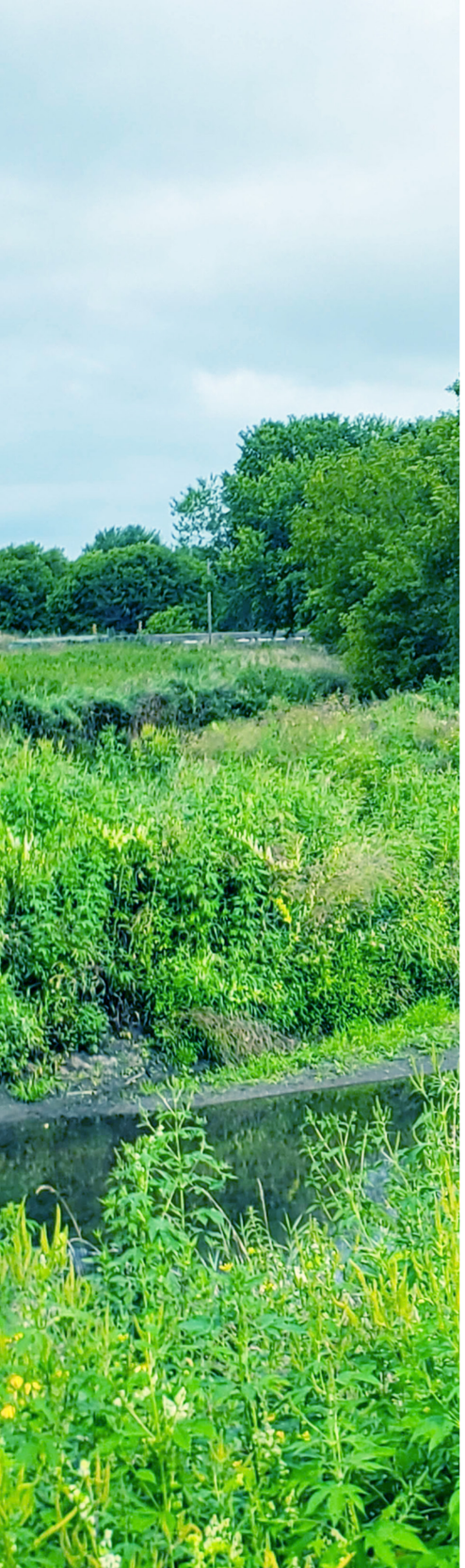
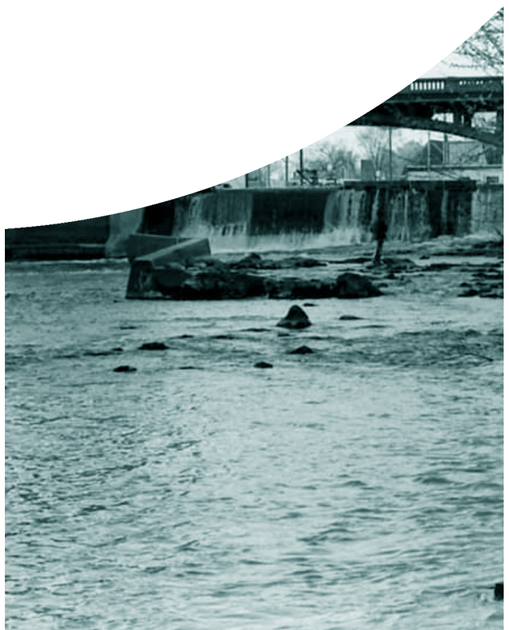


# Maquoketa River
## Watershed Management Plan

**May 2021**

Prepared by Iowa Initiative for Sustainable Communities (IISC)
for Maquoketa River Watershed Management Authority (MR WMA)



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# Acknowledgements


- City of Andrew
- City of Baldwin
- City of Cascade
- City of Delaware
- City of Delhi
- City of Dyersville
- City of Epworth
- City of Goose Lake
- City of Hopkinton
- City of Lamont
- City of La Motte
- City of Manchester
- City of Maquoketa
- City of Monticello
- City of New Vienna
- City of Preston
- City of Ryan
- City of Spragueville
- City of Strawberry Point
- City of Worthington
- City of Wyoming

- Buchanan County
- Clinton County
- Delaware County
- Dubuque County
- Jackson County
- Jones County
- Linn County

We would like to extend our sincere gratitude to the Maquoketa Watershed stakeholders, without whom the plan wouldn't have been possible. Special thanks to our project partners whose support has been crucial during the plan development:

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- The University of Iowa
- The University of Iowa School of Planning and Public Affairs
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- Alumni Mentor: Ben Curtis
- Maquoketa River Watershed Management Authority (MR WMA)
- MR WMA Project Partners: Lori Scovel and Jeff Tisl
- City of Manchester

## Thank You!


## Land Acknowledgements

The Maquoketa River Watershed is located on the homelands of the Ojibwe/Anishinaabe (Chippewa), Báxoǰe (Iowa), Kikapú (Kickapoo), Omāēqnomenēwak (Menominee), Myaamiaki (Miami), Nutachi (Missouri), Umoǰhoǰ(Omaha), Wahzhazhe (Osage), Jiwere (Otoe), Odawaa (Ottawa), Páǰka (Ponca), Bodéwadmi/Neshnabé (Potawatomi), Meskwaki/Nemahahaki/Sakiwaki (Sac and Fox), Dakota/Lakota/Nakoda (Sioux), Sahnish/Nuxbaaga/Nuweta (Three Affiliated Tribes) and Ho-Chunk (Winnebago) Nations. The following tribal nations, Umoǰhoǰ(Omaha Tribe of Nebraska and Iowa), Páǰka (Ponca Tribe of Nebraska), Meskwaki (Sac and Fox of the Mississippi in Iowa), and Ho-Chunk (Winnebago Tribe of Nebraska) Nations continue to thrive in the State of Iowa and we continue to acknowledge them.

As Watershed Management Planners, it is our responsibility to acknowledge the sovereignty and the traditional territories of these tribal nations, the treaties that were used to remove these tribal nations, and the histories of dispossession. Understanding the historical and current experiences of Native peoples will help inform the work we do.[1]

# EXECUTIVE SUMMARY

The Maquoketa River Watershed Management Plan is a regional community-driven plan with the goal to identify, prioritize, and address water-related issues such as water quality and flood mitigation. This plan serves as a guidebook and vision for the future for the member cities, counties, and Soil & Water Conservation Districts, offering a long-range perspective and ways to improve water quality and mitigate flooding throughout the watershed. The topics that the plan addresses include but are not limited to agricultural practices, water quality, present & future flooding, improved recreation, protection of the river ecosystem, and conservation practices.

## The Maquoketa River Watershed Management Authority (MR WMA)

The Maquoketa River Watershed is one of 11 tributaries to the Mississippi River, and drains water from 1870 square miles within the Mississippi River Basin. The watershed is located at the eastern part of the state of Iowa and includes 80 townships and 9 counties (Delaware Jackson, Jones, Dubuque, Clinton, Buchanan, Fayette, Clayton, and Linn Counties).

2010 Iowa legislation authorized the creation of Watershed Management Authorities. A Watershed Management Authority (WMA) is a mechanism for cities, counties, Soil and Water Conservation Districts (SWCDs), and stakeholders within an 8-digit Hydrologic Unit Code (HUC-8) to cooperatively engage in watershed planning and management. WMAs are governed by a Board of Directors and adopt by-laws.

The Maquoketa River Watershed Management Authority (MR WMA) applied to the state in 2017 and was officially recognized on October 24, 2017.

In 2020 the MR WMA partnered with the Iowa Initiative for Sustainable Communities from the University of Iowa. Through this partnership, graduate students from the School of Planning and Public Affairs developed a watershed management plan that will lead the MR WMA towards achieving its goals.

## PLANNING PROCESS

The planning process was divided into three key phases: research & data gathering, community engagement, and goal and objective setting. The first two phases informed the content and prioritization of the goals, objectives, strategies, and actions.

## COMMUNITY ENGAGEMENT

The ability to create effective and lasting change starts with knowing the community's priorities, goals, values, and abilities, which can only be done by communicating and engaging with the community. This includes reaching out to all communities within the watershed and developing a number of options to exchange information. Because of several social distancing protocols established in the State of Iowa due to the Covid-19 Pandemic, communities and officials were contacted with minimum physical exposure.

Engagement was focused around the following key stakeholder groups: urban residents, rural residents, agriculture, urban leaders & watershed government, MR WMA members, and recreation. They were engaged through multiple strategies.

### Stakeholder Survey

The Stakeholder Survey aimed to understand the respondents values, beliefs, and experiences related to watershed issues. These results helped inform public participation and the goals, objectives, and strategies of the plan. The questions dealt with water quality, flooding, recreation, impacts on water issues, conservation, and farming. The survey remained open for informing the plan from December 2020 through March 2021. It was taken by over 400 respondents. These respondents were from many different areas of the watershed and provided a wide range of perspectives that informed the plan.

### Focus Groups

Five focus groups were conducted to build a better understanding of stakeholder perceptions of water quality, water policy processes and decisions, and watershed management plan development. Focus groups were conducted for the following stakeholder groups: Recreation, Urban Leaders, Upper Maquoketa Agriculture, Lower Maquoketa Agriculture, and North Fork of Maquoketa Agriculture. These groups expanded upon results from the survey and provided depth to better solve watershed issues.

### Photo Voice

An online platform was provided for communities to post photos and stories that reflect their connection to the Maquoketa River Watershed. During the development of this plan, 10 submissions were received in the website.

### Public Input Meeting

The public was invited to give input and prioritize the goals and objectives of the plan. These comments helped reword and reorganize the goals and objectives to better suit the residents of the watershed.

# KEY RESEARCH FINDINGS

## Demographics

- The largest towns in the watershed are **Maquoketa** (6,026 people), **Manchester** (5,037 people), **Dyersville** (4,110 people), **Monticello** (3,835 people), and **Cascade** (2,078 people).
- The Maquoketa River Watershed has approximately **72,118** people as of 2018.

## Land Cover, Topography, and Soils

- The watershed is covered primarily by **row crop** and **pasture** agricultural land. **95%** percent of the watershed is privately owned.
- Rock exposures, quarries, shallow bedrock, and steep bluffs are common characteristics of the watershed.
- **Karst topography** is common in the watershed, and sinkholes are scattered throughout the watershed, with the greatest concentration occurring in Jackson County.
- The infiltration abilities of soil determine how much water stays in the soil, trickles into groundwater supplies, and runs off into streams and rivers. With greater amounts of water run-off, soil erosion increases. Overall, **erosion due to runoff from cropland** accounts for **90% of soil erosion** in the area.

## Hydrology and Flooding

- Across the Midwest, **intense precipitation** has increased substantially in recent decades. Although these factors increase the risk of flooding, studies have shown that the risk can be minimized by monitoring land cover changes and policy on natural drainage feature retention.
- The Maquoketa River Watershed's **runoff** levels show an increasing trend for the last eleven decades. There has also been a change in the difference between the highest and lowest runoff levels throughout the years, which signifies increasing **irregularity** and a higher **risk of flood and drought** events as well as soil erosion, sedimentation, and pollutant wash-off from urban surfaces.
- Major flooding events within the watershed occurred in **1925, 1944, 1947, 2002, 2004, 2008** & **2010.**

## Water Quality

- In 2018, **16 streams and 3 lakes** were listed as **impaired** waters in the Maquoketa River Watershed. Among those, 15 streams and 2 lakes are listed as impairment requiring total maximum daily load regulation.
- In 2018, 'fish loss due to animal waste' was identified as a new cause of impairment for stretches of the following three streams: Whitewater Creek, Hickory Creek, and North Fork Maquoketa River.

## Wildlife and Habitat

- **23 animal and 67 plant species** are listed as threatened, endangered, or of concern within the watershed.

# GOALS AND OBJECTIVES

Goals and objectives of the plan focus around 5 key pillars of watershed management: Water Quality, Flood Mitigation, Ecosystem Protection, Community Education & Outreach, and Organizational Representation. These goals and objectives can be achieved through strategies and specific actions.

**Goal 1** Improve water quality through techniques for nutrient management, erosion reduction, and increased infiltration

**Goal 2** Improve watershed flood management

**Goal 3** Increase watershed awareness and involvement among stakeholders

**Goal 4** Preserve, protect and improve ecologically sensitive habitats and ecosystems in the watershed

**Goal 5** Establish the WMA as a trusted community resource

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# 01 Introduction

Purpose of the Plan

Sustainability Statement

*Figure 1: River Runner Regatta-Manchester*

*Source: Photo Voice, Maquoketa River Watershed Stories*

# Purpose of the Plan

**The Maquoketa River Watershed Management Plan** is a regional community-driven plan with the goal to identify, prioritize, and address water-related issues such as water quality, flood mitigation, as well as soil preservation. Because the watershed encompasses multiple jurisdictions and populations, one of the primary goals of the watershed management plan is effective stakeholder involvement and collaboration. These stakeholders include organizations such as water preservation offices, watershed management authorities, communities, and counties. To accomplish this goal, the Iowa Initiative for Sustainable Communities (IISC) Watershed Planning Team, the Maquoketa River Watershed Management Authority (MR WMA), and communities within the watershed prioritize public engagement, seek out public input, and work with local groups and clubs that directly interact with the Maquoketa River and its watershed.

Spanning portions of nine counties, the Maquoketa River Watershed connects eastern Iowa to the Mississippi River in Jackson County. Because of the varying characters and priorities of the people within the watershed, it is vital to create a cohesive guidebook to assist with managing water quality and quantity. **This plan begins that journey...**

**This Plan is...**

- A guide to decision making
- A framework for more specific planning
- An educational tool
- A long range perspective
- A way to improve our quality of life

**This Plan is not...**

- A zoning ordinance
- A land development code
- A capital improvement plan or budget
- A development plan for a specific project

## This plan is to be used by

cities and counties to evaluate and make recommendations to the planning commissions and councils on regulatory and policy changes. It should also be used by citizens and community groups to understand the watershed's long-range plans and proposals for different geographical areas and to encourage plan implementation.

## The plan is an educational tool

used to inform and involve residents regarding the significance of the watershed, the role it plays in the larger ecosystem of the Mississippi River Watershed, and the dead zone in the Gulf of Mexico off of the Louisiana coast. Policies in this plan help residents and visitors of the Maquoketa River Watershed to find the impact of the Maquoketa River in the socio-economic development of the region as well as its importance regarding the health, safety, and welfare in their daily lives.

## This plan acts as a guidebook

and vision for the future, offering a long-range perspective, and ways to improve water quality and mitigate flooding throughout the watershed. The topics that the plan addresses include but are not limited to: agricultural practices, water quality, present, and future flooding, improved recreation, protection of the river ecosystem, and conservation practices.

### DID YOU KNOW ?

The Maquoketa River Watershed spans **9** counties of Iowa:

- Delaware
- Jackson
- Jones
- Dubuque
- Clinton
- Buchanan
- Fayette
- Clayton
- Linn

# Sustainability Statement

**Sustainability** means to create and maintain conditions under which humans and nature can exist in productive harmony, permitting the social, environmental, and economic viability of current and future generations.

**Sustainability Statement: Be a leader in Iowa watershed management, protect the Maquoketa River's resources, improve water quality, reduce flood impact, and ensure a healthy watershed for future generations.**

### Communities...

Continued protection of human health by providing clean drinking water and protecting the environment while fostering economic prosperity and societal wellbeing.

### Farmers...

Ensuring the economic viability of farms and farming in perpetuity through land and water stewardship.

### Ecosystems...

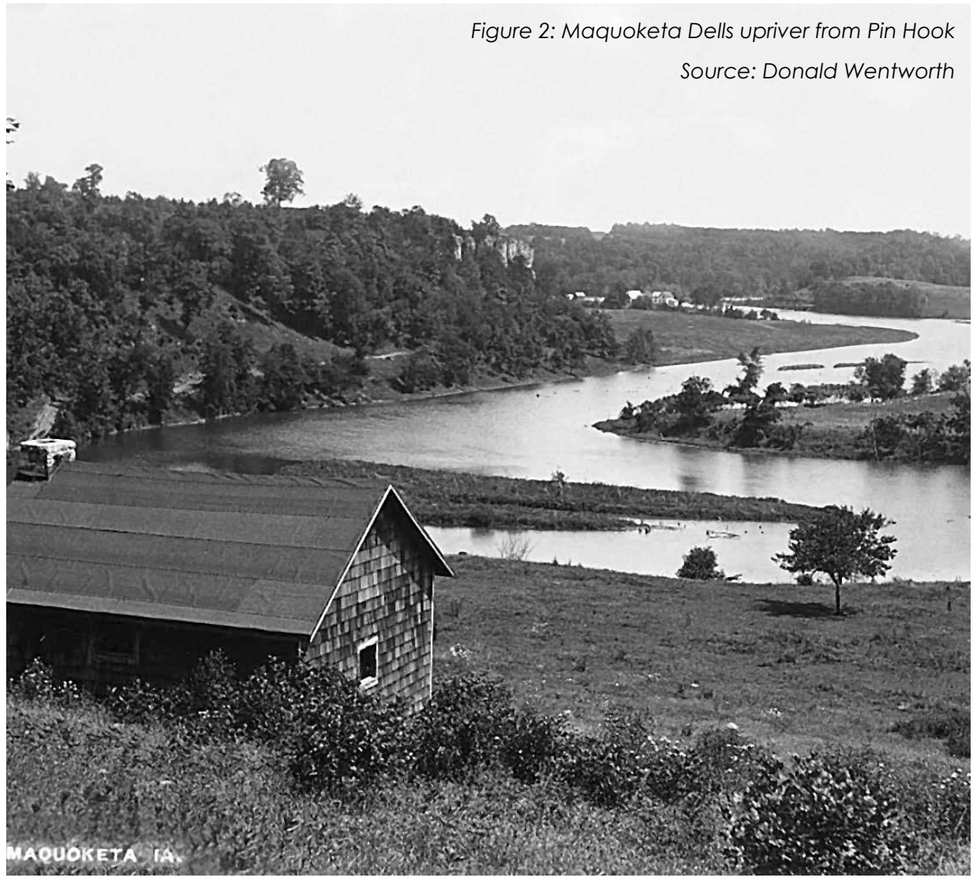
Improving water quality and flood mitigation through water management and building and maintenance of healthy soil, flourishing plant and wildlife as well as other living organisms.

### Economies...

Supporting long term economic growth by protection of the water foundational to the food system and economy.

*Figure 2: Maquoketa Dells upriver from Pin Hook*

*Source: Donald Wentworth*



# 02 Planning Context

Watershed Location

History of MR WMA

Past Planning Efforts

*Figure 3: Maquoketa River - Jackson County*

*Source: Photo Voice, Maquoketa River Watershed Stories*

# Watershed Location

he Maquoketa River Watershed is a HUC–8 level watershed and one of the sub-basins of the Upper Mississippi River Basin. The Upper Mississippi River Basin drains approximately 189,000 square miles, including large parts of the states of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. Small portions of Indiana, Michigan, and South Dakota are also within the basin.[2]

The Maquoketa River Watershed is one of the 11 tributaries to the Mississippi River, and drains water from 1,870 square miles within the Mississippi River Basin. Covering a total of 1,100,00 acres (approximately), the watershed is located at the eastern part of the state of Iowa and includes eighty townships and nine counties, with the majority of its area located in Delaware and Jackson Counties. As shown in Figure 4, the watershed also lies in Jackson, Jones, Dubuque, Clinton, Buchanan, Fayette, Clayton, and Linn Counties.

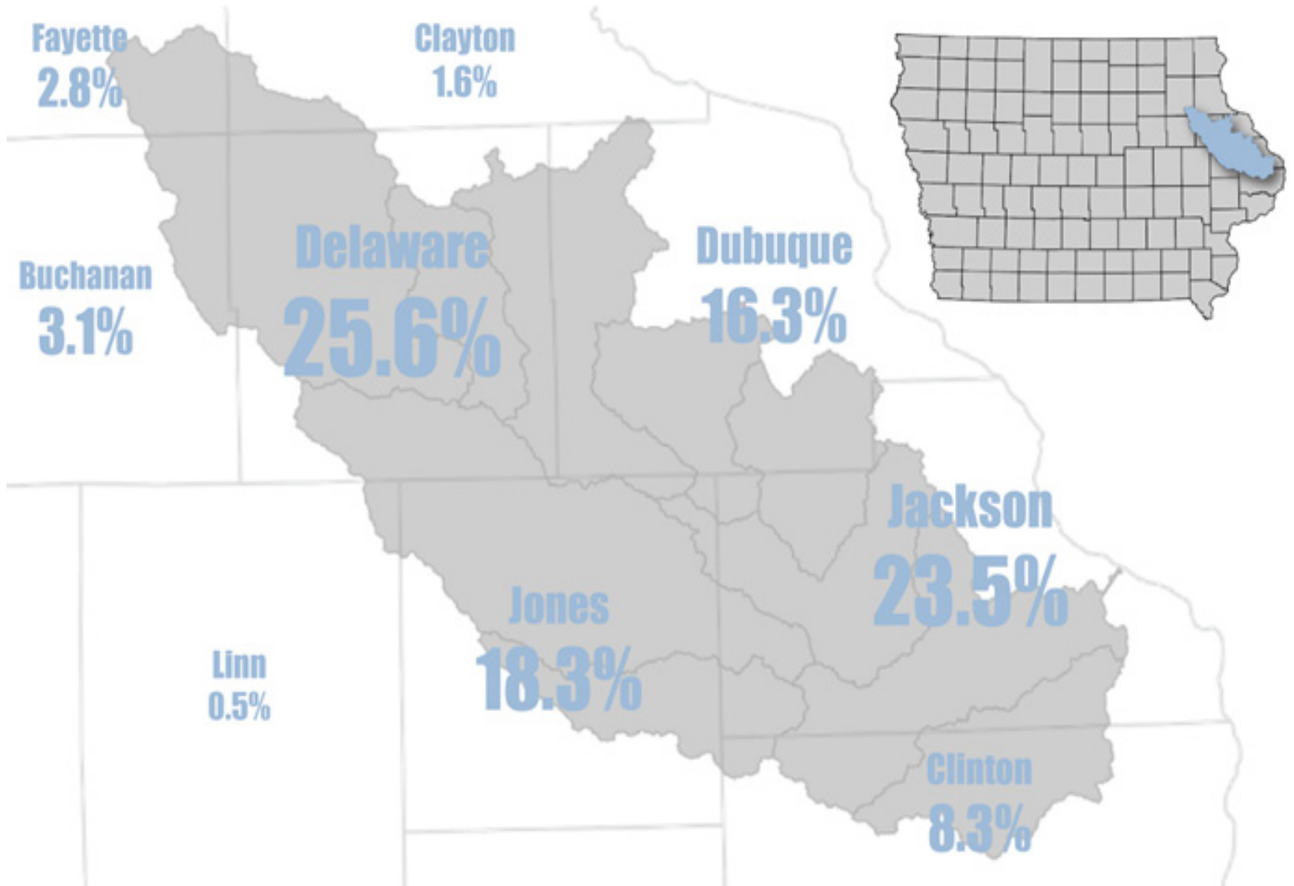



*Figure 4: Percentage of MRW Across the Nine Counties, and location of MRW in the state map of Iowa*
*Data Source: USGS, Created by Authors*

## ACRONYMS

**HUC:** Hydrologic Unit Code

## DID YOU KNOW ?

The Maquoketa River Watershed spans over **9** counties and **80** townships, and covers an area of approximately **1,100,000** acres.

# History of Maquoketa River Watershed Management Authority

The state of Iowa passed legislation authorizing the creation of Watershed Management Authorities in 2010. A Watershed Management Authority (WMA) is a mechanism for cities, counties, Soil and Water Conservation Districts (SWCDs), and stakeholders to cooperatively engage in watershed planning and management.[4] To form a WMA in Iowa, the area in question must be located within an 8-digit Hydrologic Unit Code watershed. For the description of the Hydrologic Unit Codes also called HUCs*. Furthermore, all eligible cities, counties, and SWCDs must be provided with the opportunity to join the WMA before its organization, and the WMA must be governed by a Board of Directors and adopt by-laws.[5]

*The United States Geological Survey (USGS) created a hierarchical system of hydrologic units based on surface hydrologic features, and divided it into regions, sub-regions, basins, subbasins, watersheds, and sub-watersheds. Each unit is assigned a unique Hydrologic Unit Code (HUC). This system divides the country into 21 regions (2-digit), 222 subregions (4-digit), 370 basins (6-digit), 2,270 subbasins (8-digit), ~20,000 watersheds (10-digit), and ~100,000 subwatersheds (12-digit).

## List of HUCs

2-digit HUC: First-level (regional)

4-digit HUC: Second-level (subregional)

6-digit HUC: Third-level (basin)

8-digit HUC: Fourth-level (subbasin)

10-digit HUC: Fifth-level (watershed)

12-digit HUC: Sixth-level (subwatershed)

The talk of forming a WMA for the Maquoketa River Watershed began in 2016. After the breach of the Lake Delhi dam on July 24, 2010, interested residents wanted to focus on improving water quality, reduce flooding, and protect local drinking water. After several public meetings, the founding members of the Maquoketa River Watershed Management Authority (MR WMA) filed their paperwork with the state on September 21, 2017, asking to be recognized as an official Iowa WMA. The MR WMA was officially recognized on October 24, 2017.[6]

In the following years, the MR WMA hosted several outreach and water monitoring events. In July 2018 the MR WMA welcomed Project AWARE volunteers who conducted a cleanup of the Maquoketa River.[7]

In 2019, the MR WMA conducted a water monitoring program on three separate occasions, May 4th, June 25th, and August 13th. Water samples were taken from thirty-four different sites in order to get a 'snapshot' view of the water quality in the watershed. The samples were evaluated for turbidity and analyzed for chloride, sulfate, dissolved reactive phosphorus, nitrate (N), and E. coli bacteria. These events led up to the September 17th "What's in Your Water?" event. This was a grant-supported water quality outreach event in Manchester and featured 10 interactive educational displays and activities.[8]

Contracted with Limestone Bluffs on administration, in 2020 the Maquoketa River Watershed Management Authority partnered with the Iowa Initiative for Sustainable Communities from the University of Iowa to bring in second-year graduate students from the School of Planning and Public Affairs. This partnership was created to develop a watershed management plan that will lead the MR WMA towards achieving its goals.

## Unit of Analysis

The unit of analysis for this project is the Maquoketa River Watershed, which is a sub-basin in Mississippi basin with 8-digit Hydrologic Unit Code.

## ACRONYMS

**SWCD:** Soil and Water Conservation District

**USGS:** United States Geological Survey

## Maquoketa Watershed Authority Founding Members:

**Counties:**
Buchanan, Clinton, Delaware, Dubuque, Fayette, Jackson, Jones and Linn

**Cities:**
Andrew, Aurora, Baldwin, Cascade, Delaware, Delhi, Dyersville, Epworth, Farley, Goose Lake, Hopkinton, Lamont, La Motte, Manchester, Maquoketa, Monticello, New Vienna, Preston, Ryan, Sprague ville, Strawberry Point, Worthington and Wyoming

**Soil & Water Conservation Districts:**
Delaware, Dubuque, Fayette, Jackson, Jones and Linn

**Taxing District:**
Lake Delhi Combined Recreational and Water Quality District

# Past Planning Efforts

In the past decade, cities and counties within the watershed have incorporated several policies and strategies to monitor water quality and mitigate flood hazards. There are two watershed comprehensive plans for watersheds located within the Maquoketa River Watershed. Four cities and three counties in the watershed have strategized their comprehensive plans to target water quality and stormwater management issues. Likewise, five of the counties have multi-jurisdictional Hazard Mitigation Plans, and one city, Dyersville, has a city-wide Hazard Mitigation Plan as seen in the figure below. These planning documents helped to develop consistent policies for the Maquoketa River Watershed Management Plan.

| | Multi-Jurisdictional Plans | County Plans | City Plans | | |
|---|---|---|---|---|---|
| Delaware County | - | County Plan | City of Manchester Comprehensive Plan | | |
| Jackson County | Multi-Jurisdictional Hazard Mitigation Plan | - | City of Maquoketa Comprehensive Plan | | |
| Dubuque County | Multi-Jurisdictional Hazard Mitigation Plan | - | City of Farley Comprehensive Plan | Plan Dyersville Comprehensive Plan | Dyersville Hazard Mitigation Plan |
| Buchanan County | Multi-Jurisdictional Hazard Mitigation Plan | - | - | | |
| Clayton County | Multi-Jurisdictional Hazard Mitigation Plan | County Plan | - | | |
| Fayette County | Multi-Jurisdictional Hazard Mitigation Plan | - | - | | |
| Linn County | Multi-Jurisdictional Hazard Mitigation Plan | County Plan | - | | |

*Figure 5: Past Planning Efforts in MRW*

## Watershed Plans

**The Maquoketa River Watershed Above Lake Delhi Dam Comprehensive Plan** was developed for the Watershed Above Lake Delhi Dam, which comprises 18.6% of the larger Maquoketa River Watershed. The plan has identified management strategies for each sub-watershed in the region. Among the strategies proposed are implementing best management practices for agricultural activities, promoting information and education regarding watershed health, and enhancing potential for fisheries.

**The Upper North Fork Maquoketa River Watershed Comprehensive Plan** was developed for the Upper North Fork watershed, which comprises 11.6% of the larger Maquoketa River Watershed. The plan has identified flood and water contamination as major challenges in the area. Among recommended strategies are restoring wetlands, promoting alternative construct ion practices for stormwater management, conducting targeted reforestation, protecting riparian zones, promoting best management practices for decreasing soil erosion, limiting nutrient usage, and increasing awareness of management and disposal of waste.

## City Comprehensive Plans

**The City of Farley** adopted its Comprehensive Plan in 2014. The plan emphasizes watershed-wide, as well as regional, planning for stormwater management by promoting green rooftops, minimal building footprints, compact car spaces, and minimum pavement length with green technology utilization and permeable surfaces. It also promotes educating and encouraging residents and farmers to utilize environment-sensitive practices to conserve waterways. The plan includes an informative qualitative cost comparison chart for Low Impact Development practices. Additionally, the plan follows guidelines from the Dubuque County Multi-Jurisdictional Hazard Mitigation Plan for flood risk management and recommends avoiding development and construction operations in environmentally sensitive areas, using bio-retention, green infrastructure, and natural buffers to promote stormwater infiltration.

**The City of Dyersville** adopted its new Comprehensive Plan in 2018. The plan provides clear emphasis on stormwater management practices in every future structure and on floodplains though conscious land use development. It emphasizes adequate detention facilities in industrial areas through the use of parks and open spaces and recommends against development in floodplains and wetlands. The plan also prioritizes certain areas near Tegeler Pond to ensure proper stormwater management measures. The plan follows the guidelines of 2011 Dyersville Hazard Mitigation Plan which has recommendations for stormwater management to lessen the impacts of flooding.

**The City of Manchester** adopted its Comprehensive Plan in 2012. The plan addresses flooding by prioritizing natural resources and agricultural protection through its land use planning process. It identifies hydric soils and prime agricultural lands in the community and hopes to continuously monitor residential development and potential flood hazards. The plan also has a 'Support the River Experience' policy which aims to increase accessibility and connectivity to river activities through flood buyout properties.

**The City of Maquoketa** 2040 Comprehensive Plan, adopted in 2019, identifies the importance of watershed conservation and prioritizes working in close collaboration with the MR WMA for maintaining good quality water and soil in the community. The plan hopes to achieve a healthy expansion of recreational opportunities using the Maquoketa River, while avoiding possible flood hazards through future development by following guidelines of the Jackson County Multi-Jurisdictional Hazard Mitigation Plan. The plan established policies to minimize stormwater runoff on new structures and roadways by promoting usage of green infrastructure.

## County Comprehensive Plans

**The Linn County** Comprehensive Plan focuses its planning strategies on preventing the occurrence of human-made hazards. Strategies to achieve this goal include maintaining a FEMA-approved Multi-Jurisdictional Hazard Mitigation Plan, adopting a county stormwater erosion and sediment control ordinance, and supporting watershed protection and educational initiatives by NRCS and IDNR regarding soil & water conservation and quality.

**The Delaware County** Comprehensive Plan has identified objectives in land and recreation which emphasize the protection of stream banks, floodplains, wetlands and waterways. Additionally, their natural resources are noted as important assets for tourism. The plan mitigates regional hazards through practices such as preserving an interconnected system of greenways, elevating flood prone structures, exploring funding solutions, and installing flood gauging equipment.

**The Clayton County** Comprehensive Plan emphasizes protection of natural and agricultural resources. The plan identifies opportunity points for county involvement, which include persistent attention and monitoring of water

### ACRONYMS

**FEMA:** Federal Emergency Management Agency

**NRCS:** Natural Resources Conservation Service

**IDNR:** Iowa Department of Natural Resources

quality, improving awareness of agricultural management practices, improving awareness of development impacts on stormwater runoff, and making educational information available to residents, landowners, developers and landscape businesses.

## Multi-Jurisdictional Hazard Mitigation Plans

The primary purpose of hazard mitigation planning is to identify how communities can minimize the negative impacts of natural and human-caused hazards. Hazard mitigation planning is also done to maintain eligibility for FEMA's Hazard Mitigation Assistance funding, which includes: the Hazard Mitigation Grant Program, the Pre-Disaster Mitigation Program, and Flood Mitigation Assistance. The plans are jointly prepared by local governments and jurisdictions. They organize resources, identify and assess hazards, and establish mitigation goals and actions.

The analysis of hazard mitigation plans identified multiple goals and actions that could be incorporated into the Maquoketa Watershed Management Plan including: the importance of communication and cooperation within and among communities, and the mitigation and preparation for flooding as the most reliably destructive natural hazard the watershed faces.

**The Linn County Hazard Mitigation Plan** emphasized the hazard planning efforts for different county jurisdictions such as cities, school districts, and unincorporated areas. It focused on identifying how communities can minimize the negative impacts of natural and human-caused hazards with particular focus on flooding and the destructive flooding events that occurred in Cedar Rapids. The plan identifies opportunities for improvement by establishing channels of efficient communication during hazard planning.

**The Jackson County Hazard Mitigation Plan** assessed risk to the community from natural hazards and identified levy failure, flash flooding, and river flooding as the top hazards for the community. Floods are considered the most frequent and costly natural disaster in terms of human hardship and economic loss. The plan identifies specific locations with a history of flash flooding and calls for flood mitigation on the earthen levee that runs along the Maquoketa RIver in Manchester.

**The Clayton County Hazard Mitigation Plan** placed importance on mitigation actions within the county that varied from working with property owners to clean out debris from culverts to establishing water well protection for municipal wells. The plan stressed maintaining compliance and updating flood plain ordinances. Floods were again ranked the most frequent and costly natural disaster.

**The Dubuque County Hazard Mitigation Plan** provides guidance on implementation projects and ideas that will prevent or lessen the effects of future disasters to the general. The planning committee completed an in-depth evaluation on information regarding the hazards that impact each jurisdiction within Dubuque County. Public outreach efforts included an open house and various workshops. Emergency management and utilizing resilience were emphasized within the plan as crucial elements to successful mitigation and recovery efforts.

**The Buchanan County Hazard Mitigation Plan** placed importance on comprehensively approaching mitigation and employing economies of scale by leveraging individual capabilities and sharing costs and resources to avoid duplication of efforts. This translated into organizing resources, identifying and assessing hazards, establishing mitigation goals and actions, and implementing the plan and monitoring progress. Flash flooding and river flooding were again prioritized regarding their magnitude/severity, duration, and likelihood of occurrence.

# 03 Planning Process

**WMAPlans in Iowa Overview**

**Community Engagement**

**Data Analysis**

*Figure 6: Taking a Moment at the Whitewater Canyon Overlook*

*Source: Photo Voice, Maquoketa River Watershed Stories*

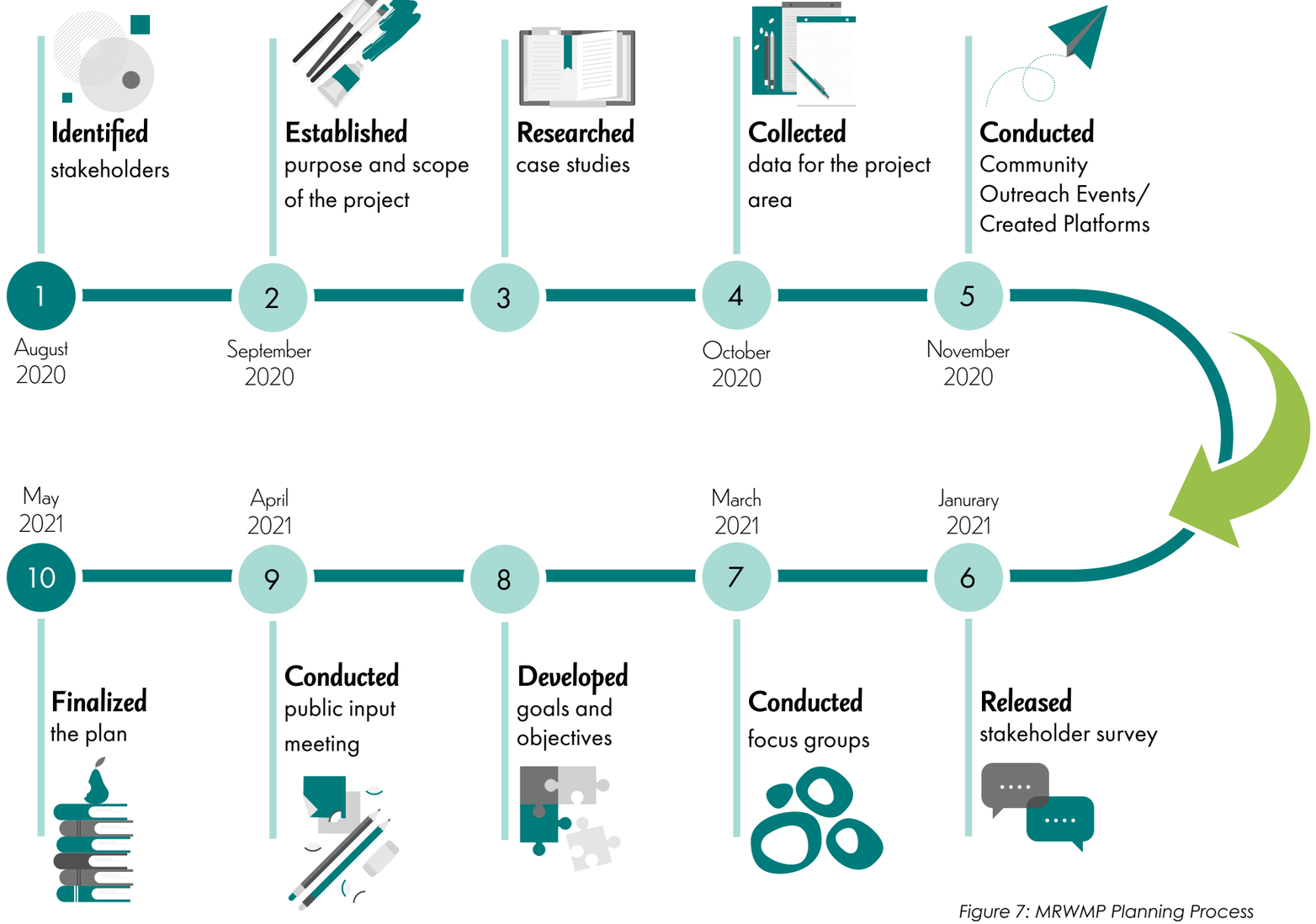



*Figure 7: MRWMP Planning Process*

# Watershed Management Authority Plans in Iowa Overview

During the early phase of the planning process, the planning team studied the published Watershed Management Planning documents in the State of Iowa to best identify the components of a watershed management plan and expand upon the existing ideas. These plans helped in understanding general steps and struggles regarding watershed management practices and in implementing recommended action plans. Public engagement strategies used by the team differed from traditional practices due to the ongoing Covid19 pandemic. Most of the studied documents approached watershed planning by collecting physical, hydrological, geological, and demographic data of the respective watersheds. Next, community engagement was a major part of the planning processes, especially prior to the assessment and analysis of major issues in the watersheds. Finally, the plans introduced policy recommendations for implementation, as well as timely evaluation of the critical areas of the watershed.

The common strategies identified among the watershed management plans, and those utilized for this plan development are discussed below:

## Data Collection Strategies

Studying past reports on geological surveys, ecological/hydrological integrity, land reforms, flood and drought risks, and hazards helped in understanding the existing health conditions and ongoing issues of the watershed. Sources like the Federal Emergency Management Agency (FEMA), Iowa Flood Center, Iowa Department of Natural Resources (IDNR), United States Environmental Protection Agency (EPA), and United States Geological Survey (USGS) have crucial, current, and historical information on the topography, flood risks, water quality standards, and pollutant sources concerning the watersheds.

**These sources were used for existing data collection and review for this plan as well.**

### Iowa Watershed Management Plans (WMPs):

- Beaver Creek Watershed Management Plan
- Catfish Creek Watershed Management Plan
- East Nishnabotna River Watershed Management and Flood Resiliency Plan
- English River Comprehensive Watershed Management Plan
- Fourmile Creek Comprehensive Watershed Management Plan
- Indian Creek Comprehensive Watershed Management Plan
- Middle Cedar Watershed Management Plan
- Mud, Spring, Camp Creeks Comprehensive Watershed Management Plan
- North Raccoon River Watershed Plan
- Squaw Creek Comprehensive Watershed Management Plan
- Turkey River Comprehensive Watershed Management Plan
- Upper Cedar Comprehensive Watershed Management Plan
- Upper Iowa River Watershed Resiliency Plan
- Upper Wapsipinicon Watershed Resiliency Plan
- Walnut Creek Comprehensive Watershed Management Plan
- West Nishnabotna River Watershed Management and Flood Resiliency Plan

### ACRONYMS

**FEMA:** Federal Emergency Management Agency

**IDNR:** Iowa Department of Natural Resources

**EPA:** Environmental Protection Agency

**USGS:** United States Geological Survey

## Public Engagement Strategies

Continuous stakeholder participation during data collection and analysis allows for the public to receive information and comment on the planning process. The outreach activities in studied plans were conducted through community-focused surveys, public hearings, public open houses, water testing demonstrations, workshops, and clean-up events paired with fun activities. Agricultural associations, farm consultants, and agricultural retailers were also used as data collection and distribution sources to maintain smooth communication between rural stakeholders and the planning team. During the promotion phase, advertisements on media outlets such as newspapers, radio stations, podcasts, websites, and social media sites, along with community-targeted-slogans, encouraged community involvement in the planning processes of the studied plans.

