000	$100,000	0.01	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
WI_5	Fremont Township	Water Infrastructure	Repair or replace discharge point.	1	Each	M	M	2	LCFPD	T, PB&D, DD, SMC	$10,000	$50,000	0.01	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
WI_8	Fremont Township	Water Infrastructure	Exposed drain tile discharges to creek, resulting in erosion. Repair or replace discharge point.	1	Each	M	M	2	AG	DOA, FB, T, PB&D, DD, SMC	$10,000	$50,000	0.01	0.00	0.01	0.00	0.00	0.00	Manitou Creek	Y	N
WI_9	Fremont Township	Water Infrastructure	Repair or replace discharge point.	1	Each	M	M	2	UT	T, PB&D, DD, SMC	$10,000	$50,000	0.01	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
WI_7	Fremont Township	Water Infrastructure	Exposed drain tile discharges to creek, resulting in erosion. Repair or replace discharge point.	1	Each	M	M		AG	T, PB&D, DD, SMC, DOA, FB	$10,000	$50,000	0.01	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
WI_4	Fremont Township	Water Infrastructure	Repair or replace discharge point.	1	Each	L	L	2	PO	T, PB&D, DD, SMC, HOA	$10,000	$50,000	0.01	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
WR_6	Fremont Township	Wetland Restoration	Create new wetland.	48.1	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD, DOT, DCEO	$3,369,000	$5,294,000	25.03	3.85	6.21	0.00	2,875.70	88.08	Manitou Creek	Y	N
WR_26	Fremont Township	Wetland Restoration	Create new wetland.	25.2	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DCEO	$1,766,000	$2,776,000	13.12	2.02	3.26	0.00	1,507.78	46.18	Manitou Creek	Y	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
WR_18	Fremont Township	Wetland Restoration	Create new wetland.	13.1	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$919,000	$1,444,000	6.82	1.05	1.69	0.00	784.09	24.01	Manitou Creek	Y	N
WR_154	Fremont Township	Wetland Restoration	Create new wetland.	12.4	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD, DCEO	$871,000	$1,369,000	6.47	1.00	1.61	0.00	743.73	22.78	Manitou Creek	Y	N
WR_93	Fremont Township	Wetland Restoration	Create new wetland.	10.6	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DCEO	$745,000	$1,171,000	5.53	0.85	1.37	0.00	635.82	19.47	Manitou Creek	Y	N
WR_73	Fremont Township	Wetland Restoration	Create new wetland.	9.9	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$695,000	$1,092,000	5.16	0.79	1.28	0.00	592.92	18.16	Manitou Creek	Y	N
WR_76	Fremont Township	Wetland Restoration	Create new wetland.	6.8	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$478,000	$751,000	3.55	0.55	0.88	0.00	407.96	12.49	Manitou Creek	Y	N
WR_105	Fremont Township	Wetland Restoration	Create new wetland.	4.4	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$310,000	$488,000	2.30	0.35	0.57	0.00	264.82	8.11	Manitou Creek	Y	N
WR_83	Fremont Township	Wetland Restoration	Create new wetland.	3.9	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$275,000	$433,000	2.05	0.31	0.51	0.00	234.98	7.20	Manitou Creek	Y	N
WR_41	Fremont Township	Wetland Restoration	Create new wetland.	3.6	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$252,000	$395,000	1.87	0.29	0.46	0.00	214.80	6.58	Manitou Creek	Y	N
WR_108	Fremont Township	Wetland Restoration	Create new wetland.	3.0	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DCEO	$210,000	$330,000	1.56	0.24	0.39	0.00	178.99	5.48	Manitou Creek	Y	N
WR_55	Fremont Township	Wetland Restoration	Create new wetland.	2.1	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DCEO	$148,000	$233,000	1.10	0.17	0.27	0.00	126.71	3.88	Manitou Creek	Y	N
WR_61	Fremont Township	Wetland Restoration	Create new wetland.	2.1	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$145,000	$228,000	1.08	0.17	0.27	0.00	123.66	3.79	Manitou Creek	Y	N
WR_19	Fremont Township	Wetland Restoration	Create new wetland.	2.1	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD, DOT, DCEO	$144,000	$226,000	1.07	0.16	0.26	0.00	122.63	3.76	Manitou Creek	Y	N
WR_33	Fremont Township	Wetland Restoration	Create new wetland.	1.8	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DCEO	$127,000	$199,000	0.94	0.15	0.23	0.00	108.30	3.32	Manitou Creek	Y	N
WR_45	Fremont Township	Wetland Restoration	Create new wetland.	1.6	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$111,000	$175,000	0.83	0.13	0.21	0.00	94.94	2.91	Manitou Creek	Y	N
WR_70	Fremont Township	Wetland Restoration	Create new wetland.	1.3	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$88,000	$138,000	0.65	0.10	0.16	0.00	75.10	2.30	Manitou Creek	Y	N
WR_77	Fremont Township	Wetland Restoration	Create new wetland.	1.2	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$83,000	$131,000	0.62	0.10	0.15	0.00	71.06	2.18	Manitou Creek	Y	N
WR_37	Fremont Township	Wetland Restoration	Create new wetland.	1.2	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$84,000	$131,000	0.62	0.10	0.15	0.00	71.41	2.19	Manitou Creek	Y	N
WR_40	Fremont Township	Wetland Restoration	Create new wetland.	0.8	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$55,000	$86,000	0.41	0.06	0.10	0.00	46.77	1.43	Manitou Creek	Y	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
WR_17	Fremont Township	Wetland Restoration	Create new wetland.	0.7	Acres	H	S	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$46,000	$72,000	0.34	0.05	0.08	0.00	38.85	1.19	Manitou Creek	N	N
WR_74	Fremont Township	Wetland Restoration	Create new wetland.	0.6	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$40,000	$63,000	0.30	0.05	0.07	0.00	33.96	1.04	Manitou Creek	Y	N
WR_106	Fremont Township	Wetland Restoration	Create new wetland.	0.5	Acres	H	S	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$38,000	$60,000	0.29	0.04	0.07	0.00	32.75	1.00	Manitou Creek	N	N
WR_16	Fremont Township	Wetland Restoration	Create new wetland.	0.3	Acres	H	S	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$24,000	$38,000	0.18	0.03	0.04	0.00	20.46	0.63	Manitou Creek	N	N
WR_62	Fremont Township	Wetland Restoration	Create new wetland.	0.2	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$15,000	$24,000	0.11	0.02	0.03	0.00	12.91	0.40	Manitou Creek	Y	N
WR_51	Fremont Township	Wetland Restoration	Create new wetland.	0.1	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$7,000	$12,000	0.06	0.01	0.01	0.00	6.39	0.20	Manitou Creek	Y	N
WR_13	Fremont Township	Wetland Restoration	Create new wetland.	16.1	Acres	M	M	1, 2, 3, 5	AG, HOA	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$1,127,000	$1,770,000	8.37	1.29	2.08	0.00	961.67	29.45	Manitou Creek	Y	N
WR_25	Fremont Township	Wetland Restoration	Create new wetland.	8.9	Acres	M	M	1, 2, 3, 5	SI	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$624,000	$981,000	4.64	0.71	1.15	0.00	532.72	16.32	Manitou Creek	Y	N
WR_42	Fremont Township	Wetland Restoration	Create new wetland.	8.4	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$586,000	$921,000	4.35	0.67	1.08	0.00	500.23	15.32	Manitou Creek	N	N
WR_22	Fremont Township	Wetland Restoration	Create new wetland.	5.3	Acres	M	M	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD, DOT	$369,000	$579,000	2.74	0.42	0.68	0.00	314.74	9.64	Manitou Creek	Y	N
WR_97	Fremont Township	Wetland Restoration	Create new wetland.	4.3	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$300,000	$471,000	2.23	0.34	0.55	0.00	255.77	7.83	Manitou Creek	N	N
WR_8	Fremont Township	Wetland Restoration	Create new wetland.	3.7	Acres	M	M	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$258,000	$405,000	1.91	0.29	0.48	0.00	219.84	6.73	Manitou Creek	Y	N
WR_15	Fremont Township	Wetland Restoration	Create new wetland.	3.6	Acres	M	M	1, 2, 3, 5	AG, LCFPD	SI, DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$249,000	$392,000	1.85	0.29	0.46	0.00	212.87	6.52	Manitou Creek	Y	N
WR_58	Fremont Township	Wetland Restoration	Create new wetland.	3.3	Acres	M	M	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$233,000	$366,000	1.73	0.27	0.43	0.00	199.05	6.10	Manitou Creek	Y	N
WR_72	Fremont Township	Wetland Restoration	Create new wetland.	3.2	Acres	M	M	1, 2, 3, 5	AG, LCFPD	SI, DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$223,000	$351,000	1.66	0.26	0.41	0.00	190.58	5.84	Manitou Creek	Y	N
WR_1	Fremont Township	Wetland Restoration	Create new wetland.	2.5	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$172,000	$271,000	1.28	0.20	0.32	0.00	147.05	4.50	Manitou Creek	N	N
WR_24	Fremont Township	Wetland Restoration	Create new wetland.	2.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD, DOT	$157,000	$246,000	1.17	0.18	0.29	0.00	133.86	4.10	Manitou Creek	N	N
WR_78	Fremont Township	Wetland Restoration	Create new wetland.	2.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$156,000	$244,000	1.16	0.18	0.29	0.00	132.78	4.07	Manitou Creek	N	N
WR_109	Fremont Township	Wetland Restoration	Create new wetland.	2.0	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$141,000	$222,000	1.05	0.16	0.26	0.00	120.58	3.69	Manitou Creek	N	N
WR_71	Fremont Township	Wetland Restoration	Create new wetland.	1.9	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$135,000	$212,000	1.00	0.15	0.25	0.00	115.19	3.53	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
WR_64	Fremont Township	Wetland Restoration	Create new wetland.	1.5	Acres	M	M	1, 2, 3, 5	AG, LCFPD	SI, DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$102,000	$160,000	0.76	0.12	0.19	0.00	87.10	2.67	Manitou Creek	Y	N
WR_96	Fremont Township	Wetland Restoration	Create new wetland.	1.4	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$101,000	$158,000	0.75	0.12	0.19	0.00	86.08	2.64	Manitou Creek	N	N
WR_84	Fremont Township	Wetland Restoration	Create new wetland.	1.4	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$95,000	$149,000	0.71	0.11	0.18	0.00	81.19	2.49	Manitou Creek	N	N
WR_53	Fremont Township	Wetland Restoration	Create new wetland.	1.3	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$90,000	$141,000	0.67	0.10	0.17	0.00	76.46	2.34	Manitou Creek	N	N
WR_36	Fremont Township	Wetland Restoration	Create new wetland.	1.1	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$78,000	$122,000	0.58	0.09	0.14	0.00	66.48	2.04	Manitou Creek	N	N
WR_50	Fremont Township	Wetland Restoration	Create new wetland.	0.9	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$61,000	$96,000	0.45	0.07	0.11	0.00	52.11	1.60	Manitou Creek	N	N
WR_35	Fremont Township	Wetland Restoration	Create new wetland.	0.8	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$59,000	$93,000	0.44	0.07	0.11	0.00	50.39	1.54	Manitou Creek	N	N
WR_39	Fremont Township	Wetland Restoration	Create new wetland.	0.8	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$57,000	$90,000	0.42	0.07	0.11	0.00	48.65	1.49	Manitou Creek	N	N
WR_20	Fremont Township	Wetland Restoration	Create new wetland.	0.8	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$55,000	$86,000	0.41	0.06	0.10	0.00	46.96	1.44	Manitou Creek	N	N
WR_27	Fremont Township	Wetland Restoration	Create new wetland.	0.7	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$51,000	$81,000	0.38	0.06	0.09	0.00	43.91	1.34	Manitou Creek	N	N
WR_114	Fremont Township	Wetland Restoration	Create new wetland.	0.7	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$49,000	$77,000	0.37	0.06	0.09	0.00	42.10	1.29	Fish Lake Drain	N	N
WR_75	Fremont Township	Wetland Restoration	Create new wetland.	0.7	Acres	M	M	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$46,000	$72,000	0.34	0.05	0.09	0.00	39.37	1.21	Manitou Creek	Y	N
WR_28	Fremont Township	Wetland Restoration	Create new wetland.	0.6	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$44,000	$70,000	0.33	0.05	0.08	0.00	37.91	1.16	Manitou Creek	N	N
WR_9	Fremont Township	Wetland Restoration	Create new wetland.	0.6	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$41,000	$65,000	0.31	0.05	0.08	0.00	35.09	1.07	Manitou Creek	N	N
WR_21	Fremont Township	Wetland Restoration	Create new wetland.	0.6	Acres	M	M	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$39,000	$61,000	0.29	0.04	0.07	0.00	33.05	1.01	Manitou Creek	Y	N
WR_66	Fremont Township	Wetland Restoration	Create new wetland.	0.5	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$37,000	$58,000	0.28	0.04	0.07	0.00	31.63	0.97	Manitou Creek	N	N
WR_69	Fremont Township	Wetland Restoration	Create new wetland.	0.5	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$37,000	$58,000	0.27	0.04	0.07	0.00	31.27	0.96	Manitou Creek	N	N
WR_10	Fremont Township	Wetland Restoration	Create new wetland.	0.5	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$37,000	$57,000	0.27	0.04	0.07	0.00	31.22	0.96	Manitou Creek	N	N
WR_38	Fremont Township	Wetland Restoration	Create new wetland.	0.5	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$33,000	$52,000	0.25	0.04	0.06	0.00	28.39	0.87	Manitou Creek	N	N
WR_56	Fremont Township	Wetland Restoration	Create new wetland.	0.4	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$31,000	$49,000	0.23	0.04	0.06	0.00	26.36	0.81	Manitou Creek	N	N
WR_67	Fremont Township	Wetland Restoration	Create new wetland.	0.4	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$31,000	$49,000	0.23	0.04	0.06	0.00	26.40	0.81	Manitou Creek	N	N
WR_57	Fremont Township	Wetland Restoration	Create new wetland.	0.4	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$31,000	$48,000	0.23	0.04	0.06	0.00	26.20	0.80	Fish Lake Drain	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
WR_85	Fremont Township	Wetland Restoration	Create new wetland.	0.4	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$30,000	$47,000	0.22	0.03	0.06	0.00	25.59	0.78	Manitou Creek	N	N
WR_54	Fremont Township	Wetland Restoration	Create new wetland.	0.4	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$25,000	$40,000	0.19	0.03	0.05	0.00	21.73	0.67	Manitou Creek	N	N
WR_34	Fremont Township	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$24,000	$37,000	0.18	0.03	0.04	0.00	20.16	0.62	Manitou Creek	N	N
WR_44	Fremont Township	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$23,000	$36,000	0.17	0.03	0.04	0.00	19.76	0.61	Manitou Creek	N	N
WR_14	Fremont Township	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	AG, LCFPD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$21,000	$34,000	0.16	0.02	0.04	0.00	18.23	0.56	Manitou Creek	Y	N
WR_23	Fremont Township	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$21,000	$34,000	0.16	0.02	0.04	0.00	18.29	0.56	Manitou Creek	N	N
WR_68	Fremont Township	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$22,000	$34,000	0.16	0.02	0.04	0.00	18.67	0.57	Manitou Creek	N	N
WR_60	Fremont Township	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$21,000	$33,000	0.16	0.02	0.04	0.00	17.94	0.55	Manitou Creek	N	N
WR_82	Fremont Township	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$19,000	$31,000	0.14	0.02	0.04	0.00	16.58	0.51	Manitou Creek	N	N
WR_135	Fremont Township	Wetland Restoration	Create new wetland.	0.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$14,000	$22,000	0.10	0.02	0.03	0.00	11.70	0.36	Manitou Creek	N	N
WR_134	Fremont Township	Wetland Restoration	Create new wetland.	0.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$13,000	$21,000	0.10	0.02	0.02	0.00	11.26	0.34	Manitou Creek	N	N
WR_125	Fremont Township	Wetland Restoration	Create new wetland.	0.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$13,000	$20,000	0.09	0.01	0.02	0.00	10.74	0.33	Manitou Creek	N	N
WR_123	Fremont Township	Wetland Restoration	Create new wetland.	0.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$11,000	$17,000	0.08	0.01	0.02	0.00	9.27	0.28	Manitou Creek	N	N
WR_136	Fremont Township	Wetland Restoration	Create new wetland.	0.1	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$9,000	$14,000	0.07	0.01	0.02	0.00	7.78	0.24	Manitou Creek	N	N
WR_133	Fremont Township	Wetland Restoration	Create new wetland.	0.1	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$9,000	$13,000	0.06	0.01	0.02	0.00	7.32	0.22	Manitou Creek	N	N
WR_124	Fremont Township	Wetland Restoration	Create new wetland.	0.1	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$8,000	$12,000	0.06	0.01	0.01	0.00	6.58	0.20	Manitou Creek	N	N
WR_132	Fremont Township	Wetland Restoration	Create new wetland.	0.1	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$8,000	$12,000	0.06	0.01	0.01	0.00	6.72	0.21	Manitou Creek	N	N
DJ_2	Grant Township	Debris Jam	Remove debris obstructing flow using American Fisheries Society guidelines.	1	Each	M	M	2	CBL	T, SMC	$15,000	$110,000	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
RSM_36	Grant Township	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.6	Acres	H	S	2, 5	PC, CBL		-	-	0.00	0.00	0.00	18.78	0.00	0.00	Manitou Creek	N	N
RSM_37	Grant Township	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	35.3	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	1,023.56	0.00	0.00	Manitou Creek	N	N
RVR_36	Grant Township	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	168.8	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$2,942,000	$14,709,000	3.51	0.43	0.61	0.00	685.31	18.04	Manitou Creek	N	N

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RVR_37	Grant Township	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	51.4	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$896,000	$4,482,000	1.07	0.13	0.19	0.00	208.82	5.50	Manitou Creek	N	N
RVR_136	Grant Township	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.0	Acres	H	M	2, 5	PO	T, PB&D, SMC, Illinois EPA	$35,000	$173,000	0.04	0.01	0.01	0.00	8.05	0.21	Manitou Creek	N	N
RVR_236	Grant Township	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.1	Acres	H	M	2, 5	PO	T, PB&D, SMC, Illinois EPA	$19,000	$97,000	0.02	0.00	0.00	0.00	4.51	0.12	Manitou Creek	N	N
RVR_87	Grant Township	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.8	Acres	H	M	2, 5	PO	T, PB&D, SMC, Illinois EPA	$14,000	$70,000	0.02	0.00	0.00	0.00	3.24	0.09	Manitou Creek	N	N
RVR_166	Grant Township	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.7	Acres	H	M	2, 5	LCPW	T, PB&D, SMC, Illinois EPA	$13,000	$64,000	0.02	0.00	0.00	0.00	2.97	0.08	Manitou Creek	N	N
RVR_7	Grant Township	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	T, PB&D, SMC, Illinois EPA	$8,000	$38,000	0.01	0.00	0.00	0.00	1.78	0.05	Manitou Creek	N	N
RVR_137	Grant Township	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	T, PB&D, SMC, Illinois EPA	$4,000	$20,000	0.00	0.00	0.00	0.00	0.94	0.02	Manitou Creek	N	N
RVR_169	Grant Township	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	T, PB&D, SMC, Illinois EPA	$4,000	$18,000	0.00	0.00	0.00	0.00	0.83	0.02	Manitou Creek	N	N
RVR_295	Grant Township	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	T, PB&D, SMC, Illinois EPA	$4,000	$18,000	0.00	0.00	0.00	0.00	0.82	0.02	Manitou Creek	N	N
RVR_58	Grant Township	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	T, PB&D, SMC, Illinois EPA	$3,000	$17,000	0.00	0.00	0.00	0.00	0.80	0.02	Manitou Creek	N	N
RVR_324	Grant Township	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	T, PB&D, SMC, Illinois EPA	$3,000	$17,000	0.00	0.00	0.00	0.00	0.78	0.02	Manitou Creek	N	N
RVR_68	Grant Township	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	T, PB&D, SMC, Illinois EPA	$3,000	$15,000	0.00	0.00	0.00	0.00	0.69	0.02	Manitou Creek	N	N
RVR_110	Grant Township	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	T, PB&D, SMC, Illinois EPA	$3,000	$15,000	0.00	0.00	0.00	0.00	0.70	0.02	Manitou Creek	N	N
RVR_34	Grant Township	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts,	0.1	Acres	H	M	2, 5	PO	T, PB&D, SMC, Illinois EPA	$2,000	$12,000	0.00	0.00	0.00	0.00	0.55	0.01	Manitou Creek	N	N

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			recessed landscape islands, or other green infrastructure BMPs.																		
SS_33	Grant Township	Stabilization	Stabilize streambank erosion.	2,700	Linear Feet	M	M	1, 2, 5	HOA, PO	T, PB&D, Illinois EPA, SMC, USACE, DOT	$405,000	$1,080,000	21.60	8.10	15.31	0.00	0.00	0.00	Fish Lake Drain	N	N
SS_35	Grant Township	Stabilization	Stabilize streambank erosion.	1,857	Linear Feet	M	M	1, 2, 5	HOA, PO	T, PB&D, Illinois EPA, SMC, USACE, DOT	$279,000	$743,000	14.86	5.57	10.53	0.00	0.00	0.00	Fish Lake Drain	N	N
SS_37	Grant Township	Stabilization	Stabilize streambank erosion.	1,186	Linear Feet	M	M	1, 2, 5	PO, HOA	T, PB&D, Illinois EPA, SMC, USACE, DOT	$178,000	$474,000	9.48	3.56	6.72	0.00	0.00	0.00	Fish Lake Drain	N	N
SS_38	Grant Township	Stabilization	Stabilize streambank erosion.	1,118	Linear Feet	M	M	1, 2, 5	PO, UT	T, PB&D, Illinois EPA, SMC, USACE, DOT	$168,000	$447,000	8.94	3.35	6.34	0.00	0.00	0.00	Fish Lake Drain	N	N
SS_34	Grant Township	Stabilization	Stabilize streambank erosion.	1,078	Linear Feet	M	M	1, 2, 5	HOA, PO	T, PB&D, Illinois EPA, SMC, USACE, DOT	$162,000	$431,000	8.63	3.24	6.11	0.00	0.00	0.00	Fish Lake Drain	N	N
SS_36	Grant Township	Stabilization	Stabilize streambank erosion.	1,066	Linear Feet	M	M	1, 2, 5	PO, HOA	T, PB&D, Illinois EPA, SMC, USACE	$160,000	$426,000	8.53	3.20	6.04	0.00	0.00	0.00	Fish Lake Drain	N	N
SS_39	Grant Township	Stabilization	Stabilize streambank erosion.	1,057	Linear Feet	M	M	1, 2, 5	UT	T, PB&D, Illinois EPA, SMC, USACE, DOT	$159,000	$423,000	8.46	3.17	5.99	0.00	0.00	0.00	Fish Lake Drain	N	N
SS_68	Grant Township	Stabilization	Stabilize streambank erosion.	990	Linear Feet	M	M	1, 2, 5	PO	LCFPD, T, PB&D, Illinois EPA, SMC, USACE	$149,000	$396,000	7.92	2.97	5.62	0.00	0.00	0.00	Manitou Creek	N	N
SS_69	Grant Township	Stabilization	Stabilize streambank erosion.	973	Linear Feet	M	M	1, 2, 5	PO	LCFPD, T, PB&D, Illinois EPA, SMC, USACE	$146,000	$389,000	7.79	2.92	5.52	0.00	0.00	0.00	Manitou Creek	N	N
SS_63	Grant Township	Stabilization	Stabilize streambank erosion.	784	Linear Feet	M	M	1, 2, 5	AG, SI	SI, T, PB&D, Illinois EPA, SMC, USACE	$118,000	$313,000	6.27	2.35	4.44	0.00	0.00	0.00	Fish Lake Drain	N	N
SS_40	Grant Township	Stabilization	Stabilize streambank erosion.	458	Linear Feet	M	M	1, 2, 5	PO	T, PB&D, Illinois EPA, SMC, USACE, DOT	$69,000	$183,000	3.66	1.37	2.60	0.00	0.00	0.00	Fish Lake Drain	N	N
SS_41	Grant Township	Stabilization	Stabilize streambank erosion.	422	Linear Feet	M	M	1, 2, 5	PO	T, PB&D, Illinois EPA, SMC, USACE, DOT	$63,000	$169,000	3.37	1.27	2.39	0.00	0.00	0.00	Fish Lake Drain	N	N
SS_67	Grant Township	Stabilization	Stabilize streambank erosion.	342	Linear Feet	M	M	1, 2, 5	HOA	T, PB&D, Illinois EPA, SMC, USACE	$51,000	$137,000	2.74	1.03	1.94	0.00	0.00	0.00	Manitou Creek	N	N
SS_66	Grant Township	Stabilization	Stabilize streambank erosion.	247	Linear Feet	M	M	1, 2, 5	HOA	T, PB&D, Illinois EPA, SMC, USACE	$37,000	$99,000	1.98	0.74	1.40	0.00	0.00	0.00	Manitou Creek	N	N
SS_19	Grant Township	Stabilization	Stabilize shoreline erosion.	7,640	Linear Feet	L	L	1, 2, 5	M, HOA	PO, Illinois EPA, SMC, USACE, DOT	$1,146,000	$3,056,000	61.12	22.92	43.32	0.00	0.00	0.00	Fish Lake Drain	N	N
SR_3	Grant Township	Stream Restoration	Establish or enhance riparian buffers, including invasive species management and floodplain connectivity enhancements, and install In-channel enhancements such as riffles, root wads, and other habitat features.	4,177	Linear Feet	L	L	1, 2, 3, 5	LCFPD	M, Illinois EPA, SMC, USACE, DOT	$2,088,000	$4,177,000	25.06	12.53	23.68	0.00	0.00	0.00	Manitou Creek	N	N
WI_3	Grant Township	Water Infrastructure	Assess dam removal feasibility.	1	Each	H	S	2	PO	T, SMC, USFWS, USACE, Illinois EPA	$15,000	$100,000	0.01	0.00	0.00	0.00	0.00	0.00	Fish Lake Drain	N	N
WI_21	Grant Township	Water Infrastructure	Partially suspended/unsupported pipe crosses stream reach. May pose debris jam or pipe failure risk. Consider alternative design.	1	Each	L	L	2	CBL	T, PB&D, SMC	$15,000	$100,000	0.01	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
WR_59	Grant Township	Wetland Restoration	Create new wetland.	39.9	Acres	H	S	1, 2, 3, 5	AG, LCFPD	DOA, FB, UT, T, USACE, USFWS, SMC, Illinois EPA, PB&D, HOA, DOT	$2,794,000	$4,390,000	20.75	3.19	5.15	0.00	2,384.67	73.04	Manitou Creek	Y	N
WR_11	Grant Township	Wetland Restoration	Create new wetland.	1.6	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$111,000	$174,000	0.82	0.13	0.20	0.00	94.38	2.89	Manitou Creek	N	N
WR_104	Grant Township	Wetland Restoration	Create new wetland.	0.8	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$55,000	$86,000	0.41	0.06	0.10	0.00	46.61	1.43	Fish Lake Drain	N	N
WR_47	Grant Township	Wetland Restoration	Create new wetland.	0.4	Acres	M	M	1, 2, 3, 5	LCFPD, UT	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$31,000	$49,000	0.23	0.04	0.06	0.00	26.57	0.81	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
WR_140	Grant Township	Wetland Restoration	Create new wetland.	0.1	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$10,000	$15,000	0.07	0.01	0.02	0.00	8.30	0.25	Manitou Creek	N	Y
FRR_11	Grant Township	Flood Risk Reduction	Design and construct storm sewer upgrades and drainage system enhancements to lower the risk of flooding of adjacent residential properties and roads.	1	Each	H	M	2	M, T	DOT, SMC, PO, DCEO	$600,000	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	Y	N
SS_24	Lake Villa Township	Stabilization	Stabilize streambank erosion.	1,230	Linear Feet	M	M	1, 2, 5	PO	AG, DOA, FB, T, PB&D, Illinois EPA, SMC, USACE, DOT	$185,000	$492,000	9.84	3.69	6.98	0.00	0.00	0.00	Manitou Creek	N	N
SS_25	Lake Villa Township	Stabilization	Stabilize streambank erosion.	1,217	Linear Feet	M	M	1, 2, 5	PO	T, PB&D, Illinois EPA, SMC, USACE, DOT	$182,000	$487,000	9.73	3.65	6.90	0.00	0.00	0.00	Manitou Creek	N	N
SS_26	Lake Villa Township	Stabilization	Stabilize streambank erosion.	636	Linear Feet	M	M	1, 2, 5	PO	T, PB&D, Illinois EPA, SMC, USACE	$95,000	$255,000	5.09	1.91	3.61	0.00	0.00	0.00	Manitou Creek	N	N
SS_22	Lake Villa Township	Stabilization	Stabilize streambank erosion.	300	Linear Feet	M	M	1, 2, 5	PO	T, PB&D, Illinois EPA, SMC, USACE, DOT	$45,000	$120,000	2.40	0.90	1.70	0.00	0.00	0.00	Manitou Creek	N	N
SS_23	Lake Villa Township	Stabilization	Stabilize streambank erosion.	273	Linear Feet	M	M	1, 2, 5	PO	T, PB&D, Illinois EPA, SMC, USACE, DOT	$41,000	$109,000	2.19	0.82	1.55	0.00	0.00	0.00	Manitou Creek	N	N
SR_3	Lake Villa Township	Stream Restoration	Establish or enhance riparian buffers, including invasive species management and floodplain connectivity enhancements, and install In-channel enhancements such as riffles, root wads, and other habitat features.	4,177	Linear Feet	L	L	1, 2, 3, 5	LCFPD	M, Illinois EPA, SMC, USACE, DOT	$2,088,000	$4,177,000	25.06	12.53	23.68	0.00	0.00	0.00	Manitou Creek	N	N
WR_112	Lake Villa Township	Wetland Restoration	Create new wetland.	3.5	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$244,000	$383,000	1.81	0.28	0.45	0.00	208.17	6.38	Manitou Creek	N	N
WR_107	Lake Villa Township	Wetland Restoration	Create new wetland.	2.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$156,000	$245,000	1.16	0.18	0.29	0.00	133.21	4.08	Manitou Creek	N	N
WR_111	Lake Villa Township	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$23,000	$36,000	0.17	0.03	0.04	0.00	19.69	0.60	Manitou Creek	N	N
WR_110	Lake Villa Township	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$21,000	$33,000	0.16	0.02	0.04	0.00	17.85	0.55	Manitou Creek	N	N
WR_130	Lake Villa Township	Wetland Restoration	Create new wetland.	0.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$11,000	$17,000	0.08	0.01	0.02	0.00	9.42	0.29	Manitou Creek	N	N
WR_131	Lake Villa Township	Wetland Restoration	Create new wetland.	0.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$11,000	$17,000	0.08	0.01	0.02	0.00	9.05	0.28	Manitou Creek	N	N
RVR_319	Village of Fox Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$19,000	$93,000	0.02	0.00	0.00	0.00	4.34	0.11	Manitou Creek	N	N
RVR_184	Village of Fox Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$18,000	$90,000	0.02	0.00	0.00	0.00	4.21	0.11	Manitou Creek	N	N
RVR_318	Village of Fox Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.8	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$14,000	$68,000	0.02	0.00	0.00	0.00	3.17	0.08	Fish Lake Drain	N	N
RVR_249	Village of Fox Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$8,000	$40,000	0.01	0.00	0.00	0.00	1.87	0.05	Fish Lake Drain	N	N
RVR_176	Village of Fox Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$6,000	$32,000	0.01	0.00	0.00	0.00	1.47	0.04	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
			pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.																		
RVR_89	Village of Fox Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$6,000	$31,000	0.01	0.00	0.00	0.00	1.46	0.04	Fish Lake Drain	N	N
RVR_97	Village of Fox Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$5,000	$26,000	0.01	0.00	0.00	0.00	1.23	0.03	Manitou Creek	N	N
RVR_197	Village of Fox Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$4,000	$22,000	0.01	0.00	0.00	0.00	1.04	0.03	Manitou Creek	N	N
RVR_41	Village of Fox Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$4,000	$18,000	0.00	0.00	0.00	0.00	0.82	0.02	Fish Lake Drain	N	N
RVR_72	Village of Fox Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$17,000	0.00	0.00	0.00	0.00	0.81	0.02	Fish Lake Drain	N	N
SS_21	Village of Fox Lake	Stabilization	Stabilize streambank erosion.	1,340	Linear Feet	M	M	1, 2, 5	PO	M, Illinois EPA, SMC, USACE, DOT	$201,000	$536,000	10.72	4.02	7.60	0.00	0.00	0.00	Manitou Creek	N	N
SS_20	Village of Fox Lake	Stabilization	Stabilize streambank erosion.	751	Linear Feet	M	M	1, 2, 5	PO	M, Illinois EPA, SMC, USACE	$113,000	$300,000	6.01	2.25	4.26	0.00	0.00	0.00	Manitou Creek	N	N
Ag_4	Village of Grayslake	Agricultural BMPs	Implement use of cover crops or other best fit agricultural BMPs	173.5	Acres	H	S	1, 2, 3, 5	AG	DOA, FB, M, DD, Illinois EPA, NRCS/SWCD	$17,000	$52,000	90.19	5.20	5.74	0.00	0.00	0.00	Manitou Creek	Y	N
RVR_201	Village of Grayslake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	5.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$87,000	$433,000	0.10	0.01	0.02	0.00	20.17	0.53	Manitou Creek	N	N
RVR_254	Village of Grayslake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.7	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$47,000	$236,000	0.06	0.01	0.01	0.00	10.99	0.29	Manitou Creek	N	N
Ag_4	Village of Hainesville	Agricultural BMPs	Implement use of cover crops or other best fit agricultural BMPs	173.5	Acres	H	S	1, 2, 3, 5	AG	DOA, FB, M, DD, Illinois EPA, NRCS/SWCD	$17,000	$52,000	90.19	5.20	5.74	0.00	0.00	0.00	Manitou Creek	Y	N
Ag_5	Village of Hainesville	Agricultural BMPs	Implement use of cover crops or other best fit agricultural BMPs	59.7	Acres	H	S	1, 2, 3, 5	AG	DOA, FB, M, DD, Illinois EPA, NRCS/SWCD	$6,000	$18,000	31.03	1.79	1.98	0.00	0.00	0.00	Manitou Creek	Y	N
Ag_9	Village of Hainesville	Agricultural BMPs	Install grassed buffer/filter strip (35 feet wide).	4,784	Linear Feet	H	S	1, 2, 3, 5	AG	DOA, FB, M, DD	$4,000	$12,000	3.38	0.31	0.34	0.00	0.00	0.00	Manitou Creek	Y	N
Ag_8	Village of Hainesville	Agricultural BMPs	Install grassed buffer/filter strip (35 feet wide).	3,320	Linear Feet	H	S	1, 2, 3, 5	AG	DOA, FB, M, DD	$3,000	$8,000	2.35	0.21	0.23	0.00	0.00	0.00	Manitou Creek	Y	N
RVR_251	Village of Hainesville	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	10.3	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$180,000	$900,000	0.21	0.03	0.04	0.00	41.93	1.10	Manitou Creek	N	N
RVR_315	Village of Hainesville	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.6	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$28,000	$142,000	0.03	0.00	0.01	0.00	6.64	0.17	Manitou Creek	N	N
RVR_82	Village of Hainesville	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts,	1.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$23,000	$114,000	0.03	0.00	0.00	0.00	5.30	0.14	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
			recessed landscape islands, or other green infrastructure BMPs.																		
RVR_171	Village of Hainesville	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$23,000	$113,000	0.03	0.00	0.00	0.00	5.27	0.14	Manitou Creek	N	N
RVR_83	Village of Hainesville	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$21,000	$105,000	0.03	0.00	0.00	0.00	4.90	0.13	Manitou Creek	N	N
RVR_39	Village of Hainesville	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$17,000	$87,000	0.02	0.00	0.00	0.00	4.08	0.11	Manitou Creek	N	N
RVR_19	Village of Hainesville	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$16,000	$81,000	0.02	0.00	0.00	0.00	3.78	0.10	Manitou Creek	N	N
RVR_9	Village of Hainesville	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$15,000	$77,000	0.02	0.00	0.00	0.00	3.58	0.09	Manitou Creek	N	N
RVR_71	Village of Hainesville	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$6,000	$31,000	0.01	0.00	0.00	0.00	1.47	0.04	Manitou Creek	N	N
RVR_101	Village of Hainesville	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$4,000	$21,000	0.01	0.00	0.00	0.00	0.99	0.03	Manitou Creek	N	N
RVR_140	Village of Hainesville	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$4,000	$19,000	0.00	0.00	0.00	0.00	0.86	0.02	Manitou Creek	N	N
SS_10	Village of Hainesville	Stabilization	Stabilize erosion.	20	Linear Feet	L	L	1,3	PO	M, DD, Illinois EPA, SMC, USACE	$3,000	$8,000	0.16	0.06	0.11	0.00	0.00	0.00	Manitou Creek	N	N
DB_6	Village of Hawthorn Woods	Detention Basin Retrofit	1. Stabilize erosion and inlet blowout. 2. Reconstruct inlet.	1	Each	H	M	2	HOA	M, SMC	$3,000	$49,000	0.01	0.01	0.00	0.00	5.69	0.06	Manitou Creek	N	N
DB_12	Village of Lake Villa	Detention Basin Retrofit	1. Remove invasive vegetation. 2. Unclog and repair inlet and outlet.	1	Each	M	M	2	PO	M, SMC, DOT	$4,000	$65,000	0.02	0.02	0.01	0.00	7.59	0.08	Manitou Creek	N	N
RSM_64	Village of Lake Villa	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.5	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	14.71	0.00	0.00	Manitou Creek	Y	N
RSM_66	Village of Lake Villa	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.5	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	42.47	0.00	0.00	Manitou Creek	Y	N
RVR_44	Village of Lake Villa	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	4.9	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$85,000	$423,000	0.10	0.01	0.02	0.00	19.72	0.52	Manitou Creek	N	N
RVR_8	Village of Lake Villa	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	3.9	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$67,000	$336,000	0.08	0.01	0.01	0.00	15.65	0.41	Manitou Creek	N	N
RVR_233	Village of Lake Villa	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable	2.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$51,000	$253,000	0.06	0.01	0.01	0.00	11.77	0.31	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
			pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.																		
RVR_14	Village of Lake Villa	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$38,000	$191,000	0.05	0.01	0.01	0.00	8.89	0.23	Manitou Creek	N	N
RVR_281	Village of Lake Villa	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$20,000	$98,000	0.02	0.00	0.00	0.00	4.55	0.12	Manitou Creek	N	N
RVR_75	Village of Lake Villa	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$19,000	$94,000	0.02	0.00	0.00	0.00	4.37	0.11	Manitou Creek	N	N
RVR_92	Village of Lake Villa	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$17,000	$83,000	0.02	0.00	0.00	0.00	3.89	0.10	Manitou Creek	N	N
RVR_157	Village of Lake Villa	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.7	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$12,000	$59,000	0.01	0.00	0.00	0.00	2.76	0.07	Manitou Creek	N	N
RVR_307	Village of Lake Villa	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.7	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$12,000	$59,000	0.01	0.00	0.00	0.00	2.77	0.07	Manitou Creek	N	N
RVR_301	Village of Lake Villa	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$7,000	$37,000	0.01	0.00	0.00	0.00	1.73	0.05	Manitou Creek	N	N
RVR_196	Village of Lake Villa	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$5,000	$24,000	0.01	0.00	0.00	0.00	1.13	0.03	Manitou Creek	N	N
RVR_258	Village of Lake Villa	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$5,000	$24,000	0.01	0.00	0.00	0.00	1.10	0.03	Manitou Creek	N	N
RVR_259	Village of Lake Villa	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$1,000	$7,000	0.00	0.00	0.00	0.00	0.31	0.01	Manitou Creek	N	N
SS_30	Village of Lake Villa	Stabilization	Stabilize streambank erosion.	514	Linear Feet	M	M	1, 2, 5	HOA, PO	M, Illinois EPA, SMC, USACE, DOT	$77,000	$205,000	4.11	1.54	2.91	0.00	0.00	0.00	Manitou Creek	N	N
SS_29	Village of Lake Villa	Stabilization	Stabilize streambank erosion.	496	Linear Feet	M	M	1, 2, 5	HOA, PO	M, Illinois EPA, SMC, USACE, DOT	$74,000	$198,000	3.97	1.49	2.81	0.00	0.00	0.00	Manitou Creek	N	N
SS_31	Village of Lake Villa	Stabilization	Stabilize streambank erosion.	315	Linear Feet	M	M	1, 2, 5	PO	M, Illinois EPA, SMC, USACE	$47,000	$126,000	2.52	0.95	1.79	0.00	0.00	0.00	Manitou Creek	N	N
SS_28	Village of Lake Villa	Stabilization	Stabilize streambank erosion.	92	Linear Feet	M	M	1, 2, 5	HOA	M, Illinois EPA, SMC, USACE	$14,000	$37,000	0.74	0.28	0.52	0.00	0.00	0.00	Manitou Creek	N	N
SS_27	Village of Lake Villa	Stabilization	Stabilize streambank erosion.	50	Linear Feet	M	M	1, 2, 5	HOA	M, Illinois EPA, SMC, USACE	$7,000	$20,000	0.40	0.15	0.28	0.00	0.00	0.00	Manitou Creek	N	N
WR_113	Village of Lake Villa	Wetland Restoration	Create new wetland.	2.5	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA, DOT	$175,000	$275,000	1.30	0.20	0.32	0.00	149.21	4.57	Manitou Creek	N	N
WR_94	Village of Lake Villa	Wetland Restoration	Create new wetland.	0.4	Acres	M	M	1, 2, 3, 5	PD	M, USACE, USFWS, SMC, Illinois EPA	$30,000	$46,000	0.22	0.03	0.05	0.00	25.22	0.77	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
WR_80	Village of Lake Villa	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	PO	M, USACE, USFWS, SMC, Illinois EPA	$23,000	$36,000	0.17	0.03	0.04	0.00	19.37	0.59	Manitou Creek	N	N
WR_81	Village of Lake Villa	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	PO	M, USACE, USFWS, SMC, Illinois EPA	$21,000	$33,000	0.16	0.02	0.04	0.00	17.93	0.55	Manitou Creek	N	N
RSM_14	Village of Lakemoor	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.4	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	10.59	0.00	0.00	Fish Lake Drain	N	N
RSM_20	Village of Lakemoor	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.4	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	39.49	0.00	0.00	Fish Lake Drain	N	N
RSM_24	Village of Lakemoor	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.8	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	22.58	0.00	0.00	Fish Lake Drain	N	N
RSM_25	Village of Lakemoor	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.0	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	28.66	0.00	0.00	Fish Lake Drain	N	N
RSM_26	Village of Lakemoor	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.4	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	11.29	0.00	0.00	Fish Lake Drain	N	N
RSM_27	Village of Lakemoor	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.5	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	14.84	0.00	0.00	Fish Lake Drain	N	N
RSM_29	Village of Lakemoor	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	2.7	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	77.00	0.00	0.00	Fish Lake Drain	N	N
RSM_67	Village of Lakemoor	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.5	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	15.82	0.00	0.00	Fish Lake Drain	N	N
RSM_68	Village of Lakemoor	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	5.0	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	145.98	0.00	0.00	Fish Lake Drain	N	N
RSM_69	Village of Lakemoor	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.4	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	10.49	0.00	0.00	Fish Lake Drain	N	N
RSM_70	Village of Lakemoor	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	9.5	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	274.24	0.00	0.00	Fish Lake Drain	N	N
RSM_71	Village of Lakemoor	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	2.1	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	61.63	0.00	0.00	Fish Lake Drain	N	N
RSM_72	Village of Lakemoor	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.3	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	38.59	0.00	0.00	Fish Lake Drain	N	N
RVR_210	Village of Lakemoor	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	6.3	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$110,000	$550,000	0.13	0.02	0.02	0.00	25.62	0.67	Fish Lake Drain	N	N
RVR_28	Village of Lakemoor	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA, DOT	$35,000	$173,000	0.04	0.01	0.01	0.00	8.07	0.21	Fish Lake Drain	N	N
RVR_209	Village of Lakemoor	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts,	1.7	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$30,000	$150,000	0.04	0.00	0.01	0.00	7.00	0.18	Fish Lake Drain	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
			recessed landscape islands, or other green infrastructure BMPs.																		
RSM_3	Village of Mundelein	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.6	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	46.12	0.00	0.00	Manitou Creek	N	N
RSM_5	Village of Mundelein	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.6	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	16.78	0.00	0.00	Manitou Creek	N	N
RSM_6	Village of Mundelein	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.7	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	21.27	0.00	0.00	Manitou Creek	N	N
RSM_7	Village of Mundelein	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.8	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	52.14	0.00	0.00	Manitou Creek	N	N
RSM_8	Village of Mundelein	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.5	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	15.19	0.00	0.00	Manitou Creek	N	N
RSM_9	Village of Mundelein	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	16.3	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	471.26	0.00	0.00	Manitou Creek	N	N
RSM_10	Village of Mundelein	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	6.5	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	187.66	0.00	0.00	Manitou Creek	N	N
RSM_11	Village of Mundelein	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	4.5	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	129.59	0.00	0.00	Manitou Creek	N	N
RSM_12	Village of Mundelein	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.1	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	32.63	0.00	0.00	Manitou Creek	Y	N
RVR_290	Village of Mundelein	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	18.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$314,000	$1,568,000	0.37	0.05	0.07	0.00	73.04	1.92	Manitou Creek	N	N
RVR_205	Village of Mundelein	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	16.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$294,000	$1,469,000	0.35	0.04	0.06	0.00	68.43	1.80	Manitou Creek	N	N
RVR_131	Village of Mundelein	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	14.4	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$251,000	$1,254,000	0.30	0.04	0.05	0.00	58.42	1.54	Manitou Creek	N	N
RVR_271	Village of Mundelein	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	4.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$70,000	$350,000	0.08	0.01	0.01	0.00	16.29	0.43	Manitou Creek	N	N
RVR_272	Village of Mundelein	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	3.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$68,000	$340,000	0.08	0.01	0.01	0.00	15.83	0.42	Manitou Creek	N	N
RVR_76	Village of Mundelein	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.8	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$32,000	$160,000	0.04	0.00	0.01	0.00	7.43	0.20	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
RVR_207	Village of Mundelein	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.5	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$26,000	$130,000	0.03	0.00	0.01	0.00	6.04	0.16	Manitou Creek	N	N
RVR_206	Village of Mundelein	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.3	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$23,000	$115,000	0.03	0.00	0.00	0.00	5.36	0.14	Manitou Creek	N	N
RVR_35	Village of Mundelein	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$19,000	$93,000	0.02	0.00	0.00	0.00	4.34	0.11	Manitou Creek	N	N
RVR_192	Village of Mundelein	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$17,000	$85,000	0.02	0.00	0.00	0.00	3.98	0.10	Manitou Creek	N	N
RVR_20	Village of Mundelein	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$17,000	$84,000	0.02	0.00	0.00	0.00	3.90	0.10	Manitou Creek	N	N
RVR_273	Village of Mundelein	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$15,000	$77,000	0.02	0.00	0.00	0.00	3.59	0.09	Manitou Creek	N	N
RVR_21	Village of Mundelein	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.8	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$14,000	$70,000	0.02	0.00	0.00	0.00	3.25	0.09	Manitou Creek	N	N
DJ_5	Village of Round Lake	Debris Jam	Remove debris obstructing flow using American Fisheries Society guidelines.	1	Each	H	S	2	PO	M, DD, SMC	$15,000	$110,000	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	Y	N
DJ_3	Village of Round Lake	Debris Jam	Remove debris obstructing flow using American Fisheries Society guidelines.	1	Each	M	M	2	HOA	M, SMC, USACE	$15,000	$110,000	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
DB_7	Village of Round Lake	Detention Basin Retrofit	Repair blowout around inlet and outlet.	1	Each	H	M	2	M	SMC	$6,000	$107,000	0.03	0.03	0.01	0.00	12.42	0.12	Manitou Creek	N	N
DB_4	Village of Round Lake	Detention Basin Retrofit	1. Unclog inlets and outlets. 2. Stabilize side slopes.	1	Each	M	M	2	HOA	M, SMC	$25,000	$411,000	0.10	0.12	0.04	0.00	47.68	0.47	Manitou Creek	N	N
DB_5	Village of Round Lake	Detention Basin Retrofit	1. Unclog inlets and outlets. 2. Stabilize side slopes.	1	Each	M	M	2	HOA	M, SMC	$17,000	$288,000	0.07	0.09	0.02	0.00	33.43	0.33	Manitou Creek	N	N
DB_8	Village of Round Lake	Detention Basin Retrofit	Unclog inlets and outlets.	1	Each	M	M	2	HOA	M, SMC	$11,000	$178,000	0.04	0.05	0.02	0.00	20.62	0.20	Manitou Creek	N	N
FRR_11	Village of Round Lake	Flood Risk Reduction	Design and construct storm sewer upgrades and drainage system enhancements to lower the risk of flooding of adjacent residential properties and roads.	1	Each	H	M	2	M, T	DOT, SMC, PO, DCEO	$600,000	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	Y	N
FRR_02	Village of Round Lake	Flood Risk Reduction	Construct a maintainable outlet for the depressional wetland area that floods N Harrison Ave.	1	Each	M	M	2	DOT, T	SMC	-	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
FRR_03	Village of Round Lake	Flood Risk Reduction	Determine if remediation of road flooding is needed.	1	Each	M	M	2	DOT, T	SMC	-	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
RSM_38	Village of Round Lake	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.1	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	4.26	0.00	0.00	Manitou Creek	Y	N
RVR_17	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	5.0	Acres	H	M	2, 5	CBL	SMC, Illinois EPA, M	$86,000	$432,000	0.10	0.01	0.02	0.00	20.15	0.53	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
RVR_127	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	4.8	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$84,000	$422,000	0.10	0.01	0.02	0.00	19.65	0.52	Manitou Creek	N	N
RVR_289	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	4.5	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$78,000	$390,000	0.09	0.01	0.02	0.00	18.18	0.48	Manitou Creek	N	N
RVR_30	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	4.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$70,000	$352,000	0.08	0.01	0.01	0.00	16.40	0.43	Manitou Creek	N	N
RVR_109	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	3.4	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$59,000	$294,000	0.07	0.01	0.01	0.00	13.72	0.36	Manitou Creek	N	N
RVR_107	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	3.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$55,000	$274,000	0.07	0.01	0.01	0.00	12.76	0.34	Manitou Creek	N	N
RVR_31	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.7	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$46,000	$232,000	0.06	0.01	0.01	0.00	10.82	0.28	Manitou Creek	N	N
RVR_57	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.6	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$45,000	$225,000	0.05	0.01	0.01	0.00	10.47	0.28	Manitou Creek	N	N
RVR_168	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$37,000	$183,000	0.04	0.01	0.01	0.00	8.54	0.22	Manitou Creek	N	N
RVR_78	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$34,000	$170,000	0.04	0.00	0.01	0.00	7.92	0.21	Manitou Creek	N	N
RVR_234	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$33,000	$167,000	0.04	0.00	0.01	0.00	7.80	0.21	Manitou Creek	N	N
RVR_293	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.5	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$26,000	$130,000	0.03	0.00	0.01	0.00	6.04	0.16	Manitou Creek	N	N
RVR_243	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.4	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$24,000	$122,000	0.03	0.00	0.01	0.00	5.70	0.15	Manitou Creek	N	N
RVR_284	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.4	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$24,000	$119,000	0.03	0.00	0.00	0.00	5.55	0.15	Manitou Creek	N	N
RVR_143	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts,	1.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$22,000	$109,000	0.03	0.00	0.00	0.00	5.10	0.13	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
			recessed landscape islands, or other green infrastructure BMPs.																		
RVR_198	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.1	Acres	H	M	2, 5	SI	M, SMC, Illinois EPA	$20,000	$99,000	0.02	0.00	0.00	0.00	4.62	0.12	Manitou Creek	N	N
RVR_270	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$20,000	$99,000	0.02	0.00	0.00	0.00	4.62	0.12	Manitou Creek	N	N
RVR_135	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$19,000	$95,000	0.02	0.00	0.00	0.00	4.41	0.12	Manitou Creek	N	N
RVR_2	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$19,000	$93,000	0.02	0.00	0.00	0.00	4.34	0.11	Manitou Creek	N	N
RVR_321	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$19,000	$93,000	0.02	0.00	0.00	0.00	4.33	0.11	Manitou Creek	N	N
RVR_203	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$18,000	$91,000	0.02	0.00	0.00	0.00	4.22	0.11	Manitou Creek	N	N
RVR_12	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$18,000	$90,000	0.02	0.00	0.00	0.00	4.19	0.11	Manitou Creek	N	N
RVR_108	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$18,000	$90,000	0.02	0.00	0.00	0.00	4.19	0.11	Manitou Creek	N	N
RVR_221	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$18,000	$90,000	0.02	0.00	0.00	0.00	4.19	0.11	Manitou Creek	N	N
RVR_253	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$18,000	$90,000	0.02	0.00	0.00	0.00	4.19	0.11	Manitou Creek	N	N
RVR_288	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$18,000	$90,000	0.02	0.00	0.00	0.00	4.19	0.11	Manitou Creek	N	N
RVR_13	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	SI	M, SMC, Illinois EPA	$18,000	$89,000	0.02	0.00	0.00	0.00	4.15	0.11	Manitou Creek	N	N
RVR_40	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$18,000	$88,000	0.02	0.00	0.00	0.00	4.09	0.11	Manitou Creek	N	N
RVR_189	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable	1.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$18,000	$88,000	0.02	0.00	0.00	0.00	4.10	0.11	Manitou Creek	N	N

