Shell Rock River Watershed Management Plan

Shell Rock River Watershed Management Coalition

December 2023

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Shell Rock River WMC

Watershed Management Plan

Prepared: December 2023

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Prepared for: Shell Rock River Watershed Management Coalition

Fiscal Agent: Butler County

Prepared by: JEO Consulting Group, Inc.

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This water quality management plan was prepared to guide the Shell Rock River Watershed Management Coalition (WMC) in developing and implementing future projects to reduce flooding, improve water quality, and enhance recreation. The plan may also serve as a basis for seeking financial support for those projects. It has been written with guidance published in EPA's "Handbook for Developing Watershed Plans to Restore and Protect Our Waters," updated March 2008, including EPA's Nine-Elements of a Successful Watershed Plan. The planning process utilized a Community Based Approach and incorporated several Iowa Smart Planning Principles.

Contact Information:

Ken Nelson, WMC Board Chairperson
Cerro Cordo SWCD Commissioner
(641) 424-4452

JEO Contact Information:

ADAM RUPE | Natural Resources Specialist
JEO CONSULTING GROUP INC
1615 SW Main St. Suite 205 | Ankeny, IA 50023
o: 402.435.3080 | f: 402.435.4110
arupe@jeo.com

TABLE OF CONTENTS

DIGITAL COPY OF MATERIALS

A USB drive has been provided in the front cover of the printed plan.

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

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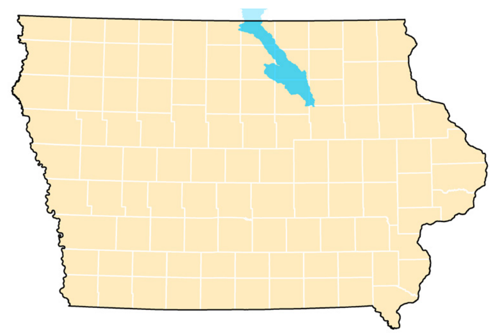
SHELL ROCK RIVER WATERSHED MANAGEMENT PLAN
Executive Summary

About the Watershed Plan



A watershed management plan was prepared for the Shell Rock River Watershed located in northeastern Iowa (shown in blue on map at right). This plan was sponsored by the Shell Rock River Management Coalition (WMC), a voluntary coalition of local counties, cities, and soil and water conservation districts (SWCDs) within the watershed.

- The plan identifies and prioritizes projects and activities to address flooding, water quality, and recreation across the watershed.
- The plan is non-regulatory and relies solely on cooperation between WMC members, farmers, and other stakeholders.
- It will be updated every 5 years to stay relevant and maintain eligibility for project funding.
- Water quality projects will rely on the voluntary adoption and use of Best Management Practices (BMPs), which are a broad set of conservation practices that help conserve soil and water resources. Examples include buffer strips, bioreactors, wetlands, manure management, and many others.

The plan contains a long-term implementation strategy (20-years), a short-term action plan (5-years), and an education plan.

COALITION MISSION STATEMENT

To assess and reduce flooding risks; repair, improve, and enhance the quality, appearance and recreational use of the Shell Rock River Watershed by encouraging municipal, public and private support and participation through education, conservation practices, and volunteering.

Chapter 1 of the plan provides a brief overview of the plan and history of the watershed.

View the full plan at www.jeo.com/shell-rock-river-wmc

Funding provided by Iowa DNR/EPA Section 319 Watershed Improvement Program and the Environmental Protection Agency (EPA)
Plan developed by JEO Consulting Group

Watershed Goals

Watershed goals, objectives, and action items were developed with input from the public, WMC partners, and watershed data.

#1: Fooding

Flood resiliency will be improved at the individual, community, and watershed level to prevent loss of life, reduce property losses, and avoid damage to infrastructure.

#2: Water Quality

Improve water quality to support all uses and ensure it meets state standards and goals.

#3: Recreation

Utilize recreation on the river to enhance local communities and connect the public with the watershed.

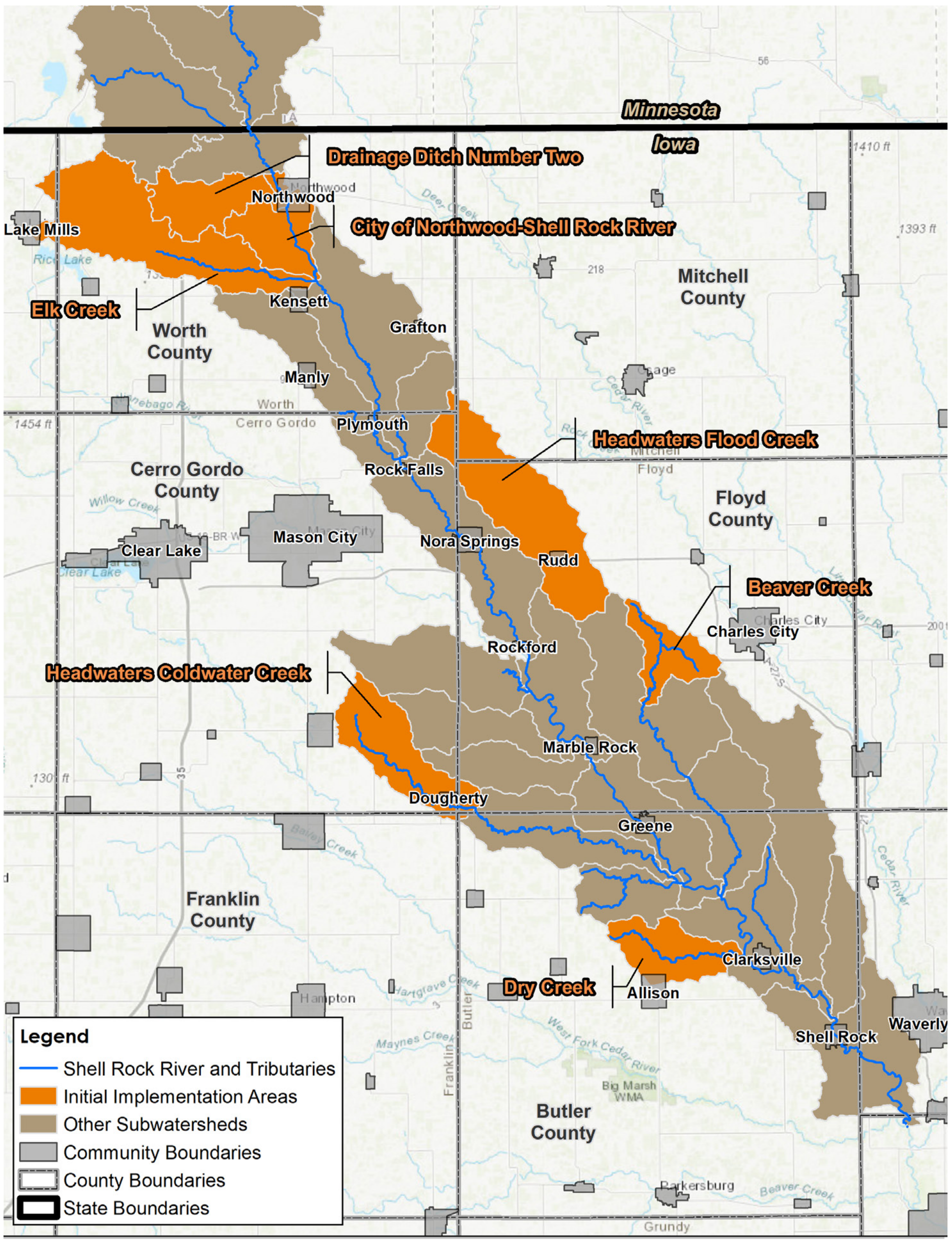
#4: Education

Create an informed, educated, and passionate public that works towards improving watershed management.

Chapters 2 and 3 outline an inventory and assessment of watershed data, including challenges and existing resources. Goals and objectives are identified in **Chapter 4.**

More Than a Plan: A Path Forward

The plan identifies initial project areas where BMPs could make a positive impact. Each project will consider the unique needs of each farmer, the landscape, and the budget of each partner.



PROJECTS AND ACTION ITEMS

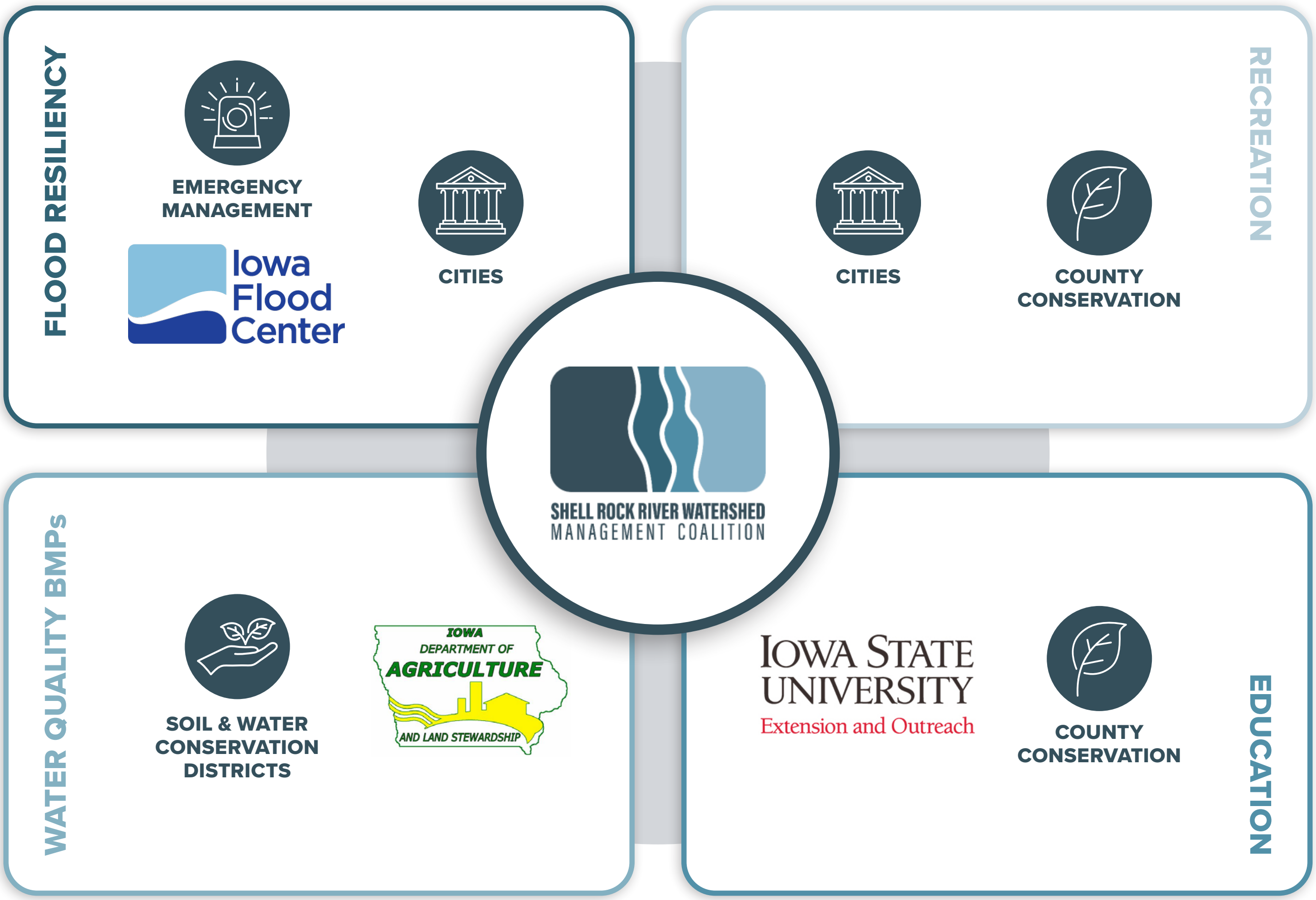
The action plan identifies several projects and activities that should be completed over the next 5 years. Some of the initial projects include:

- Develop a strategy to fund and to hire a watershed coordinator
- Complete a water trail plan for the Shell Rock River
- Install educational signage along the river and throughout the watershed
- Expand WMC membership and partnerships
- Complete a hydrologic study for flood risks and mitigation strategies
- Expand stream monitoring throughout the watershed

While **Chapter 5** outlines a long-term implementation strategy, **Chapter 6** provides a plan to involve and educate stakeholders throughout the watershed, and **Chapter 7** is a short-term action plan to provide initial focus.

A Coalition of Leaders

The SRRWMC has no direct authority to implement or fund projects. Therefore, individual WMC members and stakeholders are needed to lead implemenation.
The graphic below summarizes which goals that each partner might take a lead in.



The WMC as a Coordinator

The WMC may not sponsor projects, but will help to coordinate efforts:

- Facilitate partnerships
- Identify project funding
- Coordinate public outreach
- Identify opportunities for locally-led watershed management

Expanded Partnerships

Partnerships between WMC members and other organizations is vital to:

- Provide technical assistance
- Improve funding opportunities
- Work together on mutually beneficial projects

Chapter 8 identifies funding and technical resources that can be used to help with plan implementation.

GETTING STARTED

Within this plan are many ideas for improving the Shell Rock River Watershed and ensuring the effectivness of the SRRWMC. **This page is a place to start.**

The following steps should be completed within the first year, after adopting the plan:

1. After plan adoption, **present the plan to each jurisdiction in the watershed** (including both current and potential WMA members). Presenting the WMC's goals, specific action items, and asking for involvement in a specific way may yield the best outcomes. The included summary PowerPoint presentation may be a good starting point for this.

2. **Create an implementation committee** to lead the actions outlined in this plan.

3. **Develop a strategy to hire a watershed coordinator,** who will perform on-the-ground activities to help obtain funding opportunities, provide a catalyst for action items, and give the WMC a more stable presence. See Chapter 7 for more details.

4. **Expand water quality monitoring sites across the watershed.** This would begin by approaching potential partners on funding and requirements See Chapter 2 for more details.

5. **Investigate applying for project funding** for the following:

    a. Installation of creek signs (see DNR funding in Chapter 8)

    b. Water trail planning (see DNR funding in Chapter 8)

    c. BMP implementation through the water quality initiative (see IDALS funding in Chapter 8

6. **Host a "funding workshop" at each WMC quarterly board meeting (as a standing agenda item)**. This will assist in finding the most available funding and in formulating projects. Chapter 8 identifies possible entities or funding sources to invite and/or request funding information from. Appendix B contains the Project Funding Roadmap which outlines possible grants.

7. **Continue to recruit cities to join the coalition**. All cities in the watershed can benefit from participation in the WMC, and from implemented projects. Each city in the watershed should continue to receive regular updates and invites to meetings. A representative of the WMC should make an effort to provide an in-person update and request to each city once per year.

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CHAPTER 1. INTRODUCTION AND BACKGROUND

1.01 PLAN PURPOSE

The purpose of the Shell Rock River Watershed Management Plan is to serve as a comprehensive initiative to assist partners in implementation actions and ongoing assessment measures. The focus is on recommendations that address flooding, water quality, and recreation. The area of concern for the watershed plan is based on the Iowa portion of the Shell Rock River Watershed.

The planning process followed the U.S. Environmental Protection Agency's (EPA) nine elements for watershed planning while incorporating Iowa smart planning principles, when applicable. This plan focuses on community-identified priorities and seeks to guide improvements over the next twenty years, with a focus on shorter term goals and actions. The successful implementation of this plan is based entirely on the voluntary actions of cities, counties, landowners, farmers, and other stakeholders. This plan will help guide partners in their conservation efforts and give direction to the steps that need to be taken to meet mutual watershed goals.

1.02 WATERSHED LOCATION AND PARTNERS

WATERSHED BOUNDARIES AND OVERVIEW

The Shell Rock River Watershed spans approximately 1,131,934 acres in northern Iowa and southern Minnesota (Figure 1). This also includes the Winnebago River Watershed, which is a major tributary. The area of concern follows the Iowa portion of the Shell Rock River Watershed Hydrologic Unit Code (HUC) 8 boundaries and is comprised of 26 HUC 12 subwatersheds, two of which fall partially within Minnesota. A hydrologic unit code (HUC) is a sequence of numbers or letters that identifies a specific watershed. The boundaries are defined by the United States Geological Survey's (USGS) Watershed Boundary Dataset (WBD), and are based on topographic, hydrologic, and other relevant landscape characteristics without regard for administrative, political, or jurisdictional boundaries (USGS, 2018). The watershed ends at the confluence of the Shell Rock River and West Fork Cedar River, just south of Bremer County.

The full Shell Rock River Watershed encompasses approximately 691,351 acres, with the Iowa portion comprising 533,466 acres, and contains about 100 miles of the approximately 113-mile Shell Rock River along with other tributary streams. The majority of the watershed falls within the Iowan Surface landform, with a small portion in the northwest corner falling within the Des Moines Lobe. The Iowan Surface is characterized by low relief and subtle topography. The Shell Rock River Watershed covers portions of nine counties in Iowa, including Winnebago, Worth, Mitchell, Cerro Gordo, Floyd, Franklin, Butler, Bremer, and Black Hawk Counties, although some of these only contain a small fraction of the watershed. Approximately 75% of land in the watershed is utilized as cropland for agricultural production, primarily corn and soybean production.

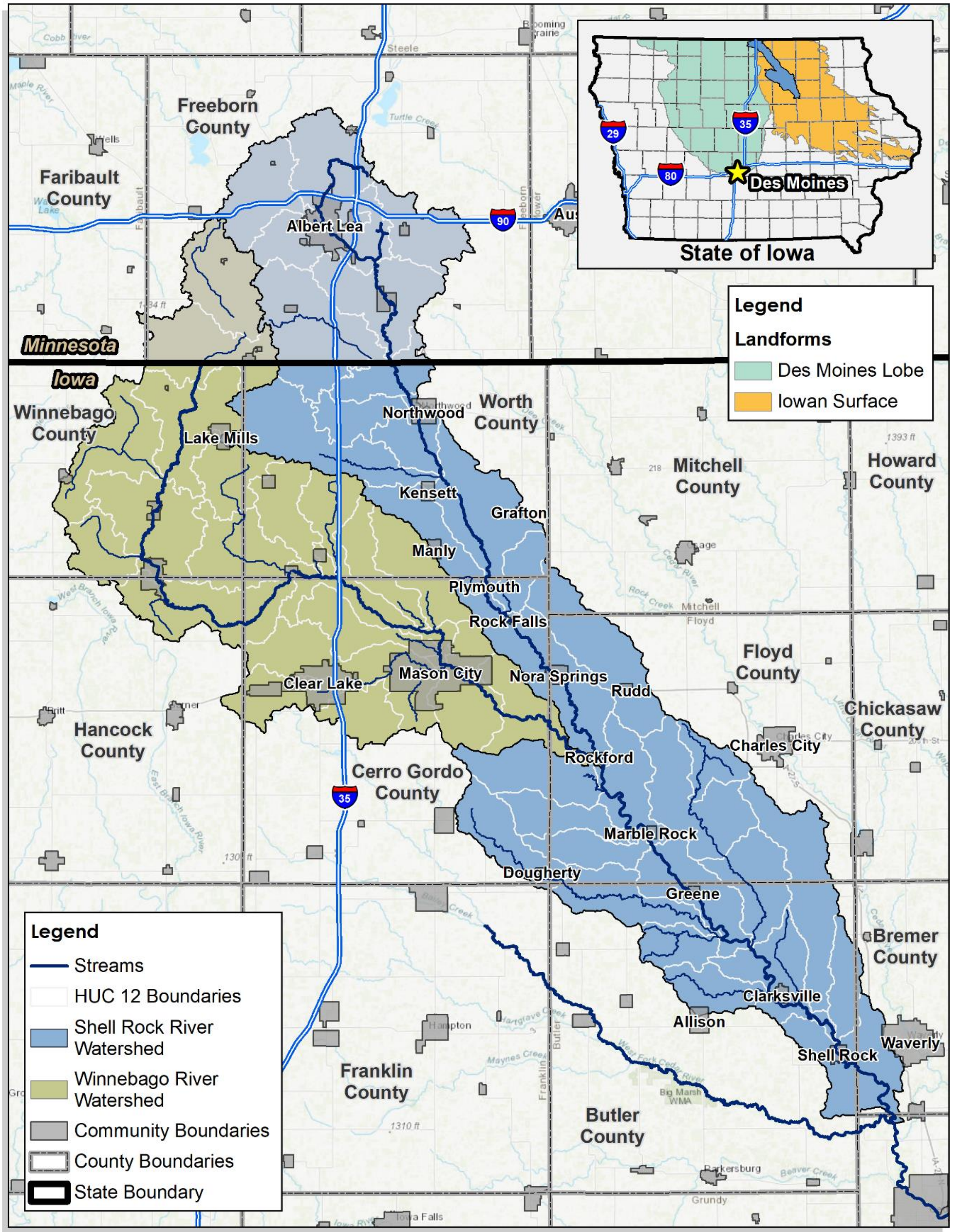


Figure 1: Shell Rock River Watershed Area

Notable tributaries within the watershed are Elk Creek, Rose Creek, Rock Falls Creek, Beaver Creek, Coldwater Creek, Flood Creek and tributaries, Palmer Creek, and Dry Creek. The Shell Rock River begins in Freeborn County in Minnesota and flows southeast until it reaches Black Hawk County and flows into the West Fork Cedar River, and shortly thereafter, the Cedar River. A summary of the Shell Rock River Watershed's characteristics is provided in Table 1. A full watershed inventory can be found in Chapter 2.

Table 1: Plan Area Characteristics

Plan Area Component	Component Details
EPA Region	VII
HUC-8	Iowa portion of Shell Rock River Watershed (07080202), excluding the contributing Winnebago River Watershed (07080203)
Counties	Portions of Winnebago, Worth, Mitchell, Cerro Gordo, Floyd, Franklin, Butler, Bremer, and Black Hawk Counties
Cities	Lake Mills*, Northwood*, Kensett, Manly*, Grafton*, Plymouth, Rock Falls, Nora Springs, Rudd, Rockford*, Marble Rock, Dougherty, Greene, Allison*, Clarksville, Shell Rock (*partially within boundaries)
Tribes	None
Estimated Population (2021)	18,886
Watershed Size	Shell Rock River (Iowa Portion): 533,466 acres* Shell Rock River (Total): 691,351 acres Winnebago River (Iowa Portion): 394,869 acres Winnebago River (Total): 440,583 acres
Major River Watershed	Shell Rock
Major Streams	Shell Rock River, Elk Creek, Rose Creek, Rock Falls Creek, Beaver Creek, Coldwater Creek, Flood Creek and tributaries, Palmer Creek, and Dry Creek
Major Economic Activity	Agriculture
Major Crop(s)	Corn, Soybean
Major Livestock(s)	Hogs and pigs, cattle and calves
Applicable TMDLs	TMDL for Algae and Turbidity, Silver Lake (2006) TMDL for Algae, Turbidity, and pH, Avenue of the Saints Lake (2019) TMDL for Indicator Bacteria, *E. coli*, Cedar River Watershed (2010) TMDL for Nitrate, Cedar River (2006)
Water Quality Impairments	Portions of the Shell Rock River are impaired due to *E. coli* and high levels of mercury in fish. Several tributaries are listed as

	impaired for reasons including *E. coli*, fish kills, pH, turbidity, and algal growth.
Other Pollutants of Concern	Nutrients (Nitrogen and Phosphorus) and Sediment
Lake/Wetland Designated Uses (Number of applicable lakes)	A1 – Primary Contact Recreation (3 lakes) BLW – Lakes and Wetlands (8 lakes and wetlands) HH – Human Health (8 lakes and wetlands)
Stream Designated Uses (Number of applicable stream segments)	A1 – Primary Contact Recreation (19 stream segments) BWW1 – Warm Water, Type 1 (13 stream segments) BWW2 – Warm Water, Type 2 (6 stream segments) HH – Human Health (5 stream segments)

Note: Additional details and data sources for this summary are found in Chapter 2.
**The Iowa portion of the Shell Rock River Watershed is the scope of this watershed plan. All other watershed sizes reported for reference.*

WATERSHED MANAGEMENT AUTHORITY

In 2010, Iowa lawmakers passed legislation authorizing the creation of watershed management authorities (WMAs) as a mechanism for cities, counties, and soil and water conservation districts (SWCDs) to cooperatively engage in watershed planning and management. A WMA is formed through a Chapter 28E Agreement between two or more eligible political subdivisions within a specific HUC 8 watershed (IDNR, 2021c). WMAs are voluntary based agreements between participating entities; however, formation of a WMA does not confer any new authority or regulatory power to the WMA or the participating jurisdictions. There are multiple benefits to cooperating with other jurisdictions within a watershed including to the ability to :

- Conduct planning on a watershed scale, which has greater benefits for water quality improvement and flood risk reduction;
- Foster multi-jurisdictional partnership and cooperation;
- Leverage resources, such as funding and technical expertise; and
- Facilitate stakeholder involvement in watershed management.

The Shell Rock River Watershed Management Coalition (SRRWMC) formed as a WMA and began regular meetings in July 2022. Multiple cities, counties, and SWCDs are currently members of the SRRWMC (Table 2). Efforts are ongoing to enlist the remaining entities as official members. The formation of the SRRWMC is in many ways the formal recognition of the decades of partnerships and conservation work that has already taken place within the watershed by communities, counties, state, federal, and entities. These partners have been working with landowners and farmers to accomplish conservation goals. Many of these efforts have continued throughout the planning process, and many of these partners are important stakeholders in this watershed planning effort.

Table 2: SRRWMC Membership Status of Eligible Entities

Entity	Member of SRRWMC?
Cities	
Allison	No
Clarksville	No
Dougherty	No
Grafton	No
Greene	No
Kensett	No
Manly	No
Marble Rock	No
Nora Springs	Yes
Northwood	Yes
Plymouth	Yes
Rock Falls	No
Rockford	No
Rudd	No
Shell Rock	Yes
Counties	
Bremer	Yes
Butler	Yes
Cerro Gordo	Yes
Floyd	Yes
Mitchell	Yes
Worth	Yes
Soil and Water Conservation Districts (SWCD)	
Bremer County SWCD	Yes
Butler County SWCD	Yes
Cerro Gordo County SWCD	Yes
Floyd County SWCD	Yes
Mitchell County SWCD	Yes
Worth County SWCD	Yes

The establishment of the SRRWMC enables "cooperation in supporting watershed planning and improvements for the mutual advantage of the political subdivisions involved" (Agreement 28E, 2021). As a WMA, Iowa Code Section 466B.22 enables the SRRWMC to:

1. Assess the flood risks in the watershed.
2. Assess the water quality in the watershed.
3. Assess options for reducing flood risk and improving water quality in the watershed.
4. Monitor federal flood risk planning and activities.
5. Educate residents of the watershed regarding flood risks and water quality.
6. Seek and allocate monies made available to the Authority for purposes of water quality and flood mitigation.
7. Make and enter into contracts and agreements and execute all instruments necessary or incidental to the performance of the duties of the Authority. The Authority shall not

have the power to acquire property by eminent domain. All interests in lands shall be held in the name of the Party wherein said lands are located.

The SRRWMC has no taxing or eminent domain authority. This plan was developed for and under the direction of the SRRWMC.

1.03 EXISTING DATA AND PROJECTS

Watershed planning requires a careful balance of scientific, regulatory, social, and economic factors. As such, this plan was developed with input and guidance from a variety of organizations, programs, and resources. The following section provides an overview of some of the most influential existing plans, projects, and data sources heavily utilized to develop this watershed plan. However, the following is not an exhaustive list of information available or utilized. Data that was specifically utilized in the plan to define watershed conditions and to inform implementation strategies is further detailed in Chapter 2 and Chapter 3.

WATER QUALITY MONITORING

The Watershed has a variety of water quality data that has been collected by multiple partners. Data collected by each partner has unique spatial variability and covers various periods of record. Chapter 3 of this plan provides additional analysis and information on existing water quality conditions. The following partners and sources of monitoring were available for the planning effort:

- Since 1999, the Iowa Department of Natural Resources (IDNR) has been measuring water quality of the Shell Rock River at the City of Shell Rock as part of the Ambient Stream Water Quality Monitoring Program.
- IIHR has been collecting daily water quality and discharge data of the Shell Rock River at the City of Shell Rock since 2019.
- The U.S. Geological Survey (USGS) has been monitoring stream flow of the Shell Rock River at the City of Shell Rock since 1953, with limited water quality data available from 1968 – 2019.

PREVIOUS WATERSHED ASSESSMENTS

Several watershed assessments have been completed which cover portions of the watershed. It is important to note that each assessment was completed on different dates, covers different spatial scales, and uses different data sources and assessment methodologies. The following assessments provided valuable data for this plan:

- Minnesota Shell Rick River + Winnebago River Comprehensive Watershed Management Plan ([Minnesota] Shell Rock River Watershed District, 2022)
- Middle Cedar Watershed Management Plan (Emmons & Olivier Resources and others, 2020)

- Upper Cedar Watershed Management Improvement Authority Watershed Management Plan (MSA Professional Services, 2015)
- Minnesota Shell Rock River Watershed Restoration and Protection Strategy (WRAPS) Report (Thompson, Ignatius, and Zanon, 2021)
- NRCS Rapid Watershed Assessment: Shell Rock (MN / IA) [undated] (NRCS, n.d.)
- ISU Shell Rock River Evaluation (provided by Dr. William L Franklin) (Woolery and others, 2007)

Each of these provided background data that was used as a starting point. Generally, each assessment provides different levels of information on water resources, identification of impairments, a review of ordinances and roles in resource management, a prioritization of subwatersheds for future management work, and recommendations for water monitoring and urban and agricultural best management practices.

IOWA NUTRIENT REDUCTION STRATEGY

The Iowa Nutrient Reduction Strategy (NRS) is a science and technology-based framework to assess and reduce nutrients–particularly nitrogen and phosphorus–delivered to Iowa waters and the Gulf of Mexico (ISU, 2022). It is part of a larger nutrient reduction strategy set forth by the Mississippi River/Gulf of Mexico Watershed Nutrient Force established in 1997 and seeks to reduce the size, severity, and duration of hypoxia in the Gulf of Mexico (ISU, 2018). Iowa is one of 12 states along the Mississippi River that was tasked with developing and implementing a state-level nutrient reduction strategy.

Initiated in 2013, the NRS was developed by the Iowa Department of Agriculture and Land Stewardship (IDALS), IDNR, and Iowa State University (ISU). The strategy is designed to reduce nutrients in surface water from both point and nonpoint sources in a scientific, reasonable, and cost-effective manner (ISU, 2018). It was the first effort in Iowa to utilize an integrated approach involving both point sources and nonpoint sources. Nonpoint source load reductions goals for nitrogen and phosphorus were established at 41% and 29%, respectively.

For more information, visit http://www.nutrientstrategy.iastate.edu.

LOCAL HAZARD MITIGATION PLANS

The Federal Emergency Management Agency (FEMA) provides financial assistance for a variety of hazard mitigation projects, including flood risk mitigation, through its Hazard Mitigation Assistance (HMA) grant programs. However, to be eligible for HMA funds, a project must be included in a FEMA-approved and locally adopted hazard mitigation plan (HMP). All six of the major counties within the SRR Watershed have local HMPs:

- Bremer County Multi-Jurisdictional Hazard Mitigation Plan (Updated 2022)
- Butler County Multi-Jurisdictional Hazard Mitigation Plan (Updated 2020)
- Cerro Gordo County Multi-Jurisdictional Hazard Mitigation Plan (Updated 2018)

- Floyd County Multi-Jurisdictional Hazard Mitigation Plan (Updated 2022)
- Mitchell County Multi-Jurisdictional Hazard Mitigation Plan (Updated 2022)
- Worth County, Iowa Multi-Jurisdictional Hazard Mitigation Plan (Updated 2018)

This watershed plan is not intended to supersede or replace existing local HMPs. This plan may augment the existing HMPs by providing a watershed approach to flood risk reduction and through pairing (where appropriate) water quality and flood mitigation projects together to provide multiple benefits, to provide access to additional funding mechanisms, and to develop more robust project partnerships.

The existing local HMPs were reviewed for flood mitigation projects, and those have been summarized in Chapter 5 of this plan. It is also recommended that new flood mitigation projects identified through the development of this plan be amended into the local HMPs. This will allow those projects to become eligible for HMA funding.

1.04 PLANNING PROCESS AND REQUIREMENTS

COMMUNITY-BASED PLANNING PROCESS

Community-based planning is a participatory process that uses local knowledge to influence and guide the development of the plan. This type of planning process is central to the development of an effective and implementable watershed management plan, which transcends typical political boundaries. The success of a plan like this is dependent on the commitment and voluntary involvement of community members—making it imperative that community members be engaged in the planning efforts. Community-based planning techniques used in this plan include the development of a website, holding regular meetings that are open to the public, the active solicitation of input from stakeholders, and holding several open-house style public meetings.

STAKEHOLDER MEETINGS

Stakeholder meetings were held in conjunction with SRRWMC board meetings (Figure 2), which are open to the public and project partners. Attendees provided input during the planning process, helped to develop watershed goals and objectives, reviewed the draft watershed plan, and were instrumental in the implementation of this plan. The project was kicked off in the fall of 2022, with the first meeting taking place in January 2023. More information about the meetings, including attendance and meeting minutes, can be found in Appendix A.

PUBLIC OPEN HOUSE MEETINGS

Two open house style public meetings (Figure 3) were held to give the public an opportunity to learn about the planning process, provide input on the concerns that are most relevant to them, and provided feedback on the draft watershed plan. More information about the meetings, including attendance and summaries, can be found in Appendix A.

Figure 2: Stakeholder Meeting on March 30, 2022

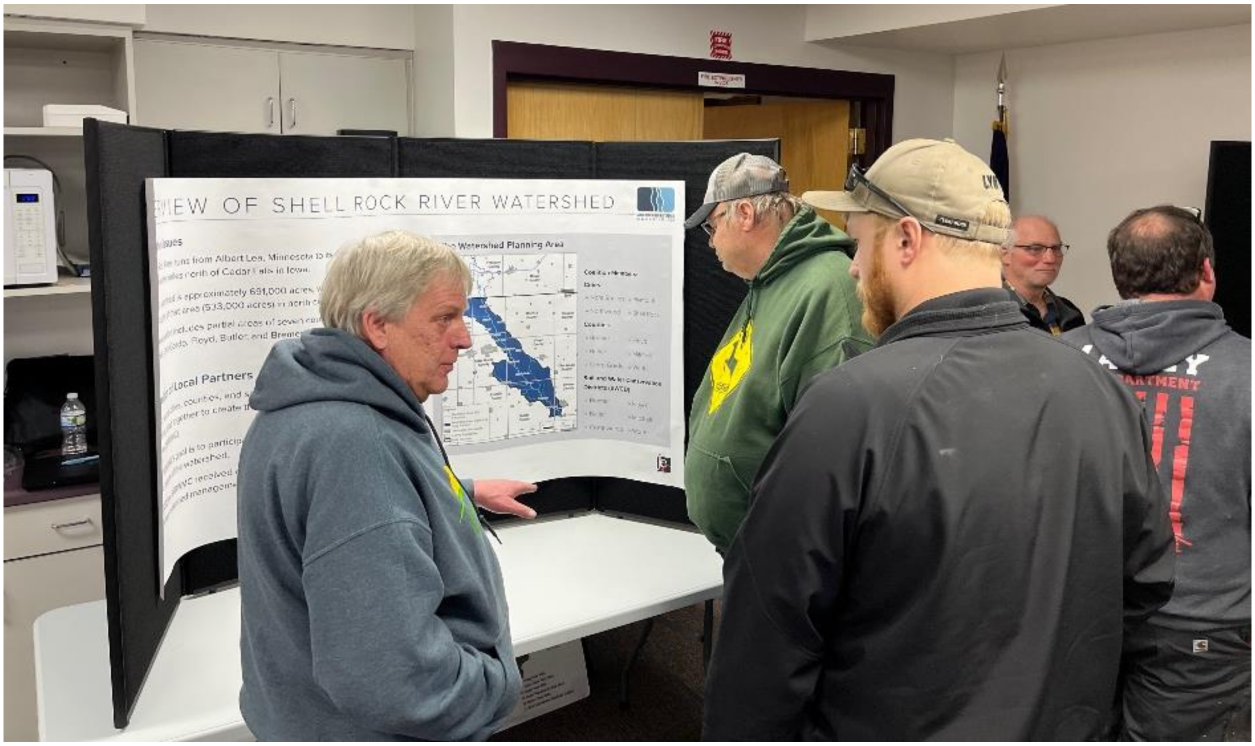


Figure 3: Open House Meeting on March 16, 2023

IOWA SMART PLANNING PRINCIPLES

The planning process has incorporated Iowa Smart Planning Principles, as described in the Iowa Smart Planning Act (Iowa Code Chapter 18B). This act identifies ten principles which must be considered and may be applied when local governments and state agencies deliberate all appropriate planning, zoning, development, and resource management decisions. Additionally, the act outlines 13 elements that may be included in a city or county comprehensive plan. While this watershed plan is not equivalent to a city or county comprehensive plans, it is conceivable that it may inform the development of these local documents in the future. Therefore, this plan addresses, to varying degrees, the following Iowa Smart Planning Principles:

- Collaboration
- Efficiency, Transparency, and Consistency
- Natural Resources and Agricultural Production
- Sustainable Design

NINE-ELEMENTS OF WATERSHED PLANNING

This watershed plan addresses the EPA's Nine-Elements, as defined in their Handbook for Developing Watershed Plans to Restore and Protect our Waters (USEPA, 2008). Throughout this plan, items that directly address one of the nine-elements are marked with a nine-element graphic like what is displayed to the left. The EPA requires that watershed projects receiving Section 319 funds be supported by either a watershed plan that addresses the Nine-Elements or an equivalent plan. Table 3 also provides an index for the location(s) of each element.

Table 3: Location of EPA's Nine Elements within the Plan

Element		Page Number(s)
a.	Identify causes and sources of pollution	69, 83, 87
b.	Estimate existing pollutant loads and expected reductions	97, 132, 146
c.	Described BMPs needed and targeted critical areas	125, 102, 135, 137
d.	Technical and financial resources; and authorities needed	189, 141, 172
e.	Develop an information/education component	155
f.	Develop a project schedule	143
g.	Describe the interim, measurable milestones	143
h.	Identify indicators to measure progress	114, 116
i.	Develop a monitoring component	149

CHAPTER 2. WATERSHED INVENTORY

2.01 INTRODUCTION

This chapter identifies components of the Shell Rock River Watershed (watershed) and provides an inventory of the watershed's characteristics. Information about watershed boundaries, demographics, physical environment, water resources, hydrology, protected areas, wildlife and habitat, and existing policy and regulations within the watershed is reported and explored in this chapter.

2.02 DEMOGRAPHIC SUMMARY

Understanding demographic data, especially farmer, and landowner statistics, can help in the development of outreach and education programs that are more targeted to the needs of the watershed. These recommendations are provided in Chapter 6.

POPULATION

In Iowa, the watershed encompasses portions of nine counties: Worth, Cerro Gordo, Floyd, and Butler Counties make up the vast majority of the area, with Winnebago, Mitchell, Franklin, Bremer, and Black Hawk Counties each having a small sliver of the watershed. Because the watershed does not fall along political boundaries, only estimates are available for demographic data. The watershed completely contains ten incorporated communities, and partially contains another six incorporated communities. Of the communities that fall completely within the SRRWMC, none have a population greater than 2,500 people. The largest metropolitan area is Northwood, which falls partially within the northern end of the watershed. The City of Waverly was not included in this analysis due to aerial imagery analysis indicating that only fringe portions of the community boundaries fell within the watershed. Population estimates are compiled by city and unincorporated county area based on the 2021 American Community Survey 5-year Estimates (U.S. Census Bureau, 2021). The total population of the watershed is approximately 18,886 with the majority (61%) residing in communities (Table 1 and Table 5).

Table 4: Estimated Population of Communities

Community	Population
Allison	279
Clarksville	1,366
Dougherty	82
Grafton	113
Greene	1,154
Kensett	266
Lake Mills (partial)*	460

Manly (partial)*	954
Marble Rock	306
Nora Springs	1,568
Northwood (partial)*	1,501
Plymouth	457
Rock Falls	160
Rockford	661
Rudd	551
Shell Rock	1,616

Source: U.S. Census Bureau, 2021

** City is only partially within the watershed, therefore only the portion within the watershed was estimated*

Table 5: Population Type Distribution

Population Type	Population	Percent
Communities	11,493	61%
Unincorporated Areas	7,393	39%
Total	**18,886**	**100.0%**

Source: U.S. Census Bureau, 2021

AGRICULTURAL ACTIVITIES

Agricultural activities dominate the land use and economy of the watershed. Understanding agricultural activities is important to understanding the potential for certain types of pollutant sources throughout the watershed. Additional assessment of pollutants is provided in Chapter 3.

The United States Department of Agriculture (USDA) Census of Agriculture (Ag Census) provides the most robust statistically valid data for this subject and is published every five years. Select data from the two most recently available years (2012 and 2017) was analyzed to understand both existing conditions and recent trends within the watershed (USDA, 2012, 2019). To estimate values within the watershed boundaries, a percent area was applied to the county-wide data for Bremer, Butler, Cerro Gordo, Floyd, Mitchell, and Worth Counties, which contain most of the watershed (Table 6). The primary crops grown in the watershed include corn and soybeans; and hogs and chickens are the primary livestock produced. The average farm size in the watershed is 357 acres, which is similar to the statewide average of 360 acres.

Table 6: Changes in Agricultural Activities from 2012 to 2017

Item	2012	2017	Percent Change
Land			
Number of Farms	884	851	-4%
Land in Farms (acres)	307,422	303,910	-1%
Average Size of Farms (acres)	343	357	4%

Livestock Inventory			
Cattle and Calves	18,114	19,098	5%
Beef Cows	2,938*	4,033*	27%
Dairy Cows	1,193*	1,122*	-6%
Equine (Horses)	594	451	-32%
Sheep and Lambs	1,072	1,137	6%
Goats	348	480	27%
Hogs and Pigs	184,164	174,576	-5%
Broilers and other Meat Chickens	961	25,827*	96%
Chickens - Layers	3,832*	34,033	89%
Turkeys	5*	48*	90%
Crops (acres)			
Corn for grain	162,736	146,578	-11%
Corn for silage	2,910	1,726	-69%
Soybeans	98,118	111,040	12%
Forage (Hay/Haylage)	4,210	4,609	9%

Source: USDA 2012, 2019

**Data from one or more counties was redacted within the USDA AgCensus reports to protect the identity of individual operations.*

AGRICULTURAL PRODUCERS (FARMERS)

Select demographic statistics for farmers in the watershed were identified from the 2017 Ag Census (Table 7). To estimate values within the watershed, a percent area was applied to the county-wide data for Bremer, Butler, Cerro Gordo, Floyd, Mitchell, and Worth Counties, which contain most of the watershed. These statistics are also presented with statewide data, to help add context. Across Iowa, farmers are predominantly male (65%), white (98%), and older than 55 (62%). Additionally, only 45% list farming as their primary occupation – which indicates they may also spend a considerable amount of time working an off-farm job. Similar trends were noted in the watershed.

Table 7: Select Statistics on Farmers in the Watershed

Item	Watershed Estimate	Iowa
Total Producers (Farmers)	1,422	N/A
Percent Male	68%	65%
Percent Female	32%	35%
Average Age	57.7	57.4
Percent of Farms that are Family Farms	95%	95%

Percent of Producers (Farmers) whose Primary Occupation is Farming	46%	39%

Source: USDA, 2019

FARMLAND OWNERSHIP

Across the Midwest a large portion of land in farms is rented to tenant farmers. In Iowa, 53% of farmland is rented. While the exact percentage of rented farmland varies throughout the Midwest, most of Iowa's neighboring states have a similar amount (USDA, 2019; Bawa and Callahan, 2021). Of the owners who rent out their land to be farmed, 57% do not currently farm themselves and 34% have no farming experience (USDA, 2019). Within the watershed, Ag Census records showed that between 30% to over 50% of farmland is rented or leased (USDA, 2019) (Figure 4). These facts indicate that conservation decisions made by farmers must also take into account their relationship or agreements with landowners. The recommendations found in later chapters of this plan have also been developed to take these factors into account.

Additional data on farmland ownership and farmer tenants at the watershed level was unavailable, however, the *Iowa Farm and Rural Life Poll* (Farm Poll) does offer information at the state level, which is useful for informing the strategies within this plan.

The Farm Poll is a survey of Iowa farmers and has been conducted annually since 1982. While the survey topics vary each year, the 2018 poll focused on several dimensions of landlord-tenant relationships. It is important to note that the Farm Poll survey is a longitudinal panel survey and not a true random sample survey, thus the results are not precise measures, but rather may be indicative of trends. Several questions have been asked at 5-year intervals since 2008, so where applicable, the 2018 poll compared results across years. Several key findings from the 2018 poll are included below (Arbuckle, 2019):

- Most farmers who rent land rent it from multiple landowners.
- 50% of the primary landlords were relatives, and 24% characterized their landlord as a friend of the family.
- About 60% indicated their landlord lived in the county and 10% lived in an adjacent county Most primary landlords lived relatively close to their land, and more than 80% within Iowa.
- Short length of tenure and tenure insecurity are often cited as impediments to tenant investment in soil fertility and soil and water conservation practices. However, most farmers had rented from their primary landlords for more than 10 years, and the length of tenure appears to be increasing.
- Communication between farmers and landlords regarding conservation was less frequent (about half as often) as communication regarding farming practices.
- Results indicated that farmer tenants perceive an increase in their responsibility for conservation actions and decline in the landlord's responsibility. This was most apparent, through the following responses:

- There was a mixture of responsibility for addressing conservation assigned between farmers and landlords. 26% of farmers indicated they were primarily responsible, but very few farmers reported that their landlord was solely responsible. In fact, 72% of farmers agreed or strongly agreed with the following statement "if conservation practices are needed on the land I rent, it is my responsibility to address the need".
- 32% of farmers agreed with the following statement: "my landlord requires me to minimize impacts on soil and water quality", as it related to contractual obligations. This was a lower response than in a previous poll in 2008 (46%)
- Similarly, agreement with the item, "my landlord has established adequate conservation measures on his/her land," declined from 73% in 2008 to 58% in 2018.

One other important source of demographic data was reviewed: *Iowa Farmland Ownership and Tenure Survey, 1982-2017: A Thirty-Five Year Perspective* (Zhang, 2018). This survey started in the 1940s, and since 1989 it has been conducted every five years as mandated by Iowa Code. Many of the findings support data presented from the Ag Census and Farm Poll. The results of this report are statistically representative for all farmland and all landowners in Iowa. While there are some differences with respect to landownership across Iowa the major statewide trends are still maintained at the more regional level. Several key findings from the 2017 survey, which are relevant to the development of strategies presented in this watershed plan, are presented below:

- 60% of farmland is owned by people over 65 years of age, and 35% of farmland is owned by people 75 or older.
- 47% of farmland is owned by women.
- 29% of Iowa farmland is primarily owned for family or sentimental reasons.
- 80% of land is owned by full-time Iowa residents, 7% by part-time residents, and 13% is owned by those who do not live in the state.
- Education has been gradually increasing among farmland owners, currently 39% of farmland is owned by someone with a bachelor's or graduate degree. The level increased to 64% when including any post high school education.
- The highest percentage of owned farmland by active farmers are for those who reported farming a total of less than 400 acres: 53% of full-time farmers and 78% of part-time farmers.
- 86% of leased acres in Iowa belong to landowners who currently do not farm.
- Other relevant trends in Iowa farmland include the continuation of aging farmland owners, increasing amount of land that is cash rented (verses crop share), and an increasing percentage of land held debt free and an associated tightening of the land market.

Additional information on the Farm Poll can be accessed here:
https://ext.soc.iastate.edu/programs/iowa-farm-and-rural-life-poll/

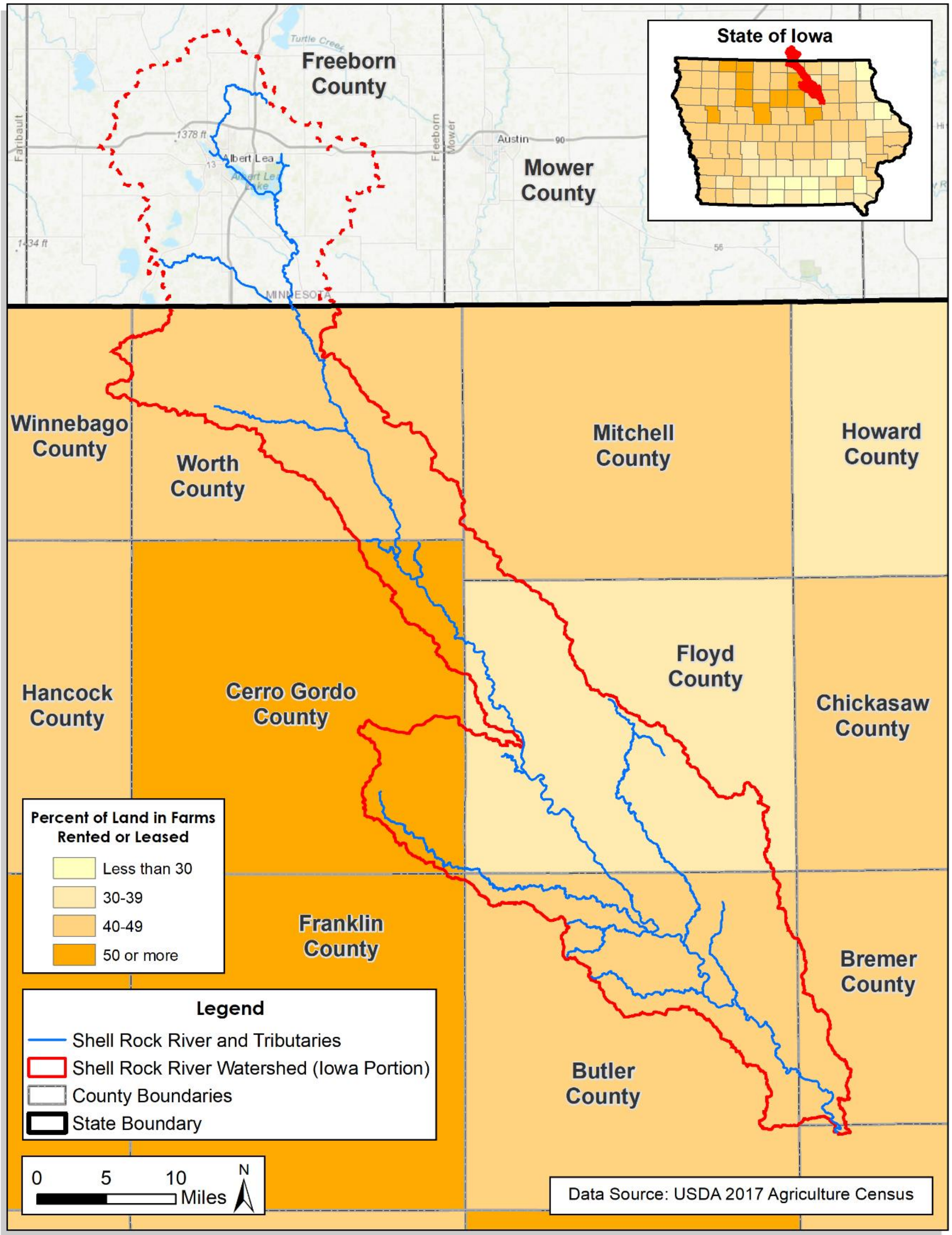


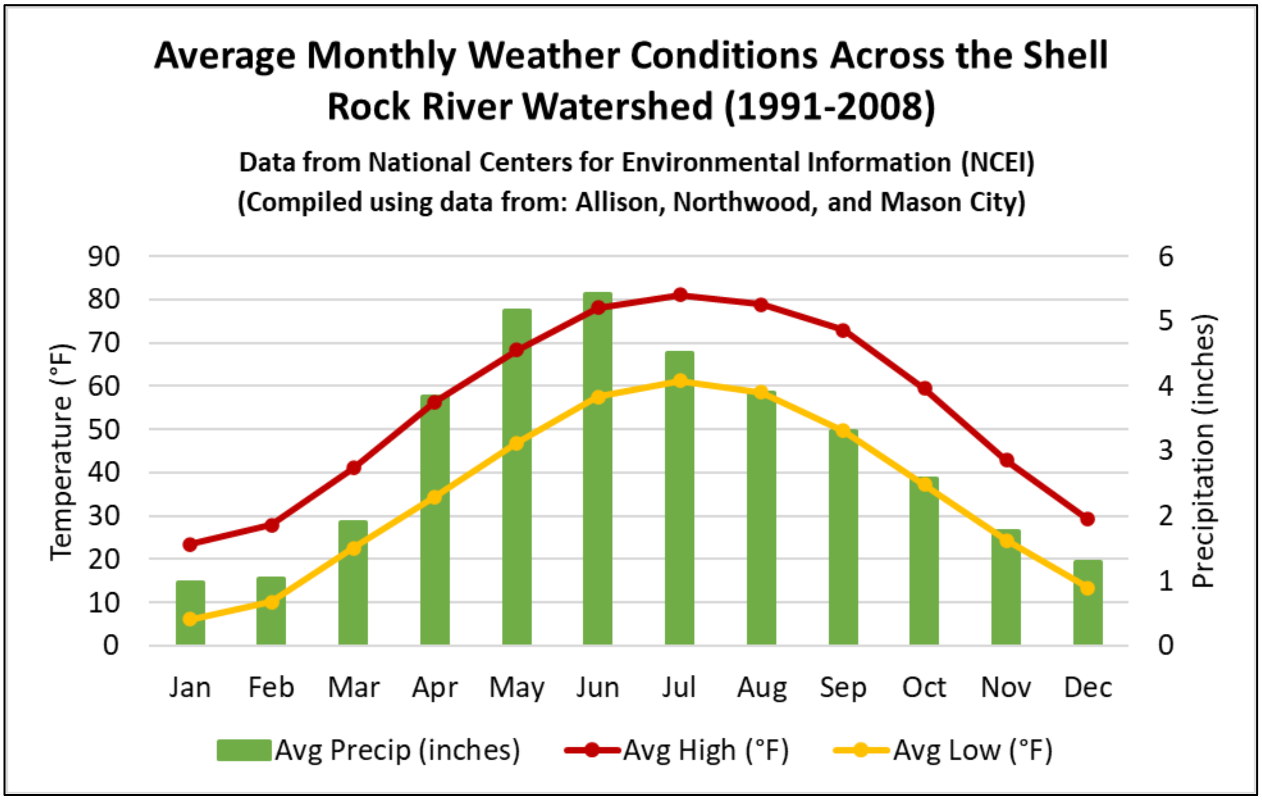
Figure 4: Percentage of Land in Farms Rented or Leased by County

2.03 PHYSICAL ENVIRONMENT

CLIMATE

The climate of the watershed is considered “Humid Continental” on the Köppen-Geiger Climate Classification System (Kottek, 2006). This climate is characterized by large seasonal temperature differences with hot, humid summers and cold winters. Annual precipitation is distributed across the year and varies slightly across the watershed (Figure 6), with the watershed receiving on average between 32 and 37 inches of precipitation per year. Weather data from the National Centers for Environmental Information (NCEI) is summarized in Figure 5, and below:

- Monthly precipitation averages range from 5.4 inches in June to 0.97 inches in January.
- Average high temperatures range from 81°F in July to 23°F in January.
- Average low temperatures range from 61°F in July to 6°F in January.



Source: NCEI, 2023

Figure 5: Average Monthly Temperature and Precipitation

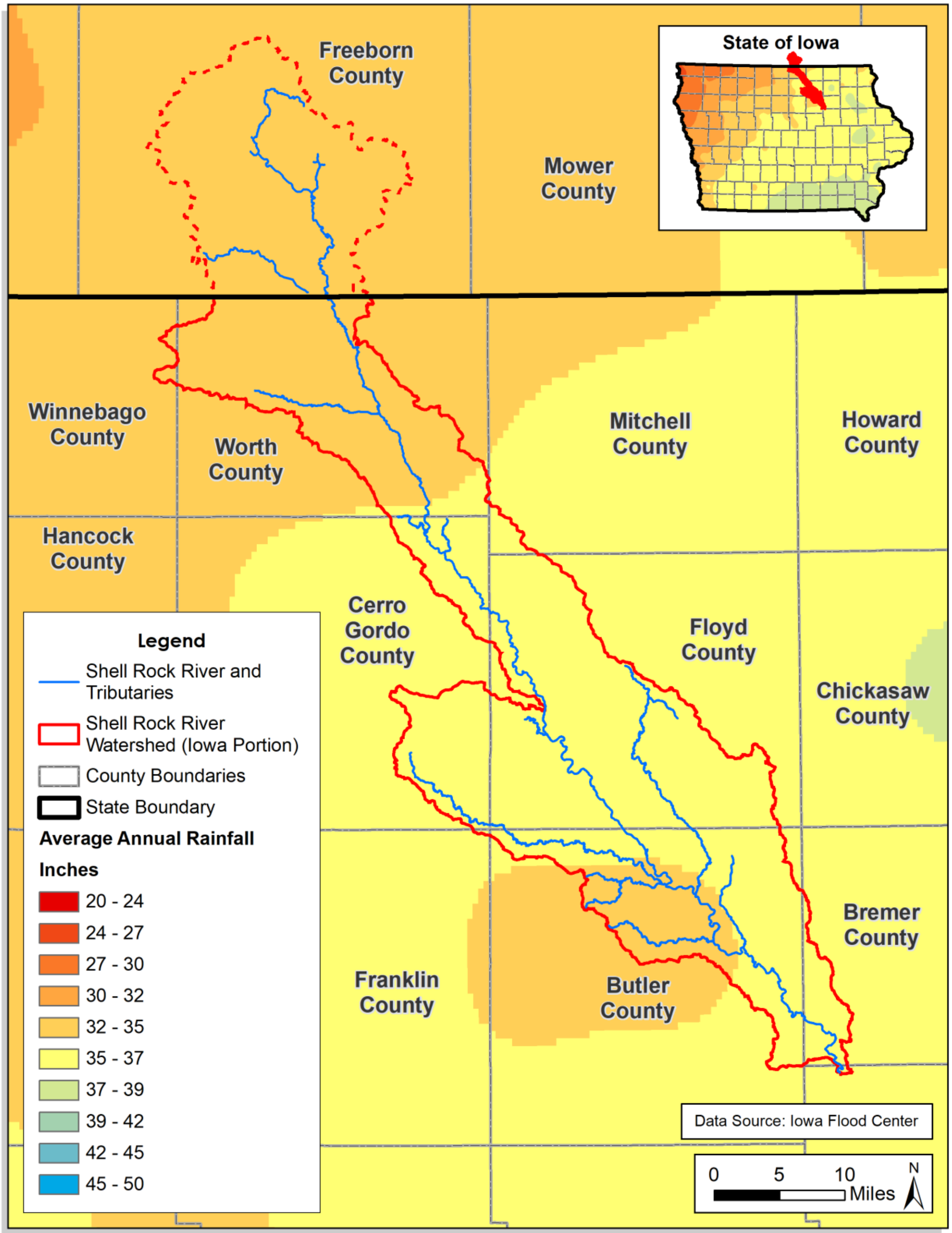
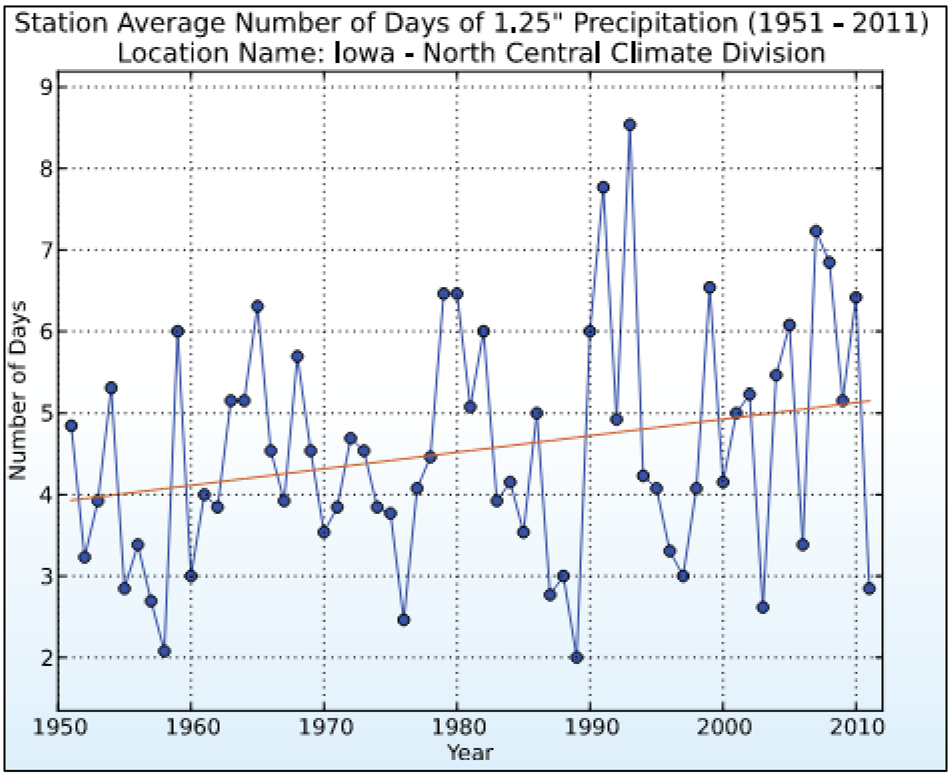


Figure 6: Average Annual Precipitation Map

PRECIPITATION TRENDS

The Midwest, including Iowa, has begun to experience more volatile and variable weather events and conditions, including increased spring rainfall, more frequent 100-year floods, and more frequent and intense drought conditions (USDA-ISU, 2011). These changes not only affect agricultural production and management decisions, but also the selection and design of conservation and flood mitigation practices. These trends in precipitation also influence streamflow levels and pollutant loading to streams – generally wetter years tend to have more runoff and pollutants delivered to waterbodies, while drier years tend to have less.