**This plan adopted these outreach ideas, and utilized them via online platform - given the limitation set by social distancing protocols. We conducted community outreach via an online stakeholder survey, five focus groups on zoom platform, story-telling on a website, and a public input meeting on zoom platform. The advertisements and promotions were done via facebook page, MR WMA website, various agricultural association identified, and several press media and radio stations that operate within the watershed area.**

## Analytical Approach

Data analysis for the studied plans focused on identifying contaminant sources, hazard-prone areas, and priority sites requiring restoration. Thes plans focused mainly on potential bacteria and nutrient sources from concentrated animal feeding operations (CAFOs), failing septic systems, pets or wildlife, and unsustainable agricultural practices. Some of the plans also utilized Agricultural Conservation Planning Framework software and flood probability toolkits to perform specific analyses. SWOT (Strength-Weakness-Opportunity-Threat) analysis was also conducted in various watersheds. As well, some of the Watershed Management Authorities identified hazard risk for vulnerable populations. In this plan, much of the analysis has been focused on community engagement data i.e. results from survey, focus group, story-telling project, and public input meeting.

**SWOT analysis has been used to analyze story-telling project data. Other feasible analysis techniques have been recommended to be utilized by MR WMA while moving forward.**

## Policy Development and Implementation Plan

Formulating policy recommendations and planning for a healthy watershed requires clear rationale and implementation benchmarks to ensure their effectiveness. The recommendations in studied plans included community-based, cost-effective best management practices (BMPs), frequent field visits for communities, watershed stewardship programs, award programs for the most successful communities, annual meetings among city & county staff, and active engagement through community education on water quality monitoring and other watershed issues.

**Most of these actions have been identified to be feasible and inducive to the goals and objectives identified for this plan, and hence have been recommended to be adopted and implemented by MR WMA accordingly.**

### ACRONYMS

**CAFO:** Concentrated Animal Feeding Operation

**BMP:** Best Management Practice

# Community Engagement

Since addressing the issues of the Maquoketa River Watershed, and initiating activities for its protection and restoration depends significantly on changing the behaviors of residents who live in the watershed, it is paramount to involve the residents as well as all the stakeholders in the process of developing the management plan. A strong sense of commitment at the community level is required to address existing issues in our lakes and streams. Watershed assessment and planning should ideally be inclusive, with the public playing an active role since early phases of the planning process. Residents should be involved in framing the problem, developing solutions and taking responsibility for implementation. The ability to create effective and lasting change starts with knowing the community's priorities, goals, values, and abilities, which can only be done by communicating and engaging with the community. This includes reaching out to all communities within the watershed and developing a number of options to exchange information. Because of several social distancing protocols established in the State of Iowa due to the Covid-19 Pandemic, the planning team developed ways of reaching out to the communities and officials that require minimum physical exposure.

## Community Groups

The Planning Team has identified five groups of stakeholders and have strategized unique levels of engagement to each of the groups to ensure effective communication.

- **Urban and Rural Residents –** People who are residing within the watershed boundary, and in an urban area (areas with 2,500 or more population as defined by US Census Bureau) are considered 'urban residents'. Likewise, people residing in areas other than urban are included as 'rural residents'. As residential areas are prone to land cover changes due to development activities, it is important to inform residents about the importance of surface permeability and environment-friendly development to maintain watershed health. Similarly, this sub-group's perception of and connection to the watershed is important in informing the planning process. This group's input was collected via survey, focus group meeting and Photo Voice platform.

- **Recreational Groups –** The Maquoketa River Watershed provides several recreational opportunities to people from both the watershed and greater region. This group consists of people who partake in activities like canoeing, kayaking, swimming, fishing, hunting, and more. The Planning Team engaged with this group by providing educational resources, collecting information about their connection to and perception of watershed health, and collaborating to develop effective strategies. This group's input was collected via survey, focus group meeting and Photo Voice platform.

- **Businesses within the watershed –** Businesses within the watershed can determine the watershed's health both in indirect and direct ways. Factories and industrial activity, as well as other businesses present in the floodplains, may impact or be affected by natural surface water drainage areas, runoff levels, and flood risk. Similarly, businesses directly involved with the surface waters in the watershed like kayak services, play an important role in maintaining water quality in our watershed. This group's understanding, perception, and goals regarding the watershed is important to develop effective strategies. This group's input was primarily collected via our stakeholder survey.

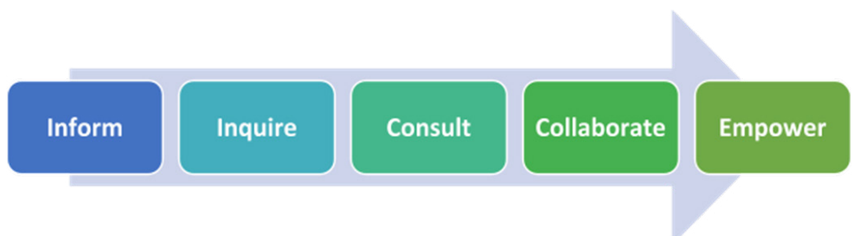



*Figure 8: Community Engagement Levels*

- **Agricultural Group –** Crop and animal agriculture have a close relation with the watershed and play a crucial role in maintaining watershed health. Agricultural practices and their location have also been identified as an important pollutant source to surface waters. Because of the importance of this relation and the prevalence of agriculture in this region, the Planning Team engaged this group through a variety of activities. Farm consultants, agricultural retailers and agricultural associations like the Iowa Soybean Association, Iowa Corn Growers Association, Iowa Pork Producers Association, Practical Farmers of Iowa, Iowa Cattlemen's Association, Iowa Dairy Association, and Iowa Farm Bureau were contacted by the Planning Team to gather input for the stakeholder survey as well as future outreach activities. This group's input was collected via survey, three focus group meetings and Photo Voice platform.
- **MR WMA Project Partners –** The Maquoketa River Watershed Management Authority is one of the project partners for this planning process, and it is important to ensure consistency between the MR WMA's and the Planning Team's expectations. The Planning Team worked in close collaboration with MR WMA Project Partners – Lori Scovel and Jeff Tisl via ongoing regular virtual meetings.

## Strategies

### Virtual Meetings

The Planning Team communicated with MR WMA Project Partners via bi-weekly virtual meetings. The team met with Faculty Advisors each week via virtual meeting and each week additionally among themselves. Frequent communication was ongoing with our Alumni Mentor throughout the process .

### Stakeholder Survey

The Stakeholder Survey aimed to understand the respondent's values, beliefs, and experiences related to watershed and its issues. These results helped inform both continued public participation and the goals, objectives, and strategies of the plan. The survey was designed t e e i e t the ene i . It was meant for visitors to the watershed, landowners, renters, rural or urban dwellers, absentee owners, and a number of other populations that may interact with the Maquoketa River. The questions dealt with water quality, flooding, recreation, impacts on water issues, conservation, and farming.

Due to restricted in-person events during the COVID-19 pandemic, a large geographical area, and a limited budget for printing, the survey was distributed primarily online. Links to the survey were available on the MR WMA's website and Facebook page. Advertising for the survey was completed through local radio stations, local newspapers, and physical community newsletters. As well, the survey was advertised through the Iowa Farm Bureau Spokesman and the focus groups conducted in February 2021. While the survey reached many people and gathered over 400 respondents, the sample is neither random nor entirely representative of the watershed. Because of its distribution, we were most likely to encounter people familiar with using technology or related to WMA activities.

The survey remained open for informing the plan from December 2020 through March 2021. While it closed for analysis in March, the survey remained open to continue to gather comments from stakeholders, which are scattered in the sidebars throughout the plan. At the time data was taken for analysis, the survey had been taken by 428 respondents. These respondents were from many different areas of the watershed and provided a wide range of perspectives that informed the plan. Information from the survey is integrated throughout the plan, but a full report is provided as an appendix. As well, the survey itself is included in the appendices.

ACRONYMS

**MRW:** Maquoketa River Watershed

# SURVEY MAIN THEMES & FINDINGS

## Recreation and Wildlife

The watershed is seen as a major recreational and economic asset to the region, where many respondents participated in watershed-related recreational activities.

**88%** believe it serves as an economic asset ‹ **74%** believe it is a defining feature ‹ **84%** believe that it serves as a recreational asset and destination for Eastern Iowa ‹ **25%** of respondents use the watershed for its scenic beauty ‹ **19%** canoe or kayak in the watershed ‹ **19%** use the watershed for fishing or hunting ‹ **74%** agreed that rivers and lakes for tourism/recreation should be improved ‹ **66%** agreed that there should be more natural areas for hunting/recreation.

Many respondents want to protect and preserve ecosystems and habitats within the watershed.

**48%** were very concerned about the loss of wildlife habitat ‹ **46%** were very concerned about the loss of aquatic habitat.

## Education and Resources

The majority of respondents indicated a need and a want for increased education and resources related to watershed issues.

**79%** agreed that incentives for communities to protect soil and water should be increased ‹ **76%** agreed that there should be more education for landowners on flood and water quality issues ‹ **54%** agreed that regulation for landowners to protect soil and water should be increased ‹ **43%** agreed and **25%** had no opinion that they would be willing to pay more to improve water quality and reduce flooding near them (ie. Taxes or fees).

## Flooding

The majority of respondents have been affected by flooding and they believe WMAs need to be the most involved in mitigating flooding impacts.

**76%** of survey respondents have experienced a flood event ‹ **60%** have been prevented from completing their daily activities or business due to flooding ‹ **31%** believe the WMA most needs to be involved to reduce flooding.

## Water Quality

Half of respondents believed water quality to be "okay" throughout the watershed, and more thought it was good than bad. The believe both agricultural, rural, and urban sources to be the main water polluters. They believe WMAs need to be the most involved in improving water quality.

**85%** believe agriculture influences water quality ‹ **83%** believe streambank erosion influences water quality ‹ **83%** believe livestock influence water quality ‹ **81%** believe illegal dumping/littering influences water quality ‹ **76%** believe run-off from paved influences water quality ‹ **31%** believe the WMA most needs to be involved to improve water quality.

## Conservation Strategies

Many respondents already participate in conservation activities.

**62%** participate in assistance in disposal of household hazardous waste ‹ **59%** minimal use of lawn & garden fertilizers/pesticides ‹ **84%** fertilize based on soil test ‹ **65%** used post-emergence herbicides ‹ **63%** participate in no-till.

## Photo Voice

Photo Voice is a platform for collecting information, traditionally from underserved communities, through photography and captions, generally revolving around a specific theme/issue. An online platform was provided for communities to participate by posting photos and stories that reflect their connection to the Maquoketa River Watershed. The platform is still left open to monitor resident perception regarding future activities in the watershed. During the development of this plan, 10 submissions were received in the website, among which recreational activities and scenic beauty were mentioned the most as being the connection that tied the participants with the watershed. Apart from that, being close to nature, water monitoring and volunteering activities were mentioned as the positive aspects and loss of businesses and Lake Delhi dam failure caused by extreme events of storm, flooding and rainfall were mentioned as the negative aspects of the watershed. A collage of the participation titled 'Maquoketa River Watershed Stories' can be found in the next page and the website can be visited at https://mrwphotovoice.wixsite.com/MR WMAphotovoice/engage/maquoketa-river-watershed.

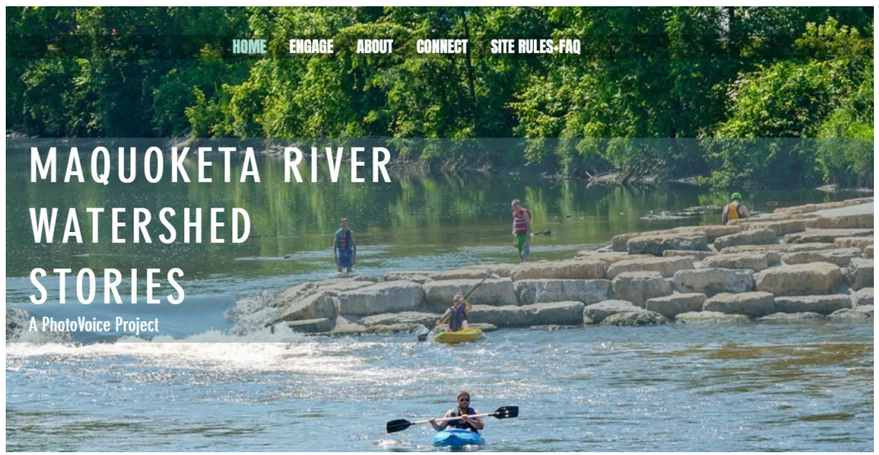



*Figure 9: MRW Photo Voice website screenshot*

## Focus Groups

The watershed management plan process used a variety of qualitative research gathering methods including the use of focus groups. The overall goal of the focus grop study was to build a better understanding of stakeholder perceptions of water quality problems, water policy processes and decisions, and watershed management plan development. Three focus groups were held with rural residents and agricultural groups. The rural residents & agricultural groups were further divided into categories based on the three major sub-watersheds of the Maquoketa River Watershed: the Upper Maquoketa River, North Fork of Maquoketa River and Lower Maquoketa River. Similarly, two separate focus group meetings were conducted for urban residents and recreational groups, totalling five focus groups conducted by the planning team. The groups discussed stakeholder interests and opinions, identifying causes of conflict as well as area of common ground. Comments made across all three groups reflected the need to achieve a reasonable balance among the many complex tradeoffs involved in watershed management.

The inclusion of quotations from the focus groups are used in the following paragraphs to strengthen goals and objectives approved by our committee. Conclusions will be further drawn and correlated with survey data.

**Major Themes Discussed by Focus Group Participants**

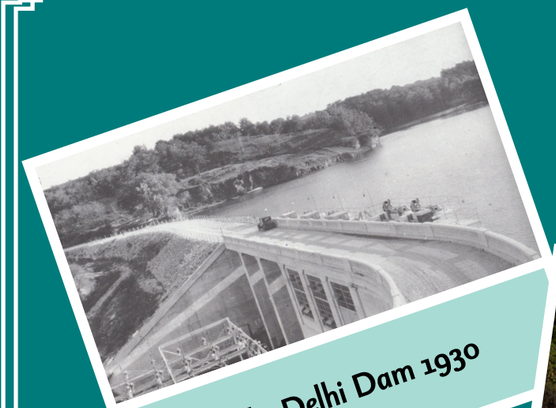
| Major Themes | Subthemes | AG | REC | URB |
|---|---|---|---|---|
| Water quality | Causes of water pollution in the water body | X | X | X |
| | Perceptions of contributing sources | X | X | X |
| Water quantity | Causes of flooding in the watershed | X | | X |
| | Severity of flooding | | X | X |
| Policies and programs | Policies and projects used to address water quality | X | X | X |
| | Policies and projects used to address water quantity | X | X | X |
| | Future policies and projects | X | X | X |
| Education/Outreach | Scientific information | X | X | X |
| | Public education | X | X | X |
| | Role of institutions (DNR, ISU, etc) | X | X | X |

*X Marks indicate topics mentioned at least once in the associated focus group (AG, agricultural; REC, recreation; URB, urban). Information is presented in tabular form as a visual indication of how group discussions compared across topics (the number of focus group participants, however, does not allow for statistical comparison across groups).*

*Table 1: Major Themes Discussed by Focus Group Participants*

# Maquoketa River Watershed

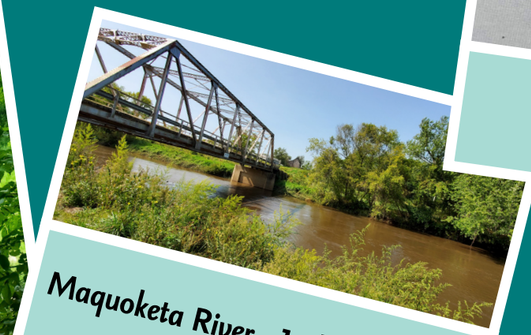
# PHOTO VOICE



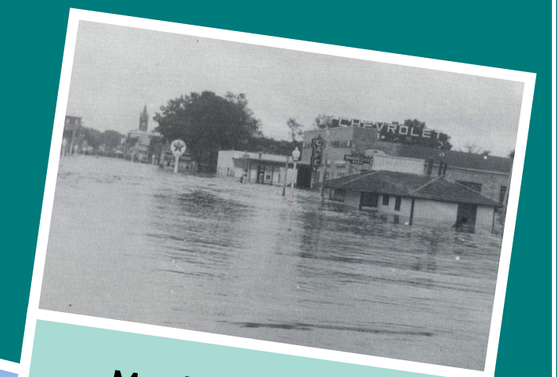
Lake Delhi Dam 1930

River Runner Regatta-Manchester

Backbone State Park



Maquoketa River - Jackson County



Manchester 1925 Flood

Maquoketa River Kayaking near Manchester

Taking a Moment at the Whitewater Canyon Overlook

A glimpse of Maquoketa's beauty

MR WMA Water Monitoring

Beautiful Fall Sunset

*X Marks indicate topics mentioned at least once in the associated focus group (AG, agricultural; REC, recreation; URB, urban). Information is presented in tabular form as a visual indication of how group discussions compared across topics (the number of focus group participants, however, does not allow for statistical comparison across groups).*

### Water Pollution Sources Mentioned by Focus Group Participants

| Major Themes | AG | REC | URB |
|---|---|---|---|
| Industrial | | X | X |
| Urban | X | | |
| Septic | X | | |
| Construction | X | | |
| Golf Courses | X | | |
| Agriculture | X | X | X |
| Atmosphere | X | | |
| Upstream | | X | X |

*Table 2: Water Pollution Sources Mentioned by Focus Group Participants*

### Flooding Mentioned by Focus Group Participants

| Major Themes | AG | REC | URB |
|---|---|---|---|
| Industrial | X | | |
| Urban | X | | |
| Septic | X | | |
| Construction | X | | |
| Agriculture | X | X | X |
| Atmosphere | X | X | X |
| Upstream | X | X | X |

*Table 3: Flooding Mentioned by Focus Group Participants*

## Public Input Meeting

The Planning Team held a final public input meeting on April 27th, 2021. Goals and objectives developed for the Plan were published and opened for comments and queries. The goals, objectives, strategies and actions have been prioritized based on the feedback from this meeting.

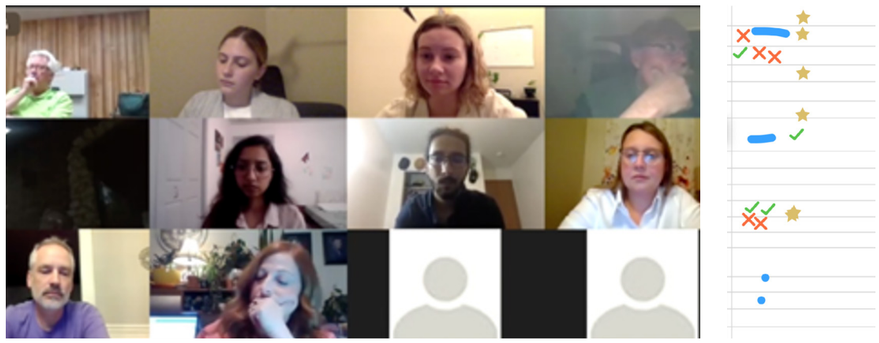


*Figure 10: Public Input Meeting held by the planning team on left, dot voting that occurred during the meeting on right*

*Source: Authors*

# Data Analysis

To ensure sustainable watershed management, optimum watershed interventions should be implemented while considering existing requirements of the ecosystems, agricultural systems, and watershed infrastructure. Hence, the methodology for this plan involves reviewing existing data of the Maquoketa River Watershed's characteristics in terms of its population demographics, land use and land cover, soils, hydrology, wildlife and habitat, and recreation and tourism. The key findings from the review are presented here, while the detailed findings can be found in Chapter 05 - Technical Report of this plan.

## Population Demographics

The Maquoketa River Watershed has approximately

**72,118**

people living in it as of 2018

The largest towns in terms of population

**Maquoketa** (6,026)
**Manchester** (5,037)
**Dyersville** (4,110)
**Monticello** (3,835)
**Cascade** (2,078)

## Land Use and Land Cover

The predominant land use in the Maquoketa River Watershed is **agriculture**, encompassing **80%**, made up of

**54%** row crops, **26%** pasture/hayland
**12%** forestland/natural areas, **17.7%** developed, **0.3%** water/wetlands

The elevation within the watershed ranges between 581 feet to 1,253 feet. The slope plays a critical role in how fast a drainage channel will convey water downstream, and, therefore, influences the sensitivity of a watershed to precipitation events. Since the land use in most of the watershed is agricultural, an average slope of 6% can have significant water quality impacts in the corn belt. Therefore, if rainfall is marked by high intensity and short duration, the watershed will respond very quickly with the peak flow occurring shortly after the onset of precipitation. Steep slopes tend to result in rapid runoff responses to local rainfall, culminating in higher peak discharges with flooding potential.

the watershed has an average slope of

**6%**

## Topography

- Rock exposures, quarries, shallow bedrock, and steep bluffs are common characteristics of the watershed. **Sinkholes** are scattered throughout the watershed, with the greatest concentration occurring in Jackson County. Certain land uses and practices may also impact the presence of sinkholes. For example, the pumping of groundwater for drinking water supply and irrigation may increase the prevalence of sinkholes and their collapses in **karst topographies**.

## Soils

- The infiltration abilities as well as the porosity of soil determine how much water stays in the soil, trickles into groundwater supplies, and runs off into streams and rivers. Soil loss poses both a problem for the health of the soil and the health of the watershed. With greater amounts of soil loss, there is the opportunity for more soil deposition in the streams and rivers and less infiltration on site. Overall, erosion due to runoff from cropland accounts for **90%** of soil erosion in the area.

### Karst Topography

Karst topography is present when the bedrock is mainly composed of easily dissolvable rocks such as limestone or dolomite (a rock similar to limestone). When exposed to groundwater, the bedrock may dissolve allowing the creation of sinkholes, springs, and losing streams. While this topography gives the region and its bodies of water unique characteristics, it can also leave it vulnerable. Contaminants can travel quicklyinto the groundwater due to these open fractures, avoiding natural filtration through layers of soil.

Soil erosion remains above sustainable levels. To be sustainable, the loss needs to be reduced to the soil's natural replacement level, which varies from 1 ton/acre/year to 5 tons/acre/year.

## Factors affecting soil:

| | |
|---|---|
| **Soil Disturbance** | Soil that is tilled or disturbed can flow easily in erosion events. |
| **Organic Matter** | The presence of organic matter in the soil, such as decayed plant matter, can improve the nutrient retention of the soil. |
| **Chemical Properties** | Chemical properties of the soil indicate the need for use of additives to increase soil productivity. |
| **Biological Properties** | Earthworms and microbial organisms in the soil can impact the nutrient levels and the structure of the soil. |
| **Diversified Plantings** | Rotating crops from one year to the next can replace nutrients used by the other, reducing the need for Nitrogen fertilizers. Above ground, plant coverage protects soil from erosion events, and underground root systems can hold soil in place allowing for greater infiltration. |

## Hydrology

- Across the Midwest, the occurrence of **intense precipitation** events has also risen substantially in recent decades. Although these factors increase the risk of flooding, studies have shown that the risk can be minimized substantially by closely monitoring land cover changes and effective policy on natural drainage features retention.

- The Maquoketa River Watershed's runoff levels show an increasing trend for the last eleven decades. There has also been a change in the difference between the highest and lowest runoff levels throughout the years, which signifies **increasing irregularity** and a higher **risk of flood and drought** events as well as soil erosion, sedimentation and pollutant wash-off from urban surfaces.

- The discharge in the Maquoketa River at Manchester is an example of the unnatural fluctuation withing the watershed. Increased discharge can also have a negative impact on the temperature and chemistry of water e.g., pH, dissolved oxygen, and toxicity, which may significantly lower habitat suitability for certain aquatic organisms.

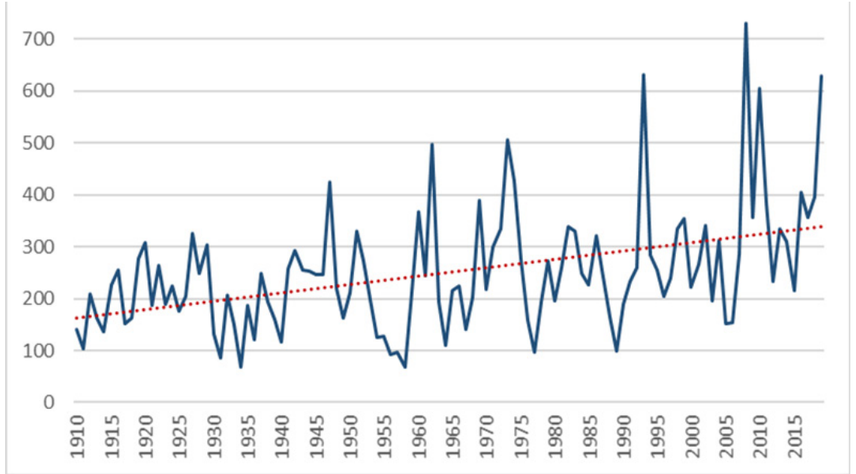



*Figure 11: MRW Runoff Level in mm, Trend from 1910-2019*

*Source: USGS, 2020*

> "Every time it rains hard enough that there is going to be flooding, I always cringe at the soil loss. - Lower Maquoketa Focus Group

## Water Concerns

- The Federal Clean Water Act (CWA) has established water quality standards based on parameters such as dissolved oxygen, water temperature, siltation, turbidity pathogens, and sedimentation for monitoring contaminants in the water bodies.
- In 2018, **16 streams** and **3 lakes** have been listed as impaired waters in the Maquoketa River Watershed.
- Among those, 15 streams and 2 lakes are listed as impairment requiring Total Maximum Daily Load regulation.
- In 2018, 'fish loss due to animal waste' was identified as a new cause of impairment for stretches of the following three streams: Whitewater Creek, Hickory Creek, and North Fork Maquoketa River

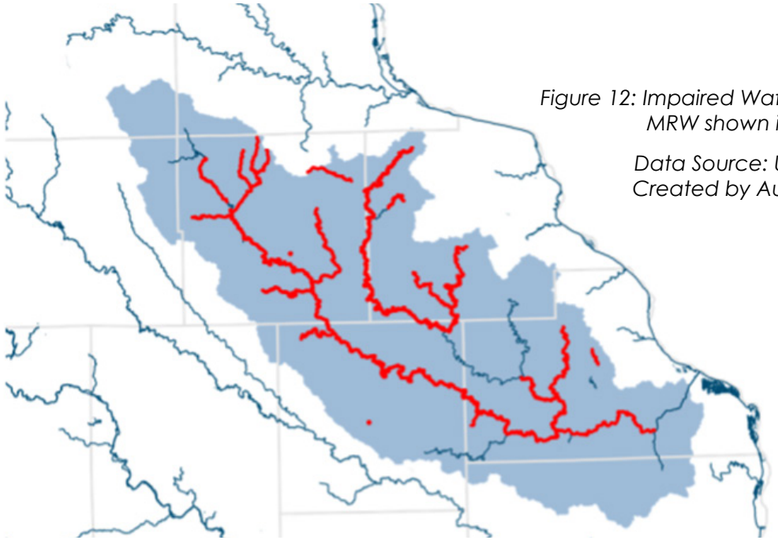


*Figure 12: Impaired Waters in MRW shown in red*

*Data Source: USGS, Created by Authors*

## Wildlife and Habitat

- Within the watershed, there are a variety of state-considered threatened, endangered, or concern species. This list is comprised of **23** animals and **67** plant species. Many of the animals of interest are endangered or threatened, while a greater proportion of the plant species are of 'concern'. Concentrations of these species are spread throughout the watershed .

## History of Flooding

- Major flood events in the watershed since 1925

| Year | Major locations |
|---|---|
| 1925 | • Upper part of the Maquoketa River Watershed |
| 1944 | • Maquoketa River Watershed |
| 1947 | • Much of state of Iowa |
| 2002 | • Delaware, Dubuque, Jackson, and Jones Counties |
| 2004 | • Delaware County |
| 2008 | • Delaware County |
| 2010 | • Maquoketa River Watershed; caused Lake Delhi Dam breach |

The Maquoketa River Watershed is constantly being monitored by the Long-Term Resource Monitoring Program Field Station at Bellevue, Iowa. The data from the above-mentioned station shows that compared to other tributaries of the Mississippi River, the Maquoketa River delivers **higher levels of suspended solids and crop nutrients**. The cumulative effect of the discharge from these tributaries has been the Zone of Hypoxia in the Gulf of Mexico below the mouth of the Mississippi, an area of nutrient concentration affecting fisheries and associated industries. The expansion of this hypoxia zone has led to calls for changes within the sub-watersheds of the Mississippi suspected of contributing to the condition. [3]

## Clean Water Act

- The United States Environmental Protection Agency (EPA) issued the Clean Water Act (CWA) as a revised version of the Federal Water Pollution Control Act in 1972. The Clean Water Act inspects the water quality of surface waters and regulates point sources that contribute contaminants. A point source is defined as a discrete source such as a pipe or man-made ditch (United States Environmental Protection Agency, 1972). The Act also issues permits to industrial, municipal, and other facilities that discharge their waste directly to surface waters (United States Environmental Protection Agency, 1972). At the state level, the Iowa Department of Natural Resources (IDNR) inspects, records, and regulates waste management and permit distribution. The waste discharge through point sources is regulated by the EPA through the National Pollutant Discharge Elimination System (NPDES).

- The CWA also lists surface waters that don't meet designated Water Quality Standards (WQS) established for the region as 'Impaired Waters' and regulates a Total Maximum Daily Load (TMDL) criteria for them based on the impairment. Iowan surface waters have their WQS set based on four designated usages: recreational, wildlife and aquatic habitat, source water supply, and human health.

## Safe Drinking Water Act

- The EPA has determined quality standards for drinking water through the Safe Drinking Water Act (SDWA). The act regulates the presence of more than 90 chemical and microbial contaminants in all drinking water supplies throughout the country, the exception being for private wells that serve less than 25 individuals (United States Environmental Protection Agency, 1996). In Iowa, the sources of drinking water are not mandated to be protected, however, they can be voluntarily protected through the Source Water Protection Program (SWPP). The Iowa DNR has published a guidebook to help a community to participate in SWPP, for which many incentives are also provided by USEPA. To maintain the optimum quality of water sources, the guidebook has listed out various effective policies and regulatory tools for land usage & conservation and environmental-friendly crop & animal agricultural practices.

## Federal Emergency Management Agency on floods

- Floods are defined and regulated based on the statistical probability of them occurring in any given time frame. The standard most commonly used for regulatory purposes, including the Watershed, is the 100 year flood. A 100 year flood has a 1% probability of occurring in any given year. Encroachment by development into the floodplain can put life and property at risk, and can also reduce the carrying capacity of the water, therefore increasing flood hazards in both downstream and upstream areas. Cities and counties within the watershed regulate floodplains through the Floodplain Overlay Districts which are part of zoning ordinances. The provisions were adopted to bring land area into compliance with FEMA's National Flood Insurance Program (NFIP).

- One of the purposes of the Floodplain Overlay District is to provide businesses and residences access to the NFIP. While minimum regulatory standards are not expected to change significantly, FEMA strongly encourages higher levels of regulation and protection by giving policy holders insurance premium discounts if the community has voluntarily exceeded minimum NFIP standards. This is done through the NFIP's Community Rating System (CRS). The highest discount (45%) is given to Class 1 communities (4,500+ CRS points), while no discount is given for Class 10 communities. Linn County is currently rated as a Class 7, which carries a 15% discount. At present, Class 7 is the highest designation in the watershed. Moving to a Class 7 community saves policy holders $117 per year on average.

### ACRONYMS

**CWA:** Clean Water Act

**IDNR:** Iowa Department of Natural Resources

**EPA:** Environmental Protection Agency

**NPDES:** National Pollutant Discharge Elimination System

**WQS:** Water Quality Standards

**TMDL:** Total Maximum Daily Load

**SWPP:** Source Water Protection Program

**NFIP:** National Flood Insurance Program

**CRS:** Community Rating System

A **floodplain** is a relatively low area adjacent to water that is subject to inundation during storms or snow melt events. A floodplain consists of a floodway, which is the stream channel and adjacent areas that are subject to strong flows, and the flood fringe, which is the area outside of the floodway prone to inundation.

# 04 The Plan

**Goals, Objectives, Strategies, and Actions**

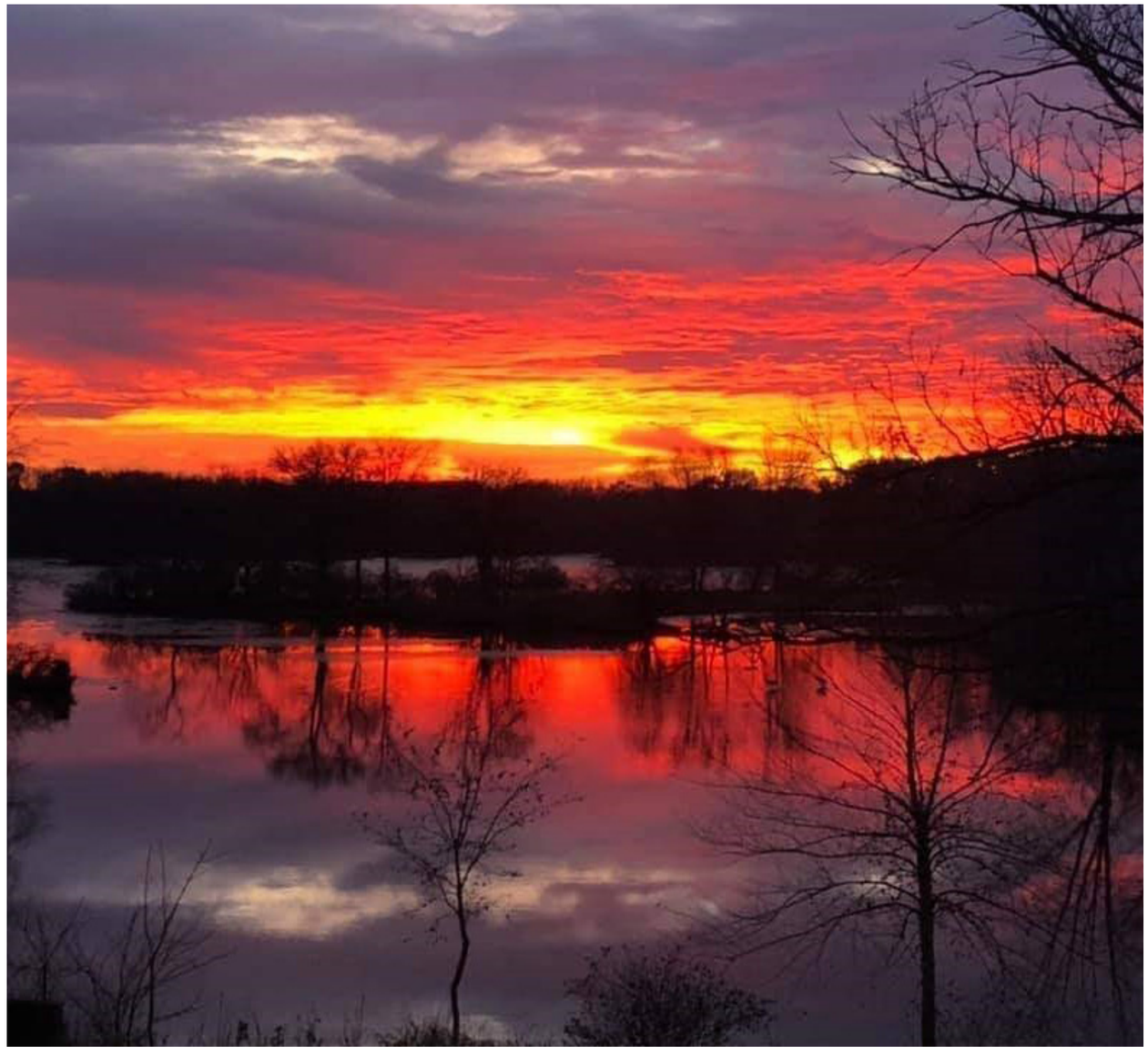


*Figure 13: Beautiful Fall Sunset*

*Source: Photo Voice, Maquoketa River Watershed Stories*

# Goals, Objectives, Strategies, and Actions

## Goal 1

**Improve water quality through techniques for nutrient management, erosion reduction, and increased infiltration**

## Goal 2

**Improve watershed flood management**

## Goal 3

**Increase watershed awareness and involvement among stakeholders**

## Goal 4

**Preserve, protect and improve ecologically sensitive habitats and ecosystems in the watershed**

## Goal 5

**Establish the WMA as a trusted community resource**

Although there is no single component that defines success, there are several factors that, if implemented, would enhance the chances of a successful watershed implementation plan. These factors include setting measurable goals and objectives, the involvement of stakeholders in the planning effort, the support of local government agencies, a plan for monitoring and evaluating implementation strategies, and ongoing communication between organization members.

Creating this watershed management plan is the first step in a coordinated effort to ensure that Best Management Practices (BMPs) are implemented and integrated with monitoring and outreach efforts. Implementing the plan involves conducting informational & educational activities, continued monitoring, and sharing results with the community.

# GOALS AND OBJECTIVES

| | | |
|---|---|---|
| 01 | **Improve water quality through techniques for nutrient management, erosion reduction, and increased infiltration** | Objective 1.1: Engage with the agricultural community to encourage techniques that increase field infiltration and reduce soil erosion.<br>Objective 1.2: Engage with the agricultural community to reduce and maximize efficiency of agricultural nutrient application.<br>Objective 1.3: Encourage practices that slow the flow of urban stormwater to increase infiltration and reduce erosion.<br>Objective 1.4: Encourage and increase bacteria management to reduce E. Coli and other bacteria levels.<br>Objective 1.5: Encourage and increase the implementation of wetlands to filter water pollutants.<br>Objective 1.6: Continue to document and report water quality indicators. |
| 02 | **Improve watershed flood management** | Objective 2.1: Advance the mission and goals of the WMA by fostering partnerships between agencies, organizations, and political entities regarding flood prevention and recovery.<br>Objective 2.2: Implement a comprehensive program of targeted activities designed to reduce flood risk and improve water quality in the Maquoketa River Watershed.<br>Objective 2.3: Increase awareness related to water quantity and strengthen connections between land use management practices and flooding. |
| 03 | **Increase watershed awareness and involvement among stakeholders** | Objective 3.1: Educate the local residents to make individual efforts and connections with the watershed.<br>Objective 3.2: Ensure all stakeholders in the watershed are included in activities and programs.<br>Objective 3.3: Expand WMA network within the watershed through outreach.<br>Objective 3.4: Work to achieve an effective interagency corporation with the upriver and adjacent WMAs, the State, the County, the Local Municipalities as well as the Soil and Water Conservation Authorities in the region. |
| 04 | **Preserve, protect and improve ecologically sensitive habitats and ecosystems in the watershed** | Objective 4.1: Prioritize natural resource sites in the watershed for preservation, protection and restoration<br>Objective 4.2: Protect streambanks, shorelines, and buffer areas within the watershed<br>Objective 4.3: Restore wetlands and riparian areas in the watershed<br>Objective 4.4: Improve habitat conditions for native flora, fauna, and marine lives in the watershed<br>Objective 4.5: Restore floodplain connectivity within the watershed<br>Objective 4.6: Protect source water sites in the watershed |
| 05 | **Establish the WMA as a trusted community resource** | Objective 5.1 Make the WMA representative of the people and interests in the watershed<br>Objective 5.2 Connect communities with resources specific to the watershed<br>Objective 5.3 Recognize and identify vulnerable populations in the watershed that may be affected by poor water quality and flooding |

With the watershed characterized and the issues analyzed, the team refined the preliminary goals to develop detailed objectives, targets, and indicators. Technical and social goals include identifying pollutant reductions needed to meet watershed goals and water quality standards, and determining which management practices should be used in critical areas to achieve those reductions. These water quantity and quality approaches and goals were refined based on data analysis.

# Goal 1 Improve water quality through techniques for nutrient management, erosion reduction, and increased infiltration

Results from the water sampling test in 2021 show several pollutants in the river and its tributaries. Improving the water quality has beneficial impacts on the animals and plants that inhabit the ecosystem, the people who use the river for recreation, and the watershed's downstream neighbors. The following objectives are aimed at reducing sedimentation, nitrogen and phosphorus nutrient levels, bacteria, temperature, and other compounds or characteristics that deteriorate the water quality and function.

*Figure 14: Planning Team at Manchester Whitewater Park*

*Source: Unknown*

According to the stakeholder survey, **75%** of respondents don't believe enough is being done to improve water quality throughout the watershed, and **43%** would be willing to pay more to improve water quality and reduce flooding near them. As well, they believe that WMAs and rural landowners need to be the most involved to create effective change in water quality. These results of the survey are supported by the water quality testing carried out each year by the Maquoketa River WMA.