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			pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.																		
RVR_245	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	SI	M, SMC, Illinois EPA	$18,000	$88,000	0.02	0.00	0.00	0.00	4.11	0.11	Manitou Creek	N	N
RVR_248	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$17,000	$87,000	0.02	0.00	0.00	0.00	4.05	0.11	Manitou Creek	N	N
RVR_103	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$17,000	$86,000	0.02	0.00	0.00	0.00	4.01	0.11	Manitou Creek	N	N
RVR_43	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	SI	M, SMC, Illinois EPA	$16,000	$82,000	0.02	0.00	0.00	0.00	3.82	0.10	Manitou Creek	N	N
RVR_170	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$16,000	$82,000	0.02	0.00	0.00	0.00	3.80	0.10	Manitou Creek	N	N
RVR_246	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$16,000	$82,000	0.02	0.00	0.00	0.00	3.83	0.10	Manitou Creek	N	N
RVR_32	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$16,000	$81,000	0.02	0.00	0.00	0.00	3.79	0.10	Manitou Creek	N	N
RVR_182	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$16,000	$80,000	0.02	0.00	0.00	0.00	3.73	0.10	Manitou Creek	N	N
RVR_174	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.8	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$14,000	$68,000	0.02	0.00	0.00	0.00	3.16	0.08	Manitou Creek	N	N
RVR_230	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.7	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$12,000	$62,000	0.01	0.00	0.00	0.00	2.89	0.08	Manitou Creek	N	N
RVR_228	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.6	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$11,000	$55,000	0.01	0.00	0.00	0.00	2.55	0.07	Manitou Creek	N	N
RVR_147	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.6	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$10,000	$50,000	0.01	0.00	0.00	0.00	2.32	0.06	Manitou Creek	N	N
RVR_283	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$9,000	$44,000	0.01	0.00	0.00	0.00	2.06	0.05	Manitou Creek	N	N

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RVR_309	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	M	SMC, Illinois EPA	$8,000	$42,000	0.01	0.00	0.00	0.00	1.96	0.05	Manitou Creek	N	N
RVR_241	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$8,000	$39,000	0.01	0.00	0.00	0.00	1.84	0.05	Manitou Creek	N	N
RVR_265	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$8,000	$38,000	0.01	0.00	0.00	0.00	1.78	0.05	Manitou Creek	N	N
RVR_88	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$7,000	$37,000	0.01	0.00	0.00	0.00	1.75	0.05	Manitou Creek	N	N
RVR_98	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$7,000	$37,000	0.01	0.00	0.00	0.00	1.73	0.05	Manitou Creek	N	N
RVR_226	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$7,000	$36,000	0.01	0.00	0.00	0.00	1.68	0.04	Manitou Creek	N	N
RVR_77	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$6,000	$32,000	0.01	0.00	0.00	0.00	1.51	0.04	Manitou Creek	N	N
RVR_24	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$6,000	$30,000	0.01	0.00	0.00	0.00	1.42	0.04	Manitou Creek	N	N
RVR_117	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	M	SMC, Illinois EPA	$6,000	$30,000	0.01	0.00	0.00	0.00	1.41	0.04	Manitou Creek	N	N
RVR_304	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$6,000	$30,000	0.01	0.00	0.00	0.00	1.39	0.04	Manitou Creek	N	N
RVR_310	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	M	SMC, Illinois EPA	$6,000	$29,000	0.01	0.00	0.00	0.00	1.36	0.04	Manitou Creek	N	N
RVR_65	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$5,000	$27,000	0.01	0.00	0.00	0.00	1.26	0.03	Manitou Creek	N	N
RVR_306	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$5,000	$26,000	0.01	0.00	0.00	0.00	1.19	0.03	Manitou Creek	N	N
RVR_25	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts,	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$17,000	0.00	0.00	0.00	0.00	0.78	0.02	Manitou Creek	N	N

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			recessed landscape islands, or other green infrastructure BMPs.																		
RVR_96	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$15,000	0.00	0.00	0.00	0.00	0.68	0.02	Manitou Creek	N	N
RVR_183	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$15,000	0.00	0.00	0.00	0.00	0.69	0.02	Manitou Creek	N	N
RVR_199	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$15,000	0.00	0.00	0.00	0.00	0.71	0.02	Manitou Creek	N	N
RVR_282	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$15,000	0.00	0.00	0.00	0.00	0.72	0.02	Manitou Creek	N	N
RVR_50	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$14,000	0.00	0.00	0.00	0.00	0.65	0.02	Manitou Creek	N	N
RVR_111	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$14,000	0.00	0.00	0.00	0.00	0.64	0.02	Manitou Creek	N	N
RVR_175	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$14,000	0.00	0.00	0.00	0.00	0.66	0.02	Manitou Creek	N	N
RVR_287	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$14,000	0.00	0.00	0.00	0.00	0.65	0.02	Manitou Creek	N	N
RVR_138	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$13,000	0.00	0.00	0.00	0.00	0.59	0.02	Manitou Creek	N	N
RVR_124	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$12,000	0.00	0.00	0.00	0.00	0.56	0.01	Manitou Creek	N	N
RVR_297	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	HOA	M, SMC, Illinois EPA	$2,000	$12,000	0.00	0.00	0.00	0.00	0.56	0.01	Manitou Creek	N	N
RVR_112	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$11,000	0.00	0.00	0.00	0.00	0.53	0.01	Manitou Creek	N	N
RVR_53	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$8,000	0.00	0.00	0.00	0.00	0.35	0.01	Manitou Creek	N	N
RVR_322	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$8,000	0.00	0.00	0.00	0.00	0.37	0.01	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
			pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.																		
RVR_49	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$1,000	$7,000	0.00	0.00	0.00	0.00	0.33	0.01	Manitou Creek	N	N
RVR_54	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$1,000	$7,000	0.00	0.00	0.00	0.00	0.33	0.01	Manitou Creek	N	N
RVR_62	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$1,000	$7,000	0.00	0.00	0.00	0.00	0.33	0.01	Manitou Creek	N	N
RVR_90	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$1,000	$7,000	0.00	0.00	0.00	0.00	0.33	0.01	Manitou Creek	N	N
RVR_145	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$1,000	$7,000	0.00	0.00	0.00	0.00	0.33	0.01	Manitou Creek	N	N
RVR_180	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$1,000	$7,000	0.00	0.00	0.00	0.00	0.33	0.01	Manitou Creek	N	N
RVR_267	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$1,000	$7,000	0.00	0.00	0.00	0.00	0.33	0.01	Manitou Creek	N	N
RVR_279	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$1,000	$7,000	0.00	0.00	0.00	0.00	0.33	0.01	Manitou Creek	N	N
RVR_61	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$1,000	$6,000	0.00	0.00	0.00	0.00	0.28	0.01	Manitou Creek	N	N
RVR_91	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$1,000	$6,000	0.00	0.00	0.00	0.00	0.30	0.01	Manitou Creek	N	N
RVR_294	Village of Round Lake	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$1,000	$6,000	0.00	0.00	0.00	0.00	0.28	0.01	Manitou Creek	N	N
SIP_3	Village of Round Lake	Stakeholder Identified Projects	Evaluate the feasibility of utilizing BMPs to enhance wetland function of the Mud Lake basin, including flood storage capacity and water quality treatment capacity.	1	Each	M	M	1,2,3	PO, HOA	EIG, FEMA, IDNR, M, USACE	-	-	-	-	-	-	-	-	Manitou Creek	N	Y
SS_77	Village of Round Lake	Stabilization	Stabilize streambank erosion.	4,806	Linear Feet	M	M	1, 2, 5	PD, PO	AG, DOA, FB, LCFPD, UT, M, DD, Illinois EPA, SMC, HOA, USACE, DOT	$721,000	$1,922,000	38.45	14.42	27.25	0.00	0.00	0.00	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
SS_78	Village of Round Lake	Stabilization	Stabilize streambank erosion.	4,704	Linear Feet	M	M	1, 2, 5	PD, PO	LCFPD, UT, M, DD, Illinois EPA, SMC, USACE, DOT	$706,000	$1,882,000	37.63	14.11	26.67	0.00	0.00	0.00	Manitou Creek	N	N
SS_82	Village of Round Lake	Stabilization	Stabilize streambank erosion.	4,352	Linear Feet	M	M	1, 2, 5	PO, HOA	M, DD, Illinois EPA, SMC, USACE, DOT	$653,000	$1,741,000	34.82	13.06	24.68	0.00	0.00	0.00	Manitou Creek	N	N
SS_80	Village of Round Lake	Stabilization	Stabilize streambank erosion.	3,009	Linear Feet	M	M	1, 2, 5	PO	M, DD, Illinois EPA, SMC, USACE, DOT	$451,000	$1,204,000	24.07	9.03	17.06	0.00	0.00	0.00	Manitou Creek	N	N
SS_79	Village of Round Lake	Stabilization	Stabilize streambank erosion.	2,990	Linear Feet	M	M	1, 2, 5	PO	M, DD, Illinois EPA, SMC, USACE, DOT	$449,000	$1,196,000	23.92	8.97	16.95	0.00	0.00	0.00	Manitou Creek	N	N
SS_81	Village of Round Lake	Stabilization	Stabilize streambank erosion.	1,846	Linear Feet	M	M	1, 2, 5	PO	M, DD, Illinois EPA, SMC, USACE	$277,000	$738,000	14.76	5.54	10.46	0.00	0.00	0.00	Manitou Creek	N	N
SS_83	Village of Round Lake	Stabilization	Stabilize streambank erosion.	1,524	Linear Feet	M	M	1, 2, 5	HOA, PO	M, DD, Illinois EPA, SMC, USACE, DOT	$229,000	$610,000	12.20	4.57	8.64	0.00	0.00	0.00	Manitou Creek	N	N
SS_74	Village of Round Lake	Stabilization	Stabilize streambank erosion.	1,116	Linear Feet	M	M	1, 2, 5	PO	M, Illinois EPA, SMC, USACE	$167,000	$447,000	8.93	3.35	6.33	0.00	0.00	0.00	Manitou Creek	N	N
SS_65	Village of Round Lake	Stabilization	Stabilize streambank erosion.	827	Linear Feet	M	M	1, 2, 5	HOA	M, Illinois EPA, SMC, USACE, DOT	$124,000	$331,000	6.62	2.48	4.69	0.00	0.00	0.00	Manitou Creek	N	N
SS_64	Village of Round Lake	Stabilization	Stabilize streambank erosion.	816	Linear Feet	M	M	1, 2, 5	HOA	M, Illinois EPA, SMC, USACE	$122,000	$327,000	6.53	2.45	4.63	0.00	0.00	0.00	Manitou Creek	N	N
SS_70	Village of Round Lake	Stabilization	Stabilize streambank erosion.	291	Linear Feet	M	M	1, 2, 5	PO	M, Illinois EPA, SMC, USACE, DOT	$44,000	$116,000	2.33	0.87	1.65	0.00	0.00	0.00	Manitou Creek	N	N
SS_71	Village of Round Lake	Stabilization	Stabilize streambank erosion.	287	Linear Feet	M	M	1, 2, 5	PO	M, Illinois EPA, SMC, USACE, DOT	$43,000	$115,000	2.30	0.86	1.63	0.00	0.00	0.00	Manitou Creek	N	N
SS_72	Village of Round Lake	Stabilization	Stabilize streambank erosion.	111	Linear Feet	M	M	1, 2, 5	PO, DOT	M, Illinois EPA, SMC, USACE	$17,000	$45,000	0.89	0.33	0.63	0.00	0.00	0.00	Manitou Creek	N	N
SS_73	Village of Round Lake	Stabilization	Stabilize streambank erosion.	111	Linear Feet	M	M	1, 2, 5	PO, DOT	M, Illinois EPA, SMC, USACE	$17,000	$44,000	0.89	0.33	0.63	0.00	0.00	0.00	Manitou Creek	N	N
SS_2	Village of Round Lake	Stabilization	Stabilize erosion.	60	Linear Feet	L	L	1,3	HOA	M, Illinois EPA, SMC, USACE	$9,000	$24,000	0.48	0.18	0.34	0.00	0.00	0.00	Manitou Creek	N	N
SR_2	Village of Round Lake	Stream Restoration	Remeander/naturalize channel and reconnect to the floodplain.	2,999	Linear Feet	H	M	1, 2, 3, 5	LCFPD	M, DD, Illinois EPA, SMC, USACE	$1,499,000	$2,999,000	17.99	9.00	17.00	0.00	0.00	0.00	Manitou Creek	N	N
WI_19	Village of Round Lake	Water Infrastructure	Repair or replace discharge point.	1	Each	M	M	2	PO	M, DD, SMC	$10,000	$50,000	0.01	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
WI_18	Village of Round Lake	Water Infrastructure	Stabilize erosion. Extend discharge point to base water level and/or install appropriate energy dissipation.	20	Linear Feet	L	L	2	PO	M, DD, SMC, USACE	$15,000	$100,000	0.16	0.06	0.11	0.00	0.00	0.00	Manitou Creek	N	N
Ot_1	Village of Round Lake	Water Quality Investigation	Identify and address the source of high Total Dissolved Solids concentrations measured in the Manitou Creek Tributary at Nippersink Road.	1	Each	M	M	5	LCHD, Illinois EPA, DD	M, Illinois EPA, ISGS/USGS, LCHD, PO	-	-	0.01	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	Y
WR_13	Village of Round Lake	Wetland Restoration	Create new wetland.	16.1	Acres	M	M	1, 2, 3, 5	AG, HOA	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DD	$1,127,000	$1,770,000	8.37	1.29	2.08	0.00	961.67	29.45	Manitou Creek	Y	N
WR_5	Village of Round Lake	Wetland Restoration	Create new wetland.	7.5	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA, DD, DOT	$523,000	$822,000	3.88	0.60	0.96	0.00	446.27	13.67	Manitou Creek	N	Y
WR_88	Village of Round Lake	Wetland Restoration	Create new wetland.	5.8	Acres	M	M	1, 2, 3, 5	PD	M, USACE, USFWS, SMC, Illinois EPA	$409,000	$642,000	3.04	0.47	0.75	0.00	348.85	10.68	Manitou Creek	N	N
WR_95	Village of Round Lake	Wetland Restoration	Create new wetland.	3.2	Acres	M	M	1, 2, 3, 5	PD, M	USACE, USFWS, SMC, Illinois EPA	$226,000	$356,000	1.68	0.26	0.42	0.00	193.22	5.92	Manitou Creek	N	N
WR_87	Village of Round Lake	Wetland Restoration	Create new wetland.	3.1	Acres	M	M	1, 2, 3, 5	AG, LCFPD, PD	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$216,000	$339,000	1.60	0.25	0.40	0.00	183.95	5.63	Manitou Creek	Y	N
WR_3	Village of Round Lake	Wetland Restoration	Create new wetland.	3.0	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA, DD, DOT	$212,000	$333,000	1.58	0.24	0.39	0.00	181.14	5.55	Manitou Creek	N	Y
WR_4	Village of Round Lake	Wetland Restoration	Create new wetland.	2.8	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA, DD	$195,000	$306,000	1.45	0.22	0.36	0.00	166.13	5.09	Manitou Creek	N	Y
WR_120	Village of Round Lake	Wetland Restoration	Create new wetland.	1.8	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$123,000	$193,000	0.91	0.14	0.23	0.00	104.77	3.21	Manitou Creek	N	Y
WR_101	Village of Round Lake	Wetland Restoration	Create new wetland.	1.1	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$79,000	$123,000	0.58	0.09	0.14	0.00	67.07	2.05	Manitou Creek	N	Y
WR_29	Village of Round Lake	Wetland Restoration	Create new wetland.	0.9	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$63,000	$99,000	0.47	0.07	0.12	0.00	53.56	1.64	Manitou Creek	N	Y

