# Mill Creek Watershed Plan

A roadmap to sustain and improve agricultural productivity, Water quality, habitat, and soil health in the Mill Creek Watershed

Prepared by:

IOWA SOYBEAN Association

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# Mill Creek Watershed Plan

A guide for water quality and soil health in the Mill Creek-Cedar River Watershed

## Developed by

Iowa Soybean Association

## Funded by

USDA NRCS
Natural Resources Conservation Service

## Planning partners

Watershed farmers, landowners and residents
Johnson and Cedar County Soil and Water Conservation Districts
USDA-Natural Resources Conservation Service
Lower Cedar Watershed Management Authority
Johnson County Conservation Board
Iowa Soybean Association

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## Contents



# 1. Summary

The Mill Creek Watershed encompasses 39,189 acres in eastern Iowa (Figure 1.1). The watershed is a sub-watershed of the Lower Cedar Watershed and includes the area of land that drains to and through the Cedar River. The Mill Creek Watershed is supported by the Lower Cedar Watershed Management Authority.

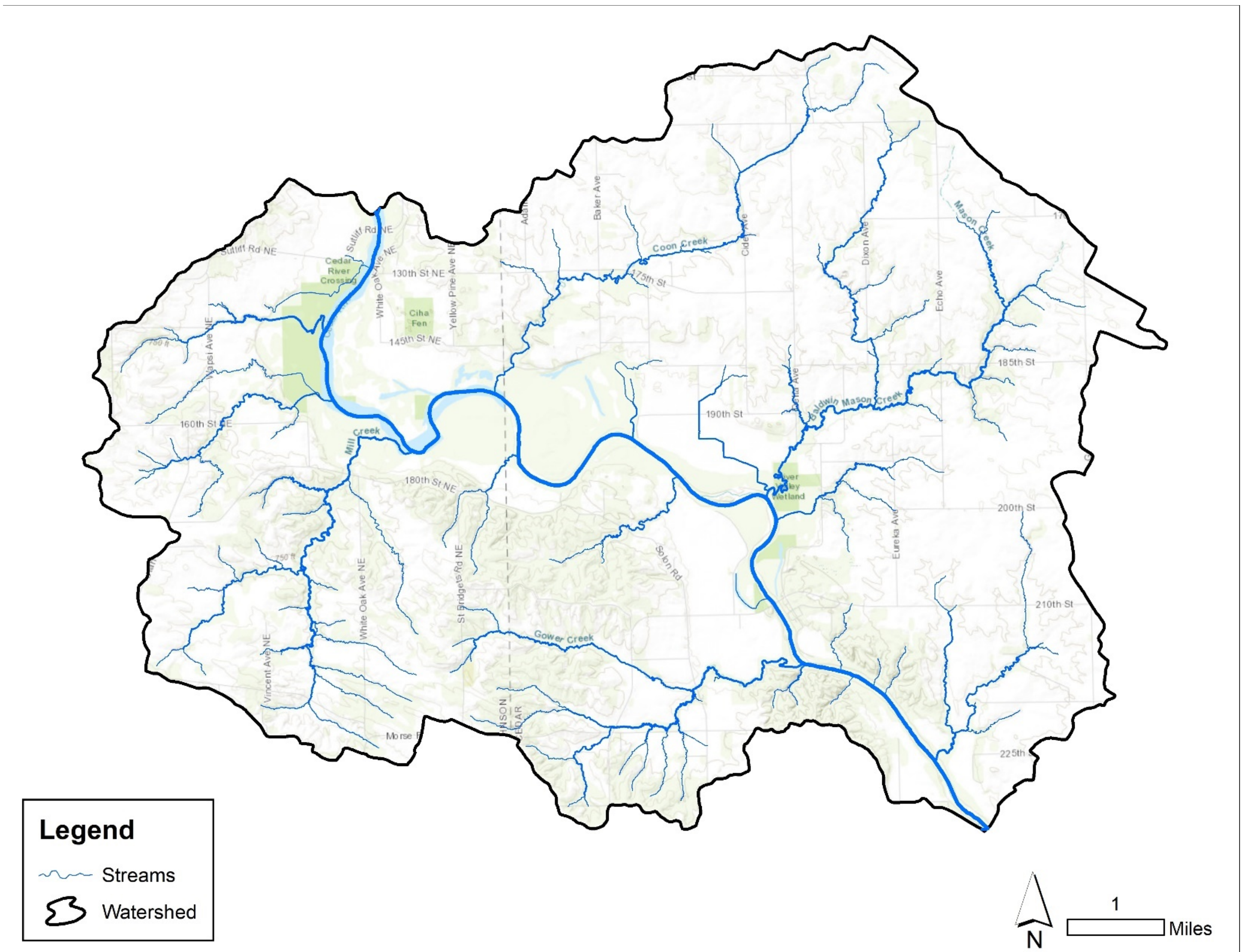


*Figure 1.1. The Mill Creek Watershed is located in Johnson and Cedar counties in eastern Iowa.*

The Mill Creek Watershed Plan was developed to support local stakeholders to establish goals, develop partnerships, and identify an action plan. The watershed plan is intended to provide guidance for land and water improvements while simultaneously enhancing agricultural sustainability and vitality. This document integrates existing datasets, assessment and mapping, and stakeholder input. The plan is designed to incorporate and address input from the watershed community. The community-based planning process integrated with data analysis and research synthesis was used to develop goals, objectives, and action steps for stakeholders and partners in the Mill Creek Watershed. The goals established by watershed stakeholders are to:

1. Improve soil health by increasing soil conservation and adoption of soil health practices.
2. Improve water quality and quantity by increasing implementation of conservation practices.
3. Increase funding and opportunities for producers and promote practice awareness.

The primary natural resource concerns in the Mill Creek Watershed are water quality and soil health, which include loss of nutrients and sediment to and through the Cedar River. Priority conservation practices identified by stakeholders include nutrient management, no-till, cover crops, extended rotations, wetlands and farm ponds, saturated buffers and bioreactors, along with basins, terraces, stream buffers, and stream bank stabilization. A combination of these conservation actions will be needed to fully meet local and statewide water quality goals.

The total investment needed to attain necessary levels of conservation adoption is estimated to be $1,886,864 for practice construction plus up to $405,000 per year. If fully implemented, it is anticipated that farmers and landowners would not only locally attain Iowa Nutrient Reduction Strategy goals but also would further reduce soil erosion, build soil health, and reduce flooding.

# 2. Watershed Characteristics

## 2.1. General Information

The Mill Creek Watershed is a 39,189-acre (61-square mile) area of land located in Johnson and Cedar counties. There are no incorporated communities in the watershed, but the unincorporated areas of Sutliff and Cedar Bluff are located in the watershed. The population as of the 2010 census is estimated to be 818. General watershed information is listed in Table 2.1.1. The Mill Creek Watershed is a 12-digit hydrologic unit code (HUC-12) watershed within the larger Cedar River Watershed (Figure 2.1.1).

*Table 2.1.1. General information about the Mill Creek Watershed.*

| | |
|---|---|
| Location | Johnson and Cedar counties |
| Incorporated Communities | none |
| Unincorporated Communities | Sutliff, Cedar Bluff |
| Population | 818 |
| Watershed Area | 39,189 acres |
| Predominant Land Use | Agriculture |
| HUC-12 Watershed | Mill Creek-Cedar River |
| HUC-12 ID | 070802060405 |
| HUC-10 Watershed | Rock Run Creek-Cedar River |
| HUC-10 ID | 0708020604 |
| HUC-8 Watershed | Lower Cedar |
| HUC-8 ID | 07080206 |

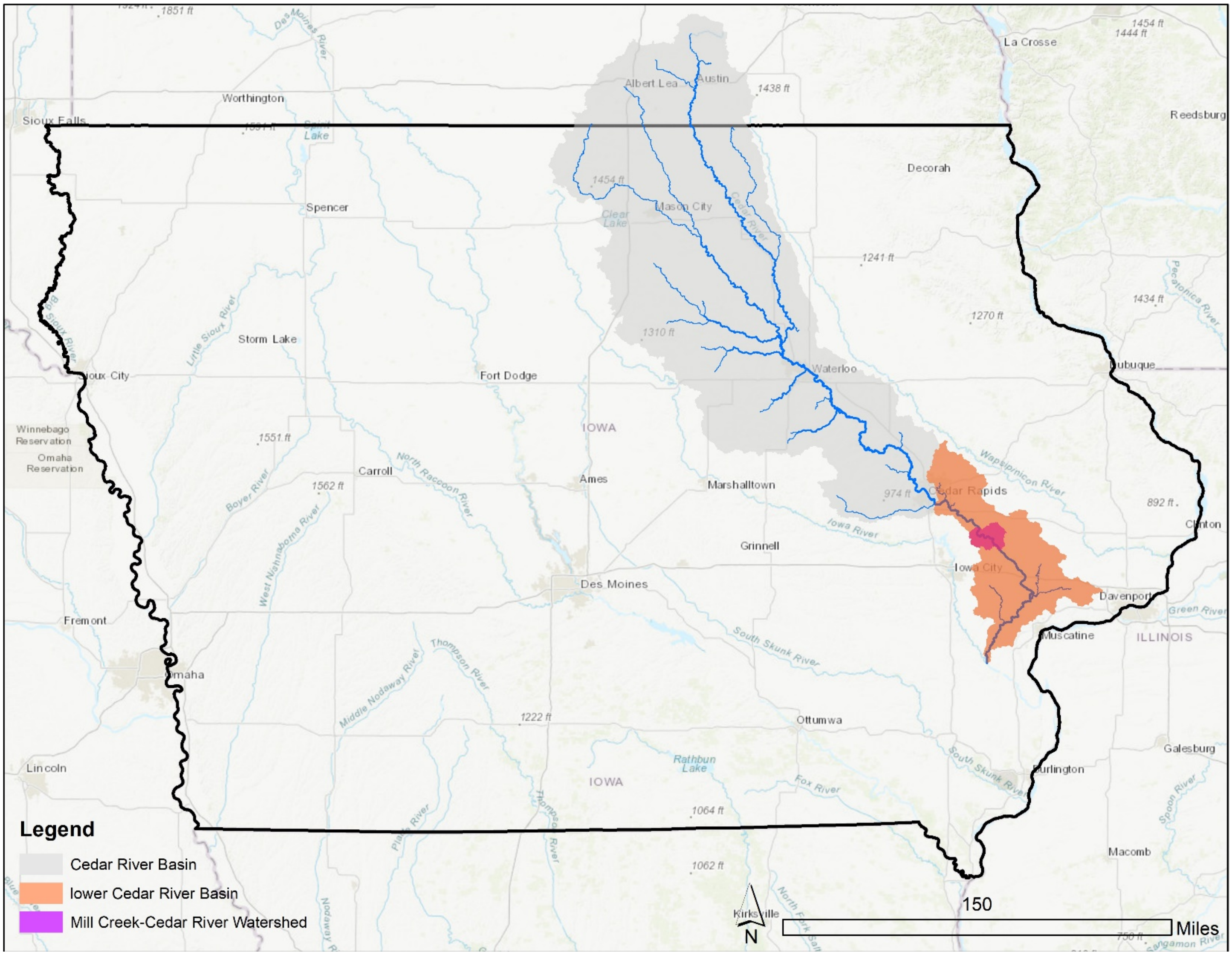


*Figure 2.1.1. The Mill Creek Watershed is nested within the larger Lower Cedar and Cedar River watersheds.*

Agriculture is the primary land use. According to public records, there are 593 landowners of agricultural land in the watershed. Of that agricultural land, 86 percent is owned by landowners living in or near the watershed, 8 percent is owned by other Iowa residents, and 6 percent is owned by out-of-state landowners.

## 2.2. Water Resources

Surface water in the watershed includes the Cedar River, Mill Creek, Coon Creek, Baldwin/Mason Creek, and Gower Creek, along with additional unnamed tributary streams (Table 2.2.1). The Cedar River has use designations including primary contact recreation, warm aquatic life, and human health/fish consumption. According to the National Wetlands inventory, there are 3,679 acres of wetlands in the watershed, which includes 2,912 acres that are flooded or exposed intermittently, temporarily or seasonally.