While the number of days when precipitation exceeded 1.25 inches across North Central Iowa has varied since 1951, Figure 7 shows that the number and intensity of these extreme precipitation events across Iowa is increasing (USDA-ISU, 2011). This can lead to, among other things, increased soil erosion and increased flooding.



Source: USDA-ISU, 2011

Figure 7: Number of Annual Days when Total Precipitation Exceeded 1.25" Across North Central Iowa from 1951 – 2011

LANDFORMS AND GEOLOGY

Iowa has been subdivided into ten distinct landform regions (Prior, 1991). In each region a unique geologic history has shaped the landscape and natural resources. Each unique landform influences the distribution of plant and animal communities and helps determine an area's vulnerability to water quality or flooding problems. The majority of the watershed falls within the Iowan Surface landform (Figure 8), with a small portion in the headwaters falling within the Des Moines Lobe. The Iowan Surface is characterized by low relief and subtle topography, the result of extensive erosion during the coldest part of the Wisconsinan glacial event, when this area fell into a cold but unglaciated tundra. The Des Moines Lobe, on the other hand, corresponds to the southernmost extent of the last glacial advance in the Upper Midwest.

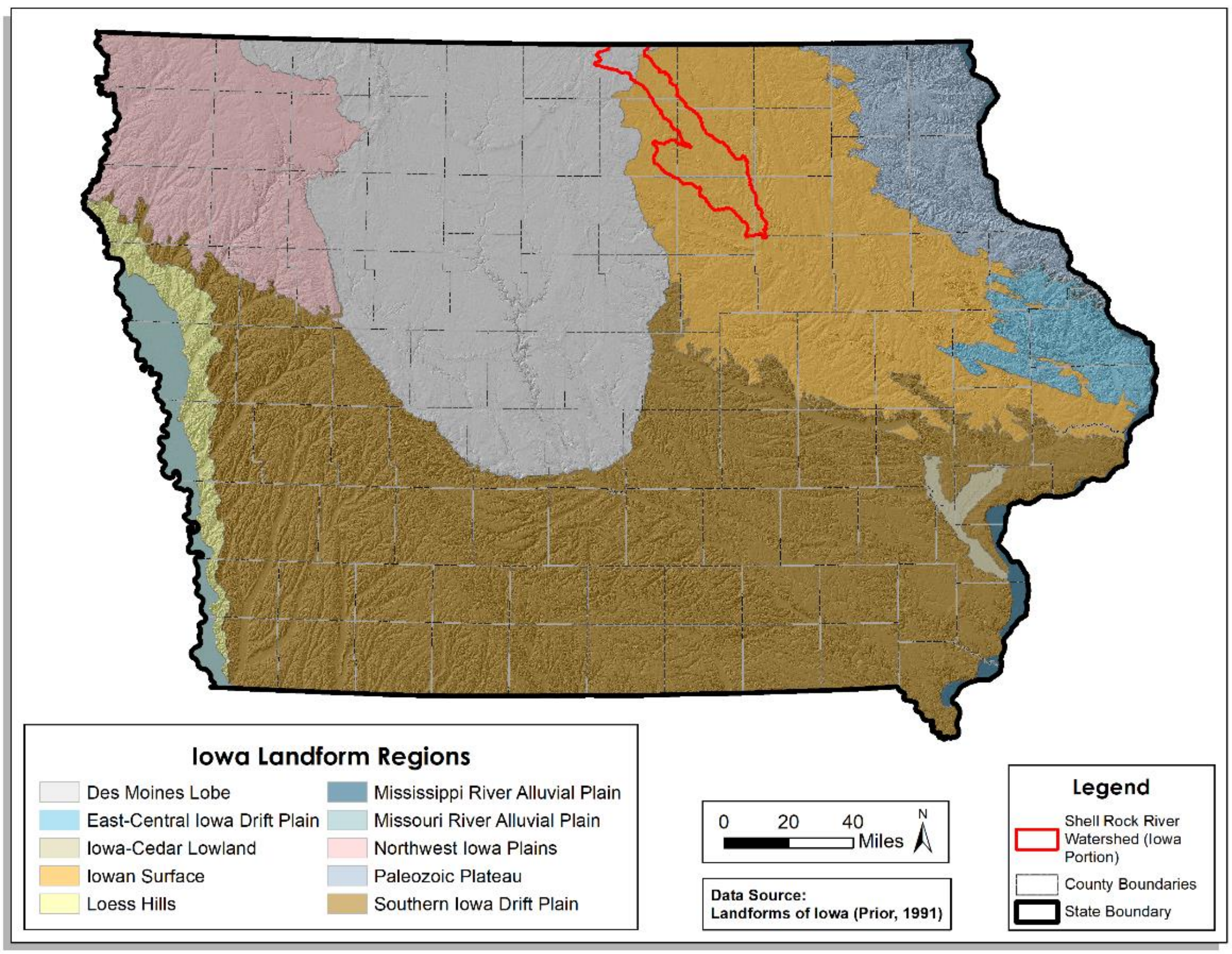


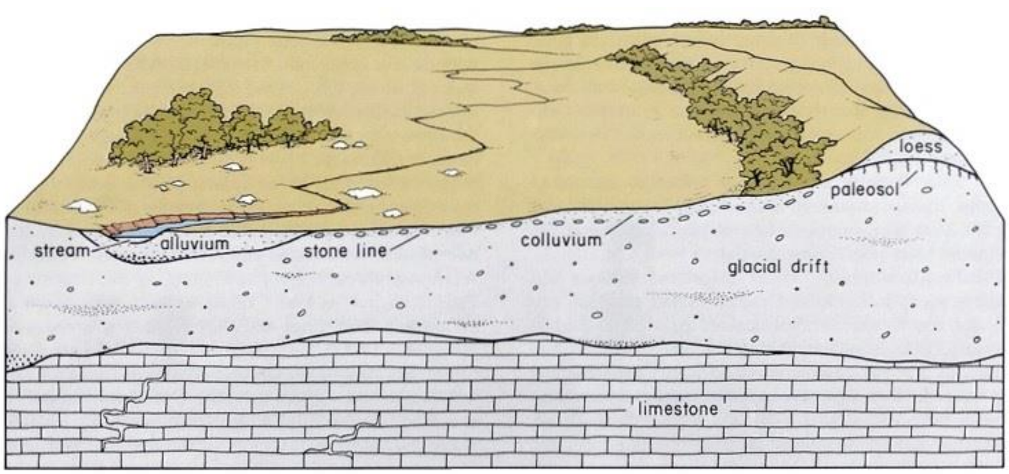
Figure 8: Landforms Within and Near the Watershed

Iowan Surface

The Iowan Surface (Figure 9) is a geologically complex region located between the bedrock-dominated landforms of the Paleozoic Plateau region and the relatively recent glacial drift landforms of the Des Moines Lobe. The southern and southeastern border of this ecoregion is irregular and crossed by major northwest- to southeast-trending stream valleys. There are no natural lakes of glacial origin in this region, but overflow areas and backwater ponds occur on some of the larger river channels contributing to some diversity of aquatic habitat (IDNR, 2023).

The geology of this region has been clearly described in *Landforms of Iowa* (Prior, 1991) and is summarized below:

> *This region evolved not from glacial deposition, but from normal processes of erosion in cold environments where frost action, downslope movement of water-soaked soil materials, and strong winds were the dominant geologic processes at work. Thus, the land surface is gently rolling with long slopes, low relief, and open views to the horizon. Drainage networks are well established, though stream gradients are low, and it can be difficult to pick out drainage divides.*
>
> *Geologic features include only a thin discontinuous deposit of loess and a residual stone line under the landscape surface which often emerges as field stone. Much of the region has relatively shallow limestone bedrock, which sometimes form karst features such as sinkholes. Because of the thin glacial drift, the flow of major rivers, such as the Shell Rock, are maintained during dry conditions by the contributions of groundwater discharge from these bedrock aquifers to the streambeds. Unfortunately, these features also make the region vulnerable to groundwater contamination.*



Source: Landforms of Iowa, 1991

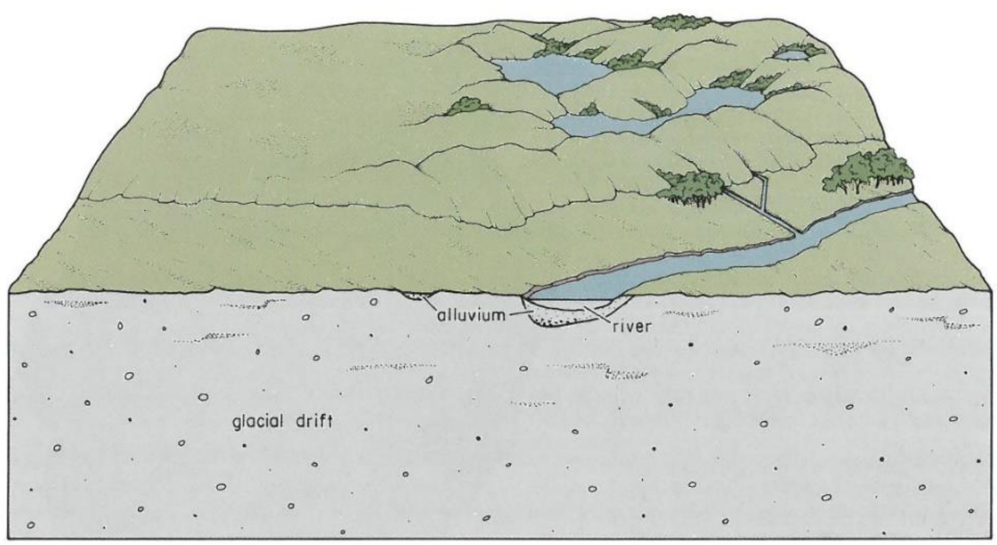
Figure 9: Typical Geologic and Terrain Cross Section of the Iowan Surface

Des Moines Lobe

The Des Moines Lobe (Figure 10) was the last area in Iowa with glaciers, making it geologically one of the youngest and flattest regions in the state. In general, the land is level to gently rolling with some areas of the moraines having the most relief. The morainal ridges and hummocky knob and kettle topography contrast with the flat plains of ground moraines, former glacial lakes, and outwash deposits. A distinguishing characteristic from other areas in Iowa is the lack of loess over the glacial drift. The stream network is poorly developed and widely spaced. What major rivers do exist have carved valleys that are relatively deep and steep-sided. Almost all of the natural lakes of Iowa are found in the northern part of this region. Most of the region has been converted from wet prairie to agricultural use through substantial subsurface water drainage. Only a small fraction of the wetlands remains, and many natural lakes have been drained as a result of agricultural drainage projects. (IDNR, 2021a)

The geology of the Des Moines Lobe has been clearly described in *Landforms of Iowa* (Prior, 1991) with key points summarized below:

> *The geology of this region is composed primarily of drift, or materials left behind by glaciers. However, due to their age these glacial drift deposits are less eroded than those in other areas of Iowa, such as the Southern Iowa Drift Plan. Following the glacial ice retreat, an inefficient drainage network was established in the Des Moines Lobe region of Iowa. Because of this post-glacial landscape, natural lakes, ponds, sloughs, and bogs formed in the hilly area. In fact, nearly all the naturally occurring lakes in Iowa are located in the Des Moines Lobe.*



Source: Landforms of Iowa, 1991

Figure 10: Typical Geologic and Terrain Cross Section of the Des Moines Lobe

TOPOGRAPHY

Topography and slope describe the shape and relief of a landscape. Topography is a measurement of elevation, while slope is the percent change in that elevation over a certain distance. These characteristics are important drivers in drainage and land use patterns within the watershed. Steep slopes lead to higher runoff rates and volumes, which can in turn produce more frequent and more severe flash flooding. High velocity runoff and low infiltration rates severely increase the risks for soil erosion and pollutant runoff.

The topography of the watershed reflects its geologic past. While the watershed is generally considered a flat landscape, there are areas of diverse topography and varying slopes, especially along the Shell Rock River and tributaries (Figure 11). Elevation tends to decrease from north to south, as one travels down the watershed. Elevations range from a low of 867 feet above sea level (ASL) in Black Hawk County, to a high of 1,384 feet (ASL) in Freeborn County in Minnesota.

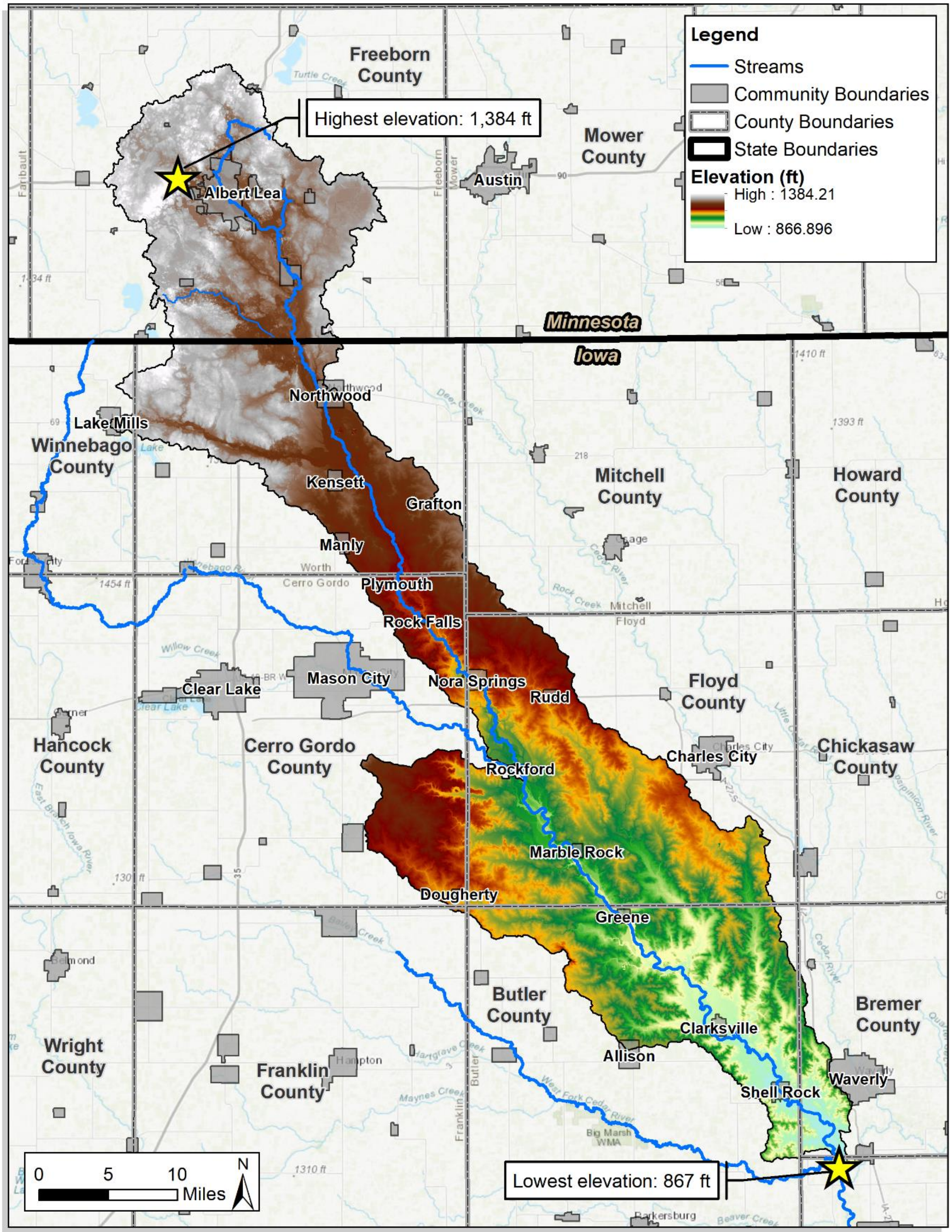


Figure 11: Topographic Relief Map

2.04 SOILS

Soil characteristics such as texture and infiltration rate directly influence the amount of runoff from the landscape and the potential for erosion. NRCS-USDA soils data was downloaded from the NRCS Web Soil Survey and analyzed specific to the watershed with the results provided in the following sections. Please note that information on estimated rates of erosion are provided in Chapter 3.

TEXTURE

Soil texture is given in the standard terms used by the USDA. These terms are defined according to the percentages of sand, silt, and clay in a soil sample that is less than 2mm in diameter. If the content of particles courser than sand (greater than 2mm in diameter) is greater than 15%, an appropriate modifier is added. The clear majority of soils (92%) found in the watershed are comprised of some sort of loam soil (Table 8). Silt loams are highest in the narrow middle portion of the watershed, and mucky soils are found in specific locations in the northern portion of the watershed, where they are associated with more lakes and wetlands within the Des Moines Lobe. Figure 12 displays the soils based upon texture throughout the watershed.

Table 8: Soil Surface Texture Classes in the Watershed

Soil Surface Texture	Percentage (Whole Watershed)	Percentage (Iowa Portion)
Loam	47%	50%
Silty clay loam	17%	18%
Clay loam	17%	13%
Silt loam	12%	14%
Other	8%	6%
Total	**100%**	**100%**

Source: NRCS, 2023

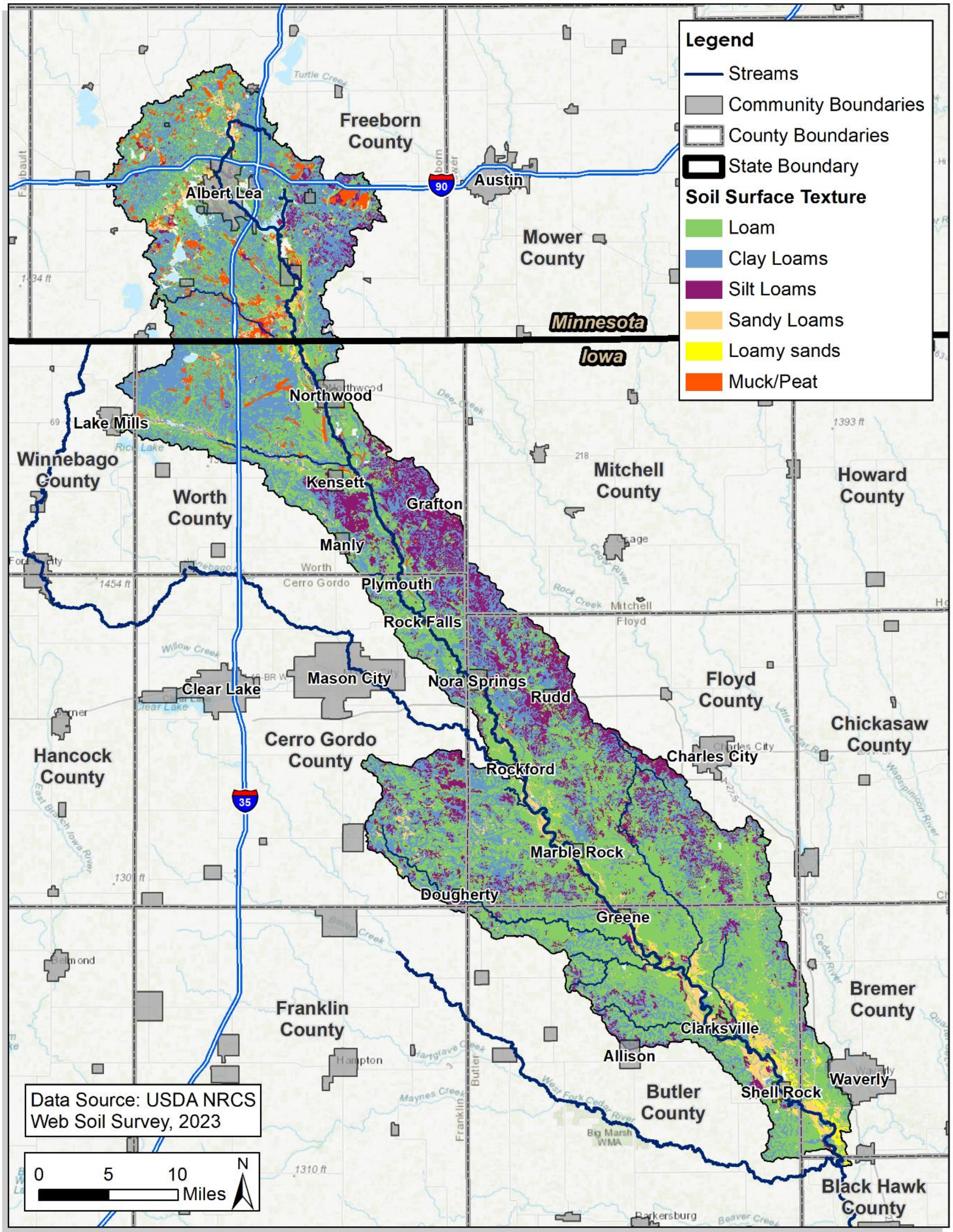


Figure 12: Soil Texture Map

INFILTRATION

The NRCS classification system divides soils into four major hydrologic soil groups (HSG): A, B, C, and D; and three dual classes: A/D, B/D, and C/D. Table 9 provides a description of the role soils plays in runoff generation. Soils within each hydrologic group have comparable runoff potential under similar storm and vegetative conditions. A significant portion (66%) of soils in the watershed consist of C or C/D soil groups, which contribute to higher runoff rates and increase flooding risks. Figure 13 illustrates the geographic distribution of HSG types. The HSGs are consistent with the soil textures describe above.

Table 9*: Breakdown of Hydrologic Soils Groups*

Soil Group	Description	Percentage in the Watershed (Total)	Percentage in the Watershed (Iowa Portion)
A	Soils in this group have low runoff potential when thoroughly wet. Group A soils typically have less than 10 percent clay and more than 90 percent sand or gravel and have gravel or sand textures. Water is transmitted freely through the soil.	4.99%	4.86%
A/D*	Dual Group, See description below table*	0.43%	0.51%
B	Soils in this group have moderate infiltration and transmission rate when thoroughly wetted. Group B soils consist chiefly of moderately well- to well-drained soils with moderately fine to moderately course textures. Water movement through these soils is moderately rapid.	13.07%	14.08%
B/D	Dual Group, See description below table*	11.06%	11.28%
C	Soils in this group have moderately high runoff potential when thoroughly wet. Group C soils typically have loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures. Water transmission through the soil is somewhat restricted.	24.48%	25.44%
C/D	Dual Group, See description below table*	42.59%	40.32%
D	Soils in this group have high runoff potential when thoroughly wet. Group D soils typically have clayey textures. Soils with a depth to a water impermeable layer less than 20 inches, and all soils with a water table within 24 inches of the surface are placed in this group. Water movement through the soil is restricted or very restricted.	3.38%	3.50%

** Soils are assigned to dual groups if the depth to a permanent water table is the sole criteria for assigning a soil to hydrologic group D. If these soils can be adequately drained, then they are assigned to dual groups. The first letter applies to the drained condition and the second to the undrained condition.*
Source: NRCS, 2022

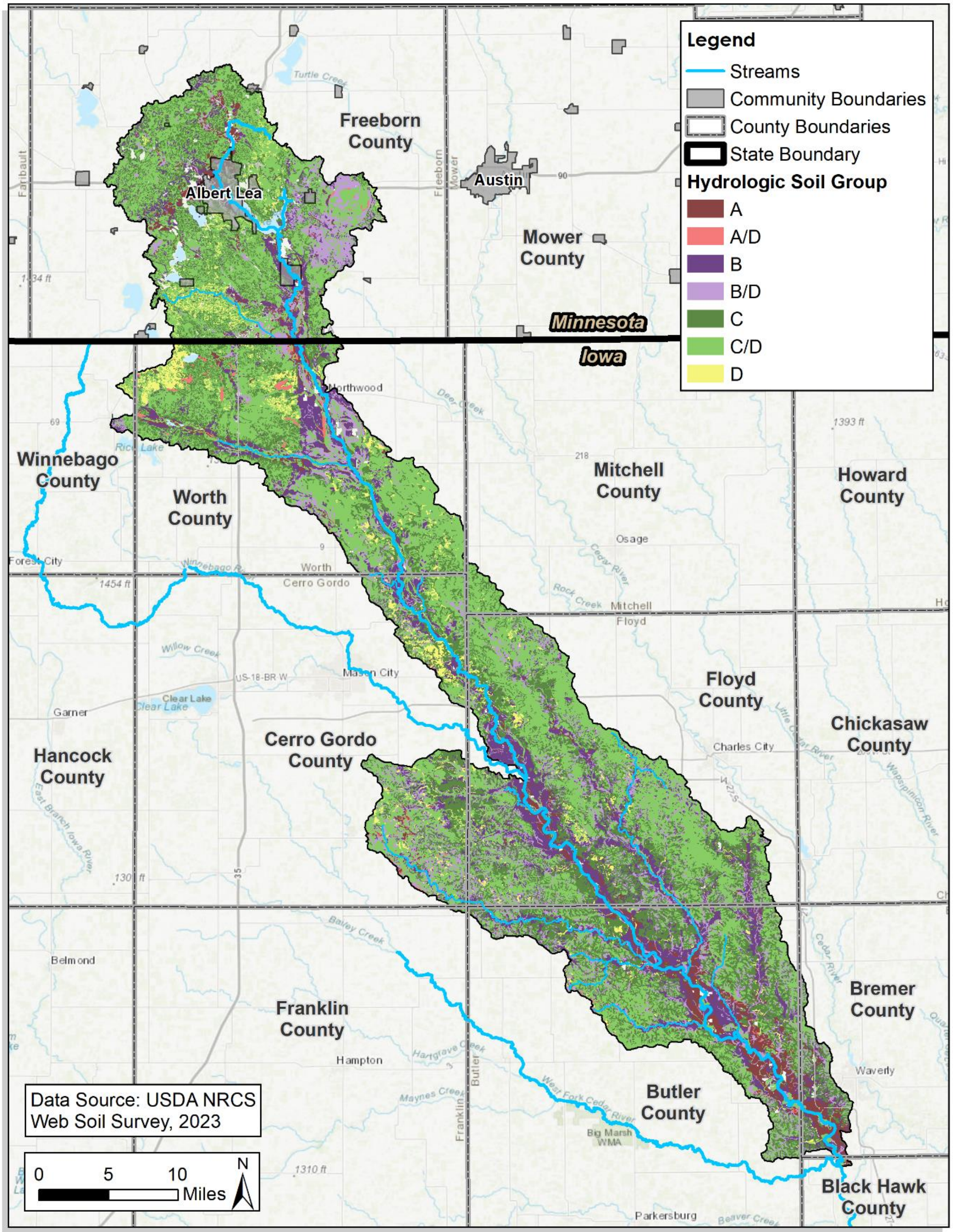


Figure 13: Hydrologic Soil Group Map

SOIL ORGANIC MATTER

Soil organic matter (SOM) is measured as a percentage by weight of soil material that is smaller than 2 mm across. Historically, soils in the Great Plains had high levels of SOM due to the deep roots of prairie grasses. However, intensive agricultural cultivation and erosion has led to reductions in SOM in some areas. SOM has implications for many aspects of soil health, and increased SOM can mean better protection against erosion, reduced leaching of contaminants due to an increase in cation exchange capacity, and better water holding capacity. SOM is greatly impacted by management strategies. Cover crops, conservation tillage, and application of organic matter-rich amendments such as compost, manure, or biochar can all result in increased SOM. SOM is variable within the watershed, with about three-quarters of soils in the Iowa portion containing over 3% SOM. (Table 10). Low SOM is mostly seen in the southern area of the watershed along the Shell Rock River where slopes are higher, and erosion is more likely to occur (Figure 14).

Table 10: Soil Organic Matter Within the Watershed

Soil Organic Matter (% by weight)	Percentage (Whole Watershed)	Percentage (Iowa Portion)
< 2%	4%	3%
2 – 3%	22%	23%
3 – 5%	39%	44%
5 – 15%	32%	30%
>15%	2%	1%

Source: NRCS, 2022

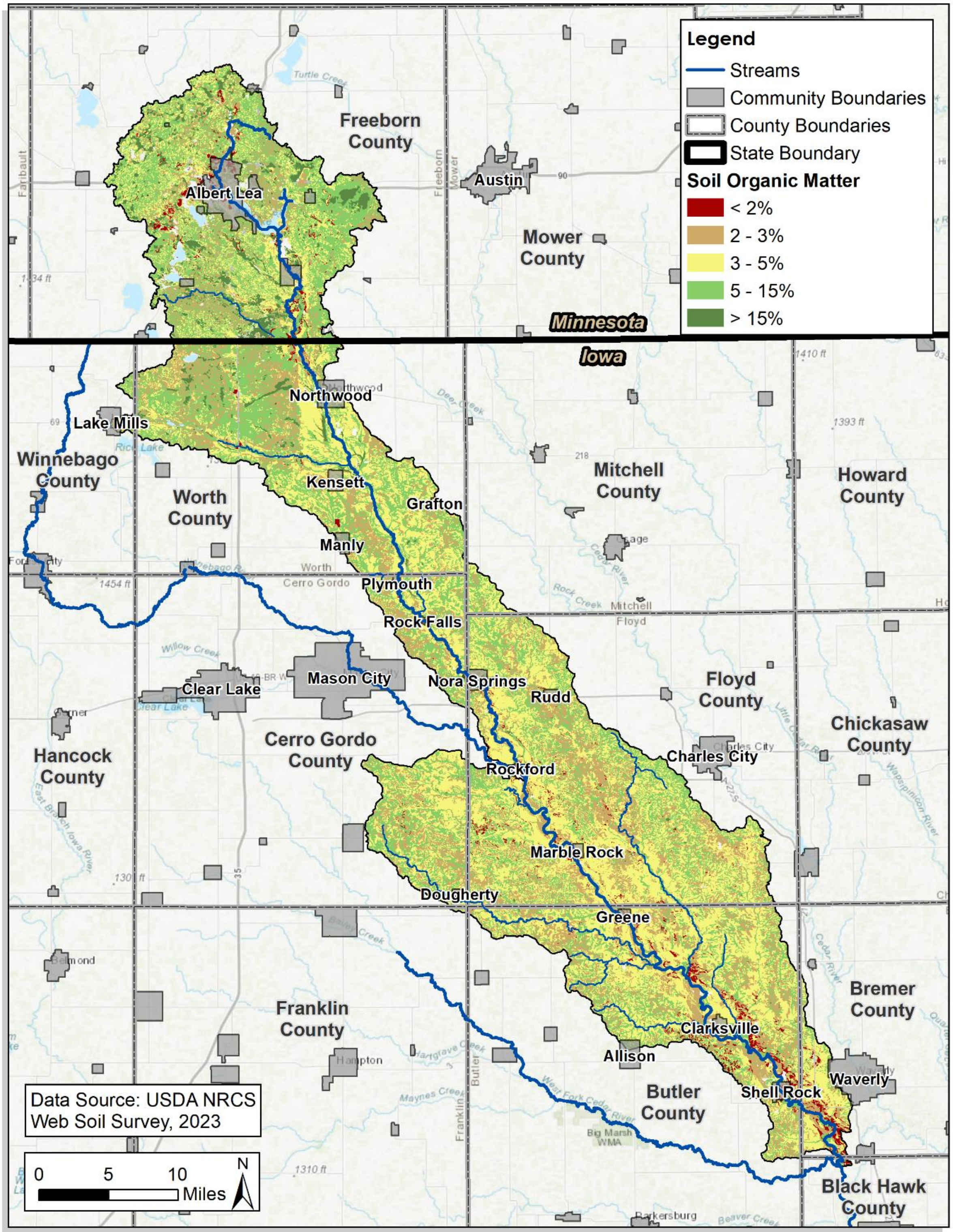


Figure 14: Soil Organic Matter Map

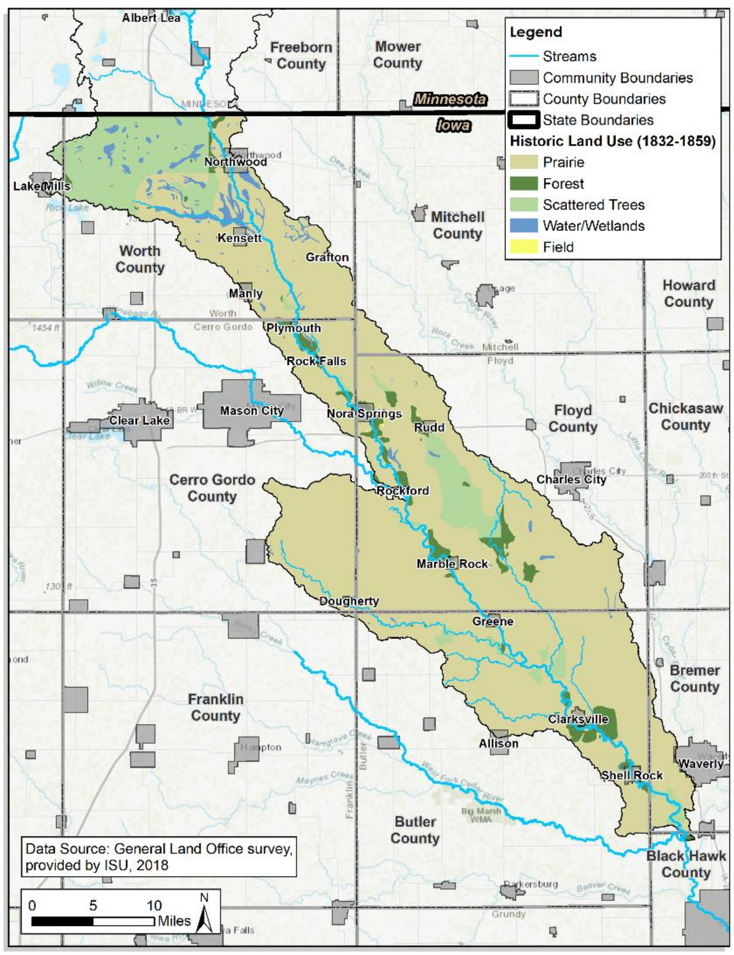
2.05 LAND USE

'Land use' and 'land cover' are two separate terms, yet they are often used interchangeably. Land use describes how people utilize the land (i.e. urban or agriculture), while land cover describes the physical material of the earth's surface (i.e., type of vegetation). For the purposes of this plan 'land use' will be used as a common term for simplicity and because the term implies intentional management.

Understanding land use is at the heart of watershed planning as the activities and uses of the land within a watershed are often the primary drivers in identifying specific sources of pollutants. Understanding how land use affects watershed functions (such as hydrology) requires an understanding of both the historical and present-day land use conditions of the watershed. Streams and other biological communities evolved in the historic setting, and understanding those conditions, as well as the modern-day changes and subsequent impacts to them, is key to finding solutions to current problems.

HISTORICAL LAND USE

Surveys conducted by the General Land Office (GLO) and developed by Iowa State University (ISU) Geographic Map Server were used to develop a map of the historical land use in the watershed between 1832 and 1859, prior to major European settlement (ISU, 2018). The majority of the watershed, like most of Iowa, was covered by prairie, with significant smaller areas covered by scattered trees, forest, and wetlands (Figure 15).



PRESENT DAY LAND USE

As European settlement and agriculture came into Iowa, land use began to drastically change. The prairie-forest-wetland mosaic was transformed into small farms, grain fields, and pastures. Changes in the 20th century were even more dramatic with the advent of improved farming technology and government incentive programs. Modern tiling machines allowed wet areas to be drained, farms increased in size and decreased in complexity, and agricultural chemical use became normal. Across Iowa, between 1900 and 2014 row crop acres increased from 9.1 million acres to 23.4 million acres, and hay and small grain acres decreased from 6.8 million acres to 1.2 million acres. The average farm size increased from 100 acres to more than 340 acres. Additionally, larger farms and field sizes have eliminated fencerow, windbreaks, and waterways (Reeder and Clymer, 2015).

A century and a half of change to Iowa's landscape has resulted in a shift in the composition of plant communities and wildlife, as well as changes in runoff and water quality. Most of the state is now covered with row crops (corn or soybean), with the remainder primarily grassland and small areas of timber, wetlands, or other land uses. The approximate percentage of Iowa's native vegetation remaining includes 0.2% of Iowa's native prairies, 5% of wetlands, and 37% of its forests (Reeder and Clymer, 2015).

Present day land use in the watershed was determined by GIS analysis of the 2022 USDA-NASS's Cropland Data Layer (Table 11). As seen in Figure 16, agriculture now dominates the watershed with 78% of the Iowa portion used for cropland and 11% for grass and pasture (a small amount of this is likely prairie). Small amounts of the watershed are covered with open water (1%) or wetlands (3%); and forested areas (3%) are most prominent along streams.

Cropland can be a major contributor to nutrient pollution in surface water. Cropland can also be subject to high erosion rates and become a source of sediment in surface water, as more disturbed soil is more vulnerable to erosion. However, there are in-field and edge-of-field practices that can help nutrient and sediment pollution that originated from cropland. Some of these BMPs include conservation tillage, cover crops, and others, and are discussed more in Chapter 5.

Table 11: Existing Land Use (2022) in the Watershed

Land Use	Percentage (Whole Watershed)	Percentage (Iowa Portion)
Cropland	75%	78%
Grassland/Pasture	11%	11%
Developed	6%	5%
Forest/Shrubland	3%	3%
Wetlands	4%	3%
Open Water	1%	1%
Total	**100%**	**100%**

Source: USDA-NASS Cropland Data Layer (2022)

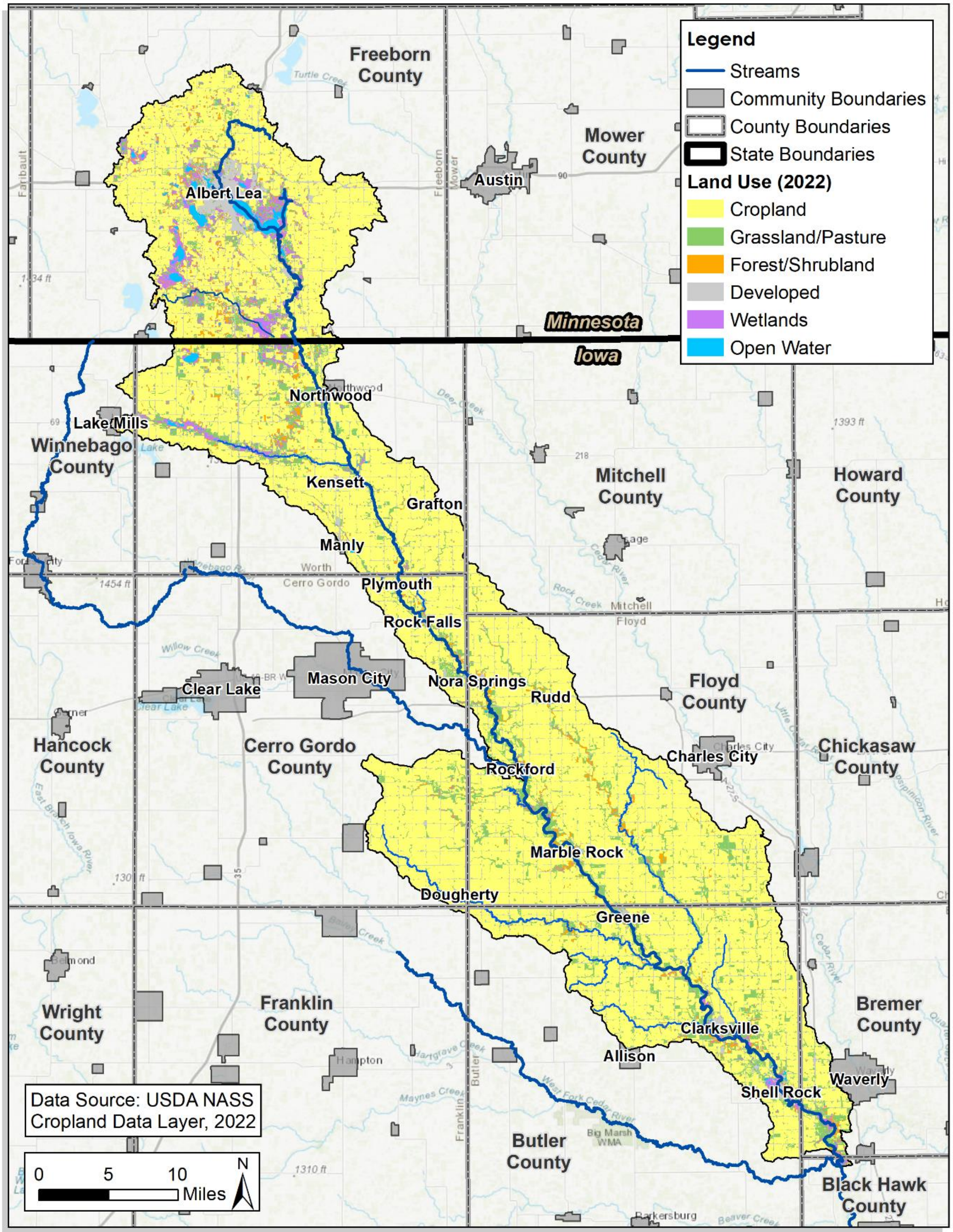


Figure 16: Present Day (2022) Land Use Map

2.06 WATER RESOURCES

STREAMS AND RIVERS

The IDNR maintains a GIS database of streams (and stream segments) that have been given designated uses for the purposes of administering the Clean Water Act. Designated uses vary but include swimming, fishing, human health, drinking water supply, and others. These designated use segments are perennially flowing streams or intermittent streams with perennial pools. Each of these designated streams or segments have been assigned an identification number for consistent identification purposes. While this plan focuses on these designated streams, much of the discussion or projects identified in this plan can also apply to or provide benefits to other streams, segments, or waterbodies in the watershed, even if unnamed.

The watershed is composed of several designated stream segments covering approximately 230 stream miles (Figure 17). There are eight additional named tributaries contributing approximately 113 miles of the 230 stream miles: Beaver Creek, Coldwater Creek, Dry Creek, Elk Creek, Flood Creek and tributaries, Palmer Creek, Rock Falls Creek, and Rose (Table 12). The watershed exhibits a dendritic drainage pattern, with many of the perennial tributaries flowing in a north-to-south direction.

Table 12: Designated Streams in the Watershed

Stream Name	Stream Length (miles)
Beaver Creek	4
Coldwater Creek	38
Dry Creek	13
Elk Creek	12
Flood Creek	19
Beaver Creek (Tributary to Flood Creek)	10
Unnamed tributary to Beaver Creek	3
Palmer Creek	10
Unnamed tributary to Palmer Creek	4
Rock Falls Creek	4
Rose Creek	4
Shell Rock River	100
Unnamed tributary to Shell Rock River	1
Unnamed tributary to Shell Rock River	9
Total Miles	**230**

Notes: Totals may not sum due to rounding

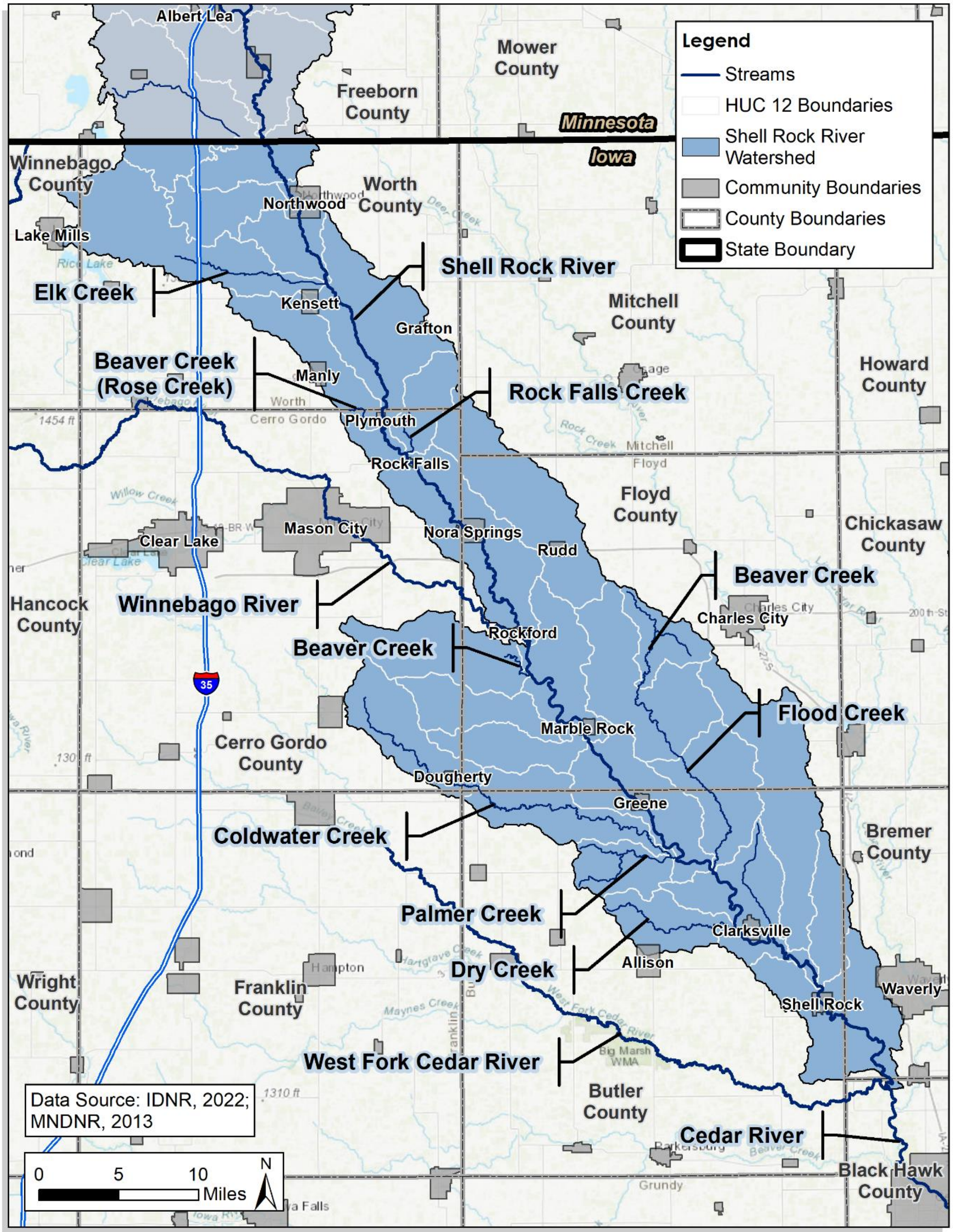


Figure 17: Map of Designated Streams

LAKES AND RESERVOIRS

Like designated streams, IDNR also maintains a GIS database for lakes, each of which has a unique identification number (lake code). There are eight designated lakes or marshes in the (Table 13 and Figure 18) Silver Lake is the largest, covering 316 surface acres of permanent pool and is located northwest of Northwood near the Minnesota border. Other designated lakes or marshes in the watershed range from 1 acres to over 100 surface acres and include Avenue of the Saints Lake, Elk Creek Marsh, and Rudd Lake. The lakes in the watershed offer recreational facilities for activities such as fishing, hiking, picnicking, and camping.

It should be noted that this plan focuses on water quality and flood resiliency as they relate to the streams in the watershed and thus further discussion on lakes will not be included. However, projects identified within the plan will likely provide benefits to many of these lakes or other waterbodies in the watershed.

Table 13: Lake in the Watershed

Lake Code	Lake Name	Surface Area (acres)
02-SHL-1790	Avenue of the Saints Lake	41
02-SHL-799	Elk Creek Marsh	4
02-SHL-791	Rockfall Pond	1
02-CED-6497	Rudd Lake	11
02-SHL-796	Silver Lake	316
02-SHL-797	Silver Lake Marsh	109
02-SHL-785	Sportsmans Pond	9
02-SHL-794	Worth County Lake	3
Total		**494**

Source: IDNR, 2022b

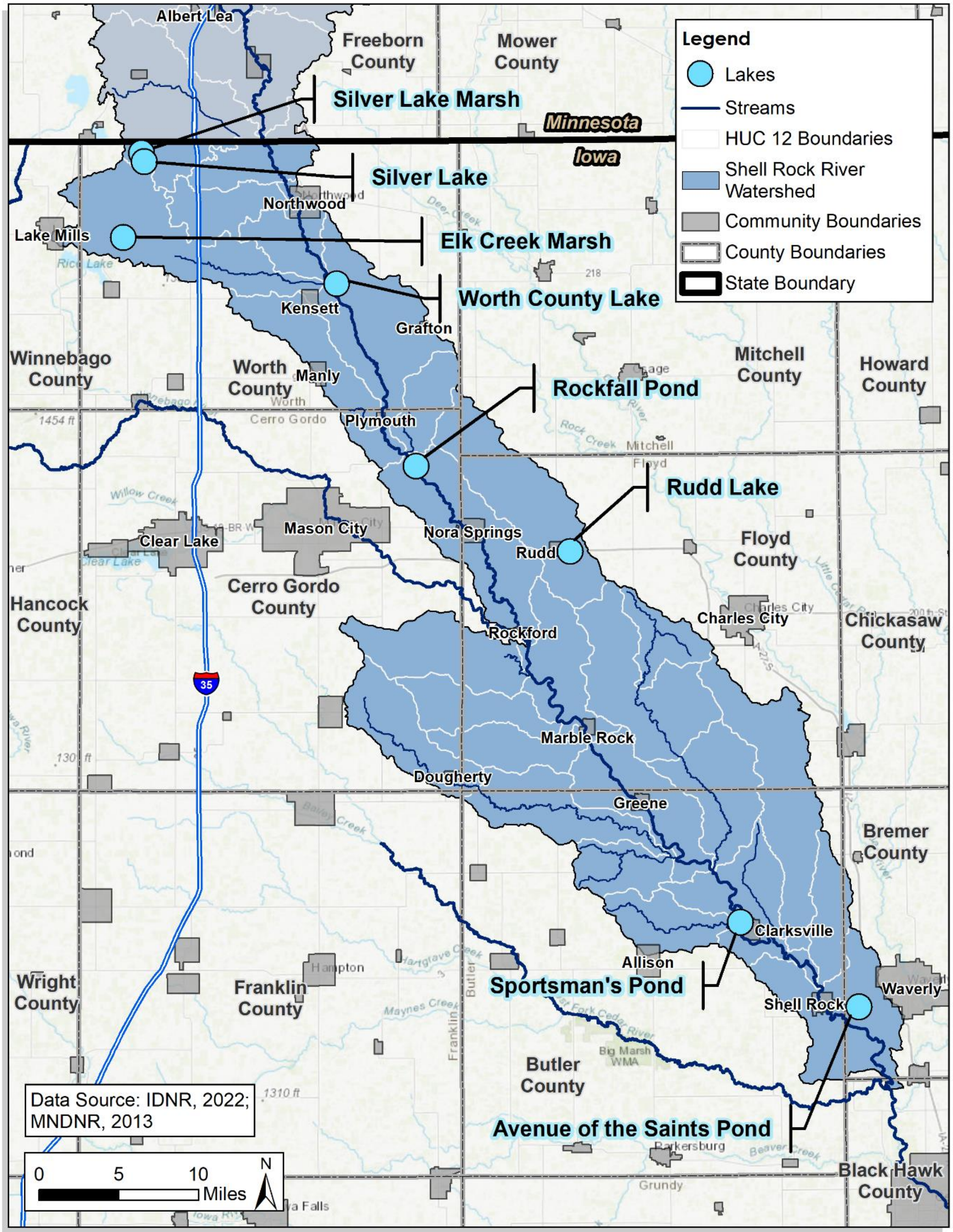


Figure 18: Map of Lakes in the Watershed

WETLANDS

Overview

Wetlands are places where plants and animals live amid standing water or saturated soils. The term 'wetland' is often used interchangeably with other terms such as swamps, sloughs, potholes, marshes, bogs, fens, seeps, oxbows, shallow ponds, or wet meadows. In addition to being essential wildlife habitat, there are socio-economic values related to wetlands. In addition to the money generated from recreation (e.g. fishing, hunting, canoeing, and bird watching), wetlands are economically valuable in flood protection, regulating watershed hydrology, protecting water quality (sediment trapping and nutrient removal), and erosion control.

Originally wetland basins once covered 4 to 6 million acres of Iowa. That represented approximately 11% of Iowa's land surface based upon historical surveys and maps of the landscape prior to European settlement. Wetlands remain part of every watershed in Iowa, but 90-95% of the original wetlands were drained and are no longer fully functional (IDNR, 2016b). Historically, Iowa's wetlands were viewed as a hindrance to land development. In less than 150 years, these rich resources were drained, filled, or otherwise altered, drastically changing the face of Iowa's land.

Many types of wetlands exist in Iowa: prairie-pothole marshes (emergent wetlands), swamps (forested wetlands), sloughs, bogs (emergent wetlands), wet meadows (emergent wetlands), fens (emergent and scrub-shrub wetlands), and shallow ponds are examples of Palustrine wetlands. The Lacustrine System includes large oxbows, natural lakes, and reservoirs. The Riverine System includes streams and rivers (Association of State Wetland Managers, 2015).

Information on Iowa's wetlands, including those found in the watershed, are primarily documented in the following publications:

- IDNR's *2016 Wetland Program Plan for Iowa* (IDNR, 2016b)
- IDNR's *2010 Wetland Action Plan for Iowa* (Evelsizer and Johnson, 2010)
- US Fish and Wildlife Service's (USFWS) *Iowa Wetland Management District Comprehensive Conservation Plan* (USFWS, 2014)

Additional information on Iowa's wetlands and the organizations that help to manage them can be found at the following websites:

- https://www.fws.gov/refuge/iowa_wmd/
- https://www.iowadnr.gov/environmental-protection/water-quality/water-monitoring/wetlands
- http://ppjv.org/

National Wetland Inventory

The USFWS has established the National Wetland Inventory (NWI) to provide biologists, managers, and others with a centralized inventory of wetlands in the United States. This was developed using remote sensing and aerial photography analysis, which is useful for a widescale inventory, however the NWI also has a tendency to miss smaller wetlands. Additionally, farmed wetlands are likely not well represented. Therefore, while useful, the NWI should not be considered a complete inventory of all wetlands and should not be used as substitute for on-the-ground surveys.

Analysis of NWI data indicates that there are approximately 14,829 acres of mapped wetlands in the Iowa portion of the watershed (Figure 19). These are all freshwater wetlands. The vast majority of these are located in the headwaters of the watershed, within the Des Moines Lobe. Table 14 provides a breakdown of approximate acreages of NWI wetlands (by type) in the watershed.

Table 14: Wetland Estimates Across the Watershed

Wetland Type	Acres (Whole Watershed)	Acres (Iowa Portion)
Emergent	16,675	6,559
Forested/Shrub	3,746	2,286
Pond	1,642	822
Lake	6,028	748
Riverine	5,068	4,414
Total	**33,159**	**14,829**

Source: USFWS National Wetland Inventory (NWI, 2023)

Many of the wetlands within the watershed are associated with the Prairie Pothole Region (PPR). The PPR is a naturally poorly drained region across North America (see Figure 19) containing thousands of shallow wetlands known as potholes, which are the result of glacier activity (as previously discussed in the landform section of this chapter). Iowa's Des Moines Lobe roughly forms the southernmost extent of the PPR of central North America. There are also many riverine wetlands that are closely associated with the corridor of the Shell Rock River and its tributaries. These mainly consist of those in the floodplain, along the river’s edge, and old oxbows or backwaters.

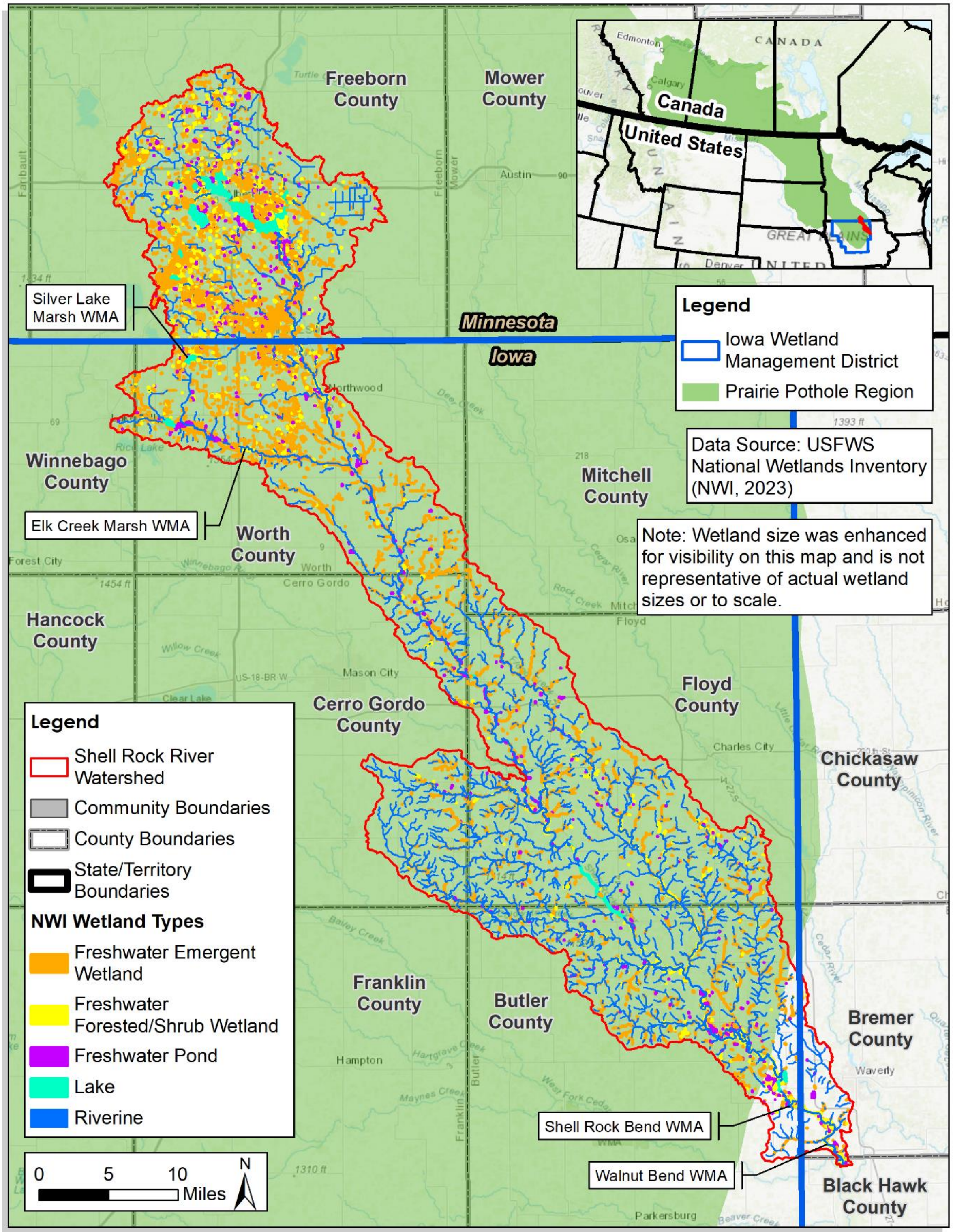


Figure 19: Wetlands Overview Map

Prairie Pothole Region

Most of the watershed is located within the Prairie Pothole Region (PPR) (Figure 19). Prior to agricultural drainage, the PPR region contained abundant wetlands, many associated with "prairie potholes" or "kettles" evident from the General Land Office (GLO) surveyors' maps and notes. The numerous potholes and depressional areas throughout the area historically formed a unique hydrologic system. While subtle features on the ground, the linked depression systems stand out as dark web-like patterns when viewed from the air. Historically, these depressions provided an infiltrative hydrology, allowing surface water to be collected, stored, and gradually released to larger streams and underground aquifers (USFWS, 2014).