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
WR_117	Village of Round Lake	Wetland Restoration	Create new wetland.	0.9	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$60,000	$94,000	0.45	0.07	0.11	0.00	51.29	1.57	Manitou Creek	N	N
WR_118	Village of Round Lake	Wetland Restoration	Create new wetland.	0.7	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$47,000	$74,000	0.35	0.05	0.09	0.00	40.27	1.23	Manitou Creek	N	N
WR_92	Village of Round Lake	Wetland Restoration	Create new wetland.	0.6	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$44,000	$70,000	0.33	0.05	0.08	0.00	37.77	1.16	Manitou Creek	N	Y
WR_30	Village of Round Lake	Wetland Restoration	Create new wetland.	0.6	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$44,000	$69,000	0.33	0.05	0.08	0.00	37.35	1.14	Manitou Creek	N	Y
WR_99	Village of Round Lake	Wetland Restoration	Create new wetland.	0.6	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$42,000	$66,000	0.31	0.05	0.08	0.00	35.87	1.10	Manitou Creek	N	N
WR_43	Village of Round Lake	Wetland Restoration	Create new wetland.	0.4	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$27,000	$42,000	0.20	0.03	0.05	0.00	22.79	0.70	Manitou Creek	N	Y
WR_98	Village of Round Lake	Wetland Restoration	Create new wetland.	0.4	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$25,000	$40,000	0.19	0.03	0.05	0.00	21.64	0.66	Manitou Creek	N	N
WR_79	Village of Round Lake	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$23,000	$37,000	0.17	0.03	0.04	0.00	19.84	0.61	Manitou Creek	N	Y
WR_119	Village of Round Lake	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$22,000	$34,000	0.16	0.02	0.04	0.00	18.42	0.56	Manitou Creek	N	N
WR_116	Village of Round Lake	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$21,000	$33,000	0.16	0.02	0.04	0.00	18.13	0.56	Manitou Creek	N	N
WR_100	Village of Round Lake	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$19,000	$30,000	0.14	0.02	0.03	0.00	16.15	0.49	Manitou Creek	N	Y
WR_137	Village of Round Lake	Wetland Restoration	Create new wetland.	0.2	Acres	M	M	1, 2, 3, 5	LCFPD	USACE, USFWS, SMC, Illinois EPA	$14,000	$23,000	0.11	0.02	0.03	0.00	12.32	0.38	Manitou Creek	N	Y
WR_129	Village of Round Lake	Wetland Restoration	Create new wetland.	0.2	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$15,000	$23,000	0.11	0.02	0.03	0.00	12.38	0.38	Manitou Creek	N	N
WR_115	Village of Round Lake	Wetland Restoration	Create new wetland.	0.1	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$9,000	$14,000	0.06	0.01	0.02	0.00	7.42	0.23	Manitou Creek	N	N
WR_139	Village of Round Lake	Wetland Restoration	Create new wetland.	0.1	Acres	M	M	1, 2, 3, 5	LCFPD	USACE, USFWS, SMC, Illinois EPA, DD	$7,000	$12,000	0.06	0.01	0.01	0.00	6.36	0.19	Manitou Creek	N	Y
DJ_8	Village of Round Lake Beach	Debris Jam	Remove debris obstructing flow using American Fisheries Society guidelines.	1	Each	H	S	2	PO	M, SMC, , DCEO	$15,000	$110,000	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	Y	N
DJ_9	Village of Round Lake Beach	Debris Jam	Remove debris obstructing flow using American Fisheries Society guidelines.	1	Each	H	S	2	PO	M, SMC, DCEO	$15,000	$110,000	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	Y	N
DJ_10	Village of Round Lake Beach	Debris Jam	Remove debris obstructing flow using American Fisheries Society guidelines.	1	Each	M	M	2	PO	M, SMC	$15,000	$110,000	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
DB_11	Village of Round Lake Beach	Detention Basin Retrofit	Determine if basin is functioning properly	1	Each	M	M	2	HOA	M, SMC	$8,000	$135,000	0.03	0.04	0.01	0.00	15.60	0.15	Manitou Creek	N	N
FRR_12	Village of Round Lake Beach	Flood Risk Reduction	1. Conduct stream and bank restoration using stone-toe and native planted slopes with slope top practices. 2. Install targeted gabion baskets near steep bank/property boundary conflicts. 3. Remove in-culvert weir at Idlewild Drive and replace culvert.	6,000	Linear Feet	H	M	2	M	DCEO, SMC, PO	-	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
FRR_06	Village of Round Lake Beach	Flood Risk Reduction	Install Triple Barrel 53” x 34” Elliptical RCP culvert at Pheasant Court to allow flow to move downstream. See Manhard Consulting DCEO Round 2 Round Lake Drain Master Plan Engineering Report for additional information.	1	Each	H	M	2	M	PO, USACE, IDNR, SMC, DCEO	$342,150	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
FRR_16	Village of Round Lake Beach	Flood Risk Reduction	Regrade area to create additional floodplain storage. See Manhard Consulting DCEO Round 2 Round Lake Drain Master Plan Engineering Report for additional information.	3,704	Cubic Yards	H	M	2	M	PO, USACE, IDNR, SMC, DCEO	$401,254	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
FRR_07	Village of Round Lake Beach	Flood Risk Reduction	Install 6’ x 5’ Concrete Box Culvert at Meadowbrook Drive to allow flow to move downstream. Restore streambanks after installation. See Manhard Consulting DCEO Round 2	1	Each	H	M	2	M	PO, USACE, IDNR, SMC, DCEO	$417,750	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	Y	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
			Round Lake Drain Master Plan Engineering Report for additional information.																		
FRR_15	Village of Round Lake Beach	Flood Risk Reduction	Regrade area by pulling back open areas to create additional floodplain storage in areas unused on Village of Round Lake Beach site. See Manhard Consulting DCEO Round 2 Round Lake Drain Master Plan Engineering Report for additional information.	5,556	Cubic Yards	H	M	2	M	PO, UT, USACE, IDNR, SMC	$492,500	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
FRR_05	Village of Round Lake Beach	Flood Risk Reduction	Install 10' x 6' Concrete Box Culvert at Golfview Drive to allow flow to move downstream. Restore streambanks after installation. See Manhard Consulting DCEO Round 2 Round Lake Drain Master Plan Engineering Report for additional information.	1	Each	H	M	2	M	PO, USACE, IDNR, SMC, DCEO	$551,925	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	Y	N
FRR_09	Village of Round Lake Beach	Flood Risk Reduction	Install Triple Barrel 9' x 8' Concrete Box Culvert at North Village Drive to allow flow to move downstream. Restore streambanks after installation. See Manhard Consulting DCEO Round 2 Round Lake Drain Master Plan Engineering Report for additional informa	1	Each	H	M	2	M	DOT, PO, USACE, IDNR, SMC, DCEO	$1,353,726	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
FRR_08	Village of Round Lake Beach	Flood Risk Reduction	Install 12.5' x 37' Conspan Type Bridge at Fairfield Road to allow flow to move downstream. Restore streambanks after installation. See Manhard Consulting DCEO Round 2 Round Lake Drain Master Plan Engineering Report for additional information.	1	Each	H	M	2	M	DOT, PO, USACE, IDNR, SMC	$3,256,050	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
RSM_41	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.5	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	15.66	0.00	0.00	Manitou Creek	N	N
RSM_42	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.5	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	42.42	0.00	0.00	Manitou Creek	N	N
RSM_43	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.1	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	3.73	0.00	0.00	Manitou Creek	N	N
RSM_44	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.8	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	22.07	0.00	0.00	Manitou Creek	N	N
RSM_45	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.9	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	26.37	0.00	0.00	Manitou Creek	N	N
RSM_46	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.2	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	33.93	0.00	0.00	Manitou Creek	N	N
RSM_47	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.2	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	35.77	0.00	0.00	Manitou Creek	N	N
RSM_48	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.0	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	29.71	0.00	0.00	Manitou Creek	N	N
RSM_49	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental	2.6	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	74.81	0.00	0.00	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
			impacts while maintaining public safety.																		
RSM_50	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.7	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	19.97	0.00	0.00	Manitou Creek	N	N
RSM_51	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.4	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	10.29	0.00	0.00	Manitou Creek	N	N
RSM_52	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.4	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	41.36	0.00	0.00	Manitou Creek	N	N
RSM_53	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	6.5	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	189.65	0.00	0.00	Manitou Creek	N	N
RSM_54	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.2	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	6.45	0.00	0.00	Manitou Creek	N	N
RSM_55	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	10.3	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	299.68	0.00	0.00	Manitou Creek	N	N
RSM_56	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.8	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	24.35	0.00	0.00	Manitou Creek	N	N
RSM_57	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.2	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	6.05	0.00	0.00	Manitou Creek	N	N
RSM_58	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.6	Acres	H	S	2, 5	C, PC	M	-	-	0.00	0.00	0.00	46.57	0.00	0.00	Manitou Creek	N	N
RSM_59	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.1	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	32.30	0.00	0.00	Manitou Creek	N	N
RSM_60	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	8.8	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	254.01	0.00	0.00	Manitou Creek	N	N
RSM_61	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.4	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	11.34	0.00	0.00	Manitou Creek	N	N
RSM_62	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.2	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	7.16	0.00	0.00	Manitou Creek	N	N
RSM_63	Village of Round Lake Beach	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	23.2	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	671.13	0.00	0.00	Manitou Creek	N	N
RVR_317	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	22.4	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$389,000	$1,947,000	0.46	0.06	0.08	0.00	90.74	2.39	Manitou Creek	N	N
RVR_195	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	21.3	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$372,000	$1,858,000	0.44	0.05	0.08	0.00	86.58	2.28	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
RVR_163	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	17.2	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$299,000	$1,495,000	0.36	0.04	0.06	0.00	69.64	1.83	Manitou Creek	N	N
RVR_47	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	11.7	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$204,000	$1,022,000	0.24	0.03	0.04	0.00	47.61	1.25	Manitou Creek	N	N
RVR_128	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	11.5	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$201,000	$1,003,000	0.24	0.03	0.04	0.00	46.75	1.23	Manitou Creek	N	N
RVR_85	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	9.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$158,000	$789,000	0.19	0.02	0.03	0.00	36.75	0.97	Manitou Creek	N	N
RVR_104	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	8.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$140,000	$701,000	0.17	0.02	0.03	0.00	32.67	0.86	Manitou Creek	N	N
RVR_164	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	7.7	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$134,000	$671,000	0.16	0.02	0.03	0.00	31.26	0.82	Manitou Creek	N	N
RVR_6	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	7.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$125,000	$623,000	0.15	0.02	0.03	0.00	29.00	0.76	Manitou Creek	N	N
RVR_22	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	7.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$124,000	$620,000	0.15	0.02	0.03	0.00	28.89	0.76	Manitou Creek	N	N
RVR_285	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	6.5	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$113,000	$565,000	0.13	0.02	0.02	0.00	26.30	0.69	Manitou Creek	N	N
RVR_99	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	5.6	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$97,000	$485,000	0.12	0.01	0.02	0.00	22.62	0.60	Manitou Creek	N	N
RVR_298	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	4.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$70,000	$351,000	0.08	0.01	0.01	0.00	16.36	0.43	Manitou Creek	N	N
RVR_73	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	3.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$53,000	$265,000	0.06	0.01	0.01	0.00	12.32	0.32	Manitou Creek	N	N
RVR_291	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	3.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$52,000	$260,000	0.06	0.01	0.01	0.00	12.10	0.32	Manitou Creek	N	N
RVR_277	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts,	2.8	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$50,000	$248,000	0.06	0.01	0.01	0.00	11.57	0.30	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
			recessed landscape islands, or other green infrastructure BMPs.																		
RVR_46	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$40,000	$201,000	0.05	0.01	0.01	0.00	9.38	0.25	Manitou Creek	N	N
RVR_45	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$40,000	$200,000	0.05	0.01	0.01	0.00	9.30	0.24	Manitou Creek	N	N
RVR_213	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.2	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$39,000	$194,000	0.05	0.01	0.01	0.00	9.05	0.24	Manitou Creek	N	N
RVR_153	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$37,000	$185,000	0.04	0.01	0.01	0.00	8.63	0.23	Manitou Creek	N	N
RVR_194	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$33,000	$167,000	0.04	0.00	0.01	0.00	7.79	0.21	Manitou Creek	N	N
RVR_239	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$33,000	$167,000	0.04	0.00	0.01	0.00	7.77	0.20	Manitou Creek	N	N
RVR_23	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$32,000	$162,000	0.04	0.00	0.01	0.00	7.54	0.20	Manitou Creek	N	N
RVR_118	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.8	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$32,000	$158,000	0.04	0.00	0.01	0.00	7.37	0.19	Manitou Creek	N	N
RVR_51	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.8	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$31,000	$155,000	0.04	0.00	0.01	0.00	7.23	0.19	Manitou Creek	N	N
RVR_165	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.7	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$30,000	$152,000	0.04	0.00	0.01	0.00	7.08	0.19	Manitou Creek	N	N
RVR_187	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.6	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$28,000	$141,000	0.03	0.00	0.01	0.00	6.59	0.17	Manitou Creek	N	N
RVR_278	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.5	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$26,000	$130,000	0.03	0.00	0.01	0.00	6.06	0.16	Manitou Creek	N	N
RVR_95	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$24,000	$121,000	0.03	0.00	0.01	0.00	5.62	0.15	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
RVR_316	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.4	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$24,000	$121,000	0.03	0.00	0.01	0.00	5.65	0.15	Manitou Creek	N	N
RVR_276	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$23,000	$114,000	0.03	0.00	0.00	0.00	5.31	0.14	Manitou Creek	N	N
RVR_33	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.2	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$21,000	$107,000	0.03	0.00	0.00	0.00	4.98	0.13	Manitou Creek	N	N
RVR_222	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$18,000	$92,000	0.02	0.00	0.00	0.00	4.31	0.11	Manitou Creek	N	N
RVR_55	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$18,000	$91,000	0.02	0.00	0.00	0.00	4.25	0.11	Manitou Creek	N	N
RVR_280	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$18,000	$89,000	0.02	0.00	0.00	0.00	4.17	0.11	Manitou Creek	N	N
RVR_84	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$18,000	$88,000	0.02	0.00	0.00	0.00	4.11	0.11	Manitou Creek	N	N
RVR_300	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$18,000	$88,000	0.02	0.00	0.00	0.00	4.12	0.11	Manitou Creek	N	N
RVR_172	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$17,000	$87,000	0.02	0.00	0.00	0.00	4.03	0.11	Manitou Creek	N	N
RVR_185	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$17,000	$87,000	0.02	0.00	0.00	0.00	4.07	0.11	Manitou Creek	N	N
RVR_211	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$17,000	$87,000	0.02	0.00	0.00	0.00	4.05	0.11	Manitou Creek	N	N
RVR_48	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$17,000	$85,000	0.02	0.00	0.00	0.00	3.96	0.10	Manitou Creek	N	N
RVR_216	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$17,000	$83,000	0.02	0.00	0.00	0.00	3.88	0.10	Manitou Creek	N	N
RVR_303	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts,	0.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$16,000	$82,000	0.02	0.00	0.00	0.00	3.81	0.10	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
			recessed landscape islands, or other green infrastructure BMPs.																		
RVR_79	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$16,000	$79,000	0.02	0.00	0.00	0.00	3.69	0.10	Manitou Creek	N	N
RVR_204	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$16,000	$79,000	0.02	0.00	0.00	0.00	3.69	0.10	Manitou Creek	N	N
RVR_220	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$16,000	$79,000	0.02	0.00	0.00	0.00	3.69	0.10	Manitou Creek	N	N
RVR_240	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$16,000	$79,000	0.02	0.00	0.00	0.00	3.68	0.10	Manitou Creek	N	N
RVR_215	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$16,000	$78,000	0.02	0.00	0.00	0.00	3.64	0.10	Manitou Creek	N	N
RVR_305	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$16,000	$78,000	0.02	0.00	0.00	0.00	3.65	0.10	Manitou Creek	N	N
RVR_178	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.8	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$15,000	$73,000	0.02	0.00	0.00	0.00	3.38	0.09	Manitou Creek	N	N
RVR_193	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.8	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$14,000	$72,000	0.02	0.00	0.00	0.00	3.35	0.09	Manitou Creek	N	N
RVR_116	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.8	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$14,000	$70,000	0.02	0.00	0.00	0.00	3.27	0.09	Manitou Creek	N	N
RVR_10	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.8	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$14,000	$69,000	0.02	0.00	0.00	0.00	3.24	0.09	Manitou Creek	N	N
RVR_250	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.7	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$13,000	$65,000	0.02	0.00	0.00	0.00	3.02	0.08	Manitou Creek	N	N
RVR_70	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.7	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$13,000	$63,000	0.01	0.00	0.00	0.00	2.92	0.08	Manitou Creek	N	N
RVR_263	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.7	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$13,000	$63,000	0.01	0.00	0.00	0.00	2.92	0.08	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
RVR_244	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.7	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$12,000	$62,000	0.01	0.00	0.00	0.00	2.91	0.08	Manitou Creek	N	N
RVR_162	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.7	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$12,000	$61,000	0.01	0.00	0.00	0.00	2.85	0.07	Manitou Creek	N	N
RVR_299	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.7	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$12,000	$61,000	0.01	0.00	0.00	0.00	2.86	0.08	Manitou Creek	N	N
RVR_296	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.7	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$12,000	$60,000	0.01	0.00	0.00	0.00	2.80	0.07	Manitou Creek	N	N
RVR_69	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.7	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$12,000	$58,000	0.01	0.00	0.00	0.00	2.71	0.07	Manitou Creek	N	N
RVR_115	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.6	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$10,000	$50,000	0.01	0.00	0.00	0.00	2.31	0.06	Manitou Creek	N	N
RVR_323	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.6	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$10,000	$50,000	0.01	0.00	0.00	0.00	2.33	0.06	Manitou Creek	N	N
RVR_126	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.6	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$10,000	$49,000	0.01	0.00	0.00	0.00	2.26	0.06	Manitou Creek	N	N
RVR_214	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$9,000	$47,000	0.01	0.00	0.00	0.00	2.19	0.06	Manitou Creek	N	N
RVR_235	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$9,000	$47,000	0.01	0.00	0.00	0.00	2.19	0.06	Manitou Creek	N	N
RVR_5	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$9,000	$44,000	0.01	0.00	0.00	0.00	2.06	0.05	Manitou Creek	N	N
RVR_225	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$9,000	$44,000	0.01	0.00	0.00	0.00	2.05	0.05	Manitou Creek	N	N
RVR_81	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$8,000	$41,000	0.01	0.00	0.00	0.00	1.89	0.05	Manitou Creek	N	N
RVR_86	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts,	0.5	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$8,000	$41,000	0.01	0.00	0.00	0.00	1.90	0.05	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
			recessed landscape islands, or other green infrastructure BMPs.																		
RVR_155	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$8,000	$41,000	0.01	0.00	0.00	0.00	1.92	0.05	Manitou Creek	N	N
RVR_202	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$8,000	$41,000	0.01	0.00	0.00	0.00	1.92	0.05	Manitou Creek	N	N
RVR_232	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$8,000	$41,000	0.01	0.00	0.00	0.00	1.89	0.05	Manitou Creek	N	N
RVR_11	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$8,000	$40,000	0.01	0.00	0.00	0.00	1.88	0.05	Manitou Creek	N	N
RVR_247	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$8,000	$40,000	0.01	0.00	0.00	0.00	1.86	0.05	Manitou Creek	N	N
RVR_29	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$8,000	$38,000	0.01	0.00	0.00	0.00	1.79	0.05	Manitou Creek	N	N
RVR_129	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$8,000	$38,000	0.01	0.00	0.00	0.00	1.78	0.05	Manitou Creek	N	N
RVR_94	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$7,000	$36,000	0.01	0.00	0.00	0.00	1.69	0.04	Manitou Creek	N	N
RVR_173	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$7,000	$35,000	0.01	0.00	0.00	0.00	1.64	0.04	Manitou Creek	N	N
RVR_93	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$7,000	$34,000	0.01	0.00	0.00	0.00	1.57	0.04	Manitou Creek	N	N
RVR_274	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$7,000	$34,000	0.01	0.00	0.00	0.00	1.60	0.04	Manitou Creek	N	N
RVR_64	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$6,000	$32,000	0.01	0.00	0.00	0.00	1.49	0.04	Manitou Creek	N	N
RVR_100	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$6,000	$31,000	0.01	0.00	0.00	0.00	1.45	0.04	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
RVR_152	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$6,000	$31,000	0.01	0.00	0.00	0.00	1.45	0.04	Manitou Creek	N	N
RVR_218	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$6,000	$31,000	0.01	0.00	0.00	0.00	1.42	0.04	Manitou Creek	N	N
RVR_80	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$6,000	$30,000	0.01	0.00	0.00	0.00	1.39	0.04	Manitou Creek	N	N
RVR_139	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$6,000	$30,000	0.01	0.00	0.00	0.00	1.40	0.04	Manitou Creek	N	N
RVR_38	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$6,000	$29,000	0.01	0.00	0.00	0.00	1.37	0.04	Manitou Creek	N	N
RVR_261	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$6,000	$29,000	0.01	0.00	0.00	0.00	1.34	0.04	Manitou Creek	N	N
RVR_200	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$6,000	$28,000	0.01	0.00	0.00	0.00	1.30	0.03	Manitou Creek	N	N
RVR_142	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$5,000	$27,000	0.01	0.00	0.00	0.00	1.26	0.03	Manitou Creek	N	N
RVR_102	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$5,000	$26,000	0.01	0.00	0.00	0.00	1.21	0.03	Manitou Creek	N	N
RVR_179	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$5,000	$26,000	0.01	0.00	0.00	0.00	1.21	0.03	Manitou Creek	N	N
RVR_113	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$5,000	$24,000	0.01	0.00	0.00	0.00	1.12	0.03	Manitou Creek	N	N
RVR_308	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$5,000	$24,000	0.01	0.00	0.00	0.00	1.13	0.03	Manitou Creek	N	N
RVR_237	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$4,000	$20,000	0.00	0.00	0.00	0.00	0.94	0.02	Manitou Creek	N	N
RVR_123	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts,	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$4,000	$19,000	0.00	0.00	0.00	0.00	0.90	0.02	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
			recessed landscape islands, or other green infrastructure BMPs.																		
RVR_146	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$4,000	$19,000	0.00	0.00	0.00	0.00	0.89	0.02	Manitou Creek	N	N
RVR_158	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$4,000	$19,000	0.00	0.00	0.00	0.00	0.89	0.02	Manitou Creek	N	N
RVR_161	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$4,000	$19,000	0.00	0.00	0.00	0.00	0.89	0.02	Manitou Creek	N	N
RVR_224	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$4,000	$19,000	0.00	0.00	0.00	0.00	0.86	0.02	Manitou Creek	N	N
RVR_133	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$4,000	$18,000	0.00	0.00	0.00	0.00	0.83	0.02	Manitou Creek	N	N
RVR_268	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$3,000	$17,000	0.00	0.00	0.00	0.00	0.79	0.02	Manitou Creek	N	N
RVR_177	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$16,000	0.00	0.00	0.00	0.00	0.75	0.02	Manitou Creek	N	N
RVR_151	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$13,000	0.00	0.00	0.00	0.00	0.59	0.02	Manitou Creek	N	N
RVR_223	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$13,000	0.00	0.00	0.00	0.00	0.60	0.02	Manitou Creek	N	N
RVR_260	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$13,000	0.00	0.00	0.00	0.00	0.62	0.02	Manitou Creek	N	N
RVR_114	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$12,000	0.00	0.00	0.00	0.00	0.58	0.02	Manitou Creek	N	N
RVR_56	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$11,000	0.00	0.00	0.00	0.00	0.52	0.01	Manitou Creek	N	N
RVR_134	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$11,000	0.00	0.00	0.00	0.00	0.49	0.01	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
RVR_160	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$11,000	0.00	0.00	0.00	0.00	0.50	0.01	Manitou Creek	N	N
RVR_227	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$11,000	0.00	0.00	0.00	0.00	0.50	0.01	Manitou Creek	N	N
RVR_269	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$2,000	$11,000	0.00	0.00	0.00	0.00	0.50	0.01	Manitou Creek	N	N
RVR_275	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$11,000	0.00	0.00	0.00	0.00	0.50	0.01	Manitou Creek	N	N
RVR_144	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$10,000	0.00	0.00	0.00	0.00	0.45	0.01	Manitou Creek	N	N
RVR_148	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$10,000	0.00	0.00	0.00	0.00	0.45	0.01	Manitou Creek	N	N
RVR_149	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$10,000	0.00	0.00	0.00	0.00	0.45	0.01	Manitou Creek	N	N
RVR_150	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$10,000	0.00	0.00	0.00	0.00	0.45	0.01	Manitou Creek	N	N
RVR_156	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$10,000	0.00	0.00	0.00	0.00	0.47	0.01	Manitou Creek	N	N
RVR_159	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$10,000	0.00	0.00	0.00	0.00	0.45	0.01	Manitou Creek	N	N
RVR_255	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$2,000	$10,000	0.00	0.00	0.00	0.00	0.46	0.01	Manitou Creek	N	N
RVR_27	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$9,000	0.00	0.00	0.00	0.00	0.44	0.01	Manitou Creek	N	N
RVR_256	Village of Round Lake Beach	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$2,000	$9,000	0.00	0.00	0.00	0.00	0.41	0.01	Manitou Creek	N	N
SS_43	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	1,009	Linear Feet	M	M	1, 2, 5	HOA	M, Illinois EPA, SMC, USACE	$151,000	$404,000	8.07	3.03	5.72	0.00	0.00	0.00	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
SS_42	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	958	Linear Feet	M	M	1, 2, 5	M, PD	Illinois EPA, SMC, USACE, HOA	$144,000	$383,000	7.66	2.87	5.43	0.00	0.00	0.00	Manitou Creek	N	N
SS_54	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	902	Linear Feet	M	M	1, 2, 5	M	Illinois EPA, SMC, USACE, DOT, DCEO	$135,000	$361,000	7.22	2.71	5.12	0.00	0.00	0.00	Manitou Creek	N	N
SS_55	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	797	Linear Feet	M	M	1, 2, 5	M	Illinois EPA, SMC, USACE, DOT, DCEO	$120,000	$319,000	6.38	2.39	4.52	0.00	0.00	0.00	Manitou Creek	N	N
SS_62	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	757	Linear Feet	M	M	1, 2, 5	M	Illinois EPA, SMC, USACE, DOT, DCEO	$114,000	$303,000	6.06	2.27	4.29	0.00	0.00	0.00	Manitou Creek	N	N
SS_46	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	707	Linear Feet	M	M	1, 2, 5	M	Illinois EPA, SMC, USACE, DOT	$106,000	$283,000	5.65	2.12	4.01	0.00	0.00	0.00	Manitou Creek	N	N
SS_47	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	706	Linear Feet	M	M	1, 2, 5	M	Illinois EPA, SMC, USACE, DOT	$106,000	$282,000	5.65	2.12	4.00	0.00	0.00	0.00	Manitou Creek	N	N
SS_58	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	658	Linear Feet	M	M	1, 2, 5	M	Illinois EPA, SMC, USACE, DOT, DCEO	$99,000	$263,000	5.26	1.97	3.73	0.00	0.00	0.00	Manitou Creek	N	N
SS_59	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	658	Linear Feet	M	M	1, 2, 5	M	Illinois EPA, SMC, USACE, DOT, DCEO	$99,000	$263,000	5.27	1.98	3.73	0.00	0.00	0.00	Manitou Creek	N	N
SS_32	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	631	Linear Feet	M	M	1, 2, 5	PD	M, Illinois EPA, SMC, USACE	$95,000	$252,000	5.05	1.89	3.58	0.00	0.00	0.00	Manitou Creek	N	N
SS_52	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	524	Linear Feet	M	M	1, 2, 5	PO	M, Illinois EPA, SMC, USACE, DOT, DCEO	$79,000	$210,000	4.19	1.57	2.97	0.00	0.00	0.00	Manitou Creek	N	N
SS_57	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	476	Linear Feet	M	M	1, 2, 5	M	Illinois EPA, SMC, USACE, DOT, DCEO	$71,000	$190,000	3.81	1.43	2.70	0.00	0.00	0.00	Manitou Creek	N	N
SS_56	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	468	Linear Feet	M	M	1, 2, 5	M	Illinois EPA, SMC, USACE, DOT, DCEO	$70,000	$187,000	3.74	1.40	2.65	0.00	0.00	0.00	Manitou Creek	N	N
SS_50	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	402	Linear Feet	M	M	1, 2, 5	M	Illinois EPA, SMC, USACE, DOT	$60,000	$161,000	3.22	1.21	2.28	0.00	0.00	0.00	Manitou Creek	N	N
SS_60	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	382	Linear Feet	M	M	1, 2, 5	M	Illinois EPA, SMC, USACE, DOT, DCEO	$57,000	$153,000	3.05	1.15	2.16	0.00	0.00	0.00	Manitou Creek	N	N
SS_48	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	344	Linear Feet	M	M	1, 2, 5	C, UT	M, Illinois EPA, SMC, USACE	$52,000	$137,000	2.75	1.03	1.95	0.00	0.00	0.00	Manitou Creek	N	N
SS_61	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	309	Linear Feet	M	M	1, 2, 5	M	Illinois EPA, SMC, USACE, DOT, DCEO	$46,000	$123,000	2.47	0.93	1.75	0.00	0.00	0.00	Manitou Creek	N	N
SS_49	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	306	Linear Feet	M	M	1, 2, 5	M	Illinois EPA, SMC, USACE	$46,000	$122,000	2.45	0.92	1.73	0.00	0.00	0.00	Manitou Creek	N	N
SS_44	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	264	Linear Feet	M	M	1, 2, 5	PD	M, Illinois EPA, SMC, USACE, DOT	$40,000	$106,000	2.11	0.79	1.50	0.00	0.00	0.00	Manitou Creek	N	N
SS_45	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	254	Linear Feet	M	M	1, 2, 5	PD	M, Illinois EPA, SMC, USACE, DOT	$38,000	$102,000	2.03	0.76	1.44	0.00	0.00	0.00	Manitou Creek	N	N
SS_53	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	231	Linear Feet	M	M	1, 2, 5	PO	M, Illinois EPA, SMC, USACE, DCEO	$35,000	$92,000	1.85	0.69	1.31	0.00	0.00	0.00	Manitou Creek	N	N
SS_51	Village of Round Lake Beach	Stabilization	Stabilize streambank erosion.	71	Linear Feet	M	M	1, 2, 5	M	Illinois EPA, SMC, USACE, DOT	$11,000	$28,000	0.56	0.21	0.40	0.00	0.00	0.00	Manitou Creek	N	N
WI_20	Village of Round Lake Beach	Water Infrastructure	Repair or replace discharge point.	1	Each	M	M	2	DOT	M, SMC	$10,000	$50,000	0.01	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
WR_103	Village of Round Lake Beach	Wetland Restoration	Create new wetland.	2.9	Acres	M	M	1, 2, 3, 5	M, PD	USACE, USFWS, SMC, Illinois EPA, DOT	$204,000	$320,000	1.51	0.23	0.38	0.00	173.95	5.33	Manitou Creek	N	N
WR_90	Village of Round Lake Beach	Wetland Restoration	Create new wetland.	1.0	Acres	M	M	1, 2, 3, 5	PD	M, USACE, USFWS, SMC, Illinois EPA	$69,000	$108,000	0.51	0.08	0.13	0.00	58.79	1.80	Manitou Creek	N	N
WR_102	Village of Round Lake Beach	Wetland Restoration	Create new wetland.	0.8	Acres	M	M	1, 2, 3, 5	M, PD	USACE, USFWS, SMC, Illinois EPA, DOT	$59,000	$93,000	0.44	0.07	0.11	0.00	50.37	1.54	Manitou Creek	N	N
WR_89	Village of Round Lake Beach	Wetland Restoration	Create new wetland.	0.5	Acres	M	M	1, 2, 3, 5	PD	M, USACE, USFWS, SMC, Illinois EPA	$33,000	$52,000	0.25	0.04	0.06	0.00	28.45	0.87	Manitou Creek	N	N
WR_121	Village of Round Lake Beach	Wetland Restoration	Create new wetland.	0.3	Acres	M	M	1, 2, 3, 5	M, PD	USACE, USFWS, SMC, Illinois EPA, DOT	$18,000	$29,000	0.14	0.02	0.03	0.00	15.57	0.48	Manitou Creek	N	N
DB_10	Village of Round Lake Heights	Detention Basin Retrofit	1. Unclog inlet. 2. Remove phragmites.	1	Each	M	M	2	PO	M, SMC, DOT	$2,000	$34,000	0.01	0.01	0.00	0.00	3.91	0.04	Manitou Creek	N	N
DB_9	Village of Round Lake Heights	Detention Basin Retrofit	1. Unclog inlet/outlets. 2. Remove phragmites.	1	Each	M	M	2	PO	M, SMC, DOT	$1,000	$23,000	0.01	0.01	0.00	0.00	2.69	0.03	Manitou Creek	N	N
FRR_14	Village of Round Lake Heights	Flood Risk Reduction	Perform a detailed study to identify solutions to flooding at the Round Lakes Height Pond and the surrounding community and implement recommended actions.	1	Each	H	M	2	M	DOT, SMC, USACE, IDNR	-	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
RVR_167	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	3.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$54,000	$269,000	0.06	0.01	0.01	0.00	12.53	0.33	Manitou Creek	N	N
RVR_42	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.7	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$30,000	$149,000	0.04	0.00	0.01	0.00	6.94	0.18	Manitou Creek	N	N
RVR_257	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$19,000	$97,000	0.02	0.00	0.00	0.00	4.53	0.12	Manitou Creek	N	N
RVR_154	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$17,000	$83,000	0.02	0.00	0.00	0.00	3.85	0.10	Manitou Creek	N	N
RVR_1	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$16,000	$82,000	0.02	0.00	0.00	0.00	3.80	0.10	Manitou Creek	N	N
RVR_264	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$16,000	$82,000	0.02	0.00	0.00	0.00	3.83	0.10	Manitou Creek	N	N
RVR_292	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.9	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$15,000	$76,000	0.02	0.00	0.00	0.00	3.53	0.09	Manitou Creek	N	N
RVR_229	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.8	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$13,000	$67,000	0.02	0.00	0.00	0.00	3.12	0.08	Manitou Creek	N	N
RVR_63	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts,	0.6	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$10,000	$52,000	0.01	0.00	0.00	0.00	2.43	0.06	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
			recessed landscape islands, or other green infrastructure BMPs.																		
RVR_312	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.6	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$10,000	$50,000	0.01	0.00	0.00	0.00	2.35	0.06	Manitou Creek	N	N
RVR_66	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.6	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$10,000	$48,000	0.01	0.00	0.00	0.00	2.24	0.06	Manitou Creek	N	N
RVR_266	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.6	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$10,000	$48,000	0.01	0.00	0.00	0.00	2.24	0.06	Manitou Creek	N	N
RVR_3	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$9,000	$44,000	0.01	0.00	0.00	0.00	2.04	0.05	Manitou Creek	N	N
RVR_16	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$6,000	$28,000	0.01	0.00	0.00	0.00	1.32	0.03	Manitou Creek	N	N
RVR_181	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$4,000	$18,000	0.00	0.00	0.00	0.00	0.82	0.02	Manitou Creek	N	N
RVR_311	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$3,000	$17,000	0.00	0.00	0.00	0.00	0.79	0.02	Manitou Creek	N	N
RVR_26	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$16,000	0.00	0.00	0.00	0.00	0.75	0.02	Manitou Creek	N	N
RVR_186	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$16,000	0.00	0.00	0.00	0.00	0.75	0.02	Manitou Creek	N	N
RVR_262	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$16,000	0.00	0.00	0.00	0.00	0.75	0.02	Manitou Creek	N	N
RVR_15	Village of Round Lake Heights	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$11,000	0.00	0.00	0.00	0.00	0.50	0.01	Manitou Creek	N	N
WR_91	Village of Round Lake Heights	Wetland Restoration	Create new wetland.	1.0	Acres	M	M	1, 2, 3, 5	PD	M, USACE, USFWS, SMC, Illinois EPA	$71,000	$112,000	0.53	0.08	0.13	0.00	60.85	1.86	Manitou Creek	N	N
Ag_5	Village of Round Lake Park	Agricultural BMPs	Implement use of cover crops or other best fit agricultural BMPs	59.7	Acres	H	S	1, 2, 3, 5	AG	DOA, FB, M, DD, Illinois EPA, NRCS/SWCD	$6,000	$18,000	31.03	1.79	1.98	0.00	0.00	0.00	Manitou Creek	Y	N
Ag_2	Village of Round Lake Park	Agricultural BMPs	Implement use of cover crops or other best fit agricultural BMPs	5.2	Acres	H	S	1, 2, 3, 5	AG	DOA, FB, M, DD, Illinois EPA, NRCS/SWCD	$3,000	$9,000	2.68	0.15	0.17	0.00	0.00	0.00	Manitou Creek	Y	N
Ag_7	Village of Round Lake Park	Agricultural BMPs	Install grassed buffer/filter strip (35 feet wide).	2,732	Linear Feet	H	S	1, 2, 3, 5	AG	DOA, FB, M, DD	$2,000	$7,000	1.93	0.18	0.19	0.00	0.00	0.00	Manitou Creek	Y	N

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FRR_01	Village of Round Lake Park	Flood Risk Reduction	Remove sediment and debris obstructing outlet. Determine if additional remedial actions are needed to reduce road flooding.	1	Each	H	M	2	M		-	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
FRR_10	Village of Round Lake Park	Flood Risk Reduction	Install 60-inch storm sewer to reduce depressional flooding at the Greenwood Pump Station, WJ Murphy Elementary School, and the surrounding neighborhood.	2,570	Linear Feet	H	M	2	M, T	DOT, SMC, PO, DCEO	$2,750,000	-	0.00	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
RVR_122	Village of Round Lake Park	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	10.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$176,000	$878,000	0.21	0.03	0.04	0.00	40.93	1.08	Manitou Creek	N	N
RVR_252	Village of Round Lake Park	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	4.2	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$73,000	$367,000	0.09	0.01	0.02	0.00	17.08	0.45	Manitou Creek	N	N
RVR_106	Village of Round Lake Park	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	4.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$70,000	$349,000	0.08	0.01	0.01	0.00	16.26	0.43	Manitou Creek	N	N
RVR_231	Village of Round Lake Park	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	3.3	Acres	H	M	2, 5	PO	M, DD, SMC, Illinois EPA	$57,000	$285,000	0.07	0.01	0.01	0.00	13.28	0.35	Manitou Creek	N	N
RVR_286	Village of Round Lake Park	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.3	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$23,000	$115,000	0.03	0.00	0.00	0.00	5.36	0.14	Manitou Creek	N	N
RVR_242	Village of Round Lake Park	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$9,000	$44,000	0.01	0.00	0.00	0.00	2.03	0.05	Manitou Creek	N	N
RVR_141	Village of Round Lake Park	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$7,000	$33,000	0.01	0.00	0.00	0.00	1.56	0.04	Manitou Creek	N	N
RVR_188	Village of Round Lake Park	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$7,000	$33,000	0.01	0.00	0.00	0.00	1.51	0.04	Manitou Creek	N	N
RVR_60	Village of Round Lake Park	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$6,000	$29,000	0.01	0.00	0.00	0.00	1.34	0.04	Manitou Creek	N	N
RVR_191	Village of Round Lake Park	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$6,000	$29,000	0.01	0.00	0.00	0.00	1.34	0.04	Manitou Creek	N	N
RVR_238	Village of Round Lake Park	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$6,000	$28,000	0.01	0.00	0.00	0.00	1.30	0.03	Manitou Creek	N	N
RVR_132	Village of Round Lake Park	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$17,000	0.00	0.00	0.00	0.00	0.80	0.02	Manitou Creek	N	N

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RVR_125	Village of Round Lake Park	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$3,000	$15,000	0.00	0.00	0.00	0.00	0.69	0.02	Manitou Creek	N	N
RVR_18	Village of Round Lake Park	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$2,000	$12,000	0.00	0.00	0.00	0.00	0.54	0.01	Manitou Creek	N	N
RVR_190	Village of Round Lake Park	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$1,000	$6,000	0.00	0.00	0.00	0.00	0.27	0.01	Manitou Creek	N	N
SIP_2	Village of Round Lake Park	Stakeholder Identified Projects	Clear flow obstructions from culvert.	1	Each	H	S	2	DOT	DD,M,SMC	-	-	-	-	-	-	-	-	Manitou Creek	N	N
SS_15	Village of Round Lake Park	Stabilization	Stabilize shoreline erosion.	6,754	Linear Feet	M	M	1, 2, 5	HOA	UT, M, DD, Illinois EPA, SMC, USACE	$1,013,000	$2,702,000	54.03	20.26	38.30	0.00	0.00	0.00	Manitou Creek	N	N
SS_14	Village of Round Lake Park	Stabilization	Stabilize shoreline erosion.	5,165	Linear Feet	M	M	1, 2, 5	HOA	UT, M, DD, Illinois EPA, SMC, USACE	$775,000	$2,066,000	41.32	15.49	29.28	0.00	0.00	0.00	Manitou Creek	N	N
SS_82	Village of Round Lake Park	Stabilization	Stabilize streambank erosion.	4,352	Linear Feet	M	M	1, 2, 5	PO, HOA	M, DD, Illinois EPA, SMC, USACE, DOT	$653,000	$1,741,000	34.82	13.06	24.68	0.00	0.00	0.00	Manitou Creek	N	N
SS_84	Village of Round Lake Park	Stabilization	Stabilize streambank erosion.	1,636	Linear Feet	M	M	1, 2, 5	PO	M, DD, Illinois EPA, SMC, USACE, HOA	$245,000	$654,000	13.09	4.91	9.28	0.00	0.00	0.00	Manitou Creek	N	N
SS_83	Village of Round Lake Park	Stabilization	Stabilize streambank erosion.	1,524	Linear Feet	M	M	1, 2, 5	HOA, PO	M, DD, Illinois EPA, SMC, USACE, DOT	$229,000	$610,000	12.20	4.57	8.64	0.00	0.00	0.00	Manitou Creek	N	N
SS_87	Village of Round Lake Park	Stabilization	Stabilize streambank erosion.	1,337	Linear Feet	M	M	1, 2, 5	PO	M, DD, Illinois EPA, SMC, USACE	$201,000	$535,000	10.70	4.01	7.58	0.00	0.00	0.00	Manitou Creek	N	N
SS_86	Village of Round Lake Park	Stabilization	Stabilize streambank erosion.	1,284	Linear Feet	M	M	1, 2, 5	HOA, AG	M, DD, Illinois EPA, SMC, USACE	$193,000	$514,000	10.27	3.85	7.28	0.00	0.00	0.00	Manitou Creek	N	N
SS_89	Village of Round Lake Park	Stabilization	Stabilize streambank erosion.	1,211	Linear Feet	M	M	1, 2, 5	AG, HOA	M, DD, Illinois EPA, SMC, USACE, DOT	$182,000	$484,000	9.68	3.63	6.86	0.00	0.00	0.00	Manitou Creek	N	N
SS_90	Village of Round Lake Park	Stabilization	Stabilize streambank erosion.	1,198	Linear Feet	M	M	1, 2, 5	AG, HOA	M, DD, Illinois EPA, SMC, USACE, DOT	$180,000	$479,000	9.59	3.59	6.79	0.00	0.00	0.00	Manitou Creek	N	N
SS_85	Village of Round Lake Park	Stabilization	Stabilize streambank erosion.	929	Linear Feet	M	M	1, 2, 5	PO	M, DD, Illinois EPA, SMC, USACE	$139,000	$371,000	7.43	2.79	5.27	0.00	0.00	0.00	Manitou Creek	N	N
SS_13	Village of Round Lake Park	Stabilization	Stabilize shoreline erosion.	625	Linear Feet	M	M	1, 2, 5	HOA	M, Illinois EPA, SMC, USACE	$94,000	$250,000	5.00	1.88	3.55	0.00	0.00	0.00	Manitou Creek	N	N
SS_88	Village of Round Lake Park	Stabilization	Stabilize streambank erosion.	95	Linear Feet	M	M	1, 2, 5	HOA	M, DD, Illinois EPA, SMC, USACE, DOT	$14,000	$38,000	0.76	0.29	0.54	0.00	0.00	0.00	Manitou Creek	N	N
SS_8	Village of Round Lake Park	Stabilization	Stabilize erosion.	35	Linear Feet	M	M	1,3	HOA	M, DD, Illinois EPA, SMC, USACE	$5,000	$14,000	0.28	0.11	0.20	0.00	0.00	0.00	Manitou Creek	N	N
SS_9	Village of Round Lake Park	Stabilization	Stabilize erosion.	25	Linear Feet	M	M	1,3	HOA	M, DD, Illinois EPA, SMC, USACE	$4,000	$10,000	0.20	0.08	0.14	0.00	0.00	0.00	Manitou Creek	N	N
WI_14	Village of Round Lake Park	Water Infrastructure	Partially suspended/unsupported pipe discharges to creek. May pose additional erosion and pipe failure risk. Stabilize outfall.	1	Each	M	M	2	PO	M, DD, SMC, USACE	$15,000	$100,000	0.01	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
WI_17	Village of Round Lake Park	Water Infrastructure	Stabilize erosion. Extend discharge point to base water level and/or install appropriate energy dissipation.	5	Linear Feet	M	M	2	HOA	M, DD, SMC	$15,000	$100,000	0.04	0.02	0.03	0.00	0.00	0.00	Manitou Creek	N	N

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WI_10	Village of Round Lake Park	Water Infrastructure	Exposed drain tile discharges to creek, resulting in erosion. Repair or replace discharge point.	15	Linear Feet	M	M	2	PO	M, DD, SMC	$10,000	$50,000	0.12	0.05	0.09	0.00	0.00	0.00	Manitou Creek	N	N
WI_22	Village of Round Lake Park	Water Infrastructure	Partially suspended/unsupported pipe crosses stream reach. May pose debris jam or pipe failure risk. Explore options to stabilize the suspended pipe.	1	Each	L	L	2	HOA	M, DD, SMC	$15,000	$100,000	0.01	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
WI_23	Village of Round Lake Park	Water Infrastructure	Partially suspended/unsupported pipe discharges to creek. May pose additional erosion and pipe failure risk. Stabilize outfall.	1	Each	L	L	2	HOA	M, DD, SMC	$15,000	$100,000	0.01	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
WI_12	Village of Round Lake Park	Water Infrastructure	Stabilize erosion. Extend discharge point to base water level and/or install appropriate energy dissipation.	10	Linear Feet	L	L	2	PO	M, DD, SMC, USACE	$15,000	$100,000	0.08	0.03	0.06	0.00	0.00	0.00	Manitou Creek	N	N
WI_13	Village of Round Lake Park	Water Infrastructure	Stabilize erosion. Extend discharge point to base water level and/or install appropriate energy dissipation.	10	Linear Feet	L	L	2	PO	M, DD, SMC, USACE	$15,000	$100,000	0.08	0.03	0.06	0.00	0.00	0.00	Manitou Creek	N	N
WI_15	Village of Round Lake Park	Water Infrastructure	Repair or replace discharge point.	1	Each	L	L	2	HOA	M, DD, SMC	$10,000	$50,000	0.01	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
WI_16	Village of Round Lake Park	Water Infrastructure	Repair or replace discharge point.	1	Each	L	L	2	HOA	M, DD, SMC	$10,000	$50,000	0.01	0.00	0.00	0.00	0.00	0.00	Manitou Creek	N	N
WI_11	Village of Round Lake Park	Water Infrastructure	Repair or replace discharge point. Stabilize erosion.	20	Linear Feet	L	L	2	PO	M, DD, SMC, USACE	$10,000	$50,000	0.16	0.06	0.11	0.00	0.00	0.00	Manitou Creek	N	N
WR_2	Village of Round Lake Park	Wetland Restoration	Create new wetland.	40.4	Acres	M	M	1, 2, 3, 5	AG	DOA, FB, UT, M, USACE, USFWS, SMC, Illinois EPA, PB&D, DD, HOA	$2,828,000	$4,444,000	21.01	3.23	5.22	0.00	2,413.86	73.93	Manitou Creek	Y	N
DJ_1	Village of Volo	Debris Jam	Remove debris obstructing flow using American Fisheries Society guidelines.	1	Each	M	M	2	SI	M, SMC	$15,000	$110,000	0.00	0.00	0.00	0.00	0.00	0.00	Fish Lake Drain	N	N
DB_2	Village of Volo	Detention Basin Retrofit	Stabilize outlet blowout and repair pipe.	1	Each	H	M	2	M	SMC, HOA	$6,000	$95,000	0.02	0.03	0.00	0.00	11.04	0.11	Fish Lake Drain	N	N
DB_1	Village of Volo	Detention Basin Retrofit	Stabilize inlet and side slope erosion.	1	Each	H	S	2	PO	M, SMC	$4,000	$70,000	0.02	0.02	0.01	0.00	8.07	0.08	Fish Lake Drain	Y	N
DB_3	Village of Volo	Detention Basin Retrofit	Investigate potential illicit discharge from southern inlet.	1	Each	M	M	2	M, PO	SMC, LCHD, PD, Illinois EPA, DOT	$17,000	$275,000	0.07	0.08	0.02	0.00	31.89	0.32	Fish Lake Drain	N	N
RSM_15	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.0	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	30.37	0.00	0.00	Fish Lake Drain	N	N
RSM_16	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.7	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	18.91	0.00	0.00	Fish Lake Drain	N	N
RSM_17	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.7	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	19.48	0.00	0.00	Fish Lake Drain	N	N
RSM_18	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.7	Acres	H	S	2, 5	M, PO, PC		-	-	0.00	0.00	0.00	49.23	0.00	0.00	Fish Lake Drain	N	N
RSM_19	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.5	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	42.69	0.00	0.00	Fish Lake Drain	N	N
RSM_21	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	2.4	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	70.94	0.00	0.00	Fish Lake Drain	N	N
RSM_22	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental	0.5	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	14.85	0.00	0.00	Fish Lake Drain	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
			impacts while maintaining public safety.																		
RSM_23	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.0	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	29.97	0.00	0.00	Fish Lake Drain	N	N
RSM_31	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.2	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	6.68	0.00	0.00	Fish Lake Drain	N	N
RSM_32	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.5	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	15.62	0.00	0.00	Fish Lake Drain	N	N
RSM_33	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.3	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	7.88	0.00	0.00	Fish Lake Drain	Y	N
RSM_34	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.4	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	12.59	0.00	0.00	Fish Lake Drain	N	N
RSM_35	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.0	Acres	H	S	2, 5	SI, PC	M	-	-	0.00	0.00	0.00	30.21	0.00	0.00	Fish Lake Drain	N	N
RSM_39	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.1	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	3.28	0.00	0.00	Fish Lake Drain	Y	N
RSM_40	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.6	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	18.66	0.00	0.00	Fish Lake Drain	Y	N
RSM_65	Village of Volo	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	1.4	Acres	H	S	2, 5	PC, CBL	M	-	-	0.00	0.00	0.00	40.68	0.00	0.00	Fish Lake Drain	Y	N
RVR_67	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	36.0	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$628,000	$3,138,000	0.75	0.09	0.13	0.00	146.22	3.85	Fish Lake Drain	N	N
RVR_4	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	15.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$263,000	$1,315,000	0.31	0.04	0.05	0.00	61.28	1.61	Fish Lake Drain	N	N
RVR_121	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	8.1	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$141,000	$703,000	0.17	0.02	0.03	0.00	32.77	0.86	Fish Lake Drain	N	N
RVR_130	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	7.3	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$127,000	$635,000	0.15	0.02	0.03	0.00	29.57	0.78	Fish Lake Drain	N	N
RVR_219	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	6.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$106,000	$530,000	0.13	0.02	0.02	0.00	24.71	0.65	Fish Lake Drain	N	N
RVR_52	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	4.6	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$81,000	$404,000	0.10	0.01	0.02	0.00	18.84	0.50	Fish Lake Drain	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
RVR_320	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	3.2	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$56,000	$280,000	0.07	0.01	0.01	0.00	13.03	0.34	Fish Lake Drain	N	N
RVR_313	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.4	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$42,000	$211,000	0.05	0.01	0.01	0.00	9.82	0.26	Fish Lake Drain	N	N
RVR_74	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.3	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$40,000	$200,000	0.05	0.01	0.01	0.00	9.30	0.24	Fish Lake Drain	N	N
RVR_59	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$39,000	$197,000	0.05	0.01	0.01	0.00	9.17	0.24	Fish Lake Drain	N	N
RVR_120	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.2	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$38,000	$192,000	0.05	0.01	0.01	0.00	8.94	0.24	Fish Lake Drain	N	N
RVR_217	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	2.1	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$36,000	$182,000	0.04	0.01	0.01	0.00	8.47	0.22	Fish Lake Drain	N	N
RVR_302	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.9	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$33,000	$166,000	0.04	0.00	0.01	0.00	7.73	0.20	Fish Lake Drain	N	N
RVR_119	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.3	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$22,000	$111,000	0.03	0.00	0.00	0.00	5.17	0.14	Fish Lake Drain	N	N
RVR_314	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	1.3	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$22,000	$111,000	0.03	0.00	0.00	0.00	5.18	0.14	Fish Lake Drain	N	N
RVR_105	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.6	Acres	H	M	2, 5	PO	M, SMC, Illinois EPA	$10,000	$51,000	0.01	0.00	0.00	0.00	2.37	0.06	Fish Lake Drain	N	N
RVR_208	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.5	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$8,000	$40,000	0.01	0.00	0.00	0.00	1.85	0.05	Fish Lake Drain	N	N
RVR_212	Village of Volo	Runoff Volume Reduction	Reduce stormwater runoff from rain gardens, bioswales, permeable pavement/asphalt, curb cuts, recessed landscape islands, or other green infrastructure BMPs.	0.2	Acres	H	M	2, 5	CBL	M, SMC, Illinois EPA	$3,000	$15,000	0.00	0.00	0.00	0.00	0.68	0.02	Fish Lake Drain	N	N
SS_1	Village of Volo	Stabilization	Stabilize erosion.	100	Linear Feet	M	M	1,3	M	Illinois EPA, SMC, USACE	$15,000	$40,000	0.80	0.30	0.57	0.00	0.00	0.00	Fish Lake Drain	N	N
SS_19	Village of Volo	Stabilization	Stabilize shoreline erosion.	7,640	Linear Feet	L	L	1, 2, 5	M, HOA	PO, Illinois EPA, SMC, USACE, DOT	$1,146,000	$3,056,000	61.12	22.92	43.32	0.00	0.00	0.00	Fish Lake Drain	N	N
WI_2	Village of Volo	Water Infrastructure	Repair or replace hydraulic structure.	1	Each	H	S	2	PO	M, SMC	$15,000	$100,000	0.01	0.00	0.00	0.00	0.00	0.00	Fish Lake Drain	N	N
WI_1	Village of Volo	Water Infrastructure	Repair or replace hydraulic structure.	1	Each	M	M	2	M	SMC	$15,000	$100,000	0.01	0.00	0.00	0.00	0.00	0.00	Fish Lake Drain	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
WR_152	Village of Volo	Wetland Restoration	Create new wetland.	10.7	Acres	M	M	1, 2, 3, 5	AG	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$748,000	$1,176,000	5.56	0.86	1.38	0.00	638.64	19.56	Fish Lake Drain	Y	N
WR_153	Village of Volo	Wetland Restoration	Create new wetland.	4.7	Acres	M	M	1, 2, 3, 5	AG	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$326,000	$513,000	2.42	0.37	0.60	0.00	278.48	8.53	Fish Lake Drain	Y	N
WR_146	Village of Volo	Wetland Restoration	Create new wetland.	1.8	Acres	M	M	1, 2, 3, 5	AG	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$128,000	$201,000	0.95	0.15	0.24	0.00	109.04	3.34	Fish Lake Drain	Y	N
WR_149	Village of Volo	Wetland Restoration	Create new wetland.	1.5	Acres	M	M	1, 2, 3, 5	AG	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$103,000	$162,000	0.76	0.12	0.19	0.00	87.74	2.69	Fish Lake Drain	Y	N
WR_151	Village of Volo	Wetland Restoration	Create new wetland.	1.4	Acres	M	M	1, 2, 3, 5	AG	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$100,000	$157,000	0.74	0.11	0.18	0.00	85.12	2.61	Fish Lake Drain	Y	N
WR_148	Village of Volo	Wetland Restoration	Create new wetland.	1.3	Acres	M	M	1, 2, 3, 5	AG	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$94,000	$148,000	0.70	0.11	0.17	0.00	80.66	2.47	Fish Lake Drain	Y	N
WR_147	Village of Volo	Wetland Restoration	Create new wetland.	1.0	Acres	M	M	1, 2, 3, 5	AG	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$68,000	$107,000	0.51	0.08	0.13	0.00	58.38	1.79	Fish Lake Drain	Y	N
WR_145	Village of Volo	Wetland Restoration	Create new wetland.	0.8	Acres	M	M	1, 2, 3, 5	AG	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D, DOT	$53,000	$84,000	0.40	0.06	0.10	0.00	45.58	1.40	Fish Lake Drain	Y	N
WR_144	Village of Volo	Wetland Restoration	Create new wetland.	0.5	Acres	M	M	1, 2, 3, 5	AG	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$36,000	$56,000	0.27	0.04	0.07	0.00	30.53	0.94	Fish Lake Drain	Y	N
WR_150	Village of Volo	Wetland Restoration	Create new wetland.	0.4	Acres	M	M	1, 2, 3, 5	AG	DOA, FB, T, USACE, USFWS, SMC, Illinois EPA, PB&D	$31,000	$49,000	0.23	0.04	0.06	0.00	26.73	0.82	Fish Lake Drain	Y	N
WR_31	Village of Volo	Wetland Restoration	Create new wetland.	0.4	Acres	M	M	1, 2, 3, 5	LCFPD	M, USACE, USFWS, SMC, Illinois EPA	$25,000	$40,000	0.19	0.03	0.05	0.00	21.49	0.66	Manitou Creek	N	N
WR_142	Village of Volo	Wetland Restoration	Create new wetland.	0.1	Acres	M	M	1, 2, 3, 5	LCFPD	USACE, USFWS, SMC, Illinois EPA	$10,000	$16,000	0.08	0.01	0.02	0.00	8.67	0.27	Manitou Creek	N	N
RSM_28	Wauconda Township	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.3	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	9.11	0.00	0.00	Fish Lake Drain	N	N
RSM_30	Wauconda Township	Road Salt Management	Implement road salt management BMP's that reduce environmental impacts while maintaining public safety.	0.3	Acres	H	S	2, 5	PC, PO	M	-	-	0.00	0.00	0.00	9.69	0.00	0.00	Fish Lake Drain	N	N
WR_32	Wauconda Township	Wetland Restoration	Create new wetland.	1.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$85,000	$134,000	0.63	0.10	0.16	0.00	72.96	2.23	Manitou Creek	N	N
WR_48	Wauconda Township	Wetland Restoration	Create new wetland.	1.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$84,000	$132,000	0.62	0.10	0.16	0.00	71.76	2.20	Manitou Creek	N	N
WR_86	Wauconda Township	Wetland Restoration	Create new wetland.	0.6	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$42,000	$65,000	0.31	0.05	0.08	0.00	35.54	1.09	Manitou Creek	N	N
WR_65	Wauconda Township	Wetland Restoration	Create new wetland.	0.5	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$38,000	$60,000	0.28	0.04	0.07	0.00	32.66	1.00	Manitou Creek	N	N
WR_128	Wauconda Township	Wetland Restoration	Create new wetland.	0.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$16,000	$25,000	0.12	0.02	0.03	0.00	13.85	0.42	Fish Lake Drain	N	N
WR_143	Wauconda Township	Wetland Restoration	Create new wetland.	0.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$16,000	$24,000	0.12	0.02	0.03	0.00	13.31	0.41	Fish Lake Drain	N	N
WR_122	Wauconda Township	Wetland Restoration	Create new wetland.	0.2	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$12,000	$18,000	0.09	0.01	0.02	0.00	9.99	0.31	Manitou Creek	N	N

Plan ID	Jurisdiction	BMP Type	Action	Quantity	Quantity Unit	Priority	Time Frame	Plan Goals Addressed	Lead Partners	Supporting Partners	Estimated Cost (Low-End)	Estimated Cost (High-End)	Nitrogen Reduction (lbs/yr)	Phosphorus Reduction (lbs/yr)	Sediment Reduction (tons/yr)	Chloride Reduction (lbs/yr)	Bacteria Reduction (billion CFU/yr)	Biological Oxygen Demand Reduction (lbs/yr)	Subwatershed	In Critical Area?	In Previous Plans?
WR_126	Wauconda Township	Wetland Restoration	Create new wetland.	0.1	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$9,000	$14,000	0.06	0.01	0.02	0.00	7.44	0.23	Fish Lake Drain	N	N
WR_127	Wauconda Township	Wetland Restoration	Create new wetland.	0.1	Acres	M	M	1, 2, 3, 5	LCFPD	T, USACE, USFWS, SMC, Illinois EPA, PB&D	$9,000	$14,000	0.06	0.01	0.02	0.00	7.37	0.23	Fish Lake Drain	N	N

APPENDIX B:
EVALUATION SCORECARDS

Scoring Criteria: A: Met or exceeded milestone(s), B: Milestone(s) 75% complete, C: Milestone(s) 50% complete, D: Milestone(s) 25% complete, F: No progress towards milestone(s), I/D: Insufficient data, N/D: No data.