*Table 2.2.1. Streams and assessment information for the Mill Creek Watershed (source: Iowa Department of Natural Resources). Use designations: A1 (primary contact recreation), B(WW-1) (warm water aquatic life), and HH (human health/fish consumption).*

| Waterbody | Cedar River | Baldwin Creek | Mason Creek |
|---|---|---|---|
| ADB Code | IA 02-CED-451 | IA 02-CED-6328 | IA 02-CED-6329 |
| Legacy Code | IA 02-CED-0020_2 | IA 02-CED-0600_0 | IA 02-CED-0620_0 |
| Segment Length | 31.0 miles | 6.5 miles | 2.2 miles |
| Use Designations | A1, B(WW-1), HH | A1, B(WW-1) | A1, B(WW-1) |
| Impairments | Bacteria, Biological | none | none |
| Other Tributaries | Mill Creek, Coon Creek, Gower Creek | | |
| Total Streams Length | 125 miles | | |

## 2.3. Climate and Hydrology

Precipitation data show that for the most recent 30 years of record, total precipitation at Mechanicsville, Iowa, averaged 37.5 inches per year for water years 1990 through 2019, with a range of 26.2 to 60.2 inches per year (Figure 2.3.1). Monthly precipitation in the watershed tends to peak during the months of May through August, with each of these months averaging at least 4 inches of precipitation from 1990 through 2019 (Figure 2.3.2).

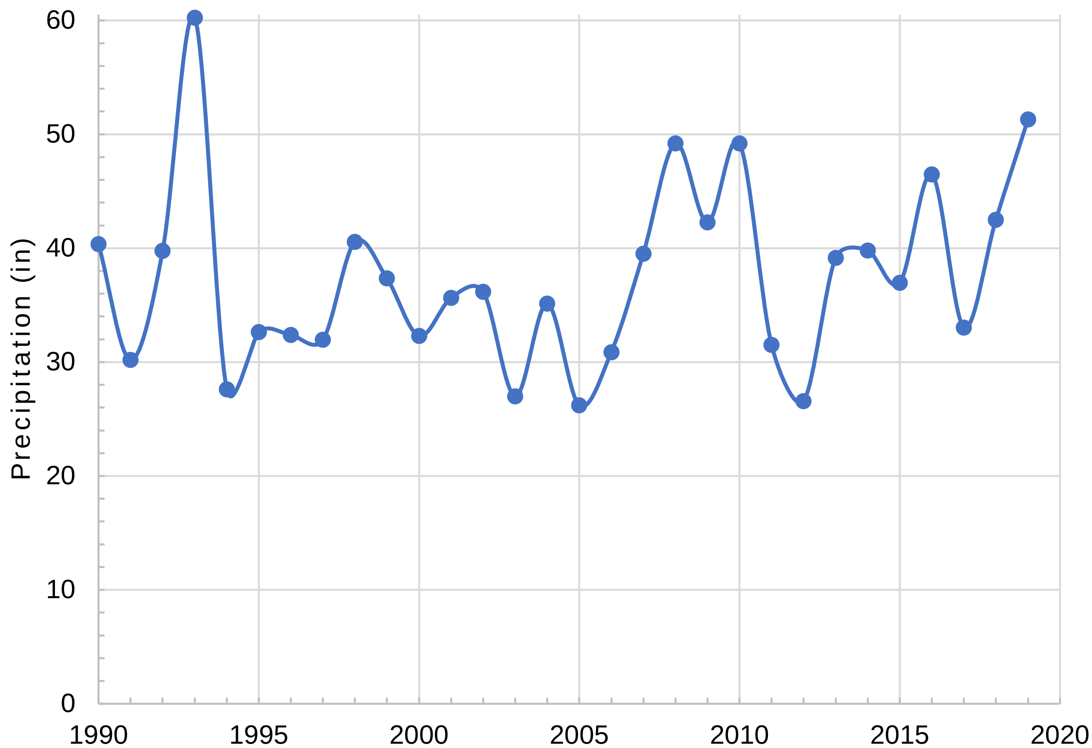


*Figure 2.3.1. Precipitation at Mechanicsville, Iowa, averaged 37.5 inches per year for water years 1990 through 2019 (source: Iowa Environmental Mesonet). A water year extends from October 1 of the previous calendar year through September 30.*

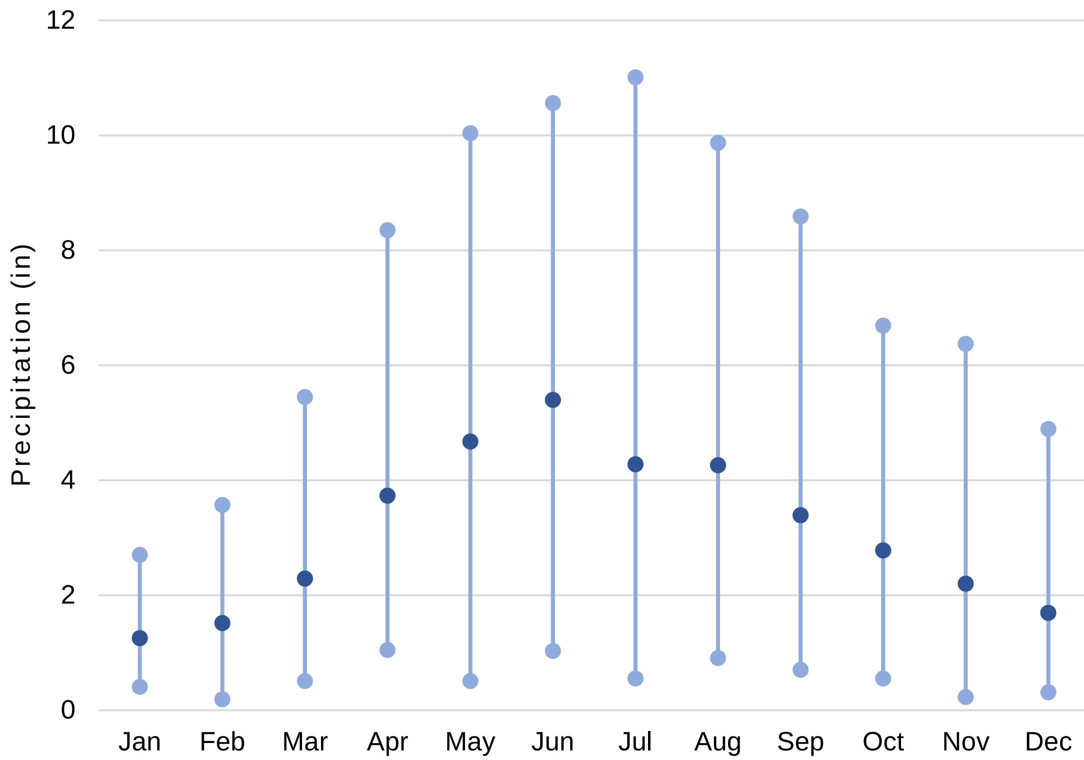


*Figure 2.3.2. Monthly average precipitation at Mechanicsville, Iowa, from water years 1990 through 2019. Bold circles indicate mean, and lower and upper bounds denote 30-year minimum and maximum, respectively (source: Iowa Environmental Mesonet).*

## 2.4. Landscape

The Mill Creek Watershed is located in Major Land Resource Area (MLRA) 108C Illinois and Iowa Deep Loess and Drift. The watershed also is located in ecoregion 47f Rolling Loess Prairies. The watershed lies within the Southern Iowa Drift Plain landform region. The watershed is dissected by a mature surface drainage network. The landscape is characterized by moderate to steep slopes and flat alluvial valleys, particularly along the Cedar River and its floodplain. Geologic parent material includes loess and loess-mantled glacial drift. Approximately 35 percent of the watershed contains alluvial deposits.

Land surface elevation in the Mill Creek Watershed ranges from 656 to 914 feet above sea level (Figure 2.4.1). Slopes vary significantly throughout the watershed, with half of the watershed having a local slope of 5 percent or less, and the other half greater than 5 percent (Table 2.4.1 and Figure 2.4.2).

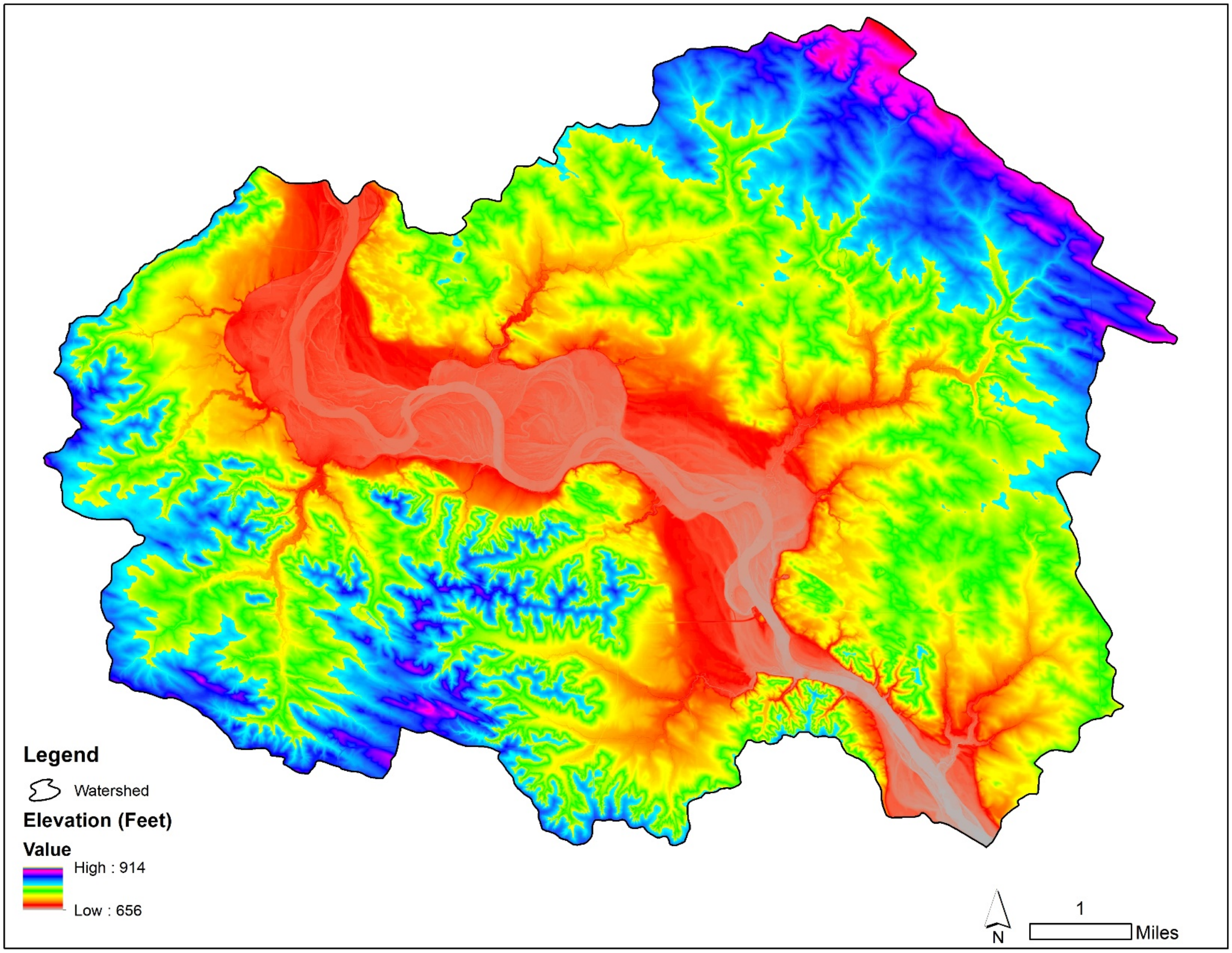


*Figure 2.4.1. Elevation in the Mill Creek Watershed derived from a high-resolution digital elevation model.*