## Objective 1.1: Engage with the agricultural community to encourage techniques that increase field infiltration and reduce soil erosion

Agricultural soil erosion has impacts on both the health of our fields and streams. Years of tall-grass prairie ecosystems created Iowa's uniquely fertile soil, making it one of the best places in the world for agriculture. However, much of Iowa's topsoil has been lost between the years of prairie clearing to today. Many modern agricultural practices can leave soil exposed to wind and water erosion by loosening, turning, or leaving the soil uncovered. Reducing soil erosion allows soil and other organic matter to stay in place, where it can hold rainwater, nutrients, and applications on the field instead of washing into the nearest creek. This reduces the overall flow and pollutant content of the streams in the Maquoketa River Watershed. As well, sediment levels and turbidity in streams can be reduced by anti-erosion efforts.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **1.1.1: Encourage the use of no-till** | • Identify farmers experienced in using no-till.<br>• Connect experienced farmers with farmers who have not implemented no-till.<br>• Identify funding opportunities and encourage MR WMA members to provide cost-sharing programs for no-till.<br>• Develop a network for sharing or renting equipment used for no-till.<br>• Host no-till education field days for farmers.<br>• Draft sample lease agreements that include conservation strategies as a term. | • US Department of Agriculture's Natural Resource Conservation Service (NRCS), Iowa Farm Bureau, Iowa DNR, Iowa State University Extension Office, Sustainable Iowa Land Trust (SILT) | • Regional Conservation Partnership Program (RCPP) funds coordination of NRCS conservation activities on a regional or watershed scale.<br>• EQIP provides agricultural producers financial and technical assistance |
| **1.1.2: Encourage the use of cover crops.** | • Identify farmers experienced in using cover crops.<br>• Connect experienced farmers with farmers who have not implemented cover crops. | • Interested community members | |

> "I have been doing no till for two and a half years and I've dropped my nitrate level by 1 part per million. - Upper Maquoketa Focus Group

Soil erosion was cited as a major concern in both the focus groups and survey conducted as a part of this plan. **59%** of survey respondents indicated that they were 'very concerned', and **35%** indicated they were 'somewhat concerned'. Throughout the focus groups, participants detailed the noticeable color change and sedimentation in the river post-storm and during high flow events. They also discussed the cuts and divots in streambanks as a result of fast and intense flooding. The participants highlighted the negative effect erosion and high flow events have on river-centered recreation in the region.

No-till is a widely accepted and adopted practice throughout the watershed. **63%** of respondents involved in agriculture use no-till on their fields. An additional **12%** are willing to consider it. Implementing no-till should be prioritized as an infiltration and soil conservation strategy as none of the respondents found the use of no-till to be 'too expensive' or 'too much extra work'.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| | • Identify funding opportunities and encourage MR WMA members to provide cost-sharing programs for cover crops.<br>• Develop a network for sharing or renting equipment used for cover crops.<br>• Host cover crop education field days for farmers.<br>• Create an informational resource on the process of implementation and benefits of cover crops.<br>• Draft sample lease agreements that include conservation strategies as a term. | • Iowa Farm Bureau, Iowa DNR, Iowa State University Extension Office, Sustainable Iowa Land Trust (SILT). | • RCPP Program<br>• NRCS |
| **1.1.3: Encourage the use of filter strips along streams** | • Connect and collaborate with technical agencies to identify ideal areas for filter strips.<br>• Identify funding opportunities and encourage jurisdictions to provide cost-sharing programs for filter strips.<br>• Develop a network for sharing or renting equipment used for establishing filter strips.<br>• Host filter-strip education field days for farmers.<br>• Create an informational resource on the implementation and benefits of filter strips. | • Iowa Farm Bureau, Iowa DNR, Iowa State University Extension Office | |
| **1.1.4: Encourage the use of wind breaks** | • Identify funding opportunities and encourage MR WMA members to provide cost-sharing programs for wind breaks<br>• Provide educational resources on the benefits of wind breaks. | • Iowa Farm Bureau, Iowa DNR, Iowa State University Extension | |

Agricultural respondents to the survey are already using cover crops and many would like to start. **41%** are already using cover crops and a third are willing to consider using them, the highest percentage of respondents willing to try a practice. However, there are a couple challenge to cover crop usage. Cover crops do not fit **10%** of respondents' operations, 4% found it too expensive, 2% believe it is too much work. The costs and additional work can be extensive depending on the crop of choice. An example cost for rye or wheat would be $67.95 to $72.45 per acre. These costs include seed cost, seedbed preparation, drilling/planting, herbicides, equipment, harvesting, and labor. Additional inputs may be necessary to kill the coverage crop for the new crop. Depending on the crop used, it may be yielded and sold, adding an economic benefit.

The respondents to the stakeholder survey showed high participation and interest in filter strip usage, with **48%** already participating and **21%** 'willing to consider'. This strategy had the second highest percentage of respondents 'willing to consider' adoption.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **1.1.5: Encourage the use of rotational grazing** | • Identify priority areas to encourage rotational grazing.<br>• Provide educational resources on the benefits of rotational grazing.<br>• Encourage MR WMA members to provide incentives for upfront costs of rotational grazing set-up. | • Interested community members, ISU Extension | 1. EQIP provides agricultural producers financial and technical assistance to implement structural and management practices that optimize environmental benefits on working agricultural lands. |
| **1.1.6: Encourage collaboration and participation with Iowa State University agricultural studies and resources related to increasing infiltration and reducing erosion** | • Connect with Iowa State University (ISU) Extension and Outreach for the watershed's agricultural community to learn or experience soil infiltration and erosion reduction strategies<br>• Advertise opportunities to MR WMA members through meetings, emails, the MR WMA website, and social media postings. | • ISU Extension, local media sources | |

**"There is a change in the attitude of people in the watershed. Sediment and larger events are more noticeable. It didn't just happen overnight and its not going to change overnight. Water quality is a big issue. - North Fork Subwatershed Focus Group**

About **42%** of survey respondents currently participate in rotational grazing.

Respondents to the Stakeholder Survey expressed wanting to learn more about many different conservation strategies.

## Objective 1.2: Engage with the agricultural community to reduce and maximize efficiency of agricultural nutrient application

Plants need nitrogen and phosphorus nutrients to grow. The soil seeds are planted in provides some of these nutrients, but as agriculture has intensified and yield expectations have increased, so has the need for nutrients in the soil. There are a few ways to replenish nitrogen (N) and phosphorus (P) back into the soil, but the most prevalent include applied nutrients in the form of manure or manufactured N and P fertilizers.

N and P are very important to crop growth and health, but in the process of application, nutrients can be washed away into nearby streams and creeks through rain events. Higher N and P concentrations in water allow for greater algal growth. There are multiple associated impacts with algal blooms, including hypoxic zones and toxin-producing algae. Hypoxic zones are aquatic areas where oxygen has been depleted by the overgrowth and decomposition algae in water spurred by the influx of nutrients. Without oxygen, fish and other aquatic creatures that need dissolved oxygen cannot survive, creating what is called a hypoxic or 'dead' zone. As well, certain types of algae release toxins harmful to both humans and animals. While some of these effects are felt close to home, many are transported downstream to other communities. The most famous example is the Gulf of Mexico 'Dead Zone' resulting from agricultural practices throughout the land draining into the Mississippi River.

Through water quality testing done by the WMA, they found high levels of nitrates and phosphates in the Maquoketa River and its sub-watersheds. It is important to reduce the amount of N and P running into the river to protect ecosystem health and recreational opportunities. While some level of added nutrients is necessary to farm at the scale and intensity done today, there are ways to maximize application efficiency and reduce applications to only what is necessary. This ultimately reduces the expenditures on fertilizer and possible run-off.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **1.2.1: Maximize nutrient application efficiency using soil or stalk tests** | • Identify funding options for soil and stalk testing<br>• Encourage local agencies and MR WMA members to provide cost-share programs for, soil, but especially stalk, testing.<br>• Establish a Soil Testing Day and encourage MR WMA members to provide testing resources (information, materials, possible funding) to their community on this day.<br>• Identify three farmers in each HUC-12 sub-watershed who regularly test soil or stalks. | • Interested community members, ISU Extension | • |

> "High nitrate levels in the water gonna cause greater expense for the municipalities especially that are pulling a lot of their water from near the rivers, having to treat those nutrients from the river water, to make it drinkable.- Upper Maquoketa Focus Group

When asked about the 'Dead Zone' in the survey, respondents showed varying concern, with **31%** being very concerned, **33%** being somewhat concerned, and **21%** not being concerned.

As well, **85%** of survey respondents believed that agriculture affects water quality in this region, and **60%** were very concerned about water pollution from agricultural sources.

Fertilizing based on soil test is the most widely adopted conservation strategy among respondents, with about **84%** indicating that they already participate in this activity. Fertilizing based upon stalk test is less widely adopted (25%), but **23%** were willing to consider it. However, an additional 23% say that it does not fit their operation.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| | • Connect testing-experienced farmers with farmers who have not used this strategy.<br>• Document progress through surveying farmers on how soil and stalk tests have changed their nutrient application.<br>• Document progress through coordinating with local agencies to understand the availability and utilization of cost share program. | • Interested community members, ISU Extension | • |
| **1.2.2: Educate the agricultural community on the positives and negatives of different nutrient application times, methods, and sources.** | • Work with community fertilizer suppliers increase spring supply.<br>• Create and distribute informational and educational resources on the consequences of fall application.<br>• Create and distribute informational and educational resources on sidedressing N fertilizer.<br>• Connect communities to information on and access to technical resources to map acreage productivity.<br>• Through the livestock assessment detailed in Strategy 3.5.1, identify sources of manure and connect with nearby row crop operations. | • Interested community members, ISU Extension | |
| **1.2.3: Reduce fertilizer use through strategies that increase soil health** | • Identify farmers experienced in using soil health improving practices.<br>• Connect experienced farmers with farmers who have not implemented soil health improving practices. | • Interested community members, ISU Extension | |

**Stalk tests** can be used to gather an understanding of the nutrient content of soil and uptake of crops, thereby informing the necessary amount to apply. This can reduce overapplication, minimizing fertilizer costs and run-off into nearby streams. Soil tests can be done before application, and stalk tests are done after the crops have grown for the season, informing the next year's application. Soil tests cost approximately $15 per sample. Cost did not appear to be a barrier to the use of soil tests, according to survey.

**Nutrients** can be applied during different seasons, from different sources, and using different methods. All of these factors have different implications for the growth, cost, labor, and nutrient loss for that growing season.

**Sidedressing** consists of injecting liquid fertilizer along the rows of growing crops using a tractor and a tank (also called 'knifing').

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| | • Identify funding opportunities and encourage MR WMA members to provide cost-sharing programs for soil health improving practices.<br>• Develop a network for sharing or renting equipment used for soil health improving practices.<br>• Host soil health improving education field days for farmers.<br>• Draft sample lease agreements that include conservation strategies as a term. | • Interested community members, NRCS, ISU Extension | • Identify potential funding sources |
| **1.2.4: Encourage collaboration and participation with Iowa State University agricultural studies and resources related to reducing and maximizing nutrient application and improving soil health.** | • Establish contacts at Iowa State University.<br>• Advertise opportunities to MR WMA members through meetings, emails, the MR WMA website, and social media postings. | • Local media, ISU Extension | |

**"Its half sickening sometimes to see how much sediment is coming down the river after even not that major of a rain event and so I think that is something that we need to focus on more is keeping the soil in the fields and keeping them out of the rivers. - Upper Maquoketa Focus Group**

Respondents to the stakeholder survey expressed wanting to learn more about many different conservation strategies.

## Objective 1.3: Encourage practices that slow the flow of urban stormwater to increase infiltration and reduce soil erosion

The use of natural buffers and greenways near the river and its streams allow areas for water infiltration, slowing water flow and reducing streambank erosion. In addition, these areas allow as buffer zones during flood events. Communities in the watershed have already implemented similar strategies in an effort to reduce flood impacts and slow water flow; a specific example is West Side Park in Dyersville. This park provides an infiltration zone for the water entering Bear Creek, a tributary to the North Fork Maquoketa River. In addition to reducing, filtering, and slowing water flow into streams and rivers, these areas provide a recreational asset to the community. As well, buffer areas would provide additional habitat for marine and wildlife in the watershed.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **1.3.1: Build an interconnected system of greenways and natural buffers to manage stormwater and provide recreational opportunities** | • Work with agencies with technical and GIS resources to identify and map areas critical to water quality.<br>• Work with MR WMA members to acquire land bordering streams.<br>• Promote and highlight the use of buffer areas as recreational opportunities. | • Iowa Flood Center (IFC)<br>• IDALS<br>• NRCS | • Stormwater Utility Funds<br>• Sponsored Projects Program via State Revolving Fund<br>• IDALS Urban Water Quality Initiative (WQI)<br>• Watershed Improvement Review Bntives Program (EQIP) |
| **1.3.2: Complete watershed-wide efforts to protect streambanks for erosion** | • Encourage MR WMA member municipalities to complete vegetated and protected streambank projects.<br>• Encourage MR WMA member municipalities to provide funding opportunities to landowners bordering the river and its tributaries to complete vegetated and protected streambank projects. | • Interested Community Members | |
| **1.3.3: Encourage the use of permeable pavers, rain gardens, and other stormwater management strategies by urban and rural landowners** | • Provide and connect respondents to educational resources on rain gardens/native landscaping and permeable pavers.<br>• Encourage MR WMA members to implement incentives or financial assistance for implementing rain gardens/native landscaping and permeable pavers. | • Interested Community Members | |

Throughout the focus groups, there was much discussion on the increasing rate of streambank erosion from fast moving, flash flood events. Multiple efforts to protect streambanks across the watershed were also discussed.

**75%** of survey respondents believe that run-off from paved surfaces is a major contributor to deteriorating water quality. The implementation of urban stormwater management strategies allows water a space to infiltrate and be held in the ground before flowing to the nearest tributary; this allows for a slower, reduced flow after rain events.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| | • Encourage MR WMA members to use rain gardens/native landscaping and permeable pavers in public projects. | • ISU Extension | • Stormwater Utility Funds<br>• Sponsored Projects Program via State Revolving Fund |
| **1.3.4: Encourage urban stormwater maintenance and review** | • Survey MR WMA members' stormwater management systems, current projects, and plans for improvement.<br>• Encourage MR WMA members to complete a stormwater management action plan.<br>• Promote communication across the watershed on what stormwater management practices are working.<br>• Draft and encourage stormwater management policies to integrate into municipal land use and development regulations. | • Interested community members, local municipalities | |

Participants in the Urban Leaders Focus Group described multiple efforts by cities in the watershed to improve their urban stormwater infrastructure. Improved stormwater management would lead to slower, less intense flooding events with less erosion across land and on streambanks. Efforts described in the focus group include stormwater system surveys, flushing storm sewers, and openness to integrating new, innovative approaches to manage stormwater.

## Objective 1.4: Encourage and increase bacteria management to reduce E. Coli and other bacteria levels

Water monitoring has indicated the presence of E. coli in the surface waters of the Maquoketa River watershed. E. coli is present in human and animal fecal matter and can cause sickness in humans. Because of its harmful impacts to human health, E. coli presence can reduce recreational opportunities in the watershed for as long as it persists. There are multiple strategies to reduce the presence and exposure to E. coli in the Maquoketa River and its tributaries. These strategies focus on managing fecal matter from livestock and humans, as we cannot control wildlife sources.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **1.4.1: Conduct a watershed-wide livestock assessment** | • Connect and collaborate with the DNR Watershed Improvement Program for further information and resources on livestock assessments | • Iowa DNR | • Sponsored Projects Program via State Revolving Fund<br>• IDALS Urban Water Quality Initiative (WQI)<br>• Watershed Improvement Review Bntives Program (EQIP) |
| **1.4.2: Identify priority feedlots and livestock operations through the livestock survey and other technical resources to target bacteria reduction or mitigation efforts** | • Create a priority list of livestock operations and areas.<br>• Connect and collaborate with MR WMA members to target policy and resources in priority areas. | • Interested Community Members | |
| **1.4.3: Work with MR WMA member counties to understand the state of septic systems in the watershed and complete updates if necessary.** | • Connect with MR WMA member county departments conducting septic testing to gather estimates of outdated or non-functioning septic system.<br>• Provide educational resources and outreach on aging and non-functioning septic systems.<br>• Encourage MR WMA member counties to provide incentives and financial assistance for updating or fixing septic systems. | • Interested Community Members | |

**"After rains there is significant decrease in water quality. I don't think it's isolated to just the Maquoketa, it's an issue for everyone to have. There are so many people that cherish the Maquoketa River. - Recreation Focus Group**

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **1.4.4: Research and encourage innovative and effective manure management strategies.** | • The MR WMA will stay apprised of innovative ways of managing manure and reducing bacteria contamination. | • Interested community members | 1. Innovative Technology Grants |

**"You're starting to see more Blue-Green Algae issues. The beach at backbone is closed for a month at a time in the summer. Cattle, Canadian Geese, farming practices, and urban practices all contribute. -Recreation Focus Group**

## Objective 1.5 Encourage and increase the implementation of wetlands to filter water pollutants

Wetlands are extremely important to both improving water quality and reducing flooding. Wetlands provide a space for water to slow down, for sediment to settle, and for plants to filter out nutrients and other compounds. While in the past many wetlands were filled in, watersheds throughout the country are reinstating and restoring them as their importance is realized.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **1.5.1: Increase awareness and provide educational resources on the importance of wetlands to water quality** | • Create graphics, posts, and videos on wetland importance to share on MR WMA platforms.<br>• Host wetland education days and organize lectures on wetland importance. | • Interested community members, ISU Extension | • Project Dependent |
| **1.5.2: Increase wetland establishment across the watershed.** | • Work with MR WMA members to identify ideal areas for wetland creation or restoration. | • Interested community members | |

**"Water quality has been an issue for a while – Despite many changes there is a lot of room for improvement. We need projects to reduce or slow down runoff. It's going to take a lot of small projects over a long period of time. -North Fork Subwatershed Focus Group**

**57%** of survey respondents answered that they believe wetlands are 'very beneficial', and 33% answered 'beneficial', at improving water quality and reducing flooding.

## Objective 1.6: Continue to document and report water quality indicators

The MR WMA has monitored water quality for multiple criteria across the watershed over the last couple years and will continue to do so. This will inform the effectiveness of past and current efforts and target future ones. However, the MR WMA will focus on communicating these results to not only the MR WMA members going forward, but the general public as well.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **1.6.1: Complete twice-a-year watershed-wide testing for criteria pollutants including nitrogen, phosphorus, chloride, turbidity/sediment, and bacteria** | • Synthesis results into clear, non-technical language.<br>• Create graphics describing water testing results.<br>• Create an online documentation of testing efforts. | • Iowa Flood Center, University of Iowa | • Stormwater Utility Funds<br>• Sponsored Projects Program via State Revolving Fund<br>• IDALS Urban Water Quality Initiative (WQI)<br>• Watershed Improvement Review Bntives Program (EQIP) |
| **1.6.2: Communicate results of testing to the community in an understandable and effective format.** | • Synthesis results into clear, non-technical language.<br>• Create graphics describing water testing results.<br>• Create an online documentation of testing efforts.<br>• Hold water quality testing demonstrations for communities within the watershed | • Iowa Flood Center, University of Iowa | |

> **"Areas where a lot of the rain is falling on paved streets, parking lots, whatever, that rain obviously is not going to soak away anywhere. And so, whatever can be done to slow that flow from hitting the storm sewers and dumping in the river real fast is part of the equation too so it's gonna take participation from everybody involved to really make something meaningful happen. - Upper Maquoketa Focus Group**

# Goal 2 Improve watershed flood management

The second goal of this plan is to improve watershed flood management. Increases in the intensity and frequency of extreme events in the watershed are consequences of a changing climate. The purpose of the plan states that watershed management is intended to offer a long-range perspective for both current and future flooding issues. Mitigating flooding through water management and the building and maintenance of healthy soil and ecosystems is key to the continued success of the Maquoketa River Watershed's communities, farms, eco-systems, and economies. This section will discuss the objectives, actions and strategies necessary to manage flooding.


*Figure 15: Manchester 1925 Flood*

*Source: Photo Voice, Maquoketa River Watershed Stories*

> **We've experienced flooding for hundreds of, thousands of years, it's just something that's gonna happen no matter how hard we try, but I do feel though we can help impact the severity of it's in the way that we do things. - Upper Maquoketa Focus Group**

**90%** of survey respondents report they are concerned about flooding in the watershed (either very concerned or somewhat concerned).

## Objective 2.1: Advance the mission and goals of the Maquoketa River Watershed Management Authority by fostering partnerships between agencies, organizations, and political entities regarding flood prevention and recovery.

In the past decade many cities and counties in the Maquoketa Watershed have incorporated policies and strategies mitigating flood hazards, leaving us with a wealth of information to draw from. Both current and past planning efforts within the watershed should be utilized for effective flood mitigation and prevention. To achieve the goal of improving watershed flood management the following actions and strategies are recommended:

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **2.1.1 Foster exceptional multi-agency/organization communication to build partnerships and engagement that will result in information sharing, and long-term commitment and sustainability beyond planning through implementation** | • Establish a flood mitigation committee that serves to communicate the mission, purpose, goals, objectives and actions of the Watershed Management Authority.<br>• Facilitate annual stakeholder meeting directly addressing flooding.<br>• Encourage agencies, organizations, departments and other partners to link online media and social media resources.<br>• Foster and encourage participation in projects that bring local, state and federal partners together with any subset of the WMA or with the WMA in its entirety for the improved functionality and health of watershed and its sub-watersheds.<br>• Work with partners independently and collectively, across political boundaries throughout the watershed, to expand collection, use, and coordination of, stream and river water quality data, stream and river flow data, precipitation data, soil moisture data, and other data that will help the WMA and its partners better understand and manage the hydrology of the watershed.<br>• Encourage local agencies and departments to refer to this plan. | • SWCD's, CCB, Engineer's Offices, NRCS, City Park and Recreation Departments, Iowa DNR, Wastewater Management Offices. | • Sponsored Projects Program via State Revolving Fund<br>• Watershed Improvement Review Bntives Program (EQIP) Stormwater Utility Funds |

## Objective 2.2: Implement a comprehensive program of targeted activities designed to reduce flood risk and improve water quality in the Maquoketa River Watershed.

Fostering implementation of this plan through expanded technical assistance and implementation of on-site practices is key to success. This plan prioritizes practices that will minimize disturbance and maximize the presence of current soil cover conditions and biodiversity. Use cover crops to recover flooded fields. Cut downs on erosion, weeds, improves water quality and enriches the soil's characteristics. Minimize disturbance of the soil, keep the ground covered and plant cover crops with deep roots in between cash crops, replenish the nutrients in the soil, and add earthworms and insects back into the system.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **2.2.1 Increase infiltration by implementing on-site practices that enhance soil health, increase water holding capacity, and reduce runoff** | • Promote the implementation of cover crops<br>• Promote the performance of no tillage, encourage strip-tillage or reduced tillage.<br>• Captured water and sediment runoff through the following actions:<br>- Install contour buffer strips grasses or legumes, that run with the contour of the crop field.<br>- Install prairie strips that alternate down the slope with a wider cropped strips.<br>- Install constructed channels of grass waterway to convey water to an outlet from a crop field.<br>• Promote tree and shrub establishment to provide year-round ground cover, living roots, and permanent vegetation in the form of woody plants.<br>• Install permeable pavement and bioswales in urban areas – permeable pavers, pervious concrete or asphalt, articulated pavers.<br>• Encourage local agencies and departments to refer to this plan. | • ISU Extension and Iowa Flood Center to research, analyze, and identify specific locations and optimization for water quality and quantity, and climate-resilient benefits. | • Project Dependent |

> "City flooding may be affected by other issues besides the river, but they are serious and need to be addressed with equal attention. - Survey Comment Section

## Objective 2.3: Increase awareness related to water quantity and strengthen connections between land use management practices and flooding.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **2.3.1 Work with schools to find residents that are at direct flood risk; also raise flood risk awareness amongst pupils by influencing curriculum to ensure that flooding is covered is taught in Geography lessons in schools.** | • Incorporate working lessons from other WMAs on community outreach.<br>• Increase frequency of community interactions and publications via a newsletter/electronic newsletter for kids.<br>• Host informational workshops and open houses<br>• Host follow-up Q&A workshops. | • WMAs in Iowa<br>• Public School Districts | • Project Dependent |
| **2.3.2 Discuss ways to help small farmers, non-profits, tribal groups, etc. submit project applications for best management practice funding, both from a level of effort and application process perspective.** | • Incorporate working lessons from WMA Executive Committee to improve processes<br>• Distribute notifications of program funding and opportunities to community groups, nonprofits, and other groups not represented in implementation projects.<br>• Host informational workshop for applicants to improve understanding of processes/approaches prior to grant cycles.<br>• Host follow-up Q&A workshops. | • Agricultural community, non-profit organizations | |
| **2.3.3 Complete a Streambank Erosion Assessment and/or Gully Assessment.** | • The DNR has developed assessment procedures to help watershed groups gauge the amount of streambank erosion and gully erosion are happening in the watershed. | • Iowa DNR | |

**"When we lost our dam in 2010 the economic impact was huge. We had marinas, we had restaurants, we had so many businesses suffer. - Recreation Focus Group**

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| | • Analyze the results and publish a map of problem streambanks and gullies for the watershed.<br>• Contact the DNR Watershed Improvement Program for training and equipment to conduct the assessments.<br>• Analyze the results and publish a map of problem streambanks and gullies for the watershed. | • Iowa DNR | • Project Dependent |

> One of the biggest issues in Delhi is siltation coming in – I think farming contributes. There are more siltation issues in the past twenty years than we've ever seen. Depth of water makes a big difference for our boating. - Recreation Focus Group

# Goal 3 Increase watershed awareness and involvement among stakeholders

Many of the residents as well the visitors of the Maquoketa River Watershed who live, recreate, or conduct business in the watershed are not familiar with concepts of watershed management and the impact that their daily activities have on the health of the watershed as a whole and the quality of water resources downstream in particular. Because watershed residents' actions directly affect the quality and quantity of water in both the streams and the Maquoketa River, increasing watershed awareness and involvement of the public becomes crucial when discussing best management practices to improve watershed health. The success of the implementation of this watershed management plan relies upon creating an informed community and empowering them to become stewards of their watershed. In order for this plan to be able to create a positive change, the ability to affect change within the Maquoketa River Watershed must originate from the local residents. Therefore, the manner in which watershed education is delivered as well as the design of the educational programs are vital and must be tailored towards a specific audience in the watershed.

The development of the educational and involvement programs will be an ongoing process. The WMA will continuously develop our educational process to identify and analyze the target audience of the watershed, create appropriate messages, package the message using the appropriate media, events, and leveraging resources, and distribute the messages. This approach will ensure that the water quality goals set by this plan will not only be understood by the residence but also inspire all members in the watershed to assist in reaching our goals so that in the next decade, we will have a healthier watershed to live, work and play in.

There are mainly three categories of audiences that this goal will address:

- The first category is residents that have the least amount of knowledge regarding the watershed. The engagement with this category will be non-technical and basic level.

- The second category is the residents who are moderately aware of the watershed and are willing to learn and modify their behaviors. This category will need intensive educational as well as involvement programs to build their knowledge

- The third category is folks who already have advanced knowledge of the watershed and are aware of the pressing issues. Since this category is already involved in advanced soil and water conservation practices, the involvement with them will be to utilize their knowledge and craft information that could be used to educate the first two categories.

> **Educate children in school about what we can do to save soil, wildlife, and littering, etc. -- not just through programs outside of school. we must reach all children they are the ones who will later own land, autos, have garbage, and want clean rivers. Therefore, they need a yearly introduction to studies, new procedures, changes in rules regarding soil and water conservation. The young generation needs to know that there's a need for improvement, and influence their parents, neighbors, and the urban public about litter, and waste in our driveways, yards, parks, public parking lots.** said one of the participants of the comprehensive watershed survey when asked for comments regarding watershed education.

A list of various activities was presented to the residents of the Maquoketa River Watershed in a survey, and they were asked if they believed if any of these activities/operations affect water quality within the watershed.

As a result, more than **17%** of the respondents did not think that agriculture, livestock, and city sewers had a negative impact on the health of the watershed.

The results of a comprehensive watershed survey determined that when the residents were asked who in their opinion needs to be involved to make the water quality better in the watershed, only **22%** thought that rural landowners play an important role, and only **10%** believed that urban residents needed to be involved because they played an important role in improving the water quality. This actively demonstrates that there is a need for awareness building and involvement of the stakeholders.

## Objective 3.1: Educate the local residents to make individual efforts and connections with the watershed

It is important to determine the existing condition and any changes that have occurred in the ecologically sensitive areas in the watershed before we can act upon improving the condition. Hence, to regularly monitor the changes and assess the conditions, a collaborative structure is needed among all the stakeholders within the watershed. Three strategies have been identified for MR WMA to move towards this objective, which include collaborating with various governmental and environmental agencies on state and federal level to identify and monitor characteristics and proportions of natural resources like flora, fauna, marine lives, and riparian areas of the watershed. Depending on the sensitivity , level of degradation, and time and budget constraints, further processes for preservation, protection and restoration of the sensitive areas will be carried out. The strategies for this objective heavily guide the implementation and evaluation strategies for other objectives of goal 4.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **3.1.1: Create Watershed Awareness Programs to raise watershed awareness among the residents as well as the visitors of the Maquoketa River Watershed** | • Create and promote seasonal recreational events for public.<br>• Use signs, storm drain stenciling, stream walks, maps, etc. to create awareness on a basic level. | • Interested community members | • Project Dependent |
| **3.1.2: Create Personal Stewardship Programs to educate the residents about the individual role they play in the watershed.** | • Create a continuous series of video lessons that promote watershed stewardship and communicate specific messages about helpful and harmful behaviors and practices of the individuals.<br>• Use field trips, lessons to a single classroom, lead educational games, and organize service-learning opportunities for schools, after-school clubs, and community groups to communicate watershed responsibility among the residents. | • Public school districts, local artists, recreational groups | |

When the residents of the watershed were asked if they feel enough is being done to address various watershed problems such as water quality and conservation, **75%** of the respondents said no. This means that there is a need for education within the watershed so that the residents know of all the activities that are being carried out by the WMA as well as other soil and water conservation authorities.

Many participants of the Focus Groups, too, suggested that there should opportunities for hands-on educational opportunities for the residents to learn about the watershed and its needs. Through hands-on educational program, the residents would become more aware of the water quality issues within the watershed.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **3.1.3: Create Professional Training Programs to educate the development community on how to apply best management practices as a watershed protection tool.** | • Conduct training seminars for the agriculture folks in various subwatershed to educate them about the best management practices and watershed protection tools specific to their subwatershed.<br>• Create a program through which the WMA would connect individuals interested in watershed related practices with the environmental organizations and scientists in the field. | • Interested community members and agricultural groups, University of Iowa | • Project dependent<br>• Our Town Grants by National Endowment for Arts |
| **3.1.4: Organize Watershed Engagement Programs to provide opportunities for the public to actively engage in watershed protection and restoration.** | • Collaboratively regularly with the state, local agencies and residents to develop water quality goals for impaired and non-impaired waters as well as the means for achieving those goals.<br>• Using research, citizen input and a broad array of available tools, develop incentives and disincentives to change individual behaviors that negatively impact water quality. | • State, local, and federal agencies and interested community members | |
| **3.1.5: Utilize creative place-making strategies to engage citizen participation and increase awareness about watershed health** | • Conduct annual workshop events in primary and elementary schools within the watershed to involve the kids in developing creative art pieces in the form of stories, poems, drawings, etc. related to their interactions with water and other natural assets of the watershed<br>• Engage with local artists and use the art pieces collected from school kids to be developed into graphics that can be used for mural/sculpture projects within the watershed<br>• Include a webpage in MR WMA website that is entirely dedicated to publishing creative writings from communities in and around the watershed about their interactions with natural assets of the watershed | • Interested community members, local artists, local businesses | |

> **"Cover Crops and Banding of the Herbicides are conservation practices that I would like to see some better practices and better results before I would do it myself. - Lower Maquoketa Focus Group**

> **"Habit is the biggest barrier. Most of the times people are set on their ways and it takes a lot for them to change their ways. I think Incentives go a long way in helping people change their habit and alter their ways. - Lower Maquoketa Focus Group**

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| | • Conduct annual participatory event with unique themes in one of the school districts (circulating each year to another school district) of the watershed where students come together to perform dance numbers, drama, storytelling, spoken poetry, etc. regarding importance of nature, wildlife and water resources of the watershed | • Interested community members | • Project dependent |
| **3.1.6: Launch and maintain a stream cleanup** | • Create an Adopt a Stream program, which enables and encourages the individual residents, groups, or organizations to take responsibility for each mile of the Maquoketa River streams. The adopted section of the stream will have to be cleaned up by the individual or group taking responsibility for it. This initiative will be a five-step process as described below:<br><br>- Getting Started: Allow the interested residents to either form a team of more than four individuals or join an existing team. Teams can be formed through their workplace, neighborhood, schools, church, and other community groups.<br><br>- Pick a Stream: Provide and assist the teams with a list of available streams that would benefit from the cleanup efforts<br><br>- Adopt A Stream: Prepare the adoption papers so that the WMA would have the information it needs to help begin planning the event.<br><br>- Clean It Up: Reserve a date and provide a check list for the teams to make sure the appropriate equipment is available. Next, Fill out the safety & liability waiver. Last, provide a Review our safety guidelines<br><br>- Clean Up Survey: prepare a short survey that ask the participants about the experience and let them share their finding through testimonies and pictures. Provide the results to the Iowa Department Of Natural Resources (DNR) on an annual basis. | • Interested community members | |

**"Everyone needs to take a more active role in keeping our river clean. - Survey Comment Section**

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **3.1.7: Hold and support educational and outreach efforts including NRCS and IDNR initiatives regarding soil and water conservation and quality, and BMPs** | • Create a team dedicated to reaching out to the residents interested in employing the BMPs | • Interested community members | • Project Dependent |
| **3.1.8: Conduct an ongoing marketing campaign to raise awareness of watershed problems, causes, possible remedies, opportunities, organization goals, and cooperative initiatives being undertaken** | • Collaborate with various media outlets to publish a series of short press releases informing the public about the condition of the watershed. | • Local media | |
| **3.1.9: Develop a watershed stewardship ethic among landowners, producers, managers, business owners, residents, and local government** | • Collaborate with Iowa Department of Agriculture and Land Stewardship.<br>• Create a series of five video content that introduce the Maquoketa River Watershed, and talk about the various elements such as, water quality, agriculture, recreation, soil health, flooding, and more | • Iowa Department of Agriculture and Land Stewardship | |

When the residents of the watershed were asked about their interest in participating in the Best Management Practices (BMPs), up to **43%** of the respondents said that they are interested in employing BMPs but need more information regarding their application and outcome.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **3.1.10: Use recreation to familiarize the residents, businesses, and landowners with the concept of what a watershed is and convey how land uses and practices within the watershed effects streams** | • Conduct tours and Speaker series for the businesses and landowners as well as the government officials that would consist of a tour around the watershed to see the areas of concern as well as to see different conservation practices.<br>• Conduct water quality tests for the residents, businesses, and landowners to involve people to spark their interest in watershed-related issues.<br>• Conduct Field Days, Workshops, and Speaker Series and having outside resources come in to present to a similar group of people. These activities can be more hands-on than just a tour and a different way to engage the public and other groups involved in the watershed plan's implementation.<br>• Organize recreational events and use the events as an opportunity to raise awareness about the watershed issues | • ISU Extension, NRCS, Interested community members | • Project Dependent |

**"Recreation is what's going to bring people in and together. - Urban Leaders Focus Group**

Through the suggestion box of the comprehensive watershed survey, many of the residents of the Maquoketa River Watershed noted that **lack of knowledge** is among one of the primary reasons that prevent them from adopting conservation strategies in their properties.

## Objective 3.2: Ensure that maximum stakeholders in the watershed are involved in the watershed activities and programs

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **3.2.1: Foster and facilitate leadership in watershed management projects:** | • Create a taskforce responsible for fostering leadership in watershed management projects:<br>• Do a need assessment among the residents to build capacity for watershed leadership. | • Interested community members, University of Iowa | • Project Dependent |
| **3.2.2: Foster and facilitate farmer leadership in watershed management projects** | • Recruit other farmers to participate in project activities, while demonstrating BMPs on the farm, providing testimonials, and mentoring other farmers to promote priority BMPs for water quality.<br>• Provide consultation by serving on advisory groups to assist watershed project staff to define project goals, tactics, or strategies.<br>• Serving in a formal leadership role to define project goals, tactics, and strategies and to direct the distribution of resources | • Interested community members | |
| **3.2.3: Develop and implement a program to Identify and support soil and water conservation committees** | • Identify the stakeholders who are implementing BMPs as well as proactive communities, and recognize and support them<br>• Host a yearly recognition event at the subwatershed level<br>• Advertise and promote the recognition and support of the committees at the Annual Meeting as well as through the WMA's website, social media, and press releases. | • Interested community members | |

When asked for feedback regarding the priorities for the watershed management plan, multiple participants of the focus groups suggested that we should find ways to reach more people that are invested in the watershed issues. Therefore, it is one of the primary objectives of the MRWMP to provide opportunities for all the residents of the watershed and to find new ways to reach a broader audience so that various groups of residents get an equal opportunity to participate in the educational activities organized by the WMA.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **3.2.4: Create a program to Identify and support at least 4 water conservation/soil health champions in every subwatershed: a farmer, an engaged citizen, a community organization, and a public official** | • Determine a success metric to recognize the watershed champion by developing a process with peer review<br>• Organize a yearly recognition event at the subwatershed level and select the champions<br>• Support the champions so that they become Soil and Water Health leaders in their communities.<br>• Advertise and promote the recognition and support of the champions at the Annual Meeting as well as through the WMA's website, social media, and press releases | • Interested community members | • Project Dependent |
| **3.2.5: Launch a campaign to Increase voluntary action by promoting the message that while conservation practices are voluntary, they should not be thought of as optional** | • Encourage community leaders in conservation and sustainable farming to be leaders in delivering this message.<br>• Utilize the local and regional media outlets to send short weekly and bi-weekly press releases with information highlighting the importance of participation in the conservation practices.<br>• Utilize the WMA's website as well as social media to create posts that talk about conservation practices that are free to adapt. | • Interested community members | |

**"If we're gonna encourage farmers to do practices that would help erosion and slow up waters, there should be incentive and programs that would make farmers want to participate and not to be forced upon them. - Lower Maquoketa Focus Group**

The concept of providing incentives as well as cost-sharing opportunities to the farmers was brought up multiple times during the discussions in the Focus Groups. in order to promote and motivate the stakeholders to participate in the practice of BMPs, the focus group participants suggested to create an initiative that would, "identify and engage with the residents who are interested in employing the conservation practices and help find sources of funding for them". Acknowledgment and giving credit to the residents who are interested and motivated in saving their watershed would encourage the rest of the community through competition and positive peer-to-peer influence to put effort and take part in the conservation practices. Furthermore, depending on the availability of funding a **watershed champion** could be selected from each of the nine counties that make the Maquoketa River Watershed. This would ensure that residents of all of the counties are engaged.

## Objective 3.3: Expand WMA network within the watershed through outreach

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **3.3.1. Bring in additional partners that may have vested interests in the watershed not already at the table and prioritize efforts for the local governments: cities, municipalities, counties needed to achieve WMA outcomes** | • Collaborate with environmental agencies like Iowa DNR<br>• Collaborate with city governments that are members of MR WMA.<br>• Foster a relationship with the school districts in the watersheds to incorporate the Maquoketa River Watershed in their classes.<br>• Conduct School tours and Speaker series. The series of bus tours consists of taking a group of students on a tour around the watershed to see the areas of concern as well as to see different conservation practices.<br>• Conduct water quality tests at the schools to involve the younger generation and to spark their interest in watershed-related issues. | • Iowa DNR, City governments, Public school districts | • Project Dependent |
| **3.3.2: Organize multiple field days in a year to talk about specific topics such as soil health, cover crops, stream restoration, nutrient management BMPs, hydrology, and other necessary topics** | • Identify the Field Days for each year.<br>• Invite the public and secure hosts and partners for the event.<br>• Conduct a press campaign to inform the public about the Field Days.<br>• Develop educational materials to educate and inform the participants of ways to improve their soil, move water through their soils and save money while doing it. | • Iowa DNR | |

**"Not everyone treats the river with the kind of respect it deserves – as we invite more users in we need them to understand their responsibility. More education is needed.- Recreation Focus Group**

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| 3.3.3:. Conduct both urban and rural outreach and target the outreach events towards the landowners in the areas critical to flooding and water quality. | • | • | • |

> "Poor construction practices and farming practices will have a negative impact in terms of water quality, but, I truly believe we're going to be a growing engine in terms of river recreation. - RecreationFocus Group

## Objective 3.4: Work to achieve an effective interagency corporation with the relevant authorities in the region

In order to promote a more cost-effective and efficient approach to water resource management interagency partnerships are vital. The goal of the Maquoketa River Watershed Management Plan is to create new partnerships as well as nurture existing ones with the counties, municipalities, the State, Federal, and all agencies in between. Since all of these entities share a common goal when it comes to water resource protection, the Maquoketa River WMA is in a unique position to identify and support collaborations between various partners/stakeholders with similar projects and programs.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **3.4.1: Work effectively with the upriver, downriver, and adjacent WMAs, the State, the County, the Local Municipalities as well as the Soil and Water Conservation Authorities** | • Work with municipalities through technical resource sharing and interagency coordination programs to promote watershed knowledge within the localities.<br>• Work effectively with the state, local municipals, upstream and downstream Soil, and Water conservation authorities.<br>• Form new partnerships with the industries within the watershed. | • SWCDs, City governments, interested community members | • Project Dependent |
| **3.4.2: Continue partnerships with technical and membership organizations** | • Collaborate with Iowa Department of Agriculture and Land Stewardship, the Iowa Soybean Association, multiple agricultural commodity groups, etc. | • Agricultural groups | |
| **3.4.3: Cultivate partnerships with the adjacent watershed authorities** | • Participate in the events of the adjacent WMAs, especially the upriver and downriver WMAs.<br>• Invite the adjacent WMAs to the Maquoketa River Watershed Management Authority's key seasonal events | • Iowa WMAs | |

> **If our boards and our councils can take sustainability into account as part of economic development we can be more sustainable. - Recreation Focus Group**

## Objective 3.5: Identify funding opportunities that could be utilized to apply the strategies identified throughout the objectives to promote Goal 3

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **3.5.1. Identify watershed grants that are targets for funding and apply for at least one grant a year** | • Apply for Watershed Development and Planning Grants: The WDPGs are issued by the Division of Soil Conservation for Districts and watershed partners to complete projects regarding watershed assessment, problem source identification, partnerships, and landowner support.<br>• Apply for Water Protection Fund and/ or Watershed Protection Fund, which offers financial assistance to Soil and Water Conservation Districts interested in watershed implementation grants, and those interested are encouraged to contact IDNR. | • SWCDs | • Project Dependent |
| **3.5.2. Meet with partners and stakeholders to identify additional financial support through private foundations and NGOs.** | • Arrange a quarterly meeting with the WMA partners and stakeholders to look for additional funding in private foundations such as the Coca-Cola Community Support program, McKnight Foundation. | • Community members | |

**"During normal flows, the water is clear. But during high flows, you don't want to look at it. It's dangerous, you don't want to drink it. When it's high flow, it's coming off fields and all that comes with that. - Urban Leaders Focus Group**

Findings from both the survey as well as the focus group sessions show that the majority of the residents deem the money or lack thereof to be the primary barrier towards the application of BMPs. During the survey, when the residents of the Maquoketa River Watershed were asked about the major barrier towards adopting conservation strategies on their property, **36%** of the respondents indicated that lack of funding is the primary barrier for them.