Objective ID	Indicator	Time frame	Milestone	Grade	Comments
1A	A1. Implementation of watershed monitoring program.	**S**	Develop monitoring program		
		M	Implement program		
		L	Continued implementation and adaptation of program		
	A2. Regular reports on water quality monitoring to community and stakeholders.	**S**	Develop monitoring program		
		M	Collect data, baseline report		
		L	Subsequent reporting		
1B	B1. Winter Maintenance Program establishment including: policy and manual development, de-icing workshop attendance and certification.	**S**	20% of municipal programs		
		M	40% of municipal programs		
		L	100% of municipal programs		
	B2. Monitoring data trends for chloride and specific conductivity.	**S**	Develop monitoring program		
		M	Collect data, baseline report		
		L	Nonpoint source pollutant trends decreasing		
1C	C1. Implementation of BMPs and management practices that reduce internal or external phosphorus loading in lakes.	**S**	3		
		M	5		
		L	10		

Objective ID	Indicator	Time frame	Milestone	Grade	Comments
	C2. Monitoring data trends for phosphorus.	**S**	Develop monitoring program		
		M	Collect data, baseline report		
		L	Nonpoint source pollutant trends decreasing		
1D	D1. Monitoring data trends for common nonpoint source pollutants.	**S**	Develop monitoring program		
		M	Collect data, baseline report		
		L	Nonpoint source pollutant trends decreasing		
1E	E1. Number of agricultural BMPs implemented that reduce nonpoint source pollution.	**S**	3		
		M	5		
		L	10		
	E2. Monitoring data trends for common nonpoint source pollutants.	**S**	Develop monitoring program		
		M	Collect data, baseline report		
		L	Nonpoint source pollutant trends decreasing		
2A	A1. Runoff volume reduction and mitigation measures implemented.	**S**	Increase 2% from baseline (2024)		
		M	Increase 5%		
		L	Increase 10%		

Objective ID	Indicator	Time frame	Milestone	Grade	Comments
2B	B1. Number of flood problem areas positively affected by flood mitigation projects implemented.	**S**	2		
		M	5		
		L	10		
	B2. Number/value of claims filed each year per community in the watershed.	**S**	Reduce by 5%		
		M	Reduce by 10%		
		L	Reduce by 25%		
2C	C1. Number of local drainage system improvement projects implemented.	**S**	5		
		M	10		
		L	25		
2D	D1. Number of Voluntary Floodplain/Hazard Mitigation Buyouts.	**S**	5		
		M	10		
		L	25		
3A	A1. Acres of wetlands enhanced and/or restored.	**S**	10		
		M	50		
		L	100		
3B	B1. Number of regional (based on SMC's Regional Green Infrastructure definition) green infrastructure projects.	**S**	1		
		M	2		
		L	3		

Objective ID	Indicator	Time frame	Milestone	Grade	Comments
3C	C1. Acres of protected natural areas preserved, managed and/or restored.	**S**	500		
		M	1,500		
		L	4,000		
3D	D1. Acres of invasive species removal/management projects.	**S**	500		
		M	1,000		
		L	2,500		
	D2. Number of aquatic invasive education and outreach efforts.	**S**	10		
		M	20		
		L	30		
3E	E1. Number of lakes with Lake Management or Aquatic Plant Management Plans.	**S**	3		
		M	5		
		L	10		
3F	F1. Linear feet of stabilization projects implemented.	**S**	5,000		
		M	10,000		
		L	25,000		
4A	A1. Number of people reached by watershed outreach campaign.	**S**	Establish outreach campaign		
		M	5,000		
		L	10,000		

Objective ID	Indicator	Time frame	Milestone	Grade	Comments
4B	B1. Number of landowners that receive information about watershed programs and projects.	**S**	2,000		
		M	5,000		
		L	10,000		
	B2. Number of workshops.	**S**	10		
		M	20		
		L	30		
5A	A1. Number of municipalities, counties, agencies and organizations that adopt the Manitou Creek-Fish Lake Drain Watershed-Based Plan.	**S**	20 Agencies		
		M	All Agencies		
		L	All Agencies		
5B	B1. Number of projects advanced/undertaken with the support of stakeholder groups.	**S**	25 recommendations/projects		
		M	100 recommendations/projects		
		L	250 recommendations/projects		
5C	C1. Number of communities and organizations that have designated a representative to participate in watershed stakeholder initiatives.	**S**	10 communities/organizations		
		M	15 communities/organizations		
		L	All communities		

APPENDIX C:
STREAM INVENTORY

STORMWATER MANAGEMENT COMMISSION

Manitou Creek and Fish Lake Drain Watersheds

Summer 2021 Stream Inventory Report

Index

Introduction

Lake County Stormwater Management Commission conducted a stream inventory of the Manitou Creek and Fish Lake Drain watersheds in the summer of 2021. This stream inventory contributes to ongoing efforts to update the Manitou Creek and Fish Lake Drain Watershed Management Plans. The purpose of the stream inventory was to record quantitative and qualitative information, including the capture of visual information, on the stream conditions in the Manitou Creek and Fish Lake Drain watersheds. The information collected provides a baseline of the overall stream conditions, which can be further extrapolated to indicate the conditions of the watershed and identify potential issues which should be prioritized when implementing watershed management strategies.

Watershed Overview

The Manitou Creek watershed is one of nine subwatersheds making up the greater Fox River watershed. The Manitou Creek watershed encompasses a total drainage area of 39.5 square miles within ten municipalities and five townships. The Manitou Creek watershed consists three catchment areas, the Manitou Creek Mainstem, Eagle Creek, and Round Lake Drain. The largest lake in the Manitou Creek watershed is Long Lake, encompassing 392.6 acres. Water flows into Long Lake, generally moving north within the Manitou Creek Mainstem catchment area, south within the Eagle Creek catchment area, and east within the Round Lake Drain catchment area. It then flows north from Long Lake, through Manitou Creek, and into Fox Lake. Manitou Creek is a singular stream reach within the Upper Fox River watershed, which joins Long Lake with Fox Lake. While Manitou Creek is within the Upper Fox River watershed, it allows water from the Manitou Creek watershed to drain into Fox Lake and was thus included in this inventory.

The Fish Lake Drain watershed is also one of nine subwatersheds making up the larger Fox River watershed. The Fish Lake Drain watershed lies directly to the west of the Manitou Creek watershed. The Fish Lake Drain watershed is 8.7 square miles of drainage area and consists of four municipalities and two townships. Significant lakes within the Fish Lake Drain watershed are Fish Lake, Fischer Lake Drain, Wooster Lake, and Duck Lake. Water collected in the southernmost part of the watershed drains into Fish Lake. From Fish Lake it then flows north, through Fish Lake Drain, into Fischer Lake Drain and then into Wooster Lake. Water continues to flow northward from Wooster Lake into Duck Lake, connected by Wooster Lake Drain. Once the flow reaches Duck Lake it continues moving north by means of Duck Lake Drain, meeting Manitou Creek and draining into Fox Lake. Manitou Creek, within the Upper Fox River watershed, allows water from the Fish Lake Drain watershed to meet with water from the Manitou Creek watershed and simultaneously drain into Fox Lake. See Appendix C for a map of the Manitou Creek and Fish Lake Drain stream inventory reaches.

A total of 79 stream reaches were assessed in the 2021 stream inventory. The Manitou Creek watershed was divided into 71 reaches, with the Manitou Creek Mainstem catchment area consisting of 42 stream reaches, the Round Lake drain catchment area consisting of 15 stream reaches, and the Eagle Creek catchment area consisting of 14 stream reaches. Similarly, the Fish Lake Drain watershed was divided into 7 stream reaches. One stream reach, Manitou Creek, is within the Upper Fox River watershed. This is a significant reach, making up 4% of our total inventory, which connects flow from both the Manitou Creek and Fish Lake Drain watersheds.

Table 1. Manitou Creek and Fish Lake Drain Reach Summaries

Catchment Areas	Number of Reaches	Average Reach Length (mi.)	Total Miles	Percent of Total Inventory
Eagle Creek	14	0.34	4.73	12%
Round Lake Drain	15	0.40	6.05	16%
Manitou Creek Mainstem	42	0.53	22.1	57%
Fish Lake	7	0.61	4.29	11%
Upper Fox River	1	1.49	1.49	4%
Total Reaches	**79**	**0.49**	**38.68**	**100%**

*The Upper Fox River is not a catchment area but a subwatershed of the Fox River watershed

Stream Inventory Assessment

The stream inventory assesses the geomorphic, hydraulic, and aquatic characterization of streams by identifying and evaluating channelization, erosion, lateral recession, debris load, hydraulic structures, discharge points, vegetation, land use, and elements with otherwise significant impact on stream functioning. Visual observations regarding aquatic and terrestrial life are also included in the stream inventory and allow for a more comprehensive assessment of the stream conditions. The stream inventory crew holds a unique perspective of the watershed having experienced each stream firsthand. The notes written by the stream inventory crew provide valuable insights such as input of local stakeholders, restricted area boundaries, elements of concern, and general ecological trends which may not be identified in other methods of data collection.

Data Collection and Methodology

The stream inventory data is captured through a uniform and standard process to ensure that it is accurate and reproducible. The stream network within the watershed is divided into reaches, smaller geographically defined segments of streams, for which data is aggregated. The stream inventory was conducted by teams of two observers who walked or canoed each reach for its entire length and collected reprehensive points using the application ArcGIS Field Maps. Data included quantitative measurements, qualitative rankings, photographs, and notes. The data was then analyzed and presented geographically using the software ArcGIS Pro.

Channel Conditions

Water Levels

Figure 1. Example of a dry pond caused by low water levels.

Northern Illinois experienced a moderate drought throughout the time this stream inventory was conducted. Streams had lower than average water levels, with an average water depth of less than two feet. Some segments of reaches were completely dry, these were most often downstream portions of reaches extending away from main clusters of reaches. Ponds, open channels, and tributaries seen on the 2020 aerial were also found to be smaller, colonized by bank vegetation, or non-existent in the 2021 inventory. The moderate drought conditions may have also increased baseflow sinuosity, bank heights, and riffle environments.

Table 2. Channel Conditions

Watershed	Range/Average	Bank Height (ft.)	Water Depth (ft.)	Velocity (ft./sec)	Top Channel Width (ft.)	Bottom Channel Width (ft.)
Accessible Reaches	Range	0-10	0-6	0-2.5	0-250	0-250
	Average	1.61	1.69	0.20	21.97	19.44

*Water depth measurements were cut off at 6 feet when observers were canoeing

Channelization

Table 3. Channelization Data

Degree of Channelization	Watershed Reach Totals				
	None	**Low**	**Moderate**	**High**	**Total**
Watershed Total	1	22	28	28	79
Percentage of Watershed	1.3%	27.7%	35.5%	35.5%	100%

Figure 2. Comparison of high vs. low channelization stream reaches. Top two images show reach with high channelization and low sinuosity. Left image shows reach with low channelization and high sinuosity.

Stream channelization describes any activity that moves, straightens, shortens, cuts off, diverts, or fills in a stream channel. These activities, which include widening, narrowing, or lining a stream channel, alter the discharge and velocity of water flowing through it. Consequently, modifications aimed to address a problem in one area of the stream channel may shift the problem to another area upstream, downstream or within the immediate area.

The degree of channelization is ranked according to the percent of channelization. Reaches with 1%-33% of the reach significantly channelized are ranked as having low channelization, reaches with 33%-66% of the reach significantly channelized are ranked as having moderate channelization, and reaches with greater than 66% of the reach significantly channelized are ranked as having high channelization. Reaches with no indication of channelization are ranked as "none" channelization. Examples of high and low channelization are shown in Figure 2.

Within the Manitou Creek and Fish Lake Drain watersheds, reaches running parallel to agricultural fields were the most likely to have the high channelization. This is likely due to these reaches being used for drainage purposes. Reaches running through dense wetlands tended to have the lowest channelization, likely due to their seclusion from human development and significant vegetative buffers. Table 3 summarizes watershed channelization data for the Manitou Creek and Fish Lake Drain watersheds. The majority of the 79 reaches had channelization that fit into the moderate and high categories. Only one reach, SC03, had no indication of channelization and fit into the "none" channelization category. See Appendix C for a map of channelization by reach in the Manitou Creek and Fish Lake Drain watersheds.

Pool, Riffle and Run Development

Table 4. Pool, Riffle and Run Development

Degree of Pool, Riffle and Run Development	Watershed Total					
	Pool Reaches		Riffle Reaches		Run Reaches	
	#	%	#	%	#	%
0-10%	76	96.2	78	98.7	4	5.1
11-30%	2	2.5	1	1.3	0	0
31-50%	0	0	0	0	0	0
51-75%	0	0	0	0	0	0
76%+	1	1.3	0	0	75	94.9
Total	79	100%	79	100%	79	100%

Figure 3. Examples of riffle/pool environments in streams.

Under baseflow conditions, pools are low-gradient areas of deeper water with slower velocity and riffles are high-gradient areas of shallow water with higher velocity. In general, pools represent localized deeper areas and riffles represent localized shallower areas. During baseflow conditions, sediment erodes from riffles and is deposited into pools. During bankfull conditions, the relationship of relative velocity in riffles and pools is reversed and sediments, along with substrate material, are scoured from pools and the channel bed and are then deposited on riffles or bars. During periods of elevated flow when the velocity in pools exceeds that over riffles, deposition and bar formation tends to occur in areas adjacent to pools. Channelization often reduces the extent of pool and riffle sequences in a stream. Runs refer to areas between rifles and pools, where terrain gradient and water velocity stays relatively consistent. Examples of pool and riffle environments are shown in Figure 3.

Due to the moderate drought conditions during the 2021 stream inventory, water levels were low in most stream reaches. These conditions created more riffle environments. The pool, riffle and run development data for Manitou Creek and Fish Lake Drain watersheds is summarized in Table 4. Most reaches were made up of primarily runs with some small areas of pools and riffles.

Streambank Erosion

Table 5. Streambank Erosion Criteria

Category	Criteria
Low (1%-33%)	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
Moderate (33%-66 %)	Bank is predominantly bare with some rills and vegetative overhang.

Severe (66%-100%)	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen trees and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross-section becomes more U-shaped as opposed to V-shaped.

Table 6. Streambank Erosion Data

Extent of Erosion	Number of points	Percentage of Watershed
None or Low	237	68.1 %
Moderate	103	29.6 %
Severe	8	2.3 %

Figure 4. Examples of severe erosion along stream banks.

Streams are dynamic systems in a perpetual state of flux; therefore, all banks exhibit some form of erosion. Surface runoff into streams contributes to streambank erosion and is dependent upon key factors such as storm events, including the duration, timing, and amount of precipitation that falls and subsequently runs off. Other key factors include the type and condition of the soil, land use, and width of vegetative buffers. In some reaches, severe streambank erosion is caused by increased runoff from urban development, channelization, sediment "starvation" caused by dams, local changes in stream gradient, and soil type. The qualitative assessment criteria for streambank erosion can be found in Table 5. Examples of severe streambank erosion are shown in Figure 4.

Within the Manitou Creek and Fish Lake Drain Watersheds significant bank erosion was identified in both rural and urban streams. Streambank erosion data is summarized in Table 6 above. Areas with severe erosion tended to be along the outside bank where streams turned sharply. Areas with lowest bank erosion tended to be in heavily armored areas or in wetland environments. Within the two watersheds, 68.1% of the erosion points collected fell into the none or low erosion categories. Comparatively, only 2.3% of the streambank erosion points collected were considered severe. One important note is that streambank erosion points were collected as a way to summarize erosion along long portions of streambank (>25ft). If applicable, many shorter areas of bank that had severe erosion were collected as cut banks. A total of 22 instances of cut banks were collected across the two watersheds. Areas where severe streambank erosion threatened the structural integrity of buildings or hydraulic structures were noted. See Appendix C for a map of erosion by reach for the Manitou Creek and Fish Lake Drain watersheds.

Lateral Recession

Table 7. Lateral Recession Rate Criteria

Category (ft./year)	Criteria
Slight (0.01-0.05)	Some bare bank but active erosion not readily apparent. No vegetative overhang. No exposed tree roots. Bank height minimal.
Moderate (0.06-0.2)	Bank is predominantly bare, with some vegetative overhang. Some exposed tree roots. No slumping evident.
Severe (0.3-0.5)	Bank is bare, with very noticeable vegetative overhang. Many tree roots exposed and some fallen trees. Slumping or rotational slips are present. Some changes in cultural features, such as missing fence posts and realignment of roads.
Very Severe (0.5+)	Bank is bare and vertical or nearly vertical. Soil material has accumulated at base of slope or in water. Many fallen trees and extensive vegetative overhang. Cultural features exposed, removed, or extensively altered. Numerous slumps or rotational slips present.

Table 8. Lateral Recession Data

Extent of Lateral Recession	Number of points	Percentage of Watershed
Slight	218	96.0 %
Moderate	9	4.0 %
Severe	0	0 %
Very Severe	0	0 %

Lateral recession rate is a qualitative way to assess the width or thickness of eroding surfaces of a channel. The Rapid Assessment Point Method for assessing lateral recession was employed to determine the degree of streambank erosion in the Manitou Creek and Fish Lake Drain watersheds. Lateral Recession Rate evaluates streambanks along the right and left bank, determined by the observer facing upstream, for each assessed reach. Within each reach, segments of the channel with specific lateral recession rate characteristics were identified. Measurements included bank height, bank width, and the lateral recession rate in feet per year, while several criteria included the presence of undercutting, bare banks, overhanging vegetation, fallen trees, exposed roots, and slips or slides. The exact criteria used for assessing lateral recession can be found above in Table 7.

Within Manitou Creek and Fish Lake Drain watersheds, 96% of lateral recession points collected fit into the slight category. The remaining 4% of points fit into the moderate category. Significant armoring, vegetative growth, and low water levels are likely the reason that lateral recession rates were found to be low in the two watersheds. During periods of higher flow, it is possible that lateral recession rates may be higher. See appendix C for a map of channelization by reach for the Manitou Creek and Fish Lake Drain watersheds.

Sedimentation

Table 9. Degree of Sedimentation Data

	Watershed Reach Totals

Degree of Sedimentation	None	Low	Moderate	High	Total
Watershed Totals	1	34	39	4	78
Percentage of Watershed	1.3%	43.6%	50.0%	5.1%	100%

Table 10. Mid-stream Island and Sediment Accumulation Data

Catchment Area	Mid-stream Island Points	Sediment Accumulation Points
	#	#
Eagle Creek	2	0
Round Lake Drain	2	0
Manitou Creek Mainstem	7	3
Fish Lake	5	2
Upper Fox River	1	0

*The Upper Fox River is not a catchment area but a subwatershed of the Fox River watershed

Figure 5. Example of sediment accumulation leading to a mid-stream island.

Typically, a stream generates, suspends, and transports sediment through high gradient reaches and deposits sediment in low gradient reaches and/or in areas where velocity decreases. These low-velocity areas may be naturally occurring areas such as pools or sloughs. They may also occur behind debris jams, beaver dams, or upstream of channel constrictions such as culverts. Decreasing discharge in the downstream direction thus promotes a stepwise movement of deposition and storage of sediment within a stream network. This results in sediment movement that does not always reach the watershed outlet but is instead remobilized during the next flow and redistributed within the watershed's channel network. The amount of sediment transported downstream during storm events will increase sedimentation rates in downstream channels. This increased sediment load can have negative effects on channel stability, fish, invertebrates, and overall stream productivity. When small or headwater streams are replaced with paved floodways during land development, sediment production may decrease, causing an increase in downstream erosion as sediment starved waters move through the watershed.

During the Manitou Creek and Fish Lake Drain watersheds stream inventory, sediment accumulation was assessed in two ways. Firstly, overall reach sedimentation was assessed on a scale of none to high. Secondly, specific instances of high sedimentation were collected as points and categorized as either mid-stream islands or sediment accumulations. An example of a mid-stream island is shown in Figure 5. The sedimentation data is summarized in Tables 9 and 10 above. Within the two watersheds, 50% of reaches inventoried had sedimentation that was considered moderate, 43.6% of reaches had low sedimentation, and 5.1% of reaches had high sedimentation. Only reach EC04 was considered to have no sedimentation, although this reach lacked water entirely and the degree of sedimentation within the reach may change if flow resumes in the stream channel. The majority of mid-stream islands and all sediment accumulations identified were in the Manitou Creek Mainstem and Fish Lake Drain.

Debris Load

Table 11. Instream and Overbank Debris Load Data

Instream Debris Load	Watershed Reach Totals				
	None (0%)	Low (1%-33%)	Moderate (33%-66%)	High (66%-100%)	Total
Watershed Total	4	50	16	8	78
Percentage of Watershed	5.1%	64.1%	20.5%	10.3%	100%
Overbank Debris Load	**Watershed Reach Totals**				
	None (0%)	**Low (1%-33%)**	**Moderate (33%-66%)**	**High (66%-100%)**	**Total**
Watershed Total	7	40	19	12	78
Percentage of Watershed	9.0%	51.3%	24.3%	15.4%	100%

Table 12. Dumping Count and Type Data

Catchment Area	Type of Dumping		
	Construction Waste	Household Waste	Yard Waste
Eagle Creek	4	1	0
Round Lake Drain	2	1	8
Manitou Creek Mainstem	7	2	3
Fish Lake	0	1	1
Upper Fox River	0	0	0

*The Upper Fox River is not a catchment area but a subwatershed of the Fox River watershed

Figure 6. Examples of streams with high instream debris loads.

Like sediment, all streams transport some amount of debris. Large organic debris such as tree limbs and branches can divert currents to create pools, bars, and slow-water habitats for aquatic organisms, while also providing allochthonous inputs. Allochthonous inputs are those that enter the stream from some outside source, such as organic matter like leaves from terrestrial plants and trees that are washed into the stream. However, too much debris can be problematic and may result in debris jams. These debris jams may cause backwater flooding, sediment deposition, and can divert current into one or both banks leading to streambank erosion. Examples of streams with high instream debris loads are shown in Figure 6 above.

Manitou Creek and Fish Lake Drain Watersheds

Within the Manitou Creek and Fish Lake Drain watersheds, the majority of instream debris was made up of woody debris from trees along stream banks. Once a small debris jam formed, flowing water carries floating debris into the existing jam, making the jam larger. Significant amounts of trash were found in debris jams throughout both watersheds. The instream and overbank debris loads are summarized in Table 11 above. Across the two watersheds, most reaches had low overbank and instream debris loads. In addition, overbank debris load tended to be slightly higher than instream debris loads. Dumping points were collected as a way to measure debris intentionally placed by humans in and along streams. Examples of dumping are shown in Figure 7 below. Instances of dumping were categorized as either construction waste, household waste, or yard waste. The dumping data for the two watersheds is summarized in Table 12 above. Construction waste and yard waste were the most common forms of dumping identified in the stream reaches. The majority of dumping points were collected in Round Lake Drain and the Manitou Creek Mainstem, likely due to the close proximity of houses and yards along the streambanks in these catchment areas. Size of waste dumped along streams varied greatly from lawn clippings to kitchen appliances. Instances of dumping involving hundreds of broken glass bottles and containers occurred along several streams.

Figure 7. Examples of dumping along stream banks. Examples include yard waste (left) and construction waste (right).

Hydraulic Structures

Table 13. Hydraulic Structure Data

Hydraulic Structures	Watershed Total
Dock	98
Beaver Dam	24
Box Culvert	21
Bridge	44
Culvert	126
Dam	10
Weir	5
Total	328
Structures per stream mile	8.5
Problem structures	7

Figure 8. Examples of hydraulic structures: beaver dam (top left), weir (top right), box culvert (bottom left).

Hydraulic structures are identified as any type of dock, dam, culvert, bridge, or weir in or across the stream channel. These structures modify the pattern or amount of flow and may act as constriction points causing backwater flooding. Culverts may act as temporary or permanent barriers if a plunge pool develops, causing the bottom of the culvert to become elevated above the water level of the pool. Additionally, dams and weirs can impede the movement of fish and other aquatic organisms within the stream network. Examples of hydraulic structures collected are shown in Figure 8.

Problem structures were determined as hydraulic structures that were in use but were unable to perform their function. Problem structures found during the 2021 stream inventory included buried, broken, or clogged culverts, and bridges with failing support structures. The hydraulic structure data is summarized in Table 13 above. In the Manitou Creek and Fish Lake Drain watersheds the majority of hydraulic structures recorded were culverts and docks. The least common structure was the weir, only 5 were identified across the two watersheds. A total of 7 problem structures were identified during the 2021 stream inventory, making up 2.13% of all hydraulic structures collected. Culverts were the most common problem structures.

Discharge Points

Table 14. Discharge Point Data

Material	Watershed Total
Clay Tile	8
Corrugated Metal Pipe (CMP)	38
Ductile Iron	15
High Density Polyethylene (HDPE)	109
Polyvinyl Chloride (PVC)	102

Manitou Creek and Fish Lake Drain Watersheds

Reinforced Concrete Pipe (RCP)	43
Total	315
Discharge points per stream mile	8.13
Problem discharge points	59

Discharge points include sanitary, storm sewer, agricultural drain tiles and sump pump pipes. Discharge points are most common in urban and residential areas where sump pump and storm sewer outfalls are numerous. Problem discharge points can contribute to streambank erosion and transport excess sediment to the stream channel.

Within the Manitou Creek and Fish Lake Drain watersheds, HDPE was the most common material used to construct discharge pipes, making up 34.6% of the total discharge points. The next most common were PVC discharge points, making up 32.4% of the total discharge points. Clay tile pipes were the least common in the two watersheds, although remnants of broken clay tile pipes were commonly seen in reaches near agricultural fields. The vast majority of discharge points inventoried did not have water flowing out of them which was likely due to the drought conditions persistent during the 2021 summer inventory.

Problem discharge points were determined as discharge points that were blocked, disjunct, broken, or causing significant erosion. Discharge points that are blocked, disjunct, or broken will eventually cause continually increasing rates of erosion. A reoccurring problem noted during the stream inventory was the state of disrepair of some clay drain tiles often utilized for agriculture. A process occurs where streambank erosion exposes longer sections tile pipes, which eventually collapse under their own weight. This effectively shortens the pipe, causing the point at which runoff discharges from the pipe to retreat from the channel, further eroding the streambank. Other significant issues included rusting and disintegration of CMP pipes and collapse of HDPE pipes. Examples of functional and problematic discharge points are shown in Figure 9 below.
A total of 59 problem discharge points were collected throughout the Manitou Creek and Fish Lake Drain watersheds, making up 18.7% of all discharge points collected.

Figure 9. Examples of functional discharge points: clay tile (top left), HDPE (top right). Examples of problem discharge points, where outflow from damaged pipes is creating erosion along stream banks: clay tile (bottom left) and ductile iron (bottom right).

Open Channels, Swales and Tributaries

Table 15. Swale, Open Channel and Tributary Data

Catchment Area	Swales	Open Channels	Tributaries
Eagle Creek	0	19	1
Round Lake Drain	0	13	1
Manitou Creek Mainstem	10	59	7
Fish Lake	8	16	4
Upper Fox River	0	11	0

*The Upper Fox River is not a catchment area but a subwatershed of the Fox River watershed

Open channels and swales divert flow away from the stream reach, especially during periods of high flow. However, tributaries contribute to and increase flow in the stream reach. Many open channels seen on the 2020 aerial were not found during the summer 2021 inventory due to the moderate drought conditions at the time. Most open channels and swales identified had no flow or low flow and most tributaries had a flow rate of trickle. Swale, open channel and tributary data is summarized in Table 15 above.

Vegetation and Land Use

Table 16. Land Use Data

Type of Land Use	Percentage of Watershed	
	Left Bank	Right Bank
Agriculture	11%	15%
Open Space	62%	59%
Recreational	2%	2%
Commercial/Industrial	3%	3%
Residential	22%	21%
Other	0%	0%

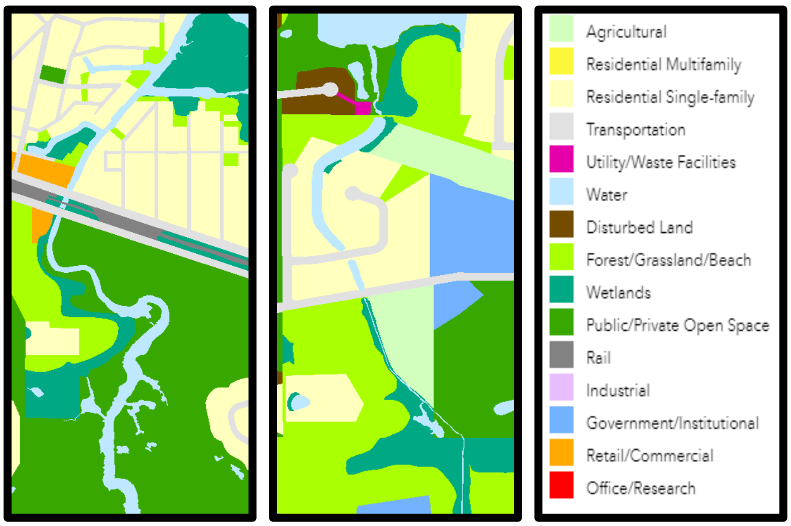


Figure 10. Example of land use data used to assist in determining watershed vegetation and land-use. Reaches shown (left to right): SC01/SC02/RL01, FL04/FL05.
[Source: maps.lakecountyil.gov/mapsonline/]

Throughout the Manitou Creek and Fish Lake Drain Watersheds, land use was relatively consistent along the left and right sides of streams. The most common type of land use was open space, making up approximately 60% of the total land use around the stream channels. The next most common was residential, which refers to single-family and multi-family housing structures. The least common land uses were commercial/residential and recreational. Land use data is summarized in Table 16 above. Figure 10 provides an example of mapping data used to help determine land use around stream reaches.

Floodplain Vegetation

Table 17. Land Cover Data

Land Cover	Left Bank	Right Bank
Tree	24%	26%
Lawn	14%	13%
Wetland	28%	28%
Crop	9%	11%
Shrub	1%	1%
Herbaceous	15%	15%
Impervious	4%	4%
Water	5%	2%
Other	0%	0%

Floodplain vegetation serves as an important function in protecting the physical, biological, and chemical integrity of water. Vegetation acts as a natural barrier by dissipating the energy of flowing water and provides protection from flooding and erosion. Vegetation filters sediments originating from land while slowing overland flows and surface run-off into water bodies. This filtering process can add nutrients to the floodplain soil. Slowed runoff across the floodplain also allows additional time for infiltration and groundwater recharge. Furthermore, the slowing of runoff provides the additional benefit of natural purification of water as local runoff or overbank floodwater infiltrates through the floodplain alluvium. Vegetation also provides habitat and nutrients for a wide variety of terrestrial and aquatic organisms. Floodplain vegetation data is summarized in Table 17 above.

The most common types of floodplain vegetation within the two watersheds were trees and wetlands. These types of vegetation each made up approximately 25% of the vegetation within the floodplain of the stream reaches. The next most prevalent types of vegetation were lawns, crops and herbaceous vegetation. The floodplain vegetation measured was generally consistent between the left and right banks. Refer to Appendix A for more information on the different vegetation types accounted for.

Vegetated Buffer or Riparian Zone

Table 18. Width of Vegetative Buffer Criteria

None	Low	Moderate	High
Width of riparian zone <20 feet; little or no riparian vegetation due to human activities	Width of riparian zone 20-40 feet; human activities have impacted zone a great deal	Width of riparian zone 40-60 feet; human activities impacted zone minimally	With of riparian zone >60 feet; human activities (parking lots, roadbeds, lawns, crops) have not impacted zone
0 1 2	3 4 5	6 7 8	9 10

Table 19. Vegetative Buffer Data

Buffer Width	Miles of Watersheds	Percent of Watersheds
None	6.04	16%
Low	12.22	32%
Moderate	11.35	29%
High	9.07	23%

The vegetative buffer or riparian zone is where aquatic and terrestrial ecosystems overlap on both sides of the stream. Riparian vegetation also provides beneficial shading to streams and lakes which helps to avoid temperature stress on fish and other aquatic organisms. The width of the riparian zone and land use characteristics were visually assessed during the Manitou Creek and Fish Lake Drain watershed inventories. The vegetative buffer grading criteria is listed in Table 18 and the vegetative buffer data is summarized in Table 19.

Throughout the two watersheds, streams flowing through urban and agricultural environments tended to have thinner vegetative buffers. In these environments, land within 5-10 feet of the stream banks were heavily influenced by human activities. Streams between agricultural fields tended to have slightly larger vegetative buffers, although these streams still fit into the none or low classifications. The stream reaches with the highest vegetative buffers tended to be flowing through forest preserves or wetland environments. Width of vegetative buffer varied significantly between reaches, and the most common buffer width grading was low at 32% of all reaches. The least common grading was none, at 16% of all reaches, which would indicate that human activity was impacting riparian vegetation within 20ft of the stream channel.

Bank Vegetation

Table 20. Bank Vegetation Data

Bank Vegetation	Left Bank	Right Bank
Grass	25%	26%
Lawn	9%	8%
Wetland	27%	26%
Trees	23%	23%
Herbaceous	12%	12%
Shrubs	2%	2%
Crops	0%	1%
None	2%	2%
Other	0%	0%

Figure 11. Bank vegetation examples: wetland (top), lawn (bottom left) and trees (bottom right).

Bank vegetation is vegetation existing within 10 feet of the stream bank. The most significant role of bank vegetation is its ability to control erosion, which in turn prevents sediment and other forms of pollution from entering the stream. Although erosion is a natural process, it is often directly or indirectly sped up through human activities. Increased rates of erosion and sedimentation affects the geomorphology, water quality, and aquatic life in the stream channel and throughout the watershed. Streams surrounded by vegetated riparian zones have intricate root systems that help to stabilize the bank and prevent erosion. This is because vegetation helps physically trap sediment and slow water runoff from the surrounding areas. Additionally, vegetated banks tend to lead to deep and narrow channels as a result of their stability and lack of heavy sedimentation.

For the Manitou Creek and Fish Lake Drain watershed inventories, grass bank vegetation refers to un-mowed grasses while lawn bank vegetation refers to mowed grass that is intentionally manicured for aesthetics. Herbaceous bank vegetation refers to vascular plants without woody stems, generally found in natural prairie environments. The “none” bank vegetation category refers to bare banks that lack significant vegetative growth. Bare banks are most common in forested areas with thick overhead canopies which block sunlight from reaching the forest floor, preventing significant ground growth. Examples of different bank vegetations can be found in Figure 11. Bank vegetation data is summarized in Table 20. The most common bank vegetation categories were grass, wetland, and trees. The least common bank vegetation categories were crops and bare banks. Agricultural land-use was common along stream banks, however there was generally a 10 to 20 foot buffer area with vegetation between the stream bank and the crop fields.

Instream Cover for Fish

Table 21. Instream Fish Cover Data

Cover Type	Reaches	
	#	%
Undercut banks	23	29.5%
Pools	3	3.8%
Macrophytes	72	92.3%
Overhanging vegetation	40	51.3%
Rootwads	5	6.4%
Boulders	12	15.4%
Backwaters	2	2.6%

*Reaches with pool % >10% included for fish cover data.

Figure 12. Examples of instream cover for fish: boulders (right) and undercut banks/overhanging vegetation (left).

A diverse habitat of instream cover is essential for diverse fish assemblages and other aquatic organisms. Instream cover for fish availability was evaluated based on the presence of a number of structural elements including undercut banks, pools over 28 inches deep, aquatic macrophytes, logs, overhanging vegetation, rootwads, boulders, and backwaters. The presence of woody debris in streams is a significant component of fish habitat which they utilize for spawning, rearing, and foraging. Significant woody debris can create areas of low flow which provide a refuge for fish during periods of high flow. Woody debris also provides cover for fish, lowering the risk of predation. Overhanging vegetation and canopy cover provide two important benefits: providing shade to the stream helps keep the temperature in the stream cool and leaf litter and organic material provide nutrients to macroinvertebrates and other aquatic organisms. These aquatic organisms in turn become an important source of food for fish and other animals in the ecosystem. Examples of instream fish cover are shown in Figure 12.

Within the two watersheds, the most common types of instream fish cover were macrophytes, overhanging vegetation, and undercut banks. The least common types of cover were deep pools and backwaters, which were present in 3.8% and 2.6% of reaches, respectively. Due to low water levels during the summer 2021 stream inventory, many types of instream fish cover were inaccessible to fish. Deeper pools and areas near hydraulic structures tended to hold most of the fish identified during the stream inventory.

Aquatic Instream Vegetation

Table 22. Instream Vegetation Data

Instream Aquatic Vegetation	Total Reaches	Percentage of Reaches
Rooted Emergent	62	79.5%
Rooted Submergent	65	83.3%
Rooted Floating	36	46.2%
Free Floating	59	75.6%
Floating Algae	60	76.9%
Attached Algae	68	87.2%
No Vegetation	1	1.3%

*Reach EC04 contained no water or aquatic vegetation

Aquatic instream vegetation is an important part of the watershed ecosystem. Plants in the stream play a vital role in food webs as well as provide habitat and shelter for fish, waterfowl, and other wildlife. Since all plants, including those that grow underwater, produce oxygen as they photosynthesize, they are the major source of oxygen for aquatic animal life. Rooted plants stabilize shorelines and stream beds. Rooted plants also absorb nutrients and filter pollutants from runoff, which improves water quality. Instream vegetation data is summarized in Table 22 above.

Certain non-native plant species such as milfoil can be extremely aggressive, taking over large areas of aquatic habitat. Invasive plant species can outcompete and destroy stands of native vegetation. Excessive aquatic instream vegetation can be indicative of nutrient pollution and create eutrophic conditions. Decomposition of dead fish, algae and other plant matter contributes to oxygen depletion. Excessive vegetative growth on the surface of lakes and streams can block sunlight and kill submerged vegetation, leading to oxygen depletion. In addition, too much vegetation can impede water flow in stream channels, drainage ditches and culverts. These areas can trap sediment and debris, and over time lead to a gradual filling in of lakes and channels.

In the Manitou Creek and Fish Lake Drain watersheds, all categories of instream vegetation were common throughout the stream reaches. The least common type of vegetation was rooted floating vegetation, which was present in only 46.2% of reaches. The most common type of instream vegetation was attached algae, which was present in 87.2% of reaches. Several reaches had excessive duckweed growth, categorized as free-floating vegetation, which may have inhibited the growth of submergent vegetation.

Substrate Composition

Table 23. Substrate Composition Data

Substrate Composition	Number of Reaches	Percentage of Reaches
Claypan	39	50%
Silt	75	96.2%
Sand	34	43.6%
Gravel	26	33.3%
Cobble	22	28.2%
Boulder	8	10.3%
Concrete	1	1.3%
Organic Matter	74	94.9%

*Some reach substrates were not visible and were omitted from table.

The streambeds within the Manitou Creek and Fish Lake Drain watersheds are composed of a variety of sediments that range in diameter from extremely fine clays to relatively coarse cobbles and boulders. Generally, fine sediments are transported in suspension until water velocity slows enough that they are deposited on the streambed. Larger sediments are not transported as readily and may only move during increased flows. Clays are typically regarded as cohesive sediments that naturally adhere to one another, and are therefore more difficult to erode, while silts are non-cohesive and easily eroded. Sands and larger sediments, such as gravels and cobbles, are less cohesive. Clay and silt-dominated banks and streambeds tend to be associated with narrow, incised channels while sand, gravel, and cobble-dominated channels are more often shallow and wide. These relationships, however, are also contingent upon several other contributing factors such as gradient, bank slope, bank vegetation and flow patterns.

Substrate is also an important measure of habitat quality. Extremely fine sediments, such as clays, adhere closely to one another and may bury the streambed. Coarse-grained sediments like gravels create interstices, allowing water, oxygen, and other dissolved and suspended materials to infiltrate the hyporheic zone. The hyporheic zone refers to the area within the stream channel that is saturated and through which there is some percolation or flow. This zone is shown in Figure 13 below. These interstitial pores also provide habitat to benthic (bottom-dwelling) macroinvertebrates, which play important roles in both aquatic food webs and ecosystem functioning. Excessive deposition of clays, silts, and fine particulate organic matter reduces the potential for infiltration and accessibility to the hyporheic zone. Excessive deposition also negatively affects filter feeders such as mussels and may cause oxygen depletion in the streambed as organic materials decompose. Refer to the diagram in Appendix A for more in-depth information about substrate sizes and classifications.

In Manitou Creek and Fish Lake Drain watersheds, the most common stream substrate was silt, which was present in 96.2% of reaches. The second most common type was organic matter, which was usually decaying plants and was present in 94.9% of reaches. The least common type of substrate was concrete, which was present only in reach RL11. Generally, most reaches were a mix of several different substrates. Within a given stream reach, substrate can vary based on water velocity, flow, land use, armoring, bank erosion, and several other factors. Substrate composition data is summarized in Table 23 above.

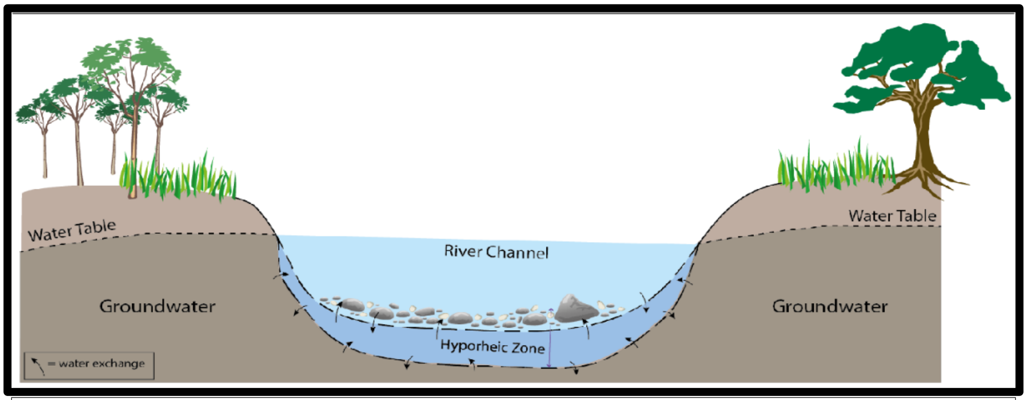


Figure 13. Diagram of hyporheic zone in river channel. [Source: Stanford and Ward, 1988]

Water Quality

Turbidity

Table 24. Water Quality Data

Water Quality	Percentage of Watershed	
	Number of Total Reaches	Percent of Total Reaches
Turbidity		
None	0	0%
Low	28	36.4%
Moderate	31	40.2%
High	18	23.4%
Water Color		
Clear	15	19.5%
Brown	62	80.5%
Gray	0	0%
Green	0	0%
Grease & Oil (Water)		
None	27	34.6%
Low	32	41.0%
Moderate	19	24.4%
High	0	0%
Grease & Oil (Sediment)		
None	61	78.2%
Low	13	16.7%
Moderate	4	5.1%
High	0	0%

*EC04 contained no water and was omitted from this table

Visual inspections of several water quality indicators were made during the stream inventory. Turbidity, water color and the presence of grease or oil in the sediment or water column were assessed. Turbidity is the measure of relative clarity of water. Material that causes water to be turbid includes clay, silt, fine inorganic matter, organic matter, algae, plankton and other microscopic organisms. During periods of low flow, water in streams is clear and the turbidity is low. During high flow events, sediment and material from the surrounding surfaces are washed into the stream. As the velocity and volume of water increases, sediments and other materials are stirred up causing the water to become muddy, brown, and turbid. Water quality data for the Manitou Creek and Fish Lake Drain watersheds are presented in Table 24.

Grease and oil enter the stream during storm events as they are flushed from surrounding parking lots, roads and bridges into the storm sewer system, often overflowing directly into the stream. Another potential source of grease and oil is illegal dumping that often originates from automotive and transportation related services. Grease and oil in the water column and sediment degrades the water quality of a stream by increasing biological and chemical oxygen demand. An additional note: iron oxidizing bacteria are present in many soils in Illinois and can cause yellow, orange, red, or brown stains and colored water. It can also cause a rainbow colored, oil-like sheen on the water or in soil and sediments. Simple water testing is available to determine if the oil-like substance present is iron oxidizing bacteria. This was observed in reachs SC21 and SC01.

Figure 14. Examples of orange color produced by non-harmful iron oxidizing bacteria. Photos taken in reaches SC01 (left) and SC21 (right).

A total of 76.6% of reaches within the Manitou Creek and Fish Lake Drain watersheds had low to moderate turbidity, while 23.4% of reaches had high turbidity. The most common water color was brown, at 80.5% of all reaches, likely due to suspended sediment and organic matter in the stream. Only 19.5% of reaches had water color deemed clear. Grease and oil were more common in water compared to sediment, with 65.4% of reaches having some grease or oil present in the water. Comparatively, only 21.8% of reaches had any grease or oil present in sediment. None of the reaches inventoried had high levels of grease or oil in the water or sediment. Furthermore, some of the oil seen throughout the two watersheds is likely produced by certain strains of non-harmful bacteria present in the stream ecosystems. Abnormal water or sediment color was noted and referred to SMC staff for further consideration.