Today, the landscape looks much different, dominated by agriculture that consists primarily of corn and soybeans. This alteration has led to an imbalanced hydrological regime. In the upstream or headwater portion of small streams, water moves off the land much faster, allowing greater stream bank and bed erosion, creating increased transport and deposition of sediment, nutrients, and other pollutants, along with more severe flooding downstream. Draining of wetlands has lowered the water table, causing natural underground springs and small streams to stop flowing. Most of these hydrological changes have occurred within a human lifetime (USFWS, 2014).

Through drainage practices, the Des Moines Lobe has been left with 3 to 4 percent of its original wetland area, which was approximately 44 percent of the total land area of the Des Moines Lobe (Arenas, 2020). Based on current land use estimates, that number has been reduced to approximately 3% of the watershed.

This area of Iowa overlaps partially with the Iowa Wetland Management District (WMD), as shown in Figure 19. The Iowa WMD consists of scattered tracts of habitat (both wetland and upland grassland) known as Waterfowl Production Areas (WPAs). Currently, there are 75 WPAs in 18 counties in north-central Iowa totaling just over 25,000 acres primarily managed by the IDNR. Even though district acquisition has only occurred in 18 counties to date, a larger 35-county boundary is approved. This boundary follows the historic range of the PPR (USFWS, 2014).

The Iowa WMD, like many other WMDs, was established in 1962 by the USFWS to effectively manage the increasing number of WPAs being acquired with funds from the 1934 Migratory Bird Hunting Stamp Act (also known as the Duck Stamp Act). WMDs were established not only to manage all the WPAs in a multi-county area, but also to work closely with the private landowners, government and nongovernment organizations, businesses, and other federal agencies in their districts to improve wildlife habitat. Uniquely in Iowa, it was decided that while the USFWS would provide federal Duck Stamp funds for land acquisitions, the IDNR would supply the personnel necessary to restore and manage the WPAs (USFWS, 2014).

Management within the Iowa WMD is also coordinated with the Prairie Pothole Joint Venture (PPJV) which was created in 1987 under the North American Waterfowl Management Plan. The PPJV is one of nearly two dozen Joint Ventures dedicated to habitat conservation across North America. Joint Ventures provide a framework for partnerships between various organizations, to work cooperatively on conservation projects, from research and planning through implementation, evaluation, and monitoring.

The PPJV is a voluntary, self-directed partnership that functions as a network of partners at the local, regional, national and international levels. The partnership involves federal and state agencies, non-governmental conservation groups, private landowners, scientists, universities, policy makers, resource managers, corporations interested in conservation, and others interested in prairie habitat conservation. Partners pool their resources and knowledge to accomplish more jointly than they could by working on their own.

ARTIFICIAL DRAINAGE

Much of Iowa, including portions of the watershed, have been made more agriculturally productive through the use of artificial drainage of the landscape. Areas that are relatively flat or lack natural drainageways are often subject to some form of man-made drainage through a combination of drainage district projects and field tiling. This artificial drainage has allowed countless acres of wetlands and other wet areas to be converted and used for agricultural production. The reclamation process is completed through the removal of surplus groundwater from surface soils to provide optimal conditions for row crop growth.

Artificial drainage is most prominent in the Des Moines Lobe area of the watershed, however, the rest of the watershed is likely to experience some level of drainage due to topography and soils. Therefore, an overview of this system is presented as to further the understanding of the overall hydrology of the watershed and how streamflows and water quality are affected.

Drainage of permanent and seasonal surface water from the landscape in lakes, ponds, wetlands, and potholes generally involves channelization of existing rivers, installation of tile drainage, and construction of drainage ditches to connect depressional areas to natural streams. Shallow groundwater is drained from fields with the uniform placement of field tiles that connect to a main drain. Field tiles can be made from clay, concrete, cement, aluminum, iron, steel, or plastic (Garvin, 2017).

To assist landowners in draining their fields, drainage districts have been created through authority granted by the Iowa Legislature and Constitution. Drainage districts are governed by a board of trustees. Typically, the county board of supervisors (where the district is located) serves as those trustees. The basic purpose of the drainage district is to provide and maintain facilities for draining the excess water in a watershed area. Figure 20 illustrates the estimated extent of drainage districts across the watershed.

While a drainage district is responsible for larger drainage infrastructure, landowners are responsible for the installation and maintenance of tiling infrastructure on their property. The estimated extent of privately tiled fields (estimated based on soil data) is shown in Figure 20. These tile lines are generally buried 3-5 feet below ground level. The tile system is necessary to move excess water from fields to streams or drainage ditches, as illustrated in Figure 21.

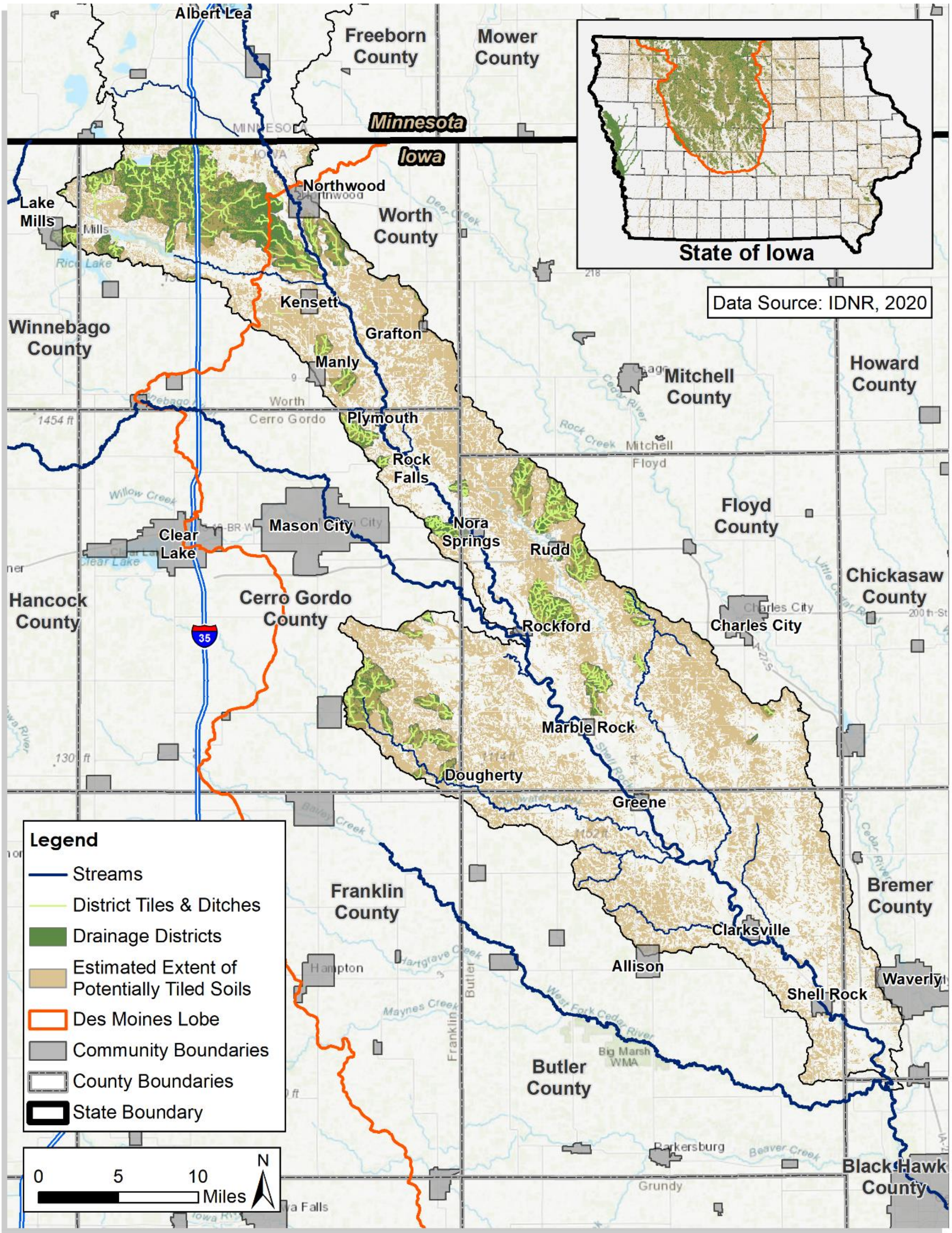
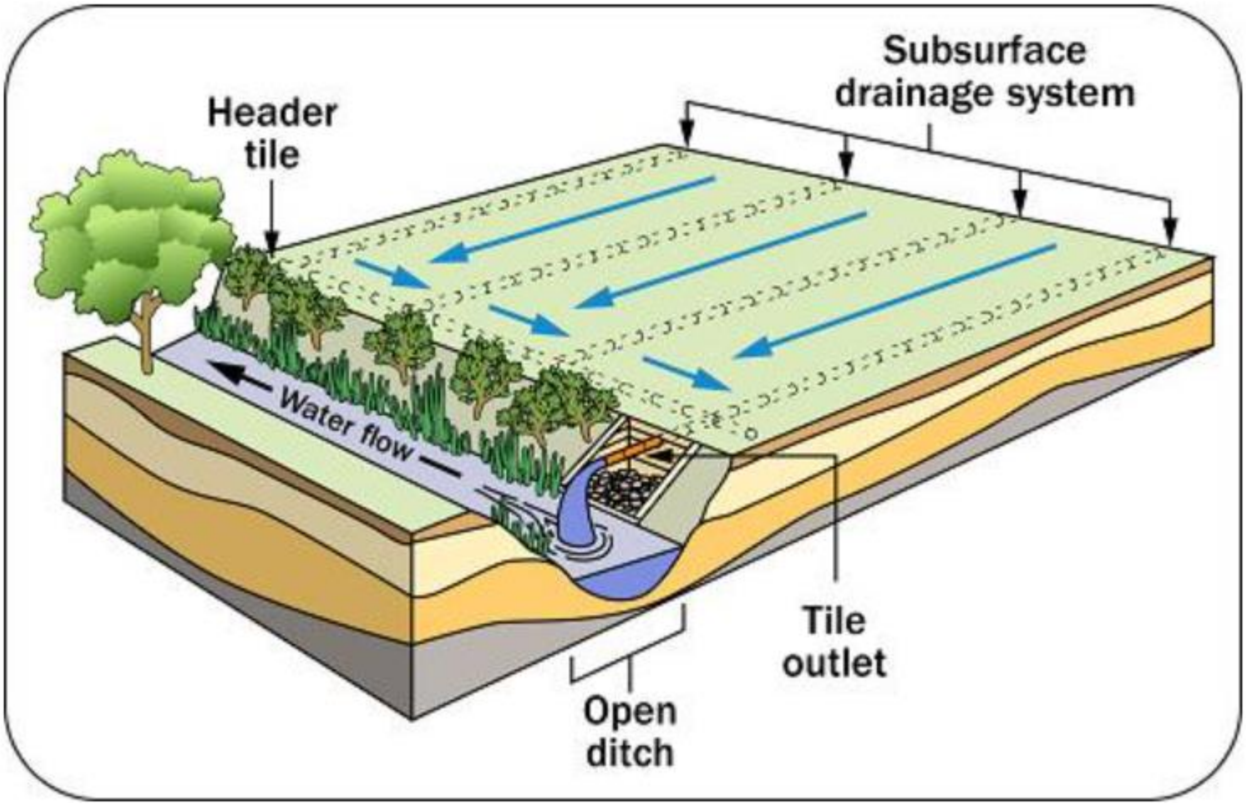


Figure 20: Estimated Extent of Tiled Fields, Drainage Districts, and Ditches

Some documentation of tiling installations, including private locations, is kept by county recorders, NRCS offices, landowners, or contractors. However, the available knowledge of the full extents of both private tiling systems and county drainage district infrastructure and drainage areas is limited due primarily to dated record keeping. The information presented in this plan only provides the reader with a general understanding of this system. For project level planning involving drainage infrastructure and tile lines landowners and county records should be consulted and corroborated with an on-the-ground assessment.



Source: Vander Veen, 2019

Figure 21: Conceptual Illustration of a Tile Drainage System

While there are many agricultural benefits to drainage, the effects on streamflow and water quality can be serious. Field tiling and drainage infrastructure lower water tables and quickly remove water from saturated soil. Water from field tiles flows into ditches and streams much more rapidly than would naturally occur. Increased streamflows can result in increased stream erosion. Additionally, flushing water from fields faster increases the risk of nutrients (especially nitrogen) being carried away and harming downstream water quality. While tile drainage presents unique challenges to watershed management, there are many new and innovative practices that can be implemented to mitigate these effects. These are discussed more in Chapter 5, but include practices such as saturated buffers, drainage water management structures, and bioreactors.

2.07 STREAM MONITORING NETWORK

The stream monitoring network in the Shell Rock River Watershed is composed of multiple streamgages, sensors, and sampling sites. Multiple entities are responsible for maintaining sites, collecting data, and distributing this information to landowners, land managers, and the general public.

The main data sources of stream monitoring within the watershed are discussed below, with a map of each site found in Figure 22. Streamflow data is discussed later in this chapter, while analysis of water quality data is presented in Chapter 3. It should be noted that the information presented here may not be all inclusive and there may be other data sources and studies available. Watershed sampling and monitoring efforts should be continued and expanded to further understand the spatial and temporal water quality patterns across the watershed.

IOWA DNR STREAM MONITORING

IDNR maintains a network of “fixed” stations to monitor ambient water quality data across Iowa. Currently, 60 stream sites are sampled year-round on a monthly basis. These sites have been monitored monthly since 1999. There is one active ambient sites located within the watershed.

There is one site within the watershed that was reviewed for inclusion in this plan.

- “Shell Rock River at Shell Rock” (ID#10120001) is located on the Shell Rock River in the city of Shell Rock and has a monitoring period of 1999 – present. Data at this site can be accessed at the following link: https://programs.iowadnr.gov/aquia/Sites/10120001.

US GEOLOGICAL SURVEY (USGS)

The U.S. Geological Survey (USGS) manages 11 continuous water monitoring sensors in Iowa. These are primarily utilized for flow and discharge measurements, with some sites having water quality data. There is one (1) active monitoring site located within the watershed:

- USGS 05462000 (Shell Rock River at Shell Rock, IA).
    - Period of record: 1953 – 2023
    - Very limited water quality data available from 1968 – 2019

Due to the limited data available at this site, it is not included in the water quality analysis of this plan. It is shown in Figure 22 for context but is not labeled since their data is not included. Additional information can be found here: https://waterdata.usgs.gov/ia/nwis/rt.

IOWA FLOOD CENTER (IFC)

The IFC (as part of IIHR-Hydroscience and Engineering) manages a continuous water monitoring network of 60 high frequency, in-stream real-time monitoring sensors across Iowa. IWQIS allows access to real-time water-quality data and information such as nitrate, pH, and dissolved oxygen concentrations, discharge rates, and temperature. There is one (1) site within the watershed.

- A sensor on the Shell Rock River at Shell Rock (WQS0083) has a period of record of 2018 – 2022.

Data from these sites can be found on the Iowa Water Quality Information System (IWQIS): https://iwqis.iowawis.org/

OTHER MONITORING SITES

Several other sites, not located in the watershed, are identified on Figure 22. These are not discussed further in this plan and are provided for awareness only.

- "Winnebago River Upstream of Mason City (US1)" is located on the Winnebago River, upstream of the City of Mason City. It has a monitoring period of 1999-2014, and can be accessed at the following link: https://programs.iowadnr.gov/aquia/Sites/10170002
- "Winnebago River Downstream of Mason City (DS1)" is located on the Winnebago River, downstream of the City of Mason City. It has a monitoring period of 1999-2014, and can be accessed at the following link: https://programs.iowadnr.gov/aquia/Sites/10170003
- "Shell Rock River" is located on the Shell Rock River 1 mile north of the Iowa/Minnesota border and just west of Gordonvsville, MN. This station is monitored by the Minnesota Pollution Control Agency (MPCA), with a period of record from 1960 to present. Data can be accessed at the following link:
    - https://www.dnr.state.mn.us/waters/csg/site.html?id=49009001

EXPANDED STREAM MONITORING

Review of existing monitoring data revealed multiple monitoring gaps due to only one active monitoring site. Unfortunately, the scale of most ambient monitoring is larger than the scale of most water quality projects. If additional monitoring funds or partners can be identified, it is recommended that a more rigorous monitoring strategy be implemented. This should include sampling at more locations along the main-stem and at major tributaries to the Shell Rock River. This could potentially be broken up along county lines (Figure 22). Ideally this sampling would be at least monthly. This would allow a more detailed understanding of existing pollutant sources within the watershed and establish baselines for future implementation projects to be compared to. Stream flow (discharge) should also be collected so that pollutant loads can be estimated, in addition to the pollutant concentration data.

PHOSPHORUS AND SEDIMENT MONITORING CHALLENGES

Estimating total phosphorus and sediment loads with available water quality data is challenging. There are two primary forms of phosphorus that need to be measured to calculate total phosphorus loads: dissolved phosphorus (commonly referred to as ortho-phosphate) and particulate phosphorus, which is attached to sediment and moves primarily by soil erosion.

Most long-term water quality sampling efforts across Iowa, including the Shell Rock River are based on monthly grab sampling. However, monthly measurements are not ideal to characterize phosphorus and sediment loading that is dependent upon storm events, which cause erosion and the subsequent loading of sediment and attached phosphorus. This means a particularly large portion of the total phosphorus load is not being accounted for in current data.

In fact, sediment and associated phosphorus loads are often dominated by erosion, a recent study (Schilling, 2022) found that streambank erosion from 3rd to 6th order streams accounted for approximately 31% of the total phosphorus exported from Iowa. The study also noted that this was likely a conservative (low) estimate as erosion from field gullies and smaller 1st and 2nd order streams was not included.

Unfortunately, there are currently no continuous monitoring sensors for total phosphorus available (like there are for nitrates). While there are ongoing studies to identify surrogates or methods to estimate total phosphorus from other water quality parameters, no existing studies or data were identified for use in this plan. Two options due exists that could be considered:

- Complete stream assessments across the watershed help quantify sediment and phosphorus pollutant loads originating from streams
- Expand stream sampling to include samples taken during storm events. Various methods exist such as utilizing flow-paced automated samplers or simpler single-stage samplers.

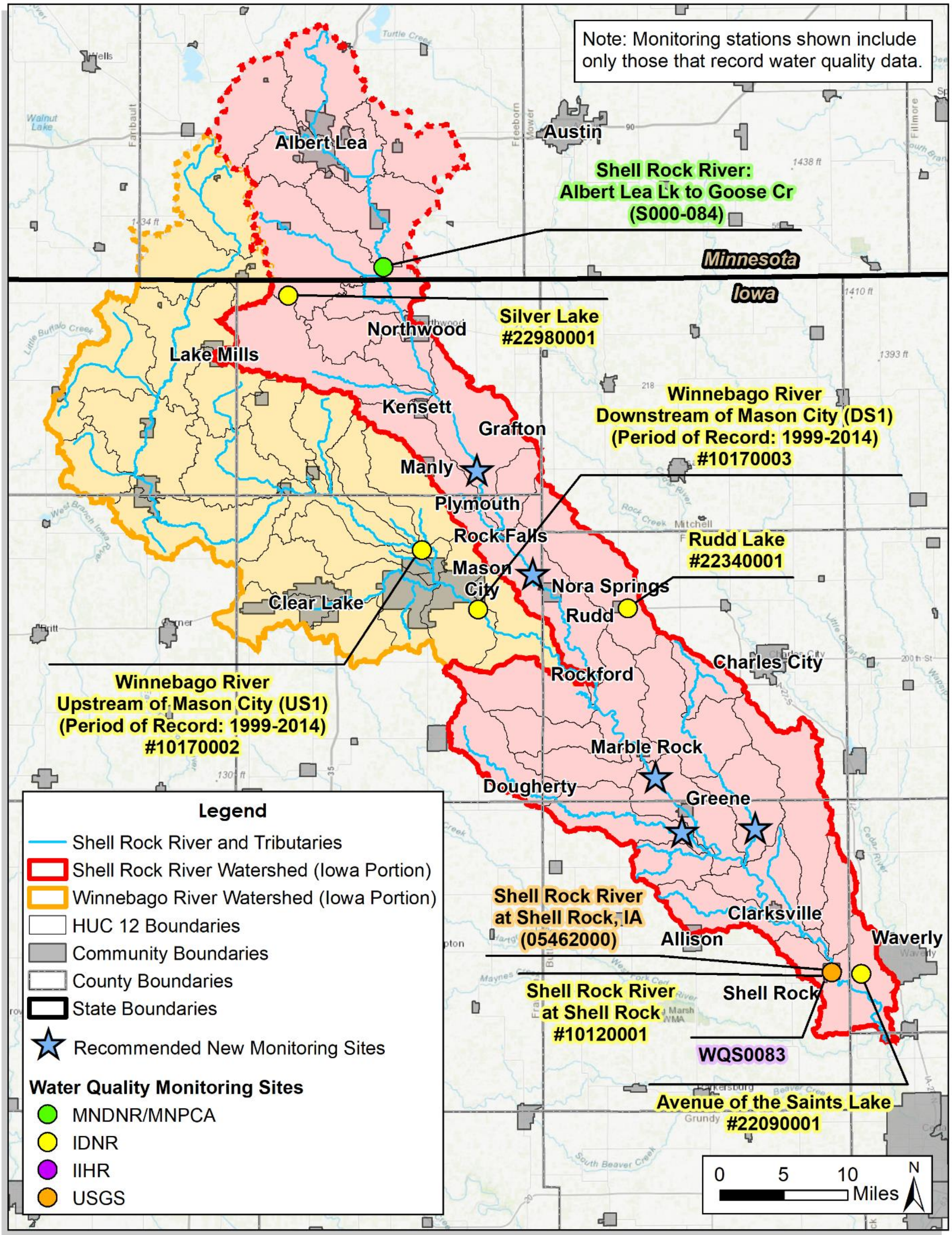


Figure 22: Water Quality Monitoring Sites in the Watershed

2.08 HYDROLOGY

HYDROLOGIC CHARACTERISTICS

Characterizing the hydrologic regime of a watershed is an important step to understanding how land and water use practices influence flooding and water quality. This understanding is also critical to building appropriate hydrologic models of the watershed. Figure 23 contains a conceptual hydrograph and cutaway which illustrates key hydrologic concepts. When the hydrologic system experiences changes, the stream system responds with changes in physical, chemical, and biological parameters. For example, land use changes may lead to increased runoff or increased flooding and reduced streambank stability which may, in turn, alter chemical and physical water quality parameters, and ultimately degrade the biological ecosystem or human uses of the stream.

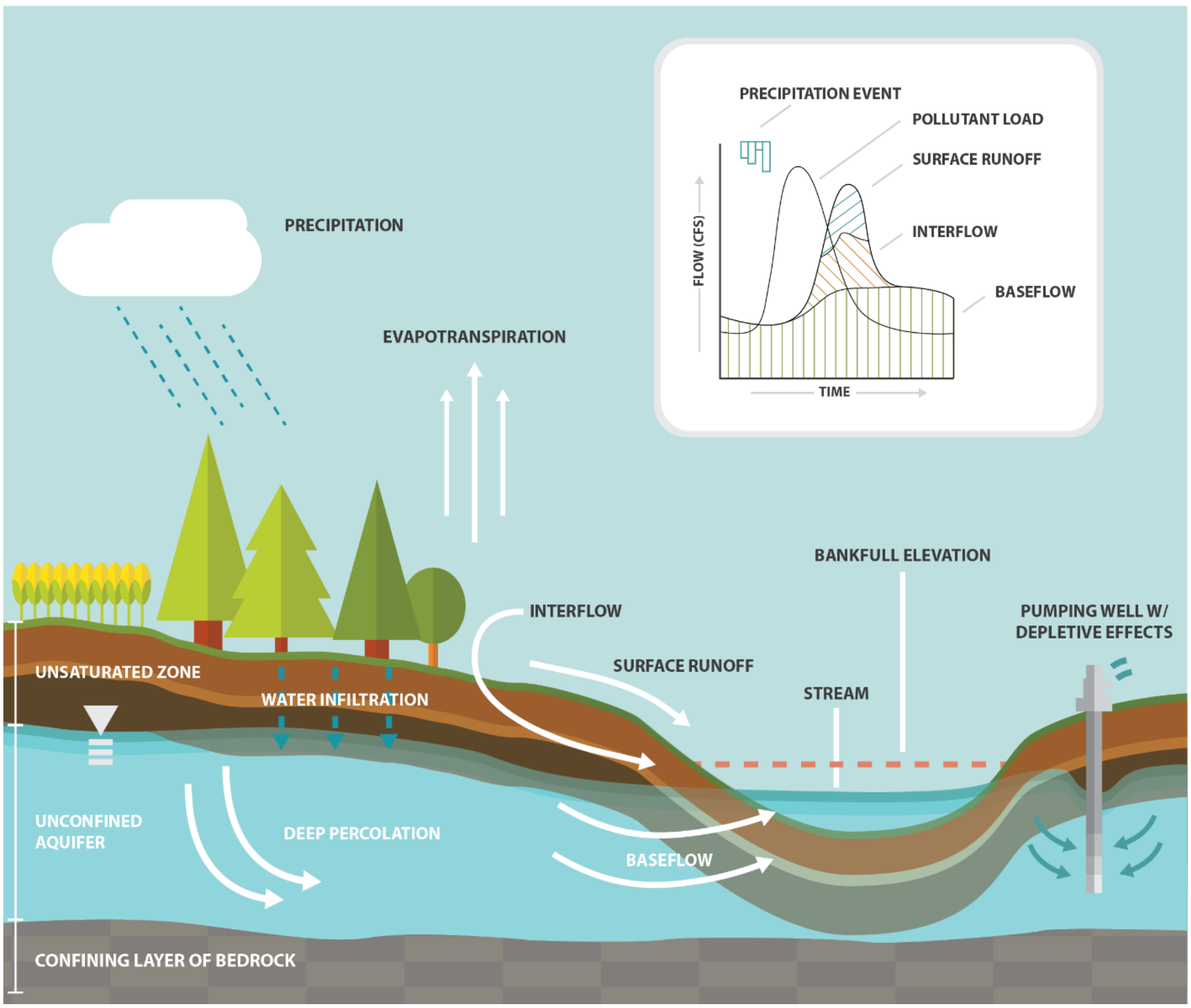


Figure 23: Conceptual Illustration of Key Water Cycle Parameters

Hydrologic processes are complex, involving many interactions that can be difficult to quantify. Additionally, impacts may be seen on both temporal and spatial scales. The location, extent, timing, and type of activities all play a role in alterations. Changes can be seen in the magnitude and timing of peak and low flows, or in year-to-year flow trends. Some activities (roads, seasonal irrigation withdrawals, etc.) cause short-lived alternations, while other activities (dams, urbanization, channelization, groundwater mining, etc.) can cause long-term changes in the hydrology of a watershed (EPA, 2003).

CHANGES IN WATERSHED HYDROLOGY

Several factors have been discussed which have changed the natural watershed hydrology over time, including land use changes (from native prairie to cities and agricultural production), artificial drainage of wetlands and shallow groundwater, and changes in precipitation patterns. A summary of the watershed's hydrology is included below; however it is recommended that a dedicated hydrologic study focused on the watershed be completed. This should also include a more detailed review of climate and streamflow data to better understand changing trends and implications on future projects. This study could be similar in scope to a study that was recently completed on the nearby Cedar River: *The Middle Cedar River Watershed – Hydrologic Assessment Report* (IFC 2019). This new study would be a powerful tool for better understanding and defining the hydrologic system of the watershed, which in turn could help to inform prioritization and implementation efforts.

LONG-TERM STREAMFLOW TRENDS

Streamflow regimes are composed of seasonally varying environmental flow components including: high flows; base flows; pulses and floods that can be characterized in terms of their magnitude, frequency, duration, timing (predictability), and rate of change (flashiness) of hydrologic conditions (Poff and others, 1997).

To understand a typical hydrologic cycle and streamflow regime within the watershed, a representative streamgage was identified to review streamflow record. The USGS streamgage located on the Shell Rock River at Shell Rock (05462000), shown in Figure 22, has a respectable period of record of 1953 – present. This location is downstream to much of the watershed. However, while representative of the area and long-term trends, it should be noted that all streams have unique responses to storm events due to variability in precipitation patterns and effects of terrain, soils, and land use. This creates both local and regional flow patterns. Additionally, the hydrology of the watershed can also be affected by artificial drainage.

A review of the discharge data for the Shell Rock River demonstrates a few trends which provide a basic understanding of its dynamic hydrologic cycle:

- Streamflow can vary considerably day-to-day (Figure 24), as precipitation is variable, however there may be significant baseflow from groundwater and tile drainage throughout certain portions of the year.

- A predictable seasonal pattern can be seen in streamflows. There is an increase in runoff in late winter/ early spring caused by snowmelt, leading to increased streamflows. There is also an increase in streamflows during the late spring and early summer storm season.
- A long-term trend of increase in streamflows has been noted across the Midwest (Brown and Caldwell, 2012). The trend at this site follows that pattern and has increased roughly threefold over the course of the observation period.
- There are long-term patterns of wet and dry periods, as seen in the running 5-year average (Figure 25). From October 2007 to March 2023, the highest daily average streamflow recorded was 46,400 cubic feet per second (CFS) in June 2008, or a crest of 20.36 feet (well above the major flood stage of 12 feet). The lowest daily average was 98.7 CFS in January 2013. The long-term average flow is 1,671 CFS, or around 9 feet in depth.
- Streamflows are seasonally predictable across the watershed, but less predictable during high flow/ flood events due to natural and anthropogenic impacts which vary across subwatersheds.

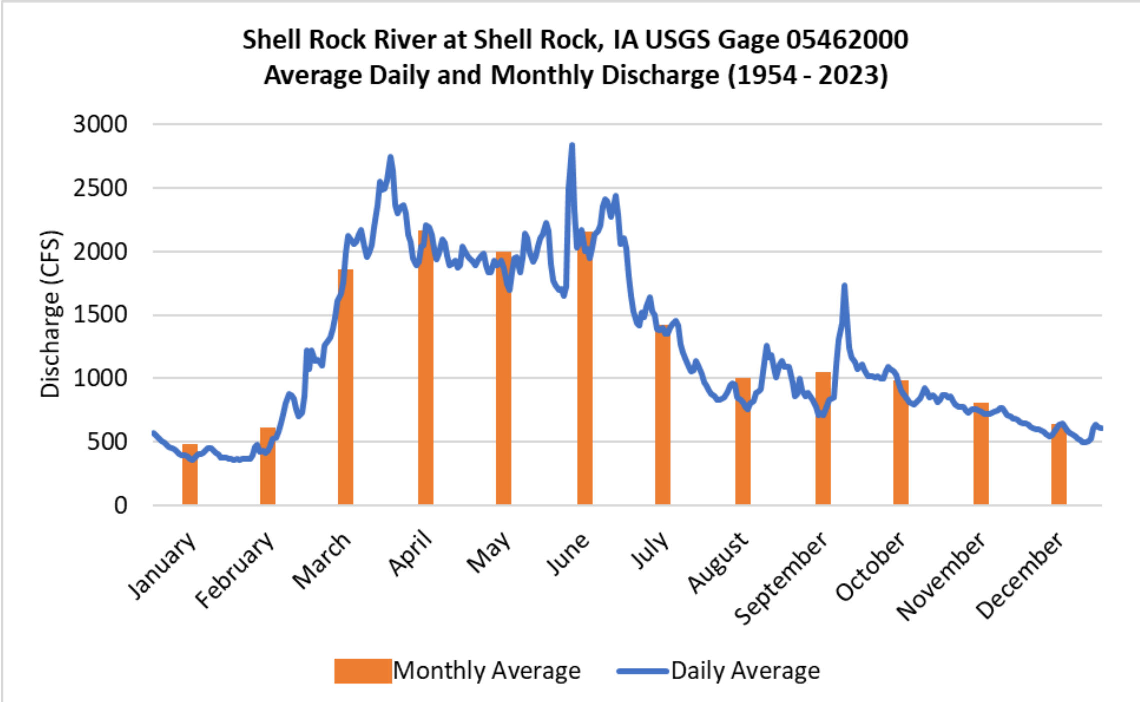


Figure 24: Streamflow Hydrograph of an Average Year for the Shell Rock River

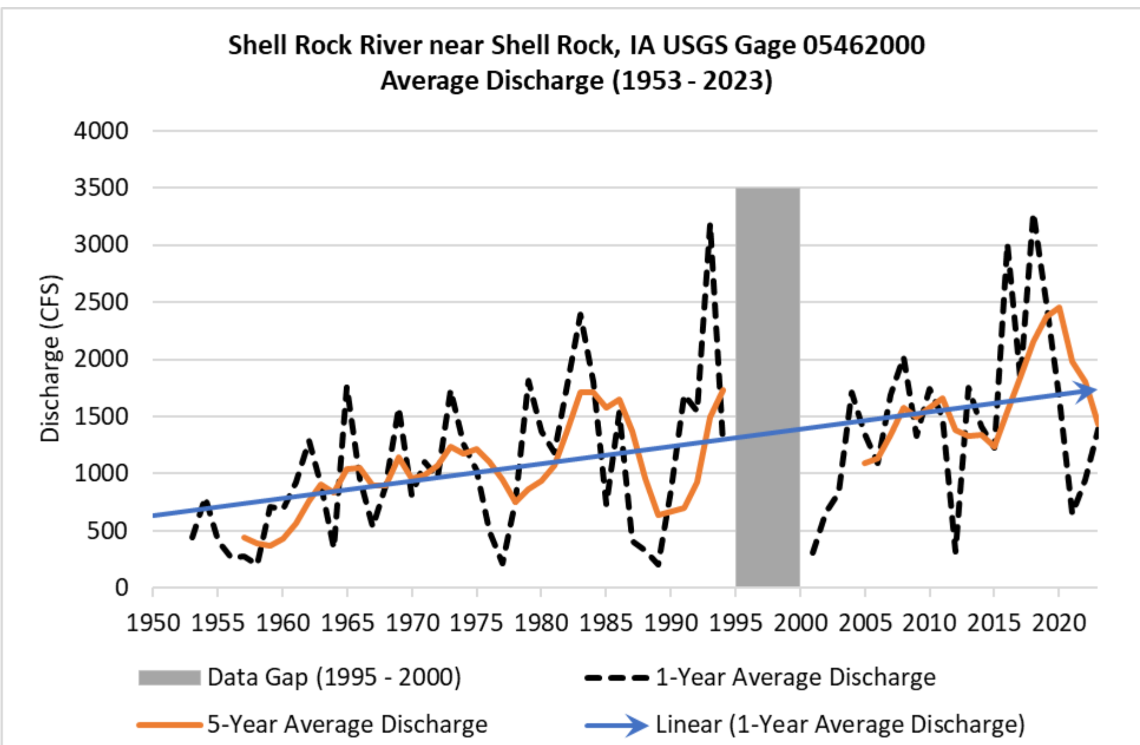


Figure 25: Long Term Streamflow Hydrograph for the Shell Rock River

2.09 FLOODING

FLOODING MAGNITUDE AND FREQUENCY

Variations in streamflow levels, including high flow or flooding events, are an important part of the natural ecological function of streams. Many fish and aquatic organisms require habitat that cannot be maintained by minimum or even typical flows over the long term. A range of flows are necessary to scour and revitalize gravel beds, import wood and organic matter from the floodplain, and provide access to riparian wetlands. Additionally, these processes are important in the natural cycling/movement of nutrients and sediments (Poff and others, 1997).

However, extremely high flows may cause flooding, which may cause damage to infrastructure, homes, businesses and other property; lead to losses in crops; and endanger human life. Balance is needed in the management of streams. Understanding these hydrological conditions is important to making management decisions regarding watershed planning, especially in regard to stream restoration and flood mitigation efforts.

The *Middle Cedar River Watershed – Hydrologic Assessment Report* provides a helpful summary of the overall nature of flooding within Iowa, and is applicable in this watershed:

> *Floods are typically related to large amounts of precipitation or snow melt and saturated or frozen soil. In Iowa, historic records show that the great majority (>90%) of floods occur in the spring and summer; the month of June shows the highest number of flood events. Precipitation records show that heavy rains occurred in the fall as well; however, Iowa soils have a larger capacity to infiltrate water late in the year, and therefore fall floods are less common. In Iowa's flood history, the events of 1993 and 2008 are on an entirely different scale than the others. These two events stand out from the rest when looking at the extent of the area impacted, recovery costs, precipitation amounts, and streamflows recorded.*

A review of data from the USGS streamgage (05462000) located on the Shell Rock River at Shell Rock provides an indication as to the magnitude and frequency of flooding that occurs in the watershed. Gage height data, which indicates the depth of water in the stream channel, was reviewed against the National Weather Service's (NWS) designated "flood stage", which is set at 12 feet. Figure 26 shows that since 2007, the average daily gage height has reached the NWS flood stage on 125 days during 28 events, with a discrete event defined by a gap of at least one day where the average gage height is below the NWS flood stage. Flooding events date back to at least the 1960s, with the most recent major flood events, as noted by historic crest date, occurred on the following dates: 6/23/2020, 3/16/2019, 6/11/2019, 10/1/2016, and 9/23/2016. The September 23, 2016 event was the highest recorded event at 21.4 feet (well over a the "major flood stage" of 20 feet).

Additional information can be found here:
https://water.weather.gov/ahps2/hydrograph.php?gage=shri4&wfo=dmx

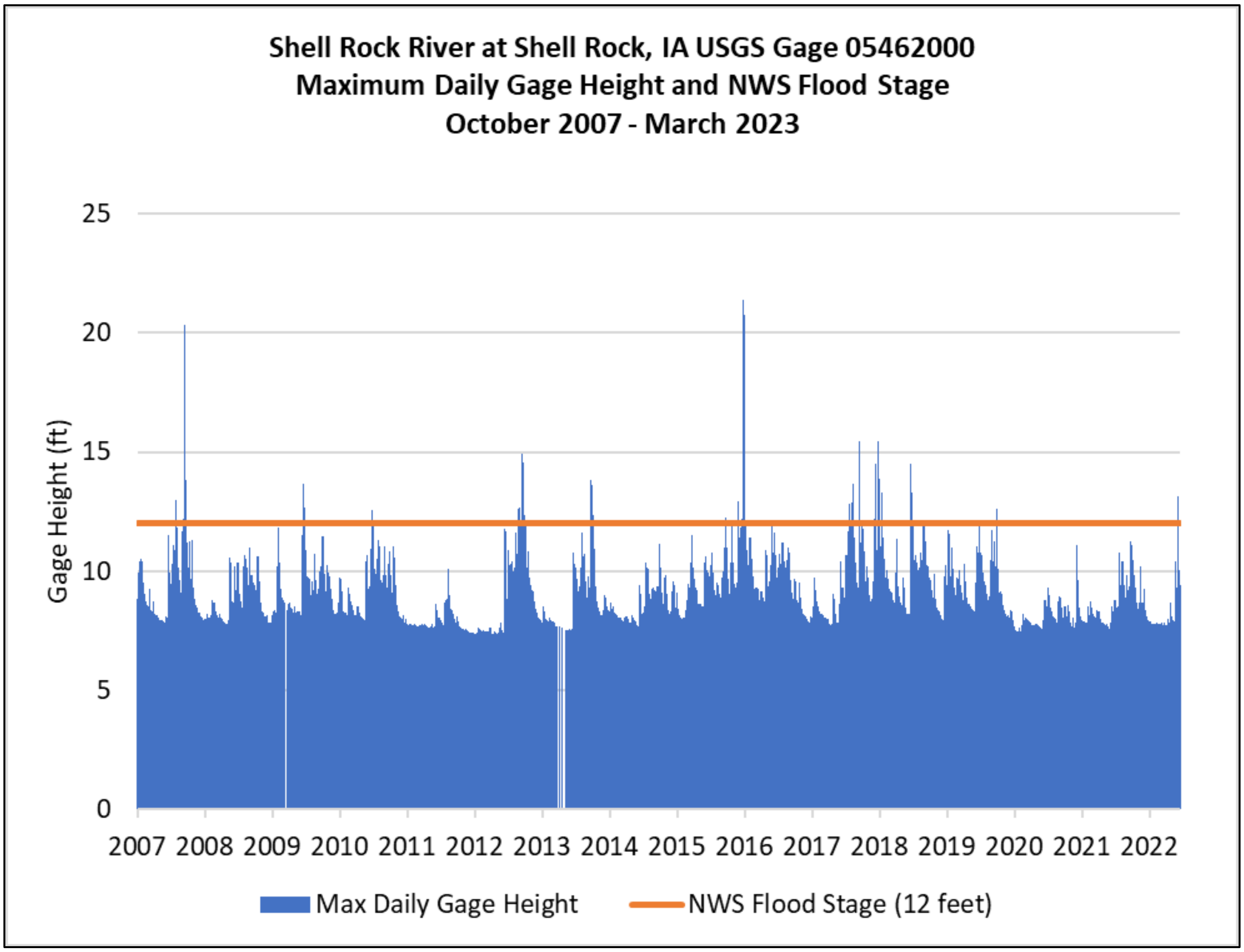


Figure 26: Maximum Daily Gage Height and Flood Stage Records for the Shell Rock River

REGULATORY FLOODPLAIN MAPPING

In general terms, floodplains are areas adjacent to creeks, streams, and rivers that include the channel and extend to the edges of a valley. These are the areas that both receive floodwaters when stream channels flow out of their banks and provide conveyance of waters during high flow events. Other floodplain functions include flood risk reduction, habitat conservation, water quality protection and groundwater recharge. The natural benefits of floodplains and flooding typically outweigh the risks, except for areas with infrastructure, homes, businesses, or other buildings. Flooding in these areas, if not properly planned for can lead to an increased risk for property damage and loss of life.

The Federal Emergency Management Agency (FEMA) has taken steps to define floodplains to both preserve their natural functions and to reduce flooding risks to human populations.

Since 2009, the Iowa Department of Natural Resources (IDNR) has been working with the Federal Emergency Management Agency (FEMA) to create and maintain flood hazard data for the State of Iowa. (IDNR, 2023b). The goal of this collaboration is to create Flood Insurance Rate Maps (FIRMs) for every county in the state.

The "100-year floodplain" (Figure 27), is the area that is predicted to flood during a 100-year storm, which has a 1% chance of occurring in any given year. FEMA is responsible for delineating this area utilizing hydrologic data and identifying base flood elevations (BFE). Generally, flood insurance and community zoning ordinances are based on a property's location in relation to the 100-year floodplain. In some areas within the watershed, a regulatory "floodway" has also been established. Floodways are areas that must not be encroached upon to prevent the BFE from increasing by more than one foot. While almost any area in the watershed is at some level of risk for flooding, regulatory floodplains and floodways have been mapped and formally acknowledged by FEMA.

Historically, cities have been developed along waterways for various reasons such as transportation and commerce. As a result, these population centers are at an increased risk to flooding. The same is true in this watershed as many of its cities are located along the Shell Rock River. The degree of flood risk for each community varies considerably based on topography, watershed size, flood control structures, land use, or other factors. Chapter 3 presents information on flood risks within the watershed, and Chapter 5 provides flood mitigation recommendations.

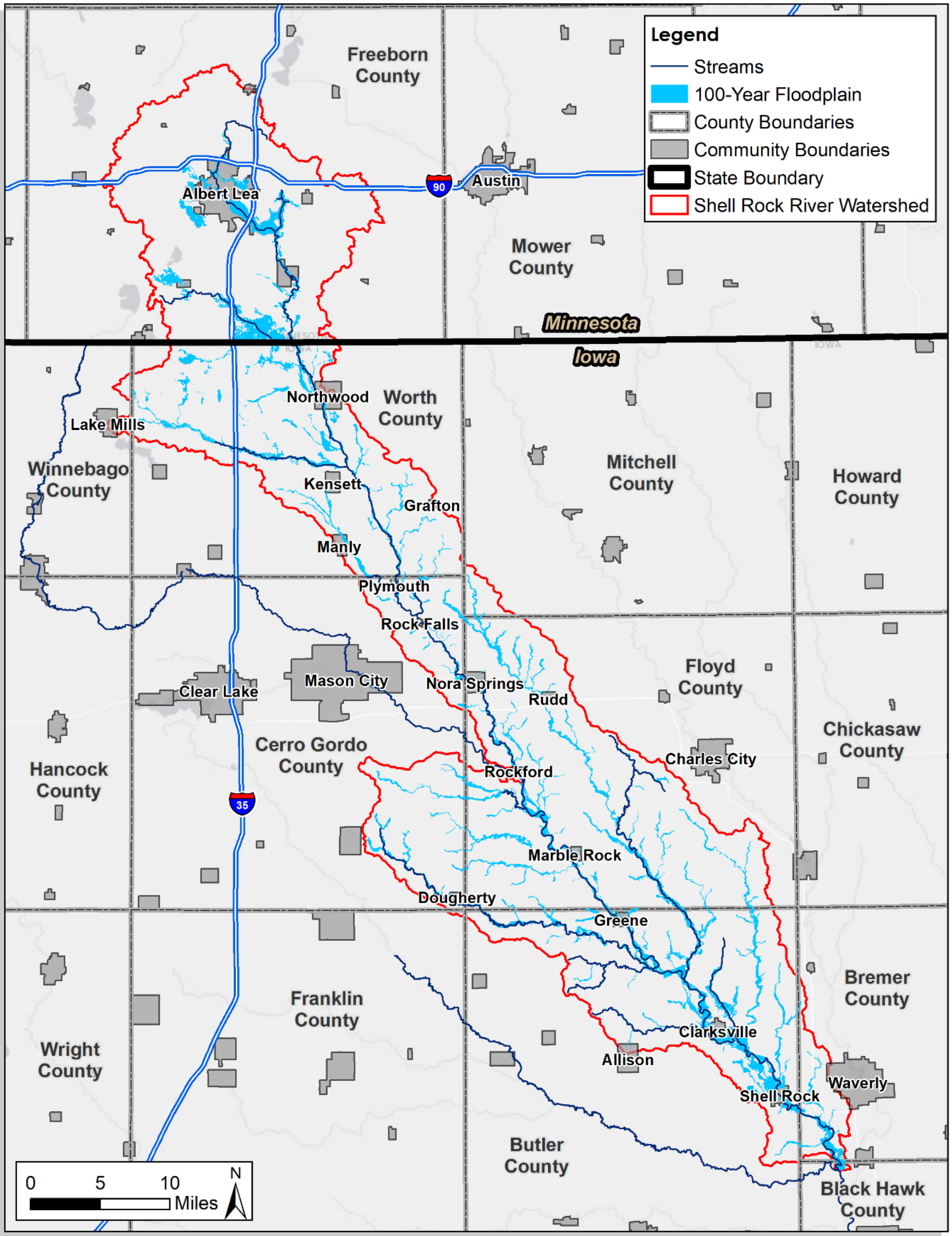


Figure 27: Map of FEMA Delineated Floodplains

2.10 RECREATION WILDLIFE, AND HABITAT

PUBLIC LANDS AND RECREATION

Iowans maintain a strong connection to wildlife, and many participate directly in wildlife-associated recreation. In 2013, a non-partisan survey of Iowa's voters found that 97% of respondents agree with the statement "We need to ensure that our children and grandchildren can enjoy Iowa's land, water, wildlife, and the natural beauty the same way we do" (Reeder and Clymer, 2015).

Land protection provides a range of benefits, including increased wildlife habitat, recreational opportunities for humans, and maintaining or restoring ecosystem functions such as water filtration, flood abatement, carbon storage, etc. (Reeder and Clymer, 2015). Where opportunities to enhance water quality or flood resilience, as identified in this plan, overlap with opportunities to conserve wildlife and habitat or expand recreational access, the likelihood of success is higher. Addressing multiple goals provides opportunities for project partnering and opens additional funding avenues for projects. The SRRWMC should look for these opportunities and work with partners towards realizing them.

Only 2.44% of land in Iowa is open to public access (IDNR, 2018). Outdoor recreation in Iowa is provided by federal (USACE, USFWS, and NPS), state (DNR), county, and city governments. It is useful to note that Iowa is the only state in the nation that offers a County Conservation Board (CCB) in all its' 99 counties. Operating at the local level, CCB lands include areas for lodging, camping, picnicking and family reunions but also areas for hunting and shooting sports. The CCB system also offers year-round outdoor educational programming, providing opportunities for local residents to grow, learn and connect with their resources.

A map of all public lands within the watershed is shown in Figure 28. This includes areas that are owned or managed by various entities. Each may have different requirements for public access and allowed activities. The following websites provided interactive, online mappers where more details for each area can be viewed:

- https://www.fws.gov/refuges/find-a-wildlife-refuge/
- https://www.iowadnr.gov/Hunting/Places-to-Hunt-Shoot
- https://www.mycountyparks.com/

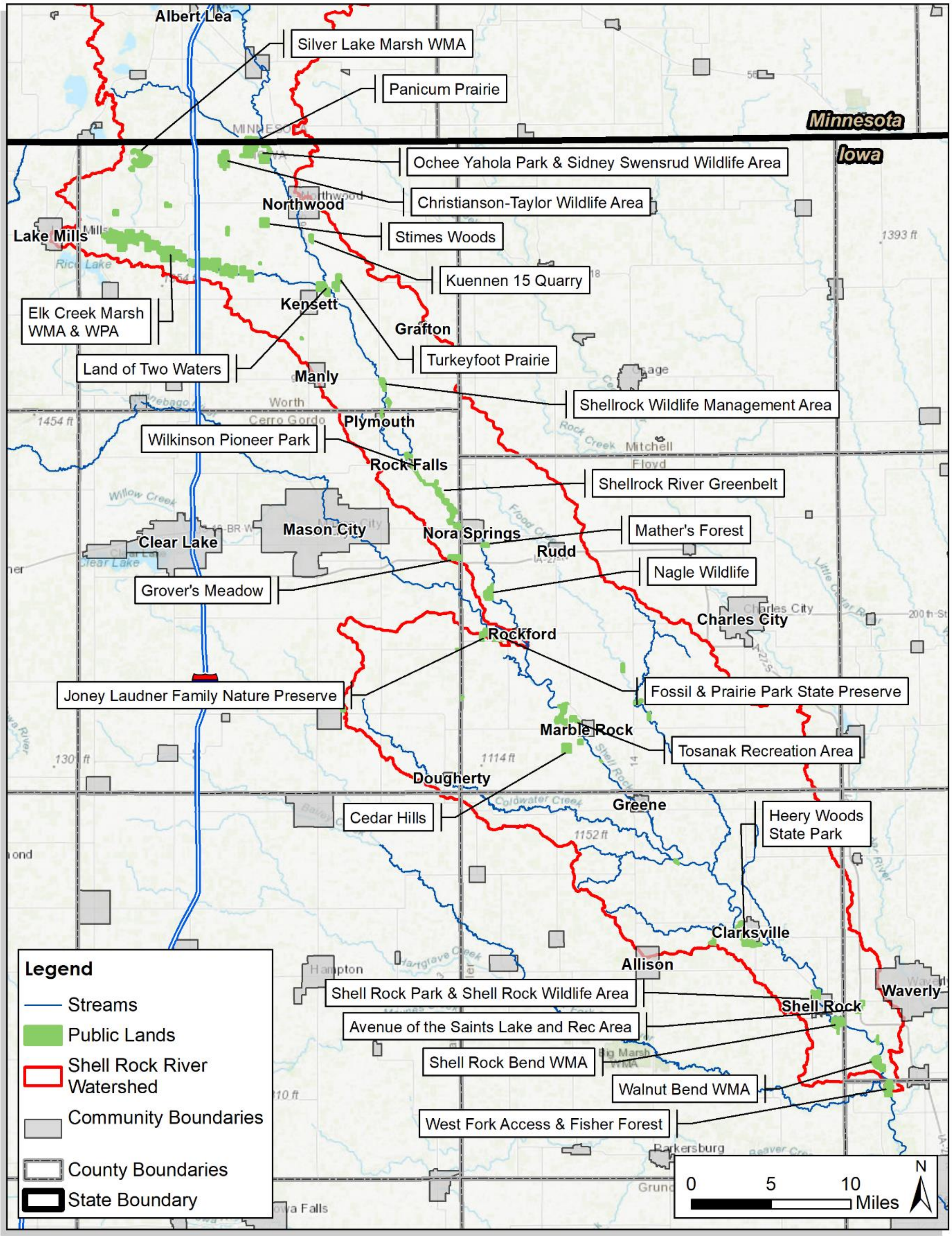


Figure 28: Parks and Natural Areas within the Watershed

OUTDOOR RECREATION PLANNING

A key resource for evaluating and planning recreation within Iowa is the Statewide Comprehensive Outdoor Recreation Plan (SCORP) titled "Outdoor Recreation in Iowa" (IDNR, 2018). Its purpose is to assess the supply of, and demand for, outdoor recreational opportunities while identifying a list of priorities for outdoor recreation. The plan also helps to qualify projects for federal funding through the Land & Water Conservation Fund. These federal grant funds must be matched with at least 50% of local contribution; and project sites must be available to the public into perpetuity.

Iowa completed its first SCORP in 1968, and it has been updated every 5-years; with the most recent being published in 2018. The most recent version brings together information and conservation priorities for many resources (wildlife, forests, wetlands, etc.) and was shaped by public input.

One of the recommendations within the SCORP is that: *Routine local-level planning (such as county-wide or specific to a park) should link to and support larger state plans that focus on conservation and recreation.* This watershed plan is one such mechanism to do that. As such, many statewide plans were reviewed, and the findings combined with stakeholder input from the planning process. Recommendations from this process are presented in Chapter 5.

IOWA WILDLIFE ACTION PLAN

IDNR updated its *Iowa Wildlife Action Plan* in 2015. This plan was written to guide the conservation of wildlife and natural places across the state and with the intent to outline the steps needed to conserve wildlife, before they are endangered, and habitat, before it becomes too costly to restore. The plan assesses the health of wildlife and habitat within the state, identifies the problems they face, and outlines the actions that are needed. The plan focuses on Species of Greatest Conservation Need (SGCN).

Habitat availability, quantity, and quality are primary factors influencing the viability of wildlife populations (IDNR, 2015). While the plan lays out several conservation related visions, strategies, and actions, they are not specific to the watershed and are not specifically designed to be solely implemented by the IDNR. They are designed to provide a broad framework of actions that can be undertaken by all levels of government, private organizations, and private citizens. They will take a broad array of funding sources, skills, expertise, and partnerships to implement.

The plan lays out three general approaches that should be undertaken. The following one is where most opportunities exist for projects and partnerships within the SRRWMC, particularly in the context of implementing this watershed management plan:

> *Habitat in rivers, streams, lakes, impoundments, and wetlands can be improved only if soil erosion, siltation, and all the associated problems are reduced. Targeting areas to protect and restore habitats for terrestrial SGCN will help with*

> *this process but will not protect enough land by itself to help all aquatic systems. Vegetative cover must be returned to more of the landscape to hold soil in place. Existing soil-retention programs like terracing, buffer strips, and no-till agriculture need to be expanded and new approaches explored to make soil conservation more widely acceptable and financially attractive to the farming community (IDNR, 2015).*

Additionally, the following goal was identified within the plan:

> *The amount of permanently protected wildlife habitat in Iowa will be doubled to 4% of the state's land area.*

The plan was developed to be a 25-year strategic plan, thus identifying specific project locations was beyond its scope. The intention was that shorter-term (1-5 year) priorities for implementing actions would be developed by individuals or partnerships of stakeholders. The geographic priorities of the plan were identified as “High Opportunity Areas for Cooperative Conservation,” and these should be used to identify the initial areas for partnerships and projects (Figure 29). There appears to be good opportunity for conservation partnerships with in the SRRWMC in the following areas:

- **Worth County** – The Elk Creek Marsh and several wildlife management areas exist here. There is also a considerable amount of artificial drainage in the area. Opportunities to restore wetlands or oxbows, install edge of field BMPs (saturated buffers, bioreactors, drainage water management structures), or create two-stage ditches should be evaluated.
- **Butler County** – Areas along the southern segment of the Shell Rock River may be good candidates for additional riparian corridor enhancement, greenway creation, oxbow restoration, and floodplain restoration.

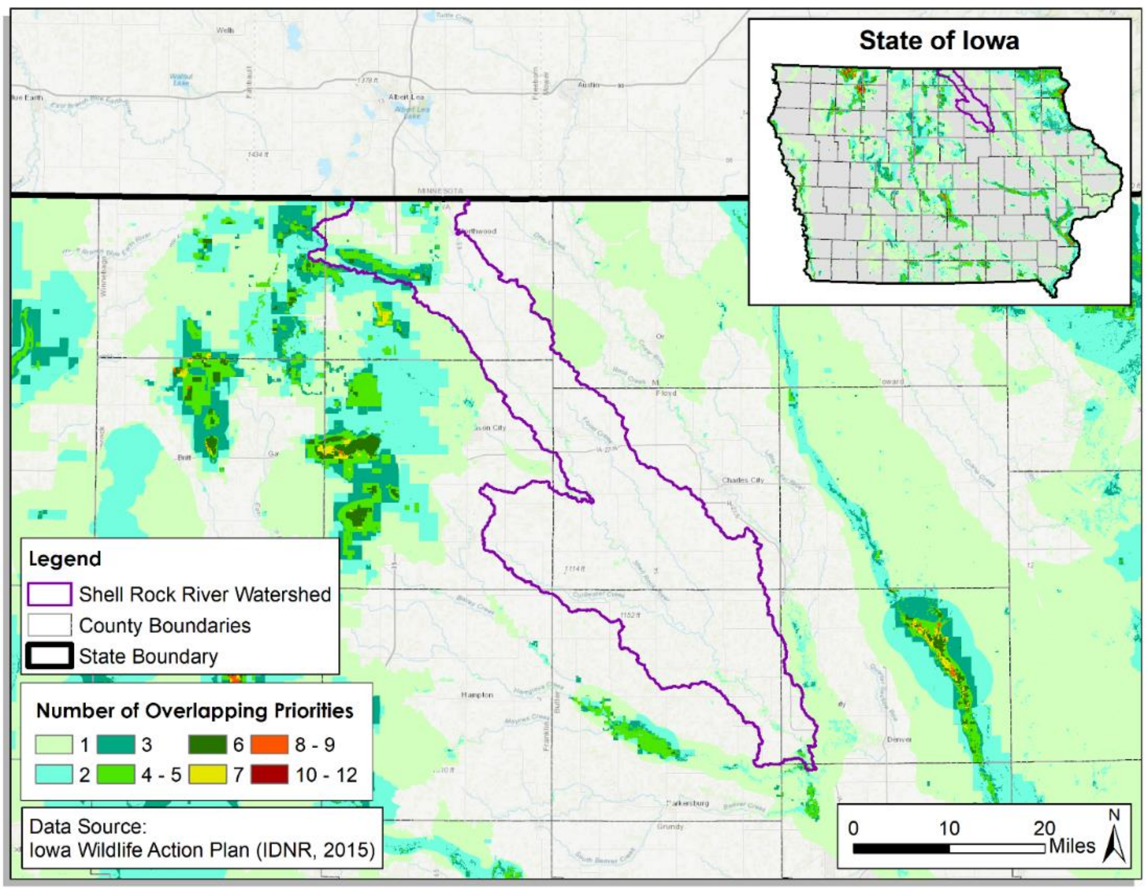


Figure 29: High Opportunity Areas for Cooperative Conservation Actions

THREATENED AND ENDANGERED SPECIES

The ranges of both federal and state listed threatened and endangered (T&E) species overlap with the watershed. Identifying specific locations of these is outside of the scope of this planning effort, however that review is best done at the project level. The following websites are useful screening tools as a part of that evaluation:

- USFWS Information for Planning and Consultation (iPaC): https://ipac.ecosphere.fws.gov/
- IDNR Natural Areas Inventory Tool: https://programs.iowadnr.gov/naturalareasinventory/pages/Query.aspx

AQUATIC INVASIVE SPECIES

Aquatic invasive species are non-native organisms introduced into rivers, streams, and lakes. They generally have few to no predators or any other natural controls on their population, such as disease or competition, allowing their numbers to grow unchecked. Once established, these species may cause irreparable harm, introduce disease, out-compete native species, change the physical or chemical characteristics of waters, damage equipment, clog water delivery systems, and negatively impact local and national economies.