# Goal 4 Preserve, protect and improve ecologically sensitive habitats and ecosystems in the watershed

Ecologically sensitive areas in a watershed include wetlands, floodplains, and aquatic and riparian habitats. These areas provide optimum habitat for most diverse wild- and marine-life and are an integral part of migratory behavior of various animals and fishes. The unique mix of biodiversity provide opportunities to create recreational spots for surrounding communities as well. Similarly, with natural filtration and storage capacity, these ecologically sensitive areas are proven to be of great importance in improving water quality and maintaining natural level of flooding with reduced risk of droughts.

Riparian wetlands and floodplains are areas that are naturally formed to help disperse the water during extreme events as such. Along with increasing awareness among the communities regarding the importance of sensitive habitats, active measures should be taken to restore the areas which have already begun degrading. Human induced activities like overgrazing and construction of physical structures that modify stream behaviors can intervene in the natural ecosystem of riparian zones in many ways. Given their sensitivity and vital role in maintaining a healthy watershed, it is important for these areas to be actively preserved, protected, and improved. The objectives that will help us get closer to the goal are described below along with various strategies and actions that could be taken for positive outcomes.

*Figure 16: Backbone State Park*

*Source: Photo Voice, Maquoketa River Watershed Stories*

As pointed out in all of the focus groups conducted by our team,

**recreational facilities**

are very important in establishing intimate connection between nature and surrounding communities, which in turn increases awareness among people about watershed health. Photo Voice participants also highlighted recreational activities, scenic beauty and being closer to nature as being major interactions with the watershed.

Our stakeholder survey showed

that **89.97%** of the participants were concerned (very concerned or somewhat concerned) about

risk of flooding and **71.47%** were concerned (very concerned or somewhat concerned) about risk of drought in the watershed. Likewise, majority of the respondents

(**65.37%**) mentioned that they find the water quality throughout the watershed to be okay or bad and

**74.76%** don't feel enough is being done to address water quality issues in the watershed. Groundwater quality and siltation were one of the major issues mentioned during several focus groups conducted during the planning process.

## Objective 4.1: Prioritize natural resource sites in the watershed for preservation, protection and restoration

It is important to determine the existing condition and any changes that have occurred in the ecologically sensitive areas in the watershed before we can act upon improving the condition. Hence, to regularly monitor the changes and assess the conditions, a collaborative structure is needed among all the stakeholders within the watershed. Three strategies have been identified for MR WMA to move towards this objective, which include collaborating with various governmental and environmental agencies on state and federal level to identify and monitor characteristics and proportions of natural resources like flora, fauna, marine lives, and riparian areas of the watershed. Depending on the sensitivity , level of degradation, and time and budget constraints, further processes for preservation, protection and restoration of the sensitive areas will be carried out. The strategies for this objective heavily guide the implementation and evaluation strategies for other objectives of goal 4.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **4.1.1: Collaborate among other governmental agencies and maintain an inventory of natural resources in the watershed** | • Identify types of native and non-native vegetations generally present in riparian zones and create an inventor<br>• Identify types of native and non-native species of birds and animals in riparian zones and create an inventory<br>• Identify all aquatic species in streams and tributaries and their natural channel in the watershed and create an inventory<br>• Maintain and make easily available an inventory of wetlands and aquifer sites in the watershed through information provided by United States Geological Survey (USGS)<br>• Maintain and make easily available an inventory of source water sites in the watershed through information provided by USGS<br>• Maintain an inventory of maps of floodplains in the watershed through information provided by Federal Emergency Management Agency (FEMA) | • Iowa DNR, USGS, FEMA | • Project Dependent |

**"Swimming, boating, hunting, fishing, chasing frogs. A childhood with the Maquoketa in the back-yard shaped the trajectory of my career. - Recreation Focus Group**

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **4.1.2: Identify natural features and monitor changes in ecological areas in the watershed** | • Identify naturally occurring ecological proportion of different types of native vegetations and monitor the changes<br>• Identify naturally occurring ecological proportion of different species of birds and animals and monitor the changes<br>• Monitor different parameters of aquatic habitat including amount of different species of marine life, water temperature and nutrients' presence<br>• Identify and monitor wetlands ecological health based on water quality in the area itself and in nearby ground or surface water site<br>• Monitor water quality and quantity in source water sites based on Water Quality Standards set by United States Environmental Protection Agency<br>• Identify streambanks and shorelines that are degrading in terms of soil erosion, siltation, and presence of vegetation<br>• Identify and monitor floodplain health based on connectivity to streams, and high and low water flows according to its hydrological function | • Iowa DNR, Iowa Watershed Approach | • Project dependent |
| **4.1.3: Prioritize restoration activities in the watershed** | • Identify sensitivity level of identified natural resource sites in the watershed<br>• Identify degradation level of identified natural resource sites in the watershed | • Environmental agencies; Iowa DNR<br>• Environmental agencies; Iowa DNR | • Project dependent |

**"Education really starts with that drop of water. Weather is the mood, and the Climate is the personality. - Recreation Focus Group**

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| | • Develop tangible targets to restore degraded ecologically sensitive areas in the watershed<br>• Identify potential funding sources and respective time and budget constraints to carry out restoration activities for degraded areas<br>• Prioritize areas to initiate restoration activities for the fiscal year based on sensitivity, urgency, time and budget constraints, and city governments' available resources<br>• Continue monitoring the priority list and update each year | • MR WMA member cities, Iowa Watershed Approach, cities within the watershed | • Project Dependent |

**"We have relatively little recreational opportunities in Iowa and its becoming more and more important. - Recreation Focus Group**

## Objective 4.2: Protect streambanks, shorelines, and buffer areas within the watershed

Streambanks, shorelines, and buffer areas are prone to damage because of human induced activities like urbanization and agriculture. However, the natural features of these areas are important in having natural balance in hydrological system of the respective streams. In addition, healthy streambanks will minimize risks of soil erosion thereby reducing debris build up in the surface waters. Buffer areas are areas that are designated to protect sensitive areas like wetlands, ponds, lakes, etc. These areas serve of great value in preserving ecologically sensitive sites, and in preserving migratory behaviors of wildlife that is present in the watershed.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **4.2.1: Minimize erosion by limiting human activities that erode streambanks** | • Provide fencing to minimize access to erodible streambanks<br>• Limit livestock grazing in riparian habitat to avoid altering natural landscape and soil stability<br>• Limit types of traffic like horseback rides, motorbikes, etc. and heavy use equipment in trails and areas that are closer to sensitive streambanks<br>• Design trails that align more with human behavior to avoid user-generated shortcuts<br>• Adopt best practices to minimize sediment during new constructions | • Interested community members, local government | • Project Dependent |
| **4.2.2: Restore stability in streambanks through native vegetations and natural infrastructures** | • Replant native riparian plants and vegetations in eroded streambanks to increase soil stability<br>• Construct riprap in streambanks with natural rock to stabilize against stream movement<br>• Install Iowa vanes to redirect stream flow and eventually collect sediment on eroded streambanks and stabilize them | • Iowa NRCS | • Project Dependent |

> **There should be limits to size and speed of boats on lake delhi, the increase is having a severely detrimental impact on shoreline and aquatic habitat. - Survey Comment Section**

> **As a kayaker, I see streambank erosion as a huge issue, followed by debris after flood events-log jams, gargbage. - Survey Comment Section**

**83.08%** believe that streambank erosion affects water quality within our watershed.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| | • Refer to 'How to Control Streambank Erosion' manual prepared by Iowa Department of Natural Resources and 'Chapter 5: Streambank and Shoreline Erosion' from National Management Measures to Control Nonpoint Source Pollution from Hydromodification prepared by United States Environmental Protection Agency for further vegetative and structural practices to stabilize streambanks and shorelines | • Iowa DNR | • Not necessary |
| **4.2.3: Restore stream buffer areas** | • Maintain and preserve minimum width of vegetated buffer around freshwater habitats<br>• Identify active streams and take note of natural stream migration to provide adequate width of buffer for natural stream movement<br>• Provide connection between buffer areas to create habitat corridors and maintain animal movement<br>• Consider land acquisition and permanent easements creation to preserve stream buffer areas | • City governments, USGS, city governments, state officials | • Project Dependent |

**"If you take a look back historically when there was prairie, large pieces of prairie would absorb the rainfall. Having a buffer along the river would be hugely beneficial to slowing down the runoff, capturing manure, and slowing sediment loss. - Recreation Group**

## Objective 4.3: Restore wetlands and riparian areas in the watershed

Wetlands are areas which are either year-round or seasonally saturated with water. They provide healthy and diverse ecosystem for numerous plants, animals, birds, as well as many marine lives that depend on them. The roots of the variety of vegetations they house help capture and release water gradually to their surroundings, helping recharge the groundwater throughout the year. This eventually reduces the possibilities of flash floods as well as droughts. They also provide natural filtration to the water that end up into the streams and lowland areas. As groundwater is one of the major sources of drinking water for our communities, wetlands are integral elements in naturally improving water quality. The vegetations that grow in riparian areas have deeper root system that provides better soil stability minimizing soil erosion. The forest cover and shrubs also provide a cooling effect to the water system, keeping the water temperature in the streams nearby cool and suitable for aquatic lives.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **4.3.1: Restore natural ecological features in degraded wetlands and riparian areas of the watershed** | • Restore original physical attributes of riparian areas such as slopes, shorelines and stream channels<br>• Restore original proportion of native plants and animals in the wetlands and riparian areas<br>• Identify and address causes of changes in any hydrological functions of the wetlands<br>• Remove non-native species of plants and animals in the areas<br>• Promote usage of passive restoration process rather than active restoration for wetlands and ripariana areas whenever feasible<br>• Avoid construction of sediment retention basins on wetland systems | • City governments within the watershed, USGS | • Wetland Program Development Grants by USEPA<br>• 5 Star Wetland and Urban Waters Restoration Program by USEPA<br>• Clean Water State Revolving Fund by USEPA<br>• Wetlands Reserve Program by NRCS |

> **I am concerned about the run off and how to prevent/reduce. Run-off brings sediment and containaments down stream. More needs to be done to encourage conservation of our soil. - Survey Comment Section**

**79.67%** mentioned they were concerned about the loss of wetlands and **42.63%** indicated they needed more information to participate in wetland restoration.

Majority of the survey respondents (**90.25%**) also believe that wetlands are beneficial (very beneficial or beneficial) for reducing flooding impacts and improving water quality. In our watershed, excessive rainfall events in the recent years which has led to increased events of flash floods have been concerning for residents, as mentioned in several focus groups.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **4.3.2: Collaborate with city governments and agencies to minimize human activities in degraded wetlands and riparian areas of the watershed** | • Establish minimum width of buffer strips alongside wetlands depending on sensitivity of the area<br>• Develop wetland protection and conservation ordinance that limits the introduction of physical infrastructures in the areas<br>• Promote usage of non-motorized trails when located nearby wetlands<br>• Incentivize usage of permeable pavements on settlement areas nearby wetlands and riparian areas | • City governments | • Other potential sources at Water Finance Clearinghouse that is administered by federal, state and local governments and agencies |

**"Sometimes programs are so cost prohibitive that they prevent conservation strategies from being put into place. It has to be black/white measurable – and sometimes black and white doesn't make a lot of sense. - North Fork Focus Group**

## Objective 4.4: Improve habitat conditions for native flora, fauna, and marine lives in the watershed

Native vegetations, wildlife and aquatic lives sustain the abundance in our watershed. Native lives flourish when in presence of native vegetation and forest areas. To preserve the asset that they are, we have to mindful about how previous development patterns have impacted them, and how the future development patterns might impact them.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **4.4.1: Improve native landscape cover in the watershed** | • Promote and organize tree and shrub planting, and forest restoration programs<br>• Conduct annual maintenance programs in riparian areas to remove invasive species of vegetations<br>• Establish a native seed bank to increase accessibility of native vegetations<br>• Conduct community programs to increase awareness among residents regarding importance of native landscape cover | • Iowa DNR, City governments, Trees Forever, ISU Extension | • Project Dependent |
| **4.4.2: Improve wildlife habitat in the watershed** | • Increase food supply and forest cover for wildlife, by applying forest edge improvement technologies<br>• Restore spring seeps to ensure adequate water supply for wildlife during winter months<br>• Provide wildlife corridors as connection points between riparian buffer zones so that wildlife movements are unobstructed, via collaboration with city and state officials to develop zoning ordinances and land use designations accordingly | • City governments; Iowa DNR | • Project Dependent |

**34.25%** said they already participated in native landscaping or wildflower and rain gardens, and **40.16%** indicated their interest to start participating.

Majority of our survey respondents (**87.74%**) indicated their concern (very concerned or somewhat concerned) for loss of wildlife habitat.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **4.4.3: Improve aquatic habitat in the watershed** | • Increase plantation of aquatic vegetation in case of reduction, to increase protection and food production for small fishes<br>• Organize and and promote regular cleanup events in critical streams<br>• Protect and restore native vegetations in riparian areas and areas nearby lakes and ponds, to maintain shades and ultimately cooler water temperature suitable for aquatic lives<br>• Increase floodplain connectivity by using strategies mentioned in Objective 4.6 below.<br>• Initiate oxbow restoration projects to increase stream connectivity and hence maintain migratory and reproductive behavior among aquatic lives<br>• Restore stream habitat and increase stream health for aquatic life | • Iowa DNR fisheries, local angler groups, local environemntal agencies, Trout Unlimited | • Project Dependent |

**“Improving fish habitat would greatly increase tourism. - Survey Comment Section**

**84.43%** about the loss of aquatic habitat in the watershed.

## Objective 4.5: Restore floodplain connectivity within the watershed

Floodplains are areas adjacent to surface waters, which are occasionally or periodically flooded. Floodplains adjacent to rivers are typically called riverine floodplains which, along with seasonal floods, are prone to flooding after excessive rainfall events. Small floods deposit sediments and nutrients in the floodplains providing fertile soil for vegetation, while during larger floods, floodplains provide natural storage and filtration for the floodwater. This eventually increases the groundwater recharge capacity and reduces debris in streams, lakes and ponds. These areas lead to natural slowing down and spreading of floodwaters, which otherwise could've led to severe destruction of properties and lives. They also house diverse vegetation and aquatic habitat, playing an important role in migratory behavior and reproductive cycle of marine lives. Floodplain restoration can be conducted with following strategies, where areas requiring immediate attention can be determined from the priority list created for critical floodplains.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **4.5.1: Restore stream connectivity to floodplains** | • Restore vertically eroded streambanks by creating slopes and planting native vegetation<br>• Restore straightened stream channels to better accommodate their natural meandering patterns<br>• Address upstream water usage in case of reduced flows into the floodplain and devise controlled water release events to simulate natural flood pulses<br>• Create a new floodplain with decreased elevation and retain parts of previous floodplain as floodplain terraces in case of vertical disconnection due to stream incision | • Environmental organizations; Impact 7G | • Project Dependent |
| **4.5.2: Restore vegetation and habitat diversity** | • Replant native riparian plants and vegetations in eroded floodplains<br>• Restore diversity of vegetation and maintain natural ecological function along with new plantations<br>• Remove non-native and invasive species of plants and vegetations in the floodplains | • Local land managers | • Project Dependent |

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **4.5.3: Minimize infrastructural barriers in floodplains** | • Increase the setback of leeves, or breach holes in them, or remove when no longer needed<br>• Install flood bypasses in the leeves to restore floodplain connectivity<br>• Minimize constructions in floodplains through collaboration with city officials to update zoning ordinance and land use designations accordingly<br>• Increase usage of sediment control basins on construction site in or nearby floodplains | • City governments | • Project Dependent |

**"There is an increasing interest in doing things sustainably. The important thing is putting this into codes. We get excited about development and growth and we don't want it to cost more – however the right steps need to be taken. - Recreation Focus Group**

## Objective 4.6: Protect source water sites in the watershed

Majority of the drinking water supply in the communities within the watershed comes from groundwater. The water supply keeps going because naturally forming aquifers, where water seeps through underground surfaces getting filtered and stored on the way. It is very important to maintain the continuity of these natural structure to ensure a healthy supply of naturally filtered water that communities can use for various purposes without having to worry about the nutrients present. The protection of source water sites is very important to be strategized to ensure healthy communities in the watershed.

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **4.6.1: Prevent harmful materials and contamination from reaching source water sites in the watershed** | • Conduct awareness programs to help communities understand the current state and importance of source water protection sites<br>• Increase awareness among communities about harms of spilling hazardous substances into ground or surface waters like motor oil, pesticides, paints, certain medicines, etc.<br>• Provide resources readily available for communities (businesses and industries especially) on how to limit the usage of and dispose hazardous and toxic wastes properly | • Local governments within the watershed | • Drinking Water State Revolving Fund by USEPA<br>• Clean Water State Revolving Fund by USEPA<br>• Conservation program funds by NRCS<br>• Other potential funding sources via Catalog of Federal and Domestic Assistance that is administered by federal, state and local governments and agencies |
| **4.6.2: Collaborate with federal, state or local government or agencies to improve source water quality** | • Collaborate with local governments to update zoning ordinances and land use designations to prevent locating chemical storage sites, impermeable pavements and animal feeding sites nearby source water sites<br>• Utilize information and resources provided by United States Environmental Protection Agency for collaborative programs through Source Water Collaborative Learning Exchange and How to Collaborate Toolkit | • Local governments within the watershed | |

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| | • Collaborate with Iowa DNR to conduct voluntary Source Water Protection Program and utilize the assessment, plan development and implementation service they provide<br>• Utilize the information Iowa DNR provides on Source Water Protection resources such as Source Water Protection Guidebook and Workbook | • Iowa DNR | • Project Dependent |

> During normal flows, the water is clear. But during high flows, you don't want to look at it. It's dangerous, you don't want to drink it. When it's high flow, it's coming off fields and all that comes with that. - Urban Leaders Focus Group

# Goal 5 Establish the WMA as a trusted community resource

Since the WMA is concerned with the watershed in its entirety and holds no regulatory power it must act as a resource for its community members and communities within the watershed that are not members.

*Figure 17: Maquoketa River Kayaking near Manchester*
*Source: Photo Voice, Maquoketa River Watershed Stories*

> "Swimming, boating, hunting, fishing, chasing frogs. A childhood with the Maquoketa in the back-yard shaped the trajectory of my career. - Recreation Focus Group

## Objective 5.1 Make the WMA representative of the people and interests in the watershed

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **5.1.1 Create space within the WMA for representation of different interests, occupations, ages, races, and ethnicities present in the watershed** | • Ensure the WMA executive committee is representative of different interests and occupations that directly affect watershed (ex. recreation, animal agriculture, crop agriculture, etc) | • Local organizations and interested community members | • N/A |
| **5.1.2 Show respect to the Indigenous peoples that were and still are in the area.** | • Land acknowledgement at the beginning of every wma event/ meeting, and on the website<br>• Learn and provide access to a comprehensive history of the Indigenous people of the watershed and how they influence the area today | • Local organizations, interested community members | |

**"Recreation is vital through this whole watershed – it starts in Backbone – goes through Manchester – gets a huge peak in Lake Delhi. It's pivotal for all these areas to be here to support the local communities. - Recreation Focus Group**

## Objective 5.2 Connect communities with resources specific to the watershed

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **5.2.1 Utilize data repository provided by IISC team to provide resources to groups within the watershed** | • Make data repository available online through the WMA website.<br>• Update online resource portal as new resources become available. | • IISC, DNR | • Project Dependent |
| **5.2.2 Provide examples of BMPs related to watershed concerns** | • Partner with Organizations and Community Members to demonstrate BMP usage and experience already in the watershed<br>• Encourage utilization and increase knowledge of funding resources for BMP | • Local organizations, community members | |

## Objective 5.3 Recognize and identify vulnerable populations in the watershed that may be affected by poor water quality and flooding

| Strategies | Actions | Potential Collaboration | Potential Funding Source |
|---|---|---|---|
| **5.3.1 Identify vulnerable population that might require special assistance during flood recovery** | • Utilize the Federal Social Vulnerability Index and FEMA floodplain maps to identify vulnerable populations | • University of Iowa, FEMA | • N/A |

# 05 Technical Report

Population Demographic

Land Use and Land Cover

Topography and Geology

Soils

Hydrology

Water Concerns

Water Quality Standards

Wildlife and Habitat

Recreation

Climate

# Population Demographics

The largest towns in terms of population are Maquoketa (6,026), Manchester (5,037), Dyersville (4,110), Monticello (3,835), and Cascade (2,078).

Watersheds are natural features and do not follow human-made border. In order to gather the most accurate demographic data, only Census Block Groups located entirely withing the watershed were used. A Census Block Group is a unit of measurement used by the Census Bureau and generally has a population between 600 and 3,000.

The Maquoketa River Watershed has approximately 72,118 people living in it as of 2018, with 23% of residents under the age of 18, 58% between the ages of 18 and 64, and the remaining 19% over the age of 65, as shown in Figure 19.

As shown in Figure 18 this area is mostly made up of people who identify as white, with just 3% of residents identifying as Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and other Pacific Islander, some other race, or two or more races.

Over half of the residents in the Maquoketa River Watershed over the age of 25 have attained an education higher than high school, with about 6% having earned a Master's, Doctorate, or Professional School degree as shown in Figure 20.

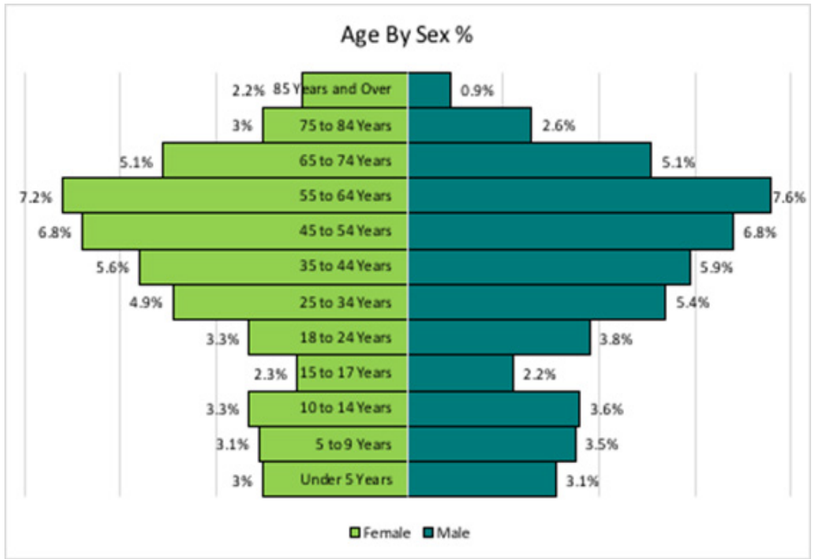



*Figure 19: Age by sex of total population in MRW*

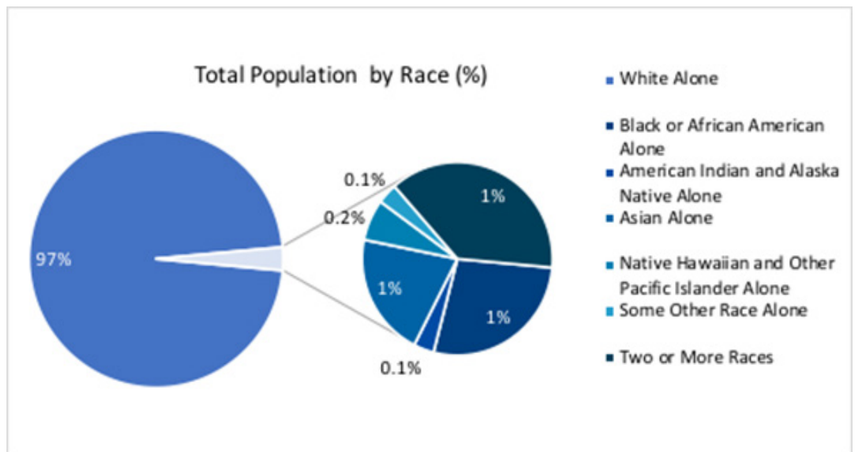



*Figure 18: Total Population by Race in MRW*

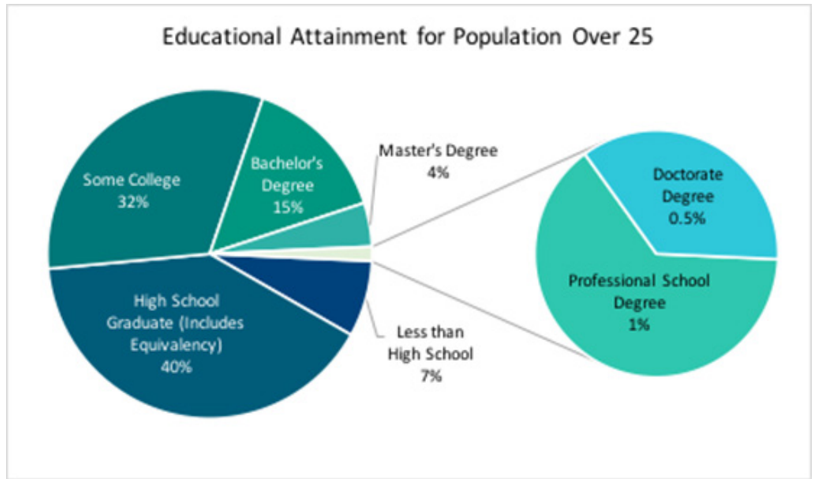



*Figure 20: Age by sex of total population in MRW*

## DEFINITIONS

**Census Block Group:** unit of measurement used by the Census Bureau and generally has a population between 600 and 3,000

The types of employment the residents of the watershed hold are well dispersed. The two largest occupation fields are professional and related occupations with 17% of employed residents and management, business, and finance with 16%. Other occupations such as construction, administrative support, production, transportation and sales each make up around 10% of the employed residents as shown in Figure 21.

Changing demographics can have huge impacts on watershed resources. For instance, urbanization, population size, economic development, and the number of households influence the amount of water withdrawn as well as the quality of the ground and surface water available in the watershed. The larger population generally require more water resources and tend to generate excessive amounts of waste that if not properly planned for and managed could end up in the streams deteriorating the water quality, killing the aquatic life, and posing a health risk for the residents who interact with the watershed regularly[9]. However, watershed planning and management can mitigate the effects of changing demographics. Localized and regional flooding and water quality problems will continue to plague areas with unfavorable physical, economic and social condition, but thro ugh watershed planning that takes into account the influence of demographics on a local and regional scale, and management that considers the importance of mitigating factors and conservation practices, a regional crisis can be foreseen and averted.[10]

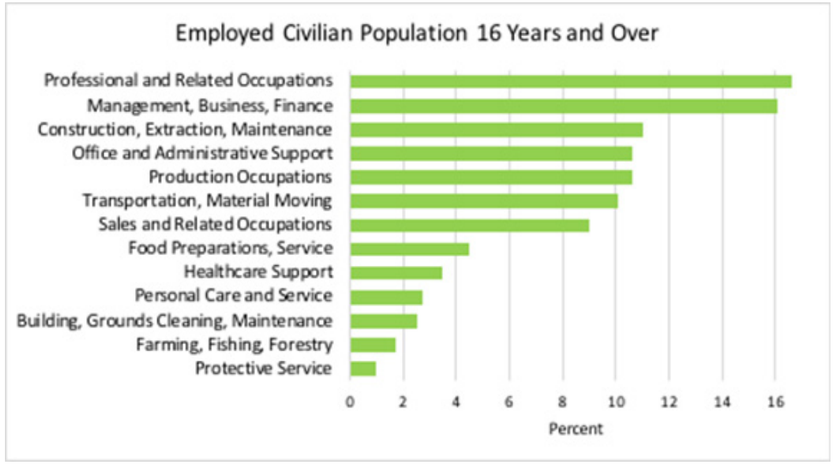



*Figure 21: Employed Civlian Population in MRW in MRW*

# Land Use and Land Cover

Water resource character and quality are partially determined by land use and land cover. Land use focuses on the use or purpose of land, while land cover describes the physical land type. Land use can be characterized by uses such as agricultural, non-agricultural, residential, commercial, or industrial. The land cover can be described by coverings such as forest, open water, or wetland. Land use and land cover can be the result of human influence such as zoning, or naturally occurring. Both have a significant impact on water quality in the watershed. Analysis of the water quality parameters shows that forest cover plays a critical role in keeping water clean. Conversely, agriculture and urban areas can lead to deterioration of water quality[11].

As shown in Figures 22 and Table 4, the predominant land use in the Maquoketa River Watershed is agriculture, encompassing 80% -- this is made up by 54% row crops and 26% pasture & hayland. Another 12% is forestland or natural areas concentrated along waterways. While 7.7% is developed, and the remaining 0.3% is covered by water and wetlands. 95% of the watershed land is privately owned, 1.8% is designated as municipal area, and the remaining 3.2% is split between public spaces and railroads[12].

| Land Use | Acres | Percent |
|---|---|---|
| Row Crop | 649,899 | 54.3% |
| Pasture Land | 293,036 | 24.5% |
| Developed - Urban Land | 142,422 | 11.9% |
| Woodland - Natural Areas | 91,777 | 7.7% |
| Hayland | 15,771 | 1.3% |
| Water | 3,324 | 0.3% |
| Wetland | 595 | 0.0% |

Table 4: Land uses in the Maquoketa River Watershed

Data Source: Natural Resources and Conservation Service

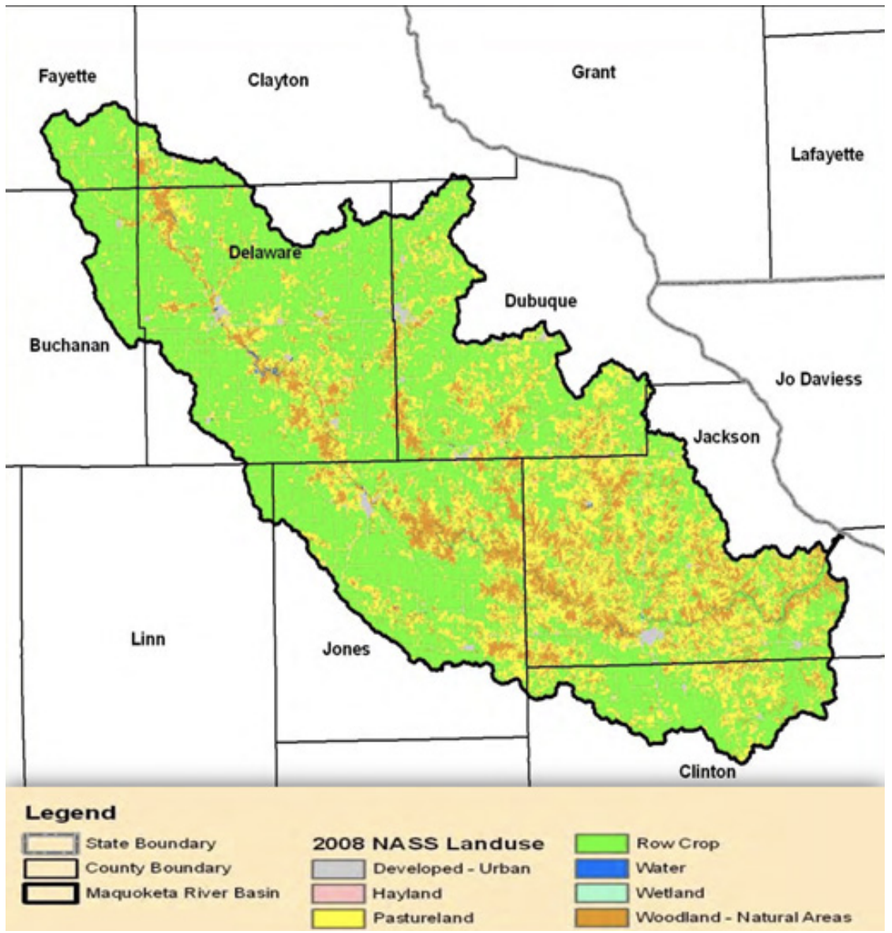



Figure 22: Land use and land cover within the Maquoketa River Watershed

Source: Natural Resources Conservation Service

## DEFINITIONS

**Land Use:** focuses on the use or purpose of land, can be characterized by uses such as agricultural, non-agricultural, residential, commercial, or industrial

**Land Cover:** describes the physical land type, can be described by coverings such as forest, open water, or wetland

## Elevation and Slope

As shown in Figure 23, the elevation within the watershed ranges between 581 feet to 1,253 feet[13] , and the watershed has an average slope of 6%[14]. The slope plays a critical role in how fast a drainage channel will convey water downstream, and, therefore, influences the sensitivity of a watershed to precipitation events.

As shown in Figure 24, the slope within the watershed varies from one location to the other. For instance, in the Upper Maquoketa subwatershed, the counties that lie in the northern part of the subwatershed such as Fayette, Clayton, Buchanan, and Delaware have a slope between the range of 1.8% to 3.9%. This provides for slower drainage. In contrast, the southern region of the same subwatershed in Jones County is well-drained with a slope of 6.5%.

The North Fork subwatershed has a much steeper slope. The northern part of this subwatershed, which occupies half of Dubuque County, starts with a 6.2% slope. Towards Jackson County, the slope increases significantly to 8.8%.

There is a similar, but opposite, trend in the Lower Maquoketa subwatershed, which occupies the southern part of Jackson County and the northern part of Clinton County. A slope of 8.8% starts in Jackson County and then changes to 6.2% in Clinton County.

Even though the average slope is 6%, it varies throughout the watershed, especially near waterways. The Turkey River Watershed, which lies north of Maquoketa River Watershed, has a similar slope (6.6%). Moreover, since the land use in most of the watershed is agricultural, an average slope of 6% can have significant water quality impacts in the corn belt. Therefore, if rainfall is marked by high intensity and short duration, the watershed will respond very quickly with the peak flow occurring shortly after the onset of precipitation. Steep slopes tend to result in rapid runoff responses to local rainfall, culminating in higher peak discharges with flooding potential[15].

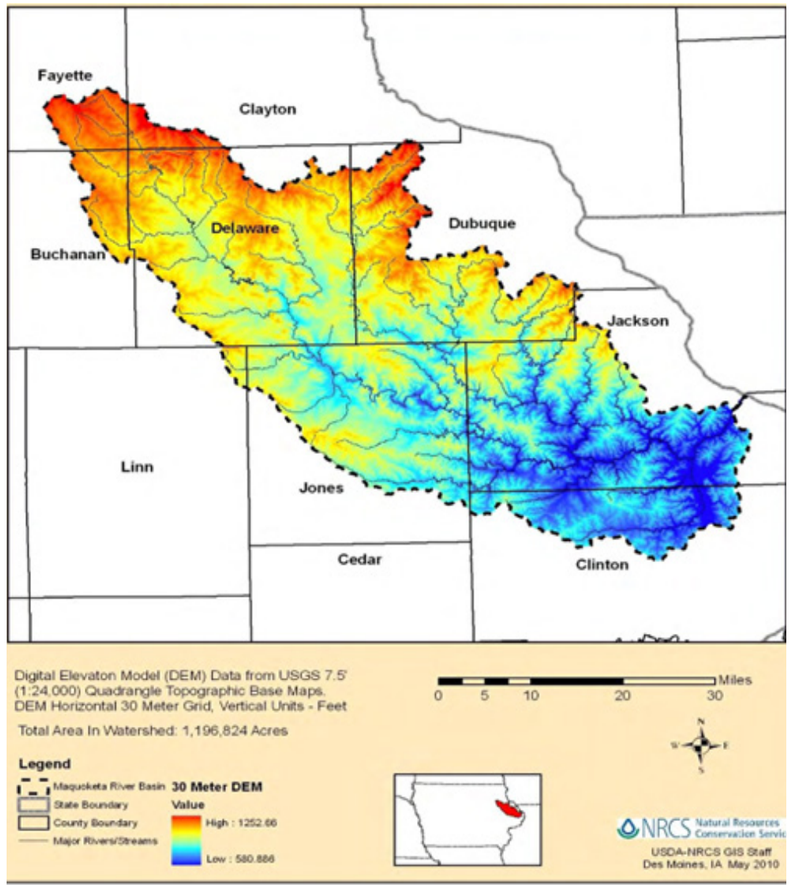



Figure 23: Elevation map of the Maquoketa River Watershed

Source: Natural Resources Conservation Service

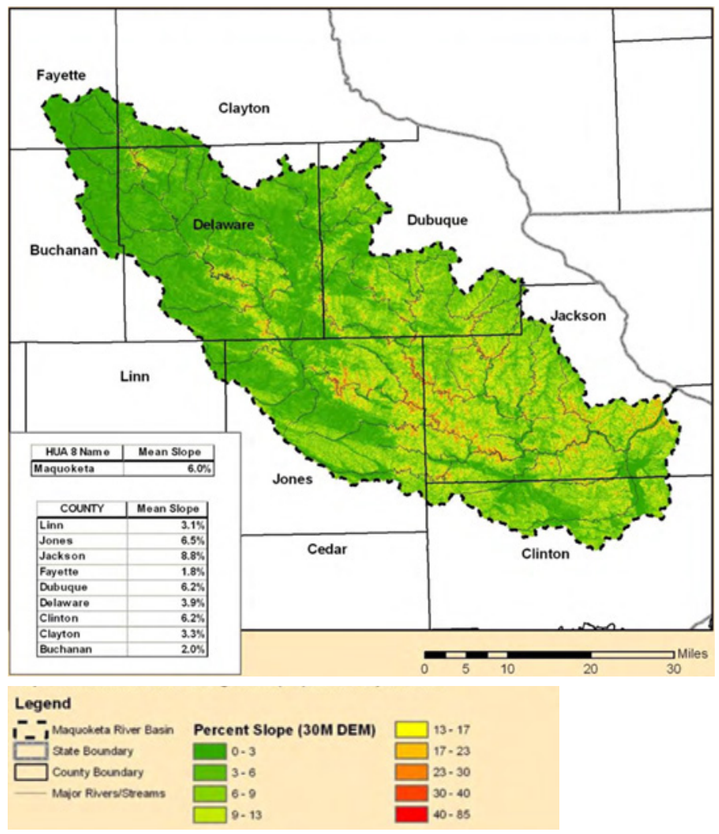



Figure 24: Percent slope map of the Maquoketa River Watershed

Source: Natural Resources Conservation Service

# Topography and Geology

Topography is the study of the shape and features of land surfaces; geology is the study of the structure and composition of those land surfaces. The geology of an area influences the topographic expression of the landscape, as well as the soil composition, land uses, and hydrologic features of the watershed. The topography and geology influence the rate and path that water takes as it passes over the landscape. It also influences the ways that water enters and leaves underground reservoirs, or aquifers.

The Maquoketa River Watershed lies within three of Iowa's seven landform regions. Most of the lower half of the watershed is in the Southern Iowa Drift Plain. In this region, a few feet of windblown silty loess blankets dense till deposited at least a half million years ago. In areas where this till has been worn away, loess overlies weathered bedrock. The landscape is divided by a well-established drainage network and is characterized by narrow ridges and short, steep slopes. The joints of the underlying bedrock influence the flow of tributaries.

Most of the upper half of the watershed is on the Iowan Erosion Surface, including nearly all of Delaware County and parts of Dubuque and Jones Counties. This landscape developed on older glacial till. Erosion, due to a period of intense winds and repeated freezing and thawing, left behind a deposit called a "stone line". This deposit is covered by thin loess or loamy sediments. The landscape is generally level to gently rolling, with long slopes.

The rivers and streams in this area are flanked by level floodplains. The plains are widest near the towns of Manchester, Monticello, and Maquoketa.

Overall, landforms of the watershed were developed in glacial deposits over the last two million years. These deposits are thinner in parts of east and northeast Iowa than in the rest of the state. Bedrock is less than 25 feet below the surface in most of the watershed. Exceptions include northeast Buchanan County and large areas of Delaware County, where the bedrock can be 150 feet or more below the surface.

Rock exposures, quarries, shallow bedrock, and steep bluffs are common characteristics of the watershed[16]. Erosion can introduce sediments (and accompanying nutrients or other compounds) into the water.