Algae

A high amount of algal growth is an indicator of high nutrient loads and is often a product of artificial fertilizer use. Excessive algae can negatively impact aquatic organisms and habitat by causing eutrophic conditions. Algae are photosynthetic and therefore take up carbon dioxide during the day and release oxygen into the water column and the air. At night, algae respire, taking oxygen out of the water column and releasing carbon dioxide. Therefore, larger populations of algae have greater potential to cause large daily oxygen fluctuations. In addition, abundant algae populations are often aesthetically undesirable and typically detract from the visual quality of water resources. A total of 76.9% of the reaches inventoried had floating algae and 87.2% of the reaches had attached algae. Algae data for the Manitou Creek and Fish Lake Drain watersheds is summarized in Table 22.

Aquatic and Terrestrial Organisms

Stream aquatic integrity in urban and agricultural settings is directly affected by physical changes in the watershed, some of which result in the degradation of chemical and physical stream conditions. Habitat information is extremely important for discriminating between physical and chemical effects. The inventory addressed aquatic and riparian life where possible or identifiable. Organisms were not specifically sampled during the stream inventory, but some animals were observed during the inventory. A wide variety of aquatic and terrestrial organisms were observed during the stream inventory of the Manitou Creek and Fish Lake Drain watersheds. Terrestrial organisms observed included white-tailed deer, voles, rabbits, squirrels, chipmunks, raccoons and mink. Species of fish present included carp, bluegill, bass, various minnows and suckers. Amphibians and reptiles identified included bull frogs, green frogs, American toads, Fowler’s toads, painted turtles, common snapping turtles and garter snakes. Macroinvertebrates present included snails, sow bugs, leeches, worms, mayflies, beetles, water striders, crayfish, dragon flies, damsel flies and caddisfly larva. Many bird species such as mallard ducks, Canadian geese, great blue herons, green herons, egrets, sandhill cranes, red-tailed hawks, barn owls, American kestrels, swans, kingfishers, killdeer, and swallows were identified. The semiaquatic rodents beavers and muskrats were identified through evidence of activity.



Figure 15. Photos of organisms identified and recorded during 2021 stream inventory. Green frogs (top left), juvenile red-tailed hawk (top right) and common snapping turtle (bottom left).

Stream Inventory Appendix A: Stream Inventory Procedure and Terms

Stream Inventory Procedure

Lake County Stormwater Management Commission conducts stream inventories as part of the overall watershed planning process. Water quality sampling is not performed as part of the stream inventory, but the sources and causes of water quality impairment in the streams are investigated. Streams are walked or canoed in the direction of upstream travel by teams of two. Right and left directional descriptions are determined by the observers facing upstream. The Manitou Creek and Fish Lake Drain stream inventories were completed in the summer of 2021 using the application ArcGIS Field Maps. An important component of the stream inventory process is the evaluation of current geomorphic, hydraulic, and aquatic stream characteristics. The major stream characteristics assessed include channelization, erosion, lateral recession, debris load, hydraulic structures, discharge points, vegetation, land use, and elements with otherwise significant impact on stream functioning.

Stream Inventory Terms

Aquatic Vegetation

The general types and relative dominance of aquatic plants are documented. Aquatic plants are an ecological assemblage that responds to perturbation and provides refuge and food for aquatic fauna. Filamentous algae can grow in fast or slow flowing streams over solid surfaces within the stream channel and can be indicative of excessive nutrient levels. Submergent, emergent, free floating, and rooted floating vegetation are considered when estimating the percentages of aquatic vegetation types over the total area of the reach.

Armoring

Armoring refers to the placement of gabions, wood, metal, riprap or other similar artificial materials along the streambank to reduce bank erosion. The one-third rule is applied where low means less than 33% of the reach is armored, moderate means 33% to 66% of the reach is armored, and high means greater than 66% of the reach is armored. If present, armoring that is failing should be noted.

Bank Height, Top Channel Width, and Bottom Channel Width

Bank height is measured from the top to the bottom of the streambank. The top of the bank occurs when there is a convex shaped transition in bank slope between the stream bank and the outlying floodplain. The bottom of the bank occurs where there is a concave shaped transition in slope between the stream substrate and the stream banks. The bottom of the stream bank may not be below the water level. Top and bottom channel widths refer to the bank to bank width across the top and bottom banks. If the top of one bank is higher in elevation than the top of the opposite bank, the top mean channel width is measured from the elevation of the lowest bank.

Beaver Activity

Low beaver activity includes an occasional bank slide or chewed stump within the reach. With moderate activity, these features become progressively more apparent. High activity is characterized by almost constant activity in wooded areas with felled trees in excess of 12 inches. Slides and beaver cut brush are also common throughout the stream. All beaver dams and lodges are noted and indicate high beaver activity.

Channel Flow Status (Stream Stage)

Channel flow status or stream stage is the degree to which the channel is filled with water. The flow status will change as the channel enlarges, for example aggrading stream beds with actively widening channels, or as flow decreases as a result of dams or obstructions, diversions for irrigation, or drought. When water does not cover much of the streambed, the amount of suitable substrate for aquatic organisms is limited. In high-gradient streams, the decrease in water level exposes logs and snags, thereby reducing the area of good habitat within the stream. Channel flow is especially useful for interpreting biological condition under abnormal or lowered flow conditions. This parameter becomes important when more than one biological index period is used for surveys or the timing of sampling is inconsistent among sites or annual periodicity.

Channelization

Channelization refers to channel modifications performed by humans. The one-third rule is applied where low means less than 33% of the reach is channelized, moderate means 33% to 66% of the reach is channelized, and high means greater than 66% of the reach is channelized. The presence of pilot channels are noted for channelized streams. A narrow, meandering pilot channel may develop within the wide and flat trapezoidal ditch that was excavated during channelization. A pilot channel is indicative of recovery from channelization.

Dominant Bank Vegetation

Dominant bank vegetation is recorded as percentages of bank surface area. The dominant bank vegetation categories to be ranked for each reach include grass, lawn, wetland, trees, shrubs, crops, herbaceous, and none. This provides an indication of bank stability and the potential for the development of debris blockages in the channel. Due to the rapid colonization capabilities of some tree and shrub species, the presence of trees and shrubs are documented even if trees or shrubs are uncommon in the reach.

Dominant Land Use and Land Cover

Dominant land use and land cover surrounding the stream are recorded as percentages of total area. The total area included for land use and land cover data collection is based on surrounding land use that could directly influence the chemical, biological and physical characteristics of the stream. The dominant land use categories to be assessed for each reach include agriculture, open space, recreational, commercial and industry, and residential. The land cover categories to be assessed for each reach include trees, lawn, wetlands, crops, shrubs, herbaceous, impervious, and water. The vegetative buffer or riparian zone for each reach is also ranked from 1-10 based on its width.

Erosion

Severe bank erosion is a significant concern for Lake County's streams and rivers. Severely eroded banks have exposed soil on nearly vertical banks extending from the top of the bank to the low water mark, meaning that erosion is constantly occurring. Highly eroded streambanks contribute heavy loads of sediment into the watershed and significantly erode during high flow periods. Active slumping and sloughing may be apparent where fresh, moist, loose soil and other signs of signs of recent bank movement, such as exposed tree roots or suspended fences extending into the stream, are found. Eroded areas are most prevalent in the outer edges of bends and meanders. Structures that are present and threatened by slumping are recorded. On impounded areas of streams, the absence of bank or littoral vegetation along the normal water mark, resulting in constant erosion, is also considered severe. Gullies are narrow channels, often on streambanks, formed by erosion of soil and sediment due to significant movement of water into the stream. Cutbanks are indents on the undersides of streambanks, usually found along bends, which are formed through erosion but also provide instream cover for aquatic organisms.

Hydraulic Structures

Hydraulic structures include dams, weirs, bridges, levees, culverts, and docks. Dimensions, construction materials, and conditions of hydraulic structures are recorded. Notes include blockages or other potentially damaging characteristics if present.

Instream and Overbank Debris Load

Instream debris load refers to natural and man-made debris including leaves, sticks, logs, lumber, trash, and sediment within the stream. The one-third rule is applied where low means less than 33% of the reach contains debris obstructing or deflecting flow, moderate means 33% to 66% of the reach contains debris obstructing or deflecting flow, and high means that greater than 66% of the reach is characterized by large accumulations of lodged and partially compacted debris spanning the entire stream width. Overbank debris load refers to loosened materials on the stream bank that are prevalent enough to potentially cause debris jams at culverts and bridges during high flow events. The locations and types of debris, as well as how it may impact the reach, are noted. The one-third rule is applied to overbank debris load similarly to the instream debris load. Dumping influences both instream and overbank debris load. Dumping is defined as an area of reach with a significant amount of a specific type of debris. Types of dumping debris are categorized into either yard waste, household waste, or construction waste.

Lateral Recession

Lateral recession rates are a qualitative way to assess width or thickness of eroding surface of a channel and are also used to estimate a quantitative measurement of soil loss in feet per year. Lateral recession rates of eroding banks for Illinois streams and gullies typically range from 0.05 to 0.5 feet per year. Rates tend to be slightly higher in perennial streams compared to intermittent flow channels. Stream banks with retreat rates of 1 or more feet per year do occur but they are uncommon and not usually widespread within a given watershed. These rates are applied as uniformly and consistently as possible along both sides of each channel. Lateral recession rates are used to obtain average annual rates of erosion, not rates that occur after heavy rain events. Rates in the very severe category of 0.5 feet or more of bank recession per year generally only occur in Illinois on segments of channels scattered throughout steep watersheds. If very severe lateral recession rates were applied throughout the entire watershed, so much sediment would be produced that the current stream systems would not be able to mobilize it through the watershed. The sediment would consequently pile up in sediment bars and islands that would block the flow of water.

Midstream Bars and Islands
Midstream bars and islands are recorded if present. Although these structures may increase habitat availability for organisms, they also reduce the unobstructed stream width and may enhance the debris accumulating potential of the reach.

Open Channels, Swales, and Tributaries
All open channels, swales, and tributaries which influenced the reach were recorded. An open channel is a moderately sized offshoot of stream that diverts water from the main flow. Similarly, a swale is a narrow, low-lying depression that carries water away when flow is significant. Tributaries are segments of moving water which contribute flow into the main stream.

Point Discharges
Point discharges include all sanitary, storm sewer, and drainpipes discharging into the stream. If the condition of the discharge point is in any way blocked, broken, disjunct, or causing erosion it is marked as a problem discharge point. The volume of exiting flow is noted in the categories of none, trickle, moderate, or substantial. Notes also include comments on odors, sheens, or high turbidity of exiting flow if present. Abnormal flow patterns in the context of recent rainfall patterns are also noted.

Pool and Riffle Development
The proportions of the reach containing riffles, runs, and pools are noted to describe the morphological heterogeneity of the reach. Pools are well defined areas of deeper than average water. Pools generally do not extend in length more than three or four times the stream width. A riffle is a section of shallower water with higher velocity and rippling, or disturbances to the surface water tension that allow turbulence and mixing to occur. Riffles must be immediately downstream of pools for the stream to be characterized as having high pool and riffle development. This is because riffles are expressions of sediment deposition and accumulation initiated by pool scour. Many streams in Lake County have low or no pool and riffle development.

Reach

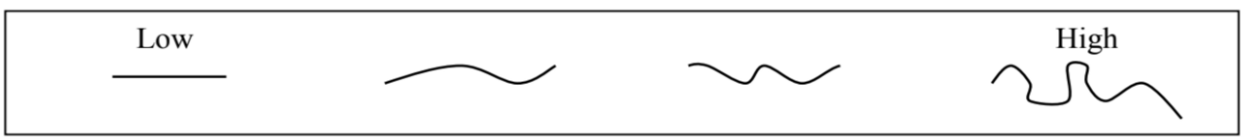
A stream reach is a stream segment having fairly homogeneous hydraulic, geomorphic, and riparian cover and land use characteristics. Where possible, beginning and end stations were established along the stream using permanent physical landmarks, such as bridges, that can be readily recognized.

Sediment Accumulations

Sediment accumulations affect the channel capacity and flow conveyance. Sediment deposition measures the amount of sediment that has accumulated in pools and the changes that have occurred to the stream bottom as a result of deposition. Deposition occurs from large-scale movement of sediment and may cause the formation of islands, point bars, shoals, or the filling of runs and pools. In some cases, sediment accumulations may not impact channel conveyance.

Sinuosity

Sinuosity is dependent on the stream stage in many channelized reaches. In many cases a narrow, highly sinuous pilot channel has developed during low stream stage within a wider, non-sinuous channel that was excavated during channelization. Therefore, sinuosity is estimated for both baseflow conditions and for bankfull conditions. However, if the stream inventory is completed during bankfull conditions, then sinuosity during basefull conditions will be difficult to estimate. The figure below is used for estimating the degree of sinuosity of a reach.



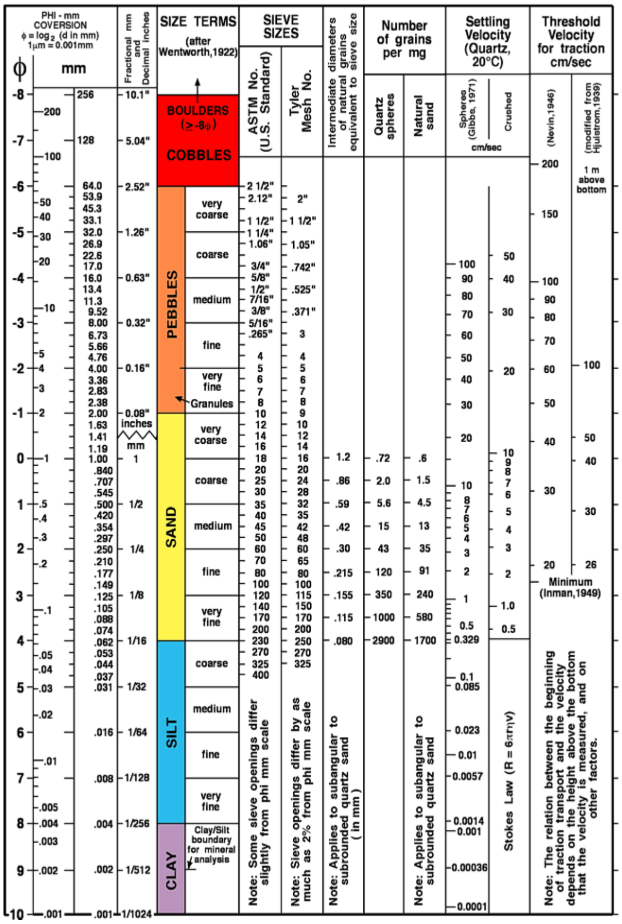
Substrate Embeddedness

Embeddedness is the extent to which cobbles, gravel, and boulder substrates are embedded. Substrates are considered embedded if more than 50% of the surface is surrounded, impacted in, or covered by additional accumulations of fine material such as sand or silt. The one-third rule is applied where high means greater than 66% of substrate is embedded, moderate means between 33% to 66% of substrate is embedded, and low means less than 33% of the substrate is embedded. A “none” embeddedness ranking is applied to reaches that are naturally composed of high levels of silt and sand because the embeddedness of coarse substrates in these reaches is not applicable.

Substrate Stability

Substrate stability is assessed according to how well the stream substrate supports the weight of the observer walking the stream. Substrate stability classified as “none” indicates that the substrate can’t support the observer’s weight and the observer quickly sinks into the substrate. These substrates are usually deep silts. Substrates with low substrate stability can be walked over, but the observer will sink several inches into the substrate if standing for an extended time period. Low stability substrates are usually silts, clays, and loose sand or gravel. Moderately stable substrates can be walked over without sinking more than an inch or two. These substrates may include coarse gravel, cobble, or organic material. Highly stable substrate can be walked on without sinking into the substrate. Substrates with high stability are often cobble, boulders, or concrete.

Substrates



Clay is made up of particles less than 0.0002 inches in diameter, which forms a dense, gummy surface that is difficult to penetrate. Silt particles are between 0.0002 to 0.002 inches in diameter. Silt is a fine material that generally feels greasy when rubbed between fingers. Sand is made up of materials from 0.002 to 0.08 inches in diameter. Sand exhibits a gritty texture when rubbed between fingers. Gravel is a mixture of rounded coarse material from 0.08 to 2.5 inches in size. Cobble is made up of stones from 2.5 to 10 inches in diameter. Boulders are rounded stones over 10 inches in diameter or large slabs over 10 inches in length. Organic substrate refers to living or decaying plant material. Reaches lined with concrete or other man-made materials are also noted. Refer to diagram for further information on substrate sizes.

Water Depth

Water depth should be measured at the deepest portion of the channel cross section, known as the thalweg. The range of water depths reflect the variation between the deepest and shallowest portions of the reach.

Stream Inventory Appendix B: Stream Reaches and Notes

Reach	Miles	Notes
EC01	0.243	Eagle Creek. Area from W Rollins Rd to middle cross section was walked, area from middle cross section to W Lake Shore Dr was canoed. Reach entirely covered in duckweed and floating piles of decomposing vegetation. Silt was 1-3 feet deep throughout reach.
EC02	0.302	Eagle Creek. Within Grant Woods Forest Preserve, borders on a residential community and runs to W Rollins Rd. Well maintained with high armoring and low erosion. Areas in forest preserve appear to be in the process of being cleared through tree cutting and controlled burns. Originally inventoried downstream but points have been flipped to represent upstream travel.
EC03	0.397	Eagle Creek. Runs along border of Grant Woods Forest Preserve and a residential community. Generally low erosion but many cutbanks when stream meanders. High armoring placed likely to combat this issue. Armoring presented as constructed rock walls especially prevalent along trails of Grant Woods Forest Preserve. Many amphibians and fish, suggesting high water quality, also make use of the cutbanks.
EC04	0.239	Dense forest with no water present. Very small stream bed full of fallen trees and brush piles. No points collected due to conditions.
EC05	0.444	Eagle Creek. Relatively urbanized reach with houses close by on both sides. This is reflected by significant debris load and dumping in stream and along streambank, many discharge points coming from houses or yards, and temporary bridges across stream likely built by residents.
EC06	0.236	Eroded with cut banks at outside banks when stream meanders throughout reach. Most of reach only has a few inches of water with wide banks, due to low water levels cobble on streambank is often exposed.
EC07	0.426	Severe undercutting on outside bends occurs throughout majority of reach. Water level appears lower than normal when considering bank heights and widths. Significant dumping and high overbank debris load with many large kitchen and home appliances found halfway through the reach on the right bank. Originally inventoried downstream but points have been flipped to represent upstream travel.
EC08	0.446	No water in the downstream half of reach. Cylindrical solid concrete pieces found in stream bed in the upstream half of reach (marked as a miscellaneous point). Originally inventoried downstream but points have been flipped to represent upstream travel.
EC09	0.456	Reach primarily runs through wetland of mostly cattaills. Deep silt in some areas. A few wire fences across stream. Lots of small channels branching off of the main stream. Many beaver dams found. Originally inventoried downstream but points have been flipped to represent upstream travel.
EC10	0.197	Several man-made dams and temporary bridges throughout reach. Dams appear to be made of sediment and small sticks and logs. Reach runs primarily through wetland and is near backyards. Silt is 1-3 feet deep throughout reach, with deepest areas close to S Cedar Lake Road. Originally inventoried downstream but points have been flipped to represent upstream travel.
EC11	0.368	Eagle Creek. Reach runs through prairie and wetland and is adjacent to a housing community. In the downstream section of reach, near Pines Blvd, trees are being cut down, possibly to clear land for construction of more homes. This section also has significant erosion and exposed tree roots of two large oak trees. Originally inventoried downstream but points have been flipped to represent upstream travel.

Manitou Creek and Fish Lake Drain Watersheds

EC12	0.342	Eagle Creek. Reach runs northwest from marshland to intersection of EC11 and EC10 near Pines Blvd. Upstream area is marsh of primarily dense cattails, with small sections of open water. Downstream area of reach surrounded by prairie and small areas of forest.
EC13	0.468	Stream runs east from area between Monaville Rd and Appleton Ln. At the time of the assessment, several areas of reach did not contain water. Dry areas were located primarily downstream, east of N Cedar Lake Rd. Originally inventoried downstream but points have been flipped to represent upstream travel.
EC14	0.161	Reach is near housing community. Resident expressed interest in dredging the pond due to concerns about the low water levels negatively effecting local duck populations. Very dense surrounding marsh with many cattails and deep silt. Originally inventoried downstream but points have been flipped to represent upstream travel.
FL01	0.902	Duck Lake Drain. Relatively developed with many houses on and around right bank near Duck Lake. Well armored near yards and houses. Open space to the left of reach. Resident reported high beaver and muskrat activity, stating that the beavers can grow up to 50lbs. Reach was entirely canoed.
FL02	0.581	Wooster Lake Drain. Reach connects Duck Lake to Wooster Lake. From Duck Lake to N Forest Ave canoed on 7/15. N Forest Ave to Wooster Lake walked on 7/16 due to low water levels. Reach has an extremely high amount of duckweed, at times covering the entire stream. Resident reported that there are many frogs in reach, another resident expressed interest in placing stone armoring along his property, a third resident commented on the amount of duckweed present.
FL03	0.331	Reach runs north from Fischer Lake Drain to Wooster Lake. Silt is 1-2 feet deep throughout, with the deepest areas near Wooster Lake. Reach was dry in some areas mid-way through stream. Banks of reach were covered in long grass, cattails and reeds. Sediment in reach had a significant number of animal tracks (mostly heron, egret and deer).
FL04	0.446	Fish Lake Drain. Runs north from W Molidor Rd to Fischer Lake Drain. The culvert connecting Fischer Lake Drain to the rest of the reach is clogged. Section downstream of the culvert near Telluride Ln to the Fischer Lake Drain culvert has substantially less water than the rest of reach. 2020 aerial shows 50ft stream width in this area but only 3ft was observed. Area upstream of the culvert near Telluride Ln had significant water and was canoed.
FL05	0.518	Fish Lake Drain. Reach runs north from Fish Lake to W Molidor Rd. Upstream area of stream runs through forested area. Downstream area of stream flows along outdoor horticulture company. Originally inventoried downstream but points have been flipped to represent upstream travel.
FL06	0.664	Reach runs north parallel to Rte 12, then flows east into Fish Lake. Surrounding land owned by YMCA Camp Duncan, the majority of which is forested or wetland. Upstream streambed, along Rte 12, was dry at time of assessment. Significant amount of glass bottles relatively downstream on the left bank (see dumping point).
FL07	0.847	Reach follows along Rte 12 near agricultural fields and then runs through Fish Lake Beach Campground and into Fish Lake. Downstream portion of reach, throughout Fish Lake Beach Campground, water has high population of floating algae. No water present in the upstream two thirds of the reach (see miscellaneous point). The upstream first third of the reach is dense forest with many culverts and agricultural drainage tiles in need of repair. Mid reach has very dense grasses.
LL01	1.489	Manitou Creek. Reach runs north, connecting Long Lake to Fox Lake. Downstream areas, closer to Fox Lake, have more wetland and open space. Upstream areas, closer to Long Lake, are more developed with many houses and docks along reach. Reach has high beaver activity with three large lodges. Reach was entirely canoed.

RL01	0.544	Round Lake Drain. Reach primarily runs through wetland with dense cattails. Area downstream from center cross section point to discharge point was not inventoried because silt was 3-4 feet thick and wading was not possible. Canoe travel may be possible if water level rises 6-12 inches.
RL02	0.364	Round Lake Drain. Downstream half of reach runs through Long Lake Park Natural Area. Reach runs east, parallel to housing complex. Streambed has 1-2 feet of silt throughout, with moderate in-stream debris made up of fallen trees/branches. Most of reach is surrounded by dense forests, although area near N Village Dr has banks made up of long grass. Reach had a high amount of trash including tires.
RL03	0.458	Round Lake Drain. Tide culvert with coverage to control flow (closed) in the downstream third of reach. Downstream half of reach is a wetland running through Mayfield Natural Drain Area. Upstream half of reach is wooded and residential, running close to yards. Erosion and discharge points increase in the residential area. Three instances of yard waste dumping in residential area near Lotus Dr.
RL04	0.303	Round Lake Drain. Reach close to utility facilities: runs through Village of Round Lake Beach Public Works campus and runs near Round Lake Sanitary District Ponds 2, 3, and 1.
RL05	0.338	Round Lake Drain. Reach was canoed from dam near Sunset Dr to culvert under Beachview Dr. Significant amount of duckweed covering surface of reach. Reach is 4-5 feet deep close to Sunset Dr, then gets shallow as it gets closer to Idlewild Dr. Silt is 1-3 feet deep throughout reach. Resident near S Channel Dr reports that he has been removing instream woody debris himself due to concerns about flooding, he is concerned that the debris will cause blockages and lead to flooding. His wife states that all of the woody debris in the stream has fallen within the past year alone.
RL06	0.222	Round Lake Drain. Many carp stranded in pond between Idlewild Dr and W Clarendon Dr. Water is extremely low. Reach runs from Idlewild Dr to N Cedar Lake Drive. Significant duckweed and floating algae in reach.
RL07	0.470	Reach is deep throughout, with significant populations of lily pads. Reach flows east from Round Lake to dam at N Cedar Lake Road. Majority of stream bank runs along backyards. Reach had significant algae/submerged milfoil, although water was clear in open areas. Reach was entirely canoed.
RL08	0.454	1-2 feet silt throughout. Reach runs very close to Round Lake Sanitary District ponds three and one. Runs between backyards with high overbank and instream debris load (garbage, dumping of yard waste and construction waste). Multiple dead animals found in reach, squirrels and most likely a coyote pup. Amount of water in reach varies.
RL09	0.643	Reach flows south from Rollins Rd bridge to Oakwood Dr culvert. Streambed silt is 1-2 feet deep throughout. Reach runs through backyards, with significant armoring and discharge points. Hardwood trees and small shrubs line the banks of the reach.
RL10	0.432	Upstream of Meadow Hill Ln does not appear to have well defined banks or stream bed. Reach runs south from area between E Cedarwood Circle/Westview Ln to W Rollins Rd. Significant amount of trash was present in stream and along stream banks. Silt present throughout reach, although most areas did not contain silt deeper than 6 inches.
RL11	0.296	Long paved section between two culverts at the upstream most portion of reach. Mowed grass lawns on both sides of stream, with 5-10 feet of unmowed area along stream banks. Reach is narrow, 2-3 feet wide in most locations.
RL12	0.465	Area downstream of E Lane Ct was not accessible due to private property. At upstream most area of reach water had a blue color, most likely some type of algae. Runs through a neighborhood of single-family homes. Significant amount of armoring and discharge points along yards, likely installed by residents.
RL13	0.233	Reach surrounded by dense wooded area. High instream and overbank woody debris, but no debris jams that are impounded or impede flow.

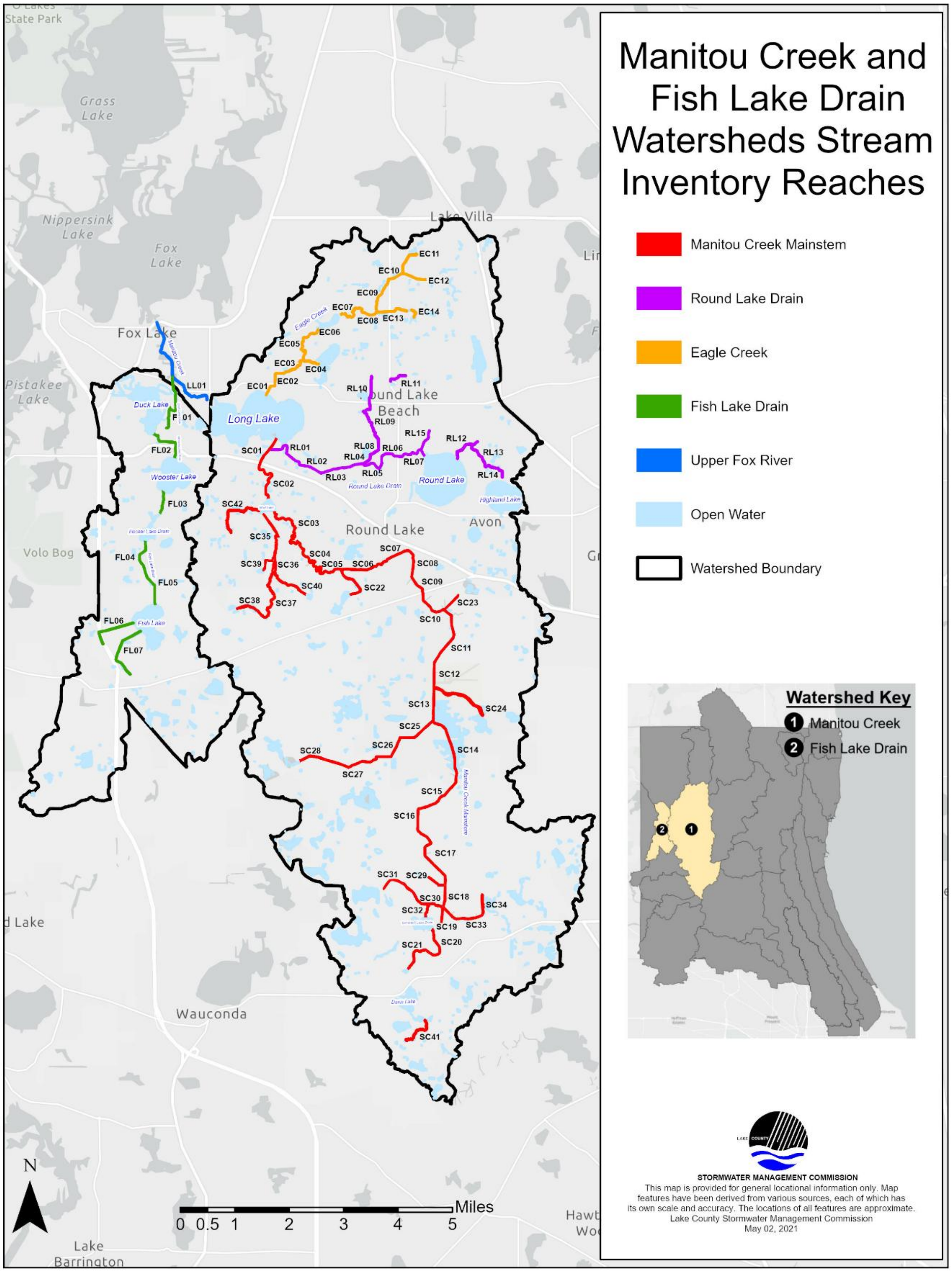
RL14	0.527	Highland Lake Drain. Majority of stream runs through Renwood Golf Course. In forested area near W Lake Ave water has blue color. Most likely dye or type of algae, possibly a product of artificial inputs. Reach runs through and adjacent to multiple man-made ponds within golf course.
RL15	0.301	Reach runs south-west into the main stem running out of Round Lake. Reach flows from E Clarendon Dr near Huebner Shores Park and meets RL07 at Lakefront Park. Reach is in a residential area with homes on either side. Significant amount of armoring along reach near homes and yards. Originally inventoried downstream but points have been flipped to represent upstream travel. Reach was entirely canoed.
SC01	0.415	Reach is one of the two reaches which connect Long Lake and Mud Lake. High channelization and in a significantly developed area, with houses on either side for most of the reach. Significant amount of docks and armoring also on both sides of reach. Runs under W Main St, Metra tracks, and Rte 134. Reach was entirely canoed.
SC02	0.699	Reach runs north from Mud lake to Rte 134 bridge. Downstream area of reach is surrounded by dense forest, while upstream area of reach is surrounded by dense cattails in wetland. Reach is 2-6 feet deep throughout. No flow was observed in reach, and water had high turbidity. An area 60 feet off of right bank, relatively upstream and owned by the adjacent housing association, appears to be in the process of being cleared (~500 x 400 ft). Reach was entirely canoed.
SC03	1.117	Frog populations much higher when compared to other reaches. Reach is at times very close to a disc golf facility. Low sedimentation and very walkable throughout. More stable than expected in marsh near Mud Lake. Multiple beaver dams and a beaver lodge found. On outside corners of turns banks have severe erosion.
SC04	0.572	Reach flows northwest from N Fairfield Bridge Rd to W Nippersink Rd. Reach runs through residential area and most banks along yards are armored. About halfway through reach, large metal walkway is present along right bank, with an area overlooking the stream. The purpose of this walkway is unknown. Several structures near bank may be susceptible to erosion in the future.
SC05	0.433	Reach runs west from Nippersink Forest Preserve to N Fairfield Road. Majority of reach is surrounded by dense forests or thick herbaceous plants. Sinuous nature of reach has caused significant erosion of outside bank at curves. Stream sediment is relatively stable, although some deeper silt is present.
SC06	0.403	Within Nippersink Forest Preserve. Armoring only at box culvert under S Cedar Lake Road. A few impounded debris jams and significant garbage, influencing high instream debris load and moderate overbank debris load.
SC07	0.666	Reach runs though heavily wooded area. Significant dumping and instream and overbank debris load (mostly garbage). Flow only apparent at riffles. Flows from MacGillis Dr to N Cedar Lake Rd.
SC08	0.241	Hundreds of plastic used shotgun wads likely washed downstream from Northbrook Sports Club. Reach runs north through trailer park residential area. Significant dumping of construction waste on banks.
SC09	0.348	Hundreds of plastic used shotgun wads likely washed downstream from Northbrook Sports Club. Reach runs north from NSC to trailer park residential area. Stream has relatively steep banks.
SC10	0.838	Reach runs north through Northbrook Sports Club to W Belvidere Rd. Lots of shotgun shells, plastic shell wads and pieces of clay pigeons along banks. Reach had high, steep banks throughout, although erosion was low. Very bad smell in water near W Belvidere Rd which was likely coming from one of the many discharge points in area. Smell was unlike normal decomposing plants/methane gas/dead animals bad smell which are commonly encountered throughout other reaches.
SC11	0.532	Reach runs north from Campbell Airport property into Northbrook Sports Club property. Many shotgun shells, plastic shell wads, and clay pigeons along banks and

		instream. However, instream and overbank debris load remains low due to very little garbage and woody debris.
SC12	0.301	Reach flows north along Campbell Airport property to W Townline Road. Area downstream of reach is part of Northbrook Sports Club. Reach has high channelization with steep banks and deep silt throughout. Water level was low at time of inventory.
SC13	0.452	Reach runs north from intersection of SC25 and SC14. Reach runs along North Churchill Lake and Campbell Airport to SC12 and SC24. Silt is 1-2 feet deep throughout. Downstream part of reach runs through open fields/wetland, while upstream part of reach runs through forested area. Reach has high channelization with relatively steep banks.
SC14	1.067	Water had very low turbidity in the downstream half of the reach, through the upstream half still had relatively low turbidity. High banks and undercuts suggest that water is normally much higher. Runs adjacent to North Churchill Lake and between South Churchill Lake.
SC15	0.424	Land-use around stream reach is primarily agricultural. Reach has steep banks with moderate channelization. Reach runs northeast from SC16 to Rte 60 culvert.
SC16	0.496	Large agricultural fields on either side of reach. Reach is highly channelized with moderate rates of erosion and lateral recession throughout. No armoring present. Erosion increases around discharge points.
SC17	0.899	Water generally very low turbidity. Surrounded by farmland and fields. Large beaver dam and bank lodge found. Relatively fast-moving flow.
SC18	0.308	Many insects in vegetation along bank. Very high channelization and low sinuosity. Relatively deep water (3-4 feet). On the boarder of Ray Lake Forest Preserve and Fremont schools. Connects to reaches running through Ray Lake Forest Preserve.
SC19	0.171	Reach is entirely within Ray Lake Forest Preserve. Downstream two-thirds of reach is through open prairie, upstream third is through Forest. Reach flows out of concrete culvert and extends to intersection of multiple reaches. Upstream culvert is less than 20 feet from an agricultural field. Width of vegetative buffer ranked 9/10 due to extremely low disturbance within forest preserve but significant disturbance near agriculture at very upstream portion. Upstream portion of reach was covered in duckweed.
SC20	0.319	Davis Lake Drain. Some areas have significantly darker color than others, this could be a change in the watercolor or the sedimentation color (likely to be sediment due to low turbidity). Very little amount of trash / debris. Consistent flow with significantly more rain lately. Surrounded by farmland but connects to streams in Ray Lake Forest Preserve through Tamarac Lake Drain.
SC21	0.701	Davis Lake Drain. Small pilot channel formed. Surrounding land was mostly agricultural. Water was very clear except for area with orange coloring due to iron oxidizing bacteria (represented by a discharge point two-thirds of the way downstream).
SC22	0.553	Within Nippersink Forest Preserve. Very little water throughout reach. Some ponds shown on aerial are now completely dry. Downstream area of reach runs through grassland, while the rest of the reach runs through dense wetland. Reach had deep silt/sediment throughout, conditions make it difficult to walk.
SC23	0.281	Reach runs through Northbrook Sports Club property and into SC10. Water only present in the very upstream portion of reach. Cobble armoring found on stream bed where SC23 meets SC10.
SC24	0.838	Water only present in the downstream half of reach. Most of reach runs through open space (wetland and forest) but close to houses in Saddlebrook Farms, some portions of reach in residential backyards. Runs from Hidden Lake to the joining of SC12 and

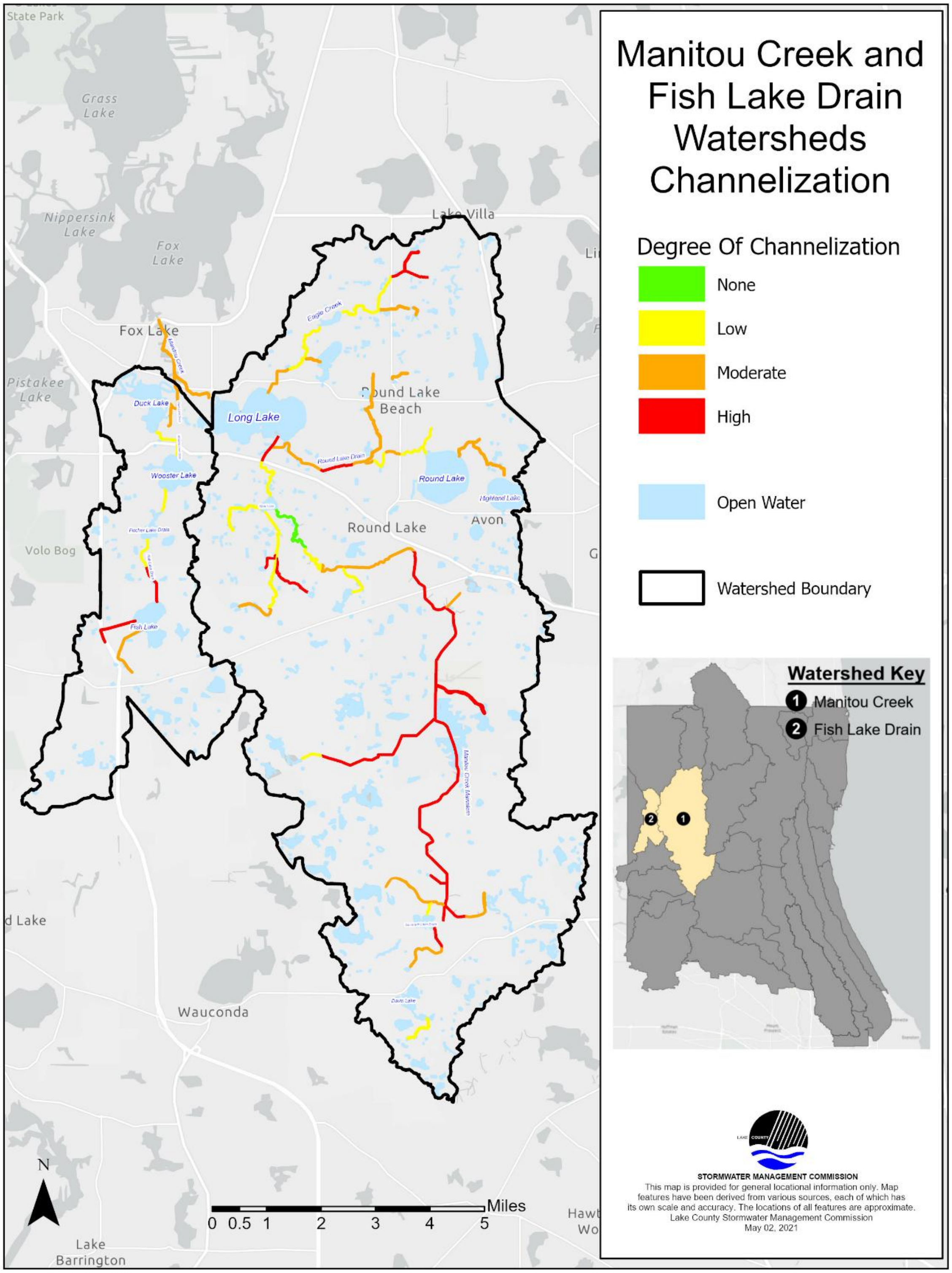
		SC13. From Saddlebrook Dr to Hidden Lake not walked due to visibility from Saddlebrook Dr.
SC25	0.690	Reach runs north from Rte 60 to intersection of SC13 and SC14. Reach runs through Lakewood Grove Park and primarily grassland. Reach is narrow with low water level. Significant duckweed on surface of water.
SC26	0.577	Lake Helen Drain. Very deep silt near Rte 60. Relatively steep banks with stream bed 3-4 ft below ground level. Runs close to agricultural fields on both sides. Near Lakewood Grove Park.
SC27	0.603	Lake Helen Drain. Reach flows east and is part of Lake Helen Drain. Surface of water covered in vegetation (duckweed and floating algae). Some trees are present along reach, although banks and surrounding land are primarily made up of long grass and farmland.
SC28	0.298	Lake Helen Drain. Moderate erosion and lateral recession immediately after W Fairfield Rd culvert but low erosion and lateral recession for rest of reach. Agricultural fields on both sides of reach. Found golf balls in reach likely coming from golf course upstream. Some open channels seen on aerial not found due to low water levels.
SC29	0.260	Reach is entirely within Ray Lake Forest Preserve. Silt was 1-2 feet deep in the center of the stream with more compacted sediment along the banks.
SC30	0.486	Air Estates Airport Creek. Runs east through Ray Lake Forest Preserve. High concentration of silt with some areas containing one to two feet of silt under a few feet of water. Silt and water level highest at downstream section when intersecting with other reaches. Significantly less water with less turbidity mid-reach compared to the rest of reach.
SC31	0.502	Air Estates Airport Creek. Deep silt in some areas. Surrounded by dense forest in some areas.
SC32	0.218	Within Ray Lake Forest Preserve along agricultural fields. No water present in reach. If water was present, it would flow north from Tamarack Lake Drain into Air Estates Airport Creek. Downstream half of reach has streambed covered in dense grasses. Concrete dam upstream holding back water from exiting Tamarack Lake Drain.
SC33	0.330	Runs west from N Fremont Center Rd to the intersection of reaches within Ray Lake Forest Preserve. Downstream half of reach runs through prairie and upstream half of reach runs through forested area with steep banks.
SC34	0.539	Surrounded by open space, agricultural fields, and Ivanhoe Golf Club. Thick cattails (rooted emergent vegetation) and deep silt throughout most of reach. No ponds found, as seen on the map. Stream at most 15 feet wide and a few feet of water deep. Water level is usually shallower than the accumulated sediment below it. Upstream half of reach runs parallel to smaller stream. Upstream quarter of reach did not have any water.
SC35	0.676	Runs north from W Nippersink Rd into Mud Lake. Reach primarily runs through wetland with dense cattails. Silt deposits seem to be deeper/less stable near Mud Lake. Stream substrate stability improves as gravel and sand becomes more prevalent in upstream portion of reach. Some open channels shown on aerial not found due to low water levels.
SC36	0.665	Fort Hill Creek. Reach runs north from Kestrel Ridge Forest Preserve to Nippersink road. Runs though backyards with bridges and armoring. Resident inquired about mosquito population. Significant armoring and hydraulic structures throughout reach.
SC37	0.428	Fort Hill Creek. Reach runs from Baxter property to Kestrel Ridge Forest preserve. Reach runs through prairie and heavily wooded area. Lots of woody debris in stream. Sediment is stable throughout reach.
SC38	0.591	Reach runs through Baxter property. Reach was not inventoried due to access issues. Reach data is only included for some categories. From overhead images, large portion

		of reach appears to be taken up by Baxter Healthcare- Round Lake Ponds 14, 12 and 9.
SC39	0.268	Runs from Valley Lakes PUD Pond 20 to SC36. Very dry, water only present close to SC36. Appears to be utilized for drainage. Likely only has a significant amount of water after rain events.
SC40	0.629	Runs from Kestrel Ridge Forest Preserve pond to W Nippersink Rd. Water not present upstream of Nippersink Estates Pond 1. Reach runs through heavily forested area, residential area, and utility area for power lines.
SC41	0.502	Reach flows north into Owens Lake from private ponds near W Schwerman Rd. Area upstream of final cross section point not surveyed due to private property. Reach is stable in most areas, with small area of deep silt near Owens Lake. Several large concrete dams throughout reach.
SC42	0.792	Water absent throughout most of the upstream half of reach. Instream debris prevalent in the upstream half of reach in the form of fallen trees and other woody debris, but there is no evidence that these debris would impede flow as there is largely no water. The downstream half of reach, through marsh and forested areas near Mud Lake, has very high frog populations compared to other reaches. Orange color in water and sediment, as previously seen (in SC21) and determined to be iron oxidizing bacteria, along stream near N Overlook Trail bridge.