*Table 2.4.1. Extent of each slope class within the Mill Creek Watershed.*

| Slope Class | Range | Percent |
|---|---|---|
| A | 0-2% | 19% |
| B | 2-5% | 33% |
| C | 5-9% | 25% |
| D | 9-14% | 12% |
| E | 14-18% | 5% |
| F | 18-25% | 4% |
| G | > 25% | 3% |

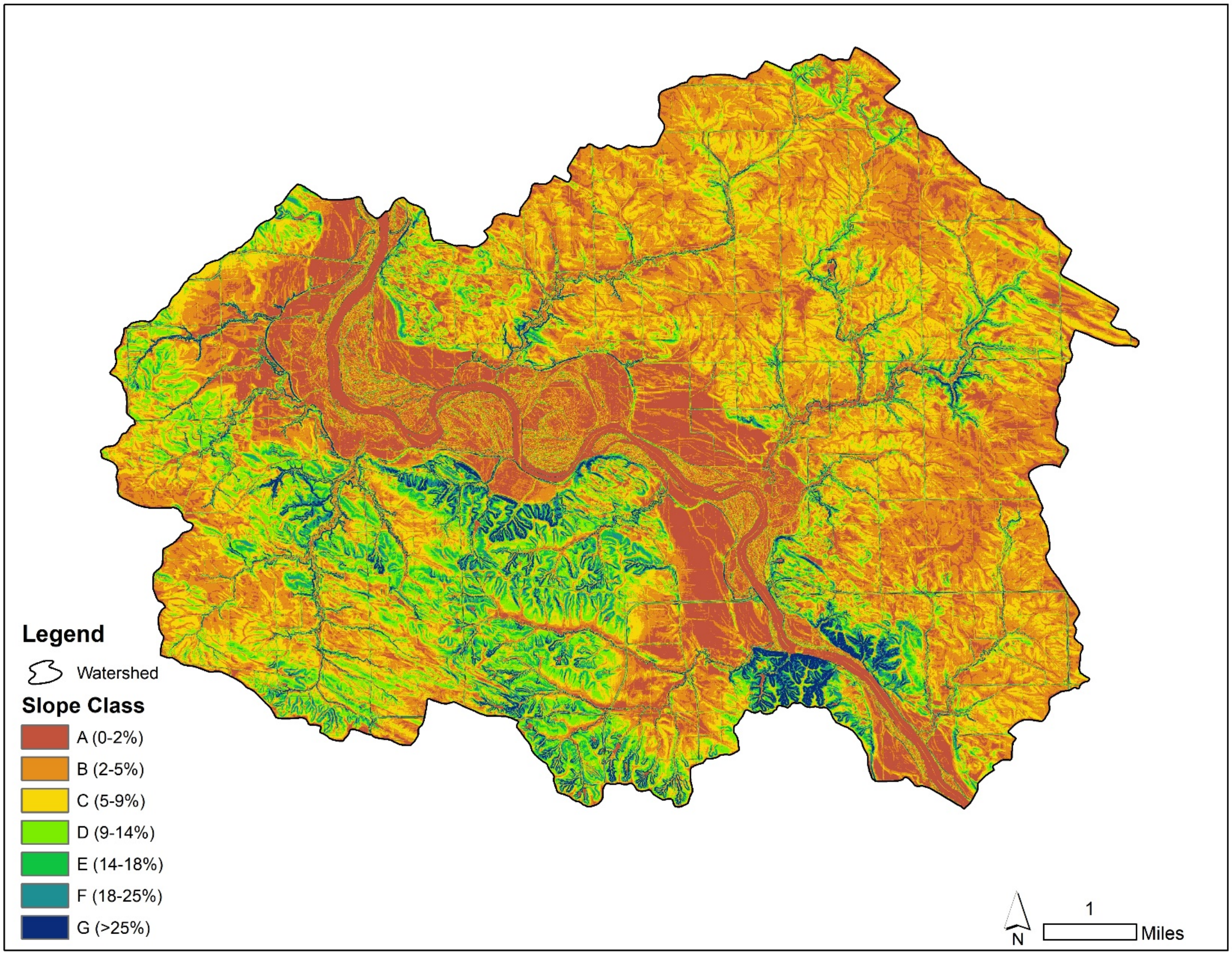


*Figure 2.4.2. Slope classifications in the Mill Creek Watershed derived from elevation data.*

## 2.5. Soils

Major soil associations in the watershed include Fayette and Tama-Muscatine-Downs. These soils formed in loess. Native vegetation was forest and tall grass prairie. Soils in the watershed are generally well drained. Common soils in the Mill Creek Watershed are shown in Figure 2.5.1. The most abundant soil series mapped in the watershed include Fayette, Tama, Downs, Dinsdale, and Sparta, which together comprise 38 percent of the watershed (Table 2.5.1).

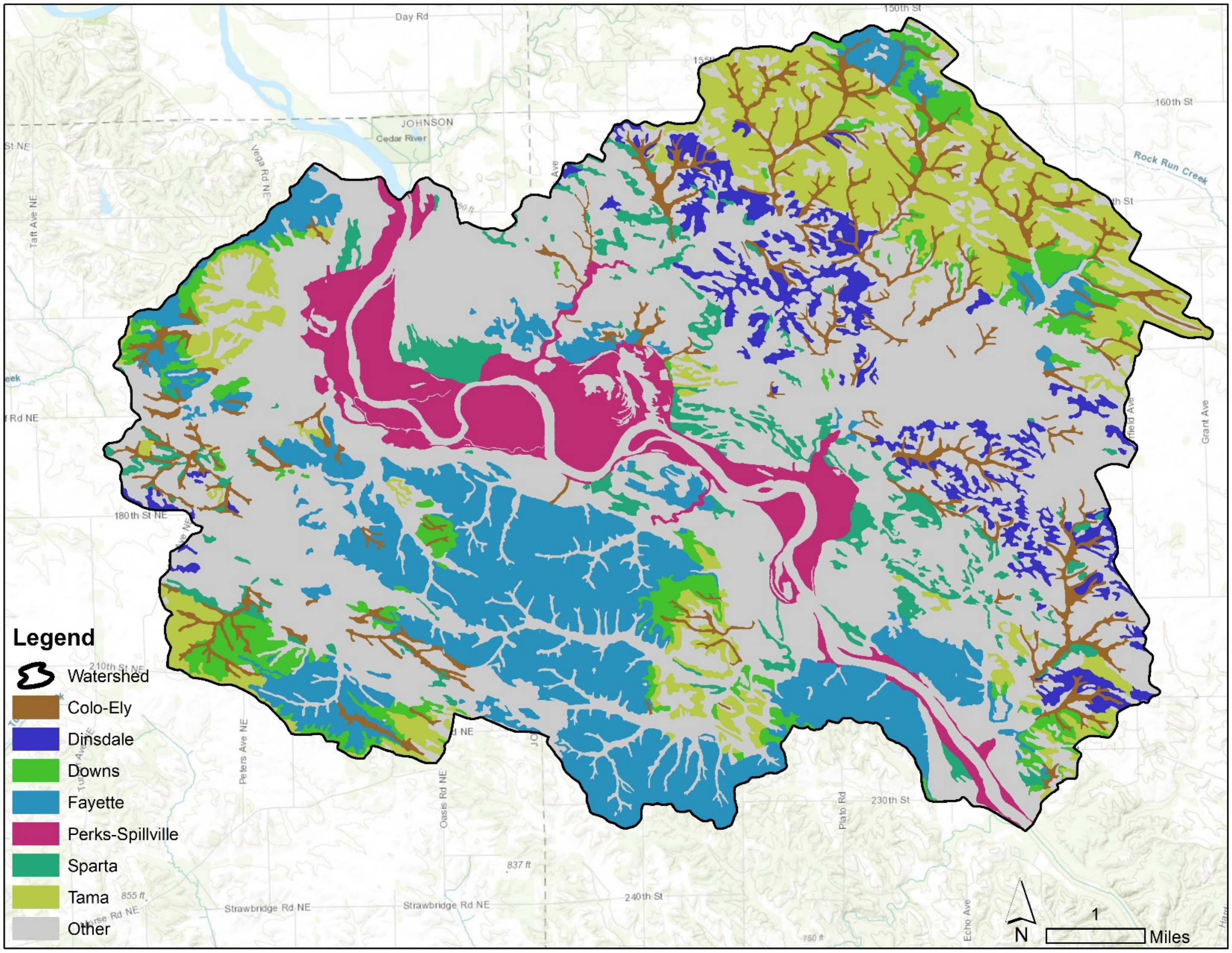


*Figure 2.5.1. Mill Creek Watershed soil map (source: Soil Survey Geographic Database).*

*Table 2.5.1. Descriptions of common soils in the Mill Creek Watershed (source: quoted directly from USDA-NRCS Official Soil Series Descriptions).*

| Series | Description |
|---|---|
| Fayette | Very deep, well drained soils formed in loess. These soils are on convex crests, interfluves and side slopes on uplands and on treads and risers on high stream terraces. Slope ranges from 0 to 60 percent. |
| Tama | Very deep, well drained soils formed in loess. These soils are on interfluves and side slopes on uplands and on treads and risers on stream terraces in river valleys. Slope ranges from 0 to 20 percent. |
| Downs | Very deep, well drained soils formed in loess. These soils are on interfluves and side slopes on uplands and on treads and risers on stream terraces. Slope ranges from 0 to 35 percent. |
| Dinsdale | Very deep, moderately well drained soils that formed in 20 to 40 inches of loess and the underlying glacial till. Dinsdale soils are on interfluves, ridges and side slopes on dissected till plains. Slopes range from 0 to 14 percent. |
| Sparta | Very deep, excessively drained soils formed in sandy outwash that has been reworked by wind. These soils are on nearly level to very steep treads and risers on stream terraces in river valleys, outwash terraces, outwash plains, and dune fields. Slope ranges from 0 to 40 percent. |

Soil drainage properties affect surface and subsurface water movement in the watershed. Approximately 31 percent of the soils in the watershed are classified as hydric. Most soils not located in floodplains or on steep side slopes are generally productive, although there is variability throughout the watershed (Figure 2.5.2).