## Karst Topography

Karst topography is present when the bedrock is mainly composed of easily dissolvable rocks such as limestone or dolomite (a rock similar to limestone). When exposed to groundwater, the bedrock may dissolve allowing the creation of sinkholes, springs, and losing streams. While this topography gives the region and its bodies of water unique characteristics, it can also leave it vulnerable. Contaminants can travel quicklyinto the groundwater due to these open fractures, avoiding natural filtration through layers of soil[17].

## Sinkholes

Sinkholes are scattered throughout the watershed, with the greatest concentration occurring in Jackson County[18]. Sinkholes occur when underlying bedrock dissolves, creating a void that may eventually collapse. These collapses vary in size and, while most develop gradually, some can occur suddenly[19].

Certain land uses and practices may also impact the presence of sinkholes. For example, the pumping of groundwater for drinking water supply and irrigation may increase the prevalence of sinkholes and their collapses in karst topographies[20].

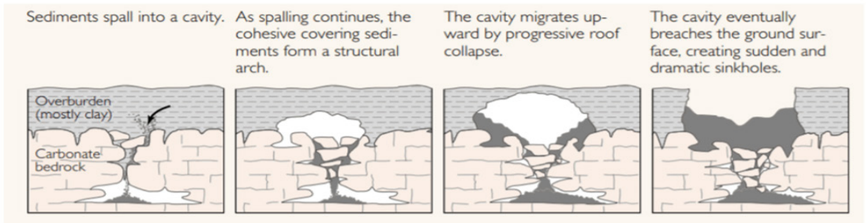



Figure 25: Process of how sinkholes form

Source: NRCS, 2011

### DEFINITIONS

**Topography:** study of the shape and features of land surfaces

**Geogology:** study of the structure and composition of those land surfaces

**Till:** unsorted material deposited directly by glacial ice and shoeing no stratification

**Loess:** fine, mineral-rich layer of windblown or glacially deposited dust and silt

# Soils

Soils are an integral part of a watershed system and its management. As water passes through the watershed towards the river, it takes with it sediments and other compounds from the land. The soils of a watershed can impact the physical and chemical makeup of rivers and streams, as well as the manner in which water enters those drainages. The infiltration abilities as well as the porosity of soil determine how much water stays in the soil, trickles into groundwater supplies, and runs off into streams and rivers.

Soils are composed of organic material, water, air, organisms, and inorganic particles. Particle size varies in diameter, and these sizes influence the water holding capacity of the soil. The categories include clay, silt, and sand, in order from smallest to largest. These components come together in different percentages to make up multiple soil compositions.

The triangle (Figure 26) shows the ways that these components can combine. An equal mixture is called loam.

According to a 2011 USDA-NRCS report on watershed characteristics, the soils in the Maquoketa River Valley differ greatly throughout the area. The characteristics coincide with the topographic regions of the watershed.

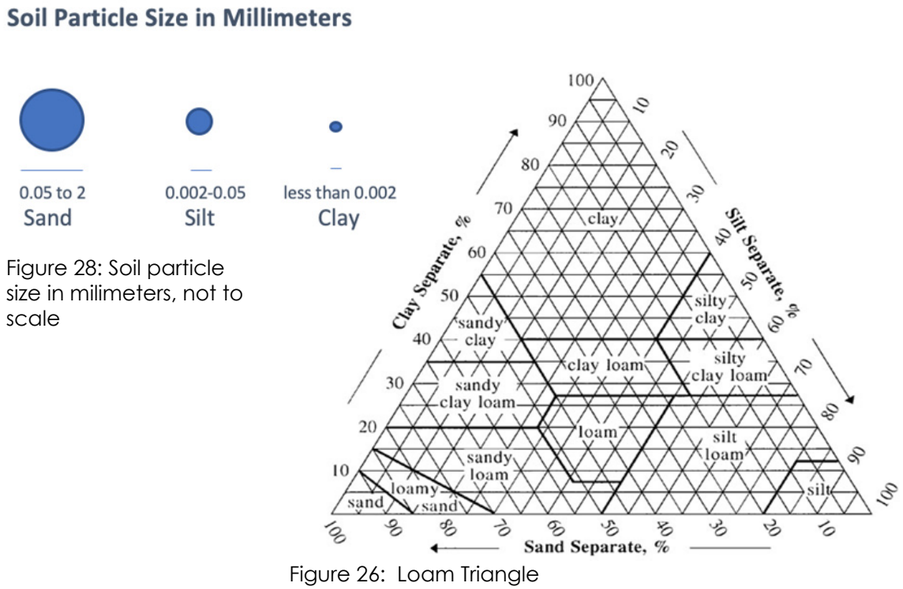



Figure 28: Soil particle size in milimeters, not to scale

Figure 26: Loam Triangle

Source: Land Subsidence in the United States, USGS

As shown in Figure 27, on the Iowan Erosion Surface, the predominant soils are silt loams that were developed in thin loss over till. On the southern Iowa Drift Plain, the dominant soil types are silt loams formed in loess and silt loams and loams formed in thin loess over weathered rock. predominant soils are silt loams that were developed in thin loess over till. These soils vary from well-drained to poorly drained depending on their landscape position and subsoil texture. Soils resulting from previous water flow in the drainages are generally poorly drained and include silt loams, silty clay loams, and loams. In parts of the valley, these soils overlie sand and gravel deposits. Both loams and silty loams absorb between 1.5 and 1.7 inches of water per foot of soil. Silty clay loams absorb between 1.8 and 2 inches of water per foot of soil[21].

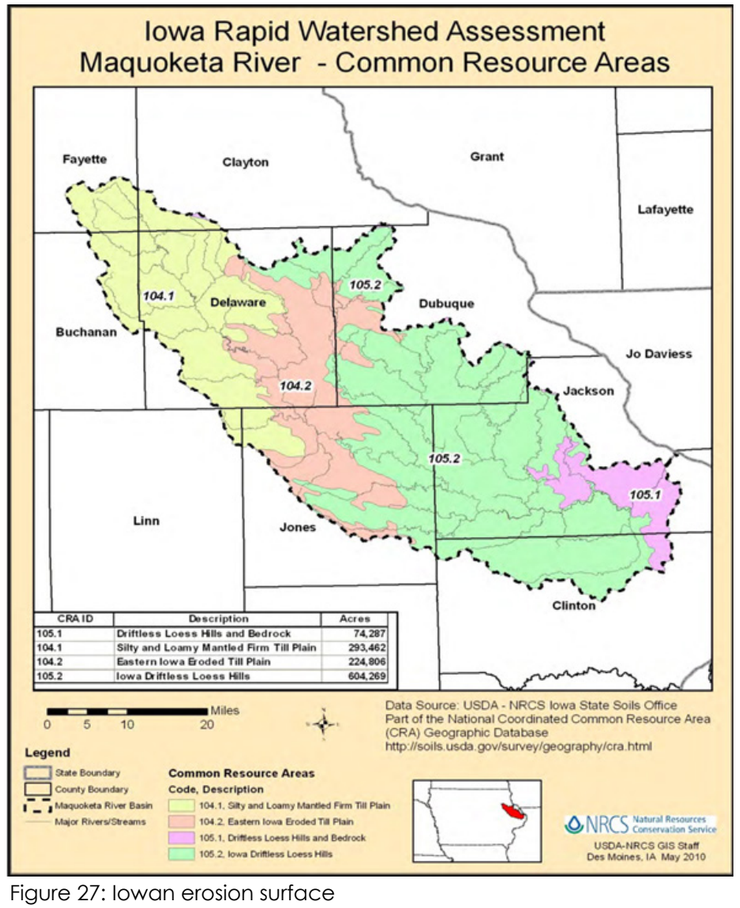



Figure 27: Iowan erosion surface

Source: NRCS, 2011

## DEFINITIONS

**Soil:** composed of organic material, water, air, organisms, and inorganic particles.

## Soil Loss

Soil loss poses both a problem for the health of the soil and the health of the watershed. With greater amounts of soil loss, there is the opportunity for more soil deposition in the streams and rivers and less infiltration on site. Overall, erosion due to runoff from cropland accounts for 90% of soil erosion in the area.

Soil erosion remains above sustainable levels. To be sustainable, the loss needs to be reduced to the soil's natural replacement level, which varies from 1 ton/acre/year to 5 tons/acre/year[22].

While the size of soil particles influences the absorbency of soil, so do several other soil health factors. Multiple soil characteristics indicate the soil's ability to stay in one place, absorb water, and nourish plants. These include the following[23]:

1. Soil Disturbance

Soil that is tilled or disturbed can flow easily in erosion events. Tilling is a widely used and important practice in modern agriculture; however, efforts to alter this activity with practices like no-till or low-till farming may help reduce cropland soil erosion.

2. Organic Matter

The presence of organic matter in the soil, such as decayed plant matter, can improve the nutrient retention of the soil.

3. Chemical Properties

Chemical properties of the soil indicate the need for use of additives to increase soil productivity.

4. Biological Properties

Earthworms and microbial organisms in the soil can impact the nutrient levels and the structure of the soil.

5. Diversified Plantings

Rotating crops from one year to the next can replace nutrients used by the other, reducing the need for N fertilizers. As well, the use of cover crops and deep-rooted crops as a soil retention mechanism can be very useful. Above ground, coverage protects soil from erosion events, and underground root systems can hold soil in place and allow for greater infiltration.

# Hydrology

## Precipitation

The amount and intensity of rainfall in the Maquoketa River Watershed vary seasonally. For instance, if we look at the precipitation pattern in the in the City of Maquoketa, the monthly precipitation measured at the city of Maquoketa is the highest in June and lowest in January, as shown in Figure 29. The average annual precipitation from 1981 to 2010 was 36.05 inches. The seasonal trend of precipitation remains similar throughout the watershed.

However, there has been an increasing trend in precipitation in the Midwest beginning in the late 1930s[24] and stretching until now[25]. The majority of this increase in precipitation has occurred during spring, summer, and fall seasons, accounting for over 90% of the increase in the overall annual precipitation[26]. Across the Midwest, the occurrence of intense precipitation events has also risen substantially in recent decades[27]. Although these factors increase the risk of flooding, studies have shown that the risk can be minimized substantially by closely monitoring land cover changes and effective policy on natural drainage features retention.

## Discharge

River discharge is measured as the velocity by which the water, with its sediment and contaminants, moves through the channel. As precipitation increases, the dischar ge also increases; however, other factors such as lag-time, snowmelt, and wind speed also affect discharge rates. Fluctuation in river flow, especially rapid increase in the discharge in the streams has several implications for Maquoketa River Watershed. Alteration of the natural regime of flow, which can be assessed in terms of the magnitude of flow, frequency, duration, timing, and rate of change, can cause numerous disasters within a watershed. For instance, flash flooding which a function of ground slope, magnitude, and rate of change of flow can lead to loss of both property and life. Moreover, significant increase in the magnitude of discharge leads to sedimentation, erosion of riverbanks, and much more.

Furthermore, increased discharge can also have a negative impact on the temperature and chemistry of water e.g., pH, dissolved oxygen, and toxicity, which may significantly lower habitat suitability for certain aquatic organisms[28]. The discharge in Maquoketa river at Manchester is an example of the unnatural fluctuation withing the watershed. As shown in Figure 30, the monthly average discharge of the Maquoketa River at Manchester for 2019 was higher during early March and mid-October. The area begins to warm by early March causing the onset of snowmelt and, hence, increased discharge. Similarly, windier conditions last for 7.7 months, from October 1 to May 25, with average wind speeds of more than 10.2 miles per hour[29]. This can cause higher debris collection, resulting in higher discharge during October.

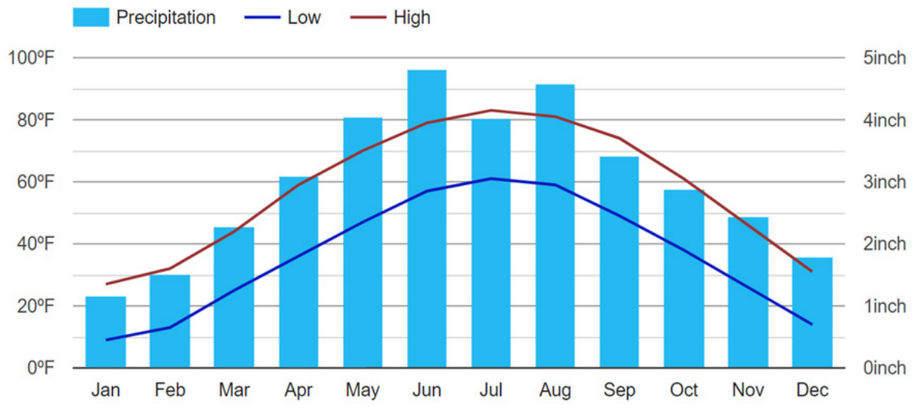



Figure 29: Monthly precipitation from 1981 to 2010 for the City of Maquoketa, Iowa

Source: US Climate Data

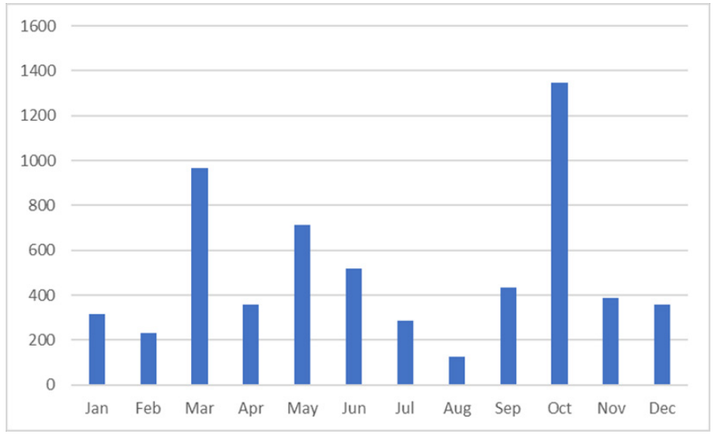



Figure 30: Monthly average discharge of the Maquoketa River at Manchester in 2019

Source: USGS, 2020

### DEFINITIONS

**River discharge:** measured as the velocity by which the water, with its sediment and contaminants, moves through the channel.

## Run-off

Water that is unable to infiltrate or absorb into soil is known as runoff water. The amount of runoff depends upon the soil type and absorbency, slope, land cover, and land use. Runoff is an important part of the hydrologic cycle, allowing water to return to natural reservoirs. However, runoff levels higher than desired can lead to floods and flash floods. Higher runoff can also signify decreased water-retaining capacity of the soil, leading to a higher risk of drought events. The runoff volume is the most important hydrologic variable for water quality protection and design because water quality is a function of the capture and treatment of the mass load of pollutants. The runoff peak rate is the most important hydrologic variable for drainage system design and flooding analysis[30]. The average annual runoff in Maquoketa River Watershed for years 2009-2019 is 383.77mm[31].

As seen in Figure 31, the Maquoketa River Watershed's runoff levels show an increasing trend for the last eleven decades. There has also been a change in the difference between the highest and lowest runoff levels throughout the years, which signifies increasing irregularity and a higher risk of flood and drought events as well as soil erosion, sedimentation and pollutant wash-off from urban surfaces.

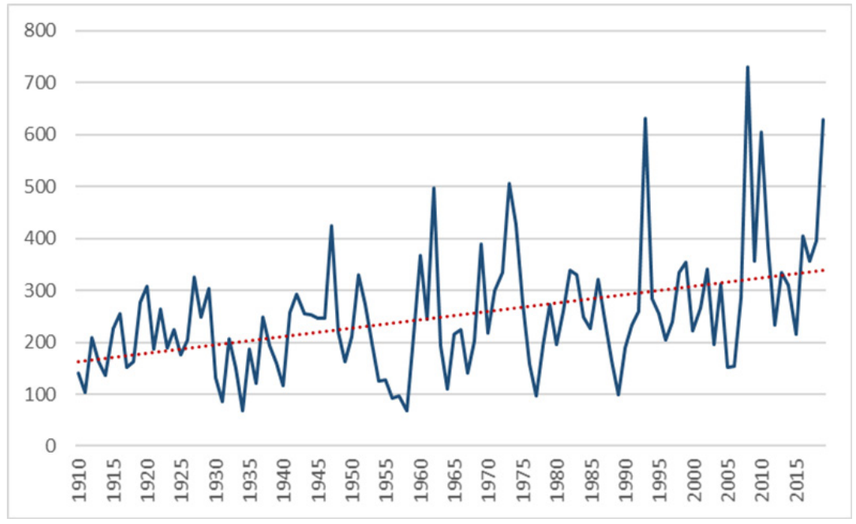



Figure 31: Maquoketa River Watershed's runoff levels from 1910 to 2015

Source: USGS, 2010

## Water Resources

The Maquoketa River Watershed has 10 HUC-10 level and 56 HUC-12 level hydrological units called 'watersheds' and 'sub-watersheds'. With seventeen major streams and both natural & man-made ponds, lakes, and impoundments, the communities in the watershed enjoy various recreational activities. For drinking water purposes, the communities in the watershed use groundwater, which is mostly supplied through the public water system. Besides drinking water, water is used for livestock and industrial purposes. As shown in Figure 33, the majority of water is used for industrial, livestock, and aquaculture in Dubuque and Delaware Counties.

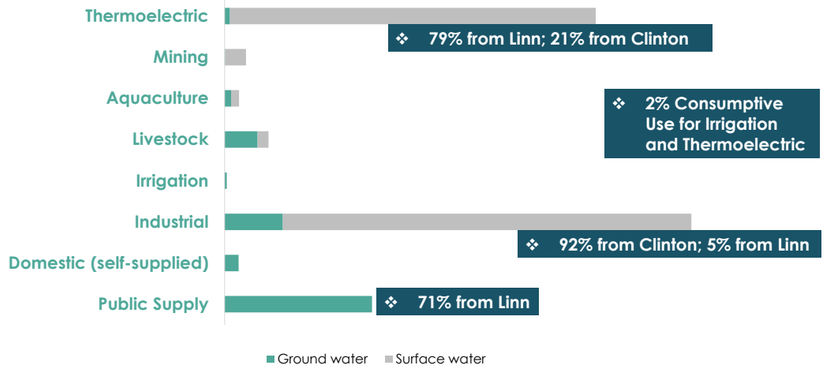



Figure 32: Estimate water usage for all 9 counties in the Maquoketa River Watershed, 2015

Data Source: USGS, Created by Authors

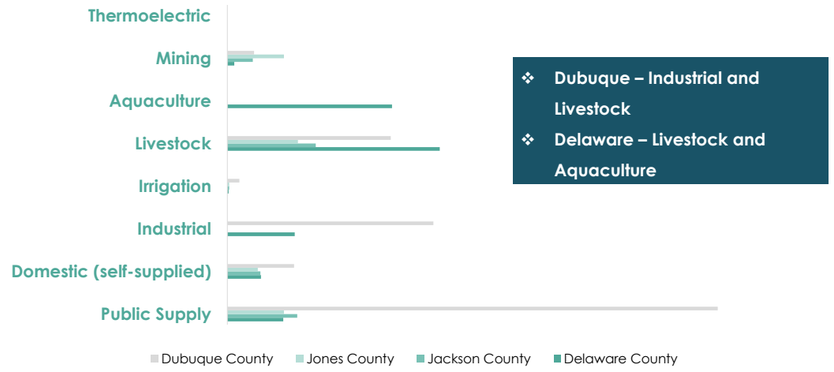



Figure 33: Estimate water usage for the 4 counties with the largest amount of land in the Maquoketa River Watershed, 2015

Data Source: USGS, Created by Authors

# Water Concerns

## Impaired waters

The federal Clean Water Act (CWA) has established water quality standards based on parameters such as dissolved oxygen, water tempera ture, siltation, turbidity pathogens, and sedimentation for monitoring contaminants in the water bodies.

According to the CWA, the state of Iowa is required to do a water quality assessment every two years and submit it to the United States Environmental Protection Agency (EPA) which then determines impaired water bodies depending on the aforementioned water quality standards. The waters assessed by the EPA are separated into five categories, the last category being for impaired waters is category 5. Category 5 water bodies require the state to regulate the Total Maximum Daily Load (TMDL) that can be discharged into them, to alleviate the impairment. According to Iowa Department of Natural Resources IDNR, a TMDL is a calculation that determines how much of a pollutant can enter a specific stream or lake in one day and still allow the lake or stream to meet the state's water quality standards. This calculation is just one part of the larger water quality improvement plan, which allows the state to regulate both point and non-point sources of pollution within the watershed. Pollutant sources are characterized as either point sources that receive a waste load allocation (WLA), or nonpoint sources that receive a load allocation (LA). For purposes of assigning WLAs, point sources include all sources subject to regulation under the National Pollutant Discharge Elimination System (NPDES) program, i.e., wastewater treatment facilities, some stormwater discharges and concentrated animal feeding operations (CAFOs). For purposes of assigning LAs, nonpoint sources include all remaining sources of the pollutant as well as natural background sources.

In 2018, 16 streams and 3 lakes have been listed as impaired waters in the Maquoketa River Watershed. Among those, 15 streams and 2 lakes are listed as Category 5 impairment requiring TMDL regulation. As listed in Table 5 below, in 2018, 'fish loss due to animal waste' was identified as a new cause of impairment for stretches of the following three streams: Whitewater Creek, Hickory Creek, and North Fork Maquoketa River (Figure 34).

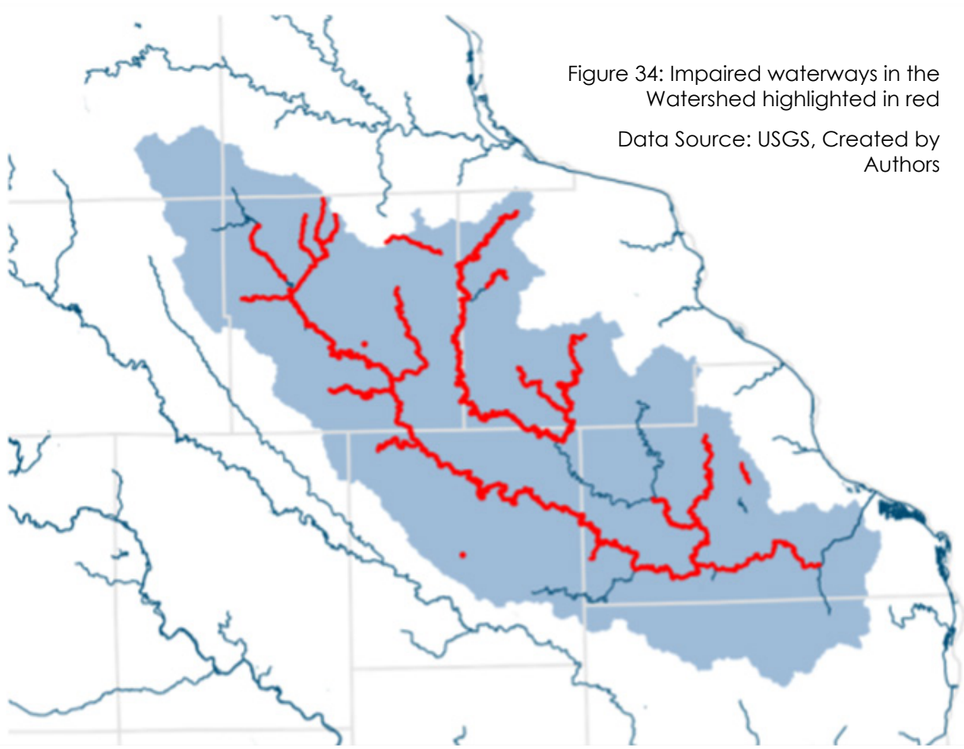


Figure 34: Impaired waterways in the Watershed highlighted in red

Data Source: USGS, Created by Authors

### The Iowa DNR's approach to TMDL:

1. Stream or lake placed on impaired waters list.
2. The DNR meets with Iowans to learn about problems and possible causes of those problems in a watershed of an impaired stream or lake.
3. DNR drafts a water quality improvement plan, which includes:
    - inventory of sources of pollution in the watershed
    - actual TMDL calculation as described above
    - water quality restoration plan (also called an "implementation plan") to be put into action by local groups in the watershed
4. The DNR asks Iowans to review the draft water quality improvement plan.
5. The DNR meets again with Iowans to gather their comments on the plan and discuss how locals can use the plan to create a local watershed improvement group and project.
6. Locals use information in the water quality improvement plan to form a local watershed group and apply for grant funding to get the project started. learn more about creating a watershed group.

| S. No. | Name | Type | Length (miles) | Impairment | Listing Rationale | Listed year | Impaired Status |
|---|---|---|---|---|---|---|---|
| 1 | Maquoketa River | River | 26.88 | Biological: loss of native mussel species | Loss of >50% of native mussel species | 2004 | Continuing |
| 2 | Maquoketa River | River | 38.05 | Bacteria: Indicator Bacteria- E. coli | Geometric mean criterion exceeded | 2008 | Continuing |
| 3 | Maquoketa River | River | 38.05 | Biological: loss of native mussel species | Loss of >50% of native mussel species | 2004 | Continuing |
| 4 | Maquoketa River | River | 22.56 | Bacteria: Indicator Bacteria- E. coli | Geometric mean criterion exceeded | 2008 | Continuing |
| 5 | Maquoketa River | River | 22.56 | Biological: low aquatic macroinvertebrate IBI | Low Biotic Index | 2006 | Continuing |
| 6 | Maquoketa River | River | 9.25 | Bacteria: Indicator Bacteria- E. coli | Geometric mean criterion exceeded | 2010 | Continuing |
| 7 | Silver Creek | River | 8.36 | Biological: loss of native mussel species | Loss of >50% of native mussel species | 2004 | Continuing |
| 8 | Buck Creek | River | 10.32 | Biological: low aquatic macroinvertebrate IBI | Low Biotic Index | 2004 | Continuing |
| 9 | Buck Creek | River | 10.32 | Biological: loss of native mussel species | Loss of >50% of native mussel species | 2004 | Continuing |
| 10 | Plum Creek | River | 19.79 | Biological: loss of native mussel species | Loss of >50% of native mussel species | 2004 | Continuing |
| 11 | Coffins Creek | River | 7.18 | Bacteria: Indicator Bacteria- E. coli | Geometric mean criterion exceeded | 2010 | Continuing |
| 12 | Honey Creek | River | 9.12 | Bacteria: Indicator Bacteria- E. coli | Geometric mean criterion exceeded | 2010 | Continuing |
| 13 | Lindsey Creek | River | 7.41 | Bacteria: Indicator Bacteria- E. coli | Geometric mean criterion exceeded | 2014 | Continuing |
| 14 | Unnamed Tributary to Maquoketa River | River | 2.48 | Fish Kill: Caused By Fertilizer Spill | Pollutant-caused fish kill | 2016 | Continuing |
| 15 | North Fork Maquoketa River | River | 34.37 | Biological: loss of native mussel species | Loss of >50% of native mussel species | 2010 | Continuing |
| 16 | North Fork Maquoketa River | River | 34.37 | Biological: low fish & invert IBIs- cause unknown | Low Biotic Index | 2008 | Continuing |
| 17 | North Fork Maquoketa River | River | 34.37 | Bacteria: Indicator Bacteria- E. coli | Geometric mean criterion exceeded | 2016 | Continuing |
| 18 | Whitewater Creek | River | 12.94 | Biological: loss of native mussel species | Loss of >50% of native mussel species | 2004 | Continuing |
| 19 | Whitewater Creek | River | 12.94 | Fish Kill: Caused By Animal Waste | Pollutant-caused fish kill | 2018 | New |
| 20 | Whitewater Creek | River | 12.94 | Bacteria: Indicator Bacteria- E. coli | Geometric mean criterion exceeded | 2010 | Continuing |
| 21 | Whitewater Creek | River | 12.38 | Fish Kill: Caused By Animal Waste | Pollutant-caused fish kill | 2018 | New |
| 22 | Johns Creek | River | 11.35 | Biological: loss of native mussel species | Loss of >50% of native mussel species | 2004 | Continuing |
| 23 | Bear Creek | River | 7.76 | Fish Kill: Caused By Animal Waste | Pollutant-caused fish kill | 2006 | Continuing |
| 24 | Hickory Creek | River | 4.52 | Fish Kill: Caused By Animal Waste | Pollutant-caused fish kill | 2018 | New |
| 25 | Hickory Creek | River | 4.52 | Biological: low fish & invert IBIs- cause unknown | Low Biotic Index | 2004 | Continuing |
| 26 | Maquoketa River | River | 19.67 | Bacteria: Indicator Bacteria- E. coli | Geometric mean criterion exceeded | 2012 | Continuing |
| 27 | North Fork Maquoketa River | River | 15.95 | Bacteria: Indicator Bacteria- E. coli | Geometric mean criterion exceeded | 2008 | Continuing |
| 28 | North Fork Maquoketa River | River | 15.95 | Fish Kill: Caused By Animal Waste | Pollutant-caused fish kill | 2018 | New |
| 29 | Farmers Creek | River | 18.09 | Biological: low aquatic macroinvertebrate IBI | Low Biotic Index | 2004 | Continuing |
| 30 | Honey Creek | River | 6.92 | Bacteria: Indicator Bacteria- E. coli | Geometric mean criterion exceeded | 2014 | Continuing |
| 31 | Rutherford Branch | River | 5.39 | Bacteria: Indicator Bacteria- E. coli | Geometric mean criterion exceeded | 2014 | Continuing |
| 32 | Backbone Lake | Lake | 2.5 | Bacteria: Indicator Bacteria- E. coli | Geometric mean criterion exceeded | 2004 | Continuing |
| 33 | Central Park Lake | Lake | 25 | Algal Growth: Chlorophyll a | Narrative criteria violation: aesthetically objection-able conditions | 2008 | Continuing |

Table 5: Impaired water-ways in the Maquoketa River Watershed

Data Source: USGS

## History of Flooding

In terms of human hardship and economic loss, floods are among the most frequent and costly natural disasters. Eastern Iowa has experienced numerous flood events and the loss of millions of dollars in property and crop damage[32]. Flood events most often occur as river or flash flooding. River flooding is typically the result of a large amount of precipitation or snowmelt throughout the season that causes river levels to rise and overtop their banks. Flash flooding, on the other hand, is usually caused by rapid rainfall or intense thunderstorm events.

River flooding is typically more predictable than flash flooding due to its nature, and it usually occurs in flood plains that have been previously mapped. The National Weather Service monitors and forecasts river levels and issues flood warnings. However, flash floods tend to be faster moving and less predictable. During intense thunderstorms, dam failure, or ice jams, flooding can occur in a matter of minutes creating very dangerous situations.

Approximately 60% of the Maquoketa River Watershed, comprising the southeast and lower part of the watershed, lies within the Southern Iowa Drift Plain landform region. These floodplain areas susceptible to river flooding are also at risk of flash flooding. However, flash flooding can occur in areas outside the floodplain as well. During heavy rain events upstream, stormwater can quickly overwhelm the drainage systems, causing flash flooding downstream.

Climate change, too, has a significant impact on the frequency and intensity of flood events as a consequence of various climatic phenomena such as cyclones, rainfalls, and sea-level rise.

Between the years 1925 to 2003, the largest known flood in the upper part of the Maquoketa River Watershed occurred on June 15, 1925. This flood occurred before the installation of the Maquoketa River gaging station near Manchester, and reached a peak discharge of 25,400 ft3/s (a recurrence interval of approximately 130 years).

Later in 1944, the Maquoketa River Watershed experienced the largest flood on record, reaching a peak discharge of 48,000 ft3/s. The flood inundated 9,872 acres and totaled $5,063,347 in damages; this included $4,230,914 in damages to crops and pasture and $832,433 in damages to the rural property.

Flooding in 1947 affected much of Iowa. The flood inundated 10,059 acres and forced the evacuation of at least 50 families. The total damage was $7,155,590.

In 2002, severe flooding occurred in the Maquoketa River Watershed in Delaware, Dubuque, Jackson, and Jones Counties. Radar indications estimated as much as 8 to 10 inches of rainfall in the upper-middle part of the Maquoketa River Watershed, which resulted in a peak discharge of 47,500 ft3/s.

On May 23, 2004, following intense thunderstorms, severe flooding occurred in the Maquoketa River Watershed in Delaware County. The peak discharge on May 23 at the Maquoketa River at Manchester gaging station was 26,000 ft3/s (a recurrence interval about 100 years). A comparison of peak discharges measured at two gaging stations located on the Maquoketa River near Manchester (station numbers 05416900 and 05417000) indicated that the 2004, 1925, and 1947 floods were the first, second, and third-largest floods, respectively, along a 3 mile stretch of the Maquoketa River downstream of the city of Manchester[33].

In 2008, once again, an unusually wet winter and spring resulted in extremely wet conditions throughout most of Iowa, especially Backbone State Park south of Strawberry Point in Delaware County where the main flood occurred and resulted in 4.2 Million in property damage.

In 2010, the Maquoketa River Watershed witnessed another large flood, which resulted in $29.7 million in property damage. This major flood occurred on July 23 to 26. A breach of the Lake Delhi Dam on July 24 intensified the situation. Rain gages at Manchester and Strawberry Point, recorded 72-hour rainfall amounts of 7.33 and 12.23 inches, respectively. The majority of the precipitation occurred during a 48-hour period, which resulted in peak discharges of 26,600 ft3/s (an annual flood-probability estimate of 0.2 to 1%) at the stream gage 05416900 in Manchester and 25,000 ft3/s (annual flood-probability estimate of 1 to 2%) at the stream gage 05418400 in North Fork Maquoketa River near Fulton. The numbers recorded on July 24 are the largest floods on record for these sites. A peak discharge, affected by the Lake Delhi Dam breach on July 24, at the gage 05418500 Maquoketa River near Maquoketa downstream of Lake Delhi, of 46,000 ft3/s on July 26 is the third highest on record.

High-water marks were measured at five locations along the Little Maquoketa and North Fork Little Maquoketa Rivers between U.S. Highway 52 near Dubuque and County Road Y21 near Rickardsville [Placeholder for a map of the area], a distance of 19 river miles. High-water marks were measured at 28 locations along the Maquoketa River between U.S. Highway 52 near Green Island and State Highway 187 near Arlington, a distance of 142 river miles[34].

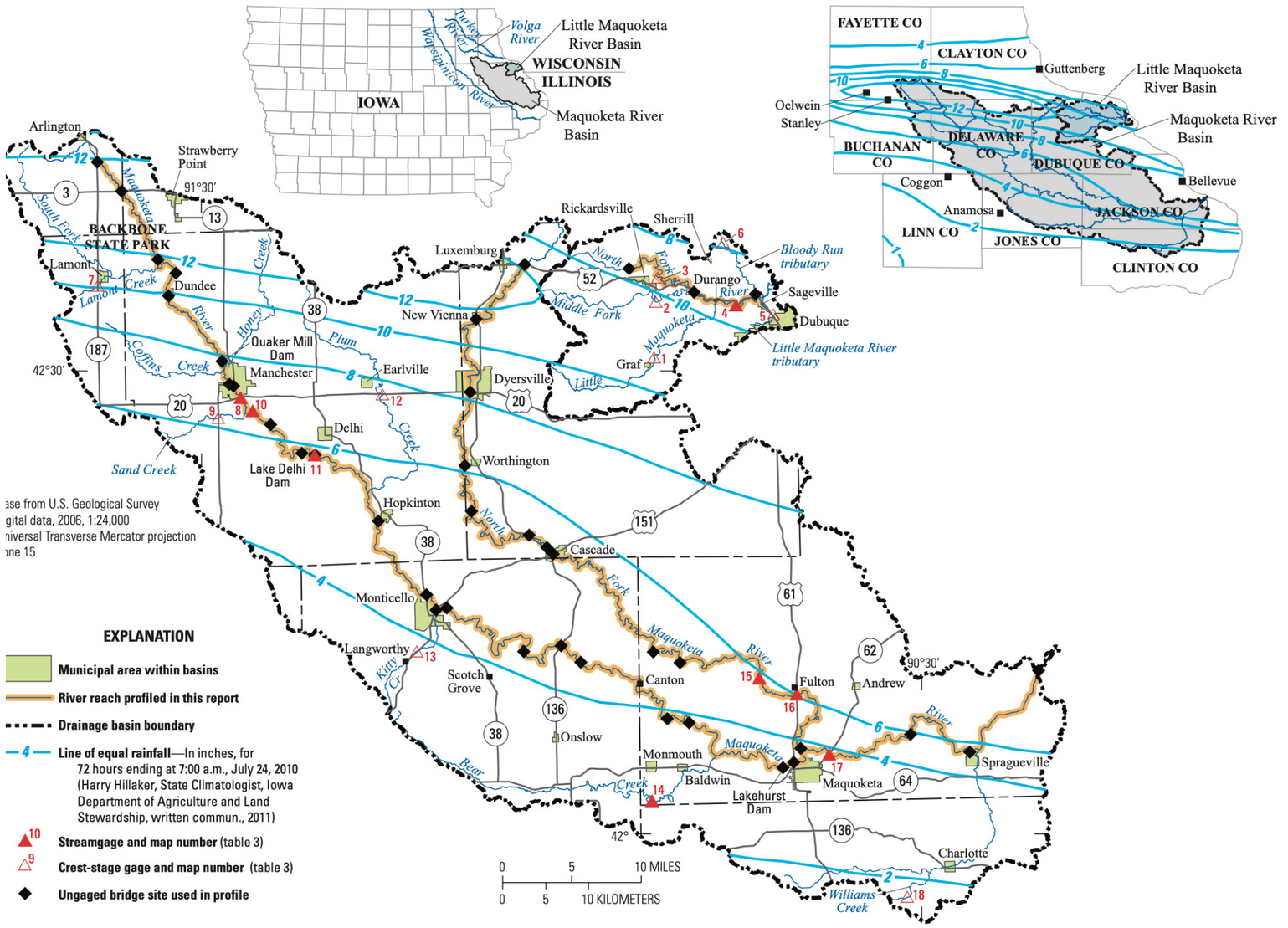



Figure 35: Little Maquoketa River and Maquoketa River Basins and lines of equal rainfall for 72 hours ending at 7:00 am on July 24, 2010

Source: USGS, 2011

# Water Quality Standards

## Clean Water Act

The United States Environmental Protection Agency (EPA) issued the Clean Water Act (CWA) as a revised version of the Federal Water Pollution Control Act in 1972. The Clean Water Act inspects the water quality of surface waters and regulates point sources that contribute contaminants. A point source is defined as a discrete source such as a pipe or man-made ditch (United States Environmental Protection Agency, 1972). The Act also issues permits to industrial, municipal, and other facilities that discharge their waste directly to surface waters (United States Environmental Protection Agency, 1972). At the state level, the Iowa Department of Natural Resources (IDNR) inspects, records, and regulates waste management and permit distribution. The waste discharge through point sources is regulated by the EPA through the National Pollutant Discharge Elimination System (NPDES).

The CWA also lists surface waters that don't meet designated Water Quality Standards (WQS) established for the region as 'Impaired Waters' and regulates a Total Maximum Daily Load (TMDL) criteria for them based on the impairment. Iowan surface waters have their WQS  set based on four designated usages: recreational, wildlife and aquatic habitat, source water supply, and human health.

## Safe Drinking Water Act

The EPA has determined quality standards for drinking water through the Safe Drinking Water Act (SDWA). The act regulates the presence of more than 90 chemical and microbial contaminants in all drinking water supplies throughout the country, the exception being for private wells that serve less than 25 individuals (United States Environmental Protection Agency, 1996). In Iowa, the sources of drinking water are not mandated to be protected, however, they can be voluntarily protected through the Source Water Protection Program (SWPP). The Iowa DNR has published a guidebook to help a community to participate in SWPP, for which many incentives are also provided by USEPA. To maintain the optimum quality of water sources, the guidebook has listed out various effective policies and regulatory tools for land usage & conservation and environmental-friendly crop & animal agricultural practices.