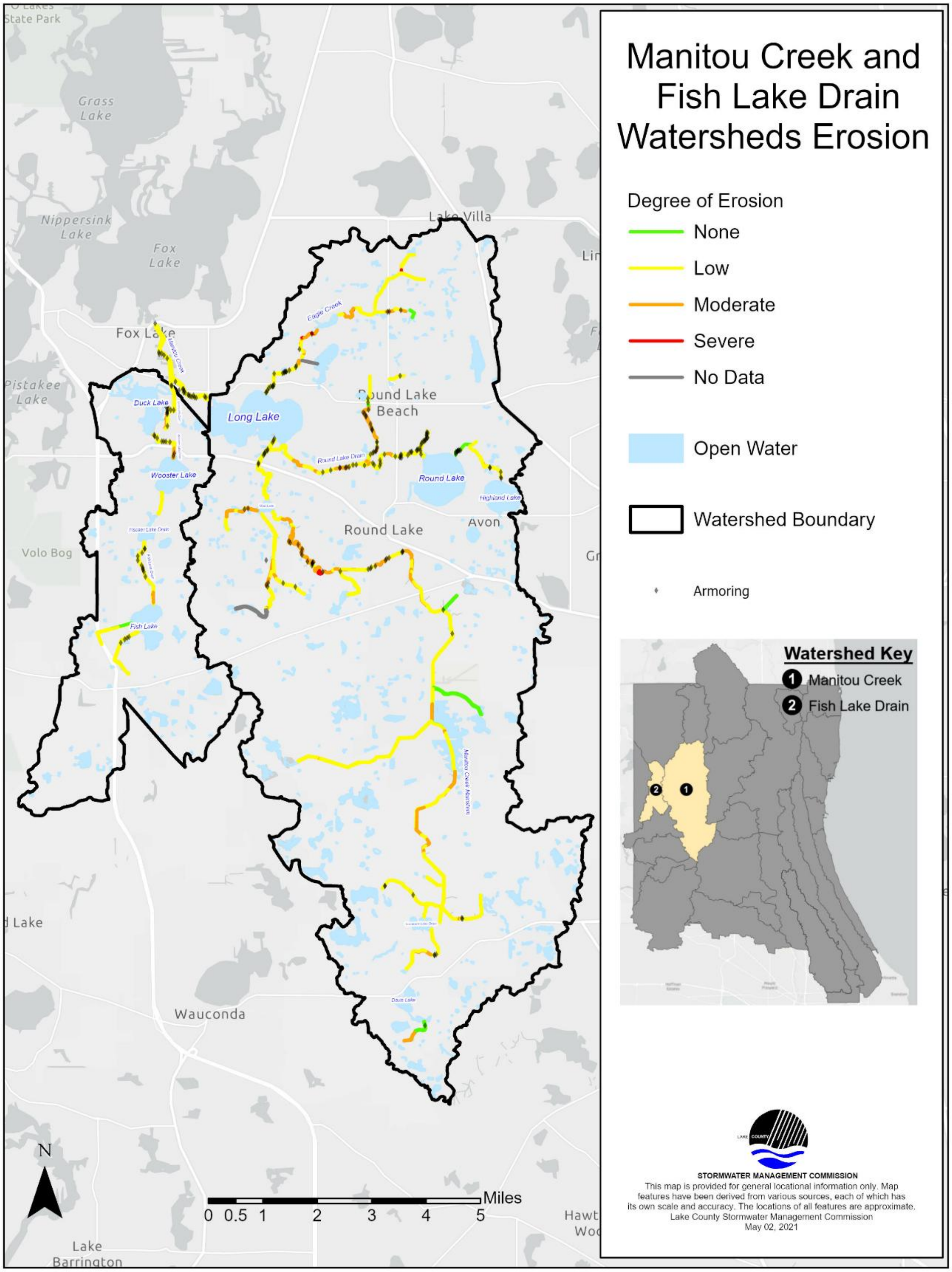
Stream Inventory Appendix C: Stream Maps



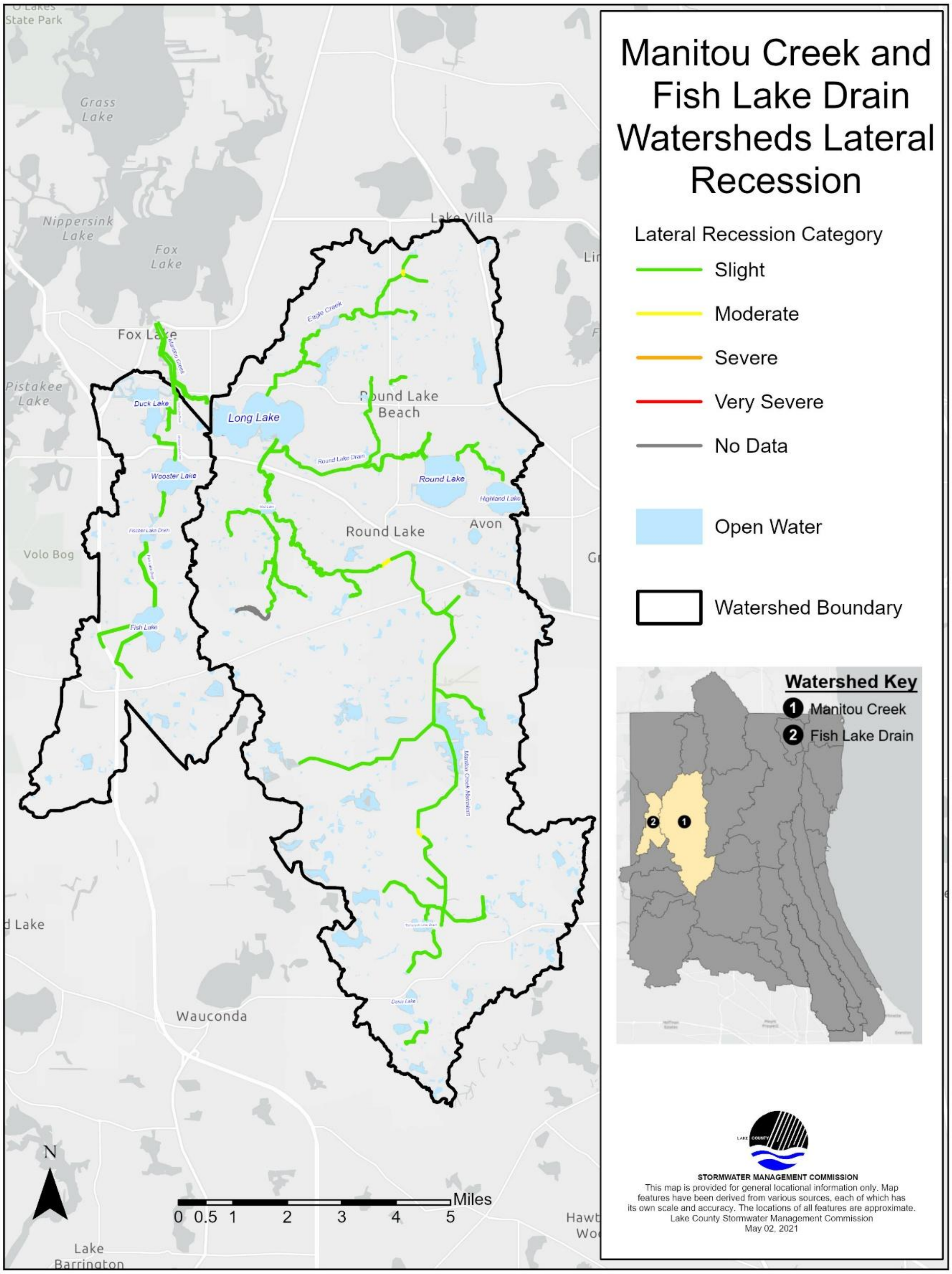
Manitou Creek and Fish Lake Drain Watersheds



Manitou Creek and Fish Lake Drain Watersheds



Manitou Creek and Fish Lake Drain Watersheds



Stream Inventory Appendix D: Miscellaneous Points

During the 2021 stream inventory of the Manitou Creek Watershed and Fish Lake Drain, some points were collected as miscellaneous points. These incidences were considered noteworthy but did not fit in the previously defined channel characteristic categories. Below is a table organizing the different descriptions of miscellaneous points collected. A total of 247 miscellaneous points were collected during the 2021 stream inventory.

Trash	Man-made Structures	Natural Structures
• Bed frame • Bicycle • Bin (metal, plastic) • Boat parts • Canoe • Car Parts (bumper, truck bed, motor) • Chain • Chair • Clay tiles • Concrete pieces • Construction equipment (signs, roadblocks, cones) • Cooler • Disconnected pipes • Dock/Boat lift (broken) • Door • Drum (metal, plastic) • Fence (broken) • Kids Toys • Ladder • Motorcycle parts • Pallets • Porcelain sink • Refrigerator • Shop vac • Shopping cart • Telephone pole (broken) • Television • Tire (bicycle, car, wagon, tractor) • Tree fort (broken)	• Animal feeder • Bird house • Boat house • Boat lift • Boat marina • Buried hose • Controllable dam • Fence (wire, electric, wood) • Hunting blind • Intake hose/pump • Metal walkway • Pipe across stream • Shooting stand • Stream gauge • Telephone pole • Temporary bridge/dam (wood, sediment)	• Beaver lodges • Dry pond/stream section

*Trash category includes man-made structures that were non-functional.

Stream Inventory Appendix E: Access

Lake County Stormwater Management Commission notified watershed stakeholders in advance of the 2021 Manitou Creek and Fish Lake Drain stream inventory. A GovDelivery notification was sent out by email to all village and township officials in the Fish Lake and Manitou Creek watersheds. In addition, an email or phone call was made to landowners owning greater or equal to 200 acres in the watersheds. Field crews also carried a letter signed by the Executive Director of the Lake County Stormwater Management Commission granting the crews authority to conduct the inventory (see permissions letter below).

Permissions Letter

May 21st, 2021

Dear Fish Lake Drain and Manitou Creek Watershed Community Official/Resident:

The Lake County Stormwater Management Commission (SMC) is developing updates to the Fish Lake Drain and Manitou Creek watershed-based plans in Lake County that includes updates to watershed plans completed in 2008. As part of this process, SMC will be completing a detailed stream inventory throughout the watersheds. The inventory will assess channel conditions such as bank height, erosion problems, bank vegetation, lateral recession rates, hydraulic structures such as bridges, culverts, and dams, pipes and swales draining to the stream, land use and vegetative cover along the stream corridor, available habitat in the stream, and channel substrate and degree of sedimentation.

Two Stream Inventory Interns, Samuel Munk and Michelle Emmerson, will perform the stream inventory during the summer of 2021. The above individuals are allowed to gain reasonable access to Fish Lake Drain and Manitou Creek watershed streams to perform the inventory. I wanted to make you aware that these staff members will be in the field this summer in case you see them on your property or receive calls or questions from your staff or constituents regarding the purpose of their work. SMC is also sending notifications to other jurisdictions in the watershed to make them aware of SMC's presence for the assessment. Local authorities will be notified in advance of site visits, so they are aware of staff presence.

The information collected in the stream inventory will be used in the development of the management plan for the Fish Lake Drain and Manitou Creek watersheds. The plans will address water quality impairments, flooding problems and natural resource protection along with other problems and opportunities identified by watershed stakeholders. The anticipated completion date of the stream inventory is September 2021. The watershed plan is expected to be completed in 2022.

If you would like additional information on the stream inventory, please contact Jeff Laramy, GIS Analyst at 847-377-7709 or jlaramy@lakecountyil.gov.

If you are interested in participating in the watershed planning process as a stakeholder, please contact Mike Prusila mprusila@lakecountyil.gov (847) 377-7713.

Thank you for your cooperation.

Sincerely,

Kurt Woolford

Executive Director

APPENDIX D:
LAKE SHORELINE ASSESSMENT

Lake Shoreline Assessment

Visual assessments of lake shorelines were conducted to characterize shoreline erosion. The degree of shoreline erosion was categorically defined as none, slight, moderate, or severe. Below are brief descriptions of each category.

> None: No visible erosion. Includes purpose-built erosion control such as riprap and sea walls.
>
> Slight: Minimal or observable erosion. Generally considered stable.
>
> Moderate: Obvious recession and/or eroded banks. Area may exhibit some exposed roots, fallen vegetation or minor slumping.
>
> Severe: Recession is characterized by eroding of exposed soil on nearly vertical banks, exposed roots, fallen vegetation or extensive slumping of bank material, undercutting, washouts or fence posts exhibiting realignment.

Lakeshore Buffer Condition

Lakeshore buffer condition was assessed using an area up to 25 feet inland from the shoreline for each reach. A 25 foot buffer was chosen based on research that indicates a 25-foot vegetated buffer is the minimum effective width for in-lake habitat maintenance (a 15 foot buffer is the minimum effective width for bank stability). The assessment was conducted utilizing 2018 and 2019 aerial images in ArcGIS. The aerial images were visually assessed to determine vegetation and impervious surface cover. The lakeshore buffers were categorized as good, fair, or poor. Below are brief descriptions of each category.

> Good: $\geq$ 70% unmowed grasses, forbs, trees and/or shrubs and $\leq$ 5% impervious surfaces
> Fair: $\geq$ 50% unmowed grasses, forbs, trees and/or shrubs or > 5% - $\leq$ 50% impervious surfaces
> Poor: $\leq$ 50% unmowed grasses, forbs, trees and/or shrubs or $\geq$ 50% impervious surfaces

APPENDIX E:
DETENTION BASIN INVENTORY

Jurisdiction	Basin ID	Latitude	Longitude	Preliminary Retrofit Opportunities	Subwatershed	Post WDO?	Basin Type
Unincorporated	03-0006	42.34414958	-88.15255921	-	Fish Lake Drain	Y	Wet
Unincorporated	03-0009	42.36808972	-88.14301409	-	Fish Lake Drain	Y	Wet
Unincorporated	03-0010	42.36837862	-88.14843676	-	Fish Lake Drain	Y	Wet
Unincorporated	03-0013	42.37372434	-88.14239649	-	Fish Lake Drain	Y	Wet
Unincorporated	03-0014	42.3741839	-88.14086666	-	Fish Lake Drain	Y	Wet
Unincorporated	03-0012	42.3733047	-88.14435859	-	Fish Lake Drain	Y	Wetland
Unincorporated	03-0036	42.34500192	-88.1490212	-	Fish Lake Drain	Y	Wetland
Unincorporated	04-0008	42.28307835	-88.07064096	-	Manitou Creek	Y	Dry
Unincorporated	04-0175	42.36144484	-88.13277358	-	Manitou Creek	Y	Dry
Unincorporated	04-0213	42.30951825	-88.06810658	-	Manitou Creek	Y	Dry
Unincorporated	04-0001	42.33892966	-88.13398016	-	Manitou Creek	N	Wet
Unincorporated	04-0002	42.33826861	-88.1326478	-	Manitou Creek	N	Wet
Unincorporated	04-0003	42.33803228	-88.13334954	-	Manitou Creek	N	Wet
Unincorporated	04-0004	42.33419079	-88.13558939	-	Manitou Creek	N	Wet
Unincorporated	04-0005	42.33261685	-88.13176465	-	Manitou Creek	N	Wet
Unincorporated	04-0203	42.33380079	-88.05213993	-	Manitou Creek	N	Wet
Unincorporated	04-0052	42.36029873	-88.13897097	-	Manitou Creek	Y	Wet
Unincorporated	04-0140	42.36394797	-88.13339491	-	Manitou Creek	Y	Wet
Unincorporated	04-0141	42.35846132	-88.13256085	-	Manitou Creek	Y	Wet
Unincorporated	04-0156	42.26334622	-88.10321094	-	Manitou Creek	Y	Wet
Unincorporated	04-0157	42.26508558	-88.10399464	-	Manitou Creek	Y	Wet
Unincorporated	04-0210	42.30658664	-88.06766139	-	Manitou Creek	Y	Wet
Unincorporated	04-0009	42.29444707	-88.07167159	-	Manitou Creek	Y	Wetland
Unincorporated	04-0197	42.28316406	-88.07614317	-	Manitou Creek	Y	Wetland
Unincorporated	04-0206	42.29622925	-88.07061388	-	Manitou Creek	Y	Wetland
Unincorporated	04-0208	42.30505821	-88.07064384	-	Manitou Creek	Y	Wetland
Unincorporated	04-0209	42.30586864	-88.06818002	-	Manitou Creek	Y	Wetland
Unincorporated	04-0211	42.30878811	-88.06565281	-	Manitou Creek	Y	Wetland
Unincorporated	04-0212	42.30968081	-88.06560468	-	Manitou Creek	Y	Wetland
Unincorporated	04-0214	42.30775086	-88.06853081	-	Manitou Creek	Y	Wetland
Unincorporated	04-0215	42.31180842	-88.11046391	-	Manitou Creek	Y	Wetland
Unincorporated	04-0217	42.34529861	-88.14512395	-	Manitou Creek	Y	Wetland
Unincorporated	04-0218	42.34633808	-88.14517988	-	Manitou Creek	Y	Wetland
Village of Fox Lake	03-0011	42.37028101	-88.15496655	-	Fish Lake Drain	Y	Wet
Village of Fox Lake	03-0016	42.36589046	-88.15641959	-	Fish Lake Drain	N	Wetland
Village of Grayslake	04-0173	42.36864129	-88.06119902	-	Manitou Creek	Y	Dry
Village of Grayslake	04-0174	42.36590731	-88.06133576	-	Manitou Creek	Y	Dry
Village of Grayslake	04-0204	42.33434374	-88.05232529	-	Manitou Creek	N	Wet

Jurisdiction	Basin ID	Latitude	Longitude	Preliminary Retrofit Opportunities	Subwatershed	Post WDO?	Basin Type
Village of Grayslake	04-0019	42.34172351	-88.0598983	-	Manitou Creek	Y	Wet
Village of Grayslake	04-0149	42.37307752	-88.05496217	-	Manitou Creek	Y	Wet
Village of Grayslake	04-0150	42.37191363	-88.05501138	-	Manitou Creek	Y	Wet
Village of Hainesville	04-0195	42.34997062	-88.06650433	-	Manitou Creek	Y	Dry
Village of Hainesville	04-0027	42.34790813	-88.06940028	-	Manitou Creek	N	Wet
Village of Hainesville	04-0026	42.34655487	-88.06983549	-	Manitou Creek	Y	Wet
Village of Hainesville	04-0029	42.34923527	-88.06225226	-	Manitou Creek	Y	Wet
Village of Hainesville	04-0040	42.35446922	-88.06738544	-	Manitou Creek	Y	Wet
Village of Hainesville	04-0043	42.35530166	-88.07124548	-	Manitou Creek	Y	Wet
Village of Hainesville	04-0046	42.35657881	-88.06973682	-	Manitou Creek	Y	Wet
Village of Hainesville	04-0151	42.35011506	-88.0634678	-	Manitou Creek	Y	Wet
Village of Hainesville	04-0221	42.35081868	-88.06502877	-	Manitou Creek	Y	Wet
Village of Hainesville	04-0023	42.34573764	-88.06964253	-	Manitou Creek	Y	Wetland
Village of Hainesville	04-0047	42.35633988	-88.06324898	-	Manitou Creek	Y	Wetland
Village of Hainesville	04-0100	42.35635467	-88.06137614	-	Manitou Creek	Y	Wetland
Village of Hainesville	04-0101	42.35474104	-88.0591481	-	Manitou Creek	Y	Wetland
Village of Hainesville	04-0176	42.34501334	-88.07166729	-	Manitou Creek	Y	Wetland
Village of Hainesville	04-0216	42.3436562	-88.06360086	-	Manitou Creek	Y	Wetland
Village of Hawthorn Woods	04-0159	42.26056306	-88.07188488	1. Stabilize erosion and inlet blowout. 2. Reconstruct inlet.	Manitou Creek	Y	Wet
Village of Hawthorn Woods	04-0183	42.2627665	-88.07118819	-	Manitou Creek	Y	Wet
Village of Hawthorn Woods	04-0158	42.24248302	-88.08001137	-	Manitou Creek	Y	Wetland
Village of Lake Villa	04-0187	42.404682	-88.08158209	-	Manitou Creek	Y	Dry
Village of Lake Villa	04-0006	42.40432721	-88.06665467	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0007	42.40930102	-88.06712751	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0082	42.39835563	-88.08313237	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0083	42.39836969	-88.08249558	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0091	42.40812971	-88.06863369	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0092	42.407695	-88.0741778	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0096	42.40226337	-88.09861361	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0097	42.40650072	-88.09547255	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0098	42.40159242	-88.09464585	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0099	42.40290217	-88.0936174	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0130	42.39544441	-88.08772043	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0132	42.39399329	-88.09154455	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0134	42.39213737	-88.09099571	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0136	42.39497677	-88.09625636	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0137	42.39397481	-88.09589549	-	Manitou Creek	Y	Wet

Jurisdiction	Basin ID	Latitude	Longitude	Preliminary Retrofit Opportunities	Subwatershed	Post WDO?	Basin Type
Village of Lake Villa	04-0139	42.39589859	-88.0931587	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0184	42.40418482	-88.09079213	-	Manitou Creek	Y	Wet
Village of Lake Villa	04-0084	42.39843024	-88.07649778	-	Manitou Creek	Y	Wetland
Village of Lake Villa	04-0085	42.40108681	-88.10535561	-	Manitou Creek	Y	Wetland
Village of Lake Villa	04-0086	42.40107141	-88.07684515	-	Manitou Creek	Y	Wetland
Village of Lake Villa	04-0087	42.40182345	-88.09164519	1. Remove invasive vegetation. 2. Unclog and repair inlet and outlet.	Manitou Creek	Y	Wetland
Village of Lake Villa	04-0088	42.40216109	-88.10399619	-	Manitou Creek	Y	Wetland
Village of Lake Villa	04-0089	42.40233566	-88.10071005	-	Manitou Creek	Y	Wetland
Village of Lake Villa	04-0090	42.40675923	-88.0725321	-	Manitou Creek	Y	Wetland
Village of Lake Villa	04-0094	42.40131966	-88.08638338	-	Manitou Creek	Y	Wetland
Village of Lake Villa	04-0095	42.40278068	-88.08052082	-	Manitou Creek	Y	Wetland
Village of Lake Villa	04-0135	42.39061062	-88.09444051	-	Manitou Creek	Y	Wetland
Village of Lake Villa	04-0138	42.39649818	-88.09517339	-	Manitou Creek	Y	Wetland
Village of Lake Villa	04-0185	42.41042052	-88.07942073	-	Manitou Creek	Y	Wetland
Village of Lake Villa	04-0186	42.40703071	-88.06896769	-	Manitou Creek	Y	Wetland
Village of Lakemoor	03-0005	42.33352117	-88.17134332	-	Fish Lake Drain	Y	Wet
Village of Lakemoor	03-0039	42.32095242	-88.17325399	-	Fish Lake Drain	Y	Wet
Village of Lakemoor	03-0038	42.32239767	-88.16562214	-	Fish Lake Drain	Y	Wetland
Village of Mundelein	04-0163	42.275041	-88.05087671	-	Manitou Creek	Y	Dry
Village of Mundelein	04-0160	42.27630054	-88.04692656	-	Manitou Creek	Y	Wet
Village of Mundelein	04-0162	42.27489877	-88.04929069	-	Manitou Creek	Y	Wet
Village of Mundelein	04-0164	42.27581818	-88.05462773	-	Manitou Creek	Y	Wet
Village of Mundelein	04-0167	42.27301455	-88.05473798	-	Manitou Creek	Y	Wet
Village of Mundelein	04-0180	42.27108357	-88.04954135	-	Manitou Creek	N	Wetland
Village of Mundelein	04-0161	42.27302203	-88.04924125	-	Manitou Creek	Y	Wetland
Village of Mundelein	04-0165	42.27586653	-88.05565389	-	Manitou Creek	Y	Wetland
Village of Mundelein	04-0166	42.2728627	-88.05620805	-	Manitou Creek	Y	Wetland
Village of Mundelein	04-0168	42.27076715	-88.05554749	-	Manitou Creek	Y	Wetland
Village of Mundelein	04-0169	42.27079907	-88.05201374	-	Manitou Creek	Y	Wetland
Village of Mundelein	04-0170	42.28641955	-88.04521955	-	Manitou Creek	Y	Wetland
Village of Mundelein	04-0171	42.28422277	-88.0429247	-	Manitou Creek	Y	Wetland
Village of Mundelein	04-0179	42.27184805	-88.05185215	-	Manitou Creek	Y	Wetland
Village of Mundelein	04-0181	42.27095437	-88.048056	-	Manitou Creek	Y	Wetland
Village of Mundelein	04-0182	42.26890381	-88.05551299	-	Manitou Creek	Y	Wetland
Village of Mundelein	04-0205	42.26666022	-88.0574646	-	Manitou Creek	Y	Wetland
Village of Round Lake	03-0017	42.35866571	-88.14670345	-	Fish Lake Drain	Y	Wet
Village of Round Lake	04-0177	42.34101238	-88.09639149	-	Manitou Creek	Y	Dry

Jurisdiction	Basin ID	Latitude	Longitude	Preliminary Retrofit Opportunities	Subwatershed	Post WDO?	Basin Type
Village of Round Lake	04-0178	42.3427186	-88.08965472	-	Manitou Creek	Y	Dry
Village of Round Lake	04-0193	42.35583406	-88.11123831	-	Manitou Creek	Y	Dry
Village of Round Lake	04-0196	42.34578945	-88.09230986	1. Repair blowout around inlet and outlet.	Manitou Creek	Y	Dry
Village of Round Lake	04-0014	42.3254279	-88.08682223	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0015	42.33282288	-88.08331007	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0016	42.33549353	-88.12177108	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0017	42.33618577	-88.09236632	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0018	42.33857135	-88.08869712	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0020	42.34346791	-88.13727353	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0021	42.34400498	-88.13339353	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0025	42.34608597	-88.12646839	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0028	42.34899824	-88.12568337	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0030	42.34915557	-88.1304813	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0032	42.35178167	-88.10485218	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0033	42.35223973	-88.13897423	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0034	42.35226886	-88.12808305	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0035	42.35299451	-88.13614864	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0037	42.35320153	-88.12715872	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0038	42.35425329	-88.1339772	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0039	42.3543466	-88.12787374	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0042	42.35482192	-88.13563345	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0044	42.35632324	-88.1301192	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0045	42.35648579	-88.1371252	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0048	42.35731593	-88.13234045	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0049	42.35763362	-88.12903067	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0050	42.35803137	-88.13921	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0051	42.35950175	-88.12860986	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0053	42.35992022	-88.14065994	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0055	42.36137768	-88.11778812	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0056	42.36346765	-88.12855397	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0103	42.3082492	-88.09107048	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0104	42.31097127	-88.096491	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0105	42.30476917	-88.08641698	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0107	42.32497038	-88.09752356	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0108	42.32777662	-88.1018027	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0110	42.31434054	-88.09581418	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0111	42.317379	-88.09822256	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0113	42.32404777	-88.09142361	-	Manitou Creek	Y	Wet

Jurisdiction	Basin ID	Latitude	Longitude	Preliminary Retrofit Opportunities	Subwatershed	Post WDO?	Basin Type
Village of Round Lake	04-0114	42.32321765	-88.09413583	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0116	42.32009523	-88.0929658	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0117	42.31718897	-88.09052933	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0118	42.32086402	-88.08797606	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0120	42.33790704	-88.08471082	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0126	42.36036695	-88.11247811	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0142	42.34133962	-88.13595096	1. Unclog inlets and outlets. 2. Stabilize side slopes.	Manitou Creek	Y	Wet
Village of Round Lake	04-0144	42.34231528	-88.12200311	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0202	42.32965786	-88.12381661	-	Manitou Creek	Y	Wet
Village of Round Lake	04-0013	42.32535013	-88.08990297	-	Manitou Creek	N	Wetland
Village of Round Lake	04-0222	42.36180573	-88.09568377	-	Manitou Creek	N	Wetland
Village of Round Lake	04-0223	42.36424843	-88.09499272	-	Manitou Creek	N	Wetland
Village of Round Lake	04-0022	42.34502829	-88.13533566	-	Manitou Creek	Y	Wetland
Village of Round Lake	04-0024	42.34636467	-88.13717642	-	Manitou Creek	Y	Wetland
Village of Round Lake	04-0109	42.32312108	-88.10010876	-	Manitou Creek	Y	Wetland
Village of Round Lake	04-0112	42.32528371	-88.09214198	-	Manitou Creek	Y	Wetland
Village of Round Lake	04-0115	42.32069024	-88.09397473	1. Unclog inlets and outlets.	Manitou Creek	Y	Wetland
Village of Round Lake	04-0119	42.33400031	-88.09499728	-	Manitou Creek	Y	Wetland
Village of Round Lake	04-0125	42.36121453	-88.11614268	-	Manitou Creek	Y	Wetland
Village of Round Lake	04-0143	42.34030222	-88.13591557	1. Unclog inlets and outlets. 2. Stabilize side slopes.	Manitou Creek	Y	Wetland
Village of Round Lake	04-0148	42.35768509	-88.11388394	-	Manitou Creek	Y	Wetland
Village of Round Lake	04-0220	42.35066405	-88.09622189	-	Manitou Creek	Y	Wetland
Village of Round Lake Beach	04-0124	42.37024257	-88.11655024	-	Manitou Creek	Y	Dry
Village of Round Lake Beach	04-0133	42.38616423	-88.08911385	-	Manitou Creek	Y	Dry
Village of Round Lake Beach	04-0188	42.38637019	-88.08455631	-	Manitou Creek	Y	Dry
Village of Round Lake Beach	04-0200	42.37915411	-88.08338599	-	Manitou Creek	Y	Dry
Village of Round Lake Beach	04-0201	42.37971786	-88.08332958	-	Manitou Creek	Y	Dry
Village of Round Lake Beach	04-0231	42.36496486	-88.11380408	-	Manitou Creek	Y	Dry
Village of Round Lake Beach	04-0059	42.37825508	-88.06653942	-	Manitou Creek	N	Wet
Village of Round Lake Beach	04-0121	42.37829277	-88.06537444	-	Manitou Creek	N	Wet
Village of Round Lake Beach	04-0057	42.36815158	-88.11194242	1. Determine if basin is functioning properly	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0058	42.36894849	-88.11409121	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0060	42.37935841	-88.08567084	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0061	42.37949337	-88.06855676	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0064	42.38290069	-88.09147001	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0067	42.38733629	-88.08648255	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0071	42.3883424	-88.0893538	-	Manitou Creek	Y	Wet

Jurisdiction	Basin ID	Latitude	Longitude	Preliminary Retrofit Opportunities	Subwatershed	Post WDO?	Basin Type
Village of Round Lake Beach	04-0078	42.39250814	-88.07522333	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0079	42.39327038	-88.07545574	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0081	42.39186176	-88.08476432	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0093	42.36729073	-88.11693317	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0122	42.38360953	-88.06416326	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0123	42.38380451	-88.06351041	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0129	42.39598286	-88.08532342	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0152	42.37931777	-88.08021514	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0153	42.37959029	-88.07969541	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0172	42.3823562	-88.06561055	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0227	42.37953529	-88.07855213	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0228	42.3795232	-88.07789438	-	Manitou Creek	Y	Wet
Village of Round Lake Beach	04-0190	42.37209692	-88.09008787	-	Manitou Creek	N	Wetland
Village of Round Lake Beach	04-0191	42.37194201	-88.09059261	-	Manitou Creek	N	Wetland
Village of Round Lake Beach	04-0192	42.37188253	-88.09131268	-	Manitou Creek	N	Wetland
Village of Round Lake Beach	04-0062	42.38285395	-88.06621749	-	Manitou Creek	Y	Wetland
Village of Round Lake Beach	04-0063	42.38301144	-88.06533978	-	Manitou Creek	Y	Wetland
Village of Round Lake Beach	04-0131	42.39715741	-88.08540053	-	Manitou Creek	Y	Wetland
Village of Round Lake Beach	04-0189	42.37943551	-88.08913168	-	Manitou Creek	Y	Wetland
Village of Round Lake Beach	04-0198	42.37912291	-88.06365028	-	Manitou Creek	Y	Wetland
Village of Round Lake Beach	04-0199	42.37995244	-88.08444023	-	Manitou Creek	Y	Wetland
Village of Round Lake Beach	04-0224	42.36572693	-88.11288026	-	Manitou Creek	Y	Wetland
Village of Round Lake Beach	04-0225	42.37852571	-88.06400158	-	Manitou Creek	Y	Wetland
Village of Round Lake Beach	04-0226	42.37942022	-88.08093375	-	Manitou Creek	Y	Wetland
Village of Round Lake Beach	04-0229	42.38108158	-88.08496526	-	Manitou Creek	Y	Wetland
Village of Round Lake Heights	04-0065	42.38652775	-88.09832789	-	Manitou Creek	Y	Wet
Village of Round Lake Heights	04-0066	42.38664888	-88.10153211	-	Manitou Creek	Y	Wet
Village of Round Lake Heights	04-0068	42.38784672	-88.09930293	-	Manitou Creek	Y	Wet
Village of Round Lake Heights	04-0069	42.38795381	-88.10105216	-	Manitou Creek	Y	Wet
Village of Round Lake Heights	04-0070	42.38846709	-88.10244229	-	Manitou Creek	Y	Wet
Village of Round Lake Heights	04-0072	42.38940588	-88.10365777	-	Manitou Creek	Y	Wet
Village of Round Lake Heights	04-0073	42.38931556	-88.10168021	-	Manitou Creek	Y	Wet
Village of Round Lake Heights	04-0074	42.3897426	-88.09796183	-	Manitou Creek	Y	Wet
Village of Round Lake Heights	04-0076	42.39044015	-88.10725049	-	Manitou Creek	Y	Wet
Village of Round Lake Heights	04-0080	42.39344669	-88.10121948	-	Manitou Creek	Y	Wet
Village of Round Lake Heights	04-0230	42.38951772	-88.09964992	-	Manitou Creek	Y	Wet
Village of Round Lake Heights	04-0232	42.38975482	-88.09912916	-	Manitou Creek	Y	Wet
Village of Round Lake Heights	04-0127	42.37938098	-88.10767078	1. Unclog inlet/outlets.	Manitou Creek	N	Wetland

Jurisdiction	Basin ID	Latitude	Longitude	Preliminary Retrofit Opportunities	Subwatershed	Post WDO?	Basin Type
				2. Remove phragmites.			
Village of Round Lake Heights	04-0128	42.38166819	-88.10806476	1. Unclog inlet. 2. Remove phragmites	Manitou Creek	N	Wetland
Village of Round Lake Heights	04-0075	42.38926567	-88.10574394	-	Manitou Creek	Y	Wetland
Village of Round Lake Heights	04-0077	42.3907504	-88.0996159	-	Manitou Creek	Y	Wetland
Village of Round Lake Park	04-0041	42.35467356	-88.08320285	-	Manitou Creek	N	Dry
Village of Round Lake Park	04-0054	42.36128191	-88.07236605	-	Manitou Creek	N	Dry
Village of Round Lake Park	04-0194	42.35232334	-88.08523803	-	Manitou Creek	Y	Dry
Village of Round Lake Park	04-0036	42.35247416	-88.07511255	-	Manitou Creek	N	Wet
Village of Round Lake Park	04-0011	42.30593381	-88.07290161	-	Manitou Creek	Y	Wet
Village of Round Lake Park	04-0012	42.3187391	-88.06721604	-	Manitou Creek	Y	Wet
Village of Volo	03-0001	42.30695147	-88.16570833	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0002	42.30751858	-88.16573015	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0003	42.32121705	-88.15131378	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0004	42.32205347	-88.15920077	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0008	42.35997673	-88.16218207	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0018	42.35132927	-88.15738206	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0019	42.34973161	-88.16005612	1. Investigate potential illicit discharge from southern inlet.	Fish Lake Drain	Y	Wet
Village of Volo	03-0020	42.35683134	-88.16404312	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0022	42.3444238	-88.16183117	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0023	42.34652669	-88.16078352	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0024	42.34870785	-88.16452847	1. Stabilize outlet blowout and repair pipe.	Fish Lake Drain	Y	Wet
Village of Volo	03-0025	42.34993253	-88.16587147	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0026	42.32227198	-88.14710146	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0027	42.32421092	-88.15082767	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0028	42.32659979	-88.13930044	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0029	42.31403005	-88.1492763	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0030	42.31648449	-88.14900025	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0031	42.31890068	-88.14437993	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0032	42.31550223	-88.14574751	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0034	42.35178075	-88.16030256	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0035	42.35181653	-88.16201488	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0042	42.3521134	-88.15603728	-	Fish Lake Drain	Y	Wet
Village of Volo	03-0007	42.35872132	-88.16026473	-	Fish Lake Drain	Y	Wetland
Village of Volo	03-0015	42.36062454	-88.16027282	-	Fish Lake Drain	Y	Wetland
Village of Volo	03-0021	42.35519677	-88.1640665	-	Fish Lake Drain	Y	Wetland
Village of Volo	03-0033	42.35753852	-88.16076322	-	Fish Lake Drain	Y	Wetland
Village of Volo	03-0037	42.32720313	-88.16322375	-	Fish Lake Drain	Y	Wetland

Jurisdiction	Basin ID	Latitude	Longitude	Preliminary Retrofit Opportunities	Subwatershed	Post WDO?	Basin Type
Village of Volo	03-0040	42.31979854	-88.14741691	-	Fish Lake Drain	Y	Wetland
Village of Volo	03-0041	42.33622752	-88.17183157	1. Stabilize inlet and side slope erosion.	Fish Lake Drain	Y	Wetland
Village of Volo	04-0031	42.34986603	-88.14320603	-	Manitou Creek	Y	Wetland
Village of Volo	04-0219	42.34666793	-88.14335638	-	Manitou Creek	Y	Wetland
Village of Wauconda	04-0145	42.3050997	-88.1227251	-	Manitou Creek	Y	Wet
Village of Wauconda	04-0146	42.28912851	-88.11887759	-	Manitou Creek	Y	Wet
Village of Wauconda	04-0154	42.29134006	-88.11875278	-	Manitou Creek	Y	Wet
Village of Wauconda	04-0207	42.30140068	-88.11041979	-	Manitou Creek	Y	Wet
Village of Wauconda	04-0233	42.29131497	-88.1219275	-	Manitou Creek	Y	Wet
Village of Wauconda	04-0010	42.29989061	-88.11421367	-	Manitou Creek	Y	Wetland
Village of Wauconda	04-0102	42.29538125	-88.10739279	-	Manitou Creek	Y	Wetland
Village of Wauconda	04-0106	42.30008154	-88.11308564	-	Manitou Creek	Y	Wetland
Village of Wauconda	04-0147	42.29329825	-88.12246847	-	Manitou Creek	Y	Wetland
Village of Wauconda	04-0155	42.29646796	-88.10775074	-	Manitou Creek	Y	Wetland

-: No action recommendation

APPENDIX F:
POLLUTANT LOAD ESTIMATION

Appendix F. Pollutant Loading Estimation

Pollutant loads were estimated based on a methodology developed by the Northeastern Illinois Planning Commission (NIPC), now the Chicago Metropolitan Agency for Planning (CMAP), for a comprehensive nonpoint source pollution study of the Lake Michigan watershed in partnership with the Lake County Stormwater Management Commission. The estimates are based on Event Mean Concentrations for several common pollutants in urban stormwater runoff. The catchments in the watershed planning area are divided into land uses and an EMC for each pollutant is assigned to each land use category. Each land use category is also assigned a runoff coefficient. The annual precipitation for the watershed, runoff coefficient, and Event Mean Concentration are used to estimate an annual pollutant loading rate (pounds/acre/year) for each pollutant and land use. Area of each land use is multiplied by the loading rate to estimate the annual pollutant load for each pollutant and land use in a catchment. All land use load estimates for each pollutant in a catchment are summed to estimate total annual load for each pollutant in a catchment.

Runoff Coefficients are calculated from the following relationship:

$Rv = 0.05 + 0.009*I$

Where

Rv = Runoff Coefficient

I = Percent impervious

Land uses were divided into “sewered” and “unsewered” to better reflect effective imperviousness. Land uses served by stormsewer systems have higher effective imperviousness and therefore higher runoff coefficients.

Land Use	**Runoff Coefficient**	
	Sewered	**Unsewered**
Commercial	0.85	0.75
Industrial	0.80	0.70
Institutional	0.50	0.30
Transportation, Auto Surface	0.85	0.50
Transportation, Utility and Waste Facilities	0.80	0.70
Residential	0.15	0.15
Agricultural	NA	0.10
Open Space	0.15	0.05
Open Water	1.00	1.00

The residential runoff coefficients were modified from the original NIPC values based on 2007 analyses for the Dead River and Kellogg Creek Watershed Management Plans, which found that the original NIPC analysis included streets within residential districts as part of the analysis. While pollutant loads in runoff from individual lots should be comparatively similar in sewered versus unsewered districts, the effect of stormsewer systems was estimated to increase the loading rate in sewered districts in the original NIPC methodology. Since that time, the roadways in which the majority of the stormsewer system is located have been removed from the residential land use polygons and set in its own land use classification (Transportation, Auto Surface). The 2007 analysis found that runoff coefficients for sewered and unsewered residential should be set equal, which is reflected in the coefficients employed here.