Prevention is the strongest defense against invasive species. Posting signs or distributing educational information are some methods to prevent the introduction of these species into the watershed. However, if any invasive species are found to be in the watershed, future projects could be designed to target their reduction and/or elimination.

Identifying specific locations of invasive species or strategies to prevent or eradicate them is outside of the scope of this planning effort, however that review is best done at the project level. The following websites provide additional information for consideration:

- https://www.iowadnr.gov/Fishing/About-Fishing-in-Iowa/Fighting-Invasive-Species.

2.11 EXISTING POLICY AND REGULATIONS

STATE WATER QUALITY STANDARDS

The IDNR manages water quality for all surface waters within Iowa through the implementation of the state's Water Quality Standards (WQS). These standards include numerical standards for many potential water quality pollutants based on the waterbody's assigned beneficial use. When multiple uses are assigned to the same waters, the most stringent criterion for the appropriate pollutant or season applies. The WQS are found in Chapter 61 of the Iowa Administrative Code, and available at https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Quality-Standards.

Iowa's WQS are in place to protect the quality of surface water for human consumption, wildlife, industry, recreation, and other productive, beneficial uses. Beneficial uses are also protected by permits issued in accordance with both the requirements of these standards and for the applicable level of treatment or control for point and nonpoint sources of pollution. It should be noted that these standards apply to all surface waters of the State, except as noted in Chapter 61, even if they are not specifically assigned a beneficial use in Chapter 61. WQS can be both in numerical and narrative formats.

While there are many WQS which apply to both streams and lakes, the only WQS utilized for the development of this plan are identified in Table 15. Identification of impaired waterways and analysis of water quality conditions is provided in Chapter 3. This plan has been written to address nonpoint source pollutant loadings of bacteria (*E. coli*), nutrients (phosphorus and nitrogen), and sediment. While there are known point sources of pollution in the watershed, those fall under various regulatory authorities. This plan is based on voluntary actions only and therefore does not address regulated (point sources) pollution sources. It should be noted that no numerical WQS exist for nutrients or sediment, therefore separate benchmarks for these pollutants have been identified (discussed below). Goals for nutrient reductions have been identified through the Iowa Nutrient Reduction Strategy (discussed below), but these are not regulatory WQS.

Table 15: Summary of Water Quality Standards Applicable to this Plan

Parameter	Beneficial Use or Category	Water Quality Standard
Streams		
E. coli Bacteria	Primary Contact Recreation* (Class A1)	Seasonal Geometric Mean: 126 organisms/100 ml Maximum Single Sample: 235 organisms/100 ml

** Standard only applies March 15 – November 15*
Source: Iowa Administrative Code, 2019

OTHER WATER QUALITY BENCHMARKS

As previously stated, there are no numerical WQS in Iowa for nutrients or sediment. Therefore, several “benchmark” water quality criteria were identified (Table 16) in order to help the assess water quality data. The following documents were utilized to provide these benchmarks:

- **Nutrients:** In 2001 EPA published recommendations for nutrient water quality criteria for rivers and streams across the country (EPA, 2000), based on ecoregions. These recommended criteria are not laws or regulations - they are guidance that states and tribes may use as a starting point for establishing criteria for their water quality standards. The watershed is located within Nutrient Ecoregion VI: Corn Belt and Northern Great Plains. The recommendation summarized a large dataset and established the median values of 0.7625 mg/L total phosphorus and 2.18 total nitrogen as the overall guidance values for the area. While this guidance has no regulatory significance in Iowa, it does serve as a useful benchmark to understand water quality conditions of streams.
- **Sediment:** Total Suspended Solids (TSS) is commonly used as a surrogate for sediment. A benchmark was identified through a methodology established by the Kansas Department of Health and Environment, who analyzed a large dataset of TSS data and associated biological monitoring data. A strong threshold relationship exists at 50 mg/L median TSS, above which streams are unlikely to support a rich diversity of aquatic life (KDHE, 2020). While this guidance has no regulatory significance in Iowa, it does serve as a useful benchmark to understand water quality conditions of streams.

Table 16: Summary of Nutrient Water Quality Benchmarks

Parameter	Water Quality Benchmark	Source
Total Nitrogen	2.18 mg/L	EPA, 2001
Total Phosphorus	0.7625 mg/L	EPA, 2001
Total Suspended Solids (TSS)	50 mg/L	KDHE, 2020

TOTAL MAXIMUM DAILY LOADS (TMDLS)

A Total Maximum Daily Load (TMDL) is developed by IDNR when a waterbody has been identified as “impaired” for one or more designated beneficial uses. TMDLs establish the maximum allowable daily load of a pollutant a specific waterbody can receive and still meet WQS. TMDLs are specific to the waterbody they are developed for, and thus can vary.

Several relevant TMDLs were found for the watershed:

- **Cedar River TMDL for *E. coli* (2010)** – This TMDL is focused on the Cedar River, however one segment of the Shell Rock River (a tributary to the Cedar River) was included. An overall 94% decrease in *E. coli* loads (during high flow conditions) was identified as needed.
- **Cedar River TMDL for Nitrates (2006)** - This TMDL is focused on the Cedar River in Linn County, near Cedar Falls. However, it includes the Shell Rock River in its loading analysis and loading requirements, as it is a major tributary of the Cedar River. It identified an overall 35% decrease in nitrate loads from existing conditions.
- **Shell Rock River (Minnesota segments) (2021)** - A TMDL for multiple parameters was developed for the Minnesota portion of the Shell Rock River. The TMDL covers bacteria, sediment, nutrients, dissolved oxygen, pH, macroinvertebrate and fish bioassessments, and nutrients in lakes. However, the focus of this plan is on Iowa, so this TMDL was not closely reviewed.
- **Lakes** - TMDLs were also available for Silver Lake and Avenue of the Saints Lake. However, the focus of this plan is the Shell Rock River and tributaries, so these TMDLs were closely reviewed.

Additional information and copies of TMDLs can be found here:

- https://www.iowadnr.gov/environmental-protection/water-quality/watershed-improvement/water-improvement-plans
- https://www.pca.state.mn.us/watershed-information/shell-rock-river

SAFE DRINKING WATER ACT

In 1974, the Safe Drinking Water Act directed the EPA to establish national drinking water standards – these are known as Maximum Contaminant Levels (MCLs). These standards set limits on the amounts of various substances allowed in public drinking water. IDNR is the primary agency responsible for enforcing the federal drinking water regulations in Iowa. The most pervasive drinking water pollutant is nitrate-nitrogen (nitrate). Nitrates are known to cause a disease called methemoglobinemia (or “blue baby syndrome”) primarily within infants, but it may also impact pregnant women and health-compromised adults. High nitrate levels in drinking water are typically caused by nonpoint source pollution, and, thus, they are of interest in this planning effort. The MCL for nitrate-nitrogen is 10 milligrams per liter (mg/L) in drinking water.

NUTRIENT REDUCTION STRATEGY GOALS

The Iowa NRS has identified statewide goals for reducing nonpoint source pollution. Specifically, for nutrient reduction, the NRS has set statewide reduction targets from nonpoint pollution sources for nitrogen at 41% reduction and phosphorus at 29% reduction. These goals have also been adopted through other local watershed management plans across Iowa.

LOCAL ORDINANCES

Research was conducted to determine the presence of relevant floodplain, stormwater management, and pet waste management ordinances for cities and counties in the watershed. Note that only cities or counties that had a significant area in the watershed were included in this review. The results of this effort may help identify project opportunities for water quality improvements or flood mitigation. These results can be seen in Table 17. Government websites were reviewed for online copies of floodplain, stormwater management, and pet waste ordinances. If a community did not have a website, or their ordinances were not available online, efforts were made to contact a community representative via email, phone calls, or during stakeholder meetings.

Table 17: Status of Local Ordinances

Entity	Ordinance Type		
	Floodplain	Stormwater	Pet Waste
Allison	Did not respond*		
Clarksville	Yes	Yes	No
Dougherty	Did not respond*		
Grafton	No	Yes	No
Greene	Did not respond*		
Kensett	No	Yes	*
Manly	No	Yes	*
Marble Rock	Did not respond*		
Nora Springs	Yes	Yes	Yes
Northwood	Yes	Yes	Yes
Plymouth	Did not respond*		
Rock Falls			
Rockford			
Rudd			
Shell Rock			
Bremer County			
Butler County			
Cerro Gordo County			

Floyd County	Yes	Yes	No
Mitchell County	Did not respond*		
Worth County	No	No	*

** Denotes a community did not respond.*

Floodplain Management

Floodplain ordinances can limit or prohibit development in flood-prone areas to help reduce the number of homes and businesses at risk of flooding. In fact, limiting development of floodplains is one of the most effective ways to lower a community's flood risk and reduce future damages. If local rules and regulations limit or prohibit development in flood-prone areas, there will be fewer buildings at risk of damage when floodwaters rise. It is recommended that all communities adopt a floodplain management ordinance that meets or exceeds the minimum National Flood Insurance Program (NFIP) requirements.

The NFIP is a federal program managed by FEMA that offers flood insurance to households and businesses throughout the United States. The NFIP is a voluntary program in which participating communities adopt and enforce minimum floodplain management regulations that limit development in the FEMA-defined 100-year floodplain. In exchange, the federal government makes flood insurance available to all residents in that community.

Iowa DNR regulates construction in floodplains and floodways in the state and promotes the orderly development and wise use of Iowa's flood plains. Additional information and resources can be found at the following link:

https://www.iowadnr.gov/Environmental-Protection/Land-Quality/Flood-Plain-Management

Stormwater Management

Stormwater occurs when precipitation falls to the ground and runs along the surface until entering a storm drain or directly enters a stream or lake. In cities stormwater often makes its way to a stormwater system, typically consisting of pipes, ditches, culvert, outfalls, etc. before it is eventually discharged to streams. Typically, stormwater does not pass through a wastewater treatment plant before being discharged to a stream. Stormwater discharge from communities has been recognized as contributing to water quality degradation, flooding, and stream erosion.

Many cities in Iowa are required to have a permit for their Municipal Separate Storm Sewer Systems (MS4s) through the National Pollutant Discharge Elimination System (NPDES) administered by the IDNR. MS4 permits require cities who meet a specific population threshold to manage their stormwater. The only city in the watershed required to have an MS4 permit is Albert Lea, located in Minnesota and outside of the Iowa portion of the watershed.

While the other cities in the watershed are not required to have an MS4 permit, it is still recommended that they pass ordinances and develop projects or programs which address stormwater management. Additional information, including model (example) ordinances are available from the Iowa Stormwater Education Partnership, at the following link: https://iowastormwater.org/

Pet Waste Management

Pet waste management ordinances address a pet owner's responsibility to clean up any solid waste left behind by their animal on both public and private property. Pet waste can contribute bacteria, nutrients, and other contaminants to surface water during precipitation events. It is recommended that all communities adopt and enforce ordinances along with educational campaigns for pet waste clean-up.

2.12 SUMMARY AND RECOMMENDATIONS

This chapter provided an inventory of watershed resources and an understanding of the watershed's characteristics. This lays the groundwork for further analysis and exploration of watershed issues and what contributes to those – especially as it relates to project opportunities.

While much data is available and summarized here, a few data gaps were identified. The following is a summary of recommendations found within this chapter that should be considered for completion prior to or during future updates of this plan.

- **Expand stream monitoring sites across the watershed -** Current stream monitoring is limited to a site near the outlet of the watershed (at Shell Rock). It's recommended additional ambient stream monitoring sites be added approximately where the river crosses each county line and/or where major tributaries enter the river (3-5 sites), which would allow for a more holistic view of the watershed when assessing future data. This would assist in better understanding where pollutants may be coming from and allow for further prioritization of projects.
- **Complete a hydrologic assessment -** A focused hydrologic study should be completed. This should also include a more detailed review of climate and streamflow data to better understand changing trends and implications on future projects. This study could be similar in scope to a study that was recently completed on the nearby Cedar River: *The Middle Cedar River Watershed – Hydrologic Assessment Report* (IFC 2019). This new study would be a powerful tool for better understanding and defining the hydrologic system of the watershed, which in turn could help to inform prioritization and implementation efforts.
- **Provide education to cities and counites on recommended ordinances –** This chapter provides recommendations on the local and voluntary adoption of ordinances related to the management of floodplains, stormwater, and pet waste. The SRRWMC should work with organizations to provide education and resources regarding these issues to cities and counties that have not yet adopted them.

CHAPTER 3. ASSESSMENT OF CURRENT CONDITIONS

3.01 INTRODUCTION

This chapter provides a watershed level overview and assessment of data related to flooding, water quality, and recreation. This information is based on available data and stakeholder input. The goal of this chapter is to provide readers with a "picture" of the watershed as it exists at this point in time. With this perspective, realistic and pertinent goals can be created for the future of the watershed.

For the purposes of this plan, monitoring data has been summarized from select sites to better understand overall watershed and stream conditions, especially as they related to sediment, nutrients (nitrogen and phosphorus), and E*. coli* water quality pollutants. While other sampling sites or data may be available within the watershed, only the most representative sites were selected for discussion in this plan. Lake data has not been included in this scope.

3.02 WATER QUALITY ASSESSMENT

IMPAIRED WATERBODIES

Lakes and streams in the State of Iowa are assigned a designated use, which defines how a particular water body is or could be used. Water quality standards are then applied to each waterbody, based on the assigned designated uses. Table 18 shows the designated lakes and streams in the watershed. Note that different designated uses can be applied to each stream segment but have been combined within the table for readability.

On even numbered years the Iowa Department of Natural Resources (IDNR) prepares the *Impaired Waters List and Integrated Report* (IR), which also includes the 303(d) list (IDNR, 2022). The 303(d) listing is composed of those lakes, wetlands, streams, rivers, and portions of rivers that do not meet all state water quality standards, which are considered "impaired waterbodies".

The most recently prepared IR (2022) was reviewed to identify the status of water quality conditions for each lake and stream segment in the watershed (IDNR, 2022). Figure 30 summarizes the impaired lakes and streams in the watershed, and Figure 31 highlights only those impaired stream segments addressed by this plan. Note that a single waterbody can be impaired for multiple reasons, and in the case of streams, at multiple locations or stream segments. Of the impaired waterbodies identified in Figure 30, a portion of the Shell Rock River has a TMDL, as well as Avenue of the Saints Lake and Silver Lake (IDNR, 2022).

Additional information on the 2022 IR and 303(d) list can be found here:
https://programs.iowadnr.gov/adbnet/Assessments/Summary/2022

Table 18: Designated Waterbodies and their Uses in the Watershed

Name	Segment ID	Reach Description	Designated Uses[1]
Shell Rock River	782*	From mouth (S4 T90N R14W Black Hawk Co.) To the south corporate limit of the City of Shell Rock in S12 T91N R15W Butler Co.	A1 (presumptive), B(WW-1), HH
	783*	From south corporate limit of Shell Rock (S12 T91N R15W Butler Co.) To confluence with Flood Cr. In S27 T93N R16W Butler Co.	A1 (presumptive), B(WW-1), HH
	784*	From confluence with Flood Cr. (S27 T93N R16W Butler Co.) to confluence with Winnebago R. in S14 T96N R18W Floyd Co.	A1 (presumptive), B(WW-1), HH
	786*	From confluence with the Winnebago River (Floyd Co.) to confluence with Rose Cr. In NW 1/4 S8 T97N R18W Cerro Gordo Co.	A1, B(WW-1), HH
	787*	From confluence with Rose Cr. (NW 1/4 S8 T97N R19W Cerro Gordo Co.) to the Iowa/Minnesota state line.	A1, B(WW-1), HH
Unnamed Tributary to Shell Rock River	3127	Mouth (T92N R15W Sec17 Butler County) to headwaters (T93N R15W Sec18 Butler County)	A1 (presumptive), B(WW-1) (presumptive)
Flood Creek	788*	Mouth (S27 T93N R16W Butler Co.) to confluence with Beaver Cr. In S36 T95N R17W Floyd Co.	A1 (presumptive), B(WW-2)
Beaver Creek (Tributary to Flood Creek)	1980	Mouth (T95N R17W Sec36 Floyd Co.) to headwaters (T96N R17W Sec35 Floyd Co.)	A1 (presumptive), B(WW-1) (presumptive)
Unnamed Tributary to Beaver Creek (Flood Creek)	1981	Mouth (NW1/4 S18 T95N R16W Floyd Co.) to headwaters in SE1/4 S21 T95N R16W Sec21 Floyd Co.	A1 (presumptive), B(WW-1) (presumptive)
Coldwater Creek	789	Mouth (S29 T93N R16W Butler Co.) to confluence with unnamed	A1 (presumptive), B(WW-2)

Name	Segment ID	Reach Description	Designated Uses[1]
		tributary in S26 T94N R19W Cerro Gordo Co.	
	3023	Mouth (T94N R19W Sec26 Cerro Gordo County) to headwaters (T94N R20W Sec1 Cerro Gordo County)	A1 (presumptive), B(WW-1) (presumptive)
Palmer Creek	790*	Mouth (NW 1/4 S29 T93N R16W Butler Co.) to headwaters in S32 T93N R17W Butler Co.	A1 (presumptive), B(WW-1) (presumptive)
Unnamed Tributary to Palmer Creek	2040	Mouth (T93N R17W Sec23 Butler Co.) to headwaters (T93N R17W Sec20 Butler Co.)	A1 (presumptive), B(WW-1) (presumptive)
Beaver Creek	792	Mo to l Beaver Cr S21T95NR18W Floyd Co.	A1 (presumptive), B(WW-2)
Rock Falls Creek	793	Mo to trib S4T97NR19W Cerro Gordo co.	A1 (presumptive), B(WW-2)
Rose Creek	795	Mouth to trib S35T98NR20W Worth Co.	A1 (presumptive), B(WW-2)
Tributary to Rose Creek	3138	From tributary (T98N R20W Sec35 Worth County) to headwaters (T99N R21W Sec34 Worth County)	A1 (presumptive), B(WW-1) (presumptive)
Elk Creek	798	Mouth to East line of S13 T99N R22W Worth Co.	A1 (presumptive), B(WW-2)
Dry Creek	2041	Mouth (T92N R16W Sec13 Butler Co.) to headwaters (T92N R17W Sec10 Butler Co.)	A1 (presumptive), B(WW-1) (presumptive)

Source: IDNR, 2022

**Designated impaired by IDNR. Additional information on impairments can be found in Chapter 3 of this plan, and in the 2022 Integrated Report.*

[1]Note: A1 – Primary contact recreation

B(WW-1) – Warm water stream capable of supporting a variety of aquatic life, including game fish (typically larger streams)

B(WW-2) – Warm water stream capable of supporting aquatic life, but not game fish (typically smaller streams)

HH – Waters that support fish that are routinely harvested for human consumption

If a stream Use Assessment and Attainability Analysis has not taken place for a particular segment, the segment is presumed to have A1 and B(WW-1) designations under Iowa's water quality standards.

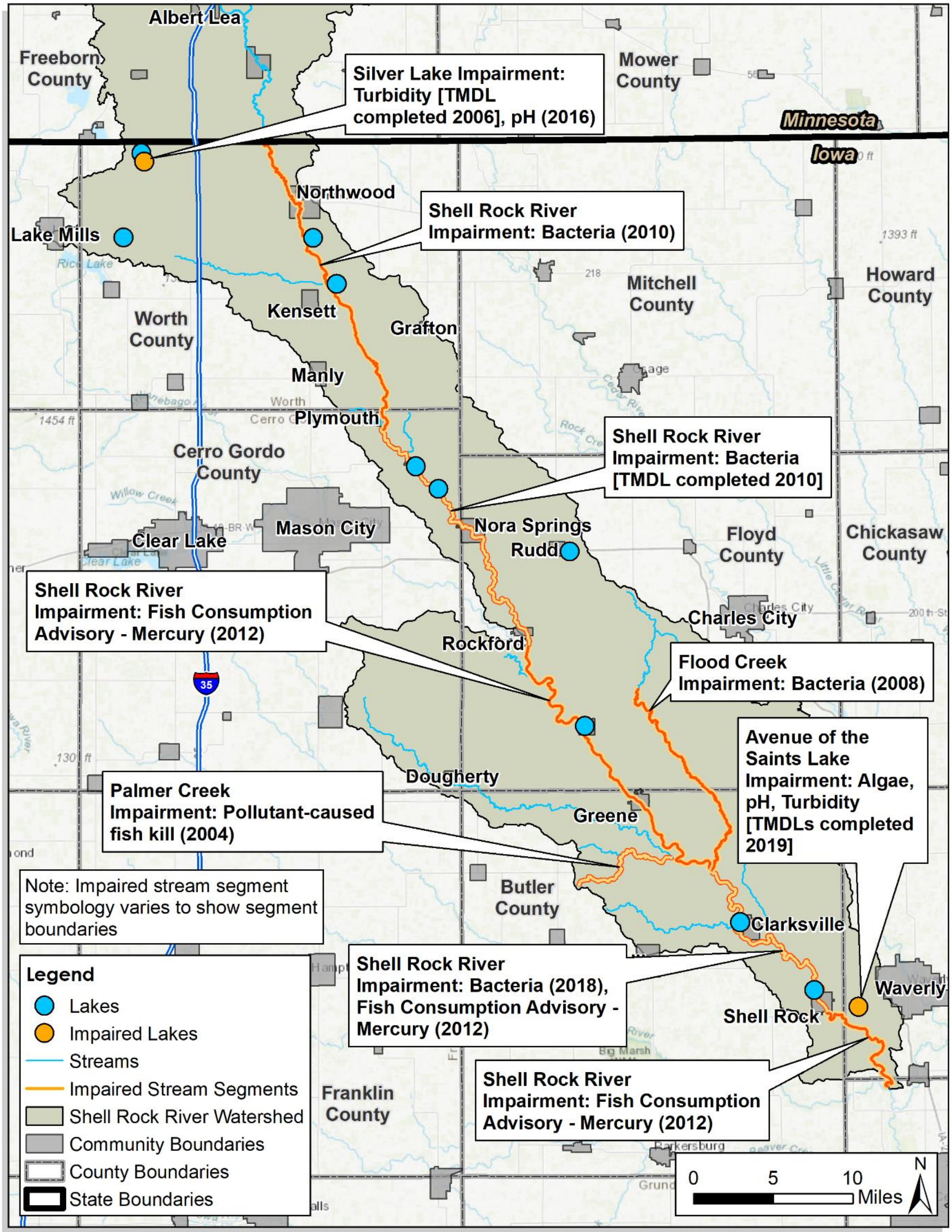


Figure 30: Impaired Waterbodies in the Shell Rock River Watershed

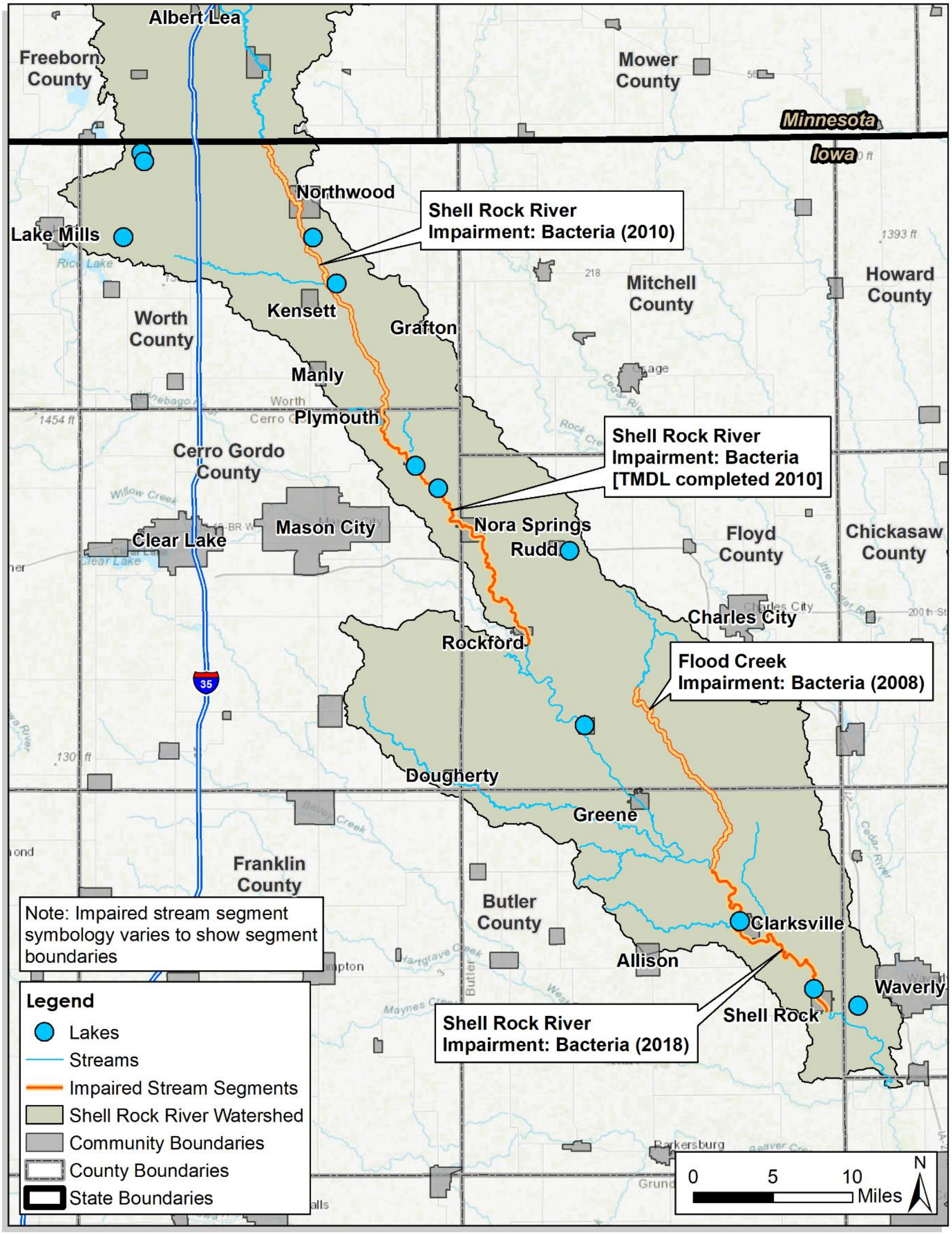


Figure 31: Impaired Waterbodies Addressed by this Plan

3.03 EXISTING WATER QUALITY

WATER QUALITY DATA REVIEW

Water quality sampling data from the Shell Rock River at Shell Rock sampling site was used in the proceeding analysis. This data is presented in comparison to the appliable water quality standards and benchmarks, which were identified in Chapter 2. In some cases, precipitation data has been displayed alongside water quality data to provide a clearer picture of the impact precipitation patterns can have on pollutant concentrations.

E. COLI BACTERIA

E. coli water quality standards do apply to the Shell Rock River. Iowa has two sets of water quality standards that apply to *E. coli bacteria* in streams:

- **The chronic water quality standard** is based on a geometric mean of samples taken during the recreation season (between March 15th and November 15th) of each year. If this geometric mean exceeds the standard (126 CFU per 100 mL of water) then the waterbody is considered impaired. Figure 32 shows that the Shell Rock River did not meet this standard in 2004 and 2018.
- **The acute water quality standard** is based on individual samples exceeding a one-time maximum quality standard (235 CFU/100 mL) during the recreation season. To qualify as impaired based on individual exceedance in a season when 10 or more samples were taken, the exceedance must be present in significantly higher than 10% of samples. If there are only 7 to 9 samples taken during the recreation season, none of the samples should exceed the one-time maximum. The Shell Rock River has exceeded the individual sample maximum water quality standard (235 CFU/100 mL) in 66 samples during the period of record. Figure 32 displays this long-term trend of exceeding this standard.

Several segments of the Shell Rock River and one tributary segment are currently impaired for primary contact recreation due to *E. coli*, making this a parameter of major concern for this plan:

- **Segment 783 of the Shell Rock River** was originally listed in 2012 for recreation impairment due to *E. coli*, was delisted in 2016, and was re-listed in 2018 for the same impairment. The most recent listing was due to both geometric mean and single sample exceedance.
- **Segment 786 of the Shell Rock River** was listed in 2006 for recreation impairment due to *E. coli*, with a TMDL completed in 2010. The listing was due to single sample exceedance only.
- **Segment 787 of the Shell Rock River** was originally listed in 2010 for recreation impairment due to *E. coli*, due to both geometric mean and single sample exceedances.
- **Flood Creek (segment 788)** has been listed as impaired for recreation due to *E. coli* since 2008, with the listing due to both geometric mean and single sample exceedances.

It is important to note that the data available for *E. coli* in the watershed and presented below is only from the downstream site at Shell Rock and may not reflect conditions at the tributary level or further upstream in the watershed. Note that DNR provides units in both MPN and CFU, which are equivalent.

Statistics for the year 2022 (most recent year data was available for the plan):

- Number of samples during the season: 12
- Seasonal geometric mean: 47.19 MPN/100mL
- Number of samples over the single sample maximum: 1
- Maximum value sampled: 930 MPN/100mL

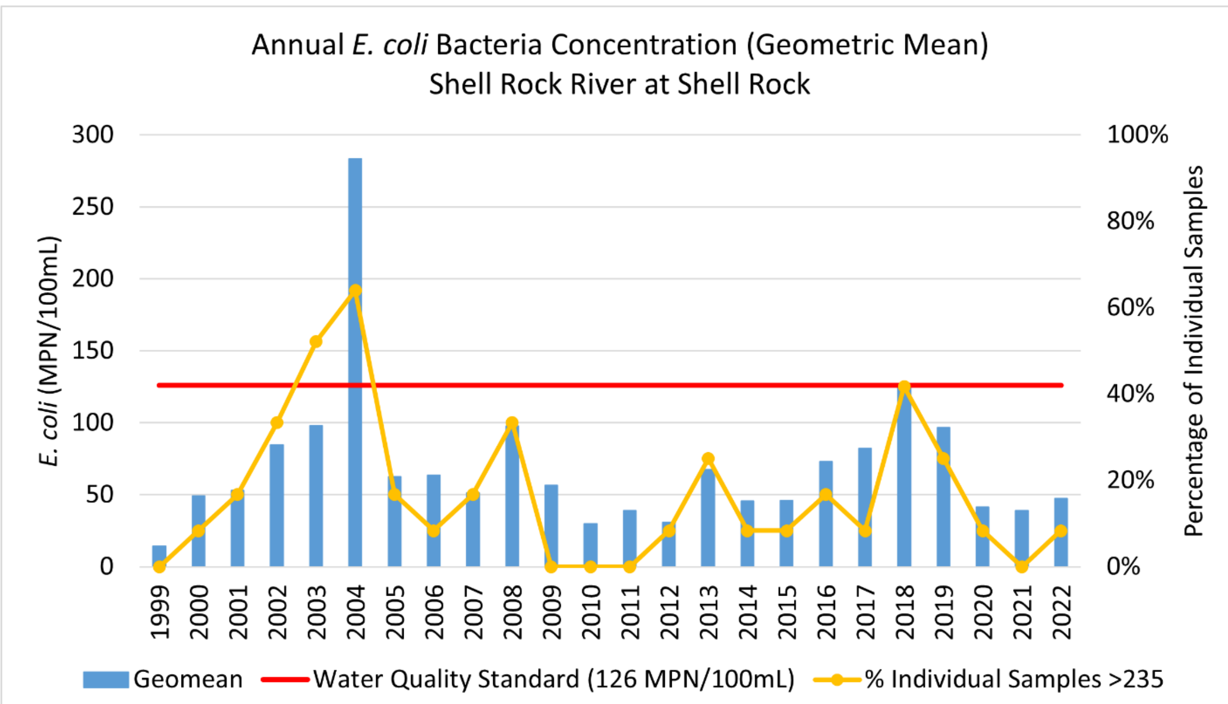


Figure 32: Annual *E. coli* Concentrations in the Shell Rock River

NITROGEN

Nitrate-nitrogen sampling results are shown in *Figure 33*. These results include both IDNR ambient sampling for 1999 – 2022, which is taken every month, and IFC sampling for 2018 – 2021, which is taken every day. Figure 34 shows the overlap of the two datasets and the corresponding monthly fluctuations. The two datasets appear to correlate closely and illustrate the seasonal fluctuations in nitrate concentrations. The maximum contaminant level (MCL) water quality standard for nitrate-nitrogen (10 mg/L), which only applies to drinking water, is also shown for reference. While the MCL is not directly applicable to the Shell Rock River, it is a useful benchmark to use as a reference of water quality. The EPA water quality benchmark for nitrogen (2.18 mg/L) is also shown for reference on the chart.

Annual median nitrate levels did not exceed the MCL in any year from 1999 – 2022. However, in almost every year nitrate levels exceeded the EPA benchmark.

Precipitation data from the Waterloo Municipal Airport weather station was used to examine the relationship between precipitation and runoff and pollutant levels. Relationships between the two parameters vary from year to year, and in some cases low nitrate values are accompanied by low precipitation. Although a variety of factors are at play, it can be important to recognize that low nitrate values in a given year may not be the result of decreased nitrate output upstream and may simply be the result of less runoff and precipitation.

A trend that is noticeable, however, is the increased levels of nitrates in the spring and fall periods (Figure 34) – this is associated with the increased precipitation during those periods. The springtime "surge" in nitrate values is generally larger than the fall period, as that is when soil is already wetter and nitrogen fertilizers are being applied (prior to uptake by crops). Thus, nitrate is most vulnerable to runoff during this time of year.

Statistics for the year 2022 (most recent year data was available for the plan):

- Number of samples: 12
- Annual median concentration: 3.85 mg/L
- Number of samples over the MCL: 0

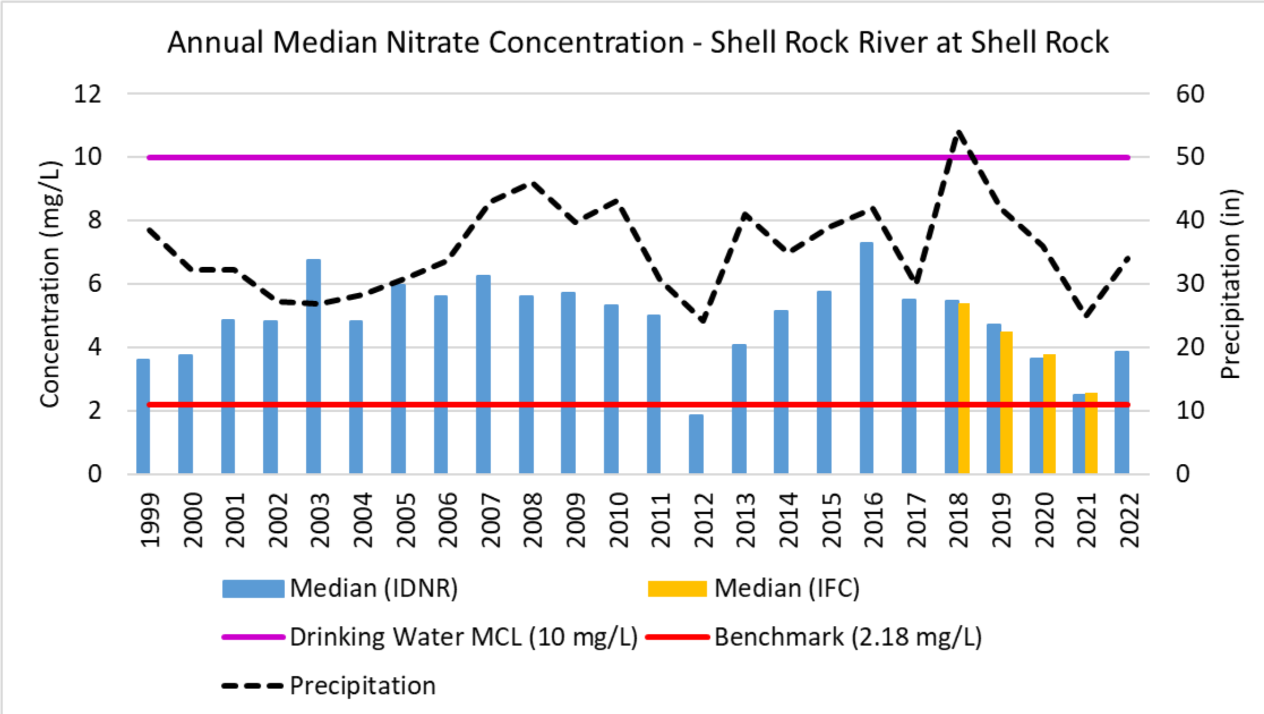


Figure 33: Annual Median Nitrate Concentrations in the Shell Rock River

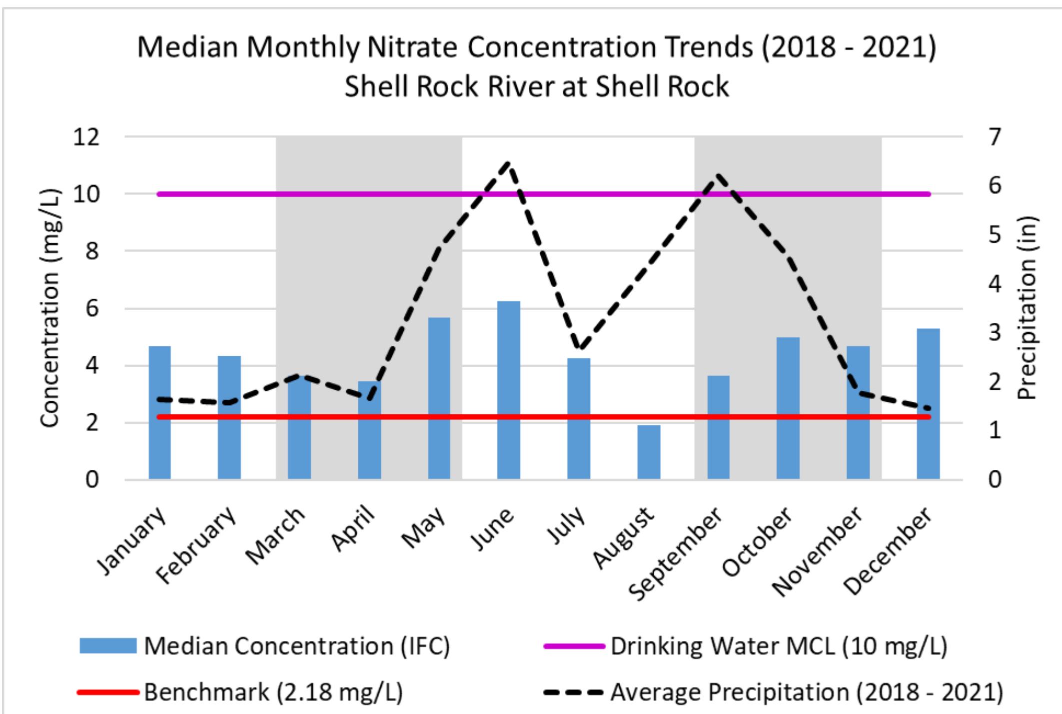


Figure 34: Monthly Median Nitrate Concentrations in the Shell Rock River

PHOSPHORUS

Phosphate-phosphorus sampling results are shown in Figure 35. The EPA water quality benchmark for phosphorus (0.7625 mg/L) is shown for reference. Note that in the Iowa water quality database (AQuIA), phosphate-phosphorus is equivalent with total phosphorus (IDNR, 2023a).

The Shell Rock River at Shell Rock has been below the benchmark every year data was assessed. However, care should be taken with interpretation of this data which is based on samples collected monthly and may not characterize these conditions adequately (see discussion is Chapter 2.07).

Statistics for the year 2022 (most recent year data was available for the plan):

- Number of samples: 12
- Annual median concentration: 0.155 mg/L
- Number of samples over the benchmark: 0

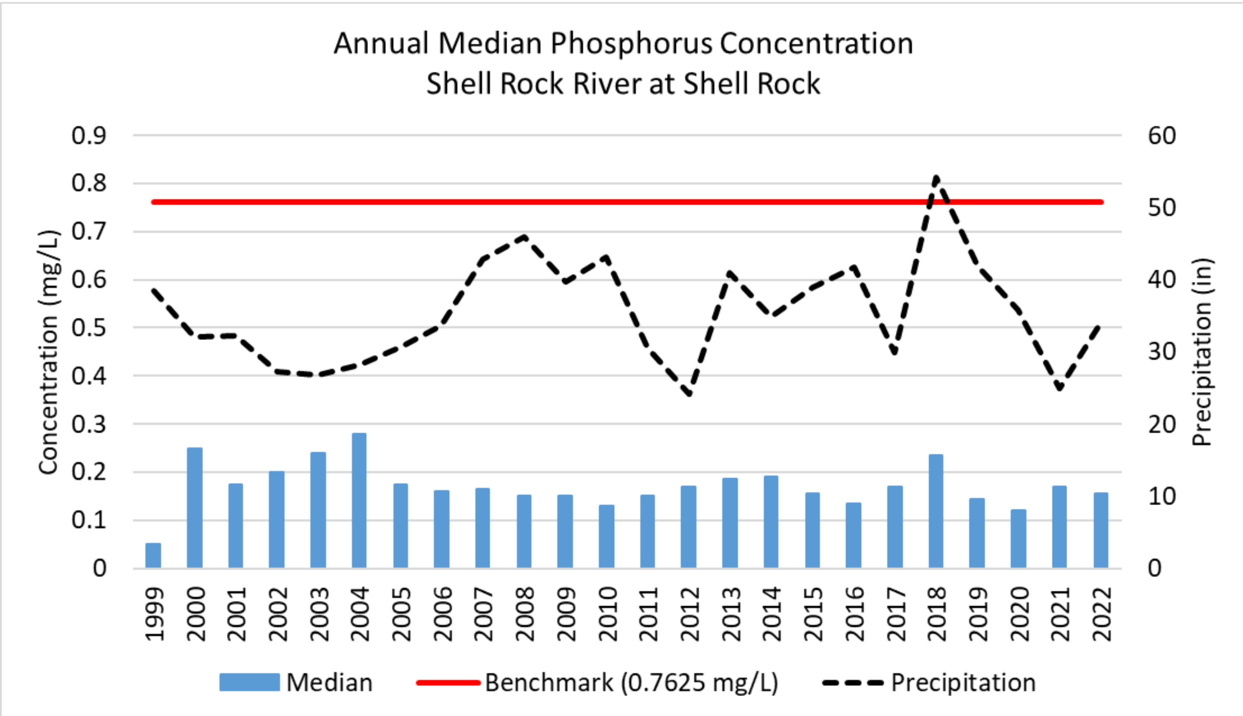


Figure 35: Annual Median Phosphorus Concentrations in the Shell Rock River

SEDIMENT

Total suspended solids (TSS) sampling results are shown in Figure 36. TSS is commonly used as a surrogate for sediment, and the Kansas Department of Health and Environment (KDHE) water quality benchmark for TSS (50 mg/L) is shown for reference.

Annual median TSS levels of the Shell Rock River at Shell Rock exceeded the benchmark in 2002, 2003, and 2004, but have otherwise been below the benchmark. However, care should be taken with interpretation of this data which is based on samples collected monthly and may not characterize these conditions adequately (see discussion in Chapter 2.07).

Statistics for the year 2022 (most recent year data was available for the plan):

- Number of samples: 12
- Annual median concentration: 20 mg/L
- Number of samples over the benchmark: 1

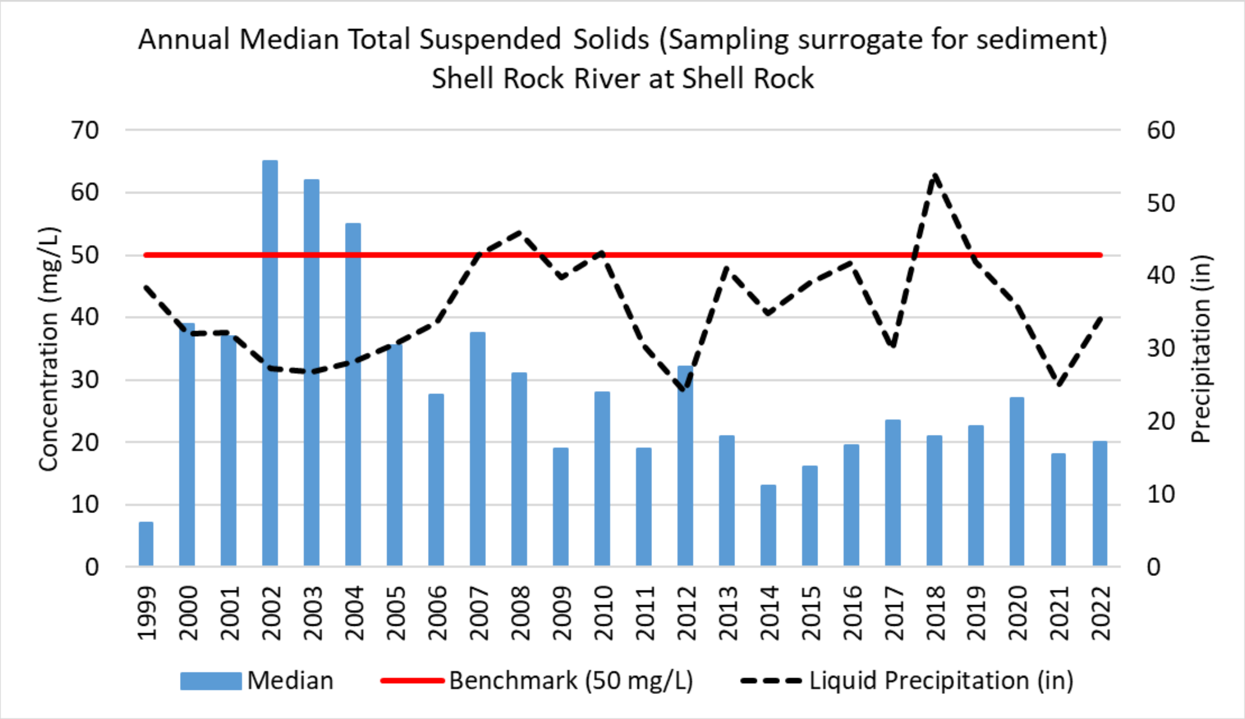


Figure 36: Annual Median TSS Concentrations in the Shell Rock River

SUMMARY OF WATER QUALITY DATA ANALYSIS

Overall, water quality conditions in the watershed are mixed, with phosphorus and sediment levels generally showing few issues, nitrogen found to be of moderate concern, and *E. coli* found to be a concern mainly in individual sample exceedances.

After a review of water quality data for the full watershed, several summary observations can be made:

- Water quality for phosphorus and sediment (TSS) is generally good. However, care should be taken with this conclusion as the current monitoring data available was based on samples collected monthly and may not characterize these conditions adequately. Results from event-based sampling, which may show different pollutant levels, should be evaluated in future updates to this plan.
- Nitrogen levels regularly exceed the benchmark but do not exceed the MCL for drinking water (used for reference only). Although nitrogen levels may not be the primary concern for the Shell Rock River itself, the watershed contributes to the Cedar River Basin and is included in the 2006 Cedar River TMDL for nitrate. Decreasing nitrogen contributions from the Shell Rock River watershed is an important part of decreasing loading downstream in the Cedar River and in the Mississippi River Basin as a whole.
- Impairments due to *E. coli* bacteria have been identified by IDNR on the Shell Rock River and Flood Creek. Impairments on the Shell Rock River are supported by the water quality data, and no data was available specifically for Flood Creek.
- While recent *E. coli* levels appear fairly low, there is a long-term history of the standard being exceeded (Figure 32). With two segments of the Shell Rock River and one segment of Flood Creek impaired due to bacteria without a TMDL, and one segment of the Shell Rock River impaired due to bacteria with a TMDL, *E. coli* remains a cause for concern.
- Targeting BMPs to directly address sources of *E. coli* and nitrogen will also lead to reductions in phosphorus and sediment.

Unfortunately, identification of "hot spots" across the watershed was not possible with the data available. "Hot spots" are locations with an above average density of pollutant sources. Identification these areas can help to focus implementation efforts where they will have the most impact. Development of a water quality model would help to identify these areas and is recommended.

3.04 POLLUTANT SOURCES

INTRODUCTION

This section of the chapter provides the reader with an understanding of the sources of the pollutants this plan addresses, including the originating sources of each, transport mechanisms, loads, and the effects of the pollutants. It is important for the reader to keep in mind that many of the pollutant sources are found in the same locations or are transported through similar hydrologic functions. Thus, targeting BMPs to one source or one pollutant often helps to reduce other pollutant loads.

This watershed plan is based on voluntary implementation of BMPs, therefore limited focus is directed towards pollutant sources that are permitted (i.e., wastewater treatment facilities, MS4 stormwater facilities, and permitted animal feeding operations). It is assumed these sources are meeting their regulatory requirements and are not contributing beyond the pollutant limits set by their permits. However, future water quality modeling efforts should identify these facilities and account for their pollutant load contributions. This allows nonpoint pollution loads to be clearly identified and separated from the total pollutant load.

POLLUTANT TYPES

Sources of pollution (Figure 37) can be separated into two primary categories:

- **A point source of pollution** is any discernible, confined, or discrete conveyance from which pollutants can be discharged – these can be easily tracked along the pollutant's travel path and identified at the source (typically with a pipe). The discharge from most point sources is regulated by the National Pollutant Discharge Elimination System (NPDES) permit program. Many industrial, municipal facilities, and some agricultural operations are required to obtain NPDES permit coverage. However, tile drainage outlets and individual homes typically do not need coverage under a NPDES permit.
- **Nonpoint sources of pollution** come from facilities, activities, or land uses that do not meet regulatory requirements to be considered point sources. These sources are not regulated, are typically smaller, or are otherwise not well defined. **These sources are the focus of implementation efforts identified within this watershed plan.**

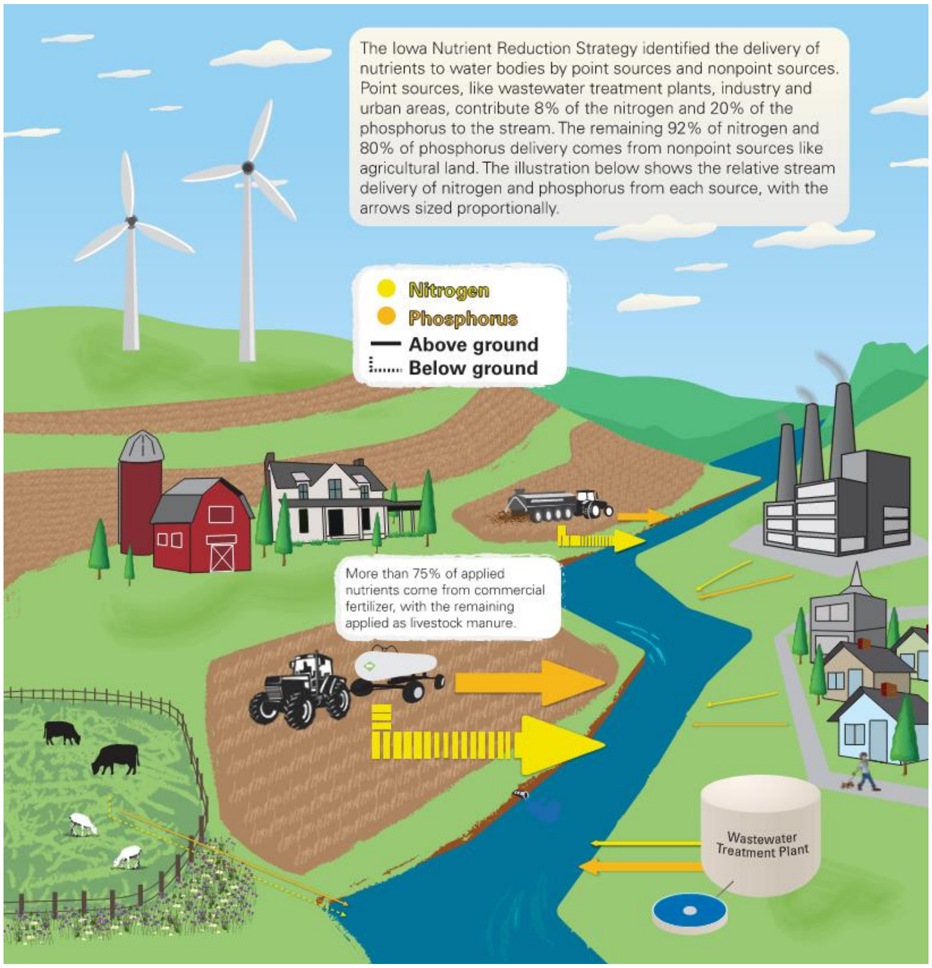


Image Source: Iowa Learning Farms

Figure 37: Stream Delivery of Nitrogen and Phosphorus from Pollutant Sources

POLLUTANT SOURCES

The pollutants addressed in this plan are bacteria (*E. coli*), nutrients (phosphorus and nitrogen), and sediment. A summary of pollutants, their sources, and their impacts is shown in Table 19, and a discussion of each pollutant follows.

Table 19: General Summary of Pollutants and Sources

Pollutant and Sources		Potential Impacts on Waterbodies
Point Sources	**Nonpoint Sources**	
Bacteria (*E. coli*)		
• WWTFs • Registered AFOs or CAFOs	• Small open feedlots & grazing livestock • Land application of manure • Underperforming septic systems • Wildlife and pets • Land application of wastewater/ sludge	• Human health risks • Recreation impairments
Nutrients (phosphorus and nitrogen)		
• WWTFs • Registered AFOs or CAFOs	• Sheet, rill, and gully erosion from crop lands • Tile line drainage • Commercial fertilizer (urban and crop lands) • Land application of manure or wastewater • Small open feedlots & grazing livestock • Stream erosion • Underperforming septic systems • Wildlife and pets	• Aquatic life impairments • Human health risks • Drinking water supply impacts • Recreational impacts
Sediment		
• Stormwater Systems • Construction Sites	• Sheet, rill, and gully erosion from crop lands • Stream erosion • Erosion from construction, and gravel roads • Erosion from timber harvesting or tree clearing • Stream erosion	• Aquatic habitat • Reduces reservoir capacity • Recreational impacts • Human health risks – fish consumption

Note: WWTF – Wastewater Treatment Facility
AFO – Animal Feeding Operation
CAFO – Confined Animal Feeding Operation

Nitrogen and Phosphorus

Nutrients such as nitrogen and phosphorus occur naturally. However, an overabundance of these nutrients may lead to impaired water quality. Nutrient enrichment in Iowa waterbodies can stem from both internal and external sources. Internal sources are those nutrients which originated from an external source but then became trapped in waterbodies and are recycled annually (primarily in lakes and reservoirs). External sources of nutrients are those which enter waterways through contaminated runoff from the sources identified in Table 19.

Excess nutrients in waterbodies produce algae (Figure 38). As these large algal blooms die off, the decaying matter utilizes oxygen in the water. Low levels of oxygen can stress and even lead to the death of aquatic life. Sometimes these blooms can be dominated by blue-green algae, which produce toxins that are dangerous to humans, pets, livestock, and other animals.

Contribution of nutrients generally happens during snowmelt or rainfall events when water runs off the landscape and carries pollutants with it. Pollutant sources include fertilizer, soil erosion, manure application sites, small open feedlots, tile line drainage, grazing livestock, stream erosion, and inadequate or malfunctioning wastewater treatment systems. It’s also important to note that nutrient runoff is highly seasonal. A large portion of nutrients runoff or leach from cropland during the spring and early summer months before crops are actively growing. Crop cover prevents nutrient loss primarily through two mechanisms: 1) Actively growing crops utilizing nutrients in the soil, and 2) Vegetation covers the otherwise bare crop ground which helps to protect soil (and attached nutrients) from erosion.

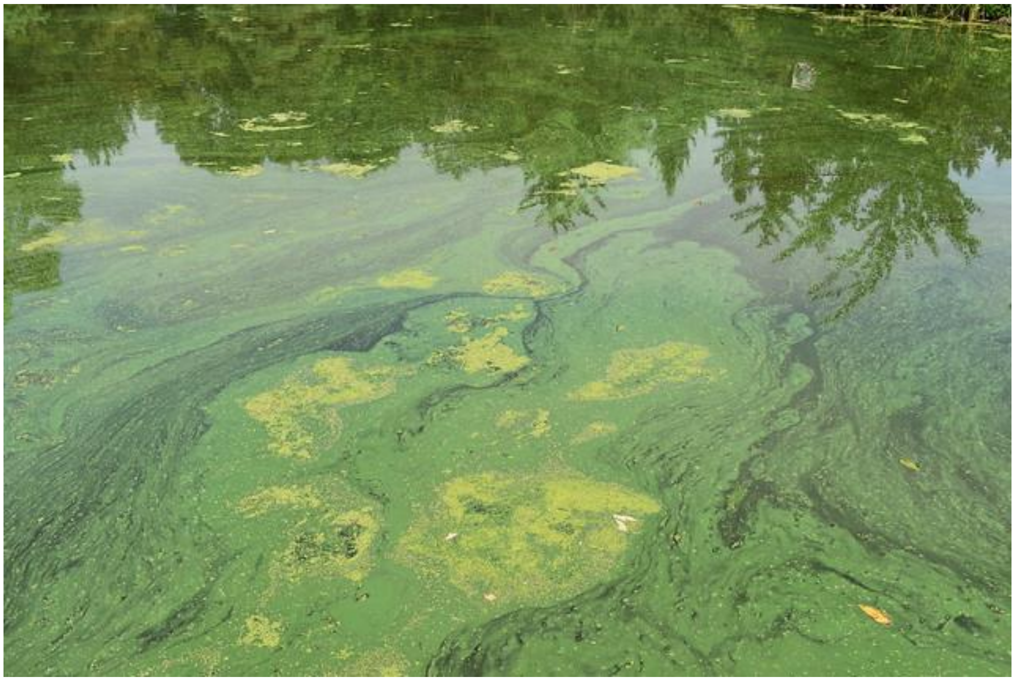


Figure 38: Example of an Algae Bloom Caused by Excessive Nutrients in the Water

Sediment

Sediment originates from stream erosion (streambank and stream bed), gully erosion in fields Figure 39), and erosion (sheet and rill) of both urban and cropland areas (where vegetations has been removed) Sediment can increase turbidity and also acts as a transport mechanism for other pollutants (especially phosphorus). Excessive sedimentation diminishes the suitability of instream and streamside habitat for fish and wildlife as sediment buries substrate that support spawning and foraging habitat for benthic and other aquatic organisms. Every land use type produces sediment through erosion; however, some are greater contributors than others. Cropland has higher sediment loss rates due to the lack of perennial vegetation. Developed regions have high levels of impervious surfaces and increased amount of land clearing for construction.

Photo by Lynn Betts, USDA Natural Resources Conservation Service (1999)

Figure 39: Erosion and Sedimentation in a Field in Iowa

E. Coli Bacteria

E. coli is a species of fecal coliform bacteria that is commonly found in the fecal matter of warm-blooded animals. Most strains of *E. coli* are harmless; however, certain strains (0157:H7) can cause mild to severe gastrointestinal illness (Figure 40). The EPA has recommended that *E. coli* be used as the primary indicator of health risk from recreational waters, therefore identifying the sources of *E. coli* contamination is important.

Pollutant sources (Table 19) of *E. coli* include: land application of livestock manure and wastewater sludge for fertilization; runoff from livestock pastures and/or livestock with direct access to waterbodies; small open feedlots; pet waste; underperforming onsite wastewater treatment systems; and natural sources such as wildlife. Runoff from precipitation can cause *E. coli* to be washed into surface waters and it can also potentially enter drinking water through abandoned or poorly constructed wells.