# Wildlife and Habitat

Within the watershed, there are a variety of state-considered threatened, endangered, or concern species. An endangered species is in danger of becoming extinct in part or all of its habitat. Threatened species are likely to become endangered. A species of concern is one that is vulnerable and may become threatened or endangered. The tables below list these types of species within the watershed. This is composed of twenty-three animal and sixty-seven plant species. Many of the animals of interest are endangered or threatened, while a greater proportion of the plant species are of 'concern'. Concentrations of these species are spread throughout the entire watershed .

| Animal Species | State Consider-ation |
|---|---|
| Lake Sturgeon | Endangered |
| Slippershell Mussel | Endangered |
| Henslow's Sparrow | Threatened |
| Cylindrical Papershell | Threatened |
| Red-shouldered Hawk | Endangered |
| Iowa Pleistocene Snail | Endangered |
| Blanding's Turtle | Threatened |
| Wild Indigo Dusky Wing | Concern |
| Columbine Dusky Wing | Concern |
| Least Darter | Endangered |
| Bald Eagle | Concern |
| American Brook Lamprey | Threatened |
| Creek Heelsplitter | Threatened |
| Blacknose Shiner | Threatened |
| Plains Pocket Mouse | Endangered |
| Zabulon Skipper | Concern |
| King Rail | Endangered |
| Creeper | Threatened |
| Otter Skipper | Concern |
| Ornate box Turtle | Threatened |
| Ellipse | Threatened |
| Variable Pleistocene Vertigo | Threatened |
| Bluff Vertigo | Endangered |

Table 6: Threatened, endangered, or concern animal species within the Maquoketa River Watershed

Source: NRCS, 2011

| Plant Species | State Consider-ation | Plant Species | State Consideration |
|---|---|---|---|
| Northern Monkshood | Threatened | Soft Rush | Concern |
| Muskroot | Concern | Hairy Pinweed | Threatened |
| Roundstem Foxglove | Threatened | Prairie Bush Clover | Threatened |
| Nodding Onion | Threatened | Crowfoot Clubmoss | Concern |
| Shadbush | Concern | Rock Clubmoss | Threatened |
| Paw Paw | Concern | Tall Millet-grass | Concern |
| Ricebutton Aster | Endangered | Rock Sandwort | Concern |
| Flat Top White Aster | Concern | Small Sundrops | Threatened |
| Kitten Tails | Threatened | Northern Adder's-tounge | Concern |
| Bog Birch | Threatened | Clustered Broomrape | Endangered |
| Prairie Moonwort | Concern | Cinnamon Fern | Endangered |
| Sweet Indian Plantain | Threatened | Royal Fern | Threatened |
| Grass pink | Concern | Eastern Prairie Fringed Or-chid | Endangered |
| Low Bindweed | Concern | Western Prairie Fringed Orchid | Threatened |
| Prince's Pine | Threatened | Meadow Bluegrass | Concern |
| Golden Saxifrage | Threatened | Shrubby Cinquefoil | Threatened |
| Hill's Thistle | Concern | Alderleaf Buckthorn | Concern |
| Spotted Coralroot | Threatened | Prickly Rose | Endangered |
| Spreading Hawthorn | Concern | Toothcup | Concern |
| Pretty Dodder | Concern | Prairie Pink | Concern |
| Showy Lady's Slipper | Threatened | Sage Willow | Concern |
| Northern Panic-grass | Endangered | Shinning Willow | Threatened |
| Slim-leaved Panic Grass | Threatened | Smith Bulrush | Concern |
| Marginal Shield Fern | Threatened | Ledge Spikemoss | Concern |
| Purple Coneflower | Concern | Great Plains Ladies-tresses | Concern |
| Dwarf Scouring-rush | Concern | Oval Ladies-tresses | Threatened |
| Woodland Horsetail | Threatened | Rosy Twisted Stalk | Threatened |
| Tall Cotton Grass | Concern | Long Beechfern | Endangered |
| Upland Boneset | Concern | Earleaf Foxglove | Concern |
| Slender Fimbry | Concern | Low Sweet Blueberry | Threatened |
| Rough Bedstraw | Concern | Valerian | Concern |
| Small Fringed Gentian | Concern | Violet | Concern |
| Spring Avens | Concern | Summer Grape | Concern |
| Bitterweed | Concern | | |

Table 7: Threatened, endangered, or concern plant species within the Maquoketa River Watershed

Source: NRCS, 2011

# Recreation and Tourism

Residents and visitors of the watershed connect to the Maquoketa River through recreation. This scenic region of Eastern Iowa boasts many different recreational opportunities for those that visit. Whether a fisherman, birdwatcher, kayaker, or simply someone looking for the peace and beauty of nature, the watershed offers unique opportunities.

From the beginning of this planning process, recreation was established as a priority for many of the groups involved. As well, it offers a bridge from people's hearts into the two main goals of this plan: to reduce flooding and improve water quality. Healthy and safe recreational utilization of the river can only happen when the river is able to maintain quality that is healthy for people and the ecosystem and when the river stays within its banks. The popularity of river activities in this watershed has led to a move connected and personal experience with the river and its issues. People interact with it regularly and see how it changes.

Portions of this plan's community engagement were aimed at understanding the recreational importance and experiences of watershed residents and visitors. Certain questions in the Stakeholder Survey and an entire focus group were devoted to this information.

## Recreation related survey results

The survey confirmed that many people utilize the Maquoketa for recreation. A quarter of respondents use the watershed for its scenic beauty. Nineteen percent canoe or kayak in the watershed. Another 19% use the watershed for fishing or hunting. Fourteen percent swim and 12% hike within the watershed. Two percent use the streams or river to water livestock or irrigate. Seven percent indicated that they use the watershed for an activity not indicated in the survey. Some of these included the following:

- Boating (the vast majority of responses)
- Biking on nearby trails
- Camping
- Water sports
- Cross-country skiing
- Foraging
- Birdwatching
- Trapping
- Photography
- Ice skating
- Picnicking

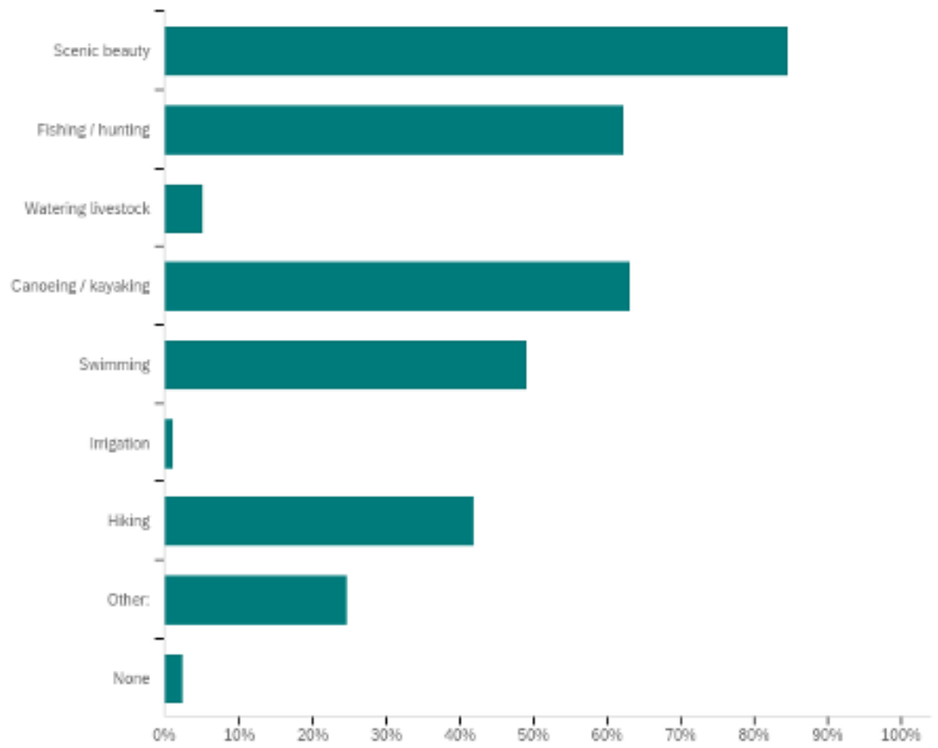
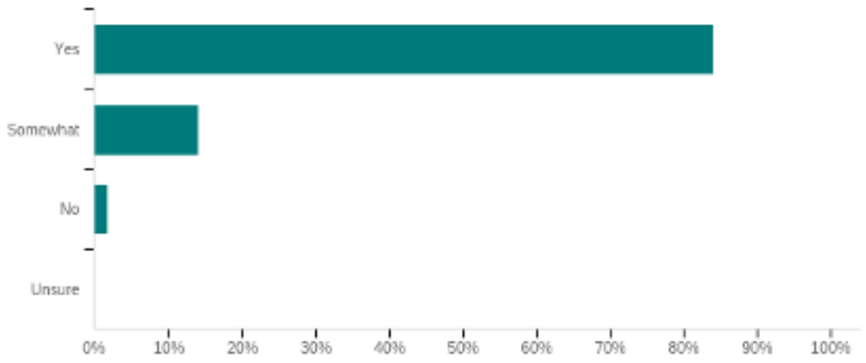



Figure 36: Have you utilized any stream or river in the Maquoketa River Watershed for any of the following purposes? (Check all that apply)

Less than 1% did not participate in any activity related to watershed. The responses to this question demonstrate the vast variety of ways residents and visitors come into contact with the watershed and its features.

As well many believe that the Maquoketa River serves as a recreational asset and destination for Eastern Iowa, with 84% answering this way.

Figure 37: Do you believe the Maquoketa River serves as a recreational asset and destination for Eastern Iowa?




Approximately 48% answered that they were 'very concerned' about the impacts of water quality and flooding on recreation and tourism (with an additional 40% answering 'somewhat concerned'). Lastly, 66% agreed that there should be more areas for hunting and recreation.

## Recreation in Focus Groups

The Recreation Focus Group invited community members involved with a variety of recreational activities to share their experiences and perspective on how water quality and flooding impact recreation in the watershed. The participants shared some favorite memories of the watershed, illustrating the deep connection watershed residents and visitors have with the lakes and streams that they recreate in.

The focus group participants highlighted sedimentation, bacteria and nutrient contamination, litter and trash, and flooding as major impacts to the recreational potential of the Maquoketa. As well, motor-powered boating was cited as a concern for many participants. Including requirement on construction to limit sediment run-off was also discussed.

They supported the addition and protection of habitat to enhance recreational and hunting opportunities.

The participants also emphasized highlighted the economic gains that recreation and tourism provide the communities throughout the watershed.

Recreation was a common throughout all the focus groups conducted, not just the one specified for it. In the Agricultural Subwatershed and Urban Leaders Focus Groups, recreation was seen as a bridge across different stakeholder groups, able to unite them on improve water quality and reducing flooding.

"I grew up in the region and grew up swimming at Freddie's Beach. Lake Delhi was where my folks bought a cabin. I bought a cabin. In all those years there were so many years where the cabin community and recreational community grew. It draws so many people into the area. It's amazing how many people you see. And those are my memories forever."

"Firepits at night with family. Jumping off the rock. Waterskiing. Pontooning. Christmas on the Lake. 3,000-15,000 in and around the Lake on any given weekend in the summer. Single largest recreational draw is the Lake. The kayak park as well in Manchester. The time being spent with family, friends and neighbors. People coming in from Minnesota, Wisconsin, Missouri, etc. We probably had over 1,000 people at a RADAR run at Smoky's Bar and Grill. Fireworks around the 4th of July timeframe. So many activities in and around the Lake and the Maquoketa River."

"Swimming, Boating, hunting, fishing, chasing frogs. My childhood with the Maquoketa in the backyard shaped the trajectory of my career."

"I love the community around the river."

## Recreational Features within the Watershed

There are many recreational features throughout the watershed. Below are several popular activities and destinations.

### Trout Fishing

The clear, cold, spring-fed streams in Eastern and North-eastern Iowa are home to several variety of trout. Trout fishing has become an attraction to this area of the state for anglers far and wide. While increasing sedimentation and rising water temperature threaten the population of Brown and Rainbow Trout throughout the region, efforts are being made to spawn new populations and clean-up the water.

Figure 38: Trout at the Manchester Fish Hatchery

Source: Ellie Mullins

### Kayaking, Canoeing, and the Manchester Whitewater Park

The Manchester Whitewater Park was constructed in an area that is prone to flooding, replacing a dam with 6 drop features and shoreline restoration & beautification that allow paddlers and floaters to enjoy the river. The new park is widely used by experienced and novice whitewater kayakers, floaters enjoying the sun, and children playing between drop features. As well, the park has provided a recreational and tourist attraction for the City of Manchester. This park brings visitors to the town who support the local economy by stopping for a bite to eat, filling up their tank of gas, or venturing into a couple shops.

In addition to the whitewater park, the entire Maquoketa River has been experiencing increases in canoers and kayaks looking to paddle through the scenic landscape. Boat rentals and restaurants are supported by the paddlers looking to spend a day on the river.

Figure 39: Manchester Whitewater Park

Source: Manchester Whitewater Park Facebook

# Climate

## Climate Analysis

The Maquoketa River Watershed as a smaller portion of the Upper Mississippi River Basin (UMRB) is very sensitive to climate change due to its unique location in Iowa. The entire Upper Mississippi River Basin stands at a place of intersection between three air masses (Pacific, Arctic, and the Gulf of Mexico) that control the climate of North America. This sensitivity to climate change has been confirmed by analysis of Holocene (past 10,000 years) sediment core data from lakes and streams in the region. The stream sediment data indicate that climate change has severe impact on floods in the watershed, and that understanding the effects of climate change on the watershed is key to quantifying future hydrologic water budget conditions as well as watershed resource management.

## Impacts of Climate Change

Agriculture, land resources, water resources, and biodiversity in a watershed is dependent on climate change and its effects. The broad subtopics with regards to agriculture are cropping systems, pasture and grazing lands, and animal management. The variety of crops and livestock in the watershed are grown in diverse climatic conditions. Regardless of the region, climate factors such as precipitation, CO2 concentrations, temperature, and water availability directly influence the health and well-being of livestock, plants, pasture, and rangeland. The variation in yield between years for any agricultural commodity is related to growing-season weather. The Synthesis and Assessment Product Report 4.3 by the U.S. Climate Change Science Program also found that weather influences insects, disease, and weeds, which in turn affect agricultural production.

With regards to land resources, the broad subtopics would be forest lands and arid lands. Climate change heavily impact the forest productivity, species composition, and magnitude and frequency of disturbance that affect forests. Forest disturbances such as storms, severe droughts, forest fires, and insect outbreaks will command public and place significant demands on management of resources. According to Assessment Product Report 4.3 by the U.S. Climate Change Science Program, in the areas where adequate water is available increased temperature and nitrogen deposition have very likely increased forest growth and will continue to do so in the near future. The report also found that soil erosion and invasion of exotic grass species in arid lands will be promoted due to increased drought, more intense thunderstorms, and higher temperatures.

In terms of water resources, water quantity (i.e. availability, and accessibility to water), and water quality in a watershed are the two mostly most important and most susceptible to change due to climate. Variations in the storage, fluxes, and quality of water affect human settlements, plants, animals, natural as well as managed ecosystems, all of which are sensitive to climate change. The effects of climate on the Maquoketa River Watershed's water storage capabilities and hydrologic functions will have vital implications for water management and planning.

Biodiversity within the Maquoketa River Watershed means species diversity and rare and sensitive ecosystems. Biodiversity is the variation of life at the genetic, species, and ecosystem levels of biological organization, is the fundamental building block of the services that ecosystems deliver to human societies. It is important because of its contribution towards the larger ecosystem, and also because it is almost impossible to recover or replace once it is lost. The Assessment Product Report 4.3, finds that climate change could lead to disruption of the relationships between pollinators, such as bees, and flowering plants.

Climate change manifests not merely as global warming, which is recognized as the impact of human activities on the planet. Extreme floods and droughts are another facet of climate change that are becoming recognized in the scientific discourse. Flooding is a function of the amount and intensity of rainfall. Climatic change forecasts for the Maquoketa River Watershed indicate an increasing trend in precipitation rates. Since the forecasted trends indicate that future Maquoketa River and tributary flooding episodes could intensify relative to current events. In the hydrologic modeling and climate change study in the Upper Mississippi River Basin using SWAT, Manoj K Jha (2004) performed an extensive assessment of potential climate change impacts on the greater region of UMRB hydrology by coupling the Soil and Water Assessment Tool (SWAT) model with the climate models. The objective was to explore streamflow and create temperature and precipitation data required by the SWAT model. Two 10-year scenario periods (1990s and 2040s) were generated by nesting the regional climate model into a coarse grid resolution global model. The combined model system produced a future climate scenario with increased precipitation of 21% with a resulting 18% increase in snowfall, 51% increase in surface runoff, 43% increase in groundwater recharge, and 50% increase in total water yield in the UMRB. This disproportionate increase in the percentages of the result of the future climate scenario is due to the increase in the intensity of precipitation

in the region. Furthermore, the increase is as a result of the shifting variables of the hydrologic budget such as snow melt, evapotranspiration, surface water runoff, and groundwater flow in the future climate.

Rainfall in the Maquoketa River Watershed ranges from 33 to 35 inches per year. This as well as other climatic conditions in the region have major environmental consequences for the watershed. Nitrate (NO3) loads discharged from the mouth of the Mississippi River have been implicated as the primary cause of the Gulf of Mexico's seasonal oxygen-depleted zone, which covered nearly 18,005 km2 as of 2019. The Maquoketa River Watershed is one of the primary sources of nutrients in the Mississippi River. According to the Journal of Environmental Quality, 35% of the NO3 load discharged into the Gulf was estimated to have originated from the tributary rivers of Iowa and Illinois during average discharge years between 1980 and 1996. This puts the Maquoketa River Watershed at the epicenter of the nitrate loading problem. Therefore, changes in Maquoketa River Watershed flow characteristics due to future climate change has the potential to further exacerbate the problem and must be managed and planned.

Moreover, climate change in the Maquoketa River Watershed is affecting the average temperature, extreme temperature, snowmelt, runoff, evaporation, and soil moisture. Longer growing seasons for wild and domestic plant species are also as a result of change in temperature. Furthermore, climate change is projected to increase drought frequency and intensity. Hotter temperatures combined with drought intensification can lead to forest decline, impacting primary production and ecosystem services such as wildlife habitat and carbon storage. To predict and manage these changes at regional scales, assessments of ecosystem responses to drought are needed across broad climate-vegetation types to complement studies on watershed responses to drought.

APPENDIX

# A Best Management Practices

**No-till farming** is extremely impactful in reducing erosion and increasing water infiltration in the soil. Tilling is the practice of digging, stirring, or overturning soil to prepare it for crops. While beneficial for planting, it can leave the soil loose and vulnerable to wind and water erosion. No-till practices leave the soil minimally or un-disturbed to reduce soil loss and increase water absorption. When the water stays on the field, less water, soil, and nutrients run into the surrounding streams and rivers. While there are costs associated with no-till (planters, pesticides), there are cost savings as well (no seedbed preparation). The total net-cost of no-till is $8.45 an acre.

**Cover crops** provide another solution to reducing agricultural erosion and increasing field infiltration. Cover crops are crops planted in-between growing seasons, when the field would normally be left bare. The crop vegetation protects the soil from wind and splash erosion, and the crop roots allow greater infiltration of water into the soil. Examples of cover crops include grasses, cereal grains, and legumes such as rye, wheat, or soybeans.

**Filter strips** along streams allow space for water to slow down, absorb, and filter through the ground and vegetation before entering the nearby stream, improving water quality, absorbing nutrients, and trapping sediment. As well, filter strips provide a buffer from flooding, ultimately reducing flood damages and reach. These areas consist of grass, shrubs, or trees planted along waterways. Filter strips are permanent solution and include a few costs. These include seeds and seedbed preparation, planting, equipment, labor, and loss of cropland. Cost estimates for filter strips are variable depending on choice of vegetation but may lie between $84.40 and $96.90 per acre.

**Wind breaks** can be used on crop or pastureland. Wind breaks consist of rows of trees or other vegetation that protects the land around it from direct wind. By breaking the wind, this strategy protects land from wind erosion. Costs to consider include seeds, seedbed preparation, planting, equipment, and labor. As well, it may take usable crop land. Cost estimates for this strategy are approximately $341.90 per acre. However, wind breaks can be strategically placed, and most costs are not recurring.

**Rotational grazing** consists of managing the planting of forage and rotating grazing across different areas of the pasture. This strategy can reduce erosion and runoff from pastureland, by allowing areas to remain vegetated. Some costs to consider include fencing costs, establishing a water source, seeds and planting of forage, equipment, and labor. To set up an area for rotational grazing, a cost estimate is $390.44 per acre. However, there are additional benefits to implementing rotational grazing, such as improved livestock health, maintaining healthy forage, improved field health, and improved water quality

**Nutrients** can be applied during different seasons, from different sources, and using different methods. All of these factors have different implications for the growth, cost, labor, and nutrient loss for that growing season.

**Timing:** Some producers will complete their nutrient application in the spring (pre growing season), and some complete it in the fall (post growing season). While fall application is typically cheaper and allows division of the work, fall-applied nutrients are more likely to end up in the water than remain in the field through a season of rain and snowmelt. Spring application is advantageous to reducing the loss of fertilizer, but lack of fertilizer supply may limit producers' ability to do so. Due to limited fertilizer supplies, increasingly wet springs, and efforts to spread out workload, producers should be encouraged to consider sidedressing their applied nutrients. Sidedressing consists of injecting liquid fertilizer along the rows of growing crops using a tractor and a tank (also called 'knifing')

**Method:** There are a couple methods besides traditional application which allow for greater absorption or reduced runoff of nutrients. The first is the aforementioned sidedressing of nitrogen fertilizers. This means that the fertilizer is applied after the crops have begun growing. This helps with nutrient loss in two ways. One, the application is pushed further out of the rainy season, where fertilizer could be easily washed away. Two, sidedressing is done post-emergence which means the plants are growing and ready to take the nutrients in. This method reduces the overall application as well, reducing cost. Secondly, the 'where' of application can be

changed to reduce run-off. Technical resources through agricultural and environmental agencies allow for farmers to identify spatial data on the productivity throughout their acreage. Producers can use this data to understand what parts of their land are unproductive and do not benefit from additional N and P fertilizers. These areas can be left out of application, reducing the overall use of fertilizer.

**Sources:** While manufactured N and P fertilizers are the most common sources of nutrients for crop growers in Iowa, overall nutrient could be maximized by using the existing manure created by hog and cattle operations. The watershed is home to both crop and livestock agriculture and connecting these two would allow for a sustainable transfer of nutrients from lot to field, without the addition of produced N and P fertilizers.

## Nitrogen Fixing Crops and Crop Rotation

, a key strategy to soil health, is one already practiced by many farmers. Many times, in Iowa, there will be a singular stalk of corn shooting up above a field of bushy soybean plants. This is because the field was previously planted with corn and is now being rotated with soybeans. Soybeans are part of the legume family, a variety of plants that host microbes that will take nitrogen from the air and 'fix' it into the soil in a form that the crop can use. So, a portion of the nitrogen that the previous year's corn crop depleted can be replaced by this year's soybean crop. This lessens the need for additional N fertilizer application.

## Crop Residue

, meaning leftover plant matter from the previous, is another way to increase soil health. Crop residue provide a source of nutrients and organic matter. Allowing the crops to decompose and release these compounds into the soil, replenishes lost nutrients and organic matter necessary for plant growth. As well, crop residue also helps prevent wind erosion when left on fields.

## Deep Rooted Crops

, or, crops with long, deep roots increase soil health by adding organic matter to the soil when they decompose and aerating and allowing greater infiltration by breaking up the soil.

## Rain Gardens and Native Landscaping

employ deep rooted and native plants to provide an area for water to infiltrate in areas that may experience flash flooding. However, increased infiltration and slowing water flow leads to less erosion and less intense flood events, reducing streambank erosion. Priority should be placed on the promotion and assistance in implementing rain gardens and native landscaping to increase infiltration and reduce stormwater runoff. The survey showed that 34% of respondents already participate in this activity, 40% were interested but needed more information, and only 11% were not interested or it wasn't applicable. This is one of the lowest percentages of respondents that responded indicating that the strategy wouldn't work, making it ideal for a first focused effort by the WMA.

## Permeable Pavers

, or, asphalt paving that contains pores for water to infiltrate allows spaces for water to infiltrate into the ground instead of traditional cement. There are multiple varieties of pavers available. Only about 12% of survey respondents use permeable pavers, but 38% were interested in learning more. However, about a fourth of respondents were not interested or pavers were not best suited to their situation. There is definite room for growth in the use of pavers, but resources should be targeted to interested and applicable respondents. Survey respondents from the Upper Maquoketa subwatershed showed the greatest interest in education on this strategy.

# B Survey Analysis

Introduction

Demographics

Watershed Uses, Views, and Experiences

Conservation Strategies and Best Managment Practices

Information Resources

Additional Comments


*Figure 17: Survey on Digital Platform*

*Source: artbasel.com*

# Introduction

The Stakeholder Survey remained open for informing the plan December 2020 through March 2021. While it closed for informing the plan in March, the survey remained open to continue to gather comments from stakeholders. At that time, the survey had been taken by 428 respondents. These respondents were from many different areas of the watershed and provided a wide range of perspectives that informed the plan.

## Methodology

### Stage 1. Previous Efforts and Survey Informants

Public participation to inform the Maquoketa River Watershed Management Plan began with a survey. This survey was informed by academic resources, previous surveys carried out by WMAs throughout the state, and the experiences and policy goals of the MR WMA and its planning team. The MR WMA as primarily informed by the following reports:

- The Turkey River Watershed Management Authority Resiliency Plan
- The English River Watershed Management Authority Plan
- The Upper Iowa Watershed Management Authority Plan
- 2017 Dry Run Creek Landowner Watershed Awareness Survey
- Clear Creek Watershed Social Assessment Urban Survey
- Indian Creek Watershed Survey
- IISC Survey Template

Questions and strategies from these surveys were adapted to build a structure for this survey.

### Stage 2. Defining Our Goals

The MR WMA's goal of this stakeholder survey was to understand the values, beliefs, and experiences related to watershed and its issues. These components helped inform both continued public participation and the eventual goals and strategies of the plan. The survey was designed so that everyone could take it. It was meant for visitors to the watershed, landowners, renters, rural or urban dwellers, absentee owners, and a number of other populations that may interact with the Maquoketa River. The questions dealt with water quality, flooding, recreation, impacts on water issues, conservation, and farming.

### Stage 3. Developing the Survey

Once a set of questions was developed, it went through multiple edits to improve clarity, decrease redundancies, and identify any missing information. The survey went through edits by both the planning team, University of Iowa faculty, and members of the MR WMA. The questions were then uploaded into the survey creation/distribution service, Qualtrics. This service allowed questions to be tailored to the appropriate audiences, based on their previous answers.

### Stage 4. Survey Distribution

Due to restricted in-person events during the COVID-19 pandemic, a large geographical area, and a limited budget for printing, the survey was distributed primarily online. Links to the survey were available on the MR WMA's website and Facebook page. Advertising for the survey was also done through local radio stations and local newspapers. As well, the survey was advertised through the Iowa Farm Bureau Spokesman and the focus groups conducted in February 2021.

### Survey Results

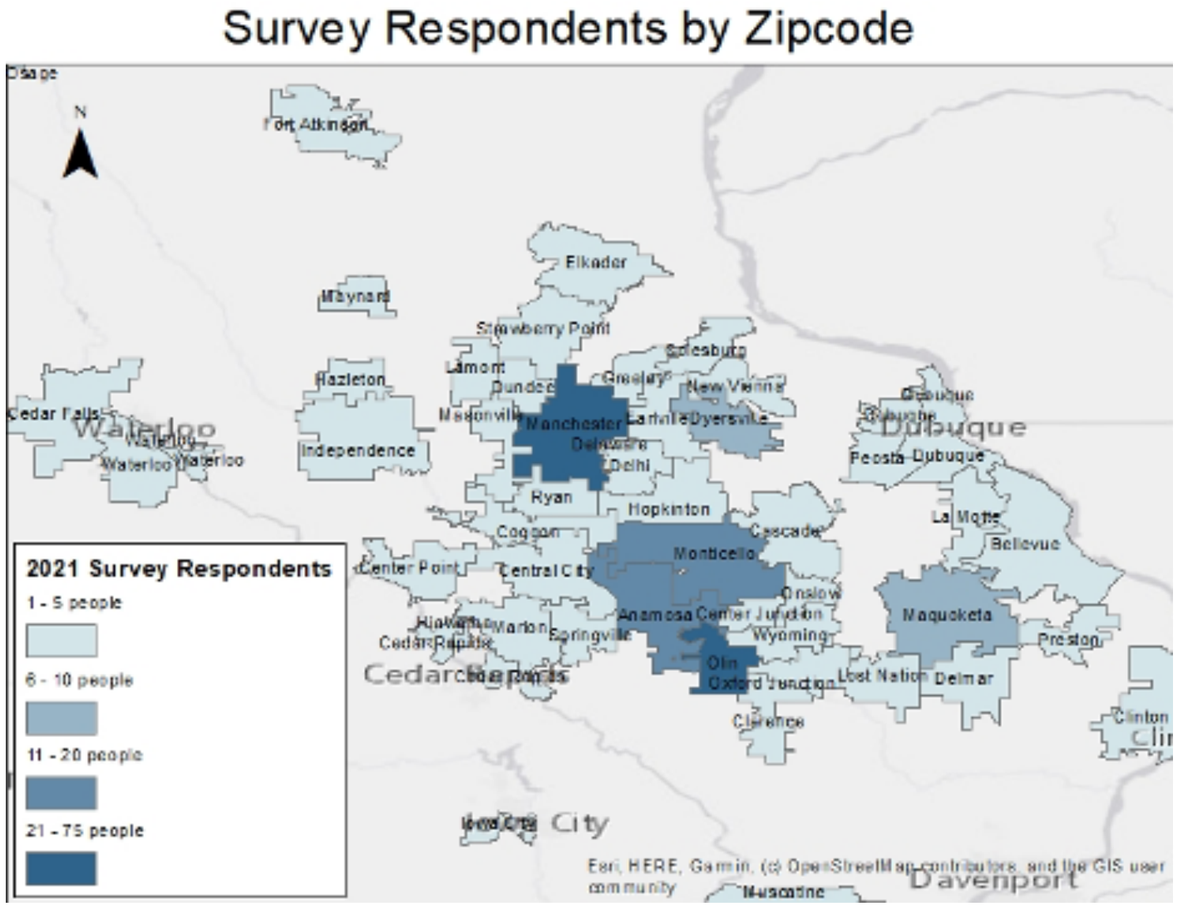
The results have been rounded to the nearest whole number and may not add up to 100%.

# Demographics

## Geography

Survey respondents were from throughout the watershed but were mainly concentrated near Manchester and between Olin and Monticello. As well, some respondents were located outside the watershed.

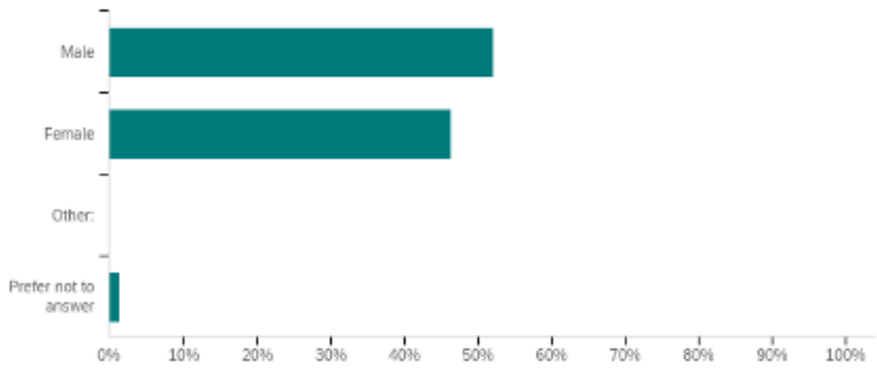
Figure 1: Survey Respondents by Zipcode




## Gender

Respondents to the survey were roughly half male (52%) and half female (46%) identifying.

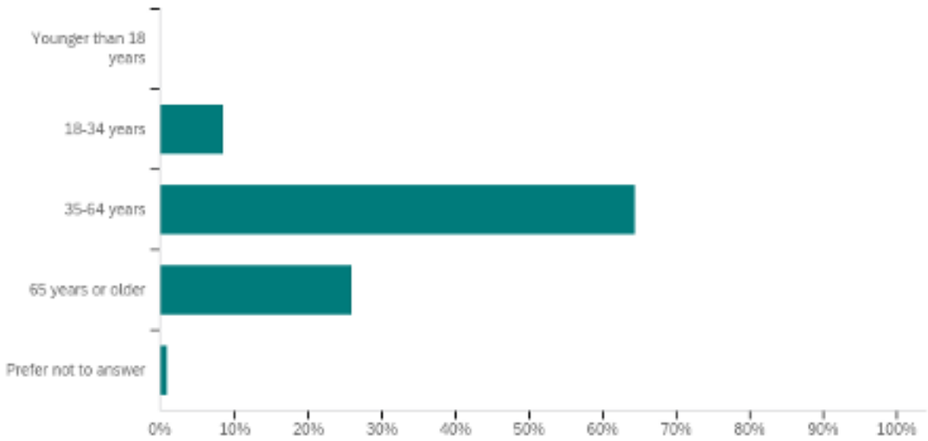
Figure 2: To which gender do you most identify?




## Age

The majority of respondents were aged 35-64 years (64%), a fourth were 65 or older, and a small percentage were 18-34 (8%). None of the respondents were under 18 years of age. The watershed population is made up primarily by the middle age brackets with 41% between age 35 and 64, followed by those 65 and above (19%) and those 18-34 (17%). Twenty-three percent of watershed residents are under 18 years of age, however many of these children would be too young to participate in the survey. The survey was more representative of residents 35-64 years and 65 years and older, while being less representative of populations younger than 35 years.

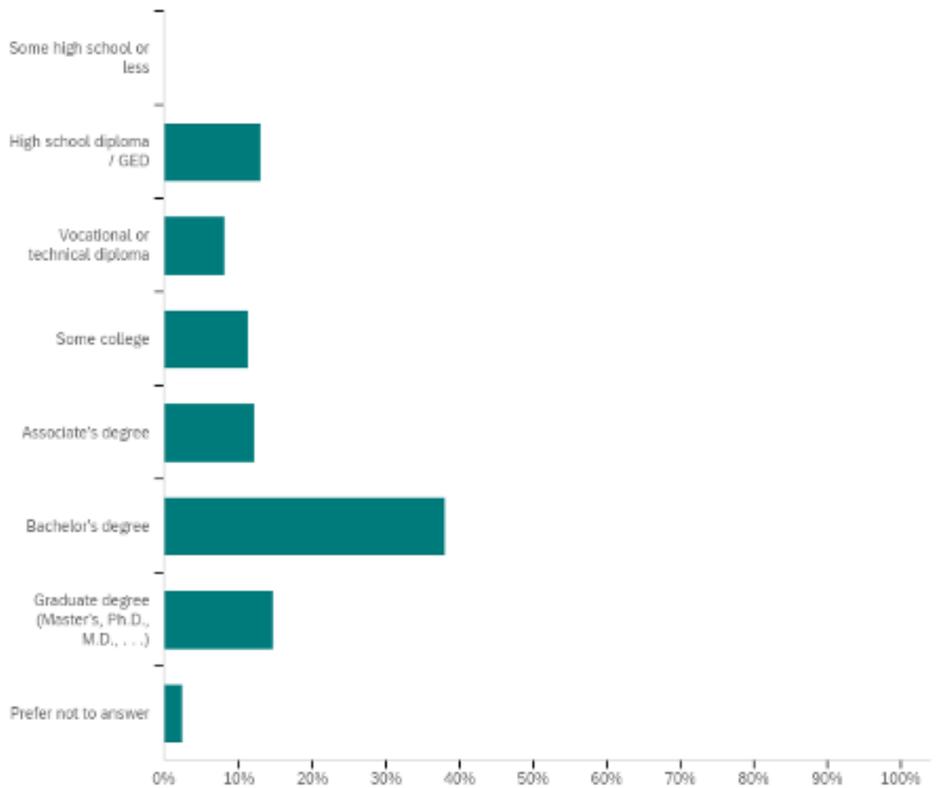
Figure 3. Which age range do you fall in?



## Education

The largest percentage of survey respondents were highly educated, with 38% attaining their bachelor's degree and 15% attaining a graduate degree (master's, Ph.D., M.D., . . .). 12% earned an associate degree, 11% have attained some level of college education, 8% earned a technical or vocational diploma, and 13% received a high school diploma or completed their GED. No respondents did not complete high school, and about 2% preferred not to answer. These demographics contrast dramatically with the general population of the watershed. In the watershed, only 15% have attained a bachelor's degree and 6% have attained a graduate degree. 32% have completed some college, 40% have completed high school or their GED, and 8% have not completed high school as their highest level of education, which are much higher percentages than those of the survey respondents.

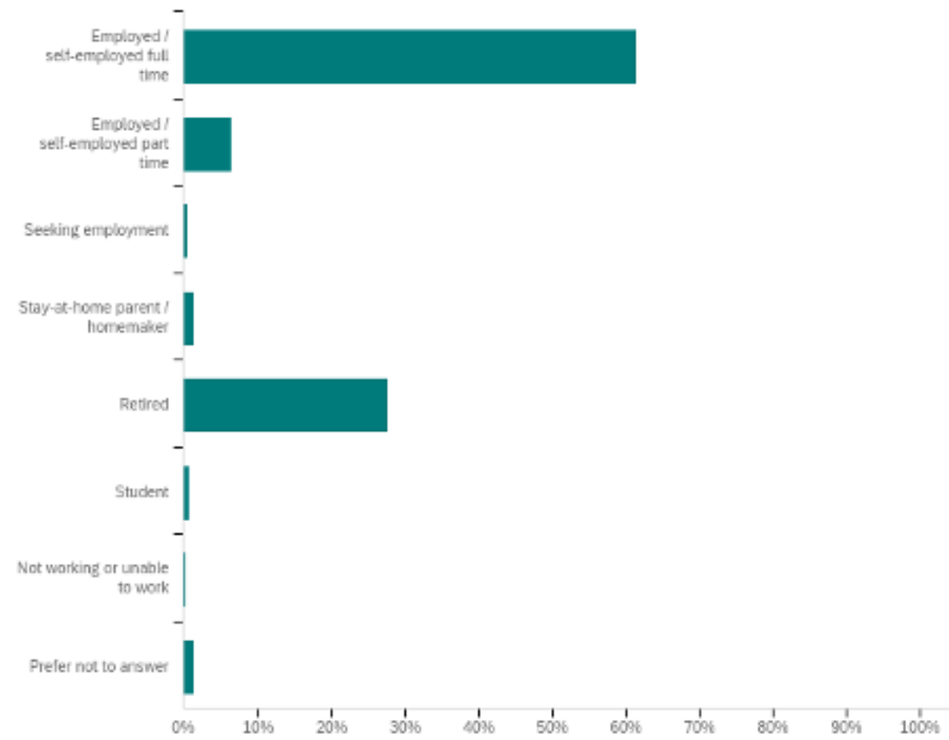
Figure 4. What is the highest level of school that you have completed or degree that you have received?




## Employment

The majority of respondents were employed or self-employed full time (62%). This is followed by retired individuals, representing 28% of respondents. Around 7% were employed or self-employed part time, 1% were stay-at-home parents or homemakers, 1% were students, 1% were seeking employment, and less than 1% were not working or unable to work. Around 1% preferred not to answer.

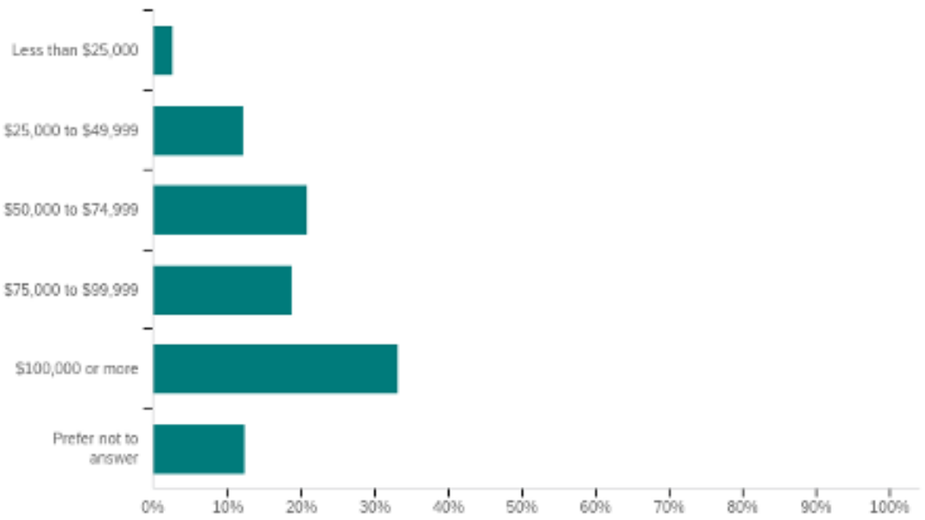
Figure 5. Which best describes your employment status?



## Income

A third of survey respondents make a household income of $100,000 or more. This is followed by 20% making $50,000 to $75,000, 19% making $75,000 to $99,999, 12% making $25,000 to $49,999, and 3% making $24,999 or less. Twelve percent of respondents preferred not to answer this question.

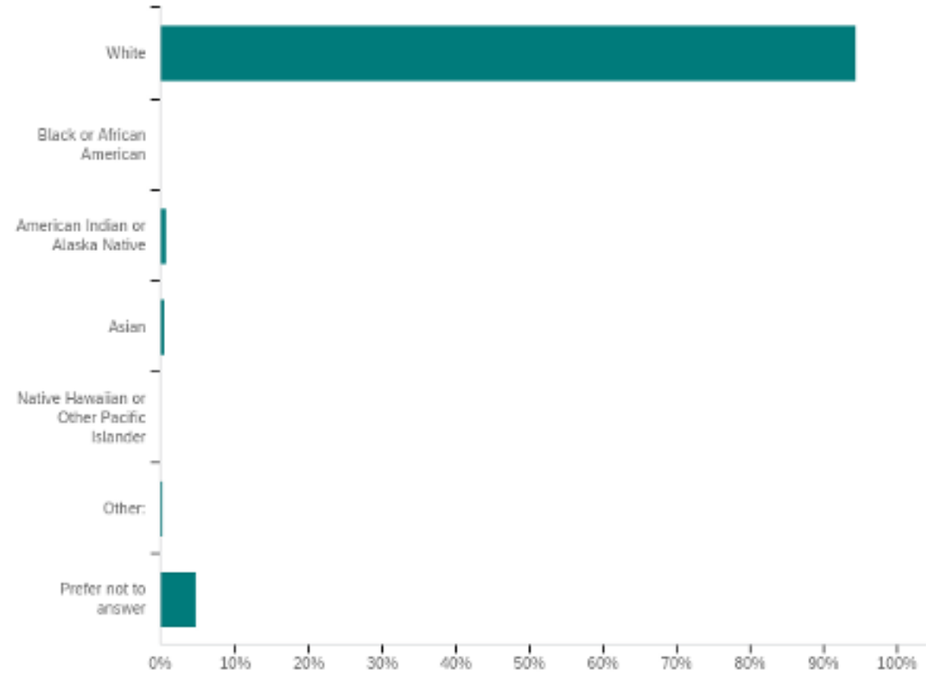
Figure 6. In what range does your annual household income fall?




## Race

Survey respondents were overwhelming White, with 94% identifying as White. About 1% identified as American Indian or Alaska Native and less than 1% identified as Asian. Less than 1% identified as a race other than the ones provided, and 5% preferred not to respond. No survey respondents identified as "Black or African American" or "Native Hawaiian or Other Pacific Islander". This is roughly proportional to the 97% White population of the watershed.