Pollutant loading rates (Lbs/acre/year) were calculated for each land use according to the following relationship:

Lt = [(P*CF*Rv)/12]*C*UC

Where:

Lt = Annual pollutant loading rate (Lbs/acre/year)

P = Annual Precipitation (in)

CF = Correction Factor to adjust for storms where no runoff occurs (0.9 used)

Rv = Runoff Coefficient

C = Event Mean Concentration (usually mg/L)

UC = Unit Conversion (2.72 used for mg/L calculations, 1.23 used for CFU calculations)

EMCs used to calculate loading rates for each land use (all units mg/L except Fecal Coliform, which is Colony Forming Units/100 mL):

Land Use	BOD	COD	TSS	TDS	TN	TKN	DP	TP	Cd	Pb	Cu	Zn	Fecal Coliform
Commercial	**15**	**103**	**206**	**495**	**3.6**	**1.2**	**0.12**	**0.23**	**0.0014**	**0.180**	**0.035**	**0.27**	1800
Industrial	**9**	**48**	**230**	**239**	**2.6**	**0.8**	**0.16**	**0.27**	**0.0047**	**0.294**	**0.039**	**0.25**	2500
Institutional	**16**	**96**	**391**	**185**	**3.2**	**1.9**	**0.18**	**0.42**	**0.0011**	**0.109**	**0.030**	**0.17**	1800
Transportation, Auto Surface	**9**	**154**	**395**	**1059**	**2.3**	**3.2**	**0.04**	**0.32**	**0.0036**	**0.467**	**0.097**	**0.56**	1400
Transportation, Utility and Waste Facilities	**9**	**48**	**230**	**239**	**2.6**	**0.8**	**0.16**	**0.27**	**0.0047**	**0.294**	**0.039**	**0.25**	2500
Residential	**11**	**70**	**153**	**216**	**3.1**	**1.6**	**0.13**	**0.40**	**0.0010**	**0.116**	**0.024**	**0.45**	8400
Agricultural	**8**	**82**	**456**	**265**	**7.1**	**2.7**	**0.25**	**0.53**	**0.0005**	**0.007**	**0.013**	**0.21**	2600
Open Space	**1**	**46**	**60**	**717**	**0.7**	**1.3**	**0.08**	**0.39**	**0.0002**	**0.016**	**0.006**	**0.08**	1000
Open Water	**1**	**46**	**60**	**717**	**0.7**	**1.3**	**0.08**	**0.39**	**0.0002**	**0.016**	**0.006**	**0.08**	276

APPENDIX G:
WETLAND RESTORATION METHODOLOGY

POTENTIALLY RESTORABLE WETLAND SITE IDENTIFICATION METHODOLOGY

Geographic data from the Lake County Wetland Restoration and Preservation Plan (WRAPP) Potentially Restorable Wetland (PRW) map layer were used as the baseline for potential wetland restoration site selection and prioritization. The Lake County WRAPP data include qualitative predictions of significance level (high, moderate, low) for various beneficial wetland functions, including ***unique wetland resources (high quality wetlands)***, ***flood water storage, nutrient transformation, sediment and particulate retention, streambank stabilization, and native fish habitat***. Additional filtering and prioritization criteria were applied to obtain a reasonable number of potential restoration sites for cost and pollutant load reduction and inclusion in the action plan. The method for prioritization is outlined below.

1) Lake County PRWs were prioritized according to the following criteria, which are weighted by the significance rating for each potentially restorable wetland (High, Moderate, Low, NA):

Function	Criteria Weight = 2.0	Criteria Weight = 1.0	Criteria Weight = 0.5	Criteria Weight = 0.25	Criteria Weight = 0.1	Criteria Weight = 0
Floodwater Storage		High	Moderate			Low & NA
In floodplain?		Yes				No
Sediment and Other Particulate Retention		High	Moderate			Low
Nutrient Transformation (P-focus)		High	Moderate			Low
Shoreline/Streambank Stabilization		High	Moderate			Low & NA
Stream Baseflow Maintenance		High	Moderate			Low & NA
Stream Shading				High	Moderate	Low & NA
Native Fish Habitat				High	Moderate	Low & NA
Unique Wetland Resource	High					NA
Waterfowl Habitat				High	Moderate	Low & NA
Wetland-Dependent Bird Habitat, Other				High	Moderate	Low & NA
Wildlife Movement Corridor				High	Moderate	Low & NA
Woodland Amphibian Habitat				High	Moderate	Low & NA

2) Based on the sum of scores for each polygon, all polygons were classified as High, Medium, or Low priority.

APPENDIX H:
COST ESTIMATES FOR BEST MANAGEMENT PRACTICES

ACTION	COST	BMP TYPE
Cover Crops, other best-fit BMPs	$100 - $300 per acre	Agricultural BMPs
Grassed Buffer/Filter Strip	$1,000 - $3,000 per acre	Agricultural BMPs
Land Retirement	$1,000 - $3,000 per acre	Agricultural BMPs
Bioswale, other best-fit vegetated filtration and infiltration BMPs	$25 per square foot	Beach Management
Invasive Species Control	$5,000 - $10,000 per acre	Beach Management
Plan Creation	$90,000 - $120,000 each	Beach Management
Debris Jam Removal	$15,000 - $110,000 depending on level of sedimentation	Debris Jam
Detention Basin Debris Removal	$6,000 - $10,000 per acre	Detention Basin Retrofit
Detention Basin Retrofit	$50,000 - $100,000 per acre	Detention Basin Retrofit
Golf Course BMPs	Project-dependent, not estimated	Golf Course Management
See Table 6-20 for Lake Actions	See Table 6-20 for Lake Actions	Lake Actions
Lakeshore Stabilization	$150 - $400 per linear foot	Lakeshore Stabilization
De-icing BMPs	Project-dependent, not estimated	Road Salt Management
Runoff Volume Reduction	$10 - $50 per square foot	Runoff Volume Reduction
Riparian Buffer and In-channel Enhancement	$500 - $1,000 per linear foot	Stream Restoration
Streambank Stabilization	$150 - $400 per linear foot	Streambank Stabilization
Discharge Point Repair/Replacement	$10,000 - $50,000 each	Water Infrastructure
Hydraulic Structure Repair/Replacement	$15,000 - $100,000 each	Water Infrastructure
Wetland Enhancement	$20,000 - $40,000 per acre	Wetland Enhancement
Wetland Restoration	$70,000 - $100,000 per acre	Wetland Restoration

*Specific action costs from detailed engineering plans not included in this Appendix.

APPENDIX I:
FUNDING SOURCES

This list of potential funding sources is compiled from a variety of sources. Funding and program availability are contingent upon federal, state, and local budgets and appropriations for the budget year in which funding is being sought, so changes may have occurred that are not reflected in the list. Contact the program representative or funding agency for updates or changes to program details. Watershed-specific funding sources are identified where appropriate.

Reference Sources

Several grant search engines and organizations exist to help identify funding sources. Fees for services or products may be charged by these organizations. When searching, be sure to clarify whether charges will be incurred. For "do-it-your-selfers," local grant data collection centers are available throughout Illinois.

Resources	Reference information
Catalog of Federal Domestic Assistance (CFDA) listed through the System for Award Management (SAM)	https://sam.gov/content/assistance-listings The catalog lists all federal funding programs available, including those for conservation. All organizations applying for federal funding must have a Unique Entity ID, a 12-character alphanumeric ID assigned by SAM.gov.
Federal Tax Incentives for Conservation	Owners of environmentally sensitive land that has been donated for conservation purposes, or has been placed in a conservation easement, or simply managed for conservation. Individuals, organizations, and others are all eligible. Websites: https://www.irs.gov/, https://ailt.org/, https://www.irs.gov/pub/irs-drop/n-04-41.pdf, https://www.irs.gov/pub/irs-utl/introduction-to-conservation-easements.pdf, and https://www.irs.gov/pub/irs-soi/17resconlooney.pdf. You can also contact the Illinois EPA, 1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois, 62794-9276. Phone: 217-782-3397.
Illinois Catalog of State Financial Assistance	https://gata.illinois.gov/grants/csfa.html The Catalog of State Financial Assistance (CSFA) is a single, authoritative, statewide, comprehensive source document of State financial assistance program information.
USEPA Green Infrastructure Funding Opportunities	https://www.epa.gov/green-infrastructure/green-infrastructure-funding-opportunities
Environmental Grantmakers Association	Provides a list of environmental grant foundations. https://ega.org/collaborate/grant-seekers
Forefront (formerly the Donors Forum of Chicago)	200 W. Madison St., 2nd Floor, Chicago, IL 60606. Phone: 312-578-0090. Website: https://myforefront.org/ E-mail: info@myforefront.org
eCivis Grants Network	Assistance for local governments to improve their grants success through expert grant research, information, grant training, and technology. eCivis, Inc. 3452 E. Foothill Blvd, Floor 9, Pasadena, CA 91107. Website: http://www.ecivis.com/ Phone: 877-232-4847. Email sales@ecivis.com or fill out the following contact form: https://ecivis.com/contact-us/

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
U.S. Environmental Protection Agency (USEPA) - issues federal environmental regulations, enforces federal environmental law, and manages many grant programs. (https://www.epa.gov/grants)					
Brownfields Grants – Assessment Grants, Revolving Loan Fund Grants, Cleanup Grants, Multipurpose Grants, Job Training Grants	EPA's Brownfields program provides direct funding for Brownfields assessment, cleanup, revolving loans, environmental job training, technical assistance, and research. EPA's Brownfields Program collaborates with other EPA programs, other federal partners, and state agencies to identify and make available resources that can be used for Brownfields activities. In addition to direct Brownfields funding, EPA also provides technical information on Brownfields financing matters.	Local governments, private not-for-profit (501C3) groups, and others	Assessment: Up to $500,000 $2,000,000 Cleanup: Up to $500,000, up to $1 million, or up to $2 million per application Revolving Loan: Up to $1,000,000 (see website link for more opportunities) Multipurpose: Up to $800,000 Job Training: For FY 2024 anticipated total estimated funding of $12 million and an estimated 24 grants awarded	https://www.epa.gov/brownfields/types-epa-brownfield-grant-funding	EPA Region 5 John Jurevis 77 West Jackson Boulevard Mail Code SB-5J Chicago, IL 60604-3507 312-886-1446 Jurevis.John@epa.gov
Environmental Education (EE) Grants	The EE Grants Program funds environmental education projects that promote awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. This program supports projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques. The EPA's ability to fund EE grants depends on budget appropriations. To stay up to date on when funding becomes available and on other EPA Environmental Education information, subscribe to the EE Grants Listserv; under "All Topics", click on "Interest" and select "Environmental Education": https://www.epa.gov/newsroom/email-subscriptions-epa-news-releases	Local and state educational organizations, private not-for profit groups, and local governments	3-4 annual grant projects chosen for $50,000 - $100,00 grant funding; cost Sharing requirement of at least 25% of total costs from non-federal matching funds	https://www.epa.gov/education/grants	Megan Gavin U.S. EPA, Region 5 77 West Jackson Boulevard Mail Code AT-18J Chicago, IL 60604 gavin.megan@epa.gov

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
Environmental Justice (EJ) Grants, Funding, and Technical Assistance	The **Environmental Justice Thriving Communities Grantmaking (EJ TCGM) Program** is a competition to select multiple Grantmakers around the nation to reduce barriers to the application process communities face and increase the efficiency of the awards process for environmental justice grants. The **Environmental and Climate Justice (ECJ) Block Grant Program** provides funding for financial and technical assistance to carry out environmental and climate justice activities to benefit underserved and overburdened communities. The **Collaborative Problem-Solving (EJCPS) Cooperative Agreement Program** provides funding for projects that address local environmental and public health issues within an affected community. The **Government-to-Government (EJG2G) Program** provides funding to governmental entities at the state, local, territorial, and tribal level to support and/or create model government activities that lead to measurable environmental or public health results in communities disproportionately burdened by environmental harms and risks. The **Thriving Communities Technical Assistance Centers (EJ TCTAC) Program** aims to establish technical assistance centers across the nation providing technical assistance, training, and related support to communities with environmental justice concerns. The **Small Grants (EJSG) Program** supports and empowers communities working on solutions to local environmental and public health issues. The program is designed to help communities understand and address exposure to multiple environmental harms and risks.	Varies	Varies	https://www.epa.gov/environmentaljustice/environmental-justice-grants-funding-and-technical-assistance EJ TCGM Webinar Slides: https://www.epa.gov/system/files/documents/2023-05/EJ%20TCGM_%20Webinar_FINAL_5.30.23.pdf	US EPA, REGION 5 Kathy Triantafillou triantafillou.kathy@epa.gov 77 West Jackson Blvd. (E-19J) Chicago, IL 60604-3507 312-353-4293
Smart Growth Technical	Offers grants to support activities that improve the quality of development and protect human health and the environment	Local governments, private not-for-profit groups, and others	In-kind contributions with assistance preferred	https://www.epa.gov/smartgrowth/epa-smart-	Office of Community Revitalization (MC 1807T) U.S. EPA

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
Assistance Opportunities				growth-grants-and-other-funding	1200 Pennsylvania Avenue NW Washington, DC 20460smartgrowth@epa.gov
Five Star and Urban Waters Restoration Grant Program	This program brings together citizen groups, corporations, youth groups and students, landowners, and government agencies to undertake projects that restore streambanks and wetlands. Projects must include a strong wetland or riparian restoration component, and should include education, outreach, and community stewardship.	Non-profit 501(c) organizations, state government agencies, local governments, municipal governments, Tribal Governments and Organizations, and educational institutions Requires at least five or more partnering organizations	$10,000 - $40,000 (avg. $20,000) grant funding	Overview: https://www.epa.gov/wetlands/5-star-wetland-and-urban-waters-restoration-grants Application Information: https://www.nfwf.org/programs/five-star-and-urban-waters-restoration-grant-program	Myra Price price.myra@epa.gov USEPA Wetlands Division Room 7410G (4502 T) 1200 Pennsylvania Avenue, NW Washington, DC 202-566-1225 Kristen Faulhaber Region 5 Wetlands Grants 312-353-4378 faulhaber.kristen@epa.gov
USEPA Office of Wastewater Management (OWM)	OWM supports the Clean Water Act by promoting effective and responsible water use, wastewater treatment, disposal and management and by encouraging the protection and restoration of watersheds. OWM provides regulatory standards, voluntary management approaches, and financial and technical assistance to states, Tribes, communities, and regulated entities to protect human health and aquatic ecosystems, reduce flooding, and protect the nation’s infrastructure investment.	Varies	Informational only inks available to multiple grant funding opportunities	https://www.epa.gov/aboutepa/about-office-water#wastewater	Environmental Protection Agency OWM (Mail Code: 4201M) 1200 Pennsylvania Avenue, N.W. Washington, DC 20460 202-564-0748 Andrew Sawyers sawyers.andrew@epa.gov
Wetland Program Development Grants (WPDG)	WPDGs provide eligible applicants an opportunity to conduct projects that promote the coordination and acceleration of research, investigations, experiments, training, demonstrations, surveys and studies relating to the causes, effects, extent, prevention, reduction and elimination of water pollution.	States, tribes, local governments, interstate associations, and intertribal consortia are eligible to apply for the Regional WPDG Request for Proposals (RFPs).	$75,000 - $220,000 with 25% local match requirement “WPDG Match Calculator (xlsx)” file is available on the website	https://www.epa.gov/wetlands/wetland-program-development-grants-and-epa-wetlands-grant-coordinators	Dertera Collins collins.dertera@epa.gov EPA Region 5 77 West Jackson Blvd., MC WW16J Chicago, IL 60604 312-353-6291

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
		Nonprofits, interstate associations and intertribal consortia are eligible to apply for the National WPDG RFPs.			
Great Lakes Restoration Initiative ***SPECIFIC TO LAKE MICHIGAN WATERSHED***	This initiative accelerates efforts to protect and restore the Great Lakes. Since 2010, the multi-agency GLRI has provided funding to 16 federal organizations to strategically target the biggest threats to the Great Lakes ecosystem and to accelerate progress related to fish consumption, safe drinking water, recreational water quality, Areas of Concern, invasive species, harmful algal blooms, and habitat protection.	States, tribes, local governments, universities, nongovernmental organizations	Varies by agency	https://www.glri.us/funding	Michael Russ russ.michael@epa.gov John Haugland haugland.john@epa.gov
Voluntary School and Child Care Lead Testing and Reduction Grant Program	The Water Infrastructure Improvements for the Nation (WIIN) Act established this grant program to award funding to states, territories, and tribes to assist local and tribal educational agencies in voluntary testing for lead contamination in drinking water at schools and childcare facilities. The Bipartisan Infrastructure Law amended the program and allowed funding for lead remediation in addition to testing. The Illinois Department of Public Health (IDPH) is implementing the Illinois lead program.	States, the District of Columbia, and territories, and tribes within the U.S The grant program is a noncompetitive voluntary program.	Funding is awarded to states based on an allocation formula that includes factors such as population including a set-aside for tribal allotments.	https://www.epa.gov/dwcapacity/wiin-grant-voluntary-school-and-child-care-lead-testing-and-reduction-grant-program#state%C2%A0 https://dph.illinois.gov/topics-services/environmental-health-protection/lead-poisoning-prevention.html	Kori Johnson-Lane EPA Region 5 johnsonlane.kori@epa.gov IDPH Asbestos and Lead Programs Phone: 217-782-3517
People, Prosperity and the Planet (P3) Student Design Competition	P3 is a competitive grants program that provides teams of undergraduate and graduate students an opportunity to gain invaluable experience through classroom learning, laboratory and field work to address environmental issues. These projects promote a shift towards more environmentally benign products, processes, and systems with the aim of improving quality of life, promoting economic prosperity, and protecting the planet.	Teams of undergraduate and/or graduate students attending U.S. colleges, universities and other post-secondary educational	Two-year award of up to $75,000	https://www.epa.gov/P3	Angela Page Office of Science Advisor, Policy & Engagement Office of Research and Development Washington, DC 202-564-7957 page.angelad@epa.gov

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
		institutions; student team members and faculty advisors must be U.S. citizens or be lawfully admitted to the U.S.			
Source Reduction Assistance (SRA) Grants	SRA grants support research, investigation, experiments, surveys, study, demonstration, education and training using source reduction approaches (also known as P2 or pollution prevention). EPA is particularly interested in projects that promote practical source reduction practices, tools, and training on P2 approaches to measurably improve human and environmental health by reducing the use of hazardous substances, reducing toxic pollutants, reducing resource use (e.g., water and energy) and reducing expenditures and liability costs to businesses, non-profit organizations and/or communities.	States, local, interstate, and intrastate government agencies and instrumentalities, federally recognized tribes, inter-tribal consortia and Section 501 (c)(3) non-profit organizations (not 501(c)(4) organizations that lobby)	$1,135,000 in federal funds awards ranging from $40,000 to $250,00 5% match requirement	https://www.epa.gov/p2/source-reduction-assistance-grants	Christine Clark U.S. EPA Region 5 77 West Jackson Boulevard (LM-8J) Chicago, IL 60604-3590 312-886-9749 clark.christine@epa.gov
Small Business Innovation Research (SBIR) Program	The SBIR program funds small businesses to develop and commercialize innovative environmental technologies. The main purpose is to perform research and development – not purchase equipment or commercialize a technology that has already been developed, or one that has very low risk and only needs capital. Broad areas of focus typically include clean and safe water, air quality and climate, land revitalization, homeland security, sustainable materials management, safer chemicals, and risk assessment. More specific topics under each of these broad areas change from year to year.	Company must be for profit, U.S. owned/operated, and under 500 people. Work must be done in the U.S.	Phase I (6 months) -Up to $100,000 Phase II (2 years) -Up to $400,000 -Funding based on the Phase I results Further Funding for Commercialization -Up to $100,000 -"Commercialization option" in Phase II for	https://www.epa.gov/sbir	Office of Science Advisor, Policy & Engagement U.S. Environmental Protection Agency 1200 Pennsylvania Avenue NW Room: 8104R Washington, D.C. 20460 OSAPE_Communications@epa.gov

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
			companies that secure third-party investment		
Illinois Environmental Protection Agency (Illinois EPA) administers state and federal environmental programs and regulations.					
Clean Water Act Section 319 Grants	These grants provide funding for implementing corrective and preventative best management practices (BMPs) on a watershed scale, for the demonstration of innovative BMPs on a sub-watershed scale, and the development of information and education nonpoint source pollution control programs.	State and local governments, nonprofits, individuals, businesses	Federal cost share at 60% maximum, 40% local match	https://epa.illinois.gov/topics/water-quality/watershed-management/nonpoint-sources/grants.html	Illinois EPA, Bureau of Water Watershed Management Section Nonpoint Source Unit 1021 North Grand Avenue East P.O. Box 19276 Springfield, Illinois 62794-9276 217-782-3362 epa.bowgrants@illinois.gov
Green Infrastructure Grant Opportunities (GIGO)	The new GIGO Program funds projects to construct green infrastructure best management practices (BMPs) that prevent, eliminate, or reduce water quality impairments by decreasing stormwater runoff into Illinois' rivers, streams, and lakes. Projects that implement treatment trains and/or multiple BMPs within the same watershed may be more effective and efficient than a single large green infrastructure BMP.	State and local governments, nonprofits, individuals, businesses	Up to 75% cost share for approved project costs; 25% local match Assistance may increase up to 85% for disadvantaged areas	https://epa.illinois.gov/topics/grants-loans/water-financial-assistance/gigo.html	Illinois EPA, Bureau of Water Watershed Management Section Green Infrastructure Grant Opportunities 1021 North Grand Avenue East P.O. Box 19276 Springfield, Illinois 62794-9276 217-782-3362
Unsewered Communities Construction Grant Program (UCCGP) and Unsewered Communities Planning Grant Program (UCPGP)	The IL EPA is aware of over 200 IL communities that have inadequate or nonexistent wastewater collection and treatment facilities, resulting in illegal surface discharges. To assist in providing solutions to this human health hazard and the adverse environmental impacts these situations harbor, IL EPA is making $100 million available through the Rebuild Illinois Capital Plan over five years for Construction Grants for wastewater collection and/or treatment facilities and making $1 million available for the next 4 years for Planning Grants to assist small and disadvantaged communities in developing a Project Plan that identifies a solution to their wastewater collection and treatment needs.	Applicants must be in good standing with the Secretary of State. Eligible proposals will come from a local government unit within the State of Illinois, as defined in Title 35 of the Illinois Administrative Code Part 365.	Varies; learn more at the following links: https://epa.illinois.gov/topics/grants-loans/unsewered-communities/uccgp.html https://epa.illinois.gov/topics/grants-loans/unsewered-communities/ucpgp.html	https://epa.illinois.gov/topics/grants-loans/unsewered-communities.html	Lanina Clark Unsewered Communities Grant Program Project Manager Lanina.Clark@illinois.gov

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
Streambank Cleanup and Lakeshore Enhancement (SCALE)	SCALE provides funds to assist groups that have established a recurring stream or lakeshore cleanup. Funds are typically used for safety attire, dumpster rentals, landfill tipping fees and promotional materials.	Organizations that have an established streambank/ lakeshore cleanup	100% cost share, awards range from $500 to $3,500	https://epa.illinois.gov/topics/water-quality/surface-water/scale.html	Illinois EPA, Bureau of Water Watershed Management Section Green Infrastructure Grant Opportunities 1021 North Grand Avenue East P.O. Box 19276 Springfield, Illinois 62794-9276 (217) 782-3362
State Revolving Fund (SRF)	SRF provides financial assistance for the design and construction of projects that protect or improve the quality of Illinois' water resources. It includes two loan programs: the Water Pollution Control Loan Program (WPCLP) which funds both wastewater and storm water projects, and the Public Water Supply Loan Program (PWSLP) for drinking water projects.	State and local governments, nonprofits, individuals, businesses	Funds projects at 100% Loan Interest Rate is adjusted annually and is based on the State of IL Fiscal Year	https://epa.illinois.gov/topics/grants-loans/state-revolving-fund.html	Illinois EPA, Infrastructure Financial Assistance Section 1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois, 62794-9276. 217-782-2027
Lake Volunteers Program	Each year, volunteers help the Lake County Health Department monitor the county's numerous lakes. A primary goal of this program is to familiarize volunteers with lake processes and the cause-and-effect relationships that exist between their lake, its watershed, weather and human activities.	Lake owners	Technical assistance; training and equipment available through LCHD	https://www.lakecountyil.gov/2381/Ecological-Services	Alana Bartolai, Lake County Health Department 500 W. Winchester Road, Unit 102 Libertyville, IL 60048 847-377-8009
Federal Emergency Management Agency (FEMA) manages programs that assist communities in disaster planning and hazard mitigation					
Flood Mitigation Assistance (FMA)	FMA helps states and communities identify and implement measures to reduce the risk of flood damage to structures insured under the National Flood Insurance Program (NFIP). These projects lessen the frequency or severity of flooding and decrease flood damage.	States, tribes and territories can submit applications on behalf of subapplicants. Homeowners, business operators, and non-profit organizations can be included in a subapplication submitted by an eligible subapplicant.	Federal cost share maximum of 75%, see website for funding caps	https://www.fema.gov/grants/mitigation/floods	FEMA Region 5, 536 South Clark Street, Chicago, IL 60605 312-408-5500

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Hazard Mitigation Grant Program (HMGP)	HMGP provides funding to state, local, tribal and territorial governments so they can rebuild in a way that reduces, or mitigates, future disaster losses in their communities. Funding assistance for implementing long-term hazard mitigation planning and projects follows a Presidential major disaster declaration.	State and local governments, qualified nonprofit organizations, tribal governments	Funding subject to a sliding scale formula. Federal cost share maximum of 75%.	https://www.fema.gov/grants/mitigation/hazard-mitigation	Sam M. AL-Basha Illinois Emergency Management Agency 1035 Outer Park Drive Springfield, Illinois 62704 217-785-9942 sam.m.al-basha@illinois.gov
Pre-Disaster Mitigation (PDM) Grant Program	The PDM grant program provides funding to state, local, tribal, and territorial governments to plan for and implement sustainable cost-effective measures designed to reduce the risk to individuals and property from future natural hazards, while also reducing reliance on federal funding from future disasters.	Only states, territories, or federally recognized tribal governments identified by Congress are eligible to apply; local governments identified in the funding opportunity are considered subapplicants.	Funding varies each year. Federal cost share is generally 75%; small, impoverished communities are eligible for up to 90% federal cost share.	https://www.fema.gov/grants/mitigation/pre-disaster	Sam M. AL-Basha Illinois Emergency Management Agency 1035 Outer Park Drive Springfield, Illinois 62704 217-785-9942 sam.m.al-basha@illinois.gov
National Flood Insurance, Increased Cost of Compliance Program (ICC)	ICC provides flood insurance policyholders with flood damaged homes and businesses in high-risk areas, also known as Special Flood Hazard Areas, with assistance to help pay the costs to bring their home or business into compliance with their community's floodplain ordinance, including building elevation, relocation, demolition, or floodproofing. The buildings must have been substantially or repetitively damaged.	Flood insurance policy holders	Federal assistance up to $30,000	https://www.fema.gov/floodplain-management/financial-help/increased-cost-compliance	For more information on ICC coverage, call your insurance company or agent, or call the NFIP toll-free at 1-800-427-4661

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Building Resilient Infrastructure and Communities (BRIC) *Replaced the Pre-Disaster Mitigation Program (PDM)*	BRIC program aims to categorically shift the federal focus away from reactive disaster spending and toward research-supported, proactive investment in community resilience. FEMA anticipates BRIC funding projects that demonstrate innovative approaches to partnerships, such as shared funding mechanisms, and/or project design.	States, territories and federally recognized tribal governments may serve as applicants; local governments may be included as subapplicants; homeowners, business operators and nonprofit organizations can be included in a subapplication submitted by an eligible subapplicant	Varies by applicant type; cost share required for all subapplications Learn more about funding and cost share requirements on the website.	https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities	Sam M. AL-Basha Illinois Emergency Management Agency 1035 Outer Park Drive Springfield, Illinois 62704 217-785-9942 sam.m.al-basha@illinois.gov
U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS) partners with state conservationist offices and provides funding and technical assistance to landowners to promote soil and water conservation.					
Agricultural Conservation Easement Program (ACEP)	ACEP helps to protect, restore, and enhance wetlands or protect working farms and ranches through conservation easements. ACEP includes the following: -Agricultural Land Easements (ALE) help private and tribal landowners, land trusts, and other entities such as state and local governments protect croplands and grasslands on working farms and ranches by limiting non-agricultural uses of the land through conservation easements. -Wetland Reserve Easements (WRE) help private and tribal landowners protect, restore and enhance wetlands which have been previously degraded due to agricultural uses. -The Wetland Reserve Enhancement Partnership (WREP) is a voluntary program through which NRCS helps partners to leverage resources to carry out high priority wetland protection, restoration, and enhancement and to improve wildlife habitat.	Landowners, land trusts, and other entities	Check with the county-based USDA Service Centers for application deadlines and most current information.	https://www.nrcs.usda.gov/programs-initiatives/acep-agricultural-conservation-easement-program	Paula Setchell Farm Service Agency Office Woodstock Service Center 1648 S. Eastwood Drive Woodstock, IL 60098 815-338-0444 Ext 2 paula.setchell@usda.gov Rebecca Briggs Natural Resources Conservation Service Office Woodstock Service Center 1648 S. Eastwood Drive Woodstock, IL 60098 815-338-0444 rebecca.briggs@usda.gov

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Conservation Innovation Grants (CIG) Program	CIG is a competitive program that supports the development of new tools, approaches, practices, and technologies to further natural resource conservation on private lands. A national CIG funding notice is announced each year; funds for single- or multi-year projects, not to exceed three years, will be awarded through a nationwide competitive grants process. The CIG state component emphasizes projects that benefit a limited geographical area. Participating states announce their funding availability for CIG competitions through their state NRCS offices.	State or local governments, federally-recognized American Indian tribes, non-governmental organizations, and individuals in all 50 states, District of Columbia, Caribbean Area, and Pacific Islands Area	Check with the county-based USDA Service Centers for application deadlines and most current information.	https://cig.sc.egov.usda.gov/?utm_source=nrcs-cig&utm_medium=site&utm_campaign=obv-redirect	Paula Setchell Farm Service Agency Office Woodstock Service Center 1648 S. Eastwood Drive Woodstock, IL 60098 815-338-0444 Ext 2 paula.setchell@usda.gov Rebecca Briggs Natural Resources Conservation Service Office Woodstock Service Center 1648 S. Eastwood Drive Woodstock, IL 60098 815-338-0444 rebecca.briggs@usda.gov
Conservation Reserve Program (CRP)	CRP is a land conservation program administered by FSA. In exchange for a yearly rental payment, farmers enrolled in the program agree to remove environmentally sensitive land from agricultural production and plant species that will improve environmental health and quality. Through the State Acres for Wildlife Enhancement (SAFE) initiative, landowners restore vital habitat in alignment with high-priority state wildlife conservation goals.	Non-federal landowners engaged in farming or ranching	Annual rental payments, as well as certain incentive payments and cost share assistance	https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/	
Conservation Stewardship Program (CSP)	CSP promotes the conservation of soil, water, air, energy, plant and animal life located on working lands. This program can help identify natural resource problems in your farming operation and provide technical and financial assistance to solve those problems or attain higher stewardship levels in an environmentally beneficial and cost-effective manner.	Individuals, organizations, and others	Check with the county-based USDA Service Centers for application deadlines and most current information. In-kind services or operations are required	https://www.nrcs.usda.gov/programs-initiatives/csp-conservation-stewardship-program	
Conservation Partners Program (CPP)	CPP provides competitive grants that support the adoption of conservation practices and regenerative agriculture principles on working lands. Some of these principles include: 1) minimizing chronic disturbances to the soil and biological community; 2) enhancing wildlife habitat; 3) maximizing crop diversity; 3) keeping the soil covered; 4) keeping a living root in the ground at all times; 5) efficiently managing water	Non-profit 501(c) organizations, state government agencies, local governments, municipal governments, tribal governments and organizations, and	$100,000 - $600,000 Matching contributions are not required, but projects that offer higher match ratios may be more competitive.	https://www.nfwf.org/programs/conservation-partners-program#:~:text=The%20Conservation%20Partners%20Program%20provides,Bill%20programs%20on%20working%20lands.ht	Todd Hogrefe Central Regional Office 612-564-7286 todd.hogrefe@nfwf.org

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	resources; and 6) integrating livestock into agricultural systems.	educational institutions			
Emergency Watershed Protection Program (EWP)	EWP provides assistance to relieve imminent threats to life and property caused by floods, fires, windstorms and other natural disasters that impair a watershed. May be used to establish vegetative cover, open restricted channels, repair diversions and levees, and purchase floodplain easements on flooded land in non-urban areas. Formal requests for assistance are due 60 days from the disaster or 60 days from when the site becomes accessible.	Public and private landowners with a project sponsor, i.e., a state or local government or special government district	Up to 75% federal cost-share for projects; Up to 90% cost-share for locations that meet the limited-resource areas (LRA) criteria as determined by the NRCS Find the LRA definition and map here: https://www.nrcs.usda.gov/programs-initiatives/ewp-emergency-watershed-protection/ewp-floodplain-buyout-option-for-limited	https://www.nrcs.usda.gov/programs-initiatives/ewp-emergency-watershed-protection	Emergency Watershed Protection Program State Points of Contact: Paula Hingson 217-353-6602 paula.hingson@usda.gov
Rural Development Water & Environmental Programs	WEP provides funding for the construction of water and waste facilities in rural communities and is proud to be the only Federal program exclusively focused on rural water and waste infrastructure needs. WEP also provides funding to organizations that provide technical assistance and training to rural communities in relation to their water and waste activities.	Rural communities with populations of 10,000 or less	Varies	https://www.rd.usda.gov/programs-services/water-environmental-programs	Betsy Dirksen Londrigan 2118 West Park Court, Suite A Champaign, IL 61821 217-403-6200
Environmental Quality Incentives Program (EQIP)	EQIP provides financial and technical assistance to agricultural producers and forest landowners through contracts up to a maximum term of ten years in length. Funding can help plan and implement conservation practices that address natural resource concerns and for opportunities to improve soil, water, plant, animal, air and related resources on agricultural land and non-industrial private forestland.	Non-federal landowners engaged in farming or ranching	Federal share maximum of 75%; some exemptions may qualify for a 90% cost-share.	https://www.nrcs.usda.gov/programs-initiatives/eqip-environmental-quality-incentives	Paula Setchell Farm Service Agency Office Woodstock Service Center 1648 S. Eastwood Drive Woodstock, IL 60098 815-338-0444 Ext 2 paula.setchell@usda.gov Rebecca Briggs Natural Resources Conservation Service Office

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					Woodstock Service Center 1648 S. Eastwood Drive Woodstock, IL 60098 815-338-0444 rebecca.briggs@usda.gov
National Water Quality Initiative (NWQI)	NWQI is a partnership among NRCS, state water quality agencies and the U.S. EPA to identify and address impaired water bodies through voluntary conservation. NRCS provides targeted funding for financial and technical assistance in small watersheds most in need and where farmers can use conservation practices to make a difference. Conservation systems include practices that promote soil health, reduce erosion and lessen nutrient runoff. These practices also enhance agricultural productivity and profitability. State water quality agencies and other partners contribute additional resources for watershed planning, implementation, outreach, and monitoring.	Landowners	Check with the county-based USDA Service Centers for application deadlines and most current information.	https://www.nrcs.usda.gov/programs-initiatives/national-water-quality-initiative	John Bullough Conservation Initiatives Coordinator: Water Quality john.bullough@usda.gov
Streambank Stabilization and Restoration Program	The Streambank Stabilization and Restoration Program is designed to demonstrate effective, inexpensive vegetative and bio-engineering techniques for limiting stream bank erosion. Program monies fund demonstration projects at suitable locations statewide and provide cost-share assistance to landowners with severely eroding stream banks.	All landowners and project sites (rural and urban) in each Illinois county	Check with the McHenry-Lake County Soil & Water Conservation District for details	https://agr.illinois.gov/resources/conservation.html	McHenry-Lake County Soil & Water Conservation District Spring Duffey Executive Director Spring.Duffey@il.nacdnet.net 1648 S. Eastwood Drive Woodstock, IL 60098 815-338-0444 x3
Watershed and Flood Prevention Operations Program (WFPO)	The WFPO Program provides technical and financial assistance to States, local governments and Tribes (project sponsors) to plan and implement authorized watershed project plans.	Public sponsorship Watershed projects up to 250,000 acres Agricultural benefits, including rural communities, must be ≥ 20% of the total benefits for the project	Varies	https://www.nrcs.usda.gov/programs-initiatives/watershed-and-flood-prevention-operations-wfpo-program	Matt Robert NRCS Illinois Watershed Program Manager 217-353-6629 matthew.robert@usda.gov

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U.S. Department of Agriculture, Forest Service (USDA-FS) manages programs that promote forestry and natural enhancement of urban areas through urban forestry programs.					
Urban and Community Forestry (UCF) Program and Inflation Reduction Act Grants	The UCF program provides technical, financial, and educational assistance, delivering nature-based solutions for climate and environmental justice, and green jobs where more than 84% of Americans live, work, and play. Some of the program goals include: • Conserving working forest landscapes • Protecting forests from harm • Enhancing benefits associated with trees and forests • Advancing environmental justice • Training the future workforce for green jobs Under the Inflation Reduction Act, the UCF Program received a historic $1.5 billion to support urban tree-planting, urban forest planning and management, and related activities, particularly in disadvantaged communities. Learn more at the website.	Local governments, educational organizations, individuals, and others	Varies	https://www.fs.usda.gov/managing-land/urban-forests/ucf	Michael Brunk Illinois Urban Forestry Administrator Illinois Department of Natural Resources One Natural Resources Way Springfield, IL 62702 217-558-2517Michael.Brunk@illinois.gov
U.S. Department of Energy (USDOE) compiles and distributes a list of monthly funding opportunities relating to energy and the environment. Go to https://www.energy.gov/eere/office-energy-efficiency-renewable-energy and click on "Clean Energy Funding".					
U.S. Department of the Interior, Fish and Wildlife Service (USFWS) manages programs to protect wildlife and habitat by means such as issuing rules for hunters and anglers, administering the Endangered Species Act, and awarding grants for environmental restoration.					
Chi-Cal Rivers Fund ***SPECIFIC TO CHICAGO RIVER WATERSHED***	The Chi-Cal Rivers Fund is a public-private partnership working to restore the health, vitality and accessibility of the waterways in the Chicago and Calumet region by supporting green stormwater infrastructure, habitat enhancement, and public-use improvements.	Local, state, federal, and tribal governments and agencies, special districts, non-profit 501(c) organizations, and educational institutions Chi-Cal Grant: *Only Chicago & Calumet*	$150,000 -$350,000; No match required but projects providing some match are more competitive	https://www.nfwf.org/programs/chi-cal-rivers-fund	Traci Giefer Great Lakes Prgm. Sr. Manager 612-564-7296 traci.giefer@nfwf.org
Bring Back the Natives (BBN)	BBN seeks to restore, protect and enhance native fish species of conservation concern nationwide, especially in areas on or adjacent to federal agency lands. BBN awards grants to projects that address the leading		Up to $510,000; 1:1 non-federal cash, in-kind donations, and/or volunteer labor	https://www.nfwf.org/programs/bring-back-native-fish?activeTab=tab-1	Kirstin Neff Southwest Rivers Program Manager 303-222-6485 kirstin.neff@nfwf.org

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
	factors in native fish species decline such as habitat alteration, environmental change, and invasive species.	*region (watersheds) applicants eligible* *BBN: Priority Projects to Great Lakes native fishes*			
Monarch Butterfly and Pollinators Conservation Fund	The Monarch Butterfly and Pollinators Conservation Fund helps to protect, conserve and increase habitat for the monarch butterfly and other pollinators. This program supports implementation of technical assistance to increase pollinator conservation practices on private working lands and improves the availability of high-quality pollinator habitat.		$150,000 - $300,000; Matching requirements vary, see website for details	https://www.nfwf.org/programs/monarch-butterfly-and-pollinators-conservation-fund	Crystal Boyd Pollinator Programs Senior Manager crystal.boyd@nfwf.org
Partners for Fish and Wildlife Programs	The Partners for Fish and Wildlife Program provides technical and financial assistance to landowners interested in restoring and enhancing wildlife habitat on their land. Projects are custom designed to meet landowners' needs.	Non-state and non-federal landowners, individuals, local government, and non-government organizations	Varies	https://www.fws.gov/program/partners-fish-and-wildlife	Michael Redmer One Natural Resources Way Springfield, IL 62702 217-557-4474 michael_redmer@fws.gov
Resilient Communities Program	The program emphasizes community inclusion and assistance to traditionally underserved populations in vulnerable areas. Regional awards will provide both natural habitat enhancement and improved protections afforded by natural resources.	Non-profit 501(c) organizations, local governments, state government agencies, and federally recognized tribes in the US	$100,000 - $500,000	https://www.nfwf.org/programs/resilient-communities-program/resilient-communities-2020-request-proposals	Carrie Clingan Program Director, Community Stewardship and Youth 202-595-2471 carrie.clingan@nfwf.org
National Coastal Wetlands Conservation Grants	The program supports long-term wetland conservation by awarding up to $1 million for wetland conservation projects. Between $18 million and $23 million are available for projects annually. Funding for the grant program is provided by the Sport Fish Restoration and Boating Trust Fund. Priority is given to projects that: support the goals of the National Wetlands Priority Conservation Plan, provide long-term conservation, conserve maritime forest on coastal barrier islands, benefit threatened and endangered species, encourage public-private partnerships, or complement other conservation projects.	Coastal and Great Lakes states, U.S. commonwealths, and territories; Tribes, local governments, conservation organizations, and private landowners are encouraged to work with state agencies to develop a project and apply.	States provide 50% of the project cost or 25% if the state has a land conservation program. Match can be provided by the state or partners and may include the value of previously conserved land and in-kind contributions.	https://www.fws.gov/story/national-coastal-wetlands-conservation-grants	Christie Deloria-Sheffield Great Lakes Coastal Program Coordinator Contact Form: https://www.fws.gov/staff-profile/christie-deloria-sheffield

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National Park Service (NPS) manages the nation's system of national parks, historic sites, etc. and serves as a conduit for some recreation-related conservation funding. (https://www.nps.gov/index.htm)					
Rivers, Trails, and Conservation Assistance Program (RTCA)	NPS-RTCA provides planning, design, and technical expertise for conservation and outdoor recreation projects. The program strives to build healthy communities, conserve lands and waters, develop organizational capacity, support public land management collaboration, and engage youth. While NPS-RTCA does not provide financial assistance or monetary grants, the program can help organizations identify potential funding sources for their projects.	Nonprofit organizations, community groups, tribal governments, national parks, and local, state, and federal government agencies	Technical Assistance	https://www.nps.gov/orgs/rtca/index.htm	David Thomson Midwest Program Manager MWR_RTCA@nps.gov
U.S. Department of Transportation (DOT) regulates the federally mandated metropolitan planning process and administers federal transportation funding.					
Illinois Transportation Enhancement Program (ITEP)	ITEP allocates resources to well-planned projects that provide and support alternate modes of transportation, enhance the transportation system through preservation of visual and cultural resources, and improve the quality of life for members of the communities. These set-aside funds include projects such as pedestrian and bicycle facilities, streetscapes, conversion of abandoned railroad corridors to trails, historic preservation, vegetation management, stormwater management, and habitat connectivity.	Local entities with taxing authority	80% federal share of project costs in general, 50% for acquisition Awards up to $3 million	https://idot.illinois.gov/transportation-system/local-transportation-partners/county-engineers-and-local-public-agencies/funding-opportunities/ITEP	General Contact: Illinois Department of Transportation Illinois Transportation Enhancement Program Room 307 2300 South Dirksen Parkway Springfield, Illinois 62764 DOT.ITEP@illinois.gov Bureau of Programming Contact: Brian McCoy Program Manager 217-782-5482 Brian.McCoy@illinois.gov District 1 (Lake County) Contact: Charles Riddle 847-705-4201
Illinois Department of Natural Resources (IDNR) manages, conserves and protects Illinois' natural, recreational and cultural resources, further the public's understanding and appreciation of those resources, and promotes the education, science and public safety of Illinois' natural resources for present and future generations.					