Image credit: KCCI 8 News, 2016

Figure 40: Water Quality Advisory Sign at a Recreational Beach Demonstrates the Health and Safety Impacts of *E. coli* on the Public

3.05 POLLUTANT SOURCE MAPPING

Using available data, pollutant sources were overlaid onto several watershed maps. These maps can be very helpful in understanding the watershed, visualizing the location of pollutant sources, and prioritization of implementation efforts. However, care should be taken when interpreting these at the field level. Each property within the watershed has unique physical characteristics and is uniquely managed by the farmer. The following pollutant sources are presented and discussed below:

- Cropland
- Urban stormwater and pet waste
- In-field Erosion
- Stream Erosion
- Livestock and manure application
- Wastewater treatment

CROPLAND

Cropland dominates the watershed (Figure 41) and is generally equally distributed across the watershed except along the river corridor and where communities are located. This exception is most pronounced in the northernmost part of the watershed, particularly the Minnesota portion. Most cropland in the watershed is corn and soybean production, which contributes to nutrient pollution through soil erosion and the runoff of commercial fertilizer. The risk of nitrogen leaching through tile drainage systems is a particular concern given that the majority of the cropland in the watershed is estimated to be potentially tiled. Cropland generally has an increased risk of erosion due to a lack of perennial vegetation. Bacterial pollution from cropland is primarily associated with manure applied as fertilizer. Due to the relatively homogonous and wide-spread nature of this land use additional analysis (such as the ACPF toolbox, tributary level water quality sampling, or water quality modeling) should be used to help identify “hotspots” and critical source areas at the subwatershed or field level.

URBAN STORMWATER AND PET WASTE

Figure 41 also shows the locations of urbanized areas within the watershed. No MS4 communities are located in the Iowa portion of the watershed. This land use category includes cities, acreages, farmsteads, etc. Most urban land is “impervious”, which means nearly all precipitation that falls on these surfaces (parking lots, streets, etc.) doesn’t infiltrate into soil, and instead increases runoff rates. Developed areas contribute to nutrient pollution primarily from the runoff of lawn fertilizer. The risk of soil erosion is typically less in urban areas than cropland areas due to increased impervious surfaces or perennial vegetation (lawns, etc.), unless construction or land clearing is occurring. Urban wildlife and improper disposal of pet waste are both sources of *E. coli* bacteria and nutrient contamination. While urban areas make up a small portion the watershed, the relative contribution (on a per acre basis) of pollutant loads may be much higher than cropland due to the increased runoff rates.

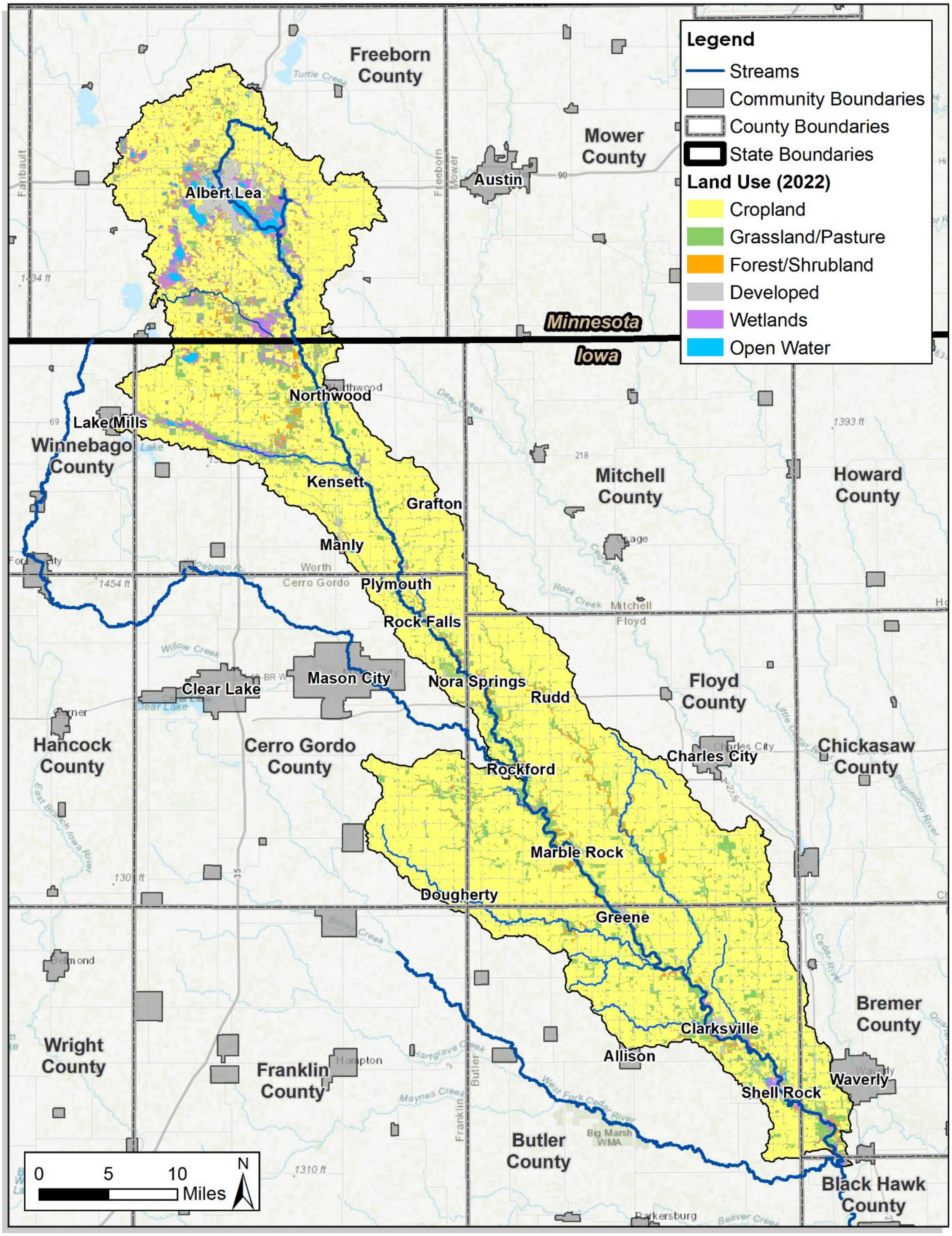


Figure 41: Land Use Distribution Across the Watershed

IN-FIELD EROSION

Average erosion rates from upland sources (primarily cropland) for each HUC 12 were estimated using the Daily Erosion Project (DEP), produced by Iowa State University. The DEP uses elevation, soils, land use, precipitation, and other weather data information to estimate erosion on a HUC 12 subwatershed basis (Gelder, 2018). Due to data limitations, DEP estimates include erosion from sheet and rill erosion, but not from gullies. These estimates are broken down further into long term averages for each HUC 12 watershed and mapped (Figure 42). Sediment loss varies across the watershed, with moderate levels seen along most of the main stretch of the Shell Rock River. The Elk Creek subwatershed in Worth County had the highest average sediment loss at 1.19 tons/acre/year. Additional data and an interactive map of the Daily Erosion Project can be access here: https://www.dailyerosion.org/

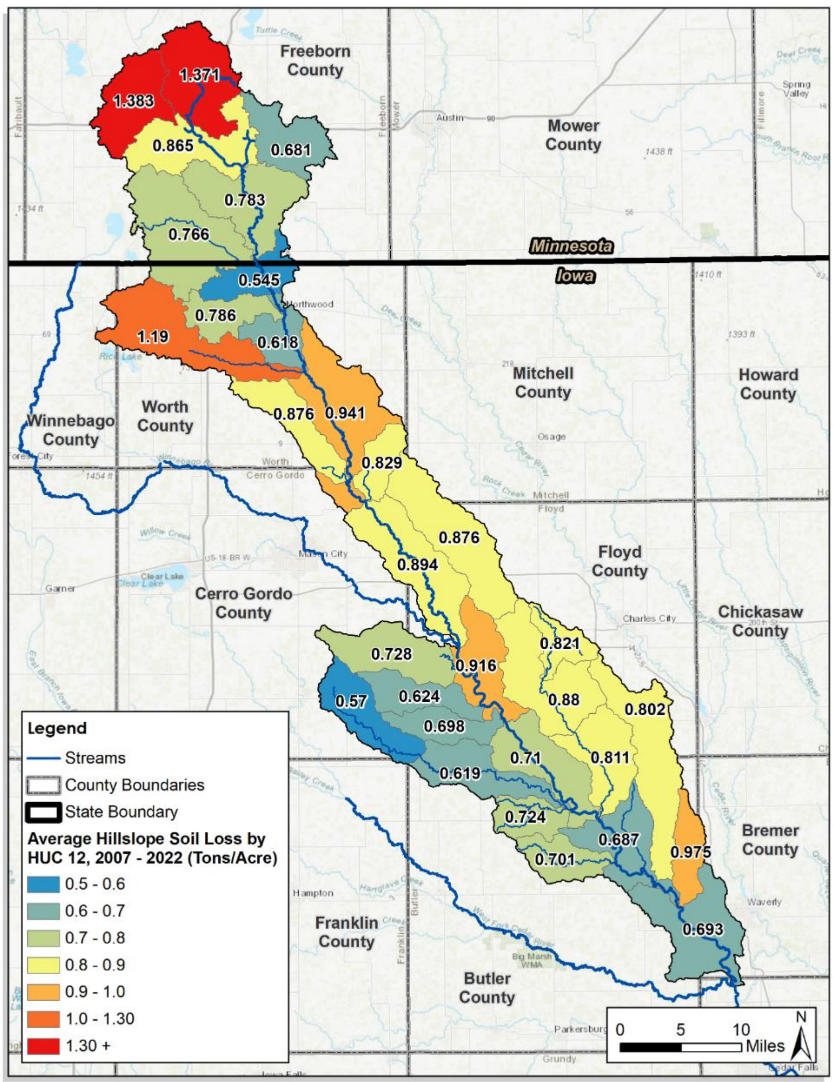


Figure 42: Average Annual Erosion by HUC 12 Subwatersheds (2007-2022)

STREAM EROSION

A channel is considered stable and in equilibrium when the energy associated with flow and channel slope balances with the sediment load and bed material size. Channels in equilibrium balance these factors over time (*Figure 43*). Erosion is a constant and a natural process in stream evolution, but it occurs at a much slower rate under stable conditions. Therefore, the concept of “stability” is better characterized as “dynamic equilibrium”.

Nature rarely operates on society’s time scale; thus, it can be difficult to determine exactly when a change in the system reflects either instability from short term impacts or a dynamic variation within a long-time frame.

Average erosion rates from stream channels can be estimated by assessing stream channel stability. Stream channel stability generally refers to the capacity of a stream channel to transport water and sediment without changing dimensions (width, depth, cross-sectional area, and slope). However, there are several complicating factors including, but not limited to:

1. Streambank and bed mobility are natural phenomenon, and stable streams differ from unstable streams primarily in their rate of bank and bed mobility; and
2. Unnaturally high rates of bank and bed mobility can have multiple causes, ranging from small-scale, local causes (such as unrestricted livestock access) to large scale, regional causes (such as stream channelization or tile drainage).

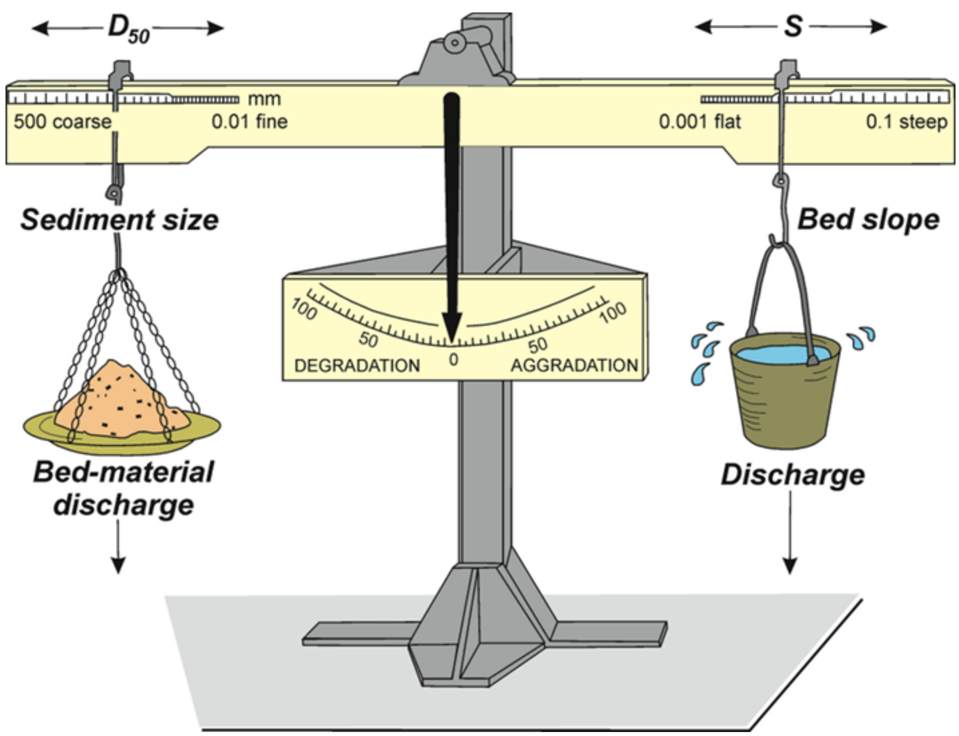


Figure 43: Lane’s Balance, a Representation of Stream Stability (Rinaldi and others, 2015)

To regain dynamic equilibrium, destabilized streams generally adjust, or evolve, through a sequence of channel forms. The stream evolution model (Simon, 1989) provides a framework to understand how stream channel morphology changes throughout this evolutionary process and is broken down into six cyclical stages (*Figure 44*). Understanding this framework allows resource managers to evaluate present channel conditions, interpret historical conditions or activities that led to the current state, and predict future channel behavior. Stream assessments are conducted to gather this type of information.

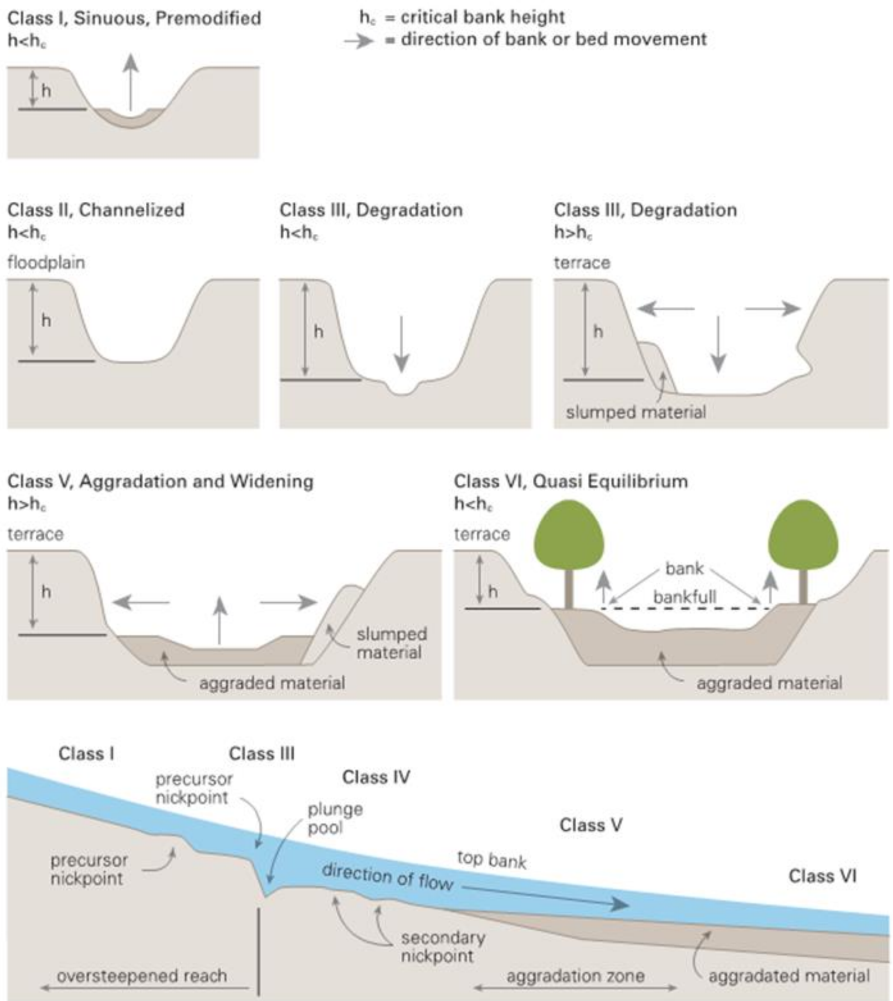


Figure 44: Simon Channel Evolution Model (Harman and others, 2012)

Information on the stability of streams is typically gathered through various types of rapid stream assessments. These evaluations provide a concise, reconnaissance-level overview of stream quality conditions and may also identify potential enhancements to improve stream health. These on-the-ground assessments focus (to varying degrees) on geomorphology, riparian conditions, and in-stream habitat. It can be useful to focus on high priority areas to protect, such as areas near bridges or other infrastructure. Desktop level assessments can either enhance in-field assessments or be used as a standalone effort to develop an initial, high-level understanding of stream stability. Desktop tools can include historic aerial photography, LiDAR, aerial oblique imagery, and local stakeholder input.

No on-the-ground stream assessment data was identified within the watershed. It is recommended that this type of data be collected as part of future plan updates. At a minimum, this should be collected within priority areas. As part of these surveys, drainage tile infrastructure should be located and evaluated. Literature review indicates that approximately 15-35% of streams in northern Iowa are likely experiencing erosion, with eroded lengths increasing as stream order increases (Schilling, 2019).

Streambank recession (erosion) rates for third order streams have been found to average 12.8 cm/year in the Des Moines Lobe landform region and 15.9 cm/year in the Iowan Surface landform region (Schilling and others, 2023). However, it is important to note that these rates can vary significantly year-to-year, based on many factors: riparian land use, grazing, local precipitation patterns, and soil/geology of stream banks. Additionally, these erosion rates tend to increase as stream order (size) increases. Such a high-level of erosion clearly places stream erosion as a major contributor to watershed sediment and phosphorus loads.

While stream erosion assessments can be done on small stream reaches with relative ease, quantifying the contribution of streambanks to pollutant loading at the watershed scale is particularly challenging due to the time and resources that would be required for an on-the-ground survey across the watershed. Several efforts are underway in Iowa to develop estimates using GIS and LiDAR based analysis paired with soil sampling. Further development of these technologies will be beneficial to future updates to this plan.

LIVESTOCK AND MANURE APPLICATION

Livestock manure, which is commonly spread on cropland as fertilizer, can be a source of nutrients, sediment, and bacteria when it is carried to streams through runoff. Additionally, cattle can cause erosion to upland areas and streambanks when they have access to those areas for an extended period of time. According to the most recent USDA AgCensus data (see Chapter 2), the primary livestock (and thus manure sources) found within the watershed are hogs (pigs) and chickens. These types of livestock are found within animal feeding operations, not in open grazing systems. Cattle, which can be found in feedlots or pastures, can also be pollutant source and are found in the watershed in fewer but still significant numbers.

Animal feeding operations (AFO) are facilities that confine livestock in a limited feeding space for an extended period of time. The IDNR recognizes two types of AFOs:

1. A **confinement feeding operation (CAFO)** confines animals to areas that are totally roofed. All confinements, including small animal feeding operations, are required to follow some level of state regulations regarding manure management and land application when building or operating a facility. Figure 45 shows there are 102 CAFOs in the watershed.
2. **Open feedlot AFOs** are facilities where livestock are kept in unroofed or partially roofed areas, where they are fed and maintained in pens for at least 45 days per year. Unlike animals on pasture, manure from the open lot is concentrated and the ground is bare of vegetation. Not all open feedlot AFOs are required to follow permitting standards.
    a. Open feedlot AFOs with 1,000 or more animal units (1,000 beef cattle, 700 mature dairy cattle, or 2,500 finishing hogs) are generally required to apply for a NPDES permit to regulate discharge of livestock waste from these operations. Some intermediate size lots may also need an NPDES permit if a stream runs through the lot or there is a man-made conveyance for discharging to a stream. For the purposes of this plan, these permitted facilities are considered zero discharging. Figure 45 shows 11 permitted open feedlot AFOs in the watershed, 7 of which overlap with the CAFOs.
    b. Nonpermitted small open feedlots are a potential source of bacteria, nutrients, and sediment. These operations are too small to be regulated by IDNR and are not required to retain any of their waste. However, there is no available mapping data of these potential pollutant sources. It is recommended that these small open feedlots be identified during future watershed plan updates through visual review of aerial photography or an on-the-ground watershed assessment.

For the purpose of this plan, it is assumed CAFOs and permitted open feedlot AFOs are meeting their regulatory requirements and are not contributing beyond the pollutant limits set by NPDES permits. Permitted open feedlots are designed to contain any runoff generated by a storm event weaker in intensity than a 25-year storm event. Therefore, management recommendations are not included in this plan for these facilities.

Regulated CAFOs and open feedlots are required to manage their manure and wastewater at the facility, however, they may still land apply manure and wastewater as fertilizer. Therefore, land application of animal waste / fertilizer should not be considered part of the "zero" discharge assumption placed on these facilities. Land applied manure and wastewater are a potential source of bacteria, nutrients, and sediment. The estimated manure application zone (provided by IDNR) is shown in Figure 45. This mapping is based on an assumption that manure is applied at an agronomic rate of 160 pounds of nitrogen per acre for a two-year crop rotation, from the estimated manure produced from each permitted facility. According to these estimates, approximately 46,660 acres of land receive manure application. It is recommended that the manure application zone estimates are updated when additional AFO mapping is completed.

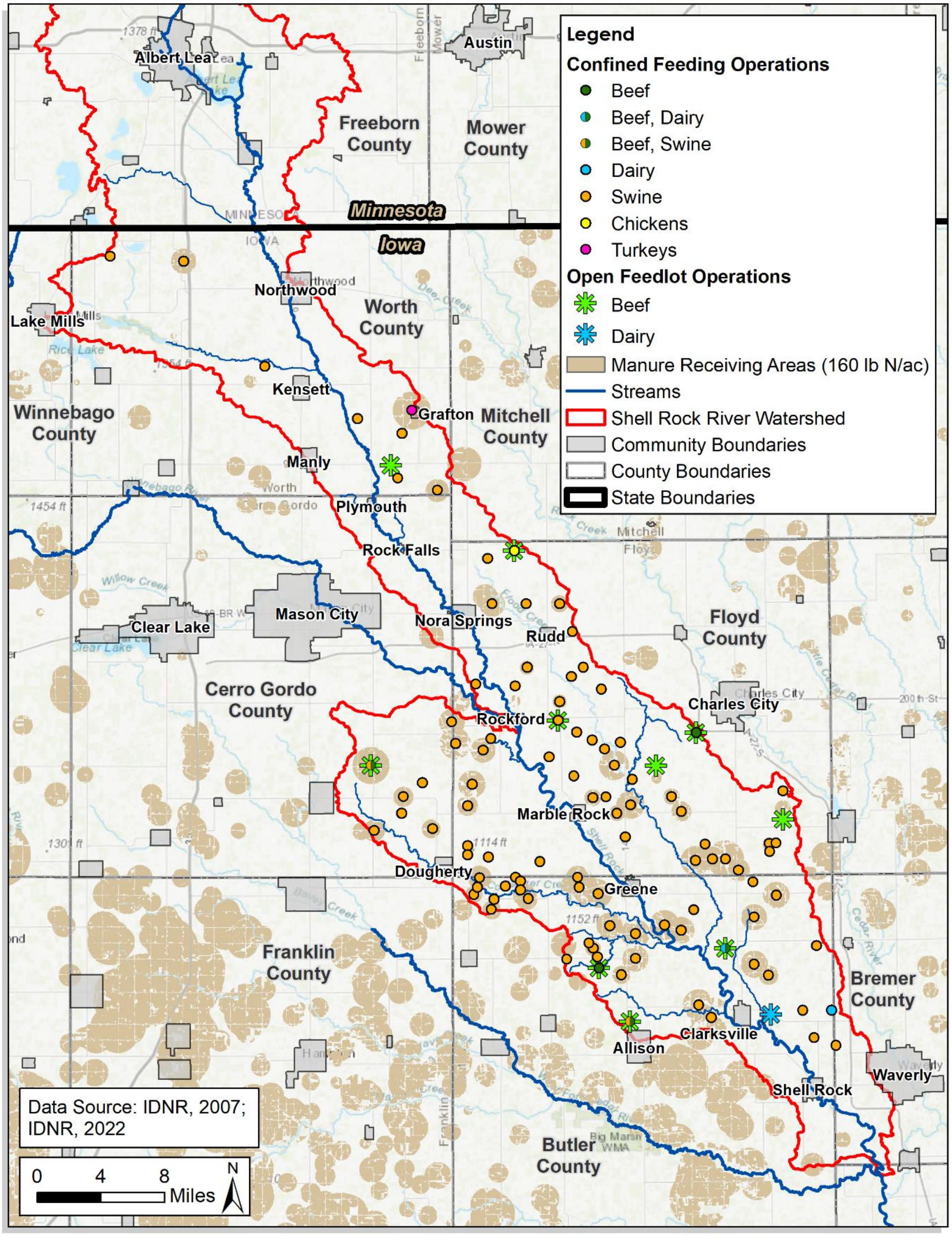


Figure 45: Location of Permitted AFOs and Estimated Manure Application Zones

WASTEWATER TREATMENT

Septic Systems are used to treat wastewater from a home or business and return treated wastewater back into the receiving environment. Septic systems can become a pollutant source for nutrients and bacteria when the systems begin to fail. There is no known estimated failure rate for septic systems in Iowa, but neighboring states (Nebraska and Minnesota) have estimated failure rates of 40-70%, indicating septic systems can be a signific source of pollution (EPA, 2002). However, no counties in the watershed reported regulating the regular inspection or pumping of septic systems.

“Unsewered communities” can also be sources of pollutants According to the DNR, an unsewered community doesn't have to be an incorporated city. A "community" has 10 or more residential homes with one or more houses per acre.; and it's "unsewered" if it lacks a central sewage treatment system or if most of its septic systems don't meet state standards. However, no unsewered communities were identified within the watershed.

Permitting of small/private septic systems (less than 1,500 gallons per day) in Iowa is regulated at the county level. However, no counties in the watershed reported having data regarding estimated location or number of systems, and therefore a map of individual systems was not available. The number of septic systems was estimated using the Spreadsheet Tool for Estimating Pollutant Loads (STEP-L) data server (Tetra Tech, 2013). There are an estimated 5,730 systems in the watershed as a whole, and Figure 46 displays estimated counts on a HUC 12 basis. The highest estimates of septic systems are found in the headwaters in Minnesota, with the highest counts in Iowa found in the vicinity of the towns of Shell Rock and Nora Springs.

Additional information on septic systems can be found here:

- EPA Septic Smart Program : https://www.epa.gov/septic
- DNR Private Septic System Program: https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Private-Septic-Systems
- Local County Sanitarian or County Health Department.

Wastewater treatment facilities which discharge to surface waters are required to have an NPDES permit, therefore, IDNR maintains a database of these records. Figure 46 shows 34 WWTFs located within the watershed. However, not all of these are municipal WWTFs, as some industrial facilities are also included in this count. It is recommended that during future updates to this plan pollutant loads be estimated for each WWTF based on a review of their discharge permit. This information will be useful for water quality modeling efforts.

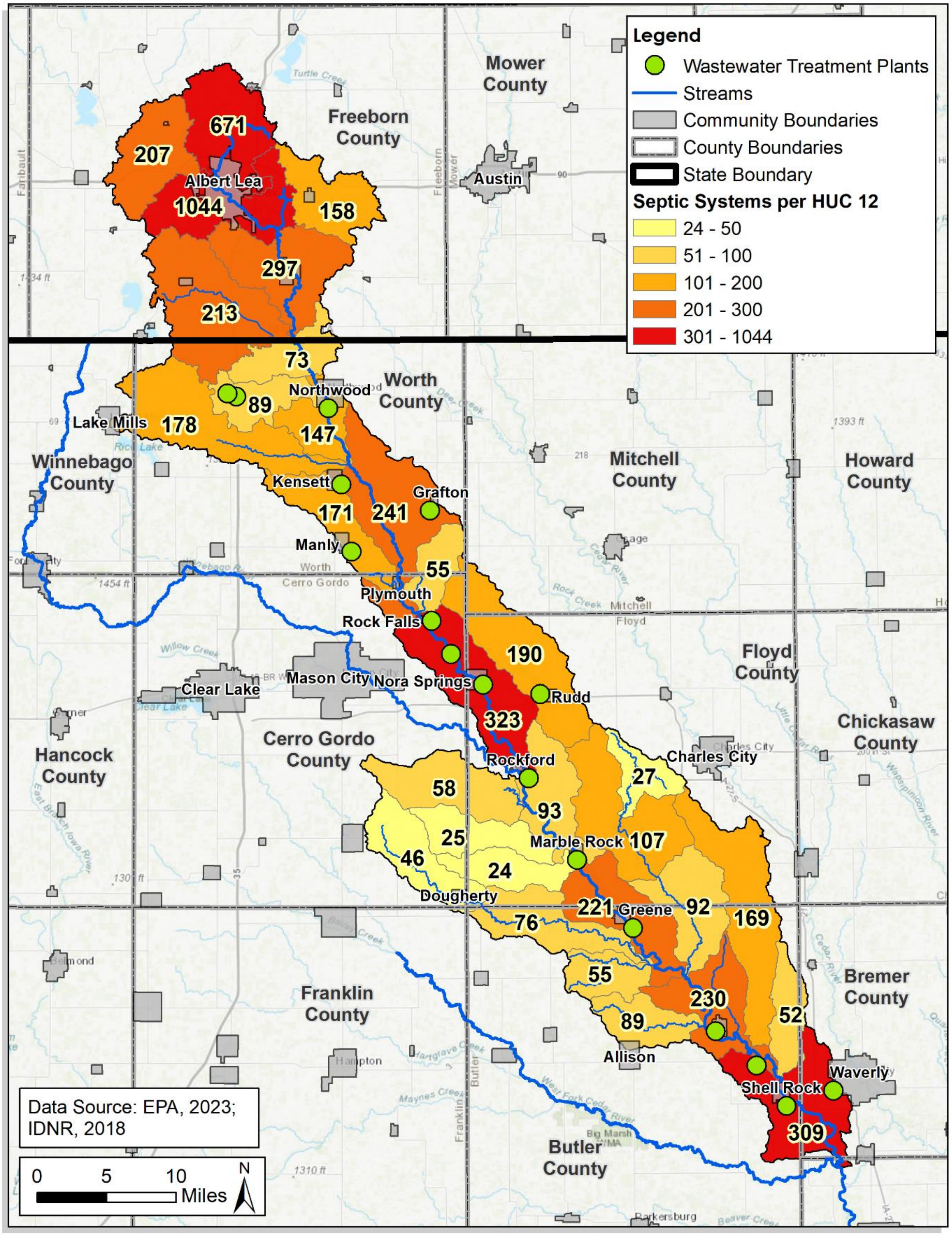


Figure 46: Permitted Wastewater Facilities and Estimated Count of Septic System

3.06 POLLUTANT LOADS

NUTRIENT LOADING

Summaries of the literature review conducted for data related to nutrient loading estimates is presented below. While the specific loading numbers in each report are dated or have other limitations; given the lack of a water quality model for the watershed, they do help to provide a reasonable representation of water quality conditions in the watershed. Pollutant load estimates from each study are provided in Table 20, and discussed below.

Table 20: Summary of Nutrient Load Estimates for Shell Rock River Watershed

Data Source	Total Nitrogen Load (lb/acre)	Total Phosphorus Load (lb/acre)
2004 Iowa Nutrient Budget Study*	14.9	0.56
2006 Cedar River TMDL* *(note that this is expressed in different units than the other studies)*	14.7 mg/L	N/A
2012 USGS SPARROW Modeling**	18.3	1.3

**Includes Winnebago River Watershed*
***Based on delivered aggregated yield*
NA – Not Assessed

As discussed earlier, it is important to recognize that sampling may not fully represent the full picture of phosphorus loading, as phosphorus adsorbed to sediment may be present in higher quantities during erosional events that are missed by monthly sampling. In fact, a recent study (Schilling, 2022) found that streambank erosion from 3rd to 6th order streams accounted for approximately 31% of the total phosphorus exported from Iowa. The study also noted that this was likely a conservative (low) estimate as erosion from field gullies and smaller 1st and 2nd order streams was not included.

2004 Iowa Nutrient Budget Study (Libra and others, 2004)

The Iowa Geologic Survey completed a statewide study titled *Nitrogen and Phosphorus Budgets for Iowa and Iowa Watersheds* (Libra and others, 2004). This study, which was supported by the IDNR's Section 319 program, estimated inputs and outputs of nitrogen and phosphorus across Iowa and its major monitored watersheds. Data represented average annual conditions for the period 1997-2002 and stream loading estimates were based on monthly water quality monitoring data across 68 large watersheds (80% of the state) from 2000-2002. This report represented the first comprehensive mapping of the distribution of major nutrient sources across the state and presented a reasonable picture of nutrient loading at the time.

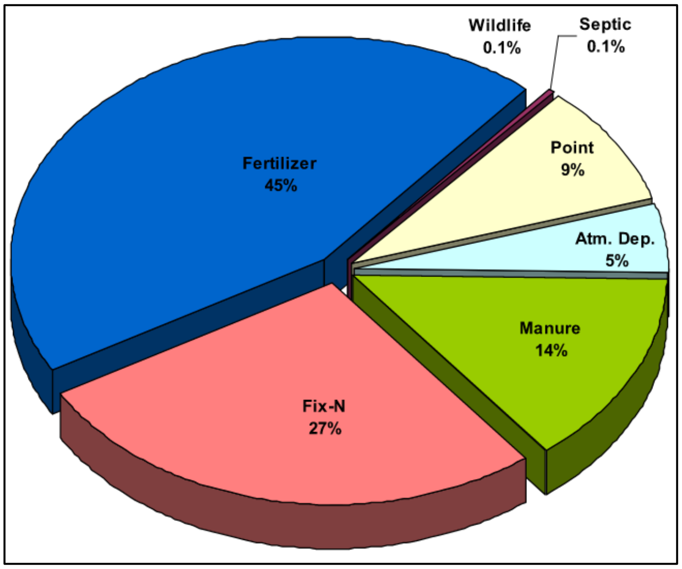
Pollutant load estimates for the Shell Rock River, were based on water quality data from the IDNR Shell Rock River at Shell Rock site are provided in Table 20. While the specific loading numbers in the report are dated, it provides a full accounting of pollutant sources and offers several insights into relative levels of pollutant loads in watersheds across Iowa:

- Watersheds with a high percentage of row crop (and nitrogen fertilizer inputs) tend to show statistically higher nitrogen loads and in-stream concentrations
- High ortho-phosphorus loads in streams were statistically related to watersheds with high manure inputs
- There was no statistical correlation of total phosphorus to other factors in the study. This was likely due to the stream monitoring data used, which was based on samples collected monthly and may not characterize total phosphorus concentrations adequately.
- State-wide point sources accounted for about 8% of stream nitrogen, with nonpoint sources accounting for the remaining 92%. For individual watersheds, point source inputs accounted for 1-15%.
    - The Shell Rock River Watershed was below the average, with 6.1% of nitrogen originating from point sources.
- State-wide point sources accounted for about 20% of phosphorus, with nonpoint sources accounting for the remaining 80%. For individual watersheds, point source inputs accounted for 1-52%. Due to inherent issues with quantifying stream loads, as previously discussed, this estimate was less reliable.
    - The Shell Rock River Watershed was about average, with 19.0% of phosphorus originating from point sources.
- A variety of factors affect the delivery of nitrogen and phosphorus from pollutant sources to streams. These include soil, geologic, climate/weather, land management practices, and the amount of nutrients available. While this study addressed the “amount of nutrients available” factor, strategies and practices to reduce pollutant loading must take all of these factors into account.

2006 TMDL for Nitrate, Cedar River (IDNR, 2006)

In 2006 IDNR completed a TMDL for the Cedar River, of which the Shell Rock River is a tributary. This TMDL was completed because the McCloud Run to Bear Creek segment of the Cedar River was impaired for Drinking Water Supply use due to nitrates. The Shell Rock Watershed was determined to contribute 37% of streamflow and 29% of Nitrate-N load to the Cedar River segment, making it the second largest contributing tributary to the Middle Cedar (only the Upper Cedar was higher). The lower contribution of nitrate load compared to discharge for the Shell Rock River was hypothesized to be the result of a dam upstream of gaging stations that could be attenuating some of the load from the watershed due to algal and plant uptake.

The vast majority (91%) of the nitrate load to the river was determined to be from nonpoint sources such as fertilizer, legume crops, and manure (Figure 47), with fertilizer and manure being the top two sources that could be addressed by voluntary BMPs. The TMDL determined that an overall reduction of at least 35% was needed to reduce nitrate levels in the segment to an appropriate level below the drinking water MCL (10 mg/L).



Source: DNR, 2006

Figure 47: Source of Nitrate Loading in the Cedar River Watershed

2012 USGS SPARROW Modeling

The United States Geological Survey (USGS) has developed the SPAtially Referenced Regression on Watershed attributes (SPARROW) water quality model (Robertson and others, 2019). SPARROW models streamflow, nitrogen, phosphorus, and suspended sediments across five regions in the United States, with Iowa falling into the Midwest Region. The nutrient and suspended sediment models have a base year of 2012, which means they were developed based on source inputs, management practices, and hydrologic conditions similar to those existing during or near 2012, which should be noted was a drought year for much of Iowa and may not represent typical conditions.

Care should be taken in interpreting the outputs from the SPARROW model. The model was developed to cover a very large area of the United States, was not developed to represent watershed specific characteristics of the Shell Rock River Watershed, and does not provide load estimates on a HUC 12 basis. Additionally, the specific loading numbers in the report are dated. However, given the lack of a water quality model for the watershed, it does help to provide a reasonable representation of water quality conditions in the watershed. Pollutant load estimates from the SPARROW model are provided in Table 20.

Additional information on the SPARROW model can be found here:

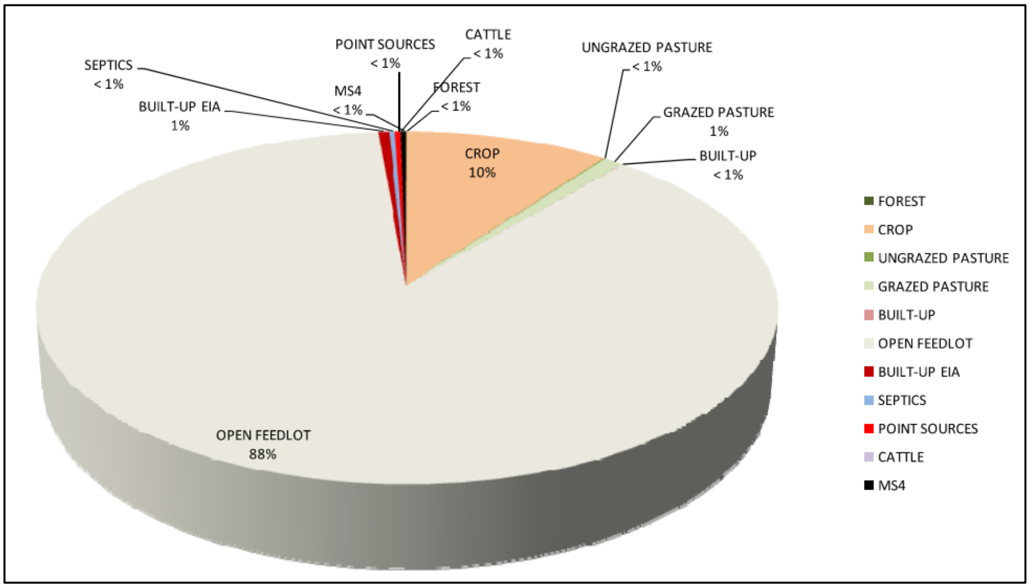
https://www.usgs.gov/mission-areas/water-resources/science/sparrow-modeling-estimating-nutrient-sediment-and-dissolved

BACTERIA LOADING

In 2010 a TMDL for the Cedar River Watershed was completed for nine stream segments that were impaired due to high levels of *E. coli* bacteria (EPA, 2010). Only one segment of the Shell Rock River was included – a 22-mile stretch of the river from the confluence with Rose Creek in Cerro Gordo County downstream to the confluence with the Winnebago River in Floyd County (stream segment 786). A water quality model was created to assist the development of the TMDL.

The watershed modeling package for the TMDL was the EPA's Hydrological Simulation Program-FORTRAN (HSPF). HSPF is a comprehensive, continuous, long-term, watershed model of hydrology and water quality across multiple water resource processes. HSPF is widely used in similar applications across the United States and was used in this TMDL to predict the hydrologic response, transport, and fate of bacteria originating from all watershed sources under existing and alternative management conditions.

Based on a review of the water quality sampling data, it was observed that the median *E. coli* concentration was 91 CFU/100ml, which is below the chronic water quality standard (126 CFU/100ml). However, 23% of samples exceeded the acute water quality standard (235 CFU/100ml) during the recreation season, thus triggering the impaired designation. Based on a load duration curve analysis, which compares pollutant loads to stream flows, it was observed that larger concentrations are measured during the summer and under high flow conditions, which indicates a large portion of the bacteria load originates from nonpoint pollution sources. Ultimately, the model predicted that runoff from open feedlots is the predominant source followed by runoff from manure application on cropland (Figure 48).



Source: EPA, 2010

Figure 48: Sources of E. coli Bacteria Loading

SEDIMENT LOADING

To fully account for sediment loads, data for both upland (in-field) erosion and stream erosion needs to be accounted for:

- No data was available for stream erosion estimates.
- Average erosion rates from upland sources for each HUC 12 were estimated using the Daily Erosion Project (DEP). Due to data limitations, DEP estimates include erosion from sheet and rill erosion, but not from gullies. The annual watershed sediment loss by year (2007-2022) from upland sources is displayed in *Figure 49*. A map by HUC 12 subwatershed is provided in Figure 42.

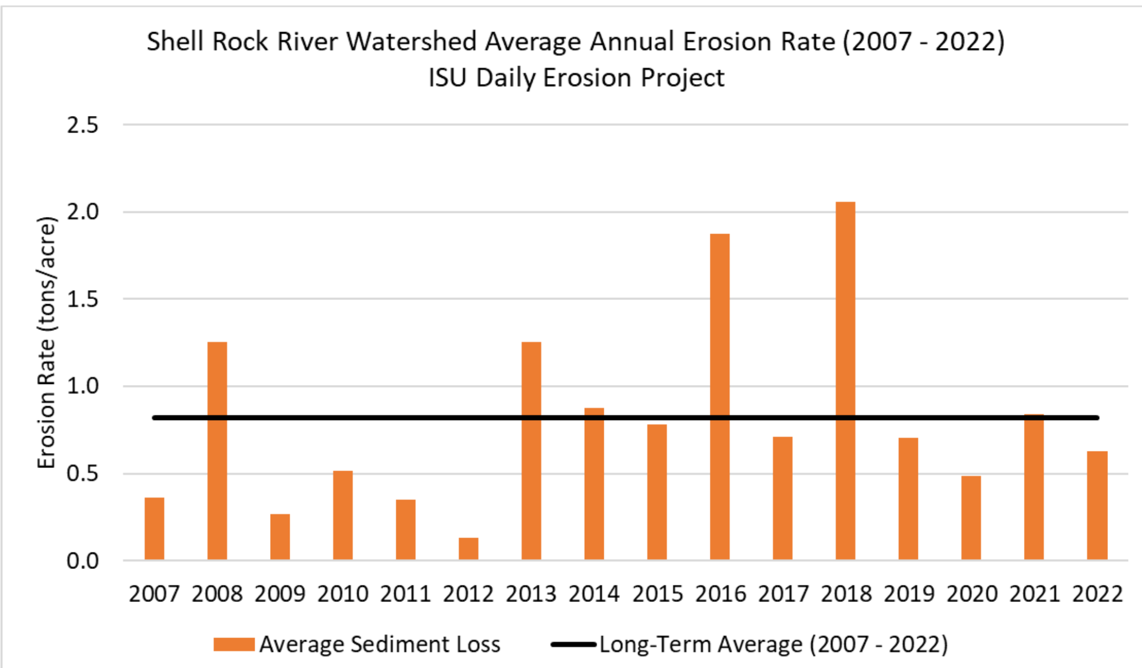


Figure 49: Average Annual Erosion Rate from Upland Sources

3.07 EXISTING BEST MANAGEMENT PRACTICES

Estimating existing BMPs and/or their treated areas is an important step in the planning process. This knowledge helps to prioritize installation of future BMPs and is necessary for calibration of water quality models. These estimates are also used to determine potential pollutant load reductions that additional treatment could have in the watershed.

This plan relies upon existing data sources and input from stakeholders to identify current BMPs. Unfortunately, no central listing or full inventory exists for this information. Multiple government agencies (NRCS, IDALS, etc.) work with farmers to install BMPs, however, that information is generally subject to privacy laws and unavailable. Additionally, many landowners implement BMPs on their own without government assistance. **Therefore, additional BMPs, not accounted for in this chapter, are likely to exist.** Suitability for future BMPs adoption and implementation is included in Chapter 5.

EDGE-OF-FIELD AND BELOW-FIELD BMPS

Figure 50 identifies the existing locations of in-field and below-field BMPs in the watershed, where GIS data was available. Table 21 details count of each of those BMPs.

The Iowa BMP Mapping Project, sponsored by ISU, provides a baseline set of existing BMPs spanning from 2007 to 2010. Existing BMPs are identified and digitized through aerial photography, hill-shade and slope grids, and other remote sensing products (ISU, 2023). ISU focused on identifying structural practices (edge-of-field) such as ponds, dams, terraces, water, and sediment control basins (WASCOBs), contour buffer strips, and grassed waterways. Personal correspondence with IDALS also aided in estimating other BMPs, such as wetlands, saturated buffers, and bioreactors. Generally, these include practices installed through the Iowa Water Quality Initiative (WQI) and Iowa Conservation Reserve Enhancement program (CREP).

Table 21: Estimated Edge-of-Field and Below-Field BMPs within the Watershed

BMP Type	Count
Contour Buffer Strips*	36 structures
Grassed Waterways*	3,215 acres
Ponds*	53 structures
Terraces*	924,117 feet
WASCOBs*	1,188 structures
Nutrient Reduction Wetland / CREP Wetland**	6 sites
Saturated Buffers**	0 sites
Bioreactors**	0 sites

**Source: ISU, 2023;*

***Source: written communication with Casey Judge, August 17, 2023*

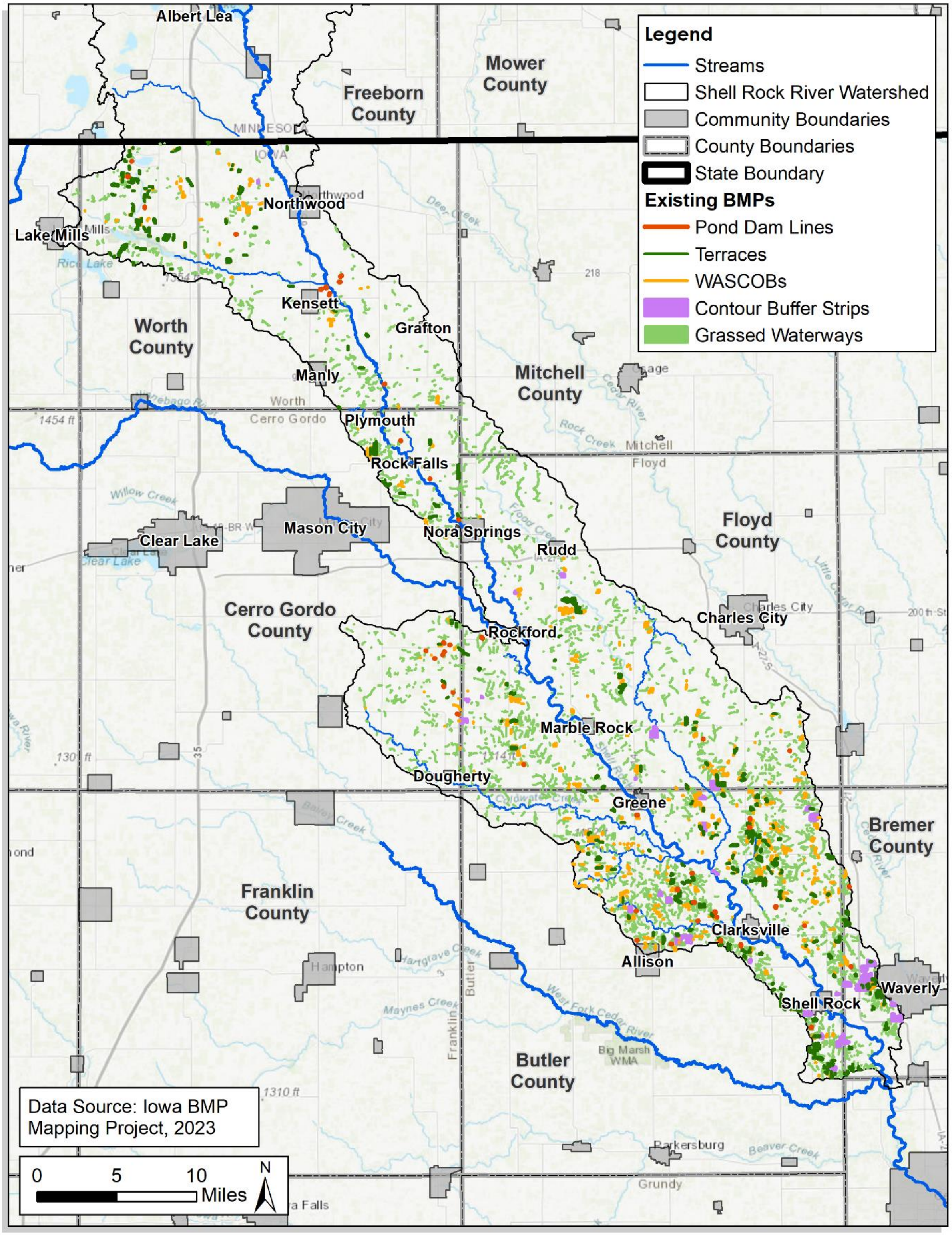


Figure 50: Map of Edge-of-Field and Below-Field BMPs in the Watershed

URBAN STORMWATER BMPS

No urban stormwater BMPs were identified through a review of available data or by watershed partners.

SOIL HEALTH AND IN-FIELD BMPS

Existing soil health and in-field BMPs are more difficult to identify as they cannot be easily identified in aerial photography and may not be permanent on a year-to-year basis. The adoption or implementation levels for these BMPs can vary year-to-year based on other farming practices. It is recommended that farmer surveys or an on-the-ground inventory of existing BMPs be performed to obtain this data prior to an implementation project or as part of future plan updates.

To gain a better understanding of adoption levels of non-structural BMPs data from the Operational Tillage Information Center (OpTIS), which is provided by the Conservation Technology Information System (CTIC), was reviewed (Table 22). According to OpTIS, from 2005 – 2021 the adoption of cover crops in the Shell Rock HUC 8 watershed was 0.71%, slightly higher than in the North-Central Iowa region as a whole, which had a rate of 0.50%. The watershed had higher adoption of conservation tillage (40.78%) compared to the adoption rate of the region (35.57%). Conservation tillage is broadly defined as a practice including strip-till, ridge-till, and mulch till systems and here is used to mean that 30% or more residue was left on fields. Based on information from the Daily Erosion Project, conservation tillage is most common in the southernmost portion of the watershed (Figure 51). When comparing the watershed to the region as a whole, it is important to note that the North-Central Iowa region had the lowest rates for both practices of any region in Iowa (CTIC, 2023).

Table 22: Soil Health BMP Adoption Rates (2005 – 2021)

Conservation Practice	Shell Rock HUC 8 Watershed Adoption Rate	North-Central Iowa Adoption Rate
Cover Crops	0.71%	0.50%
Conservation Tillage (>30% Residue)	40.78%	35.57%

Source: CTIC, 2023

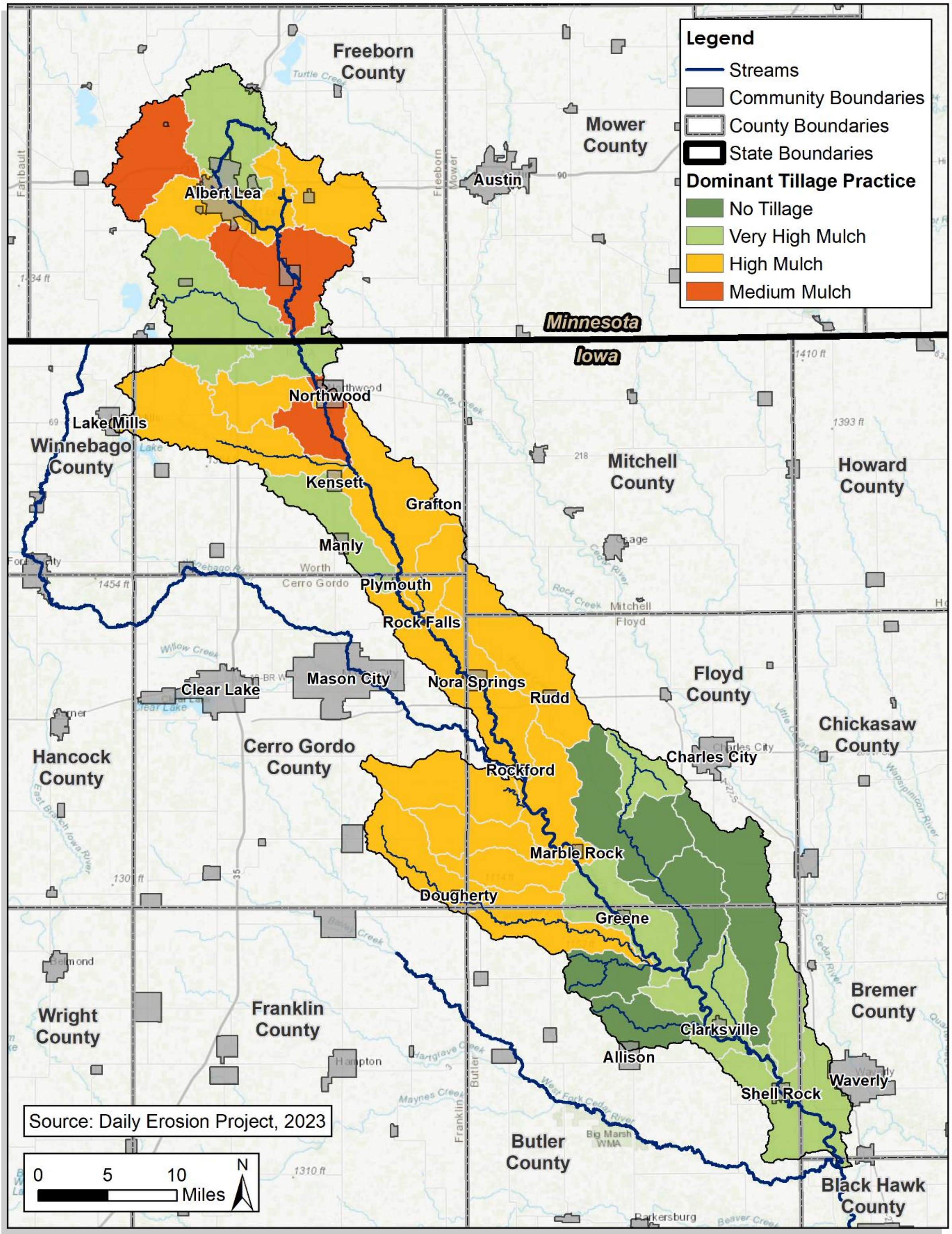


Figure 51: Dominant Tillage Practice by HUC 12

3.08 EXISTING ACPF MAPPING DATA

The Agricultural Conservation Planning Framework (ACPF) is a GIS-based toolbox that produces a standard set of outputs that can be used to better understand a watershed at the HUC 12 level. Geospatial outputs include the creation of a stream reach and catchments, suggested locations for BMPs, and other pertinent data about the watershed.

Only one HUC 12 in the watershed has undergone ACPF modeling, shown in Figure 52. It is recommended that ACPF mapping be completed for the remaining 23 HUC 12 subwatersheds. At a minimum, the ACPF tool should be utilized for any areas identified for BMP implementation. Considerations for updating existing ACPF coverage using the most recent version of the tool is also recommended.

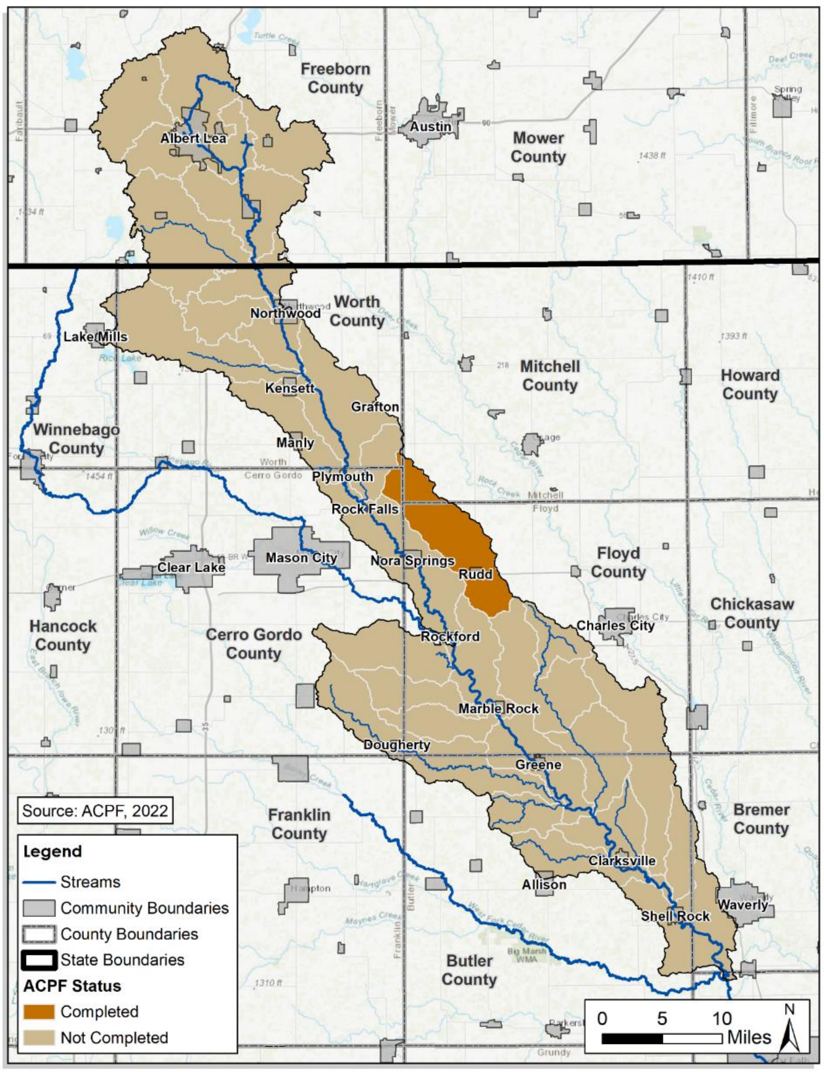


Figure 52: Status of ACPF Mapping in the Watershed

3.09 FLOOD RISK ASSESSMENT

To understand flooding risks across the watershed, a multi-level flood risk assessment was conducted. Stakeholder input was supplemented with existing data from hazard mitigation plans (HM)s), FEMA, social vulnerability as defined by the Center for Disease Control (CDC), and flood risk gradient mapping provided by the Iowa Flood Center's (IFC) Iowa Flood Information System (IFIS).

It should be noted flood hazard maps only account for riverine flooding, which occurs when an existing stream channel, whether it is a tributary or main river branch, overflows its banks. Therefore, localized flooding caused by inadequate drainage systems was not included in this assessment.

Cities with minimal flooding risk or limited historical occurrence of flooding were assigned a hazard assessment score of 1 (low risk). A more detailed review of mapping data, watershed features, and other issues that may predispose an area to flooding was completed for the remaining cities. This allowed each city to be assigned a score from 1 (low risk) to 5 (high risk), as displayed in Table 23 and Figure 53. Flood mitigation measures for each city are provided in Chapter 5.

Table 23: Flooding Hazard Assessment for Cities Within the Watershed

Five (5) (High Risk)	Four (4)	Three (3)	Two (2)	One (1) (Lowest Risk)
Greene	Nora Springs	Clarksville	Rock Falls	Allison
Rockford		Manly	Rudd	Dougherty
Shell Rock		Plymouth		Grafton
		Marble Rock		Kensett
				Northwood

It is recommended that cities, especially those most vulnerable, complete a more detailed flood risk assessment as a next step. A detailed flood risk assessment could be paired with a watershed hydrologic assessment. This would allow detailed hydraulic and hydrologic modeling scenarios to be developed and the ability to identify risks from multiple sizes or types of flooding events. The assessment should be completed with a model that has variable time step series, which allows one to visualize the source and direction that flood waters originate from, as well as the speed at which they can impact a community. This modeling is key to developing, evaluating, and prioritizing flood mitigation actions, especially at the watershed scale. The watershed-based approach allows local issues to be addressed, while also contributing positively to downstream flood mitigation effects. A final benefit is that the hydrologic assessment could be utilized by future water quality modeling efforts.