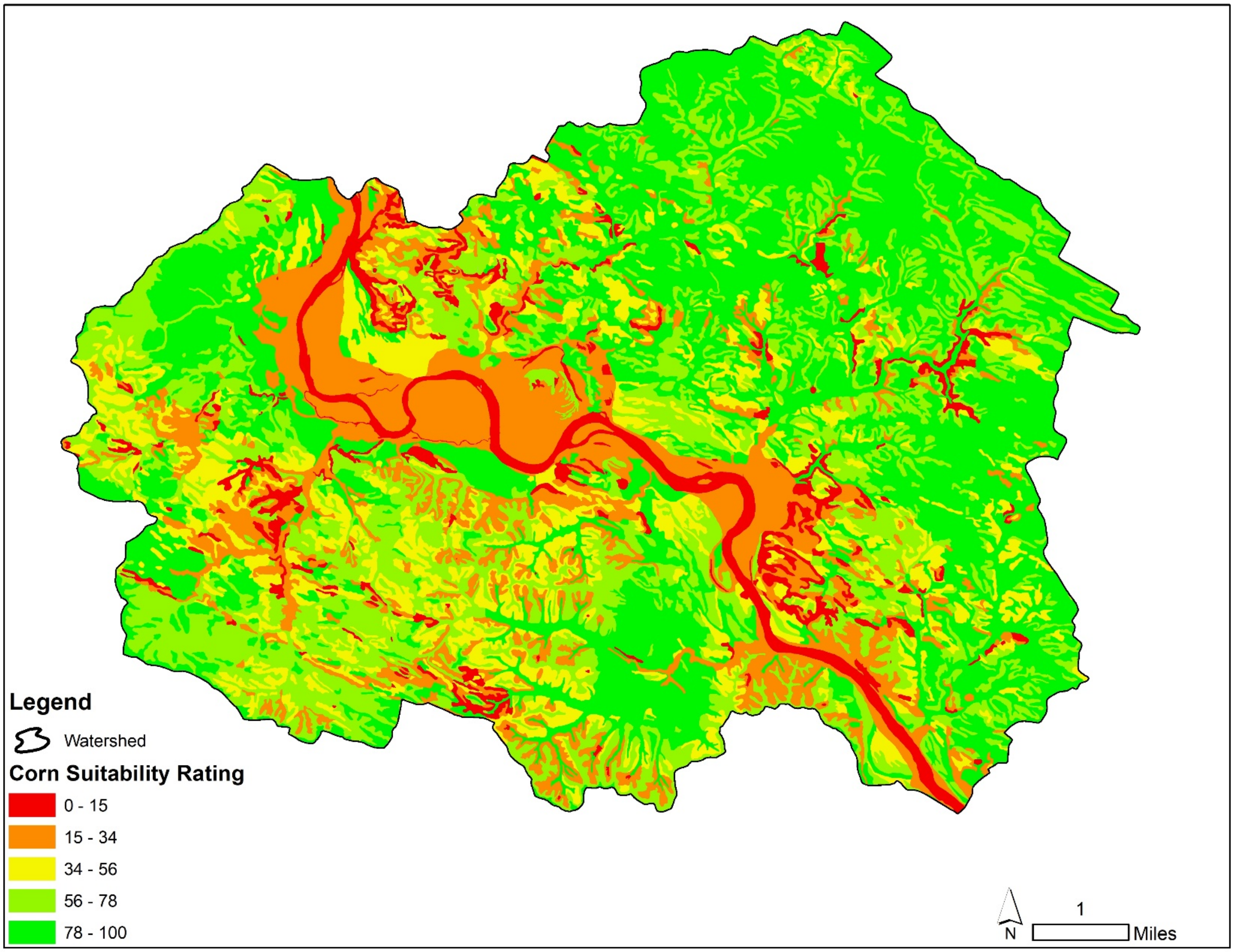


*Figure 2.5.2. Corn suitability ratings (CSR2) values are generally high for land in the Mill Creek Watershed (source: Iowa Soil Properties and Interpretations Database).*

Many soil map units in the watershed are designated as highly erodible land, especially southwest of the Cedar River (Figure 2.5.3). According to Daily Erosion Project data, hillslope soil loss as a result of sheet and rill erosion on cropland averaged 1.64 tons per acre per year from 2009 through 2018. Soil erodibility factors and digital elevation model-derived topographic factors for the Revised Universal Soil Loss Equation were used to map locations of relative soil erosion risk (Figure 2.5.4). The sediment delivery ratio for the Mill Creek Watershed is 21 percent, which represents the fraction of eroded upland sediment delivered to the watershed outlet.

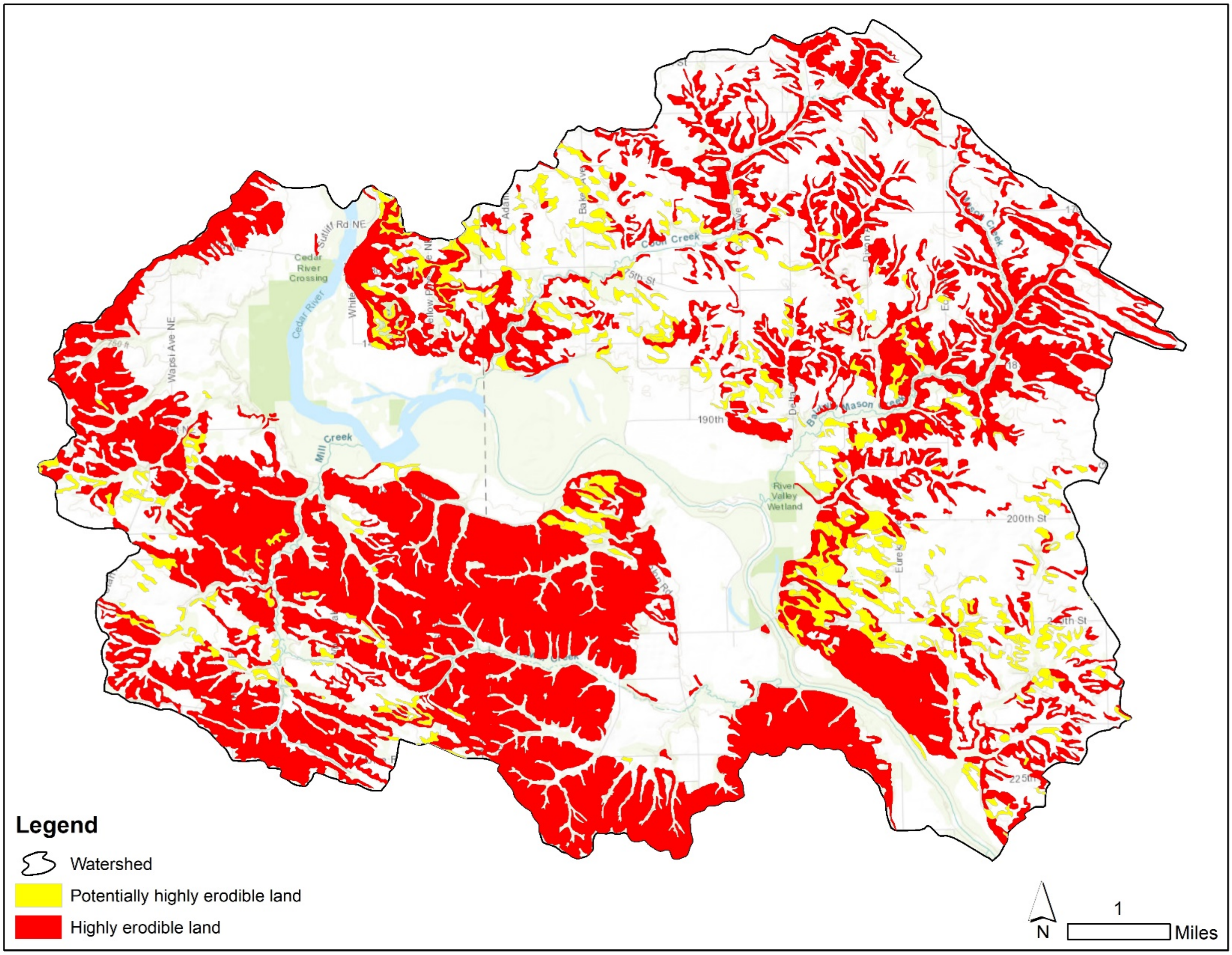


*Figure 2.5.3. Highly erodible land in the Mill Creek Watershed.*

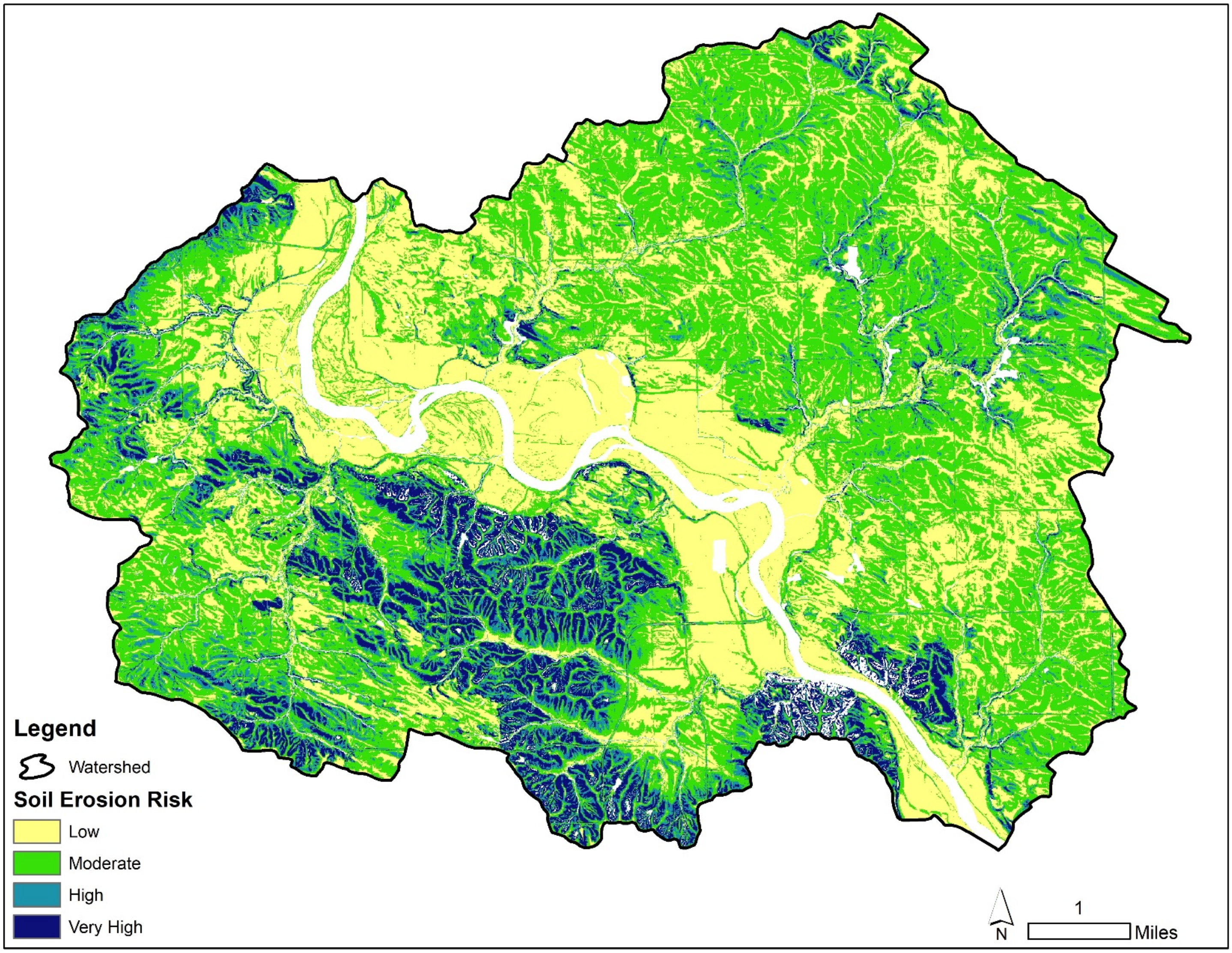

*Figure 2.5.4. Soil erosion risk naturally varies throughout the watershed based on topography and soil properties.*

## 2.6. Land Use

Native vegetation the Mill Creek Watershed included a mix of prairie (64 percent), forest (33 percent), and a small amount of savanna, water, and wetlands (less than 3 percent) (Figure 2.6.1). Presently, land in the watershed is used primarily for agriculture. According to the USDA-National Agricultural Statistics Service, on average 51 percent of land in the watershed was used for corn and soybean production from 2009 through 2018 (Table 2.6.1). High-resolution land use for the Mill Creek Watershed is shown in Figure 2.6.2.