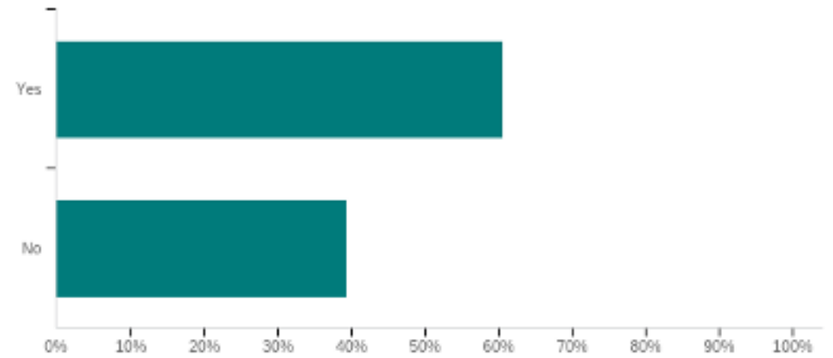
Figure 7. Choose one or more races that you consider yourself to be.



## Residence

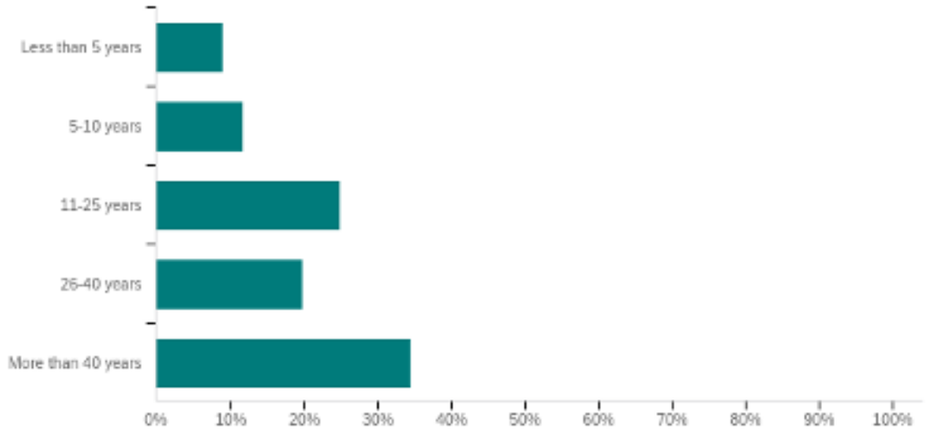
61% of respondents' primary residence was in the watershed. However, 39% answered to living primarily outside the watershed region. This may be due to absentee landowners looking to participate, or it may be capturing the voice of the many people that visit the watershed for recreation purposes. While a map was provided, it may also indicate a misunderstanding of the boundaries of the watershed.

Figure 8. Is your primary residence in the watershed?



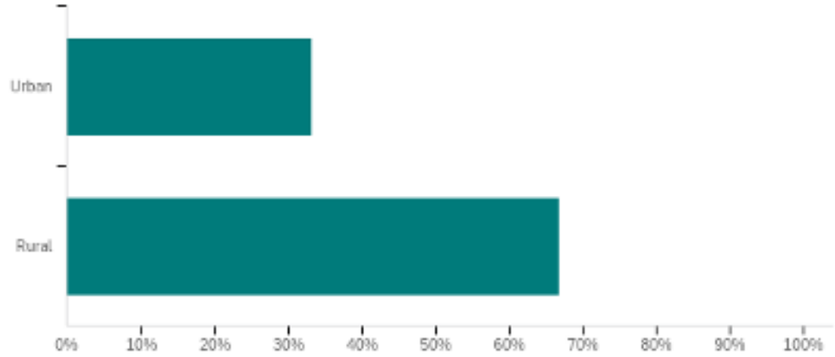

About a third of respondents that indicated that their primary residence is in the watershed have lived there for over 40 years (34%). This is followed by 25% for 11-25 years, 20% for 26-40 years, 12% for 5-11 years, and 8% for under 5 years.

Figure 9. How long have you lived in the watershed area?



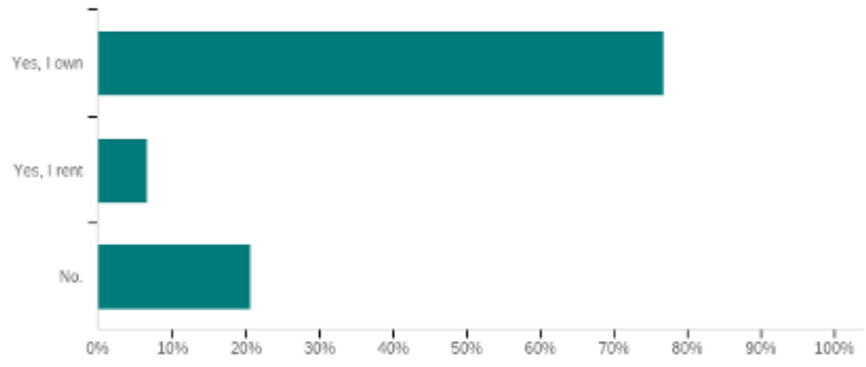

Two thirds of survey respondents live on rural property, and one third live on urban property.

Figure 10. Do you consider the property you live on to be urban or rural?



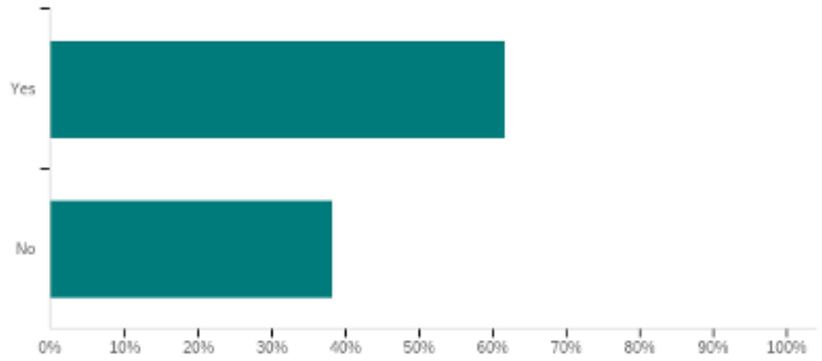

A high majority of respondents own property in the watershed (74%), 6% rent property in the watershed, and 20% do neither.

Figure 11. Do you rent or own property in the watershed? (Check all that apply)



The majority of residents own or rent property that touches stream, river, pond or wetland (62%). 38% do not.

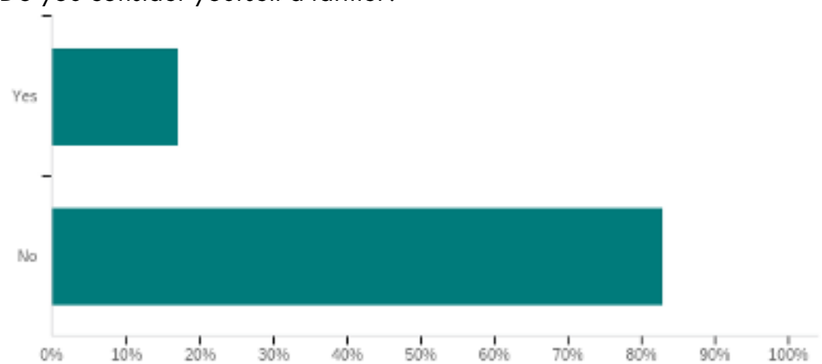
Figure 12: Does any portion of the property you own or rent touch a stream, river, pond, or wetland?




## Agriculture

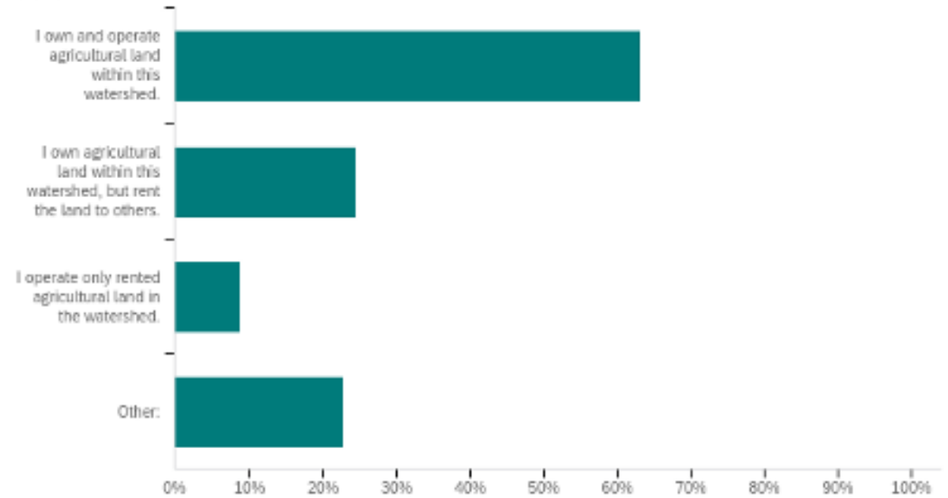
A handful of the survey respondents were involved in agriculture. 17% considered themselves to be a farmer.

Figure 13. Do you consider yourself a farmer?



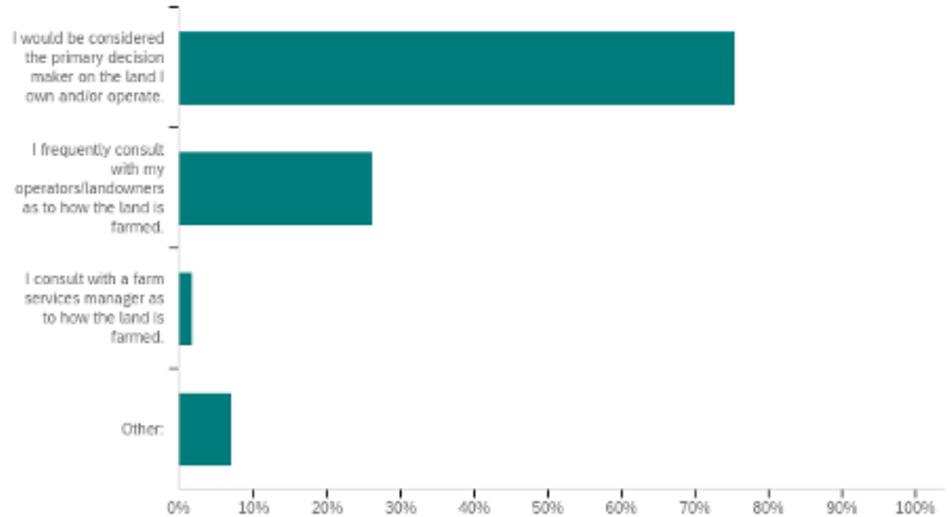

When asked about their agricultural role, 53% of farmers indicated that they own and operate agricultural land within the watershed. 21% own agricultural land within the watershed but rent it to others. 7% operate only on rented agricultural land within the watershed. 19% of the farming respondents answered 'Other'. Most responses indicated that they operate or own agricultural land outside the watershed, or they were involved in agriculture as well as other activities/employment.

Figure 14. Please indicate which of the following represents your role in the watershed. (Check all that apply)




The survey also took into account the different decision-making roles and situations present throughout the watershed's agricultural community. 68% of farming respondents indicated that they were the primary decision maker on the land they own and/or operate. 24% responded that they frequently consult their operators/landowners on farming decisions. Not many farmers consult a farm services manager in the watershed, with only 2% answering this way. 6% answered 'Other'. One of the respondents indicated in that their spouse was the agricultural decision maker.

Figure 15. Please indicate what level you play in the day-to-day agricultural production decisions. (Check all that apply)




## Watershed Businesses

A minority of survey respondents own or manage a business (16%). Of those respondents, a third have businesses that deal directly with the river or its tributaries.

Figure 16. Do you own or manage a business within the watershed?

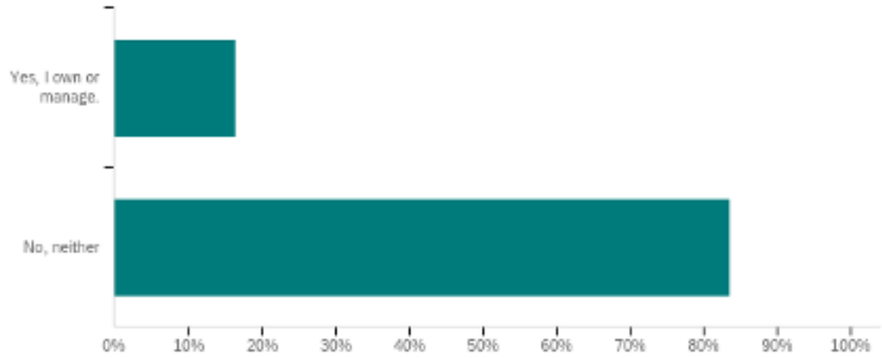
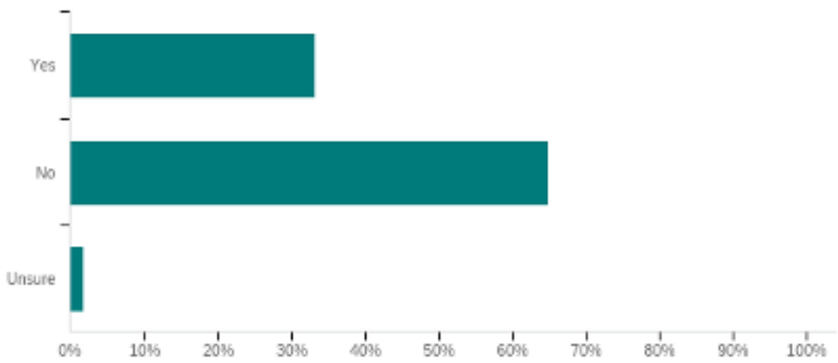



Figure 17. Does your place of business deal directly with the Maquoketa River or smaller streams within the watershed area (such as kayak rental, fishing supplies, watering livestock, irrigation, . . .)?



# Watershed Uses, Views, and Experiences

## Watershed Use

The respondents to the survey use the streams and river within the watershed for multiple recreation, enjoyment, or practical uses. A quarter of respondents use the watershed for its scenic beauty. 19% canoe or kayak in the watershed. Another 19% use the watershed for fishing or hunting. 14% swim and 12% hike within the watershed. 2% use the streams or river to water livestock or irrigate. 7% indicated that they use the watershed for an activity not indicated in the survey. Some of these included the following:

- Boating (the vast majority of responses)
- Biking on nearby trails
- Camping
- Water sports
- Cross-country skiing
- Foraging
- Birdwatching
- Trapping
- Photography
- Ice skating
- Picnicking

Less than 1% did not participate in any activity related to watershed. The responses to this question demonstrate the vast variety of ways residents and visitors come into contact with the watershed and its features.

Figure 18. Have you utilized any stream or river in the Maquoketa River Watershed for any of the following purposes? (Check all that apply)

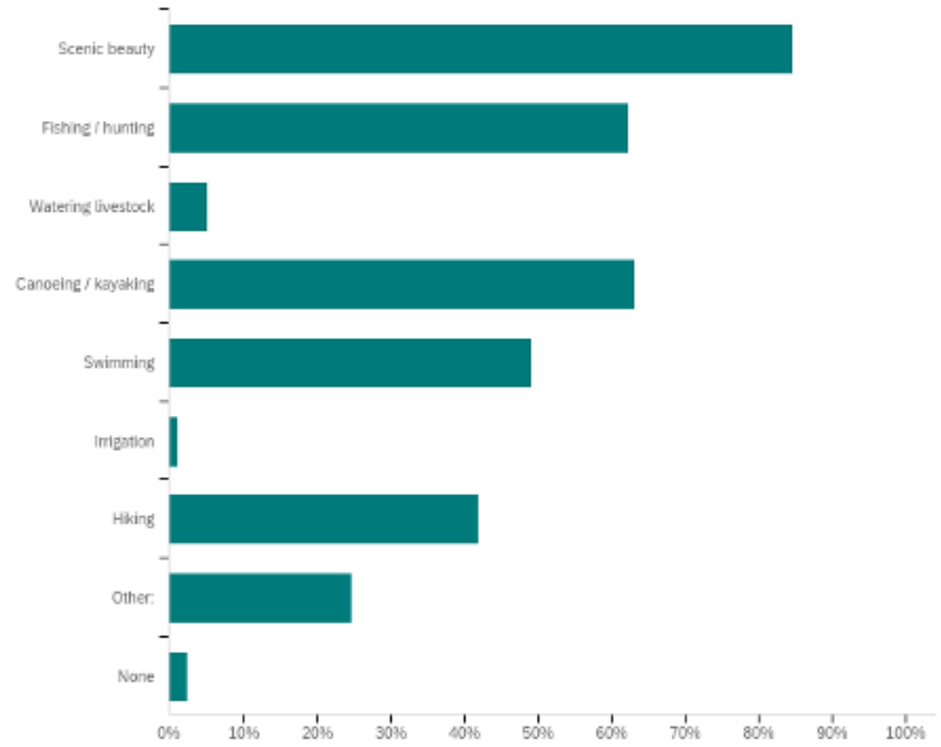


Figure 20. Do you believe the Maquoketa River is a defining feature of the region?

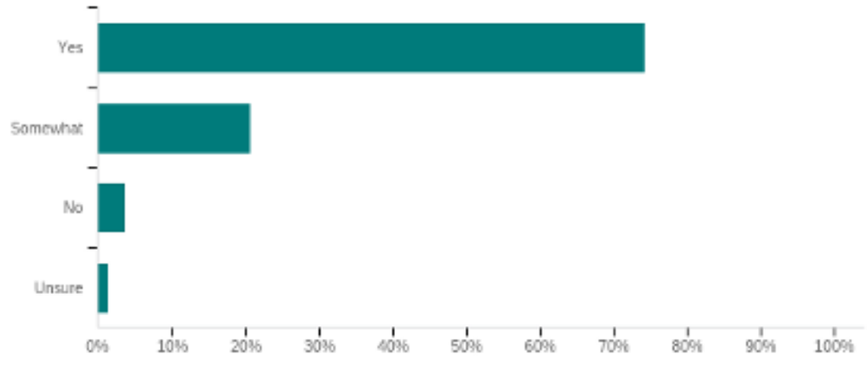
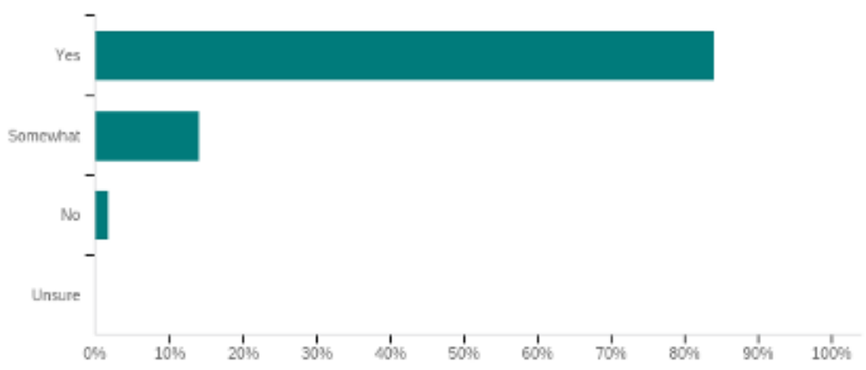



Figure 21. Do you believe the Maquoketa River serves as a recreational asset and destination for Eastern Iowa?




## Concern for Watershed Issues

The survey respondents were asked to indicate their level of concern on multiple watershed topics and issues. These included topics related to the environment and ecosystems, agriculture, the economy, climate change, and others.

Among the issues that the respondents were very concerned about include flooding (41%), extreme rainfall (36%), loss of wildlife habitat (48%), loss of aquatic habitat (46%), water pollution from urban or industrial sources (62%), water pollution from agricultural sources (60%), and soil erosion (59%).

The issues that the most respondents were not concerned about included extreme temperatures (38%), lack of groundwater (30%), Iowa's contribution to the Gulf of Mexico 'dead zone' (21%), loss of wetlands (19%), and loss of agricultural land (31%).

Many respondents indicated that they were somewhat concerned on many of these issues, and a handful indicated that they were unsure.

Figure 22. Generally, how concerned are you about the following issues?

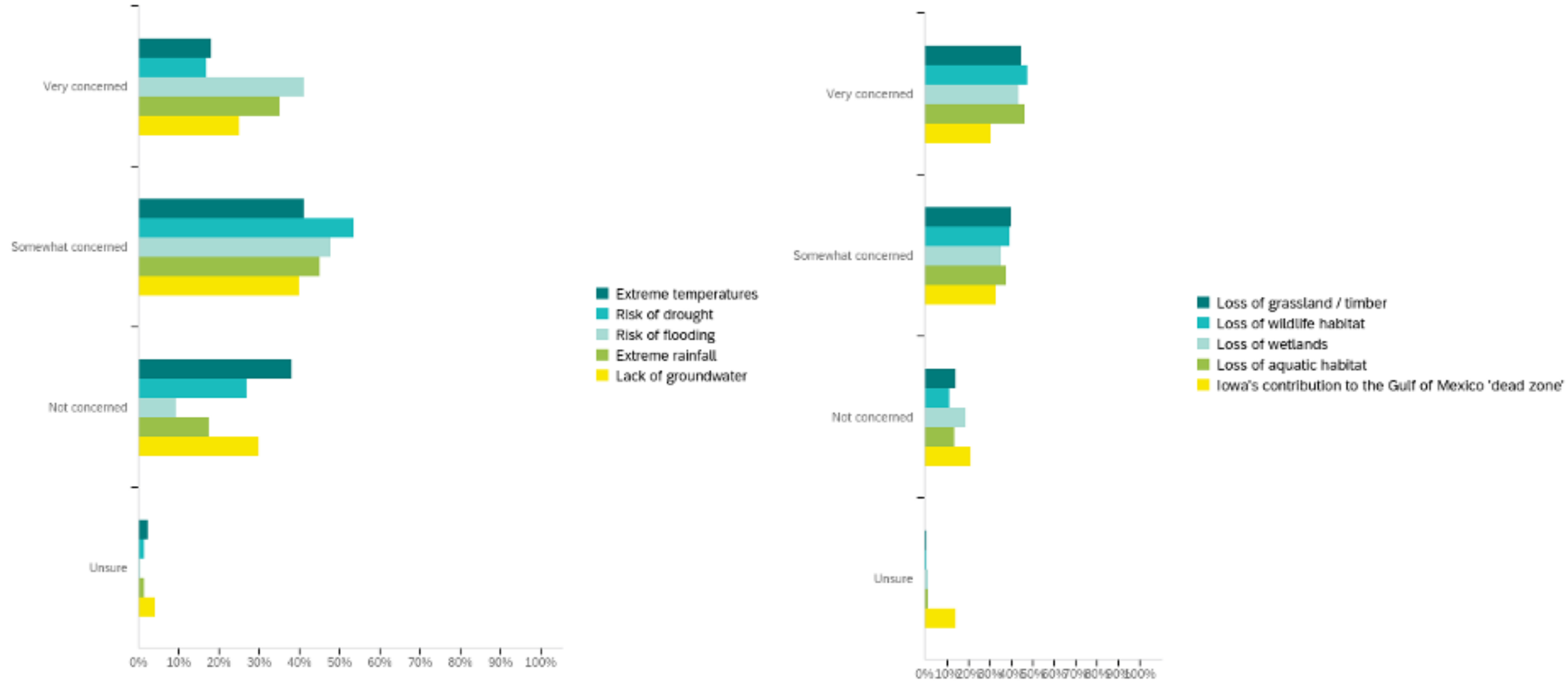
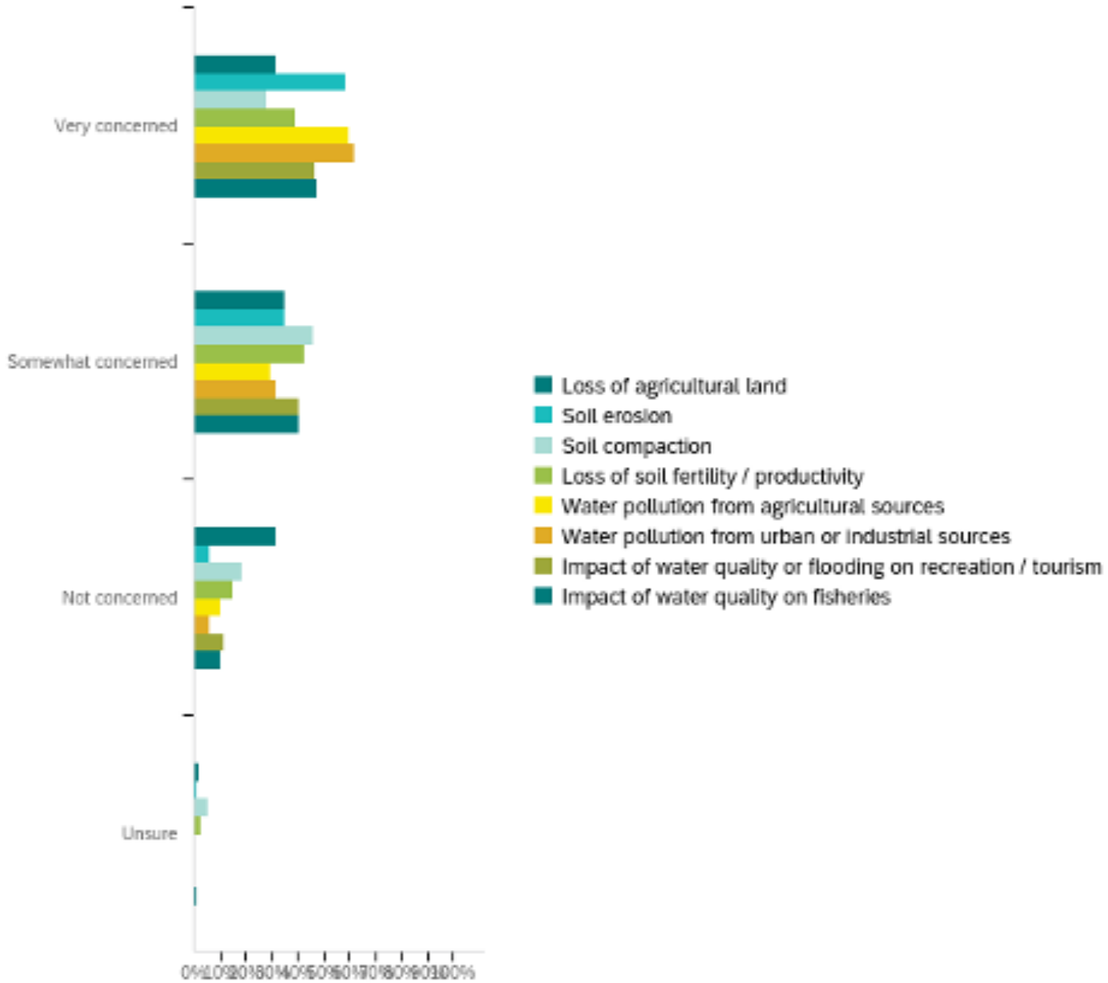


Figure 23. Generally, how concerned are you about the following agricultural and economic issues?




In addition, respondents were asked to indicate whether they agreed, disagreed, or had no opinion on multiple statements relating to watershed issues, solutions, and policy. 79% agreed that incentives for communities to protect soil and water should be increased, 76% agreed that there should be more education for landowners on flood and water quality issues, 74% agreed that rivers and lakes for tourism/recreation should be improved, 66% agreed that there should be more natural areas for hunting/recreation, and 54% agreed that regulation for landowners to protect soil and water should be increased.

43% disagreed that livestock production should be increased, 36% disagreed that crop production should be increased, 35% disagreed that regulation on private property use should be reduced, and 32% disagreed that restrictions associated with publicly funded conservation programs should be reduced.

The statement that the greatest percentage of respondents had no opinion on was "Crop resilience to extreme weather should be improved" (49%).

When asked to whether they agreed with the statement, "I would be willing to pay more to improve water quality and reduce flooding near me (ie. Taxes or fees)", 43% agreed, 32% disagreed, and 25% had no opinion. The margin of error was 5.2%, meaning, 95% of the time, the true value will fall between 38% and 48% willing to pay more to improve water quality and reduce flooding.

Figure 24. Please indicate whether you agree, disagree, or have no opinion on the following issues.

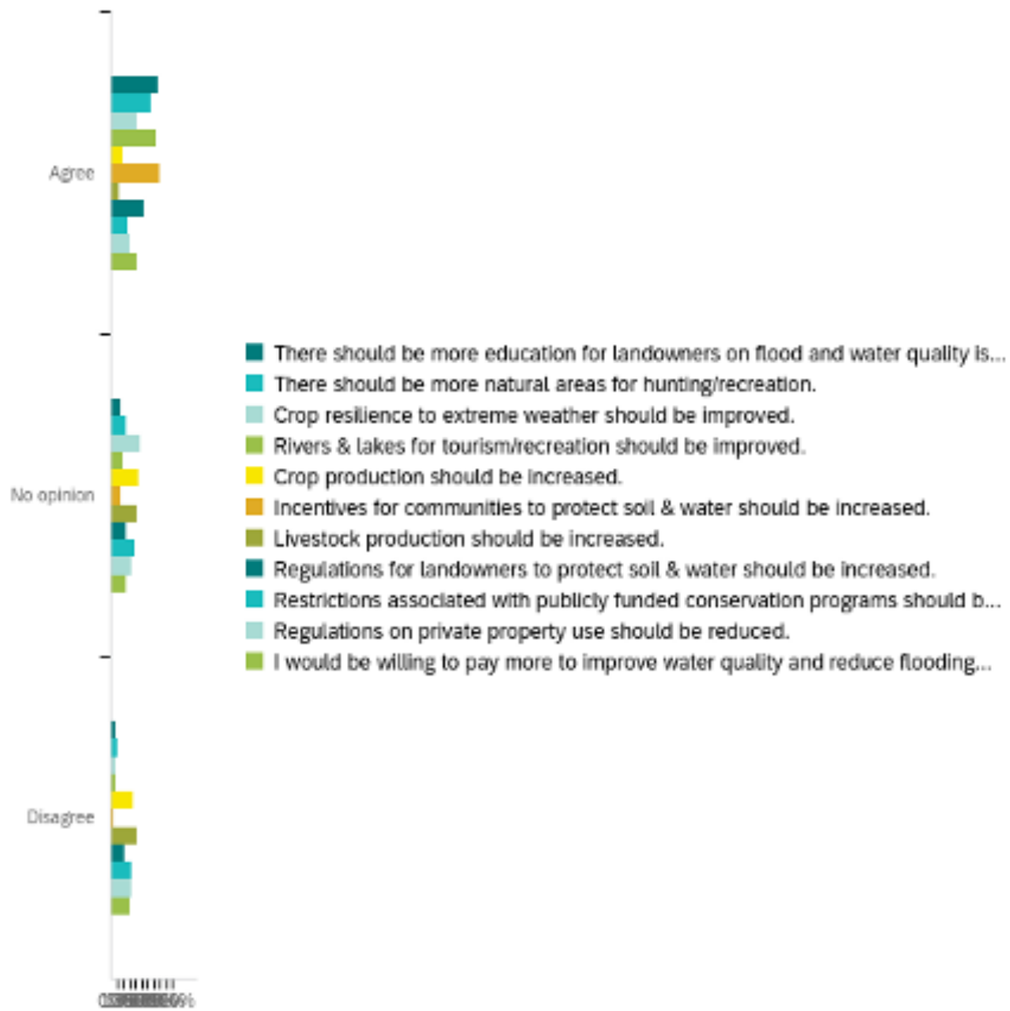



Table 1. Please indicate whether you agree, disagree, or have no opinion on the following issues.

| # | Question | Agree | No Opinion | Disagree | Total |
|---|---|---|---|---|---|
| 1 | There should be more education for landowners on flood and water quality issues. | 76% | 17% | 7% | 356 |
| 2 | There should be more natural areas for hunting/recreation. | 66% | 24% | 10% | 353 |
| 3 | Crop resilience to extreme weather should be improved. | 43% | 49% | 8% | 352 |
| 4 | Rivers & lakes for tourism/recreation should be improved. | 74% | 19% | 7% | 351 |
| 5 | Crop production should be increased. | 18% | 46% | 36% | 354 |
| 6 | Incentives for communities to protect soil & water should be increased. | 79% | 15% | 5% | 355 |
| 7 | Livestock production should be increased. | 14% | 43% | 43% | 354 |
| 8 | Regulations for landowners to protect soil & water should be increased. | 54% | 25% | 21% | 355 |
| 9 | Restrictions associated with publicly funded conservation programs should be reduced. | 29% | 38% | 32% | 351 |
| 10 | Regulations on private property use should be reduced. | 31% | 34% | 35% | 250 |
| 11 | I would be willing to pay more to improve water quality and reduce flooding near me (ie. Taxes or fees). | 43% | 25% | 32% | 352 |

## Flooding

The survey confirmed the experiences of many Iowans: flooding is a frequent and consequential issue for the residents of the Maquoketa River Watershed. Within the last fifteen years, 76% of survey respondents have experienced a flood event, and 60% have been prevented from completing their daily activities or business due to flooding. The margin of error for those with flooding experience is 4.5%, meaning, 95% of the time, the true value will fall between 71% and 80% having experienced flooding.

Figure 25. Have you experienced or been affected by flooding within the last 15 years?

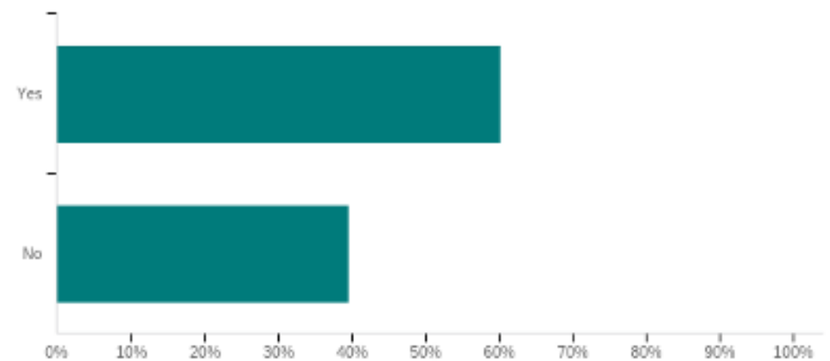
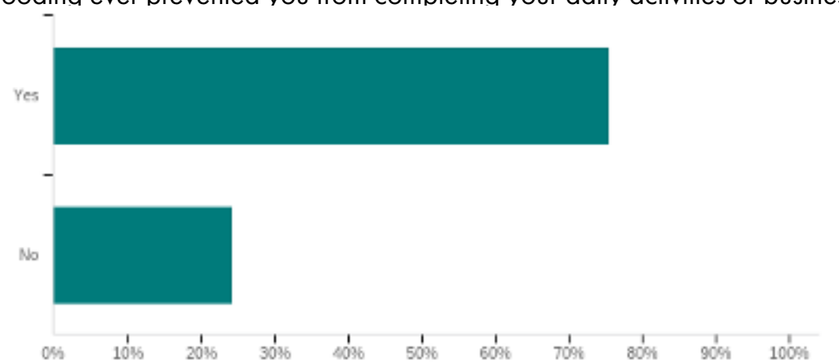



Figure 26. Has flooding ever prevented you from completing your daily activities or business?




The survey indicates that 46% percent believe that not enough is being done to reduce flooding. However, 36% percent are unsure, and 18% believe enough is being done. The respondents indicated that that the party that most needs to be involved to reduce flooding is the WMA (31%), followed by rural property owners (22%), state or federal government (19%), cities/towns (11%), counties (10%), and urban property owners (5%).

Figure 27. Do you believe enough is being done to reduce flooding in the watershed?

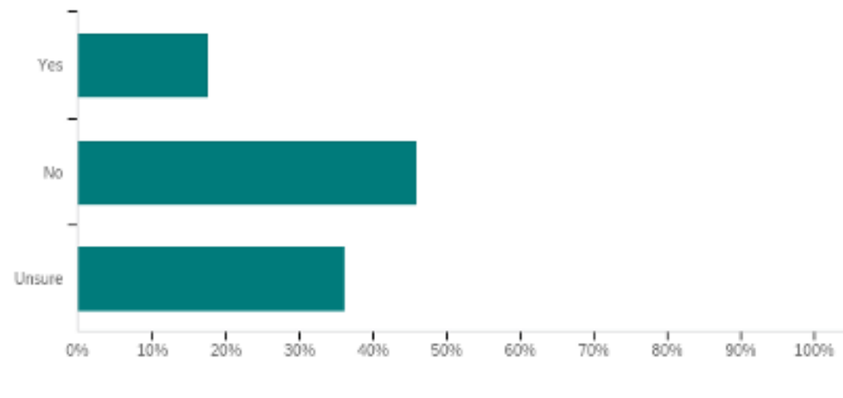


Figure 28. Who do you believe most needs to be involved to reduce flood impacts in the watershed? (Rank from 1 (most) to 7 (least))

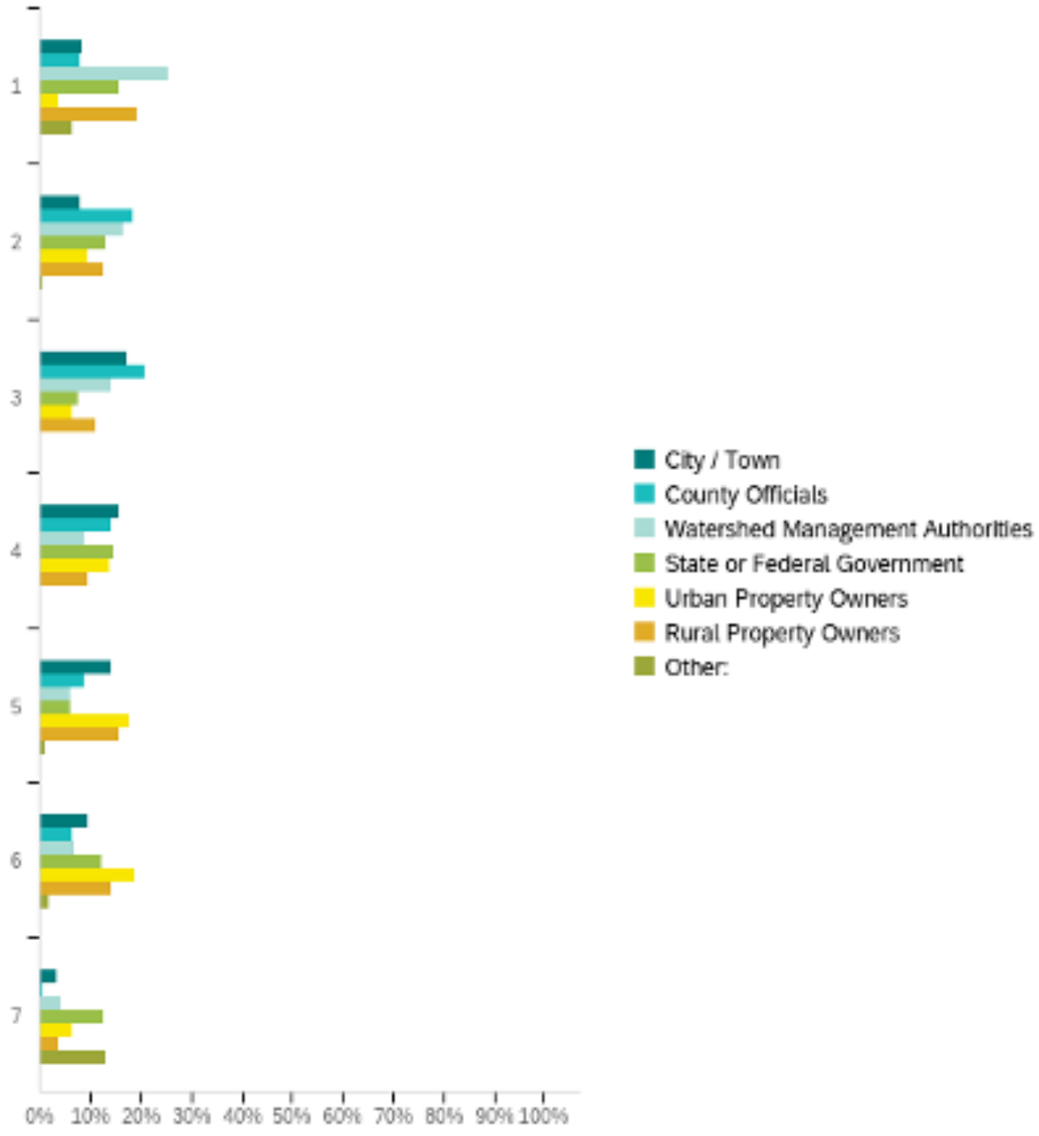



Table 2. Who do you believe most needs to be involved to reduce flood impacts in the watershed? (Rank from 1 (most) to 7 (least))

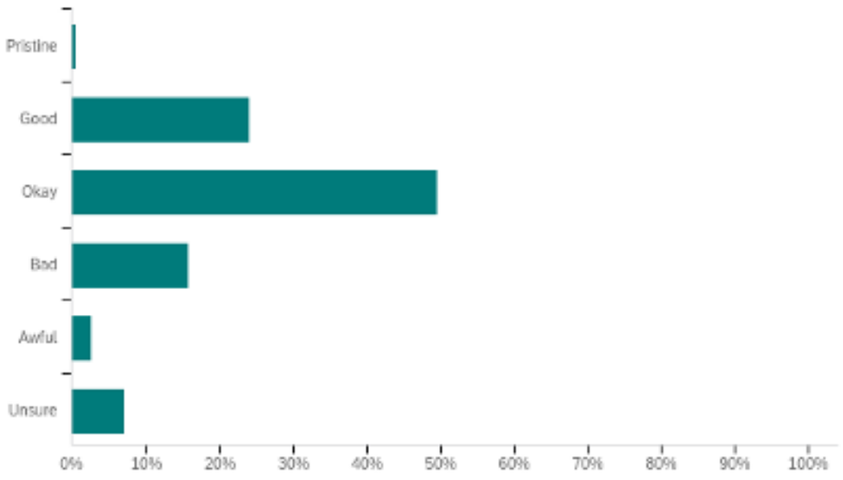
| # | Question | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total |
|---|---|---|---|---|---|---|---|---|---|
| 1 | City/Town | 11% | 11% | 23% | 21% | 18% | 12% | 4% | 244 |
| 2 | County Officials | 10% | 24% | 27% | 18% | 11% | 8% | 1% | 245 |
| 3 | Watershed Management Authorities | 31% | 20% | 17% | 11% | 7% | 8% | 5% | 263 |
| 4 | State or Federal Government | 19% | 16% | 9% | 18% | 7% | 15% | 16% | 263 |
| 5 | Urban Property Owners | 5% | 12% | 8% | 18% | 23% | 25% | 8% | 243 |
| 6 | Rural Property Owners | 22% | 14% | 13% | 11% | 18% | 17% | 4% | 278 |
| 7 | Other: | 28% | 3% | 1% | 0% | 4% | 8% | 56% | 75 |

Although three quarters of survey respondents said they had experience or been affected by flooding in the last 15 years, only 15% answered that they had flood insurance on one or more of their properties.