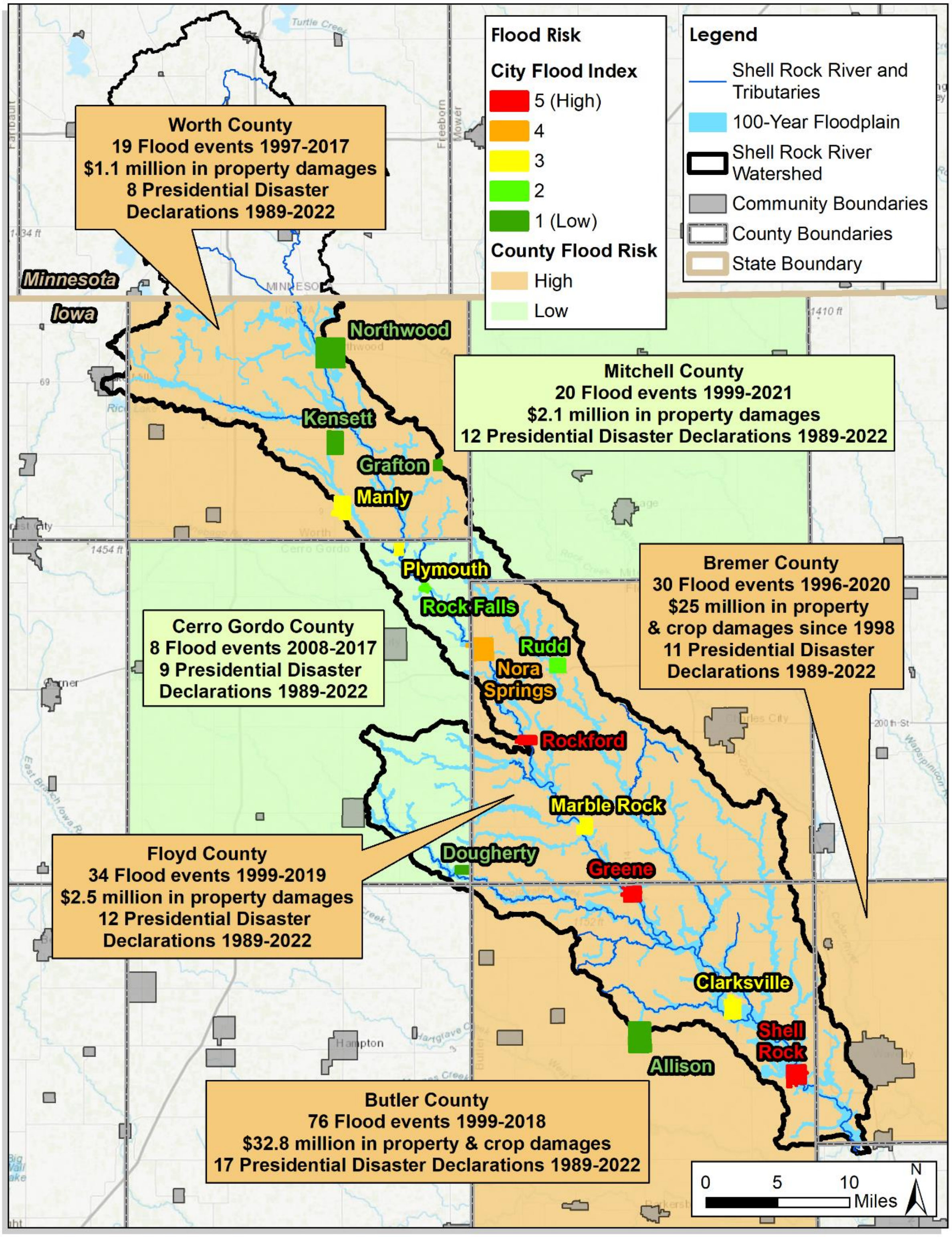


Figure 53: Watershed-Level Flood Risk Assessment

LOG JAM MANAGEMENT

Stakeholders identified log jams as a notable issue for waterway management between the cities of Marble Rock and Greene. Figure 54 shows the log congestion on a river island near Greene. Log jams have the potential to increase flooding or cause ice jams by preventing the usual flow of the river and can impact recreational use of the Shell Rock River.

Figure 54: Log Jam on the Shell Rock River near Greene, Iowa

3.10 SUMMARY AND RECOMMENDATIONS

While a rich supply of information has been reviewed and presented in this chapter, there are remaining questions and data gaps. The following is a summary of recommendations found within this chapter that should be considered for completion prior to or during future updates to this plan.

- **Additional pollutant source identification -** Locations of small open feedlots, which can be a significant source of pollutants, especially bacteria, are not known. These should be identified during future watershed plan updates through visual review of aerial photography or in-field watershed assessments. Concurrently, updated estimates and mapping of manure application areas should be completed. Pollutant loads should be estimated for each WWTF facility based on a review of their permitted discharge permit. This work could be completed with the development of a watershed model and will vastly improve the understanding of pollutant sources and loads in the watershed.
- **Complete stream assessments -** On-the-ground stream assessments should be completed across the watershed, or at least in priority subwatersheds. As part of these surveys, drainage tile infrastructure should be located and evaluated.
- **Survey producers on adoption levels of BMPs -** Existing non-structural BMPs (which include in-field and nutrient management BMPs) are difficult to identify through existing databases or review of aerial photography. It is recommended that producer surveys and/or an on-the-ground inventory of BMPs be performed prior to the update of this plan. This will enhance efforts for prioritizing BMP implementation efforts and in calibration of water quality models. This could be paired with a study to assess public perception, knowledge, behavior, and attitudes towards water quality.
- **Perform a detailed flood risk assessment for communities -** A more detailed flood risk assessment should be developed for the communities within the watershed that are most at risk to flooding. This could be performed as a standalone study, or during future updates to the county hazard mitigation plans. A detailed flood risk assessment could also be paired with a watershed hydrologic assessment. This would allow detailed hydraulic and hydrologic modeling scenarios to be developed and the ability to identify risks from multiple sizes or types of flooding events. The assessment should be completed with a model that has variable time step series, which allows one to visualize the source and direction that flood waters originate from, as well as the speed at which they can impact a community. This modeling is key to developing, evaluating, and prioritizing flood mitigation actions, especially at the watershed scale.
- **Develop a water quality model -** A water quality model was unavailable for use during the development of this plan. It is recommended that future planning or evaluation steps include the development of a water quality model. A water quality model allows quantitative estimates about existing pollutant loads to be made, as well as quantifies the effects of implementing various Best Management Practices (BMPs). It can function as a tool to evaluate management strategies, demonstrate incremental progress towards meeting water quality standards or goals, and evaluate future water quality data. Modeling

should be completed at the HUC 12 subwatershed level to assist with identifying pollutant "hot spots", and BMP targeting and evaluation efforts. Additionally, the pollutant loads should be broken down by source, not just a total aggregate load.

- **Perform a statistical analysis of water quality data -** A statistical analysis should be completed for the water quality pollutants of interest (nitrogen, phosphorus, TSS, and *E. coli*). Additionally, development of a load duration curve for bacteria will help understand if spikes in the bacteria level sampling data are during high flow events (likely driven by nonpoint sources) or during low flow events (indicating loading is coming from point sources). This work could be accomplished alongside or separately from the development of a water quality model.
- **Complete ACPF Mapping -** Only one HUC 12 in the watershed has undergone ACPF modeling. It is recommended that ACPF mapping be completed for the remaining 23 HUC 12 subwatersheds. At a minimum, the ACPF tool should be utilized for any areas identified for BMP implementation. Considerations for updating existing ACPF coverage using the most recent version of the tool is also recommended.

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CHAPTER 4. GOALS

4.01 INTRODUCTION

Watershed management plans at the HUC 8 level encompass a large geographic area and transcend traditional political boundaries, making the success of such plans dependent on wide ranging partnerships. As such, a community-based planning process was used to increase buy-in of potential partners and coalition members, who helped guide the development of the plan's goals and objectives. The goals identified within this plan are set within the boundaries of the SRRWMC Mission Statement, which is focused on the voluntary improvements to flooding, water quality, and recreation within the watershed.

ACHIEVING THE GOALS AND OBJECTIVES

To help guide the coalition towards the achievement of these goals and objectives, the watershed plan includes a **Long-term Implementation Strategy in Chapter 5**, and a **Short-term Action Plan in Chapter 7**. Because WMAs (including the SRRWMC) have no formal authority, the plan relies on the commitment and voluntary involvement partners. Therefore, education and outreach will be the cornerstone of most activities undertaken to implement this plan, thus there is an **Education Plan in Chapter 6.**

4.02 GOAL-SETTING PROCESS

The mission statement, goals, and objectives are found in Table 24. It is important to note that these reflect the needs and priorities of the watershed at the time of this plan's development. However, these needs and priorities may change over time as resources, policy, and science continues to change; thus, these goals and objectives should be reviewed and adjusted as needed, and at a minimum of every five years during plan updates in accordance with the EPA's nine elements (EPA, 2008).

STAKEHOLDER INPUT

The first step in the goal-setting process was the development of a mission statement for the coalition. A mission statement is a concise explanation of an organization's reason for existence and describes its purpose, intention and overall objectives. An initial draft version was developed and presented at the April 6, 2023 quarterly meeting. Upon review and discussion, no revisions were identified, and the coalition formally approved it at the July 6, 2023 quarterly meeting.

Concurrently, the coalition also worked to establish goals and objectives for the plan. While the mission statement helps to set the stage within which efforts to implement the watershed plan will be bounded, goal and objectives help to identify key outcomes that can be used to measure progress. Additionally, goals help to clearly communicate what the coalition hopes to achieve. Goals are written to be long-term outcomes of watershed plan implementation. Objectives define strategies or implementation steps to attain the identified goals and provide a way of measuring movement towards each goal. Additionally, many of the objectives identified here are also included in the Action Plan in Chapter 7, where additional supporting information and details are included to assist in implementation.

Draft goals were presented, discussed, and modified at the April 6, 2023 quarterly meeting. The updated draft goals were again presented at the July 6, 2023 quarterly meeting. At this meeting minor revision made prior to formal adoption.

WATER QUALITY BASELINES AND TARGETS

Goals and objectives are more likely to be achieved when they are written to be specific, measurable, and time-bound. This level of detail is particularly important to Goal #2, which is focused specifically on water quality. To develop this level of detail, the following attributes were developed for each:

- **Water quality baseline measurements** for are based on DNR stream sampling data for each pollutant from 1999-2022 monitoring data, taken at the Shell Rock, Iowa sampling site, as presented in Chapter 3. This baseline date was selected as it is long-term, consistent, and is anticipated to continue into the future. As the IFC dataset matures, and if more parameters are added, it would be beneficial for the coalition to complete additional water quality analysis in the future and consider updating these baseline estimates.
- **Pollutant reduction targets** for nitrogen and phosphorus are based on those set by the Iowa Nutrient Reduction Strategy, reduction targets for *E. coli* bacteria are based on state water quality criteria, and reduction targets for sediment/ total suspended solids (TSS) are based on partner input. Each of these are discussed in more detail in Chapter 2.
- **Target dates** for achieving these goals were set to be consistent with the Iowa Nutrient Reduction Strategy and/or the stakeholder identified 20-year window for plan completion.

These water quality baselines and targets are based on water quality data that is “representative” of the full Shell Rock River Watershed. However, as previously discussed, this sampling data also represents pollutant levels that are influenced by the Minnesota portion of the river and by the Winnebago River. Future updates to this plan should include additional detailed water quality analysis or modeling to help refine these goals or allow for incremental progress evaluation. This would also allow the objectives to be updated to be based on pollutant loads rather than pollutant concentrations.

Also, it should be noted that other tributaries likely differ in pollutant concentrations; therefore, individual goals, objectives, baselines, and reduction targets should be identified for each subwatershed as Best Management Practice (BMP) implementation projects are developed. Additional discussion on this level of planning is provided in Chapter 7.

Table 24: SRRWMC Mission Statement and Alignment of Planning Goals and Objectives

SRRWMC Mission Statement

To assess and reduce flooding risks; repair, improve, and enhance the quality, appearance and recreational use of the Shell Rock River Watershed by encouraging municipal, public and private support and participation through education, conservation practices, and volunteering.

Goal 1	**Flood resiliency will be improved at the individual, community, and watershed level to prevent loss of life, reduce property losses, and avoid damage to infrastructure.**
Objective 1.1	Complete a hydrologic study to better understand flood risks and evaluate specific mitigation actions by the end of 2027.
Objective 1.2	Integrate the watershed plan with each local county hazard mitigation plan (HMP) during the next review cycle of each HMP.
Goal 2	**Improve water quality to support all uses and ensure it meets state standards and goals.**
Objective 1.1	Reduce annual median nitrate levels by 41%, from 4.95 mg/L to 2.92 mg/L, by 2035, based on the Iowa Nutrient Reduction Strategy, through soil health, fertilizer, and drainage management practices.
Objective 1.2	Reduce annual median total phosphorus levels by 29%, from 0.17 mg/L to 0.12 mg/L, by 2035, based on the Iowa Nutrient Reduction Strategy, through erosion and manure management practices.
Objective 1.3	Maintain or reduce current annual levels of sediment loading* to streams by 10% from 28.0 mg/L to 25.2 mg/L, through reducing field and stream erosion. *Sediment loading rates currently measured by TSS sampling*
Objective 1.4	Reduce *E. coli* bacteria loads by 12% to ensure the seasonal geometric mean is maintained below 126 organisms/100mL, and to reduce the number of samples exceeding 235 organisms/100mL, through manure management practices.
Objective 1.5	By the end of 2024, expand water quality sampling throughout the watershed, by adding 3-5 sites at county lines and major tributaries.
Goal 3	**Utilize recreation on the river to enhance local communities and connect the public with the watershed.**
Objective 3.1	Complete a Water Trail Plan by the end of 2027.
Objective 3.2	Install signage about the watershed and related educational information at each river access point by 2028.
Objective 3.3	Install stream name signs at major road crossings for tributaries within the watershed by the end of 2024.

Objective 3.4 Hold an annual "Shell Rock River Rock Fest" or other similar river focused event, to bring awareness, beginning in 2025.

Goal 4 **Create an informed, educated, and passionate public that works towards improving watershed management.**

Objective 4.1 Expand the coalition membership to all eligible cities, counties, and SWCDs by the end of 2024, utilizing a strategy that shows how each community is affected by, or affects, the Shell Rock River.

Objective 4.2 By the end of 2025, develop materials and begin implementing a strategy to educate the public on water quality conditions and where that data can be accessed.

Objective 4.3 By the end of 2025, hold at least one outreach and education event in each county per year through partnerships with surrounding WMAs and other partners.

Objective 4.4 Form an education and outreach committee by the end of 2024. This committee will work with partners to implement the education plan and action items.

4.03 MONITORING INDICATORS FOR EACH GOAL

Several metrics (indicators) were identified for each goal. Indicators are what is measured, tracked, or monitored to determine whether progress is being made toward goals and objectives. Some have the capability to be measured nearly continuously, others at less frequent intervals; however, it will be important for the coalition to review these metrics on at least an annual basis. This will allow for an evaluation of the effectiveness of implementation efforts. Additional discussion on monitoring and plan evaluation can be found in Chapter 5.

Due to the long time frame it may take to achieve many of these goals, indicators which can be measured and assessed at different intervals (long, medium, and short-term) have been identified. Additional indicators may be identified as implementation and updates to this plan are carried out. It is important to recognize that different indicators are suitable to document different types of outcomes. For instance, water quality parameters may take many years to change, so in the interim, it may be useful to document social or administrative indicators as a surrogate for water quality changes that are slowly happening. Additional discussion on indicators related to education and outreach can be found in Chapter 6.

1. Goal 1 (Flooding)
   1.1. Track flood resiliency indicators, such as: public assistance claims, flood insurance enrollment and claims, properties in the regulatory floodplain, properties removed from the floodplain, and projects completed.
2. Goal 2 (Water Quality)
   2.1. Stream monitoring at Shell Rock Iowa, provided by DNR.

2.2. Estimates of hillslope (in-field) erosion, through visual assessments or the Daily Erosion Project.
2.3. Visual stream assessments results.

3. Goal 3 (Recreation)
    3.1. Track completion of projects.
    3.2. Complete an economic impact study on river based recreation and utilize data reporting from counties and cities.
4. Goal 4 (Education)
    4.1. Maintain a roster of membership and entities participating in meetings or projects.
    4.2. Utilize surveys that measure the knowledge and attitudes of target audiences.

4.04 SUMMARY AND RECOMMENDATIONS

The following is a summary of recommendations found within this chapter that should be considered for completion prior to or during future updates to this plan.

- **Develop a water quality model for the watershed -** This will allow for incremental monitoring of progress towards goals and BMP implementation to be better paired. This would also allow the objectives to be updated to be based on pollutant loads rather than pollutant concentrations.
- **Reevaluate water quality baselines -** It is recommended that the baselines utilized within the objectives be reevaluated in future updates to this plan as additional sampling data becomes available, and as additional analysis such as flow weighting, water quality modeling, etc. can be completed.

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CHAPTER 5. LONG-TERM IMPLEMENTATION STRATEGY

INTRODUCTION

This chapter presents a long-term roadmap (20 years) for how the SRRWMC, in partnership with federal, state, private, and nonprofit partners, will achieve the goals identified in Chapter 4. Project and practices to address flooding, water quality, and recreation are identified. For water quality practices, this also includes an estimate of financial and technical resources the WMC and partners will need. Due to the long-term schedule and large geographic extent of the watershed this strategy is broken down into multiple phases, and initial project areas are identified for consideration. A phased approach will allow interim progress to be measured and will require the plan to be updated at least every 5 years.

The long-term implementation strategy was developed from stakeholder input, technical analysis, and existing data available during the planning process. Previous chapters in this plan have laid the groundwork for understanding the resources, concerns, and threats within the watershed. This chapter provides guidance on “what is to be done” in the watershed. Chapter 6 provides an education plan, the use of which should accompany any implementation effort. Chapter 7 lays out an action plan for the first 5-year phase, including the potential water quality BMP project areas.

WILL THIS PLAN WORK?

While this plan is ambitious, many of the strategies presented have been successfully implemented through other watershed efforts across Iowa. Using a mixture of BMPs, it has been shown that goals can be met without sacrificing the agricultural backbone of the watershed. However, to achieve these results, it will take the following:

- Education and buy-in from farmers and cities
- Grants and other funds
- Long-term commitment from Coalition members

5.01 OVERARCHING STRATEGIES

Implementation, at both the watershed and field-level scales will be accomplished through both existing partner programs and newly identified projects. Existing programs provide landowners, farmers, and communities access to technical and financial assistance. However, to see measurable results, partners will need to work together to focus projects and actions identified in this plan. The following strategies have been identified to guide these activities:

1. **Voluntary Partnerships –** Completing projects and increasing adoption of BMPs will only by expanded partnerships and through the voluntary involvement of farmers, cities, and other partners.
2. **Compatible with Agriculture –** Agriculture is the primary economic engine and land use within the watershed. Therefore, implementation should work with this existing system and minimize land taken out of production.
3. **Education Based -** an integrated outreach and education approach will be used to help the public and partners understand watershed challenges and implement BMPs.
4. **Flood Resiliency –** A watershed approach to reduce flood impacts will benefit the entire watershed and considers a variety of techniques.
5. **Sustainable Communities** - Encourage the development and adoption of local policies that reduce urban runoff and protect the floodplain within communities.
6. **Whole Farm Conservation for Improved Water Quality –** Each farmer and landowner has unique goals and production constraints; therefore, conservation decisions are also personal. A full menu of practices will be considered including land use changes, soil health practices, and BMPs located in-field, at the edge-of-field, below fields, and within the riparian area of each farm.
7. **Integrated Recreation –** Both existing and new recreational amenities can be utilized to improve the public’s connection with the river, watershed impacts, and build support for improvements.
8. **Data Driven –** Understanding both problems and opportunities; and prioritizing efforts will be buffered by an expanded network of stream monitoring sites and ongoing public input.

5.02 FLOOD RESILIENCY PROJECTS

THE CONCEPT OF FLOOD RESILIENCY

Flood resiliency is a community's ability to "bounce back" (recover) from flooding. To do this, flooding must be reduced at both watershed and community levels, which involves multiple partners working together to implement land management policies and mitigation projects. An additional benefit of flood resiliency practices is that many of them lead to improved water quality and recreation can often be integrated.

In Figure 55, the blue bars on the far left indicate the initial, high, unmitigated risk a community faces and the low amount of resiliency (green bars) they may have. Taking strategic actions, as indicated in each bar, incrementally reduces the flood risk. Some of these actions are taken at the federal, state, and local city/county levels, whereas others are taken by the homeowners and businesses at risk. The remaining risk after all actions have been taken is the residual risk (blue bar on the far right); however, resiliency is very high at this point. This approach leads to improved safety, reduced damages, and an improved ability to recover from natural disasters. Individually each strategy may only contribute a limited amount of risk reduction; however, when the efforts are combined, a dramatic reduction in risk is achieved.

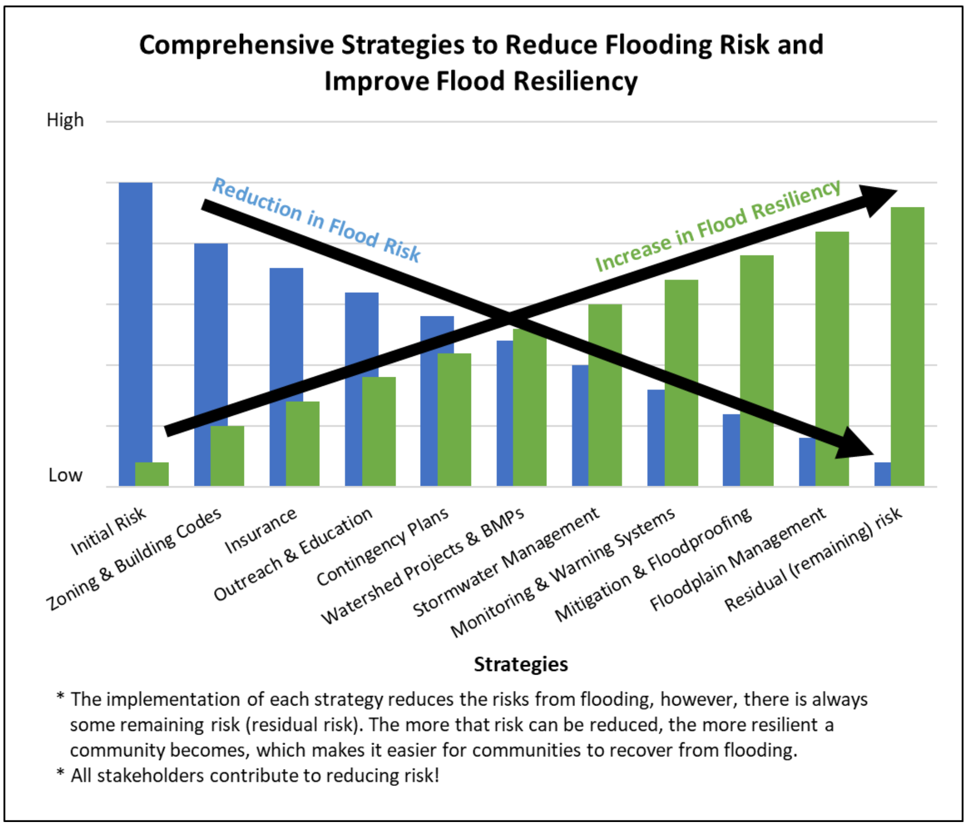


Figure 55: Illustration of How Reducing Flood Risks Leads to Increased Flood Resiliency

INTEGRATION WITH LOCAL HAZARD MITIGATION PLANS

Strategies and projects related to flood resiliency were identified through a review of local county hazard mitigation plans (HMP) and are summarized in Table 25. In addition to completing those projects, the following actions should also be completed, either as stand-alone projects, or during future updates to the county hazard mitigation plans:

- **HMP Amendment or Integration** - It is recommended to further integrate the SRRWMC Watershed Plan with each county's local HMP by recognizing or amending this plan into each HMP.
- **Flood Resiliency Inventory -** Existing indicators of flood resiliency can be tracked. As these indicators change over time, they help to showcase progress and identify areas in need of additional resources. These include but are not limited to public assistance claims; flood insurance enrollment and claims; properties in the regulatory floodplain; and properties removed from the floodplain. This can help establish a baseline across the watershed that can then be compared to changes over time. This could also be paired with a flood loss avoidance study.
- **Flood Loss Avoidance Study -** This identifies and quantifies the losses or damages avoided due to the implementation of a flood mitigation measure. The ability to assess the economic performance of mitigation projects is important to evaluate and justify public investments, encourage additional funding, and continue local support of mitigation projects and activities.

Table 25: Flood Mitigation Actions Identified in Local Hazard Mitigation Plans

Mitigation Action	Jurisdiction
Construct, retrofit, or maintain water supply, drainage, sewage, retention, and detention systems to provide for the proper functioning of those systems	Unincorporated Worth County, Grafton, Kensett, Manly, Northwood, Dougherty, Mitchell County, Floyd County
Acquire flood prone properties for conversion into green space; or elevate structures in or above base flood elevation; construction of levees, dams, and culverts to ensure adequate capacity and protection levels for property and critical facilities	Unincorporated Worth County, Grafton, Kensett, Northwood, Butler County, Bremer County, Mitchell County, Floyd County, Rockford, Nora Springs, Marble Rock, Rudd
NFIP participation	Unincorporated Worth County, Manly, Northwood, Butler County, Bremer County, Mitchell County, Floyd County, Nora Springs,

	Rockford, Marble Rock, Rudd
Infrastructure study and improvements	Unincorporated Worth County, Butler County, Bremer County, Mitchell County
Develop/update/publicize emergency management plans, including preparedness, response, recovery, operations, long term recovery, and mitigation plans and maintain data inventory.	Cerro Gordo County, Dougherty, Plymouth, Rock Falls
Replace or retrofit bridges and culverts to meet capacity requirements.	Plymouth, Bremer County
Develop and promote comprehensive cost-effective recommendation for adoption and enforcement of land use, ordinances and regulations, promote legislation, zoning, and building codes that regulate construction, and decrease risk in areas susceptible to hazards.	Cerro Gordo County, Mitchell County, Floyd County, Nora Springs, Rockford, Marble Rock, Rudd
Develop and maintain staging area for dumping during cleanup	Bremer County
Participate in and cooperate with other jurisdictions in improving watersheds, including Watershed Management Authorities and Drainage Districts	Bremer County
Mitigate erosion along waterways and ditches through vegetation management	Bremer County
Clear ditches, streams, and waterways on a regular basis	Bremer County
Purchase additional parkland in order to increase green space and reduce surface flow	Bremer County
Update flood maps/flood studies for areas throughout the county	Bremer County
Maintain, enforce and update floodplain ordinance	Bremer County
Maintain and keep storm drains clear of debris	Bremer County
Use computer software to map areas that are at risk of flooding	Mitchell County
Asking residents to help keep storm drains clear of debris (not rely solely on public works)	Mitchell County
Address flooding and land use in updated Comprehensive Development Plan	Mitchell County
Flood-proofing of historical and/or non-residential structures	Floyd County, Nora Springs, Rockford, Marble Rock, Rudd
Minor localized flood reduction projects (storm water management or other localized flood control projects)	Floyd County, Nora Springs, Rockford, Marble Rock, Rudd
Soil erosion stabilization	Floyd County, Nora Springs, Rockford, Marble Rock, Rudd

COMMUNITY FLOOD RISK EVALUATION

A high-level assessment flood risk for each city was completed, and the results are presented in Chapter 3. Based on this assessment and discussion with coalition members, potential mitigation projects for each city were identified (Table 26). Please note that these needs are preliminary and should be more throughout evaluated with a watershed hydrologic assessment prior to any implementation. Additional information on each type of flood mitigation strategy is available in these resources:

- **Iowa Watershed Approach -** Multiple BMP informational sheets were developed by Iowa State University Extension. Available at: https://iowawatershedapproach.org/
- **Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards** (FEMA, 2013) – This publication identifies potential mitigation actions for reducing risk to all types of natural hazards, including flooding. The actions are summarized into four types: 1) local planning and regulation, 2) structures and infrastructure projects, 3) natural systems protection, and 4) education and awareness programs.

Table 26: Flood Risk Assessment Mitigation Needs

City	Flood Risk Index (5=High, 1=Low)	Potential Flood Mitigation Projects (to be confirmed with further study)
Greene	5	Non-structural*, Urban stormwater systems upgrades, Channel or bridge improvements, Upstream detention (dams, cells, wetlands, etc.) on tributaries.
Rockford	5	Non-structural*
Shell Rock	5	Non-Structural*, Diversion channel, Levee/berms, Channel or bridge improvements
Nora Springs	4	Non-Structural*, Dam assessment and Emergency Action Plan (EAP) exercises.
Marble Rock	3	Non-Structural*, Urban stormwater system upgrades.
Clarksville	3	Non-Structural*, Diversion channel, Levee/berm improvements, Urban stormwater system upgrades.
Manly	3	Non-Structural* Urban stormwater system upgrades
Plymouth	3	Non-Structural*
Rock Falls	2	Non-Structural*
Rudd	2	
Northwood	1	Floodplain management, public education, and coordination with the SRRWMC.
Allison	1	
Dougherty	1	
Grafton	1	
Kensett	1	

**Non-structural measures include, but are not limited to, elevating structures, relocating structures, filling basements, wet or dry floodproofing, and flood warning systems*.

5.03 WATER QUALITY IMPROVEMENTS

TOOLBOX OF PRACTICES

Water quality improvements identified in this plan relies on the voluntary adoption and use of **Best Management Practices (BMPs), which are defined as a broad set of conservation practices that help to conserve soil and water resources.** These BMPs have been previously identified and discussed in detail by many other sources. The following resources provide background and technical information on the "toolbox" of BMPs included as part of this plan.

- **Iowa Nutrient Reduction (NRS) -** The NRS has identified multiple BMPs to reduce nutrients. Available at: http://www.nutrientstrategy.iastate.edu/
- **Clean Water Iowa -** Clean Water Iowa provides information on BMPs applicable to rural (agricultural), urban, and industrial areas. Available at: https://www.cleanwateriowa.org/
- **ACPF Toolbox Manual –** The ACPF Toolbox can be used to site various structural BMPs according to NRCS practice standards. Available at: https://acpf4watersheds.org/
- **Iowa Stormwater Education Partnership (ISWEP) -** ISWEP has developed multiple information sheets for urban stormwater BMPs. Available at: https://iowastormwater.org/
- **Prairie STRIPS –** A strategic planting of native-tall grass prairie within farm fields that is more versatile and offers more benefits than traditional contoured buffer strips. More information at: https://www.nrem.iastate.edu/research/STRIPS/
- **Oxbow Restoration Toolkit -** Provides step-by-step guidance and cross-agency standards to restore oxbow wetlands. Available at: https://www.nature.org/en-us/about-us/where-we-work/united-states/iowa/stories-in-iowa/what-is-an-oxbow/
- **BMPs for Livestock, Manure, and Animal Facilities (multiple guides)**
  - *Small Open Beef Feedlots in Iowa – A Producer Guide:* https://store.extension.iastate.edu/product/13744
  - *Small Open Lot Dairies in Iowa – A Producers Guide:* https://store.extension.iastate.edu/product/13760
  - *BMPs for Open Feedlots – Solutions for Operators:* https://store.extension.iastate.edu/product/5538
  - *Iowa Manure Management Action Group:* https://www.extension.iastate.edu/immag/
- **Iowa DNR River Restoration Toolbox -** A series of proven BMPs for stream stabilization and restoration in with emphasis on incorporating natural materials. Available at: https://www.iowadnr.gov/environmental-protection/water-quality/river-restoration
- **Low-Tech Process Based Restoration of Riverscapes Design Manual -** Provides guidelines for implementing post-assisted log structures and beaver dam analogues for stream restoration. Available at: http://lowtechpbr.restoration.usu.edu/manual/.

THE CONSERVATION PYRAMID

The conservation pyramid concept (Figure 56), recognizes that to be effective, water quality projects within agricultural watersheds must be taken through a systematic approach of a suite of BMPs. The foundation of the conservation pyramid relies on using BMPs to protect and improve soil health at the field level to improve erosion control, improve water infiltration and retention, increase soil organic matter, and improve nutrient cycling. Structural practices to control and treat runoff should then be targeted to specific in-field, edge-of-field, and riparian locations where maximum water quality benefits can be realized. Examples of BMPs that address soil health and control, or trap, pollutants are provided in the pyramid. However, there are many other actions that should be considered during implementation.

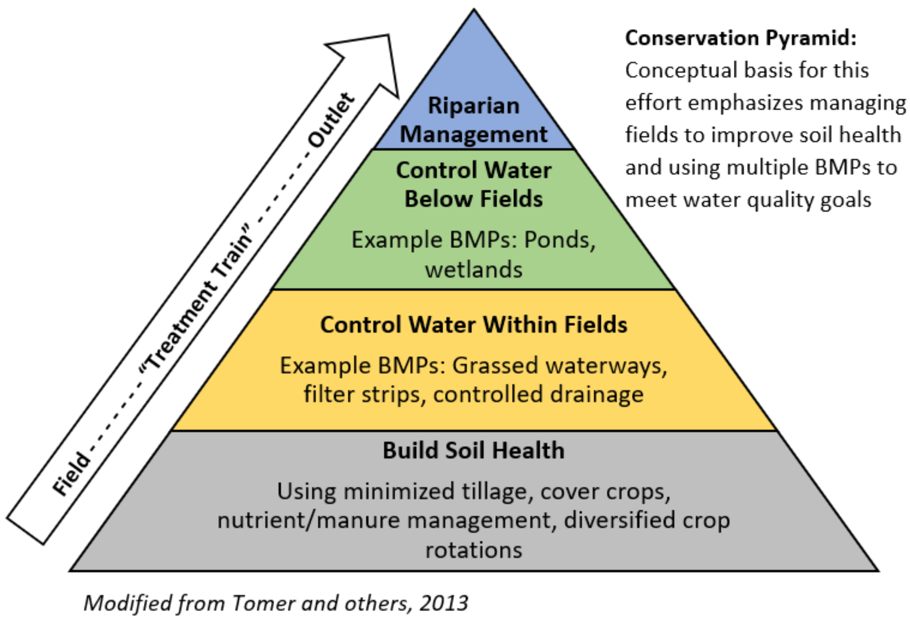
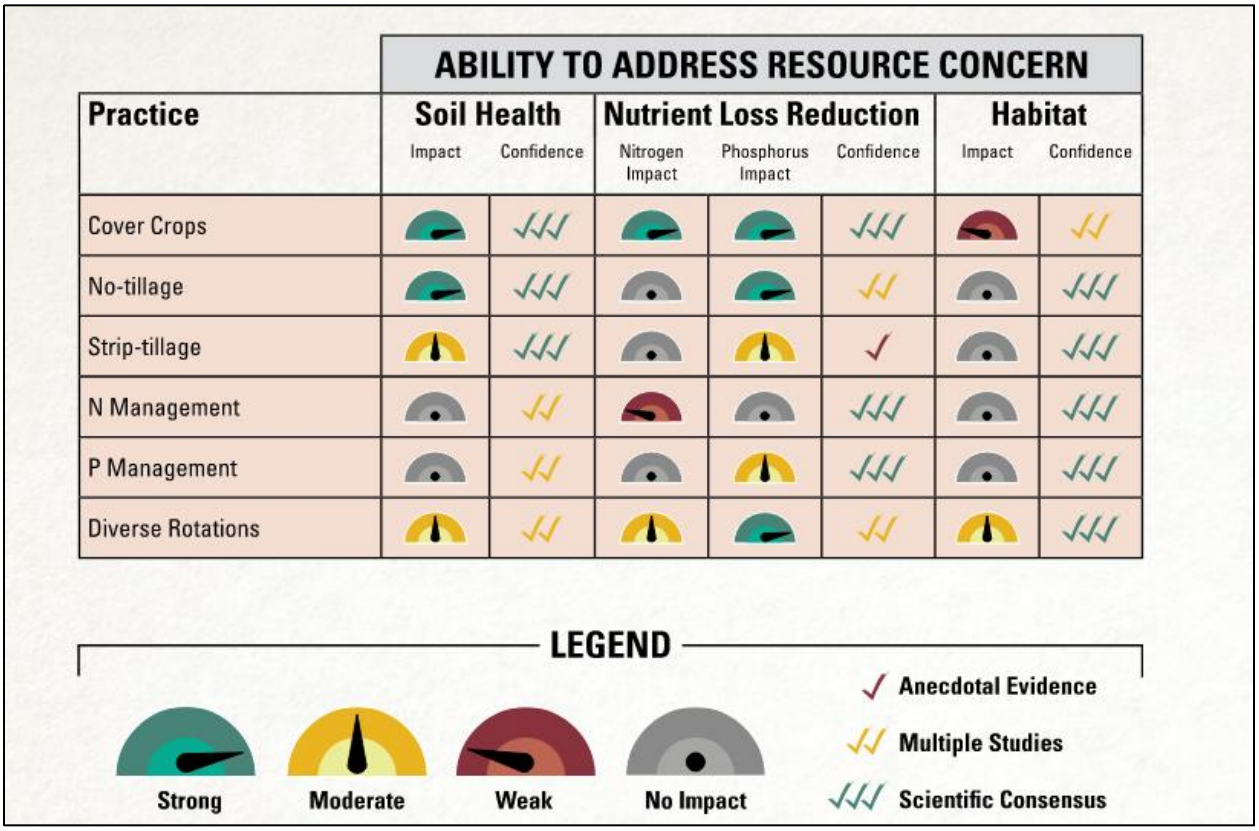


Figure 56: The Conservation Pyramid Provides a Framework for BMP Implementation

The conservation pyramid approach means that BMPs are ideally implemented in a series or a "treatment train" with each other throughout the watershed, so their effects are multiplied as implementation is scaled up. This leads to multiple practices on each farm within the watershed as implementation advances. This approach requires that a full suite of BMPs be made available for implementation, so that the correct practice can be selected based on individual site characteristics and landowner or farmer preferences.

LAND USE AND IN-FIELD BMPS

Figure 57 is an excerpt from the *Whole Farm Conservation Best Practices Manual, 2nd Edition* (ISU, 2022) and features an overview of BMPs that are based on in-field nutrient management practices, soil health concepts, and land use/cropping changes. These practices can be very effective at preventing or reducing nutrient and sediment losses before they occur and in building soil health. Drawbacks are that the practices can easily be discontinued, as they generally rely upon a change in a farmer's management style. However, this relative ease of operations change also means that the practices can be adopted at a larger scale or faster pace than structural practices that require engineering or construction. Additionally, these practices require little, if any, land to be taken out of production.

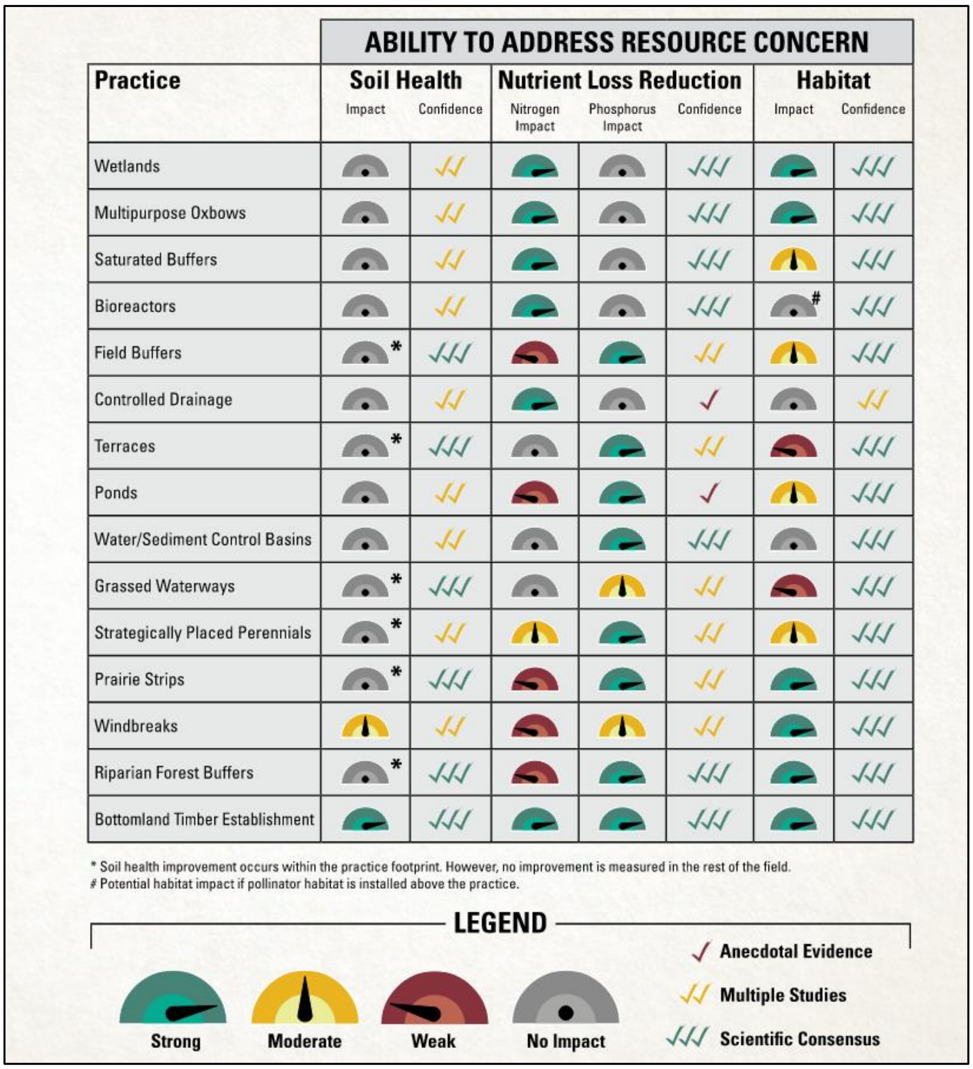


Source: (ISU, 2022)

Figure 57: Priority Land Use and In-Field BMPs for Agricultural Areas

EDGE-OF-FIELD AND BELOW-FIELD BMPS

Figure 58 is an excerpt from the *Whole Farm Conservation Best Practices Manual, 2nd Edition* (ISU, 2022) and features an overview of BMPs suitable for placement below, or at the edge-of-fields. These practices can be very effective at trapping nutrients and sediments before they enter waterways, however their benefits to soil health are generally limited. Drawbacks are that many of them require some land to be taken out of crop production, although it is generally land that requires more inputs or is less productive, and they require a higher upfront investment due to the engineering or construction requirements. A positive feature of these practices is that most have a long lifespan or are harder to discontinue and therefore will reliably provide benefits over a long period of time. Another benefit is that they require less active management from landowners than nonstructural BMPs (although they are not maintenance free).



Source: ISU, 2022

Figure 58: Priority Edge-of-Field BMPs for Agricultural Areas

RIPARIAN MANAGEMENT BMPS

Riparian management is often one of the most overlooked opportunities for adoption or installation of BMPs. Management of the riparian zone is often the last opportunity to reduce erosion, filter sediment, and trap nutrients before they enter downstream waterbodies – they are the last line of defense in water quality management. Additionally, due to the highly modified land use and hydrologic regime of the watershed, establishment of riparian buffers and BMPs is necessary to ensure that habitat exists for both terrestrial and aquatic ecosystems. Buffers and stream stabilization can also provide flood mitigation benefits.

Riparian BMPs can be applied to both urban and agricultural settings and are generally categorized as riparian buffers and stream stabilization (Figure 59), but there are various types of approaches or designs to each practice. Other BMPs can also be integrated with these BMPs, such as: bioreactors, saturated buffers, grade stabilization, channel stabilization, and floodplain restoration.

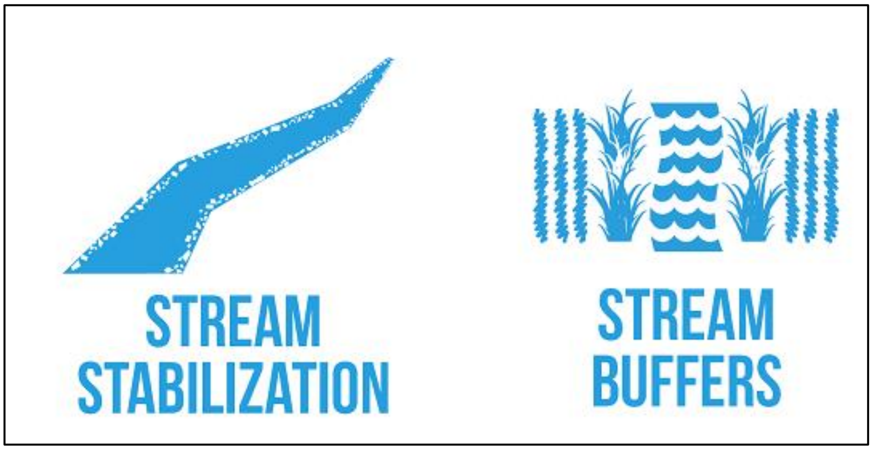


Image Credit: Clean Water Iowa, 2021

Figure 59: Priority Riparian Management BMPs

Many factors influence buffer performance including buffer width, vegetation type and age, and depth to the water table. Citing of these practices is oftentimes proceeded by the completion of a stream assessment. Additional guidance on the placement, selection, or design of individual practices can be found in the following resources:

- ACPF Toolbox
- Low-Tech Process Based Restoration of Riverscapes Design Manual
- Iowa DNR River Restoration Toolbox

LIVESTOCK, MANURE, AND ANIMAL FACILITY BMPS

While the NRS identifies the best BMPs to reduce nitrogen and phosphorus runoff from agricultural lands, it does not fully address livestock, manure, and animal facilities (especially grazing lands and small open feedlots). These can be some of the largest sources of *E. coli* bacteria runoff, which has impaired the water quality of several stream segments within the watershed. Priority BMPs for these sources are identified in Figure 60.

Figure 60: Priority BMPs for Livestock, Manure, and Animal Facilities

URBAN STORMWATER MANAGEMENT

Residential and urban landscapes generate runoff with almost every rainfall event. Conservation measures capture and infiltrate stormwater and reduce a property's contribution to water quality degradation, flashy stream flows, and flooding. The practices identified in Figure 61 are among the best practices for preventing runoff and promoting infiltration within urbanized areas. Communities can implement these conservation practices through installing new systems and retrofitting existing infrastructure.

It should be noted that that urban BMP practices presented in this plan are meant to be voluntary for communities, and not to replace any regulatory programs, such as those identified through NPDES, MS4, or other local requirements.

Image Credit: Clean Water Iowa, 2021

Figure 61: Priority Urban Stormwater BMPs

POLLUTANT TREATEMENT EFFECTIVENESS

It is important to understand the effectiveness that BMPs have in reducing pollutant loads, often referred to as treatment efficiency. The suitability and performance of BMPs can vary significantly based on site conditions, therefore detailed feasibility, design, and analysis may be needed prior to implementing a BMP.

Treatment efficiencies for nitrogen and phosphorus were identified in the Iowa Nutrient Reduction Strategy and summarized in the ISU Extension publication titled *Reducing Nutrient Loss: Science Shows What Works* (Summary sheet SP435A) (Lawrence and Benning, 2019). Excerpts from this are provided in Figure 62 and Figure 63. The full resource can be downloaded here: https://store.extension.iastate.edu/product/13960

Treatment efficiencies for *E. coli* were identified through an analysis of scientific peer reviewed literature and are summarized in Table 27. A representative efficiency was selected for display in the table.

Table 27: Summary of BMP Treatment Efficiencies for *E. coli* bacteria

Best Management Practice (BMP)	Estimated Treatment Efficiency for *E. coli*
Watershed Education and Information	10%
Onsite Wastewater Treatment System (OWTS) Upgrade	Failure rate from 40% to 5%
Pet Waste Pick-up	20%
Non-structural & Avoidance BMPs	10%
Drainage Water Management	0%
Grazing Lands Management BMPs*	40%
Cover Crops	40%
Riparian Buffers	70%
No-Till Farming	0%
Contour Buffer Strips (Prairie STRIPS, etc.)	70%
Small Open Feedlot BMPs	75%
Wetlands/Farm Ponds/Sediment Basins	78%
Bioreactors	70%
Stream Restoration / Stabilization	35%
Terraces	70%
Water and Sediment Control Basins (WASCOBs)	70%
Grassed Waterways	70%
Land Use Change & Perennial Vegetation	Dependent upon land use type
Urban Stormwater BMPs	37%

**This includes multiple practices such as rotational grazing, fencing, etc.*

Iowa Strategy to Reduce Nutrient Loss: Nitrogen Practices

This table lists practices with the largest potential impact on nitrate-N concentration reduction (except where noted). Corn yield impacts associated with each practice also are shown as some practices may be detrimental to corn production. If using a combination of practices, the reductions are not additive. Reductions are field level results that may be expected where practice is applicable and implemented.

	Practice	Comments	% Nitrate-N Reduction*	% Corn Yield Change**
			Average (SD†)	Average (SD†)
Nitrogen Management‡	Timing	Moving from fall to spring pre-plant application	6 (25)	4 (16)
		Spring pre-plant/sidedress 40-60 split Compared to fall-applied	5 (28)	10 (7)
		Sidedress – Compared to pre-plant application	7 (37)	0 (3)
		Sidedress – Soil test based compared to pre-plant	4 (20)	13 (22)††
	Source	Liquid swine manure compared to spring-applied fertilizer	4 (11)	0 (13)
		Poultry manure compared to spring-applied fertilizer	-3 (20)	-2 (14)
	Nitrogen Application Rate	Nitrogen rate at the MRTN (0.10 N:corn price ratio) compared to current estimated application rate. (ISU Corn Nitrogen Rate Calculator – **http://cnrc.agron.iastate.edu** can be used to estimate MRTN but this would change Nitrate-N concentration reduction)	10	-1
	Nitrification Inhibitor	Nitrapyrin in fall – Compared to fall-applied without Nitrapyrin	9 (19)	6 (22)
	Cover Crops	Rye	31 (29)	-6 (7)
		Oat	28 (2)	-5 (1)
	Living Mulches	e.g. Kura clover – Nitrate-N reduction from one site	41 (16)	-9 (32)
Land Use	Perennial	Energy Crops – Compared to spring-applied fertilizer	72 (23)	
		Land Retirement (CRP) – Compared to spring-applied fertilizer	85 (9)	
	Extended Rotations	At least 2 years of alfalfa in a 4 or 5 year rotation	42 (12)	7 (7)
	Grazed Pastures	No pertinent information from Iowa – assume similar to CRP	85	
Edge-of-Field	Drainage Water Mgmt.	No impact on concentration	33 (32)	
	Shallow Drainage	No impact on concentration	32 (15)	
	Wetlands	Targeted water quality	52	
	Bioreactors		43 (21)	
	Buffers	Only for water that interacts with the active zone below the buffer. This would only be a fraction of all water that makes it to a stream.	91 (20)	
	Saturated Buffers	Divert fraction of tile drainage into riparian buffer to remove Nitrate-N by denitrification.	50 (13)	
	Multi-purpose Oxbow	Targeted water quality	42 (6)	

* A positive number is nitrate concentration or load reduction and a negative number is an increase.

** A positive corn yield change is increased yield and a negative number is decreased yield. Practices are not expected to affect soybean yield.

† SD = standard deviation. Large SD relative to the average indicates highly variable results.

†† This increase in crop yield should be viewed with caution as the sidedress treatment from one of the main studies had 95 pounds-N/acre for the pre-plant treatment but 110 pounds-N/acre to 200 pounds-N/acre for the sidedress with soil test treatment so the corn yield impact may be due to nitrogen application rate differences.

Source: *Reducing Nutrient Loss: Science Shows What Works (Lawrence and Benning, 2019)*

Figure 62: Summary of BMP Treatment Efficiencies for Nitrogen

‡ See Standard Practices (blue box) on page 2 of this publication.

Iowa Strategy to Reduce Nutrient Loss: Phosphorus Practices

Practices below have the largest potential impact on phosphorus load reduction. Corn yield impacts associated with each practice also are shown, since some practices may increase or decrease corn production. If using a combination of practices, the reductions are not additive. Reductions are field level results that may be expected where practice is applicable and implemented.

	Practice	Comments	% P Load Reduction[a]	% Corn Yield Change[b]
			Average (SD[c])	Average (SD[c])
Phosphorus Management‡	Phosphorus Application	Applying P based on crop removal – Assuming optimal STP level and P incorporation	0.6[d]	0
		Soil-Test P – No P applied until STP drops to optimum or, when manure is applied, to levels indicated by the P Index[f]	17[e]	0
	Source of Phosphorus	Liquid swine, dairy, and poultry manure compared to commercial fertilizer – Runoff shortly after application‡	46 (45)	-1 (13)
		Beef manure compared to commercial fertilizer – Runoff shortly after application‡	46 (96)	
	Placement of Phosphorus	Broadcast incorporated within 1 week compared to no incorporation, same tillage	36 (27)	0
		With seed or knifed bands compared to surface application, no incorporation	24 (46)	0
	Cover Crops	Winter rye	29 (37)	-6 (7)
	Tillage	Conservation till – chisel plowing compared to moldboard plowing	33 (49)	0 (6)
		No till compared to chisel plowing	90 (17)	-6 (8)
Land Use Change	Perennial Vegetation	Energy Crops	34 (34)	
		Land Retirement (CRP)	75	
		Grazed pastures	59 (42)	
Erosion Control and Edge-of-Field	Terraces		77 (19)	
	Buffers		58 (32)	
	Control	Sedimentation basins or ponds	85	
	Blind Inlet	Sediment control	50	

[a] A positive number is P load reduction and a negative number is increased P load.
[b] A positive corn yield change is increased yield and a negative number is decreased yield. Practices are not expected to affect soybean yield.
[c] SD = standard deviation. Large SD relative to the average indicates highly variable results.
[d] Maximum and average estimated by comparing application of 200 and 125 kilogram P_2O_5/hectare, respectively, to 58 kilogram P_2O_5/hectare (corn-soybean rotation requirements) (Mallarino et al., 2002).
[e] Maximum and average estimates based on reducing the average STP (Bray-1) of the two highest counties in Iowa and the statewide average STP (Mallarino et al., 2011a), respectively, to an optimum level of 20 ppm (Mallarino et al., 2002). Minimum value assumes soil is at the optimum level.
[f] ISU Extension and Outreach publication (PM 1688).
‡ See Standard Practices (blue box) on page 2 of this publication.

Source: *Reducing Nutrient Loss: Science Shows What Works (Lawrence and Benning, 2019)*

Figure 63: Summary of BMP Treatment Efficiencies for Phosphorus

WATER QUALITY PROJECT AREAS

This plan covers a large geographical area and addresses many interrelated issues. To facilitate and focus BMP implementation efforts in a way that will lead to measurable results, initial project areas are based on HUC 12 subwatersheds. The identification and selection process of these areas utilized water quality data and input from stakeholders. After a lengthy review and selection process, the WMC's final selection consisted of 7 subwatersheds, identified in Table 28 and shown in Figure 64.

Table 28: Potential Subwatersheds for BMP Implementation

Name	HUC	Acres
Drainage Ditch Number Two	70802020201	12,650
Elk Creek	70802020202	36,464
City of Northwood – Shell Rock River	70802020203	12,441
Headwaters Coldwater Creek	70802020401	19,572
Headwaters Flood Creek	70802020501	34,021
Beaver Creek	70802020502	10,260
Dry Creek	70802020701	13,250
Total		**138,658**

These areas were identified due to a combination of coalition input, overlapping conservation priorities, flood risks, and water quality data. Coalition input was focused on starting projects in the headwaters of streams to ensure benefits would be seen across the watershed, and with the idea of working "from the outside in". These areas represent approximately 26% of the Iowa portion of the watershed, or 20% of the entire watershed.

Following adoption of this plan, SRRWMC and/or its partners will need to select an area to pursue BMP implementation efforts. This will consist of obtaining funding that will be used for BMP cost-share for landowners or farmers, education and outreach efforts, and other supporting activities. **Cost estimates and additional information on starting a project is presented in Chapter 7.**

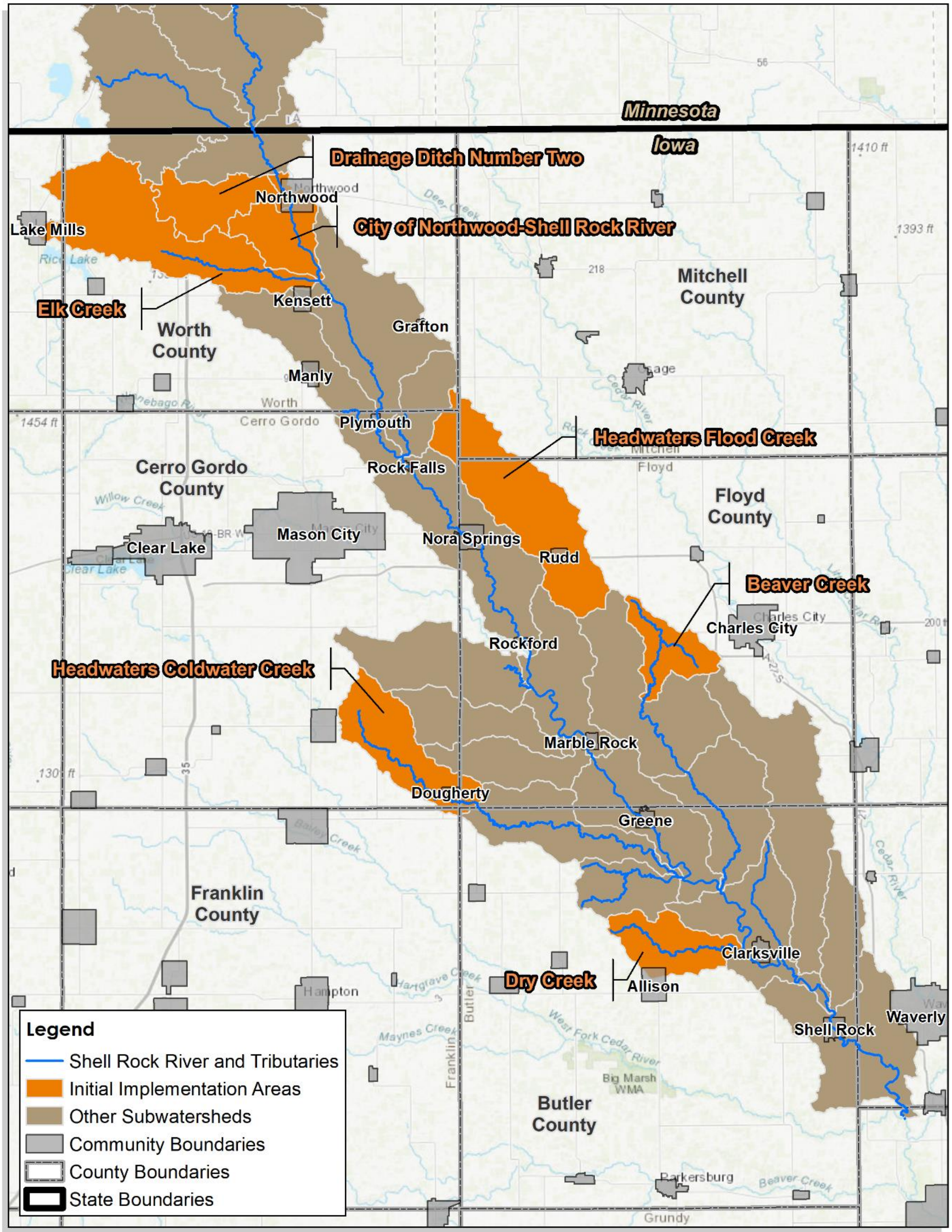


Figure 64: Initial Subwatersheds for BMP Implementation

TARGETING BMPS WITHIN A PROJECT AREA

Within each subwatershed, BMPs should be targeted to areas where they can do the most good. The appropriate time to complete additional prioritization is during planning for future implementation projects. This should take place at the farm or field scale. Development and use of ACPF data is recommended for this. The following four primary strategies have been identified and are discussed below:

- Critical Source Areas
- Cost Effectiveness
- Batch and Build
- Whole Watershed Approach

Critical Source Areas

Critical Source Areas (CSAs) are areas that make up a relatively small fraction of a watershed but generate a disproportionate amount of the pollutant load (Meals and others, 2012). CSAs occur where a pollutant source in the landscape coincides with an active hydrologic transport mechanism such as a waterway or groundwater recharge area (Figure 65). Identifying CSAs can help prioritize areas most in need of BMPs and improves cost-effectivness.