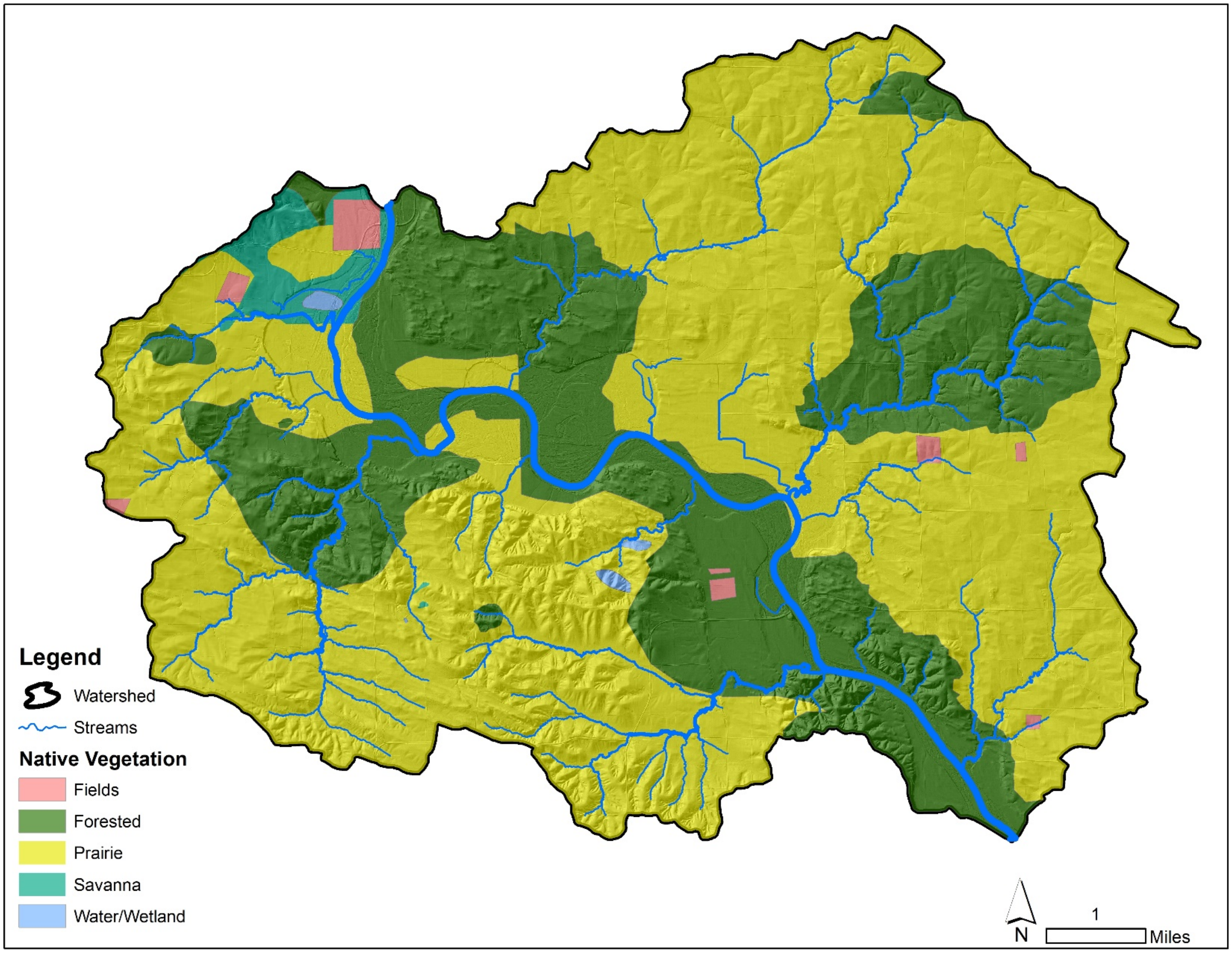


*Figure 2.6.1. Native vegetation in the Mill Creek Watershed included tall grass prairie and forest.*

*Table 2.6.1. Typical land use in the Mill Creek Watershed based on 2009 through 2018 averages (source: Cropland Data Layer).*

| Land Use | Acres | Percent |
|---|---|---|
| Corn/Soybeans | 19,875 | 51% |
| Grass/Pasture | 8,886 | 23% |
| Forest | 5,634 | 14% |
| Water/Wetlands | 2,772 | 7% |
| Developed | 1,899 | 5% |
| Other | 123 | <1% |
| Total | 39,189 | 100% |

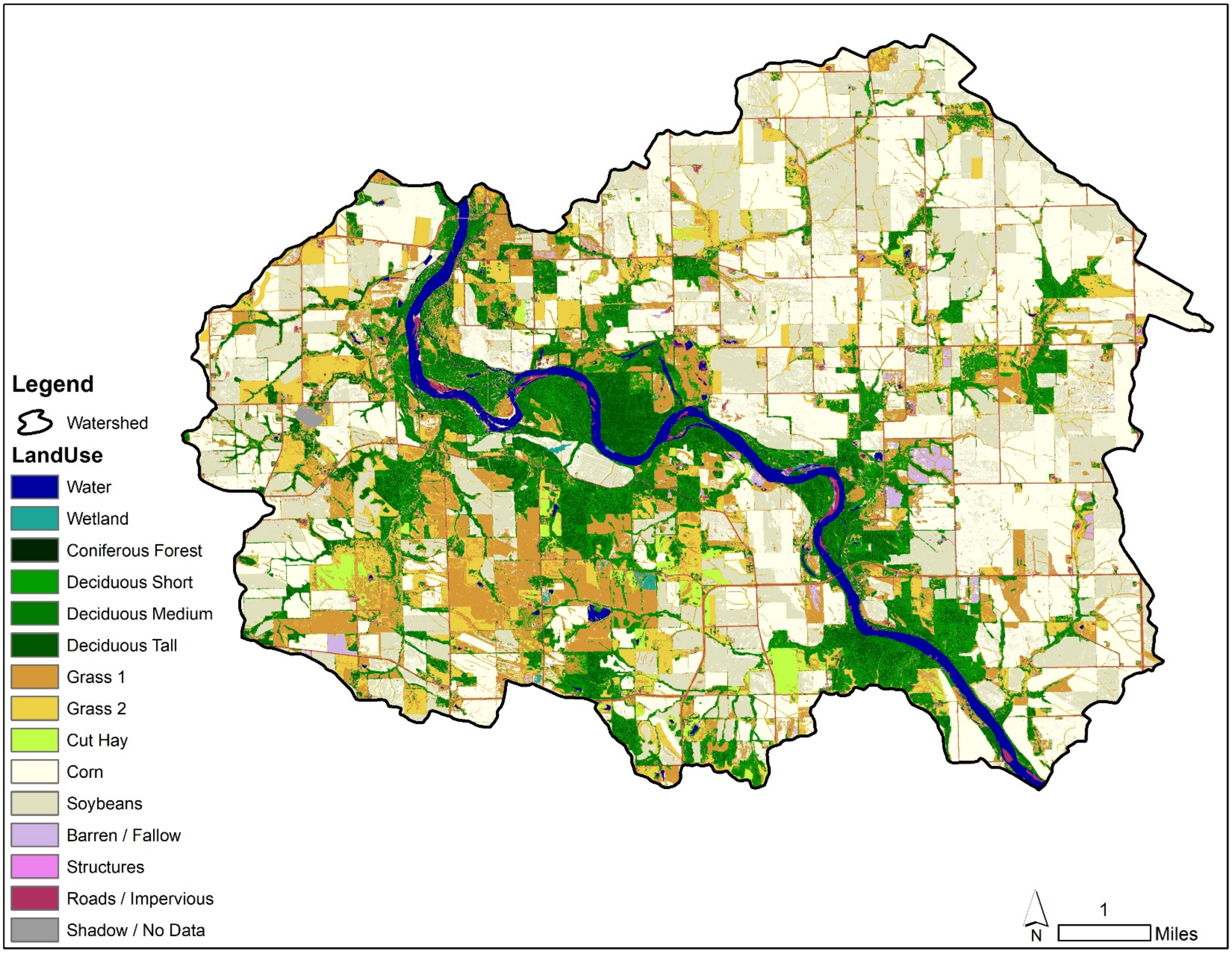


*Figure 2.6.2. High-resolution land use in the Mill Creek Watershed. The interpretation year is 2009, as land use classes were mapped based on multi-year aerial imagery and high-resolution digital elevation models (source: Iowa Department of Natural Resources).*

## 2.7. Conservation

Much conservation infrastructure and management already is in place in the Mill Creek Watershed (Figure 2.7.1). An inventory of conservation practices was completed by integrating a 2019 field assessment of in-field practices with locations of constructed practices identified through the Iowa Best Management Practices Mapping Project (Table 2.7.1). While it is difficult to capture all agronomic conservation practices, watershed residents and stakeholders confirmed that these estimated adoption levels are accurate.

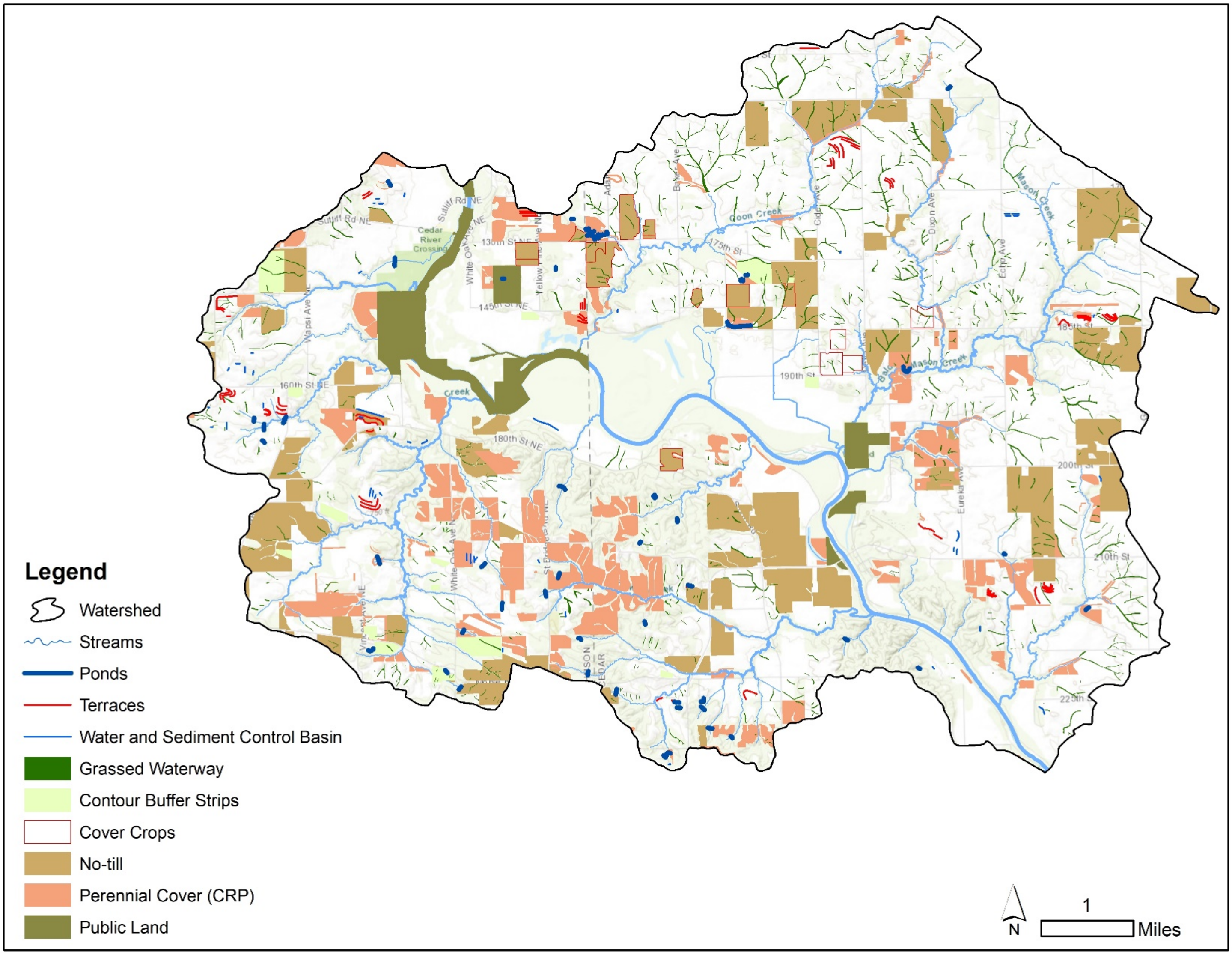


*Figure 2.7.1. Conservation practices with known locations in the Mill Creek Watershed (source: Iowa Best Management Practices Mapping Project).*

*Table 2.7.1. Inventory of agronomic and constructed conservation practices in the Mill Creek Watershed (source: Iowa Best Management Practices Mapping Project).*

| Practice | Quantity | Units |
|---|---:|---|
| No-till | 7,300 | acres |
| Cover crops | 700 | acres |
| Ponds | 54 | sites |
| Terraces | 14,410 | feet |
| Sediment basins | 4,299 | feet |
| Grassed waterways | 356,338 | feet |
| CRP | 2,694 | acres |
| County conservation | 957 | acres |

# 3. Water Quality Conditions

## 3.1. Resource Concerns

The water quality constituents of interest in the Mill Creek Watershed include sediment, phosphorus, and nitrogen (Table 3.1.1). In addition to soil conservation to enhance agricultural productivity and local surface water quality, nitrogen and phosphorus transport is a high priority due to the Iowa Nutrient Reduction Strategy (INRS). The INRS provides a scientific and technological framework for agriculture, industries, and communities in Iowa to reduce nitrogen and phosphorus loss to Iowa and downstream waters.