## Water Quality

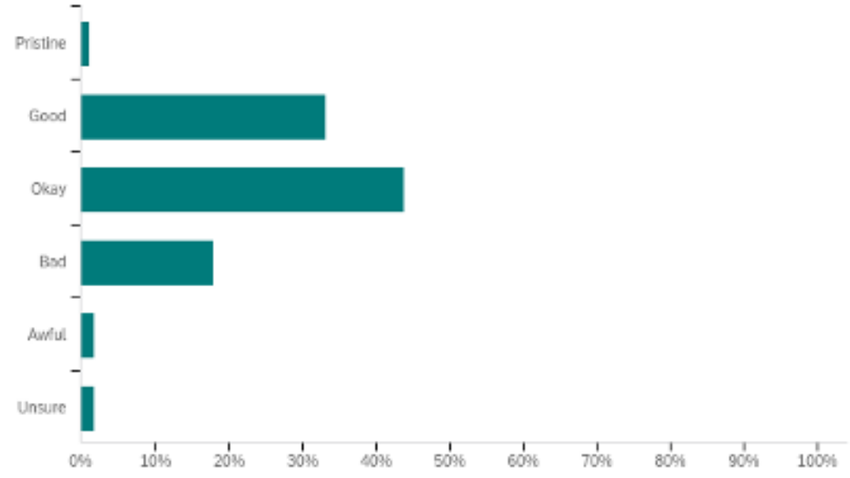
Overall, survey respondents had neither bad nor good views of the water quality. 50% answered that the water quality was 'okay', 24% answered that it was 'good', 16% answered that it was 'bad', 3% answered that it was awful, and less than 1% answered that it was 'pristine'. Around 7% were unsure about the water quality throughout the watershed.

Figure 29. Overall, how would you rate water quality throughout the whole watershed?



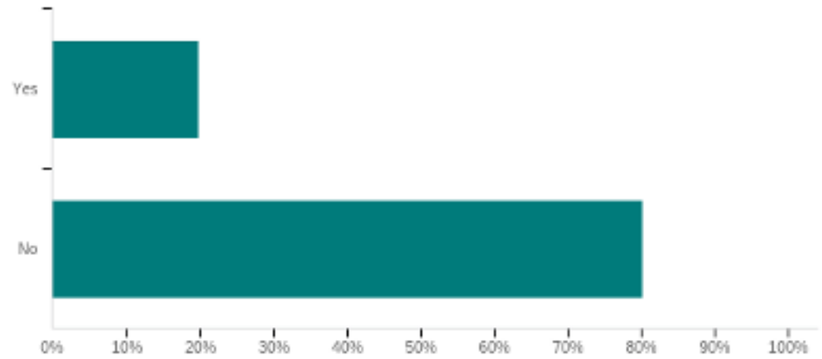

However, when asked about the quality of streams, rivers, pond, or wetlands that touch property owned by respondents, the answers slightly diverged from the middle, with 1% answering 'pristine', 33% answering 'good', 44% answering 'okay', 18% answering 'bad', and 2% answering 'awful'. About 2% were 'unsure' about the quality of the water touching their land, indicating that people may be more aware of the water in their vicinity.

Figure 30. How would you rate the water quality of the streams, rivers, ponds, or wetlands that touch the property you rent or own?




Unlike flooding, most have not been prevented from their daily activities as a result of bad water quality (80%).

Figure 31. Has the water quality in the watershed area ever prevented you from completing your daily activities or business?




The respondents have many different views on what impacts water quality in the Maquoketa. Some of the factors they believe are most influencing include agriculture (85%), streambank erosion (83%), livestock (83%), illegal dumping/littering (81%), and run-off from paved surfaces (76%). Factors they believe have less of an impact include automobiles (46%), pet waste (40%), and landfills (34%).

Figure 32. Do you believe these activities/operations affect water quality in the Maquoketa River Watershed?

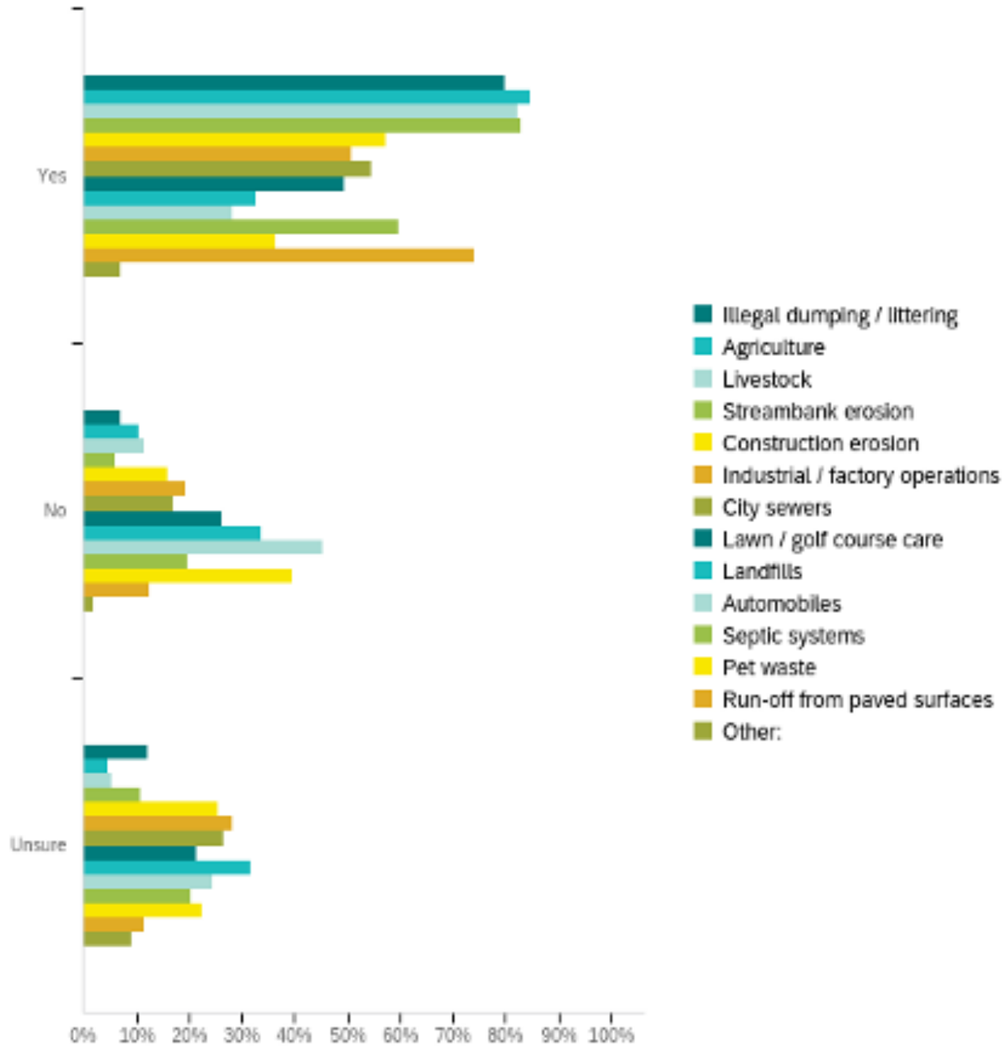


Table 3. Do you believe these activities/operations affect water quality in the Maquoketa River Watershed?

| # | Question | Yes | No | Unsure | Total |
|---|---|---|---|---|---|
| 1 | Illegal dumping/littering | 81% | 7% | 12% | 327 |
| 2 | Agriculture | 85% | 10% | 5% | 329 |
| 3 | Livestock | 83% | 12% | 5% | 328 |
| 4 | Streambank erosion | 83% | 6% | 11% | 331 |
| 5 | Construction erosion | 58% | 16% | 26% | 327 |
| 6 | Industrial. factory operations | 52% | 20% | 29% | 325 |
| 7 | City sewers | 56% | 17% | 27% | 325 |
| 8 | Lawn/golf course care | 51% | 27% | 22% | 322 |
| 9 | Landfills | 33% | 34% | 32% | 324 |
| 10 | Automobiles | 29% | 46% | 25% | 324 |
| 11 | Septic systems | 60% | 20% | 20% | 329 |
| 12 | Pet waste | 37% | 40% | 23% | 326 |
| 13 | Run-off from paved surfaces | 76% | 13% | 12% | 324 |
| 14 | Other | 39% | 10% | 51% | 59 |

Three quarters of respondents don't believe enough is being done to address water quality issues in the watershed. Once again, the parties that respondents felt needed to be most involved included the WMA (32%), rural property owners (23%), and state or federal government (18%). Those they felt needed to be involved the least were urban property owners.

Figure 33. Who do you believe most needs to be involved to make water quality better? (Rank from 1 (most) to 7 (least))

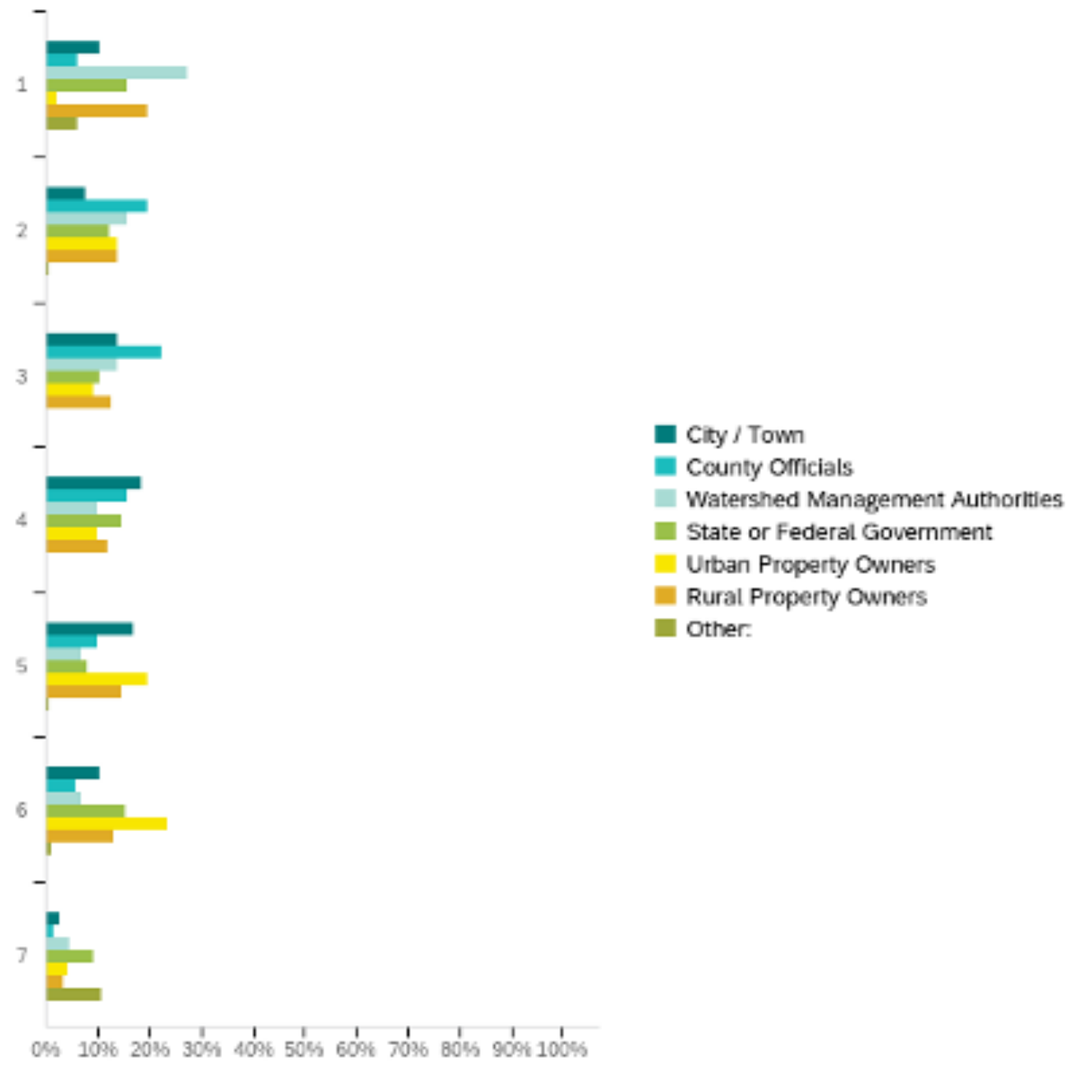
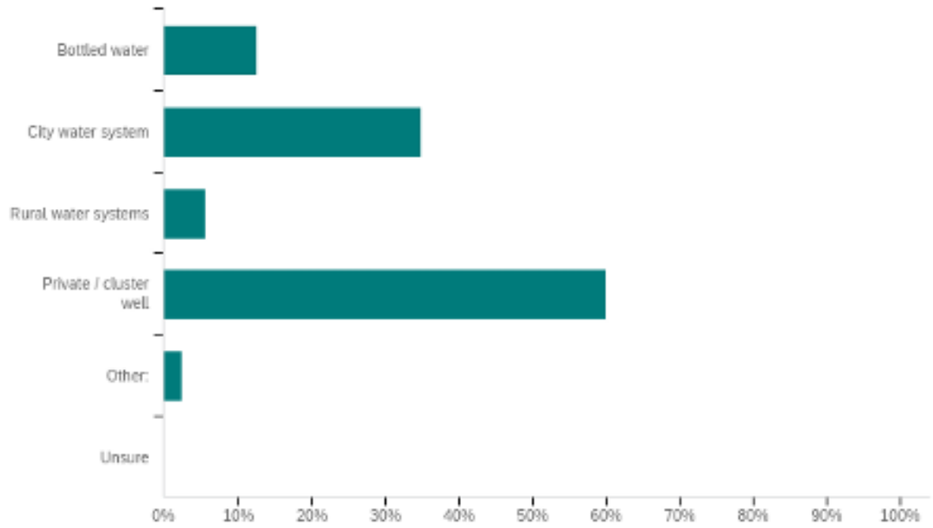


Table 4. Who do you believe most needs to be involved to make water quality better? (Rank from 1 (most) to 7 (least))

| # | Question | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total |
|---|---|---|---|---|---|---|---|---|---|
| 1 | City/Town | 13% | 9% | 17% | 23% | 21% | 13% | 3% | 247 |
| 2 | County Officials | 8% | 24% | 28% | 19% | 12% | 7% | 2% | 247 |
| 3 | Watershed Management Authorities | 32% | 18% | 16% | 12% | 8% | 8% | 5% | 261 |
| 4 | State or Federal Government | 18% | 15% | 12% | 17% | 9% | 18% | 11% | 262 |
| 5 | Urban Property Owners | 3% | 17% | 11% | 12% | 24% | 29% | 5% | 254 |
| 6 | Rural Property Owners | 22% | 15% | 14% | 14% | 16% | 15% | 4% | 273 |
| 7 | Other | 32% | 3% | 0% | 2% | 3% | 5% | 55% | 60 |

As a primarily rural watershed, most respondents get their drinking water from private/cluster wells (52%). Additional drinking water sources include city water systems (30%), bottled water (11%), rural water systems (5%), or other unmentioned sources (2%).

Figure 34. Where does your home water supply come from? (Check all that apply)Table 4. Who do you believe most needs to be involved to make water quality better? (Rank from 1 (most) to 7 (least))



# Conservation Strategies and Best Management Practices

## Non-Agricultural

The respondents were asked to indicate their interest or experience with a selection of conservation strategies. This set of strategies was designed to be applicable to urban and rural dwellers, but not those involved in agriculture. The survey-takers indicated a variety of activities they already participate in, or ones they'd be interested in. The most widely adopted practice is seeking assistance in proper disposal of hazardous household waste, with 62% of respondents already participating in this activity. Other activities with higher rates of participation include minimal use of lawn and garden fertilizers/pesticides (59%), establishing windbreaks around dwellings (44%), and using conservation cover plantings (41%).

Practices that respondents were interested in but needed more information included wetland restoration (43%), native landscaping/wildflower and rain gardens (40%), filtering vegetation strips along creeks (39%), and permeable pavers (38%). The most respondents didn't know about wetland restoration.

Practices that the respondents were either not interested in or did not apply to their situation included practices that other respondents' were interested in, such as permeable pavers (24%), wetland restoration (24%), and filtering vegetation strips (22%).

Major factors that prevent respondents from implementing practices on their land include money (36%), labor (21%), and time (20%). 10% indicated 'space' as a prohibiting factor. Many others (12%) indicated challenges not provided in the survey options. These included the following:

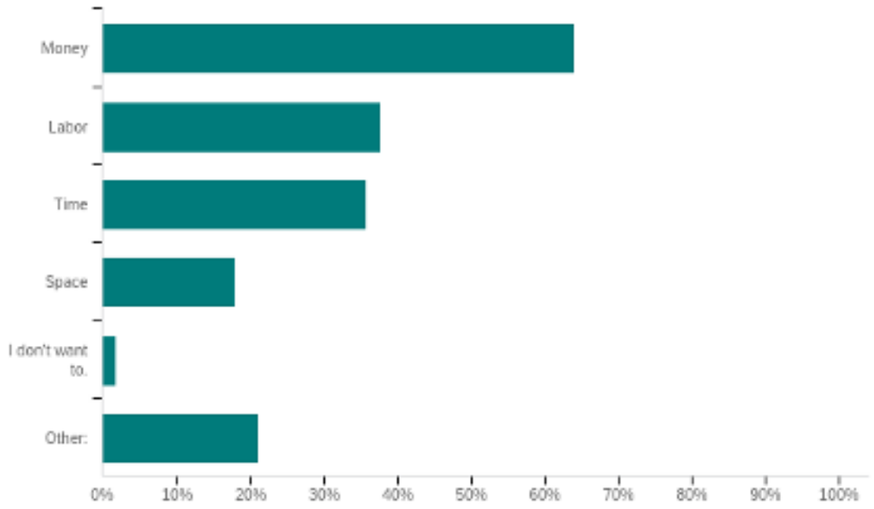
- Not needed/doesn't apply
- Lack of understanding in the value it would bring
- Provided options
- Education/additional information
- Cooperation of neighbors
- Government
- Equipment rental
- Old age
- Disagreement within household
- Don't have control of the land
- Need willing tenants
- Implementing practices slowly
- Often ineffective

In addition, about 1% indicated that they did not want to implement these strategies on their land.

Table 5. Please indicate your interest or participation in the following activities.

| # | Question | I already participate in this activity. | Interested, but need more information. | I don't know about this activity. | Not interested / Not applicable | Total |
|---|---|---|---|---|---|---|
| 1 | Assistance in disposal of household hazardous waste (paint, pesticides, cleaners) | 62% | 22% | 8% | 8% | 253 |
| 2 | Permeable paving (pavers that allow water to absorb into the ground) | 11% | 38% | 27% | 24% | 253 |
| 3 | Native landscaping / Wildflower & rain gardens | 34% | 49% | 15% | 11% | 254 |
| 4 | Wetland restoration | 14% | 43% | 20% | 24% | 251 |
| 5 | Minimal use of lawn & garden fertilizers/pesticides | 59% | 25% | 6% | 10% | 252 |
| 6 | Conservation cover (plantings to help protect soil from erosion) | 41% | 34% | 9% | 15% | 253 |
| 7 | Filtering vegetation strips along creeks | 23% | 39% | 14% | 23% | 252 |
| 8 | Windbreaks around dwellings (trees or shrubs planted to reduce wind impacts) | 44% | 31% | 10% | 16% | 251 |
| 9 | Other | 29% | 19% | 19% | 32% | 31 |

Figure 35. What, if anything, prevents you from adopting conservation strategies on your property? (Check all that apply)




## Agricultural

A second question was provided to respondents that had indicated they were involved in farming. This question was designed with conservation strategies aimed at agricultural (crop and livestock) operations. Respondents indicated their participation and barriers to participation for multiple strategies.

The watershed agricultural community that participated in this survey indicate a high level of adoption of a few strategies. These practices included fertilizing based on a soil test (84%), post-emergence herbicides (65%), conservation tillage (63%), and no-till (63%). The strategy that the fewest respondents are currently using is strip till (8%).

There are additional strategies that farmers would be willing to consider. The most popular ones amongst these include cover crops (34%) and fertilizing based on a stalk test (23%).

The respondents indicated which factors limited their ability to implement specific practices; these factors included 'need additional information', 'doesn't fit my operation', 'too expensive', 'too much extra work', or a different factor not provided.

The respondents most needed additional information about fertilizing based on a stalk test (23%) and banding of herbicides (20%).

The respondents' operations didn't align most with strip till (53%), rotational grazing (50%), and timber management (40%).

Overall, the respondents didn't find the strategies too cost prohibitive, but the most expensive appeared to be spot application of herbicides (4%) and cover crops (4%).

Similarly, these farmers didn't find these practices to be too much work, but the ones appearing to require the most extra work were spot application of herbicides (6%) and conservation tillage (4%).

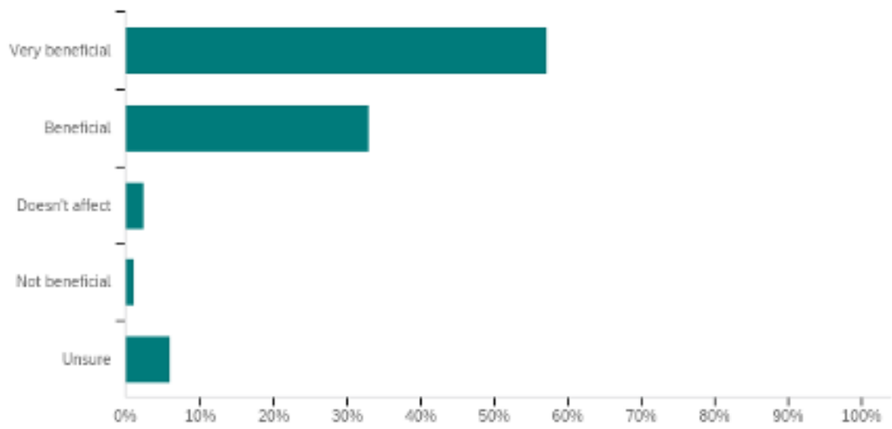
Table 6. Of the following conservation practices, please indicate which you currently use, as well as those you may consider adopting. Also, indicate the reasons you feel limit your ability to either adopt or maintain these practices. (Check all that apply)

| # | Question | Currently Use | Willing to Consider | Need additional information | Doesn't fit my operation | Too expensive | Too much extra work | Other | Total |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Contour farming | 48% | 8% | 10% | 29% | 2% | 2% | 2% | 52 |
| 2 | No-till | 63% | 12% | 4% | 14% | 0% | 0% | 6% | 49 |
| 3 | Cover Crops | 42% | 33% | 5% | 9% | 4% | 2% | 5% | 55 |
| 4 | Conservation tillage | 63% | 12% | 8% | 6% | 2% | 4% | 6% | 51 |
| 5 | Contour filter strips | 45% | 14% | 12% | 24% | 0% | 0% | 4% | 49 |
| 6 | Filter strips along streams | 48% | 21% | 4% | 25% | 0% | 0% | 2% | 48 |
| 7 | Pasture renovations | 40% | 12% | 8% | 33% | 3% | 2% | 4% | 48 |
| 8 | Rotational grazing | 42% | 4% | 2% | 50% | 0% | 0% | 2% | 48 |
| 9 | Timber management | 40% | 12% | 6% | 40% | 0% | 2% | 0% | 40 |
| 10 | Strip till | 8% | 12% | 16% | 53% | 0% | 2% | 8% | 49 |
| 11 | Banding of herbicides | 14% | 14% | 20% | 37% | 2% | 2% | 10% | 49 |
| 12 | Spot applicaiton of herbicides | 40% | 19% | 9% | 21% | 4% | 6% | 2% | 53 |
| 13 | Post-emergence herbicides | 65% | 10% | 8% | 10% | 0% | 0% | 6% | 48 |
| 14 | Fertilize based upon soil test | 84% | 6% | 6% | 2% | 0% | 0% | 2% | 50 |
| 15 | Fertilize based upon stalk test | 25% | 23% | 23% | 23% | 2% | 0% | 4% | 48 |
| 16 | Other | 50% | 17% | 0% | 0% | 17% | 0% | 17% | 6 |

## Wetlands

Survey-takers were asked for their opinion on the importance of wetlands to improve water quality and reduce flooding. The majority believe wetlands to be very beneficial (57%). 33% believe wetlands to be beneficial, 3% think that they do not affect water quality and flooding, and 1% think they are not beneficial. Around 6% are unsure.

Figure 36. How beneficial do you believe wetlands are at reducing flooding and improving water quality?



# Information Resources

Multiple questions were asked to understand where people living in or involved with the watershed get their information and how much they trust this information. These questions will be useful in understanding how to communicate with the watershed.
Unsurprisingly, respondents rely on the internet most to find community information (17%). This is followed by community newspapers (15%), word of mouth (14%), and social media (11%). The mediums least used to gather community information include by phone (2%) or text messaging (4%). Some additional resources provided by respondents include the following:

- Experience / involvement with issues
- Radio
- Other news outlets
- PBS
- Community organizations (Chamber of Commerce, church, . . .)
- Meetings / informational sessions

When making agricultural or conservation decisions, respondents most turn to conservation services (12%) or a family member, neighbor, or friend (12%). This is followed by university extension services (11%), farming publications (11%), and the internet (10%). The respondents turn to the local government the least (2%).
When asked how helpful they find the information given by these resources, the respondents find information from conservation authority resources (48%), educational resources (39%), and personal resources (39%) 'very helpful'.

# Additional Comments

The survey provided a space for individuals to share additional comments with the MR WMA relating to water quality, flooding, and conservation issues. The comments demonstrate the wide variety of opinions, perspectives, experiences, and possible solutions throughout the watershed.

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| I live 2 houses away from a dry run in town that floods every 3-5 years it seems. The water comes from farm fields up north by the Delaware County Fairgrounds. The last flood was in Oct of 2018. We got 1-1/2 ft of water in our basement and 2 neighbors to the west and north of us for water up to their basement ceilings due to basement egress windows breaking. |
| Delhi dam needs to be proactive when heavy rains are forecasted |
| I no longer believe the farmers are the best stewards of their land. I believe the majority farm ditch to ditch. Waterways are being tore out and more tile lines installed. Manure from factory farms is polluting our streams and rivers so they are visibly damaged. I don't believe local farmers will change practices without regulations. My family was so proud to be some of the first farmers to install terraces and waterways. Now new farmers are tearing them all out. It's sad to see what our farmers are doing to our environment in our communities, our state and our country. |
| Every government official who sees fit to manage other people's property ought to take their own personal savings or take out a personal loan, purchase a couple hundred acres of land at ten grand per acre, and be personally responsible for it under the same regulations they wish to impose on others. I'd have a lot more faith in government if that was the case. You can eliminate every farm, and you will still have nitrates in the water. You will still have thousands of geese pooping on the beach, and hundreds of deer pooping in the streams & woods, and their dead bodies floating down the river and getting caught in the dam (imagine the outcry if they would have been pigs). You'll still have sewage discharges from municipalities. There will still be spikes in fecal bacteria and nitrates. What you won't have is any farmers left to blame. Farmers are already beat to death with regulations handed down by people with no skin in the game or real experience. I like the river and have spent as much time there as most people, but there needs to be realistic expectations on both sides of these issues. |
| When the flooding affects my work it is has been because of heavy rain/flash flooding coming from the north and there is really little we can do other than shut our drains and close. Wait until it crests and then we are usually good to go. Maybe close for a day. |
| Drinking water in Manchester,Iowa awfull.Clorine taste from high chlorine to try to cover up nittate problem.No swimming at our beautiful Backbone state park beach area because of fecal material. Farm chemicals have ruined this area drinking and recreation |
| Maq. river thru Manchester looks silted in; West side river bank in Manchester possibly underutilized; Impact of lg. #'s of geese and their waste on shorelines and water; limiting max # of livestock in confinement bldgs per county or watershed as the waste |
| Removal of dams have destroyed the maquoketa river. |
| Too many boats at times |
| Water quality, erosion are always going to be a problem as long as we have concrete roadways and parking lots. To think that we need more regulation is both dangerous and reckless. In manchester the watershed to the river is around 2700 acres of pattern tiled farm ground. Maybe you should be asking how can we make the increase in water flow through the water shed create more efficiencies for the city, I.e energy/commercial fishing/ tourism. There has to be a way to harness this water and make it work for our community. I am excited to see all of your ideas/thoughts and concerns but now I am concerned because I haven't seen one thing presented that will take what we have now and increase revenue. More taxes and regulation is not the answer especially being we are 45 minutes from the 3 big city. We should be trying to generation new business and homes. I'd challenge you guys to change course and bring this city a plan to bring business here that at stuck in cities that are currently under siege. |
| DNR,COUNTY AND STATE EMPLOYEES SHOULD BE CLEANING AND WORKING CLEANING RIVER BANKS. |
| I believe more needs to be done to replace deep pools and other habitat for fish. Dams are being removed and river beds are being reworked because of that but removes some of the best fishing holes we have had. |
| I think farmers should be held more accountable for watershed management |
| Need more flood/water control upstream |
| not an issue but if water quality was so important, and we are polluting so bad, why does the NRCS not have supplied water test kits to all farmers/landowners/interested individuals so the general public could monitor the water quality and get results from the practices that they have installed |
| I believe we need more long term conservation programs like "CRP". All farm drainage tile should have outlets that go into holding or filtration ponds before going into Creeks, Streams and Rivers. We need Creeks and Stream areas that have very little human activity (Refuge) to protect Wildlife. |
| N/A |
| Hold people and businesses accountable. Keep the pay offs and lobbying out of it! |
| Everyone needs to take a more active role in keeping our river clean. There is a lot of littering and dumping that happens in the area. It needs to stop. |

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| More emphasis needed on agriculture and business run-off/pollution |
| There seems to be no clear leader on this issue. I'm sure DNR does not have the staff, and maybe doesn't have the responsibility, to address this. |
| I truly believe pastoral agriculture can play an important role in sustainability of our local watersheds. Loss on grasslands in proximity to our streams and rivers is a concern. Managed grazing can improve soil structure, and thus water quality, while providing local economic support. |
| We can do better for our watershed. Thanks for working to affect positive change and build partnerships. We can do better! |
| Good Luck! |
| stabilize the banks of the river and the streams that feed it. |
| Too many farmers allowing manure runoff directly into water. |
| I believe it needs to be a collaborative effort with farmers to understand how it is in their best interest to protect the watershed. The state needs to quit supporting short term profits and focus on longer term impacts of inaction and mismanagement of water quality. |
| educate children in school about what we can do to save soil, wildlife, litterering, etc---not just thru programs outside of school. we must reach all children and at school is the place with speakers, videos, and hand outs of before and after photos. Children will later own land, autos, have garbage, want clean rivers, so they need yearly introduction to studies, new procdures, changes in rules or how they can create a need for improvement by their parents, neighbors, and the urban public about litter, and waste in our driveways, yards, parks, public parking lots. Take pride oin areas you live and visit. Take home your waste and pick up litter you see before you as you walk , bike. Also don't burn leaves or rake into the street so it becomes a community problem. Put your plastic bags, gum wrappers,sandwich wrappers in your pocket or auto to later put in the garbage. Too many people are slobs and have no sence of responsibility to our communities. Look at all the little pieces of litter along our sidewalks, timbers area, road ditches, parking lots etc.cese |
| City flooding may be affected by other issues besides the river, but they are serious and need to be addressed with equal attentio. |
| Ongoing dredging of Lake Delhi, Backbone Lake, etc. should have ongoing funding from boat fuel tax, and kayak, canoe, PWC and boat registrations. |
| Improving fish habitat would greatly increase tourism. |

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| North of Manchester about 2 miles used to be "The Mill Pond". It was about a 10 acre lake/watershed that has vanished in the last 15 years due to flooding and a dam removed. As a result the dept of water up river has dropped 3-4 feet from what it was in the 90's and early 2000's. It was a place of recreation, tons of wildlife and great fishing holes. This could be explored as the catch basin already exists and could help the river get back to healthier levels. I've enjoyed this river for 30+ years and absolutely love "Ms Maquoketa". Would love to see us all work together to come up with a plan to preserve the river banks from washing and making the river wider then shallower. Would love to see the millpond used once again. Want to see my children enjoy this river as much as I have in my life. Thanks for helping with this project. One piece of advice. Knowledge is ONLY power WHEN it's used! Please make a difference and act on it! Thank you! |
| I believe actions have been taken but there is a lot more that could be done |
| This survey was longer than anticipated. That's why I usually do not partake in surveys. |
| I think Watershed Issues/Concerns are being adequately addressed. |
| there should be limits to size and speed of boats on lake delhi, the increase is having a severely detrimental impact on shoreline and aquatic habitat |
| Federal, State and County did not enforce regulations in regards to repairing the shore line after the flood of 2010. Vast amounts of waterway disappeared because property owners built concrete walls past the original high water mark there by reducing the cubic ft, flow of the river. It still going on today. Not obtaining permits to insure proper construction methods were used has resulted in rip rap filling the channel with additional small rock added ever year. It is hard to get behind public projects when current regulations are not followed and enforced. |
| I would love to see the water quality improved. I used to spend a lot of time of Lake Delhi, and now hesitate to let my kids near the water because it is so filthy. Thank you for the survey. |
| I believe some of the boats that produce large waves are very hard on our shorelines and would like to see some regulations related to that |
| We have a summer cottage on Lake Delhi. Since the construction of the new dam, we don't have as many concerns about flooding, but are very concerned about the degree of new construction on the lake, removal of trees and ground cover to accomplish construction without any regard to how this contributes to siltation and erosion/runoff into the lake itself. If this continues, we won't have a lake anymore. I feel this is negatively impacting our water quality. I am also very concerned about runoff from farms in the area and chemicals used on lawns next to the lake. We don't need lawns that look like golf courses. Property owners need education on natural ways to care for their lawns that do not pollute our waters. Thank you for doing this survey. I am very happy to participate and provide input into what I feel the issues are. |

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| The Hartwick Bridge is big reason for upstream flooding. Bridge was built wrong and should have been longer, but county funding caused it to be built incorrectly. |
| The community of Lake Delhi among many others is deeply affected by lack of flood control and water quality due to lack of flood control. These major water events are not going away anytime soon. The water up river needs more places to go during high water events such as wetlands where it can be cleaned and slowly released over time improving water quality, wildlife habitat and protect property owners. |
| Dredging lake Delhi |
| I have been on the Maquoketa River since 1950's. The quality has changed over time. There's more flow but the quality has changed. Seems hard water with occasional septic or sewer scum on surface. Not sure where this comes from. Hog lots, septic or sewer dumping??? Appreciate your time to assess our lovely lake. Would like to keep a recreational are for decades to come. Farm tiling, cities with more cement, industry, hog lots have been dumping unsure. |
| The bad water quality is my biggest concern. I think we need to put our time and money into improving the water quality in our lakes, rivers, and ponds. |
| Do not regulate, educate! |
| So very glad university people are getting involved. The more brains the better. |
| Lake Delhi is Great |
| High nitrate levels closing popular public swimming areas. |
| Make it as clean as possible |
| factory farms in the watershed are a problem and animal manure disposal is my area are a big problem. There are bery few regulations on farms and there should be |
| When there is more that 3" of rain north of Manchester, the people that run the dam need to open it so those of us between manchester and the lake do not get flooded. They opened it up enough once last year and we did not have river water on our land. That was the ONLY time it was opened timely in 4 years |
| Poorly managed Delhi Dam which causes unnecessary flooding upper end of lake |
| Let high water out faster!!! When the come up tell it out. Watch how rain up river. More gages . More people watching. Ben on river 40years Love it |
| Too much tiling going on and hooking up to one tile that can't take it |
| This watershed is small and confined, not much impacts this watershed and this water shed does not impact others, much |
| LESS JET SKI TRAFFIC AND LARGE OVER SIZE BOATS |

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| We feel the size of the motors allowed on the lake are causing great damage to the shorelines. Increasing erosion rapidly |
| The Maquoketa river is also used as a recreational water space. Currently there are no regulations for size of recreational watercraft, nor the number of watercraft, nor the behavior of those operating the watercraft. Difficult for the watershed to be improved unless all who use this space treat it as it should be to preserve and maintain it as a natural water source. |
| During times of flooding, the river looks like chocolate milk. We have to get the FB out of State Govt and let conservation work.. |
| With the new damn, things improved. |
| I see rural farmland runoff as #1 problem with water quality. |
| I am concerned about the run off and how to prevent/reduce. Runoff brings sediment and containaments down stream. More needs to be done to encourage conservation of our soil. |
| Really wish the Delhi Dam had not been rebuilt. More needs to be done with the septic systems in Lake Delhi area. |
| 'No Opinion' about increase or decrease in Regs does not mean no opinion about development of targeted, scientific based regs. A good approach could lead to an increase in some regs while decreasing other. Asking about and publicizing survey results regarding an 'increase' or 'decrease' in regs with no context will not help solve the issues, it only serves to politicize the overall issue. |
| Thanks for working on this watershed! |
| 20 years ago I owned a house in a flood plain that had its basement flooded. At that time the city of Dyersville seemed to be ignorant of flood issues. There were flood basins north of town that had been filled in. |
| Appreciate being able to express my opinions about watershed and water quality issues in this area. Thank you. |
| Lake Delhi is a great asset to the whole area. |
| Hog confinement proposed on the north edge of Manchester. It is too close to the water tower and too close to town. City dwellers have rights too. |
| Thank you for helping us to care for this great treasure, our Maquoketa River and lake at Lake Delhi :) |
| There needs to be more legislation governing hog and livestock facilities. |
| Need flood mitigation for downtown Manchester in the watershed. |
| Cut banks along the river and livestock in pastures with small streams at numbers greater than the pasture can accommodate are two issues I see on nearly all my commutes through the watershed. |

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| I live just the other side of the hill from this watershed area, and I use it for recreation all the time! |
| Get rid of the rapids!! |
| We have made much progress to improve the water quality within the Maquoketa River watershed over the past several years. Especially the removal of the Quaker Mill dam project and the removal of the Hoag dam in downtown Manchester and the installation of the white water drop structures. |
| Why can no one dredge the river to prevent or alleviate flooding? Isn't that the simplest resolution? |
| I would like to know more on how the lake delhi dam has affected the wareshed since being rebuilt |
| We need to focus on funding for authorities to monitor/discipline land owners-and make sure laws are created to penalize those that do not meet expectations. Education first, support to do the right thing, if not-accountability. Landowners and governments (city/county/state) should be included in being held accountable |
| Lets make it better for all - everyone lives in a watershed! |
| Cut back on crop chemicals |
| Tell us how urban properties add to the problem |
| The Maquoketa River is leading the way on ruining not only its river but the Mississippi River as well. This is because the Clean Water Act of 1972 left "Non Point" source pollution to the states. Iowa has done nothing to stop the Ag industry from tilling every field and allowing all that soil water and nutrients to run right into this watershed. |
| the hardest part is convincing farmers and educating them |
| I'm 68 years old and have lived all my life other than my college years close to the Maquoketa river. While the river seems to be holding its own, the tributaries all are in terrible condition. It is unusual to find much fish life in the creeks anymore. The damage as I see it is caused by reckless agricultural practices. |
| My 300 acre farm is located within a quarter mile of the Maquoketa river, 9 miles south of Bellevue, IA. I actively use NRCS CRP conservation programs on my farm. CAFOS are a big contributor to watershed and underground stream contamination. I am concerned about groundwater contamination, chemical runoff from farm fields, etc. |
| If the county would put time & money into some landscaping & dredging out the island, clearing the beach, it would make for a perfect place for families to use. |
| Small changes and community cooperation go a long way. |
| The rural property owners (farmers) have the most potential to damage the river and it's watershed. They also have the greatest ability to protect it and to improve it. |

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| Much more needs to be done to improve water quality. Rural landowners and farmers need to step up and implement strategies and practices that are beneficial and sustainable. Chemical and fertilizer applications need to be restrained. Streambank erosion and degradation needs to be addressed with state level policies enacted similar to Minnesota or other states who value their water quality. Soil erosion in rural areas needs to be curbed through education and incentives for good farming practices. |
| As a kayaker, I see streambank erosion as a huge issue, followed by debris after flood events-log jams, gargbage.. |
| Too many field tiles, Way too many hog confinements! |
| I would be interested in implementing more conservation but am not confident in the abilities of my local experts to guide me to install long term solutions that will fit my goals. I am also like many, hampered by cost. I do not have a lot of extra income right now to direct towards my conservation goals. |

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# Maquoketa River
## Watershed Management Plan