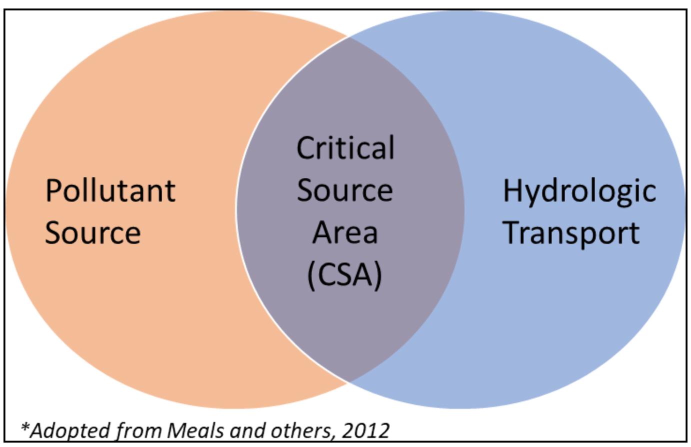


Figure 65: Illustration of the Concept of Critical Source Areas (CSA)

ACPF can be used to find CSAs in two ways: 1) Critical Zones, which are riparian areas most likely to convey disproportionally high amounts of runoff into streams, and 2) the Field Runoff Risk Assessment, which ranks agricultural fields according to potential for pollutant delivery. The field runoff risk assessment in ACPF provides a relative risk rating based on two factors:

- Slope steepness – Steeper fields have a higher risk of generating runoff.
- Distance to stream – The closer a field is to a waterbody, the greater the risk a pollutant will be delivered to that waterbody.

Once the assessment is complete, in ACPF version 4.0, each field receives a relative classification: A (very high risk), B (high), C (moderate), or D (low). In older versions of ACPF the rankings are slightly different. Fields classified as A and B are typically considered critical source areas and should be prioritized for implementation efforts.

Cost Effectiveness

The ACPF Financial and Nutrient Reduction Tool (ACPF FiNRT) is a recently developed ACPF-compatible tool that provides information about estimated costs and nitrate reduction outcomes from ACPF-generated BMP scenarios.

This tool provides context for broader watershed analysis regarding farmer and landowner preferences, trade-offs, ecosystem services beyond water quality, and available technical and financial support. Information about potential outcomes from various BMP scenarios is provided at multiple scales: BMP, field, and watershed.

The tool uses financial and expected field-scale nitrate loss to estimate the total long-term costs and cost effectiveness of BMP implementation using the following inputs:

- Costs of BMPs are calculated long-term to include both installation and maintenance
- Opportunity costs of removing land from row-crop production for BMP installation
- Based on BMP placement, nitrate reduction efficiencies for each BMP are applied to estimate nitrate reduction at multiple scales.

The outputs from the tool include:

- Area treated by BMPs
- Nitrate load and load reduction potential from BMPs
- Nitrate load reduction at field and watershed levels
- Total costs (direct costs + opportunity costs)
- Cost efficiency (cost per lbs. of N reduced per individual conservation practice and scenario).

At the time this plan was developed, the ACPF FiNRT tool was released in beta version for Iowa. As implementation of the plan proceeds, or during future plan updates, it is recommended that the ACPF FiNRT tool be utilized to further refine implementation strategies and prioritize BMPs in a way that will be most effective.

Batch and Build

In recent years, Iowa has pioneered the use of a “batch and build” approach to implementing priority BMPs (Figure 66). This model modernizes the project management process by allowing all paperwork, including site planning, contractor hiring, government approvals and project funding, to be coordinated through a single entity acting as a fiscal agent. This allows enhanced oversight and incentivizes contractors by installing batches of BMPs on multiple farms at once, leading to faster adoption of BMPs This efficient and cost-effective model generally focuses on edge-of-field BMPs such as saturated buffers and bioreactors.

For the Shell Rock Watershed, the subwatersheds identified in the Worth County area (Elk Creek, Drainage Ditch Number Two, and City of Northwood-Shell Rock River), would make a great candidate for this approach.

Image Credit: Clean Water Iowa

Figure 66: Batch and Build Implementation Model

Whole Watershed Approach

This is an approach where the entire project area is opened to BMP implementation. This approach can make sense after a project has focused on smaller targeted areas for a few years and is “running” out of those locations to implement BMPs.

Another way to utilize this approach is to just select a limited number of high priority BMP types and target key pollutant sources. **For the Shell Rock River Watershed, this approach could be applied to small open feedlots across the full watershed and/or to limited manure management and grazing livestock practices.**

BMP TARGET LEVELS

Target levels for BMP implementation were developed to aid the WMC and partners in estimating technical and financial resources needed to implement this plan. These targets have been identified for select BMPs only – those most likely to be the focus of implementation efforts and those most likely to be adopted. Targets were estimated from partner input, average ACPF sited practice outputs for neighboring watersheds (where ACPF data existed), and thorough a review of existing BMP levels. The rationale, or reason behind how the target level for each BMP was identified is summarized in Table 29. Cost estimates for implementation are found in later sections of this chapter.

Table 29: BMP Target Level Rationales

BMP	Target Level Rationale
Bioreactors	Estimated based on ACPF outputs for neighboring watersheds
Conservation Tillage	Currently estimated that 41% of cropland already utilizes this BMP. Target level is set at achieving 100% adoption rate.
Cover Crops	Currently estimated that 0.7% of cropland already utilizes this BMP. Target level is set at achieving 100% adoption rate.
Drainage Water Management	Estimated based on ACPF outputs for neighboring watersheds
Grassed Waterways	Estimated based on ACPF outputs for neighboring watersheds
Nutrient Management	Assumed 50% of watershed utilizes some form of this BMP. Target level is set at achieving 100% adoption rate.
Nutrient Reduction Wetland / CREP Wetland /Ponds	Estimated based on ACPF outputs for neighboring watersheds
Oxbow Restoration	No target level set. Additional study needed.
Livestock and AFO Practices	No target level set. Additional study needed.
Prairie STRIPs / Contour Buffer Strips	Estimated based on ACPF outputs for neighboring watersheds
Row Crop Conversion to Perennial Cover / Wildlife Habitat	Target level is set at doubling the existing acres, based on the 2015 Iowa Wildlife Action Plan.
Saturated Buffer	Estimated based on ACPF outputs for neighboring watersheds
Riparian Buffers	Estimated based on ACPF outputs for neighboring watersheds
Urban BMPs	No communities are known to have completed projects. Target level is set completing at least one project in each community within the watershed.

It should be noted that some of these potential BMPs identified may overlap with existing BMPs (due to data limitations), and thus, the targets provided should be considered an estimate only. As implementation begins, a detailed review of LiDAR, aerial photography, and in-field surveys should be completed to further estimate BMP needs. This review should be completed prior to landowner consultation for BMP siting.

COSTS

The full-scale implementation of water quality BMPs is expected to be a costly endeavor. Cost opinions presented here are based upon the BMP targets levels, but other practices may also be considered. Cost opinions are provided at the most conservative levels (most expensive) to avoid underestimating the necessary funding levels. However, it is likely that costs will rise over time, and these estimates may no longer be valid. It should also be noted that some of these costs may overlap, or some projects may not be necessary, depending upon other projects that are built; therefore, these cost estimates should be updated at a minimum of every five years when the plan is updated.

Cost opinions were calculated based on literature reviews, professional experience, and information provided by stakeholders. Cost opinions include anticipated staff time, design costs, materials cost, and implementation costs, where necessary. Due to the broad scope and long implementation time frame of this plan, actual costs may vary widely. This may be due to, but not limited to, the following factors: inflation, site specific conditions for BMPs, varying methodologies for BMP implementation, changes to the plan based on monitoring results, or other unforeseen changes to operational costs.

Please note that the direct and indirect costs of any BMP can vary from site to site and are contingent on initial conditions, hydrology, soils, cropping system, practice design, management characteristics, and highly variable opportunity costs (such as removing acres from crop production). The costs presented here are simply baseline numbers and are meant to be informative rather than prescriptive. Detailed cost estimates should be prepared for each implementation project prior to starting.

Table 30 provides a cost opinion for full scale BMP implementation across the watershed. Chapter 7 provides cost opinions for BMPs implementation within the project areas. It is not expected that this will be accomplished in the short-term, however, it does provide the order of magnitude that full scale BMP implementation will cost. Not included are costs for monitoring, plan maintenance/updates, or other evaluations/studies that have been recommended in the plan. Individual cost estimates should be prepared for those efforts based upon the scope desired by the SRRWMC, and at the time services are needed.

These cost opinions should be used for general planning purposes only, as cost opinions and budgeting techniques can vary widely based on the type of project being planned. In addition, the reader should keep in mind that cost opinions are representative of the total cost of implementation, which may be shared among various stakeholders and landowners through financial assistance and other funding strategies. Information on partners and technical and financial tools to help implement this plan is discussed in Chapter 8.

Table 30: Estimated BMPs Needed and Cost Opinions for BMP Implementation across the Entire Watershed

BMP Practice	Target Number for Cost Estimate	Unit for Cost Estimate	Unit Cost	Total Cost
Bioreactors	1,886	Site	$10,150	$19,142,900
Conservation Tillage	244,673	Acres	$30	$7,340,197
Cover Crops	410,226	Acres	$44	$18,049,959
Drainage Water Management	82,509	Acres	$88	$7,260,792
Grassed Waterway	2,469	Acres	$5,277	$13,028,867
Nutrient Management	206,580	Acres	$75	$15,493,492
Nutrient Reduction / CREP Wetlands	466	Site	$25,055	$11,675,630
Oxbow Restoration	*	Site	$7,500	*
Livestock and AFO Practices	*	*	*	*
Prairie STRIPs / Contour Buffer Strips	1,571	Acres	$298	$468,158
Row Crop Conversion to Perennial Cover / Wildlife Habitat	87,855	Acres	$330	$28,992,150
Saturated Buffer	573	Acres	$360	$206,280
Riparian Buffer**	9,980	Acres	$308	$3,073,840
Urban BMPs	15	Community	$275,000	$4,125,000
Total				**$128,857,265**

**Study needed to determine site locations and/or practice types*
***Includes vegetative buffer only, not locations where engineering measures are needed to stabilize the streambank or channel*

SCHEDULE AND MILESTONES

Schedule

The schedule for BMP implementation is based on a phased approach. The plan is required to be updated every five years; therefore, each phase will be in increments of five years. Table 31 provides a watershed-wide summary of major activities expected to be achieved during the first 5-year phase of this plan. Activities are subject to approval by the SRRWMC, or other project sponsors, and may change as the plan is implemented. This schedule will be updated at a minimum of every five years when the plan is updated. It should be noted that not listing a major activity on this schedule does not preclude it from being executed by the SRRWMC or one of its partners. Additional information for action items can be found in the Action Plan in Chapter 7.

The total schedule length is based on a 20-year timeframe; however, it is possible that the level of BMPs needed across the watershed will take much longer to implement. Phase I activities will include the initiation of watershed BMPs, and each following phase will include a plan revision and will build upon implementation achieved to date. A summary of progress achieved during each will be included in future plan revisions. Guidance and resources on yearly evaluation of progress, and evaluation of BMP effectiveness can be found later in this chapter.

Milestones

It is unlikely that measurable water quality improvements will be realized at the watershed level over the short-term. To evaluate short-term successes other measurable milestones should be used. Milestones are checkpoints or special events that mark developments during or at the end of projects. In this way, they can be used to gauge progress towards meeting the project schedule and goals. BMP implementation is a relatively simple, but effective way, to gauge success towards water quality goals. Table 32 identifies milestones to be met during each five-year phase of implementation.

The BMP targets used to develop these milestones were estimated from partner input, ACPF mapping data from neighboring watersheds, and through a review of existing BMP levels (discussed in Chapter 3). It is assumed that achieving these BMP targets will take place through a phased and prioritized approach across each subwatershed. Due to the scale of estimates, existing BMP levels were removed (accounted for) in reaching the total target levels.

Milestones should be reviewed on a yearly basis and adjusted accordingly for changes to the schedule during 5-year updates.

Table 31: Schedule for Watershed BMP Implementation

Major Activity	Phase 1					Phases 2 - 4
	2024	2025	2026	2027	2028	2029-2043
Plan approval and adoption	X					
Water Quality Monitoring (ongoing)						
Select Subwatershed for BMP Implementation	X					
Apply for BMP project funding	X	X				
Implement BMPs using cost-share & education plan						
Project evaluation and report (varies by funding source)					X	
Full evaluation and update of watershed plan					X	
Continue implementation as identified						X
Annual or Ongoing Administrative Activities						
BMP implementation tracking	X	X	X	X	X	X
Quarterly WMC meetings	X	X	X	X	X	X
Hold annual review meeting and distribute report	X	X	X	X	X	X

Table 32: Phased Milestones for BMP Implementation Across the Watershed

BMP	Existing Level	Unit	New BMPs to be Implemented					
			Phase 1: 2024 – 2028	Phase 2: 2029 – 2033	Phase 3: 2034 – 2038	Phase 4: 2039 – 2043	Total New BMPs to Implement	Watershed Target (Existing + New)
Bioreactors*	-	Sites	472	472	472	472	1,886	1,886
Conservation Tillage	168,487	Acres	103,290	103,290	103,290	103,290	244,673	413,160
Cover Crops	2,933	Acres	103,290	103,290	103,290	103,290	410,226	413,160
Drainage Water Management*	-	Acres	20,627	20,627	20,627	20,627	82,509	82,509
Grassed Waterways	7,016,738	Feet	3,098,550	3,098,550	3,098,550	3,098,550	5,377,463	12,394,201
Nutrient Management*	206,580	Acres	103,290	103,290	103,290	103,290	206,580	413,160
Nutrient Reduction Wetlands / CREP Wetlands / Ponds	59	Sites	131	131	131	131	466	525
Oxbow Restoration*	-	Sites	**	**	**	**	**	**
Livestock and AFO Practices*	-	*	**	**	**	**	**	**
Prairie STRIPs / Contour Buffer Strips	36	Sites	1,655	1,655	1,655	1,655	6,582	6,618
Row Crop Conversion to Perennial Cover / Wildlife Habitat	87,855	Acres	43,927	43,927	43,927	43,927	87,855	175,710
Saturated Buffer*	-	Sites	603	603	603	603	2,411	2,411
Riparian Buffer***	-	Acres	2,495	2,495	2,495	2,495	9,980	9,980
Urban BMPs	-	Communities	3	4	4	4	15	15

**No known existing sites (or data unavailable) for these BMPs*

***Study needed to determine possible site locations and/or practice types*

****Includes vegetative buffer only, not locations where engineering measures are needed to stabilize the streambank or channel*

POLLUTANT LOAD REDUCTIONS

Multiple BMPs, strategies, and projects have been recommended within this plan. To help understand the benefits any of these could have on water quality, it is recommended they are evaluated using a watershed or water quality model. As previously discussed, a model was not available during the preparation of this plan. However, a review of existing studies, which utilized a water quality model and evaluated BMPs, can be used to better understand the effectivness of the implementation plan outlined in this watershed plan. The following studies were reviewed, and are discussed further below:

- 2006 TMDL for Nitrate, Cedar River Watershed (IDNR, 2006)
- 2010 TMDL for E. Coli, Cedar River Watershed (IDNR, 2010)

During future plan updates a watershed model should be developed to estimate benefits at a minimum of the subwatershed (HUC 12) scale. Ideally, benefits of individual structures or BMPs could also be included, however, that could be difficult due to the scale and complexity of data required.

Until a water quality model is developed, the IDNR Pollutant Reduction Calculator (PRC) should be used during implementation projects. The PRC is a web-based tool developed to determine sediment, phosphorus, and nitrogen delivery reductions from BMP implementation in watersheds smaller than 250 acres (IDNR, 2004). The PRC may also be a useful tool when planning BMP implementation on a landowner or parcel basis.

The PRC can be accessed here: https://programs.iowadnr.gov/tmdl/PollutantCalculator.

Nitrate Load Reductions

In 2006 IDNR completed a TMDL for the Cedar River, which identified the Shell Rock River as the second largest contributor of nitrate to the Middle Cedar. Additional background information is provided in Chapter 3. A brief implementation strategy was also included, which recommended the following: urban stormwater BMPs, nutrient management, conservation tillage, crop rotation, CRP, and wetlands.

The study identified that decreases in nitrate concentration were significantly correlated with increasing CRP and wetland land use, which suggests that even slight increases in BMP adoption has a significant impact on nitrate concentrations in the stream. The study suggests that for the greatest benefit, BMPs should be installed at locations with the greatest ability to influence both nitrate and water flow. For the Shell Rock River, locations in the western portions of the watershed, where historical drainage and tiling is most significant, were identified.

E. coli Bacteria Load Reductions

In 2010 IDNR completed a TMDL for the Cedar River, which also included a segment of the Shell Rock River impaired due to *E. coli* bacteria. Additional background information is provided in

Chapter 3. A supplemental implementation plan was included in the TMDL to assist with planning purposes. The plan evaluated the conditions of all perennial streams and the feasibility of BMPs to achieve water quality standards. Several BMP scenarios were evaluated: BMPs at small open feedlots, manure management on cropland, OWTS (septic system) upgrades, and reducing cattle contact with streams (exclusion fencing, alternative water sources, etc.). Implementation of BMPs at small open feedlots appeared to be the most cost effective (pollutant load reduced per dollar spent). The study provided the following summary:

> *It is clear from the model predictions that the TMDLs [water quality standards] established in this document are feasible and water-quality conditions throughout the watershed can come into compliance through technically feasible BMPs. Additional cost-benefit analysis and review of the model results will allow the development of a more focused and phased implementation plan.* (IDNR, 2010)

5.04 RECREATION PROJECT OPPORTUNITIES

Identification of potential recreation projects and needs was completed through community input and assessment of existing recreation planning documents. A key part of this input includes worksheets filled out by cities, counties, and SWCDs within the watershed. The following project opportunities have been identified and should be considered for further study or implementation by SRRWMC members:

- Improved access at existing recreation areas (including Walnut Bend WMA)
- Improved amenities (parking, restrooms, dump stations, etc.) at existing facilities
- Additional access points for canoe/kayak launches and for fishing
- Development of a lake in Butler County
- White water park on the Shell Rock River (could also include dam removal)
- Better information on water level conditions within the Shell Rock River, and how they affect boat access
- Additional wetlands for hunting
- Debris management (log jams) along the river, where it impacts access and use
- Rental options for kayaks, tubes, or other equipment
- Community campgrounds
- Additional places for riding horses and ATVs
- Comprehensive map or brochure that highlights recreation amenities within the watershed (this could be completed with a water trail plan)

Designating the Shell Rock River as a Water Trail was a key recommendation identified. The coalition, led by CCBs and cities, should work together to obtain funding from the Iowa DNR to complete a water trail plan. This process involves landowner and public engagement and would comprehensively evaluate needs along the river such as: access, signage, and obstacles (Figure 67). Designation could offer significant economic benefits to the area. It should be noted that the portion of the Shell Rock River located in Minnesota is already designated as a water trail.

5.05 EVALUATING IMPLEMENTATION PROGRESS

EVALUATION MODEL

Ultimately, implementation of this plan will produce improvements in water quality and improved flood resiliency. However, there are significant challenges in measuring these changes across a large watershed over the short-term. Statistically significant trends in water data can take decades to become apparent or to be properly validated due to variability in weather or climate, watershed land use changes, and legacy pollutant sources.

However, other indicators of change can be used in the short-term to help track implementation progress. The SRRWMC will utilize the Iowa Nutrient Reduction Strategy's (NRS) logic model to quantify, track, and evaluate implementation efforts. While the original NRS Logic Model is focused solely on water quality, flood resiliency concepts have been incorporated for use in this plan (Figure 68). Using the NRS logic model provides the WMC access to a standardized state-wide reporting system and process.

The measurable indicators that correspond to each category, as outlined in Figure 68, provide specific parameters in which to track annual changes and persistent trends. These factors are used to develop a standardized protocol for evaluating progress. Monitoring indicators are identified for each goal within Chapter 4. There are four categories to the NRS Logic Model:

- **Inputs** - measured as funding, staff, and resources; affect changes in Human category.
- **Human** - measured as outreach efforts and shifts in attitudes and behaviors; affects changes in Land category.
- **Land** - measured as land use changes and adoption of BMPs or other projects; ongoing implementation of these over time leads to measurable, long-term changes in the Water category.
- **Water** - indicators include changes in water quality or flood risk reduction - measured through both monitoring and modeling.

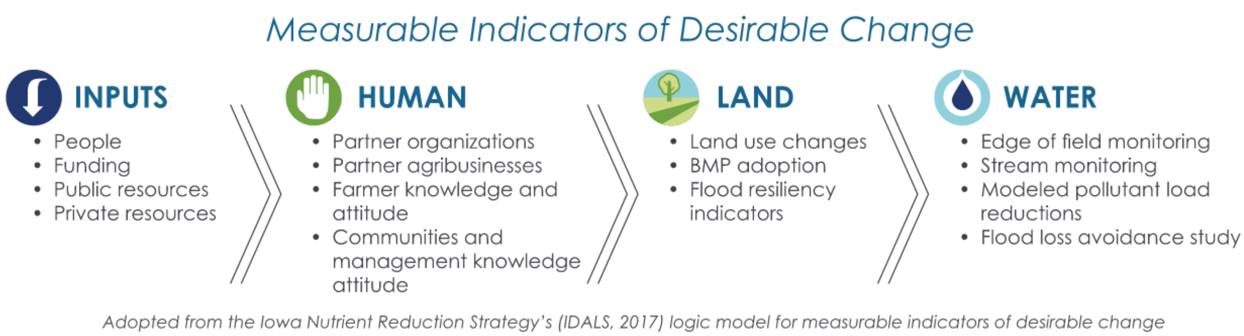


Figure 68: Logic Model Used to Identify Measurable Indicators of Desirable Change

TRACKING AND REPORTING DASHBOARD

Evaluating success or failure is a critically important step in implementing a watershed plan. To assist with tracking, reporting, and evaluating the indicators used in the NRS logic model, several interactive web-based dashboards have been developed (Figure 69). This revised reporting structure aims to increase the timeliness, frequency, and transparency of updates. The dashboards can be accessed here:

https://nrstracking.cals.iastate.edu/tracking-iowa-nutrient-reduction-strategy

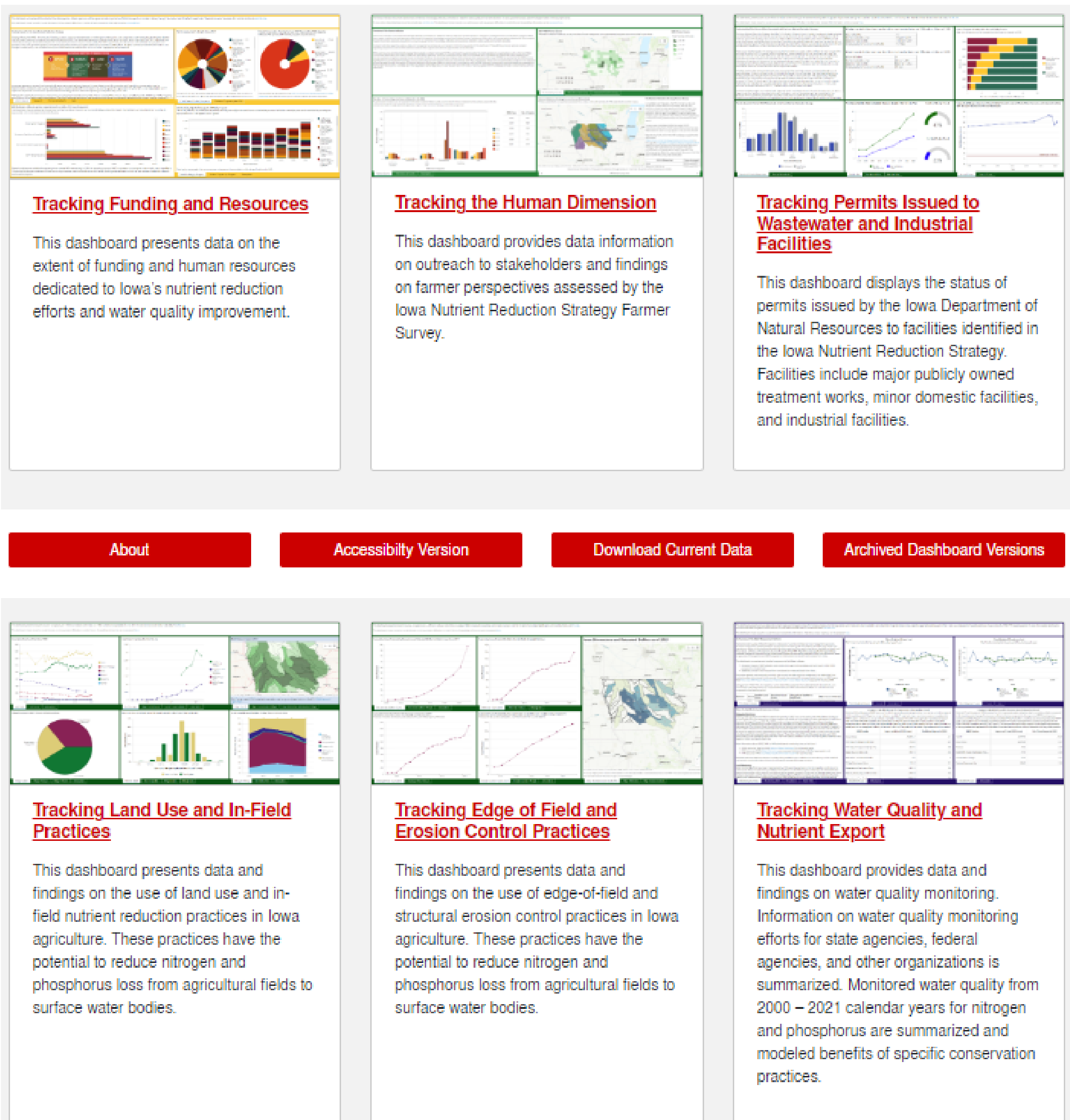


Figure 69: Interactive Data Dashboard (Screenshot)

EVALUATION TIMEFRAME

The evaluation process of this plan will follow an adaptive management approach. Adaptive management is a systematic process of "learning by doing," as illustrated in Figure 70. This process is utilized in situations where there is uncertainty in precisely how selected actions will affect the outcome, but management decisions must be made. This process involves executing and evaluating various alternatives, allowing managers to make more well-informed and better decisions in the future. Overall, adaptive management is the process of using the best available science to implement management actions today, learn from those results, and revise actions as required.

The SRRWMC will utilize an adaptive management scheme to evaluate and adjust plan implementation efforts over time. Monitoring assessments will take place continuously, with evaluation and adjustment actions taking place both as necessary and formally at yearly and 5-year increments.

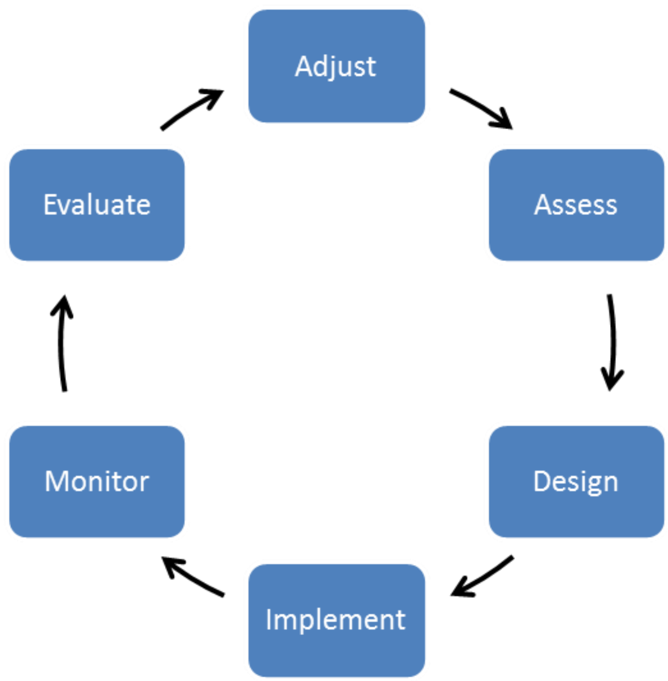


Figure 70: Basic Procedural Steps of Adaptive Management

The evaluation metrics laid out in this chapter are meant to help guide the SRRWMC towards meeting its stated goals and objectives. However, they are also useful to inform the public and partners on the work that is being done and the resources that are needed. The recommended frequency of reporting on these metrics is discussed below and summarized in Table 33.

- **On-Going / Quarterly Board Meetings -** On-going tracking is recommended for current projects, BMP implementation, public outreach, and partner updates. Quarterly board meetings provide a logical time to provide updates on these topics to board members and the public. By tracking these items regularly, yearly updates will be more manageable to accomplish.

- **Annual Board Meeting -** Watershed project partners should host an annual review meeting to provide an opportunity to update the public on activities and evaluate progress. This may take the place of one quarterly meeting board meeting; however, extra effort should be made to invite the press and stakeholders to this meeting. Annual reports should be completed by all partners and members of the coalition, and the results summarized and presented. An annual report documenting metrics should be prepared by the coalition and widely distributed. These annual reports can be evaluated to show changes over time and to help identify gaps where additional inputs are needed.
- **5-Year Annual Review -** Every five years this plan will be completely reviewed, evaluated, and updated. Preceding annual reports will provide a good basis to begin this review; however, at this time an updated analysis should be done on key subjects such as water quality data, watershed modeling, public surveys, land use changes, loss avoidance studies, goal setting, and identifying priorities. Milestones, goals, and objectives should all be reviewed at this time.

Table 33: Summary of the Timeframe Each Evaluation Metric Should be Completed

Quarterly Board Meetings	Annual Board Meeting	Every 5 Years
Updates on BMP implementation and pollutant reductions	Water quality monitoring report	Watershed models updated with new inputs
List of completed projects	Submit updates to the NRS Tracking Dashboard	Formal survey of landowners and farmers on knowledge, attitudes, and behaviors
Summary from pollutant reduction calculator tools	Review annual progress toward goals	Perform/update loss avoidance study
Summary of any recent public outreach or education events		Review goals and objectives
Grants, staffing, and partner updates		Complete update to watershed plan

Note: This summary is not meant to exclude any other metrics which may be useful towards plan evaluation or future updates

5.06 SUMMARY AND RECOMMENDATIONS

Improving flood resiliency, water quality, and recreation throughout the watershed is possible with a long-term commitment by cities, counties, farmers, and other partners. Long-term funding, planning, and dedication to the implementation of this plan will be required.

While a long-term and comprehensive implementation plan has been presented in this chapter, there are several key recommendations that are highlighted below, which should be completed as initial steps, joint projects, or during future plan updates. Individual cost estimates should be prepared for these efforts based upon the scope desired by the SRRWMC, and at the time services are needed.

Flood Resiliency Projects

- **HMP Amendment or Integration -** It is recommended to further integrate the SRRWMC Watershed Plan with each county's local HMP by recognizing or amending this plan into each HMP.
- **Flood Resiliency Inventory -** Complete a baseline study of existing indicators of flood resiliency: public assistance claims; flood insurance enrollment and claims; properties in the regulatory floodplain; and properties removed from the floodplain. This can be compared to changes over time and will assist in gauge plan implementation and help identify funding needs.
- **Flood Loss Avoidance Study -** Complete a study to identify and quantify losses or damages avoided due to the implementation of flood mitigation measures. Assessing the economic impact of mitigation projects helps to evaluate and justify public investments, encourage additional funding, and build local support of mitigation projects.

Water Quality Improvements

- **Select Project Area for BMP Implementation -** Following adoption of this plan, the SRRWMC and its partners will need to select an area to pursue BMP implementation efforts. This will consist of obtaining funding that could be used for BMP cost-share, education and outreach efforts, water quality modeling, and other supporting activities.

Recreation Project Opportunities

- **Designate the Shell Rock River as a Water Trail -** The coalition, led by CCBs and cities, should work together to obtain funding from the Iowa DNR to complete a water trail plan. This process involves landowner and public engagement and would comprehensively evaluate needs along the river such as: access, signage, and obstacles.

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CHAPTER 6. EDUCATION PLAN

6.01 INTRODUCTION

This chapter serves as an education plan, which provides a diverse framework for outreach, information, and education (I&E) efforts that will support the implementation of this watershed plan. This includes strategies and methods to engage watershed residents, landowners, farmers, and other stakeholders. Additionally, this plan includes recommendations for evaluating I&E activities and sharing lessons learned, success stories, and other outcomes with stakeholders.

Outreach, information, and education refers to the on-going process of informing and involving stakeholders in the development and implementation of the watershed plan. This process is essential as the success of the watershed plan is dependent on the voluntary participation in plan implementation. An informed and involved public is needed not just for the initial implementation efforts, but the long-term adoption and maintenance of best management practices (BMPs) within the watershed.

This education plan provides a framework that future efforts can be built on. Those efforts can take place at both the full watershed scale and within project implementation areas. Two primary takeaways from this education plan include:

1. This chapter should be used as a guide to develop unique education plans for each BMP implementation project, based on the unique target audiences and project goals in those areas identified in Chapter 7.
2. The highest priority educational activities for the watershed are identified in the Action Plan in Chapter 7.

In addition to the stakeholder input received during the watershed planning process, this education plan is based on best practices outlined in *The Social Indicator Planning & Evaluation System (SIPES) for Nonpoint Source Management: A Handbook for Watershed Projects* (Genskow and Prokopy, 2011). The SIPES handbook is an excellent resource regarding the identification and monitoring of social indicators, or measures that describe the awareness, values, and behaviors of people and communities, related to water quality improvement.

Additionally, recommendations and key findings from the *Lyons Creek Watershed Project: Lessons Learned from Partner & Participant Reflections* (Losch and others, 2016) were reviewed and considered for inclusion in this education plan. This report provided lessons learned from a 319-funded watershed improvement project recently completed in central Iowa: Lyon's Creek Subwatershed. Therefore, this report provides very valuable insights for this plan. A copy of the Lyon's Creek report can be found at:

https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Watershed-Improvement

6.02 TARGET AUDIENCES

While the watershed as a whole can be an audience for I&E efforts, it should not be the only audience. To be most effective, I&E should be based on the needs of a target audience. A target audience is a population subset that is the ideal recipient of a message based on shared characteristics or interests. The use of target audiences maximizes the effectiveness of I&E efforts because it helps to deliver a relevant message to the individuals who can most readily benefit from or act on that information. Specific target audiences should be identified for each implementation project, based on goals specific to that project.

Across the watershed, several potential target audiences have been identified including, but not limited to:

- Land managers, property owners, and residents throughout the watershed and within each project area
  - Row crop farmers
  - Animal agricultural / livestock farmers
  - CAFO managers/owners
- Farmers who implement specific BMPs, and those with the potential to implement similar practices
- WMC Board of Directors and representatives
- Schools
- Government staff and elected officials, at various levels:
  - City
  - County
  - State
  - Federal
- Rural homeowners with private wells and/or septic systems
- Urban property owners and residents
- Absentee landowners, both local and distant
- Crop consultants, agri-chemical dealers, Co-ops, drainage contractors, and other agricultural-based local businesses
- Outdoor recreational users or groups (water trail users, etc.)- both within and external to the watershed
- Civic leaders, such as service organizations and non-profits
- Youth (Future Farmers of America [FFA], agricultural students, science classes, etc.)
- Young, beginning, or transitional farmers
- Ag-based non-profits (ISA, Iowa Corn Growers Association, Farm Bureau, etc.)
- Environmental service non-profits
- Lawn care providers

In addition to identification of target audiences, effective I&E requires an understanding of how to reach and lead an audience to take action. By developing this understanding, the WMC will be better positioned to influence people's awareness, values, and behaviors regarding watershed improvements. The type of information that should be developed for each target audience include:

- **Preferred delivery method:** what format (in-person, mailer, email, website, video etc.) and frequency of communication does the audience prefer?
- **Motivators and incentives:** what drives the decision-making process of this audience?
- **Existing perceptions:** what do they currently think about the issues?
- **Barriers and obstacles**: what would prevent this audience from engaging?

This type of information can be collected a variety of ways, such as through surveys, in-person interactions, and advisory boards. This information for target audiences should be identified and gathered at the outset of each implementation project, based on the unique audiences and project circumstances. The initial research can also serve as baseline information for on-going monitoring of the awareness, values, and behaviors of target audiences. Monitoring social indicators alongside environmental indicators will offer meaningful insight regarding the progress made in achieving the goals and objectives described in this plan. Refer to the SIPES handbook for additional details on how to use social indicators to help plan, implement, and evaluate watershed improvement projects.

RURAL (AG) VS URBAN AUDIENCES

The watershed includes both rural and urban areas. While these are two distinct target audiences, each meriting tailored outreach materials and activities, care should be taken how each are defined. While there are differences between rural and urban audiences, they are all residents of the same watershed and will still share many values and similarities. Table 34 outlines some general strategies to consider when tailoring outreach materials and activities to either audience.

Table 34: Generalized Outreach Considerations for Rural and Urban Audiences

Rural	Urban
• Generally, more homogenous population and may be more skeptical of change. • Sparser population, and more geographically spread, than urban audiences. • Information is shared through word of mouth and community centers (gas stations, coffee shops, etc.). • Media tends to be the weekly paper, but increased use of local social media. groups/sites is becoming more common. • Conduct one-on-one or small group meetings. • Door-to-door contact can be very effective, sometimes you have to meet people where they are. • Tone down your approach; it's critical a program does not project a slick, “big city” image. • Utilize a local liaison; a known, friendly face. • Take it slow and easy; don't barge right in.	• Generally, more diverse interests and more people to contact. • Messages compete with many others. • Attention spans may be shorter. • Focus on concise, clear messaging. Avoid complicated or layered messaging. • Use the internet, e-mail, and direct mail in tandem. • Identify and include neighborhood councils, homeowners associations, or other local organizations as appropriate.
Both Audiences	
• Listen, listen, listen • Adapt your message to the local context • Build a team that reflects the composition of your audience • Be clear with objectives and timeframe. • Build in extra time to your schedule - meaningful outreach takes time. • Be appreciative of the time and participation audiences are willing to give. Everyone is balancing various responsibilities. • Identify and engage community influencers and opinion leaders (hint: they aren't just elected officials). • Remember that effective outreach is based on mutual trust. • Avoid stereotyping, or assuming what each audience knows, understands, or values. • Don't be judgmental and leave your ego at home. • Both audiences can be technologically savvy yet may still prefer in-person engagement. • Remember, there is lots of overlap between rural and urban populations, especially when considering the high levels of absentee landowners across the watershed.	

6.03 STRATEGIES

Each I&E strategy is based on one of two types of outcome change: information or behavior.

An **information-based strategy** seeks to fulfill information needs, while a **behavior-based strategy** seeks to motivate change. Typically, an information-based strategy should precede a behavior-based strategy, but that is not always the case. For example, information needs could be sufficiently met for commonly understood topics using a behavior-based approach, such as household water conservation.

These two basic types of strategies and associated activities are to be considered a component of the overall I&E strategy of this plan. They should be implemented when appropriate but will work best when they inform or supplement the action items outlined in Chapter 7. A determination of which strategy to use should be made at the outset of any implementation project based on goals specific to that project.

INFORMATION-BASED STRATEGY

The purpose of an information-based strategy is to increase awareness or understanding of a specific topic:

- When the desired outcome is increased awareness, the goal of the strategy is to make target audiences aware that issues are present, as well as what actions have been or are being taken.
- When the desired outcome is increased understanding, the goal of the strategy is to broaden or deepen the target audience's understanding of issues and projects.

Table 35 provides an outline of efforts that could be used to support an information-based I&E strategy. These activities are a key a component of the overall I&E strategy for this plan, and can also be adopted for use in more detailed implementation project areas.

Table 35: Potential Activities for Information-Based Outcomes

Activity	Outcome
Create logos, taglines, and key messages for the watershed (or specific projects) to create a sense of place and value.	Awareness
Promote the watershed plan through newsletters, flyers, press releases, websites, and events.	Awareness
Acknowledge, recognize, record, and share previous and existing conservation efforts or other projects completed.	Awareness
Provide updates on plan progress and monitoring through newsletters, flyers, press releases, websites, and events.	Awareness
Install watershed and stream name signage at all major road crossings	Awareness

Identify and partner with other groups within the watershed that are already conducting flood resiliency, water quality, or recreation efforts.	Understanding
Develop a reporting system to identify successes and failures of projects.	Understanding
Provide educational opportunities (fact sheets, public meetings, field days, classroom activities, etc.) that focus on specific issues, solutions, and funding opportunities.	Understanding
Showcase the relevancy and benefits of this plan's implementation to help audiences understand local impact.	Understanding
Develop and organize demonstration sites, tours, and field days.	Understanding

BEHAVIOR-BASED APPROACH

The purpose of a behavior-based approach is to provide information that leads to changes in values and behaviors. This plan seeks to address change at two levels:

- At the first level, I&E will seek to influence or change existing values and behaviors so as to gain acceptance and adoption of BMPs.
- At the second level, I&E will seek to influence generational change. Generational changes involve shaping the attitudes, values, and behaviors of future land managers, farmers, residents, and decisions makers. Generational change will ultimately help enhance the sustainability of implementing BMPs throughout the watershed.

Table 36 provides an outline of efforts that would support a behavior-based I&E strategy. These activities are a key a component of the overall I&E strategy for this plan, and can also be adopted for use in more detailed implementation plans for priorities watershed areas.

Table 36: Potential Activities for Behavior-Based Outcomes

Activities	Outcome
Provide information directly to target audiences about the benefits of BMPs, as well as technical and financial programs available to assist in the implementation of BMPs.	Change in existing values and behaviors
Provide information directly to farm consultants, agricultural retailers, engineers, and other audiences that have a high degree of influence on landowner and farmer decisions.	Change in existing values and behaviors
Hold targeted coffee shop meetings, tailgate sessions, and other informal information exchanges to build relationships and to learn more about the barriers and obstacles audiences perceive regarding implementation of BMPs.	Change in existing values and behaviors
Identify and work with target audiences to develop a water quality monitoring program.	Change in existing values and behaviors; Generational change

Include school-aged youth in project plans, such as field tours of project sites, and water quality monitoring sites.	Generational change
Provide information about water quality and other benefits of BMPs to youth-based programs (FFA, 4-H, agricultural students, science classes, etc.)	Generational change
Provide information targeted for younger generations at regularly used recreation areas (beaches, picnic shelters, water trails, etc.) about the importance of watershed management and its relation to water quality and flood resiliency, especially as it related to the location where information is posted.	Generational change

WATERSHED TARGETED STRATEGIES

The following strategies were identified by stakeholders and through literature review specifically for use during the implementation of this plan:

- **Leverage Partnerships**
    - Multiple organizations are already providing informational materials and offering educational opportunities. The WMC should look at partnering with them to leverage those existing efforts, make them more locally relevant, and avoid "reinventing the wheel".
    - While there are multiple organization to work with, it's recommended that the WMC start by working with and utilizing existing educational resources from the following entities:
        - Iowa State University Extension's Conservation Learning Group - https://www.conservationlearninggroup.org/
        - Iowa Learning Farms - https://www.iowalearningfarms.org/
        - Iowa Stormwater Education Partnership - https://iowastormwater.org/
- **Utilize messaging from the "Whole Farm Conservation Manual".**
    - The *Whole Farm Conservation Best Practices Manual, 2nd edition* (ISU, 2022) was developed by ISU Extension and seeks to summarize the existing scientific consensus of BMPs and streamline the BMP recommendation process for landowners, farmers, and natural resource professionals. The manual complements the NRCS's conservation planning process and integrates BMPs from the Iowa Nutrient Reduction Strategy.
    - This is recommended reading for every WMC member.
    - The manual can be obtained from ISU Extension: https://store.extension.iastate.edu/product/15823
- **Implement lessons learned from the Lyon's Creek Watershed Improvement Project.** The WMC should become more familiar with this project and the key lessons learned, which are documented within the previously mentioned Lyon's Creek Report (Losch and others, 2016). These include, but are not limited to:
    - Create a sense of shared understanding, project goals, and criteria for success

- Employ a full-time watershed coordinator
- Find common ground between landowners and cash-rent operators
- Simplify access to the multitude of adjacent, concurrent, and /or overlapping BMP cost-share programs from various partners
- Utilize active-recruitment strategies for outreach/education to target audiences
- Provide data from local sources and or local demonstrations as much as possible
- Plan for a long-term timeframe of implementation. It will take a long-term "campaign" to gain trust and recognition from farmers.
- Provide clear, consistent, and science backed information on pollutants, sources, impacts, and attributes of BMPs (costs, benefits, limitations, etc.)
- Casting blame decreases farmers interest in participation or willingness to adopt BMPs.
- Identifying and highlighting local "champion farmers" to help deliver messaging increases credibility and visibility

- **Develop and utilize water trails to create a sense of place and leverage opportunities for educational outlets.**
  - By having the Shell Rock River designated as a water trail, the WMC could help to create local concern for and ownership of the watershed. This would focus the conversation on protecting local resources instead of more ambiguous goals set by outside entities.
  - Future water trail access points could also serve as natural places for educational signs, events, and for people to connect with the river. This would help the public see and experience firsthand the resources this plan seeks to protect in a much more intimate way.
- **Make water quality data easy to find**
  - A common issue identified by stakeholders was the challenge with finding existing water quality data. Improving access and knowledge of this data will better educate all stakeholders and help support the need for action.
  - Initially, the WMC should work with DNR, IFC, USGS or others to identify a simple web-based location to share how to access this data. As a next step, working with those same partners to create an annual monitoring report, or some other output that is clear, concise, and easy to share with the public should be a priority.
  - As watershed monitoring expands across the watershed, there may be options to utilize a web-based mapping and data visualization tool to access the data. Here are two examples:
    - https://www.cleanwaterhub.org/
    - https://programs.iowadnr.gov/aquia/
- **Utilize ACPF mapping data to focus farmer outreach**
  - ACPF mapping and analysis can help identify critical source areas and recommended locations for BMP implementation.
  - In areas that ACPF mapping is completed, outreach efforts should be prioritized and emphasized around getting farmers and landowners in critical source areas to

adopt conservation practices. Critical source areas, discussed in Chapter 5, produce a disproportionately high level of pollution compared to others within the watershed. Treating these areas with BMPs will therefore produce the largest impact on water quality per dollar spent on practices. ACPF maps provide a starting point for these conversations with landowners.

- **Leverage virtual technology to expand outreach efforts.**
    - Within Iowa, the watershed spans across portions of nine counties and sixteen cities, and approximately 50% of the land is owned by absentee landowners (many of them residing outside the watershed) – this is a huge geographic area to focus outreach and education on. While this plan does include targeted outreach efforts inside of project areas, virtual technologies can be used to expand the impact of all efforts relatively cheaply.
    - It is recommended that all, or at least some key events, have a virtual option for attendance or for viewing meeting materials. Additional planning ahead of time can also ensure that events are "virtual friendly" and increase interaction with virtual participants. This will also allow these events to be shared across social media and delivered to absentee landowners and other stakeholders that are unable to be reached locally.
    - Work with the ISU Farm Management Team to host targeted farmland leasing workshops within the watershed that target absentee landowners. Additional contact information is here: https://www.extension.iastate.edu/ag/farm-management
- **Identify and Showcase BMP Demonstration Sites**
    - Demonstration sites serve as living examples of projects. They provide the opportunity for people to discuss and view the implementation process, installation techniques, and real-life accounts of the project successes and/or challenges.
    - Little is known about what existing farms or BMPs could be used as demonstrations. The SRRWMC should work with ISU Extension, North Iowa Area College, SWCS, NRCS, cities, and others to identify demonstration sites that exist. If there are gaps in the types or geographic location of sites, this would be a great opportunity for a project.

6.04 DELIVERY METHODS AND MATERIALS

I&E methods should be tailored to the target audience. This will make efforts more effective and more likely to achieve the desired outcome. Each outreach campaign should consider the utilization of a diverse set of methods to reach targeted audiences. *Table 37* describes a variety of potential I&E methods.

Table 37: I&E Delivery Methods

Method	Description	Recommended Use
One-on-One Contact	On-site meetings to discuss location of projects or to answer questions about programs and projects.	For siting practices within project areas.
Direct Mailing	Targeting informational mailer sent to all properties within specified area.	For increasing attendance of meetings or project participation.
Media	Newspaper, radio, television news, agriculture-based magazines, outdoor magazines, etc.	For increasing awareness of activities and progress.
Electronic and Social Media	Websites, social media platforms (Listserv emails, Facebook, Twitter, etc.)	For supplementing other outreach methods
Signage	Billboards, cooperator recognition signs, traveling displays, demonstration signs, high water mark signs, etc. When possible, should include interpretive information.	For high-traffic areas, such as major intersections, public beaches, entrances to recreation areas, boat ramps, water trails, or area events.
Events	Events related to water resources, such as training opportunities, demonstration field days, and recognition picnics.	For use in conjunction with other area events, such as county fairs or other partner events.
Field Days or Workshops	Hands-on and site-specific event, such as a site tour, outdoor recreation clinic, training, equipment calibration, water quality testing, etc.	For use in supporting the education or adoption of a specific management activity.
On-site Project Demonstration	Water quality monitoring and BMP installation or maintenance.	For use in supporting the education or adoption of a specific management activity.
Curriculum	Lesson plans and materials for formal and informal education.	For youth-based outreach.

Educators	Assist with the development and delivery of materials.	For youth-based outreach.
Water Quality Test Kits	Simple water quality test kits that show instant sample results and provide a hands-on involvement and learning opportunity.	Provide to volunteers, youth groups, civic groups, or volunteer farmers.

USE OF MEDIA

Selection of media type should be considered based on the target audience and type of strategy being used. While each type of media outlet may have a different cost for publication, their effectiveness also varies based on its use by target audience. Media use by farmers (a key target audience for this watershed plan) was recently measured in the *2021 Iowa Farm and Rural Life Poll* (Arbuckle, 2021), as summarized below and in Figure 71:

> Local or state TV news was the most frequently used source, with 77% of farmers reporting use or several times daily. National TV news and local or state radio news and talk were essentially tied for second, with 62% reporting viewing either daily or several times weekly. Twitter and podcasts were the least frequently used, with just six percent of farmers reporting use of these either daily or several times weekly. It is important to note that although farm magazines were not among the most frequently used, 87% of farmers indicated using farm magazines at least monthly, second only to local or state TV news.

	Never	Less than Monthly	Monthly	Weekly	Several Times Weekly	Daily
Local or state TV news	6%	3%	3%	12%	17%	60%
National TV news	14%	7%	4%	13%	21%	41%
Local or state radio news and talk	11%	8%	5%	14%	22%	39%
Cable/Satellite TV	34%	2%	2%	5%	8%	50%
Facebook	47%	5%	3%	8%	12%	25%
Farm magazines (paper or online)	6%	7%	28%	28%	21%	9%
Local newspaper (online or paper)	12%	9%	7%	42%	11%	19%
Streaming video service (Netflix, Amazon Prime Video, Disney+, Hulu, HBO Max, etc.)	49%	9%	7%	11%	12%	11%
National newspaper (online or paper)	48%	14%	5%	13%	9%	12%
Iowa Public Radio	44%	17%	9%	13%	9%	8%
YouTube	44%	16%	11%	13%	10%	6%
Podcasts	68%	14%	7%	6%	4%	3%
Twitter	88%	4%	2%	1%	2%	4%

Figure 71: Use of Various Media Types by Farmers

TIMING

Consideration should also be given to the timing which I&E materials and efforts are employed. Timing of I&E can be based on target audience research, such as avoiding information distribution to farmers during harvest, or timed to occur alongside relevant events, such as county fairs. Regardless of the basis, timing should be deliberate to help ensure target audiences will be receptive to I&E efforts.

6.05 EVALUATION

Each I&E activity should undergo at least some level of evaluation for several reasons:

1. Evaluation supports mid-course adjustments and follow-up outreach to ensure the strategy is achieving its desired outcome.
2. Evaluation provides an alternative means (i.e. social indicators) to measure the progress of this plan's goals and objectives.
3. Evaluation will help the WMC refine its I&E strategies for future projects and initiatives.

Evaluation methods should be selected before an I&E activity begins, so they can be employed throughout a project or initiative. This early emphasis also prevents evaluation from being overlooked. Evaluation methods include, but are not limited to:

- Tracking if or how the target audience engaged in each activity or method;
- Conducting pre-, mid-, and post-surveys;
- Providing and encouraging completion of evaluation forms;
- Offering and assessing the interest in participation incentives;
- Hosting formal or informal focus groups to discuss specific practices; and
- Tracking media coverage.

Evaluation data should be summarized for each project to allow for side-by-side comparison of efforts and outcomes. Evaluation data can also be gathered to measure the collective progress in achieving this plan's goals and objectives.

As the implementation efforts are just getting started, there may be limited data regarding existing attitudes, behaviors, values, or beliefs of target audiences. Until this baseline data can be collected, it will be useful to refer to the following existing data sources (listed by publication year):

- 2015 – Public Perceptions of Water Quality in Iowa: A Statewide Survey (Wittrock and others, 2015)
- 2015 - Farmer Perspectives on Iowa's Nutrient Reduction Strategy - Iowa Farm and Rural Life Poll
- 2019 - Iowa Farmers and the Iowa Nutrient Reduction Strategy: Survey Results from the Upper Mississippi-Maquoketa-Plum Watershed
- 2022 - Farmer Perspectives on 4R Plus, Cover Crops, and Soil Health - Iowa Farm and Rural Life Poll

Unless otherwise noted, these publications are available for free through the ISU Extension Publications website: https://store.extension.iastate.edu/

6.06 SUMMARY AND RECOMMENDATIONS

This education plan provides a framework that project-level efforts will be built on. Given the importance of outreach and education to the success of this watershed plan, the WMC should begin implementing these activities right away. The following is a summary of initial recommendations for this process:

- **Prioritize building relationships with stakeholders -** Efforts to expand WMC membership to all eligible entities must start with education. Efforts directed towards city councils and other local stakeholders should be prioritized, and focused on building awareness and understanding of what the WMC is and is not.
- **Begin implementing the strategies identified in the Action Plan in Chapter 7 -** These were prioritized by stakeholders and can be executed outside of BMP implementation projects, and parallel or in partnership to education efforts that other watershed partners are already pursuing.
- **Leverage Partnerships -** Multiple organizations are already providing informational materials and offering educational opportunities. The WMC should start leveraging these partnerships by working with the following entities:
    - Iowa State University Extension's Conservation Learning Group - https://www.conservationlearninggroup.org/
    - Iowa Learning Farms - https://www.iowalearningfarms.org/
    - Iowa Stormwater Education Partnership - https://iowastormwater.org/
- **Survey farmers and landowners -** Completing a baseline survey of awareness and attitudes will help identify of barriers to adoption of BMPs, inform implementation planning, and provide a baseline for future plan evaluation. This could be paired with farmer surveys to identify current adoption levels of nonstructural BMPs and financial impacts of conservation.
- **Build on lessons learned - I**n addition to each WMC member reviewing the Lyon's Creek summary report discussed in this plan, the WMC should host speakers during regular meetings who can share lesson's learned this and other projects around Iowa.

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CHAPTER 7. SHORT-TERM ACTION PLAN

7.01 INTRODUCTION

To help guide the Shell Rock River WMC and other stakeholders in the successful implementation of this plan, a detailed action plan has been developed. This action plan is focused on prioritized actions that could be realistically implemented over the short-term (less than five years). The action plan is comprised of groups of specific and independent activities that can be completed to work towards achieving the plan's goals and objectives. The activities were identified through evaluation of watershed data and input from WMC members and stakeholders. Additional consideration was given to ensure that action items were identified for each of the draft goals.

The action plan covers the two following types of activities:

1. **Water Quality Project Areas** – These areas were identified for initial efforts of focused implementation of Best Management Practices (BMPs) within the larger watershed. Focusing and concentrating on the implementation of BMPs within project areas allows the partners to maximize efforts, resources, and impacts. Supporting information for these areas are included as part of the long-term implementation plan in chapter 5.
2. **Supporting Action Items** – These action items are focused on activities that both support BMP implementation in project areas, build capacity for other WMC activities, and establish a more robust foundation for future watershed management decisions.

7.02 WATER QUALITY PROJECT AREAS

Initial BMP implementation efforts from this plan will be focused within specific subwatersheds (Figure 72), which are listed below by the primary county each is located in. It is anticipated these counties would take the lead in implementation, with support from other partners or the counties that the subwatersheds cross into. Additional information on why these areas were selected is found in Chapter 5.

- Worth County
  - Elk Creek Subwatershed
  - Drainge Ditch #2 Subwatershed
  - City of Northwood Subwatershed
- Floyd County
  - Headwaters Flood Creek
  - Beaver Creek Subwatershed
- Cerro Gordo County
  - Headwaters Cold Creek
- Butler County
  - Dry Creek

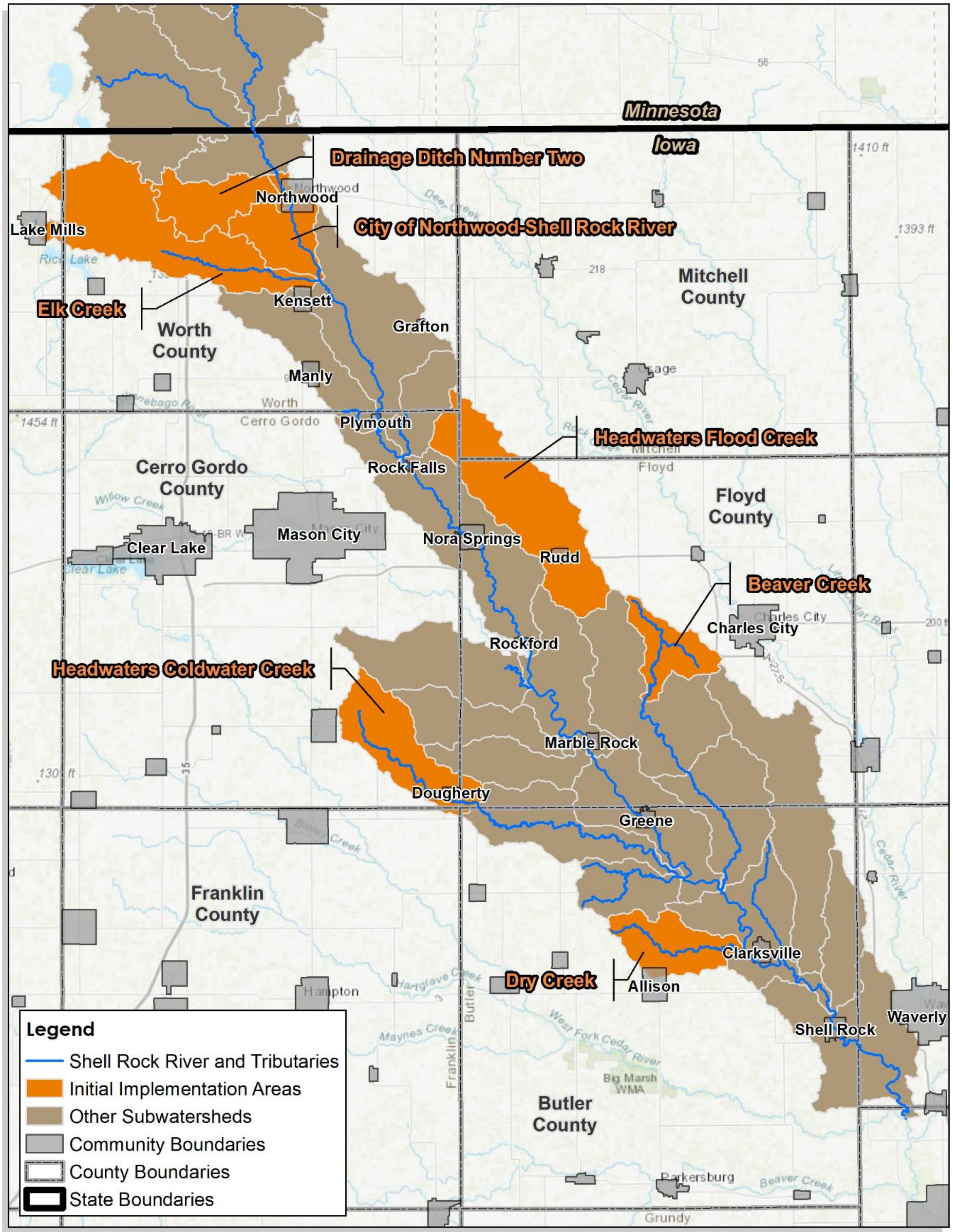


Figure 72: Potential Subwatershed Areas for BMP Implementation

STARTING A PROJECT

Following the adoption of this plan, the SRRWMC will need to select one (or a group) of these subwatersheds for an implementation project. This will consist of obtaining funding that will be used for BMP cost-share for landowners/farmers, education and outreach efforts, and other supporting activities. A detailed project plan will be developed, based on the information in this watershed plan, and may include the following:

- Lead project sponsor, fiscal agent, and contributing partners
- Project description and scope
- Goals and objectives (tied to this plan, but specific to the project area)
- Proposed BMPs (BMP targets are provided below)
- Determine approach for targeting or prioritizing BMPs within the project area (based on information in Chapter 5)
- Estimated pollutant source and load reductions (based on information in Chapter 5)
- Education and outreach activities (based on information in Chapter 6)
- Monitoring and evaluation procedures
- Schedules and milestones
- Budget (initial cost estimates provided below)

Additionally, the following data collection and analysis is recommended at the project level:

- Completion of ACPF modeling
- Identification of critical source areas (CSAs) using ACPF
- Identification of the most cost-effect BMPs, using ACPF FiNRT
- Complete a watershed assessment, to identify the following:
    - Refine existing BMP estimates using both ground truthing and stakeholder input
    - Inventory land use, cover crops, and tillage practices
    - Estimate erosion and sediment delivery
    - Map nonpermitted open feedlot AFOs
    - Map possible oxbow restoration locations
- Comple of a stream assessment, to identify the following:
    - Erosion estimates
    - Identify critical areas for BMPs
    - Map drainage tile infrastructure

COSTS AND BMP TARGETS

BMP-level cost estimates for each project subwatershed are found in Table 39 through Table 45, with a summary of those provided in Table 38. Target levels for BMP implementation in each project area have been developed based on the rationale provided in Chapter 5. These cost opinions presented are based upon the estimated needs for each priority BMP, but other practices may also be considered. Costs for education, monitoring, or other special studies can vary widely and are not included here and should be identified on a project-by-project case.