*Table 3.1.1. Water quality constituents of concern in the Mill Creek Watershed include nitrogen, phosphorus, and sediment. There also are bacteria and biological water quality impairments documented for the Cedar River.*

| Constituent | Context |
|---|---|
| Nitrogen | Local stakeholder goal and Iowa Nutrient Reduction Strategy |
| Phosphorus | Local stakeholder goal and Iowa Nutrient Reduction Strategy |
| Sediment | Local stakeholder goal to address water quality and soil health resource concerns |
| Bacteria | Secondary concern due to documented impairment in Cedar River |

The Iowa Department of Natural Resources has identified bacteria and biological water quality impairments for the segment of the Cedar River that flows through the Mill Creek Watershed. The location where these impairments were identified is located upstream of the Mill Creek-Cedar River HUC-12 sub-watershed. The bacteria impairment was first identified in 2002, and the biological impairment was first identified in 2004 due to a loss of native mussel species. Flooding also was identified by watershed stakeholders as a priority resource concern.

## 3.2. Water Quality

Water quality monitoring data for the Mill Creek Watershed are sparse and dated. For the Cedar River at Cedar Bluff (AQuIA site #10160001), the 2000 through 2006 median nitrate plus nitrite concentration was 5.4 mg/L (as nitrogen), and the median phosphate concentration for the same period was 0.31 mg/L (as phosphorus). Monitoring data, assessment information from the ADBNet and AQuIA databases for the Cedar River, and estimated nutrient loss and erosion rates are provided in Table 3.2.1.

*Table 3.2.1. Use designations, assessment details, biological and chemical water quality, and watershed-scale nutrient and sediment yields and loads for the Mill Creek Watershed (sources: Iowa Department of Natural Resources, Daily Erosion Project).*

| Parameter | Value | Interpretation and Details |
|---|---|---|
| Class A1 use | Partially supporting | Primary contact recreation; Impairment identified upstream |
| Class B(WW-1) use | Not supporting | Warm water aquatic life; Impairment identified upstream |
| Class HH use | Fully supporting | Fish consumption/human health |
| NOx-N (mg/L) | 5.4 | Nitrate (NO3) + nitrite (NO2) as nitrogen (N), 2000-2006 median |
| PO4-P (mg/L) | 0.31 | Phosphate (PO4) as phosphorus (P), 2000-2006 median |
| NO3-N yield (lb/ac/yr) | 21.1 | Estimated nitrate loss from cropland |
| P yield (lb/ac/yr) | 0.35 | Integrates soil erosion, sediment delivery ratio, and P enrichment ratio |
| Soil loss (t/ac/yr) | 1.64 | Sheet and rill erosion transported from hillslopes |
| Nitrate-N load (lb/yr) | 405,289 | Baseline nitrogen loss |
| P load (lb/yr) | 6,722 | Baseline phosphorus loss |
| Soil erosion (t/yr) | 31,501 | Baseline sheet and rill erosion |

As the majority land use in the watershed, agriculture is the primary source of nitrogen, phosphorus, and sediment loss from uplands in the watershed. Critical source areas have been identified for these priority water resource constituents (Figure 3.2.1). These areas were prioritized through an analysis of soil, topographic, and hydrologic factors.

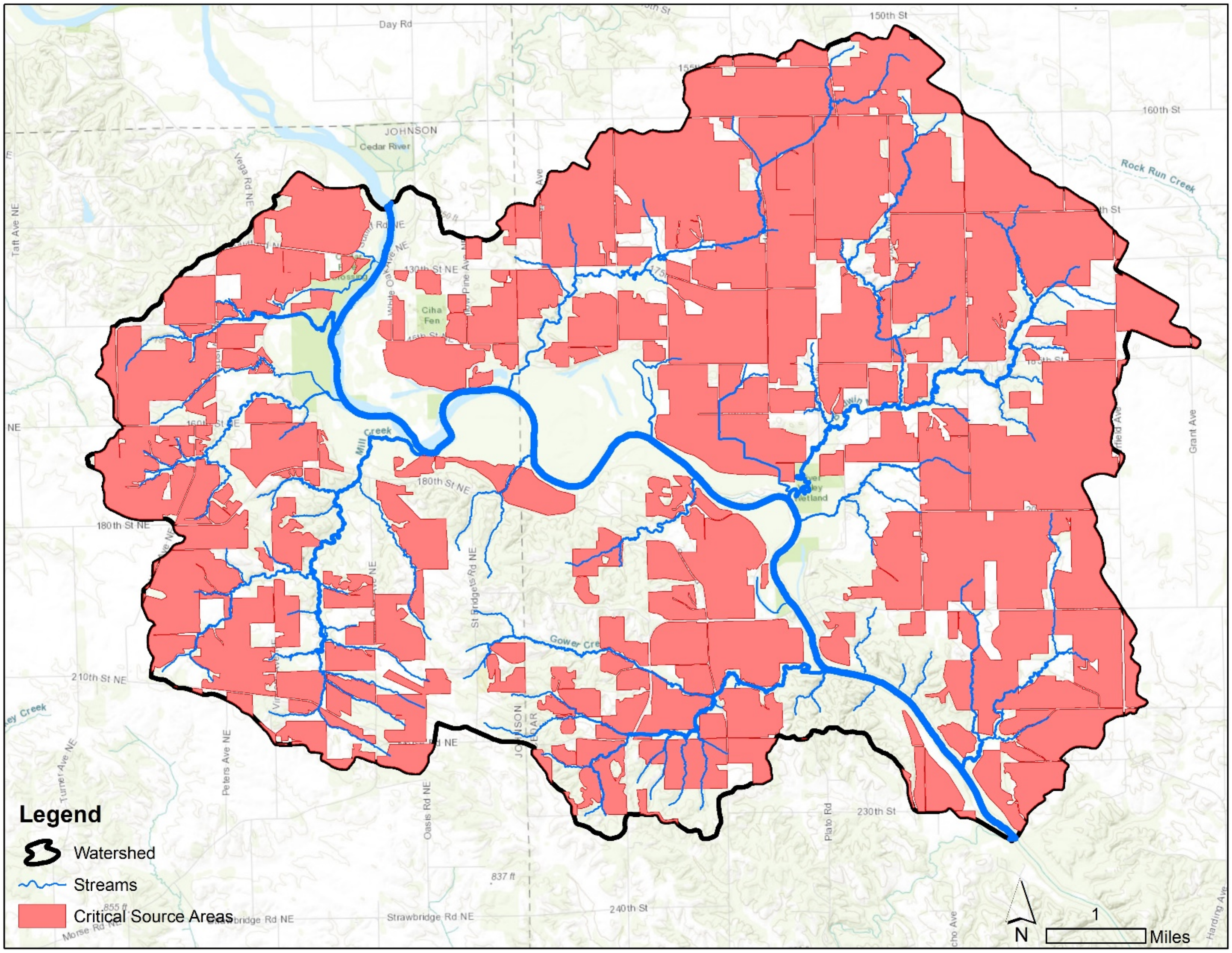

*Figure 3.2.1. Critical source areas for nitrogen, phosphorus and sediment loss in the Mill Creek Watershed.*

Continued and increased water quality monitoring will be important to evaluate trends and outcomes of the watershed project over time. Stakeholders in the Mill Creek Watershed identified water quality improvement as a top priority.

# 4. Goals and Objectives

## 4.1. Goals

Watershed goals were established through a community-based, participatory planning process. Local farmers, landowners, technical experts, and watershed partners engaged in facilitated discussions to identify local conditions, challenges, and opportunities. From these conversations a set of goal statements was developed to serve as guides for watershed improvement. The goals for the Mill Creek Watershed are to:

1. Improve soil health by increasing soil conservation and adoption of soil health practices.
2. Improve water quality and quantity by increasing implementation of conservation practices.
3. Increase funding and opportunities for producers and promote practice awareness.

## 4.2. Objectives

Specific objectives have been established for each goal to facilitate implementation and evaluation as watershed improvement actions occur.

### Goal 1. Improve soil health by increasing soil conservation and adoption of soil health practices.

*Objective 1.1.* Minimize soil erosion by meeting or exceeding USDA-Natural Resources Conservation Service soil erosion conservation planning criteria.

*Objective 1.2.* Increase soil organic matter as indicated by positive trends in the Soil Conditioning Index.

### Goal 2. Improve water quality and quantity by increasing implementation of conservation practices.

*Objective 2.1.* Achieve Iowa Nutrient Reduction Strategy goals of 41 percent nitrogen and 29 percent phosphorus loss reductions relative to baseline conditions.

*Objective 2.2.* Monitor water quality to assesses trends. Nitrogen, phosphorus, sediment, and bacteria levels each should be quantified regularly.

*Objective 2.3.* Increase water storage across the watershed by improving soil infiltration and constructing practices to permanently and temporarily hold water.

*Objective 2.4.* Manage flood-prone and drought-susceptible areas to maximize natural and economic resilience.

### Goal 3. Increase funding and opportunities for producers and promote practice awareness.

*Objective 3.1.* Develop and distribute outreach materials regularly to watershed residents, farmers, landowners, and partners. Emphasize farmer-to-farmer learning.

*Objective 3.2.* Partner with individuals and organizations that can implement and support conservation in the watershed.

*Objective 3.3.* Identify relevant and timely public, private, and innovative sources of funding to provide and increase technical and financial assistance in the watershed.

*Objective 3.4.* Track investment in the watershed, quantify benefits provided, and report outcomes to funding partners and stakeholders.

## 4.3. Timeline

Watershed stakeholders established 2035 as the target date to achieve full-scale implementation of the watershed plan. A 15-year planning horizon balances the needs for immediate adoption with long-term transitions in conservation cropping systems. Additionally, 2035 aligns with the goal of the Mississippi River/Gulf of Mexico Hypoxia Task Force. To facilitate adaptive management and evaluation of interim milestones, three 5-year phases for project implementation are recommended: 2021 through 2025, 2026 through 2030, and 2031 through 2035. A detailed implementation schedule for each phase is provided in Section 5.3.

## 4.4. Outcomes

Fully implemented, the conservation practices in this watershed plan are anticipated to contribute to significant environmental outcomes. Annually, these outcomes would include 239,807 pounds of nitrogen loss reduction, 4,531 pounds of phosphorus loss reduction, 18,303 tons of soil conserved from erosion, and net greenhouse gas reductions equivalent to 10,170 tons of carbon dioxide.

# 5. Implementation Plan

## 5.1. Priority Conservation Practices

Priority conservation practices were identified through stakeholder input and applied analysis. To determine a set of high priority practices, watershed farmers and technical experts weighed the relative impact and adoption likeliness of many conservation practices. These two characteristics were compared (Figure 5.1.1).