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
IDNR Grant Opportunities	The IDNR offers multiple funding opportunities. All grants administered by the department are subject to available funding.	Varies	Varies	https://dnr.illinois.gov/grants.html	Illinois Department of Natural Resources One Natural Resources Way Springfield, IL 62702 217-782-6302 DNR.Grants@illinois.gov
Federal Recreational Trails Program (RTP)	This program provides funding assistance for acquisition, development, rehabilitation and maintenance of both motorized and non-motorized recreation trails. By law, 30% of each state's RTP funding must be earmarked for motorized trail projects, 30% for non-motorized trail projects and the remaining 40% for multi-use (diversified) motorized and non-motorized trails or a combination of either.	Federal, state and local government agencies, not-for-profits organizations and private operators of motorized recreational facilities open to the public	Up to 80% project funding Max. grant of $200,000 per application for nonmotorized development projects (represents a total min. project cost of $250,000 per application) No max. grant award amount for acquisition projects and for motorized projects	https://dnr.illinois.gov/aeg/federalrecreationaltrailsprogram.html	Illinois Department of Natural Resources, Office of Grant Management and Assistance One Natural Resources Way Springfield, Illinois 62702 217-782-7481 DNR.Grants@illinois.gov
Illinois Habitat Fund	The Illinois Habitat Fund Grant Program includes projects that are seeking to preserve, protect, acquire or manage habitat (all wetlands, woodlands, grasslands, and agricultural lands, natural or altered) in Illinois that have the potential to support populations of wildlife in any or all phases of their life cycles.	Not-for-profit organizations or government agencies that have the expertise, equipment, and permission from landowners (if applicable) to develop and/or manage habitat	$10,000 - $300,000, no match requirement	https://dnr.illinois.gov/grants/habitat-funding-opportunity.html	Susan Duke, IDNR One Natural Resources Way Springfield, Illinois 62702-1271 217-785-4416 susan.duke@illinois.gov
Open Space Lands Acquisition and Development (OSLAD) Program	OSLAD is a state-financed grant program that provides funding assistance to local government agencies for acquisition and/or development of land for public parks and open space. LWCF is a similar program with	Local units of government	Up to 50% of approved project costs; grant amount varies depending	https://dnr.illinois.gov/grants/openspacelandsaquisitiondevelopment-grant.html	Illinois Department of Natural Resources One Natural Resources Way Springfield, IL 62702-1271

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
Land & Water Conservation Fund program (LWCF)	similar objectives. Projects vary from small neighborhood parks or tot lots to large community and county parks and nature areas.		on project type and number of residents		217-782-7481 DNR.Grants@illinois.gov
Schoolyard Habitat Action Grants	Support enhancement of wildlife habitat, with emphasis on youth involvement and education	Teachers, nature center personnel and adult youth group leaders	Maximum annual award of $2,000 per project	https://dnr.illinois.gov/education/grants/grantsshag.html	Illinois Department of Natural Resources' Division of Education One Natural Resources Way Springfield, IL 62702-1271 217-524-4126 dnr.teachkids@illinois.gov
Illinois Biodiversity Field Trip Grants & Free Educational Materials	This program supports field trips for students to visit natural areas, natural history museums, and other natural resource related activities, so they can study some aspect of Illinois' biodiversity. Conservation education materials, including lesson plans, can be used separately.	Teachers of grades prekindergarten – 12 (including home-schooling teachers)	$500 limit per teacher	https://dnr.illinois.gov/education/grants/grantsibftg.html	
Illinois Coastal Management Program (CMP) Grants ***SPECIFIC TO LAKE MICHIGAN WATERSHED***	CMP grants protect, preserve, and restore the natural and cultural resources along the Illinois Lake Michigan shoreline. Funding is administered by CMP through a cooperative agreement between IDNR and the National Oceanic and Atmospheric Administration (NOAA)'s Office for Coastal Management. To receive funding, a project must advance CMP's priorities within the coastal area boundary. Habitat and low-cost construction projects (including signage) must be located entirely within the coastal area.	Local governments, universities, and non-profit organizations Habitat and construction projects must be located within the Illinois Coastal Zone.	$1,000 - $150,000 (2021)	https://dnr.illinois.gov/cmp/grants.html	Ania Bayers Acting Program Director 312-814-6384 Ania.Bayers@Illinois.gov DNR.CMP@illinois.gov
Illinois Natural Areas Stewardship Grant Program	This program provides grants to Conservation Land Trusts to 1. increase stewardship on dedicated Illinois Nature Preserves and registered Land and Water Reserves and 2. increase stewardship capacity within Conservation Land Trusts. Funding for this grant program is derived from the Illinois Natural Areas Acquisition Fund (NAAF) and must be used by the Department of Natural Resources for the acquisition, protection, and stewardship of natural areas, including habitats for endangered and threatened species.	Conservation Land Trusts exempt from taxation under Section 501 (c) (3) of the federal Internal Revenue Code and include in purposes the restoration and stewardship of land for conservation	Up to $100,000 Match of 5% or $1000, whichever is less	https://dnr.illinois.gov/grants/stewardshipgrants.html	Susan Duke Department of Natural Resources Office of Grant Management and Assistance One Natural Resources Way, Springfield, IL 62702-1271 217-785-4416 susan.duke@illinois.gov
Illinois Department of Agriculture (IDOA)					

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
Sustainable Agriculture Grant Program	This grant program supports practices that maintain producers' profitability while conserving soil, protecting water resources and controlling pests through means that are not harmful to natural systems, farmers or consumers. The grant program funds sustainable agriculture research, education and demonstration through conferences, training, on-farm research and educational outreach.	Organizations, governmental units, educational institutions, non-profit groups and individuals	Varies	https://agr.illinois.gov/resources/conservation.html	Illinois Department of Agriculture Bureau of Land and Water Resources State Fairgrounds P.O. Box 19281 Springfield, IL 62794-9281 217-785-5593
Illinois State Board of Education (ISBE) Useful website to search for educational grants: https://www.isbe.net/Pages/Grants.aspx					
Lake County: https://www.lakecountyil.gov/553/Stormwater-Management-Commission					
Lake County SMC Watershed Management Board (WMB) **Watershed Management Assistance Grant (WMAG)** **Stormwater Infrastructure Repair Fund (SIRF)**	Watershed Management Board (WMB) grants provide up to 50% cost-share for projects that address flood damage mitigation, water quality improvement and natural resources enhancement within Lake County (includes green infrastructure). Flood mitigation/reduction criteria receive the greatest weight in determining funding awards. WMAG supports the growth and sustainability (i.e., organizational capacity) of local watershed partnerships in Lake County. For this program, a "watershed partnership" is defined as an inclusive, enduring, diverse, community-based group organized to identify and resolve watershed problems and issues. The $100,000/year SIRF can assist local units of government in resolving interjurisdictional drainage and flooding related problems (i.e., stormwater management system infrastructure needs). The SIRF program is a 50/50 cost share match for SIRF eligible projects in Lake County.	WMB/WMAG/SIRF: All project proposals must be signed and supported by a WMB member. A WMB Board Member can be a Chief Elected Official of any Lake County Municipality, a Lake County Township Supervisor, the President of an Active Lake County Drainage District, a Lake County Board Member, or a Delegate of one of the above.	Cost-share at least 50% with funds or in-kind services or a combination of both $12,000 set aside for WMAG applications; no cost-share requirement $100,000 - $150,000 available each year for planning, engineering analysis, alternate solution evaluation, design, capital construction, maintenance and repairs projects	https://www.lakecountyil.gov/3635/Watershed-Management-Board-WMB https://www.lakecountyil.gov/2308/Flooding-Flood-Protectionhttp	Lake County Stormwater Management Commission 500 W Winchester Road Libertyville, IL 60048847-377-7700 stormwater@lakecountyil.gov

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
Stream & River Clean Up Projects	SMC offers small grants for stream and river clean-up projects.		Up to $500 for stream and river clean-up projects		
Lake County Deicing Workshop	The Annual Lake County Deicing Workshop provides an opportunity to focus on sensible salting practices for roadways, parking lots and sidewalks. This workshop's snow and ice removal presentations include the effects of weather conditions & storing materials, surface safety, environmental effects (chloride use), materials selection, maintenance best management practices and application rate & calibration.	All winter maintenance operators, planners, supervisors, product distributers, and maintenance personnel	Technical and informational assistance	https://www.lakecountyil.gov/2284/Winter-Maintenance-Best-Practices	Alana Bartolai 847-377-8009 ABartolai2@lakecountyil.gov
Lake County Voluntary Buyout Program	Using federal and state matching grants, SMC offers a voluntary buyout program for repetitively flood damaged structures in Lake County.	SMC maintains a list of properties that are candidates for buyouts when funds become available.	Buyouts are typically 75% federal and 25% local cost share for qualified structures	https://www.lakecountyil.gov/DocumentCenter/View/20510/Voluntary-Floodplain-Buyout-Program-Brochure-PDF?bidId=	Sharon Osterby 847-377-7706 sosterby@lakecountyil.gov
Chicago Metropolitan Agency for Planning (CMAP)					
Local Technical Assistance Program (LTA)	LTA addresses local issues at the intersection of transportation, land use, and housing, including the natural environment (including green infrastructure components), economic growth, and community development. The program provides assistance to communities across the Chicago metropolitan region to undertake planning projects that advance the principles of GO TO 2040.	Local governments, nonprofits, and intergovernmental organizations	Technical Assistance & CMAP recommendations Local match between 5-20% of the value of the assistance for larger planning projects Contribution depends on the type, size, and community cohort	https://www.cmap.illinois.gov/programs/lta	Chicago Metropolitan Agency for Planning 433 West Van Buren Street, Suite 450 Chicago, Illinois 60607 312-454-0400 Can also contact applications@cmap.illinois.gov for questions about the application process
Congestion Mitigation and Air Quality Improvement Program (CMAQ)	CMAQ is a federally funded program of surface transportation improvements designed to improve air quality and mitigate congestion. The primary consideration for CMAQ projects is the cost-effectiveness of their air emissions reductions, measured as either the cost per kilogram of volatile organic compounds (VOC) reduced or the cost per	Any state agency or unit of government having the authority to levy taxes and those agencies authorized to	80% federal / 20% local match	https://www.cmap.illinois.gov/mobility/strategic-investment/cmaq	Refer to the Project Contacts webpage: https://www.cmap.illinois.gov/mobility/strategic-investment/cmaq/project-contacts

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
	kilogram of fine particulate matter (PM2.5) and nitrogen oxides (NOx) reduced.	receive FTA Section 5307 funding Private for-profit and non-profit organizations are required to partner with a public sponsor.			
Transportation Alternatives Program (TAP-L)	The locally programed TAP-L is a federally funded program of surface transportation improvements designed to support non-motorized transportation. The TAP-L program is designed to fund non-motorized transportation projects and in northeastern Illinois those funds are focused on the completion of the Regional Greenways and Trails Plan. For TAP-L funding, only bicycle facility projects are eligible.	Regional trans. authorities, transit agencies, natural resource or public land agencies, school districts, & local or regional gov't entities	65-80% federal funding The local match does not necessarily have to be provided directly by the sponsor but must be a non-federal funding source to qualify. Learn more here: https://www.cmap.illinois.gov/documents/10180/1512766/CMAQ_TAP_CRP_24-28_App_Booklet.pdf/a4315f12-be1a-4375-f391-1dab300939a4?t=1673962249591	https://www.cmap.illinois.gov/mobility/strategic-investment/transportation-alternatives	CMAP Program Manager Doug Ferguson 312-386-8824 dferguson@cmap.illinois.gov
Surface Transportation Program (STP)	STP supports larger-scale regional projects that address regional performance measures and the goals of ON TO 2050. Project eligibility is focused on projects of significant cost and multijurisdictional projects in eight categories that address federal performance measures and priorities of ON TO 2050: bicycle and pedestrian barrier elimination, bus speed improvements, bridge rehabilitation or reconstruction, highway/rail grade crossing improvements, road reconstruction, road expansion, corridor or small area safety, transit station improvements, and truck route improvements.	Any state agency or unit of government having the authority to levy taxes	Lake County: 80% federal/20% local STP funding match Jurisdictions in the highest need group (Cohort 4) are considered eligible to utilize TDCHs as local match for STP-L.	https://www.cmap.illinois.gov/committees/advisory/council-of-mayors/stp	Mike Klemens, 847-377-7455 mklemens@lakecountyil.gov

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
Metropolitan Water Reclamation District of Greater Chicago (MWRD) ***– Eligible for Cook County Applicants Only***					
Green Infrastructure Partnership Opportunity Program	The MWRD's goals for the Green Infrastructure Partnership Opportunity Program include: build GI to reduce stormwater flows to local sewer systems and prevent combined sewer overflows; use GI to address local flooding and draining problems; promote GI as a complimentary way to manage stormwater with natural systems; aesthetically enhance public areas and increase a community's "green space"; and provide improvements in water quality.	Public entity able to enter into an IGA with the MWRD	Varies, depends on the effectiveness of the proposed green infrastructure	https://mwrd.org/green-infrastructure-partnership-opportunity-program-0	Holly Sauter Principal Civil Engineer Metropolitan Water Reclamation District of Greater Chicago 312-286-6023 SauterH@mwrd.org
Stormwater Partnership Program	The Stormwater Partnership Program funds projects in Cook County that address flooding and drainage concerns. These projects utilize a variety of traditional engineered solutions such as localized detention, upsizing critical storm sewers and culverts, pumping stations, and establishing drainage ways, alongside green infrastructure.		Reimbursement of construction related costs only. Amount of funding based on stormwater benefits of the proposed project, the social-economic need of the community, & availability of funding	https://mwrd.org/stormwater-partnership-program	Richard Fisher Principal Civil Engineer Metropolitan Water Reclamation District of Greater Chicago stormwater@mwrd.org
Flood-Prone Property Acquisition	This program is comprised of three distinct components: Local Sponsor Assistance Program - MWRD's top priority will be to facilitate the Illinois Emergency Management Agency's federally funded program by assisting Local Sponsor communities in providing their share of the cost for property acquisition; MWRD Initiated Program - in communities where MWRD's Board of Commissioners approved capital projects from MWRD's Detailed Watershed Plans, should the cost of a property acquisition alternative be less than the capital project and provide equivalent benefits, the acquisition alternative will be pursued; Local Government Application Program - MWRD will consider applications directly from local governments requesting acquisition of specific flood-prone structures.		MWRD will provide reimbursement for an agreed upon percentage of the purchase price only. MWRD will not reimburse for closing costs, attorneys' fees, demolition or other costs.	https://mwrd.org/flood-prone-property-acquisition	

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
Other Public & Private Organizations					
Section 4 Capacity Building for Community Development and Affordable Housing Program	The Section 4 Program strengthens the nation's lower-income rural and urban communities by bolstering non-profit community developers that build and invest in those neighborhoods. Section 4 provides grants on a competitive basis to national intermediary community development organizations, which in turn provide training, education, financial support and development assistance to local organizations throughout the country.	Community Development Corporations (CDCs), Community Housing Development Organizations (CHDOs), Tribes, Tribally Designated Housing Entities (TDHEs), Tribal Housing Authorities (THAs), and Native CDFIs Learn more on page 10 of this document: https://www.enterprisecommunity.org/sites/default/files/2023-03/fy21-s4-rfp-rural-tribal-3-29-23.pdf	Varies	https://www.hudexchange.info/programs/section-4-capacity-building/ https://www.enterprisecommunity.org/news/hud-section-4-capacity-building-grants	Office of Policy Development and Coordination in HUD's Office of Community Planning and Development capacitybuilding@hud.gov Enterprise Community Partners, Inc. 70 Corporate Center 11000 Broken Land Parkway, Suite 700 Columbia, MD 21044 rfp@enterprisecommunity.org
Illinois Clean Energy Community Foundation	This program's mission is to improve energy efficiency, advance the development and use of renewable energy resources, and protect natural areas and wildlife habitat in communities across Illinois.	Private not-for-profit organizations, educational organizations, local governments	Call for details, which change year to year	https://www.illinoiscleanenergy.org/	Contact Form: https://www.illinoiscleanenergy.org/contact-us/ Gabriela Martin Program Director Illinois Clean Energy 2 N. LaSalle St., Suite 1140 Chicago, IL 60602 312-372-5191 gmartin@illinoiscleanenergy.org
RiverWatch	RiverWatch is a volunteer-driven effort to collect stream data from Illinois streams and submit the data to the Illinois Natural History Survey. RiverWatch	All Illinois streams	Monitoring training, forms, and kits	http://www.ngrrec.org/riverwatch/about/	Danelle Haake, RiverWatch Director and Stream Ecologist NGRREC/L&C

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
	utilizes trained volunteers to collect quality assured data on wadeable streams and fosters coordination among groups involved in similar monitoring efforts.				One Confluence Way East Alton, IL 62024 618-468-2784 dhaake@lc.edu
Trust for Public Lands (TPL)	From helping to raise funds for conservation; to protecting and restoring natural spaces; to collaborating with communities to plan, design, and create parks, playgrounds, gardens, and trails; TPL works with communities to ensure that development happens for them, and not to them. For example, TPL created the "Natural Solutions Tool Greater Chicago: A Watershed Approach" to guide green infrastructure investment in portions of Cook, Will, and DuPage Counties: https://www.tpl.org/resource/natural-solutions-tool-greater-chicago	Local government, private not-for-profit organizations, educational organizations, and others	Technical and informational assistance to identify lands to be protected and assist in financing and land transactions	https://www.tpl.org/	The Trust for Public Land Chicago Office 120 S. LaSalle Street, Suite 2000 Chicago, Illinois 60603 312-750-9820 chicago@tpl.org
Great Lakes Commission ***SPECIFIC TO LAKE MICHIGAN WATERSHED***	Great Lakes Sediment and Nutrient Reduction Program provides grants to reduce nutrients and sediments entering the Great Lakes.	Non-federal units of government or incorporated non-profit organizations	$300,000 cap per project	https://www.glc.org/work/sediment	Nicole Zacharda Program Manager 734-396-6084 nzacharda@glc.org
National Fish and Wildlife Foundation ***SPECIFIC TO LAKE MICHIGAN WATERSHED***	Sustain Our Great Lakes (SOGL) is a public–private partnership designed to sustain, restore and protect fish, wildlife and habitat in the basin by leveraging funding, building conservation capacity, and focusing partners and resources toward key ecological issues.	Non-profit 501(c) organizations, state government agencies, local governments, municipal governments, Tribal governments and organizations, and educational institutions	Varies, $100,000 - $1,000,000 Matching contributions are not required for funding categories 1, 2, and 3, but projects that offer a 1:1 match ratio will be more competitive. A match ratio of at least 1:1 is required for funding category 4.	https://www.nfwf.org/programs/sustain-our-great-lakes-program	Aislinn Gauchay Program Director 612-564-7284 Aislinn.Gauchay@nfwf.org
Illinois American Water Environmental Grant Program	This program offers funding for innovative, community-based environmental projects that improve, restore or protect the watersheds, surface	A proposed project must be located within an American Water service area,	Maximum grant amount of $5,000	https://www.amwater.com/ilaw/News-Community/environmental-grant-program/	Mike Jones Illinois American Water mike.jones@amwater.com

FUNDING SOURCE	DESCRIPTION	ELIGIBILITY	ASSISTANCE	WEBSITE	CONTACT
	water and groundwater supplies in Illinois American Water's local communities.	completed between May and November of the grant funding year, and be a new or innovative community initiative or serve as significant expansion to an existing program.			
Illinois-Indiana Sea Grant (IISG)	IISG aims to bring the latest science to those who can best use the information and serves a critical role in empowering people to solve problems in sustainable ways. The program is funded through the National Oceanic and Atmospheric Administration (NOAA), the University of Illinois and Purdue University, but IISG also works in partnerships with key organizations, institutions, and agencies in the region to reach more audiences and multiply opportunities for success. IISG brings together scientists, educators, policy makers, community decision makers, outreach specialists, business leaders, and the general public to work towards a healthy environment and economy.	Focus on the southern Lake Michigan region	The program offers several educational and training resources regarding stormwater and green infrastructure. IISG also provides funding to researchers in Illinois and Indiana who are working on issues of importance to the southern Lake Michigan region.	https://iiseagrant.org/work/stormwater-green-infrastructure/ https://iiseagrant.org/research/funding-opportunities/	Eliana Brown Stormwater Specialist 217-265-0760 brown12@illinois.edu Carolyn Foley Research Coordinator 765-494-3601 cfoley@purdue.edu

APPENDIX J:
MAP DATA SOURCES

Figure Number	Title	Data Sources
1-2	Municipalities and Townships	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
1-3	Manitou Creek-Fish Lake Drain Watershed Location Map	Lake County SMC, Illinois EPA, County of Lake, IL, County of McHenry, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
1-4	2022 303(d) Impaired Waters	Lake County SMC, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-5	Early 1800's Plant Communities	Lake County SMC, INHS, LCFPD, Illinois EPA, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-6	Manitou Creek-Fish Lake Drain and Fox River Watershed Locations	Lake County SMC, Illinois EPA, County of Lake, IL, County of McHenry, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-7	Glacial Moraines	Lake County SMC, ISGS, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-8	HUC 12 Watersheds	Lake County SMC, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-9	Water Resources	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-10	Topography	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-11	Hydric Soils	Lake County SMC, Lake County Department of Information Technology, USDA-NRCS, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-12	Highly Erodible Soils	Lake County SMC, Lake County Department of Information Technology, USDA-NRCS, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph,

Figure Number	Title	Data Sources
		METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-13	Hydrologic Soil Groups	Lake County SMC, Lake County Department of Information Technology, USDA-NRCS, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-14	Subwatershed Map	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-16	Catchments Map	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-18	Municipalities and Townships	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-19	2020 Household Population	Lake County SMC, CMAP, US Census Bureau, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-20	2020-2050 Household Population Change	Lake County SMC, CMAP, US Census Bureau, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-21	2020 Employment	Lake County SMC, CMAP, US Census Bureau, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-22	2020 – 2050 Forecasted Employment Change	Lake County SMC, CMAP, US Census Bureau, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-23	2010 Median Age	Lake County SMC, CMAP, US Census Bureau, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-24	Median Household Income	Lake County SMC, CMAP, US Census Bureau, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph,

Figure Number	Title	Data Sources
		METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-25	Current Land Use	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-26	Planimetric Imperviousness	Nearmap, Lake County SMC, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-27	Future Land Use Projections	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-28	Roadway Jurisdictions	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-29	Existing and Proposed Trails	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-30	Planned Roadway Improvements	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-32	Green Infrastructure	Lake County SMC, Lake County Forest Preserve District, CMAP, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-33	Protected and Managed Lands	Lake County SMC, Lake County Forest Preserve District, CMAP, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-34	Restoration Opportunities	Lake County SMC, Lake County Forest Preserve District, CMAP, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.

Figure Number	Title	Data Sources
3-35	Parks and Open Space	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-36	Golf Courses	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-37	Forest and Nature Preserves	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
3-38	Wetland Locations	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-39	Stream Inventory Reaches	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
3-40	Channelization by Stream Reach	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
3-45	Problem Hydraulic Structures	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
3-47	Problem Discharge Points	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
3-49	Riparian Buffers by Stream Reach	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc

Figure Number	Title	Data Sources
3-50	Lakes	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
3-51	Stormsewersheds	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
3-52	Inventoried Detention Basins	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-53	2022 303(d) Listed Waterbodies	Lake County SMC, County of McHenry, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-54	Watershed Monitoring Site Locations	Lake County SMC, Illinois EPA, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
3-71	Wastewater Discharge Permits	Lake County SMC, Illinois EPA, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
3-72	Pesticide Application Point Source Discharge Permit	Lake County SMC, Illinois EPA, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc.
4-5	Impervious Cover by Catchment in the Manitou Creek-Fish Lake Drain Watershed	Lake County SMC, Nearmap, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-6	Estimated Impervious Cover by Catchment Based on Future Land Use Mapping	Lake County SMC, Nearmap Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc

Figure Number	Title	Data Sources
4-7	Estimated Percent Change in Catchment Impervious Cover Based on Future Land Use	Lake County SMC, Nearmap, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-9	Estimated Annual Nonpoint Source Total Suspended Solids Loading	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-10	Estimated Annual Nonpoint Source Total Dissolved Solids Loading	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-11	Estimated Annual Nonpoint Source Total Phosphorus Loading	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-12	Estimated Annual Nonpoint Source Dissolved Phosphorus Loading	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-13	Estimated Annual Nonpoint Source Total Nitrogen Loading	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-14	Estimated Annual Nonpoint Source Total Kjeldahl Nitrogen Loading	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-15	Estimated Annual Nonpoint Source Chemical Oxygen Demand Loading	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-16	Estimated Annual Nonpoint Source Biological Oxygen Demand Loading	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-17	Estimated Annual Nonpoint Source Cadmium Loading	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc

Figure Number	Title	Data Sources
4-18	Estimated Annual Nonpoint Source Lead Loading	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-19	Estimated Annual Nonpoint Source Copper Loading	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-20	Estimated Annual Nonpoint Source Zinc Loading	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-21	Estimated Annual Nonpoint Source Fecal Coliform Loading	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-22	Hotspot Areas for Nonpoint Source Pollution Loading	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-23	Pollutant Loading Critical Areas	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
4-24	Streambank and Shoreline Erosion Critical Areas	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
5-2	Flood Problem Areas	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
5-3	Structures in the FEMA Special Flood Hazard Area	Lake County SMC, FEMA, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
5-5	Special Flood Hazard Area Types and Boundaries	Lake County SMC, FEMA, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc

Figure Number	Title	Data Sources
5-11	Existing Flood Storage	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
6-1	Critical Areas	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
6-2	Wetland Enhancement Recommendations	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
6-3	Wetland Restoration Recommendations	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
6-4	Site-Specific Recommendations	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
6-5	Basin-Wide Site-Specific Recommendations	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc
6-6	Lakes with Recommended Actions	Lake County SMC, Lake County Department of Information Technology, County of Lake, IL, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Geotechnologies Inc

Appendix K:
Previous Action Plans

*See referenced plan for full action recommendation details

Plan	Action	Status
2004 Manitou Creek Watershed Plan	Floodplain Study: Round Lake Drain FIS Restudy	PARTIALLY COMPLETE
2004 Manitou Creek Watershed Plan	Floodplain Study: Eagle Creek FIS Restudy	PARTIALLY COMPLETE
2004 Manitou Creek Watershed Plan	Floodplain Study: Unified FIS through Long Lake	
2004 Manitou Creek Watershed Plan	Flood Audits: Round Lake Drain Flood Audit	PARTIALLY COMPLETE
2004 Manitou Creek Watershed Plan	Flood Audits: Long Lake Flood Audit	
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Evaluate GRLPD Renwood Golf for Flood Control	COMPLETE
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Evaluate Increased Round Lake Drain Conveyance	COMPLETE
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Evaluate Mud Lake for Flood Control	
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Evaluate Round Lake Drain Storage Sites Between Sunset and Lotus	
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Evaluate Round Lake Drain Storage Sites North of Rollins and West of Cedar Lake Rd	
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Evaluate Round Lake Drain Storage Sites North of Rollins and West of Orchard	
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Evaluate Eagle Creek Storage Sites North of Monaville Road	
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Evaluate Eagle Creek Storage Sites East of Fairfield Road	
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Evaluate Mainstem Storage Sites: South of Nippersink and West of Fairfield	
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Evaluate Mainstem Storage Sites Northbrook Sports Club	WETLAND MITIGATION BANK
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Evaluate Mainstem Storage Sites Campbell Airport	
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Evaluate Levees	
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Evaluate Increased Round Lake Drain Capacity Lotus to Fairfield	
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Evaluate Increased Round Lake Drain Capacity Round Lake Drain Tributary	
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Evaluate Increased Round Lake Drain Capacity Re-Route High Flows to Mud Lake	
2004 Manitou Creek Watershed Plan	Flood Damage Reduction Analysis: Identify Structures for Buyout	PARTIALLY COMPLETE, VOLUNTARY
2004 Manitou Creek Watershed Plan	Evaluate Lake Level Management to Reduce Flooding: Round Lake	

*See referenced plan for full action recommendation details

Plan	Action	Status
2004 Manitou Creek Watershed Plan	Evaluate Lake Level Management to Reduce Flooding: Highland Lake	
2004 Manitou Creek Watershed Plan	Evaluate Lake Level Management to Reduce Flooding: Long Lake	
2004 Manitou Creek Watershed Plan	Drainage Improvements: Update Storm Sewer Data	PARTIALLY COMPLETE, ONGOING
2004 Manitou Creek Watershed Plan	Drainage Improvements: GIS Tile Map Base	ONGOING UPDATES
2004 Manitou Creek Watershed Plan	Drainage Improvements: Round Lake Drain Drainage Study	
2004 Manitou Creek Watershed Plan	Drainage Improvements: Green Infrastructure Guidance	
2004 Manitou Creek Watershed Plan	Drainage Improvements: Develop Ecologically Friendly Stream Cleaning Guidance	
2004 Manitou Creek Watershed Plan	Increase Water Resources Monitoring: Develop River Watch programs	
2004 Manitou Creek Watershed Plan	Increase Water Resources Monitoring: Attain Full Participation in VLMP	PROGRAM SUSPENDED BY STATE OF ILLINOIS
2004 Manitou Creek Watershed Plan	Increase Water Resources Monitoring: Monitor Lakes on a 5-year Schedule	COMPLETE
2004 Manitou Creek Watershed Plan	Increase Water Resources Monitoring: Install and Maintain Additional Flow Gages	
2004 Manitou Creek Watershed Plan	Increase Water Resources Monitoring: Perform Additional Stream Water Quality Monitoring Annually	
2004 Manitou Creek Watershed Plan	Increase Water Resources Monitoring: Perform Annual Benthic Surveys and Fish Surveys Every Three Years	
2004 Manitou Creek Watershed Plan	Urban Soil Erosion and Sediment Control: Train and Certify SESC Inspectors	COMPLETE (LAKE COUNTY DECI PROGRAM)
2004 Manitou Creek Watershed Plan	Urban Soil Erosion and Sediment Control: Increase WDO and NPDES Review and Inspection Efforts	ONGOING PER WDO
2004 Manitou Creek Watershed Plan	Urban Soil Erosion and Sediment Control: Evaluate 10-year Zero-Release SESC	
2004 Manitou Creek Watershed Plan	Agricultural Soil Erosion and Sediment Control: Enroll Farms in Conservation Tillage and CRP	
2004 Manitou Creek Watershed Plan	Agricultural Soil Erosion and Sediment Control: Develop Riparian Zones and Grassed Waterways	
2004 Manitou Creek Watershed Plan	Implement Stormwater NPDES Phase II: Road Salt Storage and Application	ONGOING
2004 Manitou Creek Watershed Plan	Implement Stormwater NPDES Phase II: Herbicide and Fertilizer Storage and Application	ONGOING
2004 Manitou Creek Watershed Plan	Implement Stormwater NPDES Phase II: Other Public Works Chemical Storage and Handling	ONGOING
2004 Manitou Creek Watershed Plan	Urban Stormwater Management Retrofit Projects: Retrofit Non-WDO Detention in Round Lake Watershed	
2004 Manitou Creek Watershed Plan	Urban Stormwater Management Retrofit Projects: Retrofit Non-WDO Detention in Highland Lake Watershed	

*See referenced plan for full action recommendation details

Plan	Action	Status
2004 Manitou Creek Watershed Plan	Urban Stormwater Management Retrofit Projects: Retrofit Non-WDO Detention in Long Lake Watershed	
2004 Manitou Creek Watershed Plan	Urban Stormwater Management Retrofit Projects: Implement Round Lake Drain COE 206 Restoration Projects	MAYFIELD DRIVE BASIN PROJECT COMPLETE
2004 Manitou Creek Watershed Plan	Urban Stormwater Management Retrofit Projects: Evaluate Grant Woods for Eagle Creek Water Quality Management	
2004 Manitou Creek Watershed Plan	Urban Stormwater Management Retrofit Projects: Evaluate Mud Lake for Water Quality Management	
2004 Manitou Creek Watershed Plan	Lake Diagnostic Studies: Study Phosphorus Control for Long Lake	
2004 Manitou Creek Watershed Plan	Streambank Stabilization: Implement COE 206 Streambank Stabilization Project	
2004 Manitou Creek Watershed Plan	Streambank Stabilization: Stabilize Mainstem Reaches	
2004 Manitou Creek Watershed Plan	Streambank Stabilization: Stabilize Round Lake Drain Reaches	
2004 Manitou Creek Watershed Plan	Streambank Stabilization: Stabilize Eagle Creek Reaches	
2004 Manitou Creek Watershed Plan	Habitat Restoration Projects: Evaluate Eagle Creek Riparian Wetland Restoration Grant Woods	
2004 Manitou Creek Watershed Plan	Habitat Restoration Projects: Evaluate the Re-Connection of the Mainstem to Existing and Drained Wetlands	
2004 Manitou Creek Watershed Plan	Habitat Restoration Projects: Evaluate the Re-Connection of Existing and Drained Wetlands to Eagle Creek	
2004 Manitou Creek Watershed Plan	Habitat Restoration Projects: Create Pool, Riffle and Other Habitat Features in Mainstem Reaches	
2004 Manitou Creek Watershed Plan	Habitat Restoration Projects: Create Pool, Riffle and Other Habitat Features in Round Lake Drain	
2004 Manitou Creek Watershed Plan	Habitat Restoration Projects: Evaluate Channel Dredging on Long and Round Lakes	
2004 Manitou Creek Watershed Plan	Habitat Restoration Projects: Form an Open Space Committee to Oversee Plan Implementation	
2004 Manitou Creek Watershed Plan	Habitat Restoration Projects: Inventory and Prioritize Open Space Parcels	
2004 Manitou Creek Watershed Plan	Habitat Restoration Projects: Adopt the Greenway Plan	
2004 Manitou Creek Watershed Plan	Regulatory Changes: Consider Mitigation Credit for Stream Habitat Restoration for IWLC	
2004 Manitou Creek Watershed Plan	Regulatory Changes: Prioritize Stream Habitat Restoration for COE Mitigation Credit	
2004 Manitou Creek Watershed Plan	Regulatory Changes: Provide Development Incentives to Implement the Greenway Plan	
2004 Manitou Creek Watershed Plan	Regulatory Changes: Consider Conservation Overlay District	
2004 Manitou Creek Watershed Plan	Regulatory Changes: Consider Zoning and Subdivision Code Changes to Implement Greenway Plan for Developing Parcels	

*See referenced plan for full action recommendation details

Plan	Action	Status
2004 Manitou Creek Watershed Plan	Regulatory Changes: Pursue Acquisition of Dedication of Ecologically Sensitive Areas	
2004 Manitou Creek Watershed Plan	Plan Implementation: Sewer Fee Surcharge for Long Lake Rehabilitation	
2004 Manitou Creek Watershed Plan	Plan Implementation: Consider a Special Service Area for Long Lake Rehabilitation	
2004 Manitou Creek Watershed Plan	Plan Implementation: Evaluate Projects for Private Sponsorship (Clean Up, Monitoring)	
2004 Manitou Creek Watershed Plan	Plan Implementation: Seek Private Foundation Grant Support for Projects	
2004 Manitou Creek Watershed Plan	Plan Implementation: Organize a Grant Committee to Seek at Least One 319 Project Annually	
2004 Manitou Creek Watershed Plan	Plan Implementation: Make Better Use of Available NRCS and SWCD Restoration Funds	
2004 Manitou Creek Watershed Plan	Coordination: Continue Support for Manitou Creek Advisory Committee	
2004 Manitou Creek Watershed Plan	Coordination: Continue Implementation of Existing WDO	ONGOING
2004 Manitou Creek Watershed Plan	Coordination: Encourage Certification of Floodplain Managers	ONGOING
2004 Manitou Creek Watershed Plan	Coordination: Continue Enforcement Officer Training	ONGOING
2004 Manitou Creek Watershed Plan	Coordination: Develop a Coordinated Flood Warning and Response Plan	COMPLETE
2004 Manitou Creek Watershed Plan	Coordination: Coordinate 5-year Capital Improvement Drainage Plans	
2004 Manitou Creek Watershed Plan	Coordination: Monitor Plan Progress	ONGOING
2004 Manitou Creek Watershed Plan	Coordination: Support Open Space Committee	
2004 Manitou Creek Watershed Plan	Coordination: Coordinate 5-Year Public Works Programs for Savings	
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Perform stream and lake monitoring using volunteers and professional staff	PARTIALLY COMPLETE
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Develop zoning and subdivision code to implement Green Infrastructure Plan	
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Implement watershed-wide runoff reduction program	
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Perform annual stream inspections for debris and other conditions	
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Conduct floodproofing workshops	PARTIALLY COMPLETE
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Perform periodic updates to Flood Problem Area Inventory	COMPLETE
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Perform demonstrations and provide incentives for retention based stormwater management approaches	
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Provide technical guidance on design and implementation of retention-based BMPs and conservation design	
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Increase level of enforcement of soil erosion and sediment control through certified inspector program or other measures	COMPLETE

*See referenced plan for full action recommendation details

Plan	Action	Status
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Develop and distribute educational materials on source control and lot-level BMPs	COMPLETE
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Hire watershed manager to lead watershed implementation	
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Form Plan Implementation Committee to provide prioritization direction and lead periodic plan updates	
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Adopt plan at municipal and county level. Obtain IEPA approval as a Watershed-Based Plan to ensure eligibility for grants, etc.	COMPLETE
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Stewardship education for stream, lake, and wetland property owners	
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Incorporate watershed processes and issues into school curricula	
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Publicize Fish Lake Drain activities and resources to improve interest in watershed stewardship and Plan implementation	
2009 Fish Lake Drain Watershed-Based Plan	Watershed General: Develop prioritized monitoring program to target resources and evaluate success in meeting watershed goals	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 1A: Floodproofing of floodprone structures (58 structures)	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 1A: Protect lands identified in Green Infrastructure Plan	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 1A: Develop & implement restoration management plan for large wetland east of Duck Lake	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 1A: Repair gully erosion north of 134 & west of Wilson Road	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 1A, Reach 1A: Vegetative Management (burning) to re-establish native riparian plant communities	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 1A, Reach 1B: Repair failing sheet pile wall	COMPLETE
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 1A, Reach 2A: Establish native buffer along streambank	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 1A, Reach 2A: Woodland management south of creek, east of Forest Way	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 1A, Reach 2B: Management Unit 1, Sub-Unit 1A, Reach 2B: Re-establish wooded wetland plant community	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 1A, Reach 2C: Woodland riparian corridor management	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 1A, Reach 2C: Selected streambank stabilization	

*See referenced plan for full action recommendation details

Plan	Action	Status
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 1A, Duck Lake: Source controls & lot-level BMPs surrounding lake	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 1A, Duck Lake: Shoreline stabilization	PARTIALLY COMPLETE
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 1A, Duck Lake: Establish native buffer along shoreline	PARTIALLY COMPLETE
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 1B: Do not increase hydrologic connection of depressional storage areas	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 2: Floodproofing of structures in the floodplain (two structures)	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 2: Protect lands identified in Green Infrastructure Plan	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 2: Develop & implement restoration management plans for ADID wetlands	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 2: Restore isolated wetland east of Wooster Lake & address drainage	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 2, Reach 3: Management of invasives (reed canary grass)	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 2, Wooster Lake: Streambank regrading to address erosion	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 2, Wooster Lake: Source controls & lot-level BMPs surrounding lake	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 2, Wooster Lake: Retrofit curb and gutter area on NE side of lake	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 2, Wooster Lake: Shoreline stabilization (plantings & weir replacement)	COMPLETE
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 2, Wooster Lake: Develop hydrologic and nutrient budgets for Wooster Lake	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 2, Wooster Lake: Perform in-Lake restoration activities as recommended in LCHD report	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 2, Wooster Lake: Establish native buffer along shoreline	PARTIALLY COMPLETE
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 1, Sub-Unit 3A: Protect lands identified in Green Infrastructure Plan	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3A: Implement & continue use of agricultural BMPs on cropland and landscape nurseries	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3A: Address runoff from landscape nursery	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3A, Reach 4A: Regrade banks and establish native riparian buffer	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3A, Reach 4A: Establish emergent and rooted aquatic vegetation through channel bottom	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3A, Reach 4B: Energy dissipation at culvert outfall	

*See referenced plan for full action recommendation details

Plan	Action	Status
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3A, Reach 4B: Debris removal	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3A, Reach 4B: Artificial riffles to reduce erosion pressure at toe of slope	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3A, Reach 4B: Bioengineering streambank stabilization	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3A, Reach 4C: Perform modest bank regrading & establish native buffer along shoreline	COMPLETE
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3A, Fischer Lake: Source controls & lot-level BMPs surrounding lake	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3A, Fischer Lake: Shoreline stabilization of Lake and Island	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3A, Fischer Lake: Establish native buffer along shoreline	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3A, Fischer Lake: Perform Lake restoration activities as recommended in LCHD report	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3B: Implement Sub Unit specific runoff rate and volume standards	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3B: Use Conservation Design Principals to prevent increases in runoff volumes	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3C: Use Conservation Design Principals to prevent increases in runoff volumes	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3C: Conservation easements for natural areas identified in comprehensive plans (See Green Infrastructure Plan & Future Land Use Map)	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3C: Do not increase hydrologic connection of depressional storage areas	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3D: Implement Sub Unit specific runoff rate and volume standards	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 3, Sub-Unit 3D: Use Conservation Design Principals to prevent increases in runoff volumes and protect ADID wetland	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4A, Reach 4A: Protect lands identified in Green Infrastructure Plan	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4A, Reach A&B: Develop & implement restoration management plans for ADID wetlands	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4A, Reach A&B: Restore/create wetlands in areas of hydric soils SE of Fish Lake	

*See referenced plan for full action recommendation details

Plan	Action	Status
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4A, Reach A&B: Implement agricultural BMPs	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4A, Reach A&B: Address runoff from landscape nursery	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4A, Reach 5A: Stabilize eroding streambanks and establish contiguous riparian buffer	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4A, Reach 5B: Woodland management	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4A, Reach 5C: Woodland management	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4A, Reach 5C: Streambank stabilization	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4A, Fish Lake: Manage shoreline vegetation (included in ADID restoration cost)	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4B: Protect lands identified in Green Infrastructure Plan	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4B: Implement agricultural BMPs	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4C: Protect lands identified in Green Infrastructure Plan	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4C: Implement Sub Unit specific runoff rate and volume standards	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4C: Use Conservation Design Principals to prevent increases in runoff volumes and protect ADID wetland	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4C: Replace regional drain tile from 120 with naturalized wetland swale	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4D: Protect lands identified in Green Infrastructure Plan	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4D: Retrofit stormwater BMPs in existing developed areas	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 4, Sub-Unit 4D: Do not increase hydrologic connection of depressional storage area	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 5: Protect lands identified in Green Infrastructure Plan	PARTIALLY COMPLETE
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 5: Develop & implement restoration management plans for Monihan Lake	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 5: Use Conservation Design Principals to prevent increases in runoff volumes and protect ADID wetland	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 5: Retrofit stormwater BMPs in existing developed areas	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 5: Vegetative management of wetland areas	

*See referenced plan for full action recommendation details

Plan	Action	Status
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 5: Implement agricultural BMPs	
2009 Fish Lake Drain Watershed-Based Plan	Protect lands identified in Green Infrastructure Plan	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 6: Implement Sub Unit specific runoff rate and volume standards	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 6: Use Conservation Design Principals to prevent increases in runoff volumes	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 6: Implement agricultural BMPs	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 6: Retrofit stormwater BMPs in existing developed areas	
2009 Fish Lake Drain Watershed-Based Plan	Management Unit 6: Restore/create wetlands in areas of hydric soils	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #2:Plant natives along banks. Decrease turbidity,	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #3: Plant natives along banks	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #4: Plant natives along banks	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #5: Decrease turbidity.	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #6: Plant natives where turf grass is.	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #7: Plant more natives along basin.	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #8: Plant more natives on slopes.	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #9: Plant native plants along banks. Replace plastic	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #10: Plant natives along banks. Reduce turbidity. Remove	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #11: Unclog inlet B	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #12: Plant natives along banks. Basin water quality needs	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #13: Plant natives along banks. Reduce turbidity.	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #14: Plant natives along banks.	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #16: Decrease turbidity and sediment.	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #17: Plant natives along banks.	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #18: Add native plants on west side of basin.	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #19: Plant natives along banks. Reduce algae.	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #20: Plant natives along banks. Reduce algae.	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #21: Plant natives along banks. Reduce algae.	
2009 Fish Lake Drain Watershed-Based Plan	Detention Basin #22: Plant natives along banks. Reduce algae. Unclog	