The assumptions and exclusions that these cost opinions are based on are provided in Chapter 5. These cost opinions are based on the full cost of each BMP, not just on the cost-share rates which can vary However, costs are subject to change based on final design needs, inflation, bidding climate at the time of construction, and project size and complexity.

This plan assumes that multiple funding sources will be utilized for implementation. Information on possible technical and financial resources to assist with plan implementation can be found in Chapter 8. Note that the costs given below are based on complete BMP implementation; however, those efforts may be spread over multiple years depending on funding availability or BMP adoption rates.

Table 38: Summary of Cost Estimates for BMP Implementation

Initial Implementation Subwatershed	Total Cost for BMP Implementation
Drainage Ditch Number Two (12,650 acres, 2% of Shell Rock Watershed)	$3,358,530
Elk Creek (36,464 acres, 7% of Shell Rock Watershed)	$9,519,643
City of Northwood-Shell Rock River (12,441 acres, 2% of Shell Rock Watershed)	$3,806,925
Headwaters Coldwater Creek (19,572 acres, 4% of Shell Rock Watershed)	$4,596,039
Headwaters Flood Creek (34,021 acres, 6% of Shell Rock Watershed)	$7,941,412
Beaver Creek (10,260 acres, 2% of Shell Rock Watershed)	$2,426,495
Dry Creek (13,250 acres, 2% of Shell Rock Watershed)	$2,596,267
Total	**$34,245,311**

Note: Only subwatersheds identified for initial projects are included in this table.

Table 39: Estimated BMP Needs for the Drainage Ditch Number Two Implementation Area

BMP Practice	Target Number for Cost Estimate	Unit for Cost Estimate	Unit Cost	Total Cost
Bioreactors	45	Site	$10,150	$453,959
Conservation Tillage	5,434	Acres	$30	$163,031
Cover Crops	9,111	Acres	$44	$400,902
Drainage Water Management	1,957	Acres	$88	$172,175
Grassed Waterway	103	Acres	$5,277	$541,789
Nutrient Management	4,588	Acres	$75	$344,121
Nutrient Reduction / CREP Wetlands	11	Site	$25,055	$286,698
Oxbow Restoration	*	Site	$7,500	*
Livestock and AFO Practices	*	*	*	*
Prairie STRIPs / Contour Buffer Strips	37	Acres	$298	$11,162
Row Crop Conversion to Perennial Cover / Wildlife Habitat	2,748	Acres	$330	$906,923
Saturated Buffer	14	Acres	$360	$4,880
Riparian Buffer**	237	Acres	$308	$72,889
Urban BMPs	0	Community	$275,000	$0
WASCOBs	0	Feet	$6	$0
Total				**$3,358,530**

**Study needed to determine site locations and/or practice types*

***Includes vegetative buffer only, not locations where engineering measures are needed to stabilize the streambank or channel*

Table 40: Estimated BMP Needs for the Elk Creek Implementation Area

BMP Practice	Target Number for Cost Estimate	Unit for Cost Estimate	Unit Cost	Total Cost
Bioreactors	129	Site	$10,150	$1,308,560
Conservation Tillage	11,165	Acres	$30	$334,938
Cover Crops	25,850	Acres	$44	$1,137,392
Drainage Water Management	5,640	Acres	$88	$496,304
Grassed Waterway	258	Acres	$5,277	$1,363,836
Nutrient Management	13,017	Acres	$75	$976,300
Nutrient Reduction / CREP Wetlands	32	Site	$25,055	$798,425
Oxbow Restoration	*	Site	$7,500	*
Livestock and AFO Practices	*	*	*	*
Prairie STRIPs / Contour Buffer Strips	108	Acres	$298	$32,175
Row Crop Conversion to Perennial Cover / Wildlife Habitat	8,471	Acres	$330	$2,795,529
Saturated Buffer	39	Acres	$360	$14,107
Riparian Buffer**	682	Acres	$308	$210,106
Urban BMPs	0	Community	$275,000	$0
WASCOBs	8,662	Feet	$6	$51,970
Total				**$9,519,643**

**Study needed to determine site locations and/or practice types*

***Includes vegetative buffer only, not locations where engineering measures are needed to stabilize the streambank or channel*

Table 41: Estimated BMP Needs for the City of Northwood-Shell Rock River Implementation Area

BMP Practice	Target Number for Cost Estimate	Unit for Cost Estimate	Unit Cost	Total Cost
Bioreactors	44	Site	$10,150	$446,450
Conservation Tillage	5,059	Acres	$30	$151,779
Cover Crops	8,483	Acres	$44	$373,233
Drainage Water Management	1,924	Acres	$88	$169,327
Grassed Waterway	125	Acres	$5,277	$661,390
Nutrient Management	4,272	Acres	$75	$320,371
Nutrient Reduction / CREP Wetlands	12	Site	$25,055	$306,597
Oxbow Restoration	*	Site	$7,500	*
Livestock and AFO Practices	*	*	*	*
Prairie STRIPs / Contour Buffer Strips	37	Acres	$298	$10,977
Row Crop Conversion to Perennial Cover / Wildlife Habitat	2,958	Acres	$330	$976,282
Saturated Buffer	13	Acres	$360	$4,813
Riparian Buffer**	233	Acres	$308	$71,683
Urban BMPs	1	Community	$275,000	$275,000
WASCOBs	6,503	Feet	$6	$39,021
Total				**$3,806,925**

**Study needed to determine site locations and/or practice types*

***Includes vegetative buffer only, not locations where engineering measures are needed to stabilize the streambank or channel*

Table 42: Estimated BMP Needs for Headwaters Coldwater Creek Implementation Area

BMP Practice	Target Number for Cost Estimate	Unit for Cost Estimate	Unit Cost	Total Cost
Bioreactors	69	Site	$10,150	$702,375
Conservation Tillage	10,402	Acres	$30	$312,058
Cover Crops	17,440	Acres	$44	$767,369
Drainage Water Management	3,027	Acres	$88	$266,393
Grassed Waterway	110	Acres	$5,277	$582,765
Nutrient Management	8,782	Acres	$75	$658,684
Nutrient Reduction / CREP Wetlands	19	Site	$25,055	$482,352
Oxbow Restoration	*	Site	$7,500	*
Livestock and AFO Practices	*	*	*	*
Prairie STRIPs / Contour Buffer Strips	58	Acres	$298	$17,270
Row Crop Conversion to Perennial Cover / Wildlife Habitat	1,075	Acres	$330	$354,717
Saturated Buffer	21	Acres	$360	$7,572
Riparian Buffer**	366	Acres	$308	$112,775
Urban BMPs	1	Community	$275,000	$275,000
WASCOBs	9,451	Feet	$6	$56,709
Total				**$4,596,039**

Study needed to determine site locations and/or practice types

***Includes vegetative buffer only, not locations where engineering measures are needed to stabilize the streambank or channel*

Table 43: Estimated BMP Needs for Headwaters Flood Creek Implementation Area

BMP Practice	Target Number for Cost Estimate	Unit for Cost Estimate	Unit Cost	Total Cost
Bioreactors	120	Site	$10,150	$1,220,880
Conservation Tillage	17,582	Acres	$30	$527,459
Cover Crops	29,478	Acres	$44	$1,297,052
Drainage Water Management	5,262	Acres	$88	$463,049
Grassed Waterway	201	Acres	$5,277	$1,060,508
Nutrient Management	14,845	Acres	$75	$1,113,347
Nutrient Reduction / CREP Wetlands	33	Site	$25,055	$838,432
Oxbow Restoration	*	Site	$7,500	*
Livestock and AFO Practices	*	*	*	*
Prairie STRIPs / Contour Buffer Strips	70	Acres	$298	$20,970
Row Crop Conversion to Perennial Cover / Wildlife Habitat	2,503	Acres	$330	$825,980
Saturated Buffer	37	Acres	$360	$13,162
Riparian Buffer**	636	Acres	$308	$196,028
Urban BMPs	1	Community	$275,000	$275,000
WASCOBs	14,924	Feet	$6	$89,547
Total				**$7,941,412**

**Study needed to determine site locations and/or practice types*

***Includes vegetative buffer only, not locations where engineering measures are needed to stabilize the streambank or channel*

Table 44: Estimated BMP Needs for Beaver Creek Implementation Area

BMP Practice	Target Number for Cost Estimate	Unit for Cost Estimate	Unit Cost	Total Cost
Bioreactors	36	Site	$10,150	$368,197
Conservation Tillage	5,336	Acres	$30	$160,092
Cover Crops	8,947	Acres	$44	$393,676
Drainage Water Management	1,587	Acres	$88	$139,648
Grassed Waterway	82	Acres	$5,277	$432,809
Nutrient Management	4,506	Acres	$75	$337,918
Nutrient Reduction / CREP Wetlands	10	Site	$25,055	$252,857
Oxbow Restoration	*	Site	$7,500	*
Livestock and AFO Practices	*	*	*	*
Prairie STRIPs / Contour Buffer Strips	30	Acres	$298	$9,053
Row Crop Conversion to Perennial Cover / Wildlife Habitat	775	Acres	$330	$255,697
Saturated Buffer	11	Acres	$360	$3,969
Riparian Buffer**	192	Acres	$308	$59,119
Urban BMPs	0	Community	$275,000	$0
WASCOBs	2,243	Feet	$6	$13,461
Total				**$2,426,495**

**Study needed to determine site locations and/or practice types*

***Includes vegetative buffer only, not locations where engineering measures are needed to stabilize the streambank or channel*

Table 45: Estimated BMP Needs for Dry Creek Implementation Area

BMP Practice	Target Number for Cost Estimate	Unit for Cost Estimate	Unit Cost	Total Cost
Bioreactors	47	Site	$10,150	$475,490
Conservation Tillage	6,402	Acres	$30	$192,054
Cover Crops	10,733	Acres	$44	$472,272
Drainage Water Management	2,049	Acres	$88	$180,341
Grassed Waterway	0	Acres	$5,277	$0
Nutrient Management	5,405	Acres	$75	$405,383
Nutrient Reduction / CREP Wetlands	8	Site	$25,055	$201,264
Oxbow Restoration	*	Site	$7,500	*
Livestock and AFO Practices	*	*	*	*
Prairie STRIPs / Contour Buffer Strips	0	Acres	$298	$0
Row Crop Conversion to Perennial Cover / Wildlife Habitat	1,782	Acres	$330	$587,991
Saturated Buffer	14	Acres	$360	$5,126
Riparian Buffer**	248	Acres	$308	$76,346
Urban BMPs	0	Community	$275,000	$0
WASCOBs	0	Feet	$6	$0
Total				**$2,596,267**

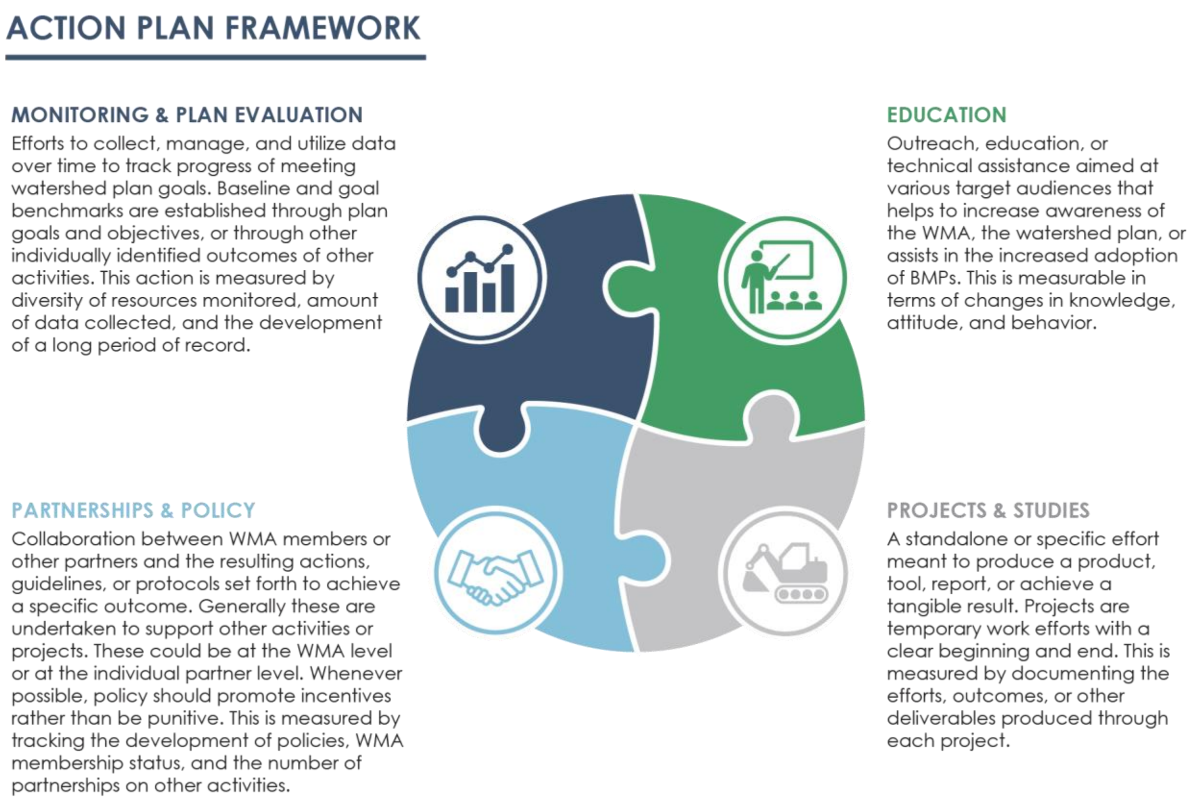
**Study needed to determine site locations and/or practice types*

***Includes vegetative buffer only, not locations where engineering measures are needed to stabilize the streambank or channel*

7.03 ACTION PLAN FRAMEWORK

Action items which support the implementation of BMPs and other priorities within this plan have been developed around a framework of four categories of activities (Figure 73): Education, Projects and Studies, Partnerships and Policy, and Monitoring and Plan Evaluation.

Figure 73: Action Plan Framework



Each activity in the action plan lists includes the following information:

- **Description** – a description of the activity or action to be taken.
- **Goals Addressed –** which goals of this plan the activity seeks to advance.
- **Timeline/Milestones** – an estimate of when, or at what interval, the activity should be completed.
- **Primary Activity Lead** – who is responsible for leading or facilitating the activity.
- **Potential Partners** – a list of agencies or organizations that may directly partner with the primary activity lead to complete the action.
- **Other Technical & Funding Resources** – a list of other likely resources that could aid in completion of the activity, beyond direct partners.

It is important to note that the action plan has been developed to help realize the goals and objectives identified within this plan. Should those change, the action items should also be reevaluated. At a minimum, they should be reviewed annually and updated every five years during plan updates in accordance with the EPA's nine elements (EPA, 2008).

7.04 PARTNER ROLES

While the SRRWMC is the sponsor of this plan, it has no direct authority to implement actions or other recommendations on its own. The success of this plan is reliant on the voluntary coordination and cooperation of numerous partners. Individual WMC members and stakeholders will ultimately be needed to lead implementation.

Each partner is unique in its capabilities and priorities, and the following list summarizes the anticipated role each may plan in implementation. This list is not exhaustive nor is it set in stone, additionally, it is a goal of the plan to expand the number and diversity of partners working to implement this plan.

- **Shell Rock River Watershed Management Coalition (SRRWMC)**
    - The WMC will act as the lead facilitator and coordinator for projects throughout the watershed. It will promote a watershed perspective of common issues, help to connect funding opportunities with local project sponsors, and serve as a regional source of information exchange.
    - A key role of the WMC is to facilitate partnerships, project opportunities, public meetings/outreach events, and identify other opportunities for locally-led watershed management.
    - Develop a working relationship between SRRWMC members (or potential members) and with other watershed management organizations. This may include joint meetings, shared learning opportunities, project resources, or other areas of mutual benefit.
- **Counties –** County governments can serve as local sponsors for leading the implementation of projects. They can promote or encourage policies to protect floodplains and reduce runoff. They can leverage their local funds against other grant programs. The following includes the following county-level organizations/staff should be involved: County Conservation Board (CCB), County Emergency Manager, Drainage District, County Engineer.
- **County Conservation Boards (CCBs) -** While CCB's are not formal members of the SRRWMC, many are serving as designated representatives for their respective counties. CCBs have unique responsibilities, capabilities, and a history of working on projects or programs that affect the watershed. In particular, they are anticipated to take the lead on education efforts and on many of the recreation related projects.
- **Cities -** City governments can serve as local sponsors for implementing projects within or near their communities and can leverage their local funds against other grant programs. They can promote or encourage policies to protect floodplains and reduce runoff. Primary

projects are anticipated to be related to urban conservation, stormwater management, and flood mitigation.

- **Soil and Water Conservation Districts (SWCD)** – Each county's SWCD can provide funding and technical expertise for the implementation of agricultural BMPs.
- **Iowa DNR (IDNR)** – Through multiple programs, including the Section 319 program, IDNR can provide technical expertise and funding through education and grant programs to assist with implementation of BMPs. Additionally, IDNR will continue to provide data through the water quality sampling program and can provide assistance in evaluation of the data. IDNR can also provide expertise towards river restoration, floodplain management, and water trails.
- **NRCS -** Local NRCS offices/staff can be a leader in implementing agricultural BMPs through technical support and targeted funding. Additionally, partners may also work with NRCS's Iowa State Office to access other funding programs such as the Regional Conservation Partnership Program (RCPP) or the Watershed and Flood Prevention Operations (WFPO or PL-566) program.
- **Iowa State University (ISU) Extension** – ISU Extension can provide leadership for outreach and education efforts, especially those directed at farmers and landowners, to help boost adoption of BMPs.

7.05 WATERSHED COORDINATOR – A CATALYST FOR ACTION

The SRRWMC has taken the lead on the organizational and planning elements for watershed management across political boundaries. As such, the WMC serves as a central hub for communities, counties, SWCDs, and other stakeholders to come together. While the WMC has no formal authority or jurisdiction to implement actions, it does provide a mechanism for its members to leverage their existing authorities or capabilities and act in a unified direction.

This leadership and coordination role would be most effectively manifested if there was a watershed coordinator to assist in the day-to-day operations of the WMC and implementation of this plan. A recent study (Hansen, 2023) has shown that the most successful watershed-based groups are those with a watershed coordinator, which is a staff person responsible for managing and implementing projects and administrative tasks. A watershed coordinator typically has the following responsibilities:

- Completes the day-to-day work of engaging communities, farmers, and other project partners
- Assists in getting conservation practices installed
- Coordinates project efforts between watershed partners
- Works to bring in outside resources, through grant writing, building partnerships, and finding technical assistance for other projects

Various options exist for hiring or employing this position, these include, but are not limited to:

- Jointly funded between all SRRWMC entities
- Jointly funded between neighboring CCBs or partial utilization of CCB naturalists or other employees
- Splitting funding and workloads with neighboring WMAs
- Hiring a grant writer to assist on a project-by-project basis

A watershed coordinator serves as a catalyst for action – and hiring one should be a top priority for the SRRWMC.

7.06 ACTION PLAN

The action plan consists of Table 46 through Table 49

EDUCATION ACTION PLAN

Table 46: Action Plan for Education Activities

EDUCATION									
#	Action Item and Description	Goals Addressed				Timeline/ Milestones	Primary Activity Lead(s)	Potential Partner(s)	Other Technical or Funding Resources
		Flooding (#1)	Water Quality (#2)	Recreation (#3)	Education (#4)				
1	Install signage about the watershed and related educational information at each river access point (Objective 3.2).				X	By 2028	CCBs	DNR, Cities	ISU Extension
2	Install stream name signs at major road crossings for tributaries within the watershed (Objective 3.3).				X	By the end of 2024	Counties	Cities, DNR, DOT	
3	Hold an annual "Shell Rock River Rock Fest" or other similar river focused event, to bring awareness (Objective 3.4)			X	X	Beginning in 2024	Cities	CCB	
4	Develop materials and begin implementing a strategy to educate the public on water quality conditions and where that data can be accessed (Objective 4.2)		X		X	By the end of 2025	CCBs	SWCDs	ISU Extension, IFC
5	Hold at least one outreach and education event in each county per year through partnerships with surrounding WMAs and other partners (Objective 4.3)				X	Begin by the end of 2025, then ongoing	CCBs	Other WMAs	ISU Extension
6	Form an education and outreach committee, who will work with partners to				X	By the end of 2024	CCB naturalists	SRRWMC members	

EDUCATION

#	Action Item and Description	Goals Addressed: Flooding (#1)	Goals Addressed: Water Quality (#2)	Goals Addressed: Recreation (#3)	Goals Addressed: Education (#4)	Timeline/ Milestones	Primary Activity Lead(s)	Potential Partner(s)	Other Technical or Funding Resources
	implement the education plan and action items (Objective 4.4)								
7	Start an education campaign to help cities understand management options related to stormwater, floodplains, and pet waste.					Complete by the end of 2025	SRRWMC	ISWEP, DNR	IFC
8	Establish a single website for the SRRWMC, with a primary goal of making water quality (and other data) easy for the public to find			X		Establish in 2024	Butler County	Counties	n/a
9	Identify and map existing BMP demonstration sites within each county, to be used for education activities. This could start with champion farmers. Where sites do not exist, create a strategy to develop new sites or expand existing ones. Include those owned by the county or other public entities but prioritize highly visible sites and those on private property (cooperating landowners) or working farms.		X	X		Beginning 2024	CCBs	SWCDs, Extension	DNR, Cities

PROJECT AND STUDIES ACTION PLAN

Table 47: Action Plan for Projects and Studies

PROJECTS & STUDIES									
#	Action Item and Description	Goals Addressed				Timeline/ Milestones	Primary Activity Lead(s)	Potential Partner(s)	Other Technical or Funding Resources
		Flooding (#1)	Water Quality (#2)	Recreation (#3)	Education (#4)				
1	Complete a hydrologic study to better understand flood risks and evaluate specific mitigation actions. (Objective 1.1)	X	X			By the end of 2027	Counties	Cities, DNR, IHSMD	IFC
2	Complete a Water Trail Planning project (Objective 3.1). This would also include a review of access points, possible whitewater locations, dams, and other obstructions along the river; an estimate or count of river users; and signage needs (education, river miles, etc.) along the river.			X	X	By the end of 2027	CCBs	Cities, DNR	DNR
3	Develop a water quality model, which might also include statistical analysis of water quality data, watershed and stream assessments, farmer surveys, ACPF mapping, and pollutant source identification.		X			Complete by the end of 2028	SRRWMC	DNR	IFC
4	Apply for grant funding to implement BMPs, education and outreach, or other activities within a project subwatershed	X	X		X	By the end of 2025	SRRWMC	DNR, IDALS	SRRWMC members

PARTNERSHIPS AND POLICY ACTION PLAN

Table 48: Action Plan for Partnerships and Policy Activities

PARTNERSHIPS & POLICY									
#	Action Item and Description	Goals Addressed				Timeline/ Milestones	Primary Activity Lead(s)	Potential Partner(s)	Other Technical or Funding Resources
		Flooding (#1)	Water Quality (#2)	Recreation (#3)	Education (#4)				
1	Integrate the watershed plan with each local county hazard mitigation plan (HMP) during the next review cycle of each HMP. (Objective 1.2)	X				2029	County Emergency Managers	IHSEMD	
2	Expand the coalition membership to all eligible cities, counties, and SWCDs, utilizing a strategy that shows how each community is affected by, or affects, the Shell Rock River (Objective 4.1)	X	X	X	X	By the end of 2024	SRRWMC	SRRWMC members	WMC members
3	Develop a strategy to hire an watershed coordinator.	X	X	X	X	Begin the process in 2024, with a goal to hire in 2025	SRRWMC	SRRWMC members	CFRA, other WMAs

MONITORING AND PLAN EVALUATION ACTION PLAN

Table 49: Action Plan for Monitoring and Plan Evaluation Activities

MONITORING & PLAN EVALUATION									
#	Action Item and Description	Goals Addressed				Timeline/ Milestones	Primary Activity Lead(s)	Potential Partner(s)	Other Technical or Funding Resources
		Flooding (#1)	Water Quality (#2)	Recreation (#3)	Education (#4)				
1	Expand water quality sampling throughout the watershed, by adding 3-5 sites at county lines and major tributaries (Objective 1.5). The data should be shared with the public and be easy to access.	X	X		X	Begin process in 2024, start monitoring in 2025	Counties	CCB naturalists, DNR, IFC, Volunteers, Coe College, ISA	USGS
2	Add a stream level, gaging, or monitoring site at the City of Greene	X	X		X	By the end of 2024	Greene	IFC	USGS

CHAPTER 8. FUNDING AND TECHNICAL RESOURCES

8.01 INTRODUCTION

The power to implement this plan lies with each city, county, and SWCD member of the SRRWMC. The primary role of the WMC is to champion the plan, coordinate member actions within the watershed, and help to leverage resources and partnerships. These resources include both financial and technical assistance. Individual members of the WMC are taxing authorities and may be able to contribute a local match (cash or in-kind funds); however, the WMC does not have this authority or any funds of its own. Therefore, it is important to identify a variety of outside funds to leverage against the limited available local sources. The intent of this chapter is to identify resources that may be available to support implementation.

All available monetary and technical resources will need to be explored and leveraged to achieve the plan goals. This includes partnering with Federal, state, and local governments; academia; nonprofits; businesses; and other local entities (*Figure 74*). The discussion in this chapter focuses on those programs or agencies that are most likely to provide significant funding for projects, BMPs, or other actions items. However, a full listing of organizations and the primary type of assistance they can provide is found in the Project Funding Roadmap in Appendix B. This summary specifies the primary type of assistance (financial and/or technical), along with the primary activities each address (as correlated to the action plan) for each agency or program. It should be noted that during the implementation process, other resources or partners may be identified and should be considered at that time.

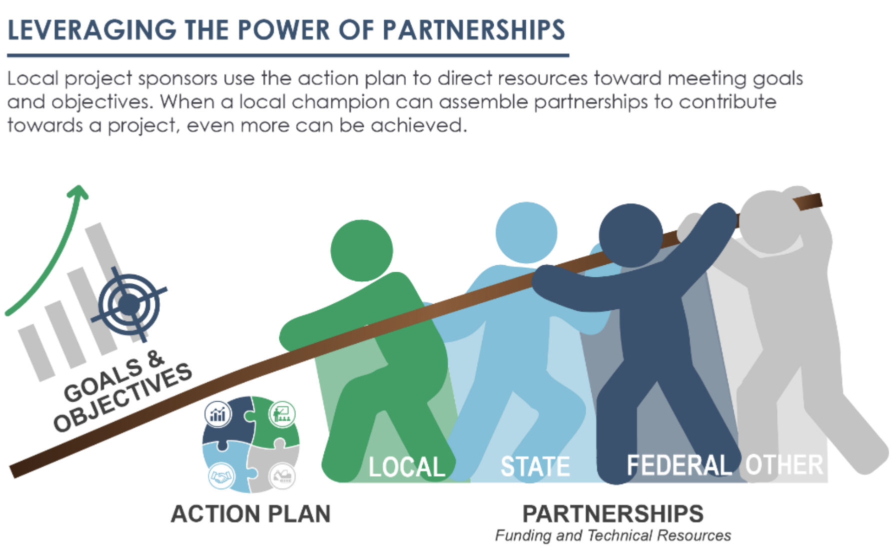


Figure 74: Partners from all levels will be necessary for successful plan implementation.

8.02 FUNDING WORKSHOP AND EDUCATION

There are many grant programs and local funding options presented in this chapter. It is recommended that the WMC hold a “funding workshop” and/or feature regular guest speakers during “learning moments” at regular WMC meetings. These events will help WMC members understand various funding models and programs – and identify those that would fit with the goals of this plan and the resources needed for the watershed.

The following entities should be invited to participate, as they can provide more detailed information on the programs or funding options identified within this chapter.

- IHSEMD, DNR, IDALS, and NRCS
- Center for Rural Affairs
- Iowa Stormwater Education Partnership
- County Auditor
- Iowa League of Cities
- Iowa State Association of Counties
- Watershed Management Authorities of Iowa
- City or County Attorney
- Sand County Foundation
- Other communities that have successfully utilized these options
- Other WMAs or watershed coordinators
- Drainage District Attorney or Auditor
- Iowa Drainage District Association
- Iowa Nutrient Research and Education Council
- Others, as identified

8.03 LOCAL FUNDING FORMULA

Various forms of a local funding formula are a relatively new model that has begun to be explored and utilized by WMAs across Iowa. The strategy is based on a voluntary, per-capita funding formula and involves WMC members contributing funding on a per capita basis, with the formula established upon factors such as population size, acres within the watershed area, and total available budget. For example, the Maquoketa River WMA was able to raise over $50,000 in one year through this strategy.

More information can be found in Appendix B, or online:
https://www.cfra.org/publications/leveraging-local-funds-watershed-improvement.

8.04 WATER QUALITY FUNDING

While there are many options for funding the implementation of water quality BMPs, the WMC should start by looking at the most readily available programs (Table 50). Each funding program has their own requirements that must be met prior to accessing the funding, and many programs typically only fund certain types of practices. However, piecing these programs together for landowners is critical. By providing landowners with multiple funding options and helping them navigate the administrative hurdles, more BMPs will be implemented, and a better leveraging of local match sources will be achieved. It should be noted that while the programs and BMPs identified in Table 50 primarily benefit water quality, many of them have secondary benefits for flood risk reduction and wildlife habitat.

8.05 FLOOD RESILIENCY FUNDING

Improving flood risk reduction, mitigation, or resiliency involves implementing projects, practices, and programmatic changes throughout a community and watershed. There are multiple options to help pay for many of these initiatives; however, the WMC should start by looking at the most readily available programs (Table 51). Each funding program has their own requirements they must meet prior to accessing the funding, and many programs typically only fund certain activities. However, piecing these programs together is necessary to address the many aspects of flood resiliency. By working with multiple programs, the WMC will better leverage local match sources. It should be noted that while the activities identified in Table 51 primarily address flood resiliency, many of them have secondary benefits for water quality.

Table 50: Water Quality BMP Funding Sources

Practice Type (examples) / Funding Agency	DNR		IDALS				FSA	NRCS			Partners			
	Watershed Program (319 Program)	State Revolving Fund (SRF) Sponsored Projects	Iowa Water Quality Initiative (WQI)	Financial Incentives Program	Urban Conservation Program	Conservation Reserve Enhancement Program (CREP)	Conservation Reserve Program (CRP)	Environmental Quality Incentives Program (EQIP)	Agriculture Conservation Easement Program (ACEP)	Conservation Stewardship Program (CSP)	Regional Conservation Partnership Program (RCPP)	Nonprofit Conservation Organizations (PF, DU, NWTF, TNC)	USFWS (various programs)	Practical Farmers of Iowa
Nutrient Management Sidedress N, agronomic rate application, 4Rs, etc.	X		X					X		X	X			X
Tillage No-till, strip till	X		X	X				X		X	X			
Cover Crops Rye, oat, clover, radish, etc.	X		X	X				X		X	X		X	X
Edge-of-Field Erosion Control Grassed waterways, terraces, WASCOBS, ponds, etc.	X	X		X				X		X	X		X	
Edge-of-Field Practices Wetlands, saturated buffers, bioreactors, etc.	X	X	X			*wetlands only*		X		X	X	X	X	
Land Use Changes / Alternative Crops Pasture conversion, buffers, prairie STRIPS, land retirement, crop rotations, wetlands, etc.	X	X		X	X		X	X	X	X	X	X	X	X
Livestock/Small Open Feedlots Waste systems, clean water diversion, vegetative treatment, open lot runoff management, manure management plans, grazing plans / infrastructure, heavy use area protection, etc.	X	X						X		X	X			X
Grazing Lands Management Exclusion fencing, alternative water sources, grazing management plans, stream crossings, etc.	X							X	X	X	X	X	X	
Riparian Area Management Buffers, stream stabilization, grade control, floodplain restoration, oxbow restoration, fish	X	X			X		X	X			X	X	X	
Urban Stormwater BMPs Bioretention, bioswales, rain gardens, permeable pavers, soil restoration, septic systems, etc.	X	X			X									

Table 51: Funding Sources for Flood Resiliency Projects

Action Type (examples) / Funding Agency	Building Resilient Infrastructure and Communities (BRIC)	Flood Mitigation Assistance (FMA)	Hazard Mitigation Grant Program (HMGP)	Public Assistance Section 406	Community Development Block Grants	Water Waste Disposal Loan & Grant Program	Flood Plain Management Program	Watershed and Flood Prevention Operations (WFPO or PL-566)	Emergency Watershed Protection Program (Recovery and Floodplain Easements)	Agricultural Conservation Easement Program
	FEMA / HSEMD				HUD	USDA	DNR	NRCS		
Acquisition / Demolition / Relocation	X	X	X						X	X
Structure Elevation	X	X	X							
Floodproofing Structures	X	X	X							
Local Flood Risk Reduction Projects bridge/culvert replacement, storm system upgrades, detention cells	X	X	X	X	X	X		X	X	X
Green Infrastructure (Urban Drainage) green space, rain gardens, infiltration basins, bioswales			X		X	X			X	
Non-localized Flood Risk Reduction Projects bridges, dams, levees, detention cells, channel widening, diversion channels	X		X	X	X	X		X	X	
Structural Retrofits dam and detention cell rehabilitation	X	X	X	X	X	X		X		
Administrative Actions building code and floodplain management ordinance updates and enforcements	X		X				X			
Social Vulnerability flood awareness and education programs, community rating system (CRS), warning systems		X			X					
Floodplain Mapping Improved mapping products, Risk MAP		X	X					X		
Mitigation Planning Parcel-leve planning, flood mitigation plan, drainage studies, watershed plan, GIS inventory, flood risk assessment			X		X					

8.06 KEY STATE AND FEDERAL RESOURCES

There are several key agencies and programs that will be important to explore for funding and technical assistance. Each one of these programs will bring a unique set of opportunities and individual priorities that must be aligned with those of the WMC members and partners. The WMC should help start an initial dialog with each agency. The intent is to identify possible partnership opportunities and to be best positioned for when funding becomes available. The section below highlights primary programs that may be of interest to the WMC. It should be noted that participation with any of these entities will depend on the alignment of goals between the WMC, stakeholders, and the funding agency.

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

FEMA funding is administered via Iowa Homeland Security & Emergency Management (HSEMD). Local communities should work with FEMA and the Iowa Department of Natural Resources (IDNR) on floodplain management issues. Many flood mitigation projects are specifically eligible and of high priority for FEMA under existing funding programs. County emergency managers and their communities should work with HSEMD on obtaining project funding through the hazard mitigation assistance (HMA) program under one of the following programs:

- **Hazard Mitigation Grant Program (HMGP):** https://www.fema.gov/grants/mitigation/hazard-mitigation
- **Building Resilient Infrastructure and Communities (BRIC) Program:** https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities
- **Flood Mitigation Assistance (FMA):** https://www.fema.gov/grants/mitigation/floods

US ARMY CORPS OF ENGINEERS (USACE) – ROCK ISLAND DISTRICT

USACE has multiple programs that can be tapped to obtain assistance for both planning and implementation type projects. USACE should be contacted by the WMC about the following programs:

- **Section 14 – Emergency Streambank and Shoreline Protection:** https://www.saj.usace.army.mil/Sect14EmergencyStreambankProtection/
- **Section 22 – Planning Assistance to States:** https://www.nae.usace.army.mil/missions/public-services/planning-assistance-to-states/
- **Section 206 – Aquatic Ecosystem Restoration:** https://www.saj.usace.army.mil/Sect206AquaticEcosystemRestoration/

UNITED STATES DEPARTMENT OF AGRICULTURE (USDA)

The USDA has two primary programs that should be considered:

- **The Water and Waste Disposal Loan & Grant program.** This program provides low interest loans or grants to finance drinking water, storm water drainage, and waste disposal systems for rural communities with 10,000 or fewer residents. In 2018, the USDA awarded $256 million to 81 projects in 35 states through this program. https://www.rd.usda.gov/programs-services/water-environmental-programs/water-waste-disposal-loan-grant-program
- The **Conservation Reserve Program (CRP)** is a long-standing conservation program that is used to fund the establishment of permanent vegetation such as crop conversions and buffers. https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/

US FISH AND WILDLIFE SERVICE (USFWS)

The USFWS currently can help implement projects through the Partners for Fish and Wildlife Program, which provides technical assistance and cost-share incentives directly to private landowners to restore fish and wildlife habitat. The WMC should explore a possible working relationship with the USFWS to enhance these efforts.
https://www.fws.gov/program/partners-fish-and-wildlife

NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

NRCS has long standing relationships with many farmers in the WMC. Through both the state and local offices NRCS provides conservation assistance (financial and technical) through various programs. There are many NRCS programs, and thus the WMC should work to form a partnership with each local NRCS office to learn about each program, and how they can be promoted and utilized to achieve common goals. Programs include:

- Environmental Quality Incentives Program (EQIP): https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/
- Conservation Stewardship Program (CSP): https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/
- Regional Conservation Partnership Program (RCPP): https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/rcpp/
- Watershed and Flood Prevention Operations (WFPO or PL-566): https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/landscape/wfpo/

IOWA DEPARTMENT OF NATURAL RESOURCES (IDNR)

The IDNR has multiple primary programs that the WMC should consider:

- The **Resource Enhancement and Protection (REAP) Program** can provide funding for conservation education as well as on-the-ground BMPs. Counties, cities, and nonprofits can apply for this grant. https://www.iowadnr.gov/Conservation/REAP
- The **Private Lands Program** provides technical assistance and can help secure funding to private landowners interested in installing BMPs. The WMC can work with the local IDNR biologists to identify landowners and to assist in conservation efforts. https://www.iowadnr.gov/conservation/wildlife-landowner-assistance
- IDNR administers the **Flood Plain Management and Dam Safety Programs** which can be consulted to assist in various flood mitigation projects and local floodplain ordinance development. https://www.iowadnr.gov/Environmental-Protection/Land-Quality/Flood-Plain-Management
- The **Lake and River Restoration Program**, as well as the **Watershed (Section 319) Program** all have funding and technical assistance available to help implement projects and BMPs within priority watersheds or waterbodies. https://www.iowadnr.gov/Environmental-Protection/Water-Quality
- The **IDNR Water Trails Program** provides technical assistance and grant funding to study, create, and develop water trails across Iowa. https://www.iowadnr.gov/things-to-do/canoeing-kayaking/water-trail-development
- The **State Revolving Fund (SRF) Sponsored Projects** program can fund a wide variety of water quality projects through low-interest loans. For communities already utilizing SRF funding for water infrastructure projects (drinking or wastewater), a portion of the interest paid can be redirected towards water quality improvement projects. This lets the overall interest rate to be reduced and allows the community to finance two projects for the cost of one. https://www.iowasrf.com/index.cfm
- The **Water Quality Financing Program** is a relatively new low interest rate program established through SF512 in 2018. The program is administered by the Iowa Finance Authority in partnership with the IDNR and IDALS. It is focused on helping project sponsors implement BMPs from the Iowa Nutrient Reduction Strategy.
- Funding from the **Grants to Counties Water Well Program** is made available to local county health departments to provide financial assistance to their residents for private water well services. The program is administered through the Iowa Department of public Health, through close coordination with IDNR. Additional information: https://idph.iowa.gov/Environmental-Health-Services/Grants-to-Counties-Water-Well-Program
- The IDNR **County Creek Sign Grant Program** began in 2014 provides funding to DOT, cities, and counties to install creek signs at bridges. This helps to not only build awareness but to motivate the public to adopt water quality actions.

IOWA DEPARTMENT OF AGRICULTURE AND LAND STEWARDSHIP (IDALS)

IDALS has numerous programs available that would greatly enhance the WMC's efforts towards plan implementation. Many of these are funneled through a local SWCD, which can take the lead in contacting regional coordinators or urban conservationists to assist in accessing these programs. Given the IDALS well established state funding and existing contacts with farmers, the WMC should establish a strong working relationship with IDALS to achieve common goals utilizing one or more the following programs:

- Conservation Reserve Enhancement Program (CREP)
- Iowa Financial Incentives Program
- Urban Conservation Program
- Water Quality Initiative (WQI)
- Batch and build water quality projects
- Low interest loan available for drainage district improvements
- District Buffer Initiative

IDALS is available online at https://iowaagriculture.gov/.

8.07 LOCAL FUNDING OPTIONS

PUBLIC FUNDS

While outside funding from grants, loans, or other sources will be needed to fully implement this plan, there is also a need for local match (cash or in-kind). This may be required for matching funds to grants, to leverage against other funds, to pay staff that can coordinate and apply for other funding sources, or to simply pay for projects directly. Each WMC member and stakeholder is unique in its financial resources available and taxing structure; therefore, the following options are meant to be flexible and to inspire the WMC members to develop something that fits them best.

IN-KIND SERVICES

Many grant programs allow all or a portion of the "local match" to be made up of in-kind services instead of a cash match. In-kind contributions typically include the work of local government staff or materials towards a specific project. This might be coordination, landowner outreach, public education, or completing technical work they are qualified to do. Communities need a consistent and reasonable way to document, track, and report in-kind services in order for them to count towards match on grant funded projects.

GENERAL FUND DOLLARS

A portion of a community or county's general funds could be budgeted towards the implementation of this plan. This could be for specific projects, programs, or administrative costs of the WMC. The WMC could also consider establishing a general fund to which each member contributes. A common use of this fund among other WMCs is to hire a watershed coordinator. By having a paid watershed coordinator, the WMC would be able to pursue other grant funds, essentially leveraging local funding to bring outside funding into the community for project implementation.

CAPTIAL IMPROVEMENT FUND

A city may establish a reserve fund for capital improvement projects. This fund is built using tax revenue on a yearly basis, which is levied for the fund to accumulate money for the financing of specified capital improvements or to carry out a specific capital improvement plan. While it does take several years to build up a fund capable of making major improvements, this fund allows a city to save for specific projects without the need for issuing debt (bonds). When the city bonds for a project or to make a larger purchase, the city pays interest on those bonds.

PERMIT, FEES, AND DEVELOPER CONTRIBUTIONS

Communities can establish new fees, earmark a portion of existing permit and fee structures, and/or establish requirements for developer contributions for new development in flood prone areas or areas that may contribute to water quality problems. The proceeds can be accumulated into a separate fund that is tied to specific project types. One kind of these fees is known as a stormwater utility fee, which is discussed below.

STORMWATER UTILITY FEE

A stormwater utility is a stand-alone city utility that is used to pay for capital improvements, operations, maintenance, and meeting federal/state permit obligations. Rates are typically based on the quantity of hard surface (or impervious area) on a property. This funding option can be used to help pay for urban stormwater improvements or flood mitigation projects.

GENERAL OBLIGATION BONDS

General obligation bonds are backed by property taxes and are issued by a city or county for a wide array of community betterment projects. These are typically best suited for infrastructure projects.

LOCAL OPTION SALES TAX (LOST)

LOST is a special-purpose tax implemented and levied at the city or county level. A local option sales tax is often used as a means of raising funds for specific local area projects. Jurisdictions that don’t already exercise a LOST, or those that already do, could consider targeting LOST funds towards projects identified in this plan.

SPECIAL ASSESSMENT DISTRICTS

Certain improvements can be financed by special assessments. This method of financing is a tax upon a property owner for a portion of the costs incurred by the city for a particular improvement. This could be considered for a variety of projects, especially urban stormwater improvements or flood mitigation projects.

TAX INCREMENT FINANCING (TIF)

Tax Increment Financing (TIF) is a tool that encourages private development in areas experiencing blight and disinvestments, typically areas in or near downtown. A TIF program provides a method for financing public costs (roads, sewer, infrastructure, etc.) associated with a private development project by using the projected increase in property tax revenue, which would be a result of the new development bringing increased value to the property. This could be considered for a variety of projects, especially urban stormwater improvements or flood mitigation projects.

LEASE PURCHASE PROGRAM

A lease-purchase agreement allows a city to purchase and use an item while making payments on the item. These items include pieces of equipment, such as fire trucks, or real estate, such as land or buildings. These agreements are similar to private "rent-to-own" agreements. It is very important that cities consult with their bond attorney to ensure the agreement is worded in such a manner to benefit the city.

UTILITY FRANCHISE FEE

In 2009, Iowa authorized cities to charge up to 5 percent in franchise fees on gas and electric bills. All revenues collected must be deposited in a separate account from the city's general fund. These funds can only be used for authorized purposes, which includes the repair, remediation, restoration, cleanup, replacement, and improvement of existing public improvements and other publicly owned property, buildings, and facilities, projects designed to prevent or mitigate future disasters, and the establishment, construction, reconstruction, repair, equipping, remodeling, and extension of public works, public utilities, and public transportation systems. These purposes could include projects or portions of a project that are intended to improve water quality or flood resiliency.

8.08 PRIVATE FUNDS

While outside financial assistance is important to help implement BMPs, existing programs rarely cover 100% of all project or BMP costs. It is also important that willing landowners, citizens, farm operators, etc. have a "stake in the game". Many BMPs and practices require long term maintenance or behavior changes. Ensuring individuals are invested in the success of a particular BMP will help ensure they continue the maintenance or behavioral change into the future. These costs will vary by practice type and by the extent of funding received from other sources. Financial assistance through incentives is necessary for many conservation measures, particularly for smaller farmers that may not be able to afford to install more costly measures.

8.09 NONPROFITS AND PRIVATE FOUNDATIONS

Successfully implementing this plan will require creative approaches to project funding. A broader range of funding resources will create opportunities for additional implementation options. Alternative funding sources can sometimes be found at the regional or local level through partnerships with private sector businesses, private foundations, and other nonprofit organizations. Creativity is often needed in fitting various funding sources together to ensure project objectives are met, while also meeting the purposes of each funding source.

This may lead to finding project benefits through secondary effects, or piggy backing projects together. For example, a “trail project” may provide an opportunity to improve an area’s hydrology, install educational activities, or implement streambank stabilization structures. Another example can be found through the wildlife habitat programs that IDNR or various conservation nonprofits have. Many of these program activities, such as wetland restoration or other habitat improvements, provide secondary benefits to water quality or flood resiliency.

The following options for partnerships (Table 52) have been identified due to the possibilities for working together as financial and/or technical resources, and because they have a track record of success. However, forming successful partnerships is not as clear-cut as applying for grants.

Successful partnerships involve engaging a broad spectrum of stakeholders, each with diverse programs and interests, and employing combinations of resources (both directly and indirectly) t to solve problems. The reality is that significant increases in government funding to address flooding or water quality issues are not apparent on the immediate horizon and the WMC will need to be creative, cooperative, and proactive to realize implementation on a meaningful level. Table 52 should not be considered all-inclusive, as other options may be identified during the implementation process and should be considered at that time.

Table 52: Options for Local Partnerships

Nonprofits	
Iowa Land Improvement Contractors Association (LICA)	
Iowa Stormwater Education Partnership	
Citizens groups (Rotary, etc.)	
Northern Iowa Area Community College	
Diamond Jo Casino (via Worth County Development Association)	
Iowa State University	Leopold Center for Sustainable Agriculture
	Iowa Learning Farms
	Prairie STRIPS
	Extension
Conservation Organizations	Groundwater Foundation
	The Nature Conservancy
	Izaak Walton League
	Pheasants Forever – both state level and local chapters
	Ducks Unlimited
	National Wild Turkey Federation
	Iowa Natural Heritage Foundation
	Sand County Foundation
	Center for Rural Affairs
Agriculture Associations	Iowa Soybean Association (ISA)
	Iowa Corn Growers Association
	Iowa Cattlemen's Association
	Iowa Pork Producers Associations
	Soil Health Partnership
	Women, Land, and Legacy Program
	Practical Farmers of Iowa
	Women Food and Agricultural Network
Corporate Foundations, Grants, or Giving (types of entities to consider)	
Co-Ops and other agricultural businesses (implement, sales, and equipment dealers)	
Feedlots or other larger farming operations	
Wineries or other similar types of agritourism businesses	
Local businesses	
Corporate businesses (Wal-Mart, John Deere, casinos, railroads etc.)	
Other endowments or community foundations	
Fund Raising Campaigns	
Crowdfunding (GoFundMe, Kickstarter, etc.)	
Traditional fund raisers (raffles, sales, etc.)	

8.10 ALTERNATIVE FUNDING OPTIONS

PAY FOR SUCCESS

A Pay-for-Success (PFS) program is a financing structure which leverages private investment to achieve outcomes with a public benefit (Figure 75). PFS projects are designed to attract private capital to conservation, broadening the funding base available for programs and infrastructure improvements. This structure benefits communities by getting projects and BMPs on the ground which have direct benefits to their community, while significantly reducing financial risk.

Essentially, the investors and service providers take on the risk of a project (flood project, BMPs, etc.), anticipating that successful outcomes will bring returns that make shouldering the costs worthwhile. These returns can be financial, but they also include social or environmental outcomes (flood risk reduction, water quality, etc.). The local government pays for outcomes, not practices or interventions, lowering risk and ensuring that public funds go towards effective and proven solutions. Conservation Innovation Grants, a program from the NRCS, may be a great starting point for the WMC to begin a pilot PFS program.

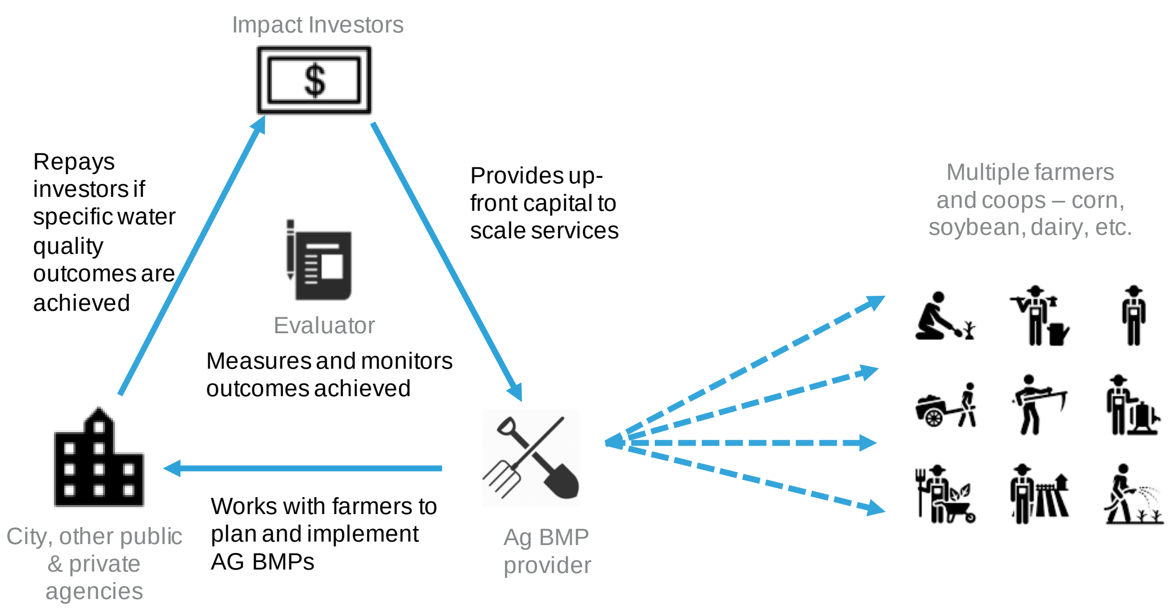


Figure 75: Pay for Success Financing Model

WETLAND BANKING INSTRUMENT

A mitigation bank is a wetland, stream, or other aquatic resource area that has been restored, established, enhanced, or preserved for the purpose of providing compensation for unavoidable impacts to aquatic resources as permitted under Section 404 (of the U.S. Clean Water Act) or a similar state or local wetland regulation. A mitigation bank may be created when a government agency, corporation, nonprofit organization, or other entity undertakes these activities under a formal agreement with a regulatory agency.

In a typical mitigation bank, a government agency or a firm acquires a large tract of land and restores or creates wetlands. Based on the extent and type of wetlands restored, “credits” are earned which can then be sold to those who need them to satisfy mitigation requirements on their own projects. If the WMC or one of its members were to establish a mitigation bank, not only would the available credits assist in permitting some flood resiliency or water quality projects, but the income generated could be used to help pay for those projects.

IN-LIEU FEE MITIGATION PROGRAM

An In-Lieu Fee (ILF) is one method of compensatory mitigation for damages to the environment. It is used to compensate for impacts or unavoidable losses to wetlands and streams due to development, road-construction, or other projects. With ILFs, mitigation occurs when a permittee provides funds to an in-lieu-fee sponsor (e.g. a public agency or non-profit organization). In most cases, the sponsor collects funds from multiple permittees to pool the financial resources necessary to plan for, build, and maintain a mitigation or ecosystem restoration site. Like mitigation banking, in-lieu fee mitigation is often “off-site.” Unlike mitigation banking, it typically occurs after the permitted impacts.

IDNR has investigated the feasibility of an in-lieu fee compensatory mitigation program (ILF program) to serve the needs of stream mitigation work for USACE permittees in Iowa. This process was initiated in response to conversations with various constituent groups and complements IDNR’s work on other river restoration initiatives, including the River Restoration Best Management Practices Toolbox and Iowa Stream Mitigation Method. Work to date has culminated in the document titled “In-Lieu Fee Market Assessment and Alternatives Analysis,” (Bentley and others, 2017). Analysis has shown that an IDNR-sponsored ILF program could be financially sustainable. The WMC should continue to monitor the development of the ILF program as it could be a valuable source of project funding in the future.

WATER QUALITY TRADING

Water quality trading programs are used in various places throughout the United States to make water quality permit compliance easier, raise funds for projects, and ultimately improve the water quality of streams and lakes. This type of program focusses on incentives instead of penalties to achieve goals. A trading program can be operated on various scales, but the larger the better.

The Iowa Nutrient Reduction Exchange (NRE) is in early stages of framework development, and currently four communities are participating: Dubuque, Cedar Rapids, Storm Lake, and Ames.

8.11 SUMMARY AND RECOMMENDATIONS

Ultimately, funding will be needed to implement this watershed plan. This chapter has presented many options and ideas; however, it will be up to the WMC to pursue these sources. Therefore, there is only one recommendation found in this chapter:

- **Hold a Funding Workshop or Devote Regular WMC Meeting Agenda to Funding**
    - The WMC should consider holding a "funding workshop" and/or feature regular guest speakers at the quarterly WMC meetings. These events will help WMC members understand various funding models and programs – and identify those that would fit with the goals of this plan and the resources needed for the watershed.
    - The following entities should be invited to participate, as they can provide more detailed information on the programs or funding options identified within this chapter.
        - IHSEMD, DNR, IDALS, and NRCS
        - Center for Rural Affairs
        - Iowa Stormwater Education Partnership
        - County Auditor
        - Iowa League of Cities
        - Iowa State Association of Counties
        - Watershed Management Authorities of Iowa
        - City or County Attorney
        - Sand County Foundation
        - Other communities that have successfully utilized these options
        - Other WMAs or watershed coordinators
        - Drainage District Attorney or Auditor
        - Iowa Drainage District Association
        - Iowa Nutrient Research and Education Council
        - Others, as identified

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LIST OF ABBREVIATIONS AND ACRONYMS

ACPF	Agricultural Conservation Planning Framework
AFO	Animal Feeding Operation
AQuIA	Iowa Water Quality Database
ASL	Above Sea Level
BFE	Base Flood Elevation
BMP	Best Management Practice
BRIC	Building Resilient Infrastructure and Communities
CAFO	Concentrated Animal Feeding Operation
CCB	County Conservation Board
CFS	Cubic feet per second
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CSA	Critical Source Area
CSP	Conservation Stewardship Program
CTIC	Conservation Technology Information Center
DEP	Daily Erosion Project
DNR	Department of Natural Resources
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
FEMA	Federal Emergency Management Agency
FFA	Future Farmers of America
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
ft^3/s	Cubic feet per second
GIS	Geological Information System
GLO	General Land Office
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HSEMD	Homeland Security & Emergency Management
HSG	Hydrologic Soil Groups
HUC	Hydrologic Unit Code
IDALS	Iowa Department of Agriculture and Land Stewardship
IDNR	Iowa Department of Natural Resources
IEDA	Iowa Economic Development Authority
IFC	Iowa Flood Center
IFIS	Iowa Flood Information System
IHSEMD	Iowa Homeland Security Emergency Management Division
ILF	In-Lieu Fee
IR	Integrated Report
ISA	Iowa Soybean Association
ISU	Iowa State University
ISWEP	Iowa Stormwater Education Partnership
KDHE	Kansas Department of Health and Environment
LICA	Land Improvement Contractors Association

LOST	Local Option Sales Tax
MCL	Maximum Contaminant Level
Mg/L	Milligrams per liter
MS4	Municipal Separate Storm Sewer Systems
NASS	National Agricultural Statistics Service Information
NCEI	National Centers for Environmental Information
NFIP	National Flood Insurance Program
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRE	Nutrient Reduction Exchange
NRS	Nutrient Reduction Strategy
NWI	National Wetland Inventory
NWS	National Weather Service
OpTIS	Operation Tillage Information System
OWTS	Onsite Wastewater Treatment System
PFS	Pay-for-Success
PPJV	Prairie Pothole Joint Venture
PPR	Prairie Pothole Region
PRC	Pollutant Reduction Calculator
RCPP	Regional Conservation Partnership Program
REAP	Resource Enhancement and Protection
SGCN	Species of Greatest Conservation Need
SIPES	Social Indicator Planning and Evaluation System
SPARROW	Spatially Referenced Regression on Watershed attributes
SRF	State Revolving Fund
SRRWMC	Shell Rock River Watershed Management Coalition
STRIPS	Science-based Trials of Rowcrops Integrated with Prairie Strips
SWCD	Soil and Water Conservation District
T&E	Threatened and Endangered
TIF	Tax Increment Financing
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WASCOB	Water and Sediment Control Basin
WBD	Watershed Boundary Dataset
WFPO	Watershed and Flood Prevention Operations
WMA	Watershed Management Authority
WMC	Watershed Management Coalition
WMD	Wetland Management District
WQI	Water Quality Initiative
WQS	Water Quality Standards
WWTF	Wastewater Treatment Facility