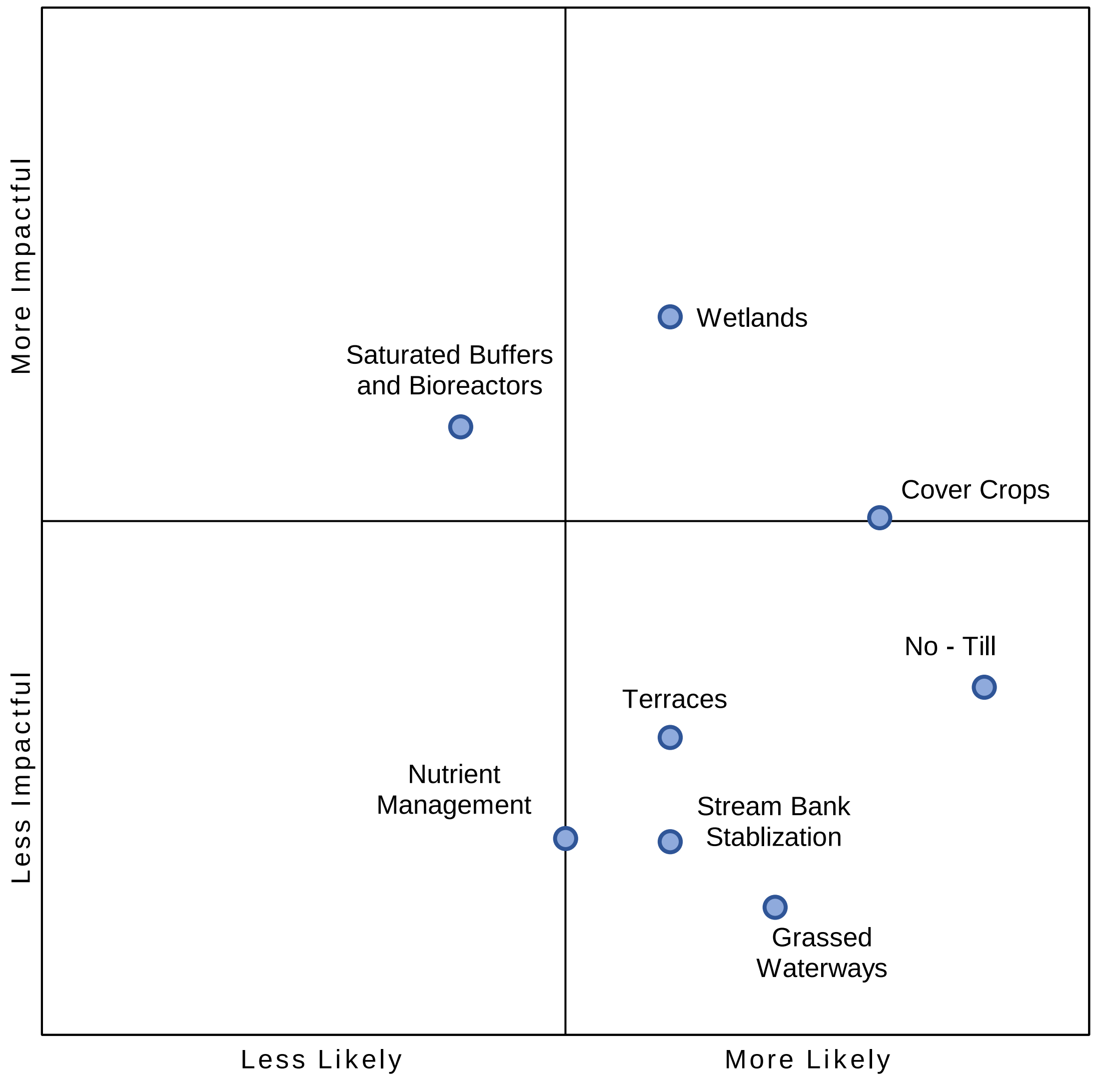


*Figure 5.1.1. Relative impact and adoption likeliness for conservation practices according to watershed stakeholders. In general, higher priority practices are those that have greater potential to impact watershed goals and that are more likely to be broadly adopted.*

The needed levels of each of these priority conservation practices were determined using simple water quality models based on the Iowa Nutrient Reduction Strategy. Potential locations for conservation practices throughout the watershed were identified with the Agricultural Conservation Planning Framework (ACPF) mapping software. The ACPF tools provided insights into landscape capacity for various types of practices. These locations are mapped in an atlas included as an appendix to this plan.

## 5.2. Conceptual Plan

Priority conservation practices along with their needed quantities are listed in Table 5.2.1, and potential locations for adoption are shown in Figure 5.2.1. While conceptual, this combination of practices and geographic distribution illustrates the level of effort that will be needed to meet watershed goals.

*Table 5.2.1. Priority conservation practices and adoption level goals.*

| Practice | Units | Goal | Notes |
|---|---|---|---|
| N management | ac/yr | 11,000 | All corn acres |
| No-till | ac/yr | 12,000 | Soybeans + 25% of corn |
| Cover crops | ac/yr | 12,000 | Soybeans + 25% of corn |
| Extended rotation | ac/yr | As needed | for economics & soil health |
| Wetlands | sites | 4 | Larger impoundments for flood control |
| Farm ponds | sites | 20 | |
| Saturated buffers & bioreactors | sites | 70 | |
| Basins & terraces | feet | As needed | for erosion control |
| Stream buffers | acres | As needed | for stream protection |
| Bank stabilization | feet | As needed | For stream protection |

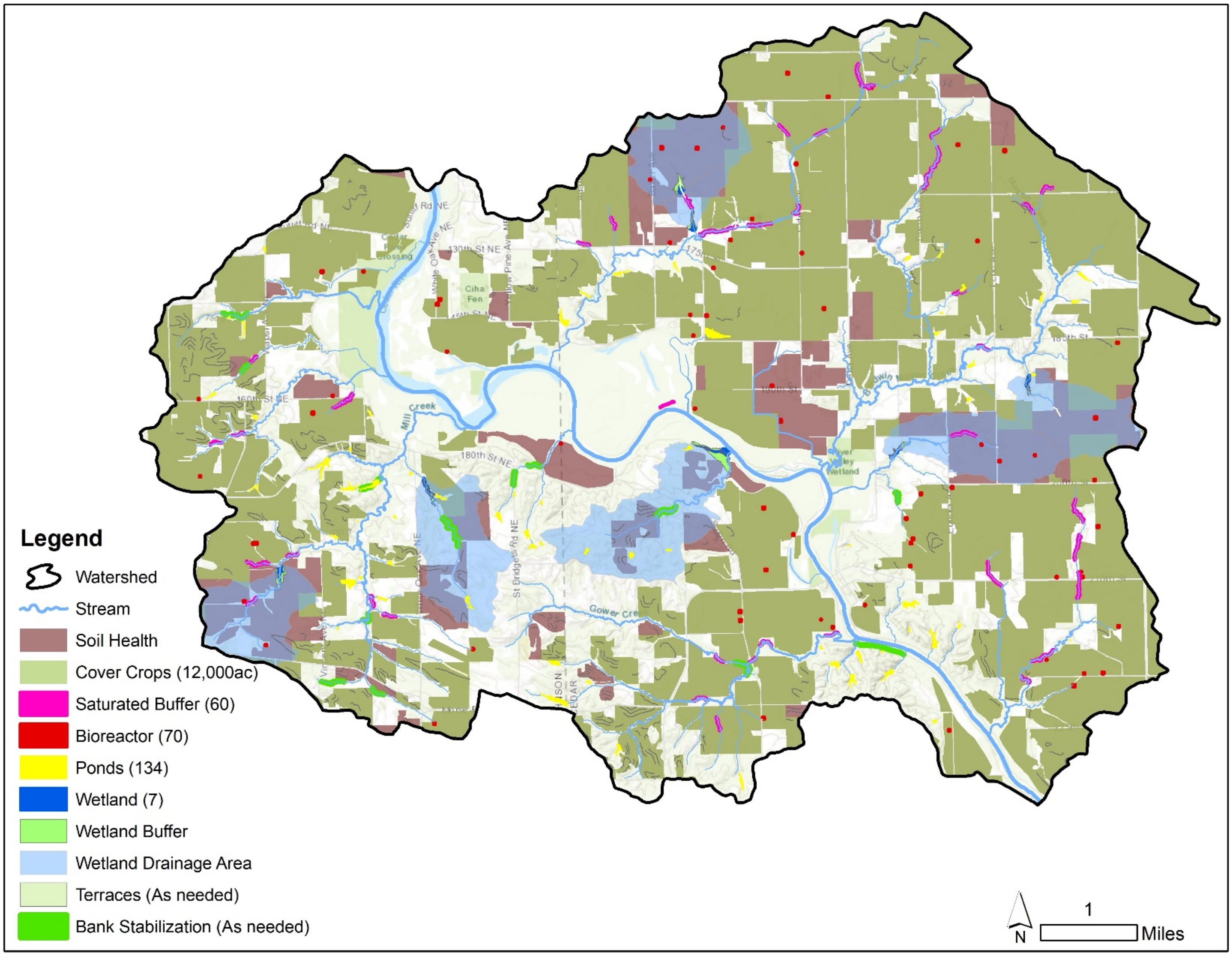


*Figure 5.2.1. Conceptual plan for conservation practice implementation.*

## 5.3. Implementation Schedule

An implementation schedule was developed to facilitate evaluation of interim project milestones before the 2035 target date for full plan implementation. Three project phases are recommended: 2021 through 2025, 2026 through 2030, and 2031 through 2035. Existing, phased, and cumulative implementation goals are provided in Table 5.3.1.

*Table 5.3.1. Implementation schedule for the Mill Creek Watershed.*

| Priority Conservation Practice | Unit | Current Level | Phase 1: 2021-2025 | Phase 2: 2026-2030 | Phase 3: 2031-2035 | Cumulative Goal |
|---|---|---|---|---|---|---|
| N management | ac/yr | - | 2,000 | 4,000 | 5,000 | 11,000 |
| No-till | ac/yr | 7,300 | 1,700 | 3,000 | - | 12,000 |
| Cover crops | ac/yr | 700 | 1,300 | 4,000 | 6,000 | 12,000 |
| Extended rotation | ac/yr | - | *As needed for economics & soil health* | | | |
| Wetlands | sites | - | 1 | 1 | 2 | 4 |
| Farm ponds | sites | 54 | 7 | 8 | 5 | 74 |
| Saturated buffers & bioreactors | sites | - | 5 | 15 | 50 | 70 |
| Basins & terraces | feet | 18,709 | *As needed for erosion control* | | | |
| Stream buffers & bank stabilization | acres | - | *As needed for stream protection* | | | |

# 6. Roles and Responsibilities

Watershed management requires commitment, collaboration, and coordination among multiple entities. Much of the responsibility for implementing the watershed plan ultimately will be assumed by farmers and landowners, so it is critical to continue to involve them in leadership roles. The following list identifies current and potential project partners along with their key functions.

| Stakeholder Group | Roles |
|---|---|
| Farmers and landowners | Implement conservation practices, evaluate on-farm performance, share knowledge and experience with others, and partner with relevant operator or owner on conservation practice adoption. |
| Lower Cedar Watershed Management Authority | Coordinate watershed activities with other watershed management authority member entities across the broader Lower Cedar Watershed. |
| Johnson and Cedar Soil and Water Conservation Districts | Hire watershed project staff, pursue and obtain grants and other funding, evaluate implementation progress, and develop partnerships. |
| USDA-Natural Resources Conservation Service | Provide technical and financial assistance, provide conservation practice design and engineering, house project staff as needed, and provide associated office space, computer, phone, and vehicle as available. In addition to assistance provided through the local USDA service center, the NRCS is well positioned to support watershed goals by providing access to federal funding programs for working lands conservation. |
| Iowa Department of Agriculture and Land Stewardship | Provide technical support for the watershed project and provide opportunities for state funding for soil and water conservation practices. |
| Iowa Department of Natural Resources | Conduct water quality monitoring and water resources assessments. |
| Johnson and Cedar Counties | Coordinate with county emergency managers as needed, maintain county conservation board properties and provide public educational opportunities, and coordinate on infrastructure projects with an emphasis on natural resource resilience. |
| Conservation and farm organizations | Engage members, provide environmental and/or agronomic services as appropriate, and support mutual goals. |
| Educational institutions | Local schools can provide educational programming. Universities such as Iowa State University and the University of Iowa can provide opportunities for research, extension, and flood-focused programs. |

# 7. Funding Needs and Opportunities

## 7.1. Resource Needs

Watershed management requires substantial investment in technical assistance (human resources) and financial assistance (funding to support practice adoption or construction). Table 7.1.1. provides estimated implementation costs by conservation practice.

*Table 7.1.1. Estimated annual or initial costs of priority conservation practices.*

| Practice | Units | Goal | Unit Cost | Total Cost |
|---|---|---|---|---|
| N management | ac/yr | 11,000 | -$5 | -$55,000 |
| No-till | ac/yr | 12,000 | -$10 | -$120,000 |
| Cover crops | ac/yr | 12,000 | $40 | $480,000 |
| Wetlands | sites | 4 | $87,551 | $350,204 |
| Farm ponds | sites | 20 | $38,333 | $766,660 |
| Saturated buffers & bioreactors | sites | 70 | $11,000 | $770,000 |

The total cost to fully implement the Mill Creek Watershed Plan is estimated to be $1,886,864 in up-front capital plus an additional $405,000 per year in annual operating expenses. This annual operating budget includes $305,000 per year in conservation financial assistance plus approximately $100,000 per year to fund watershed management and technical assistance, which includes salary and benefits for a watershed coordinator, supplies for outreach materials and events, water monitoring, and overhead costs such as office space, computer, phone, and vehicle.

Short- and long-term cost savings to farmers and landowners are anticipated from adoption of no-till and optimized nutrient management. These financial gains could offset near-term adoption costs associated with other practices such as cover crops. Investment in soil and water conservation should be balanced between one-time, up-front construction and annual, in-field practices to efficiently achieve watershed goals. The costs and benefits (both economic and environmental) should be aligned with needs and goals of individual farmers and landowners that will implement each conservation practice.

For context, these implementation costs were compared to annual revenue and asset value of cropland in the watershed. Based on 10-year averages of corn and soybean acreages, yields, and prices, the gross annual revenue from corn and soybean production in the watershed is $14,345,000, or $747 per acre. The annual plan implementation cost of $405,000 per year represents 2.8 percent of annual gross revenue. Based on 2019 data, agricultural land in Johnson County, Iowa averaged $8,674 per acre, for a total asset value of $166,602,000 in the watershed. The initial capital investment cost of $1,886,864 represents 1.1 percent of the total value of watershed cropland.

## 7.2. Funding Sources

Funding opportunities include state and federal grants and cost-share, which typically are obtained and administered by a soil and water conservation district. State programs include the Iowa Water Quality Initiative and the Iowa Financial Incentive Program. Federal programs include Environmental Quality Incentives Program, Conservation Stewardship, Conservation Reserve Program, and Regional Conservation Partnership Program.

Nontraditional, innovative approaches will be necessary to secure long-term sustainable funding for watershed improvement. To supplement cost-share from state and federal sources, watershed stakeholders could pursue finance-based funding models that provide payments for environmental outcomes generated by conservation practices. Opportunities to measure, research, manage, and optimize farm enterprise-scale profitability also could be pursued to ensure that farmers maintain and build their financial strength over time in addition to their natural resource capital.

# 8. Outreach and Engagement Plan

Outreach and education will be needed on an ongoing basis to provide information to watershed stakeholders. Outreach initiatives and materials should be designed to accomplish specific goals. Messaging and formats should be tailored to specific audiences. Local and regional media should be engaged as appropriate to build awareness and understanding of the watershed project.

Communications and coordination should be conducted by a watershed leadership team. The Lower Cedar Watershed Management Authority board of directors may be able to support this function. Ideally, the Mill Creek Watershed group also should include farmers and landowners, USDA-Natural Resources Conservation Service, soil and water conservation district commissioners and staff, Iowa Department of Agriculture and Land Stewardship, and other local partner organizations.

In addition to sharing information, outreach should drive engagement and participation. Public events such as field days and meetings are important venues to share information, yet these events present important opportunities to foster community ties within and around the watershed. Watershed improvement is highly collaborative, so such community bonds and cooperation will be essential for sustained, long-term success. For example, cooperative learning opportunities that facilitate farmer-to-farmer knowledge sharing will allow more producers to adopt best practices and adaptive management as they refine their operations with new or additional conservation practices.

# 9. Monitoring and Evaluation Plan

## 9.1. Monitoring

Multiple indicators should be monitored to track progress and measure success. Water quality monitoring will be a key indicator of overall conditions within the watershed. Stakeholders should continue to work with the Iowa Department of Natural Resources to monitor stream water quality and assess trends. At a minimum, water quality parameters to measure include inorganic nitrogen, dissolved phosphorus, turbidity or total suspended solids, and bacteria. In addition to continuing to monitor the Cedar River at Cedar Bluff, tributary streams in the watershed also could be monitored to evaluate water quality at a finer scale (Figure 9.1.1).

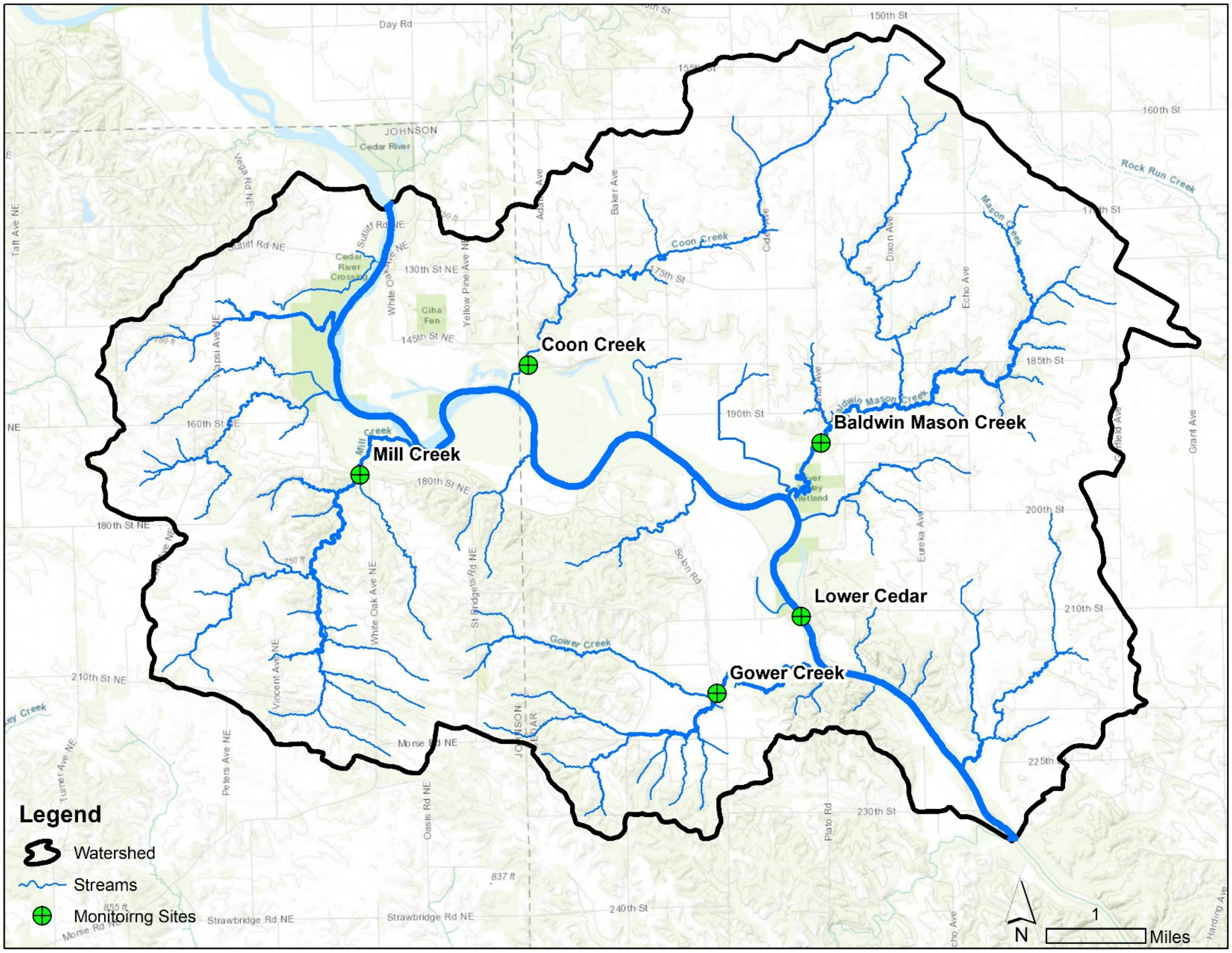


*Figure 9.1.1. Locations to monitor surface water quality of the Cedar River and its tributaries in the Mill Creek Watershed, including Mill Creek, Coon Creek, Baldwin and Mason creeks, and Gower Creek.*

Field-scale water monitoring also can be used to evaluate the effectiveness of individual conservation practices, and could include soil health testing, nutrient management trials, or crop tissue sampling. Such agronomic studies can be important sources of data to inform decision making by individual farmers and landowners. Environmental outcomes of conservation practice implementation can be measured using USDA-Natural Resources Conservation Service conservation planning tools and criteria (e.g., Revised Universal Soil Loss Equation 2, Soil Conditioning Index), other public agroecosystem models (e.g., Nutrient Tracking Tool, COMET-Farm), or private sustainability and stewardship technology platforms.

Watershed project evaluation also should include tracking of social indicators such as surveys of attitudes and awareness, event attendance, and media reach. Additional success indicators such as practice adoption and retention, new project participants, and new project partners should be documented and reported.

## 9.2. Evaluation

Watershed project actions and progress should be tracked in four categories: administration, engagement, implementation, and outcomes. The following chart provides details on what, when, and how to measure within each of these categories.

| Metric | Frequency | Details |
|---|---|---|
| **Administration** | | |
| Formal project review | Annually | An annual project review meeting should be conducted with project partners, funding entities, and supporting agencies. The review should capture the following metrics and provide a platform both to celebrate accomplishments from the past year and to plan for the next year. |
| Project advisory meetings | Quarterly | Project leaders—including farmers—should meet regularly, ideally quarterly, depending on timing of agriculture field work. These gatherings should be used to ensure project goals and objectives are being accomplished. Upcoming outreach, events, and monitoring activities also should be coordinated. |
| **Engagement** | | |
| Awareness and attitudes | Periodically | Awareness of the project and watershed goals should be assessed. This qualitative data will provide a measure of trends in stakeholder knowledge, opinions, and actions. |
| Event engagement | Event-based | Evaluations can be tied to specific events in order to provide direct feedback to increase participation and learning outcomes from future events. |
| Project participation | Annually | The number of watershed farmers and landowners that implement and maintain conservation practices should be tracked annually. Other types of participation such as leadership and event attendance also could be tracked. |
| **Implementation** | | |
| Practice adoption | Annually | Locations of newly implemented conservation practices should be tracked throughout the project, and total adoption levels and acres treated should be reported annually. |
| Practice retention | Annually | In addition to constructed practices that will function over multiple years, retention of in-field management practices should be emphasized. Locations of these conservation practices can be identified through field assessments, and will become increasingly easy to track with remote sensing technology. |
| **Outcomes** | | |
| Water quality monitoring | Monthly | Surface water quality parameters should be measured monthly or semi-monthly during the growing season. Stream water monitoring data will be essential to determine if long-term water quality improvements are attained. |
| Agronomic testing | Seasonally | Agronomic and profitability outcomes should be evaluated to determine and understand the impacts and benefits of individual or integrated conservation practices. Research results can be aggregated and shared with all farmers across the watershed to support learning, practice adoption, adaptive management, and continuous improvement. |
| Outcomes modeling | Annually | Conservation outcomes should be quantified, especially nutrient loss reduction, soil conservation, and greenhouse gas reductions. While it likely will not be feasible to perform field measurements for all implemented conservation practices, agroecosystem models, tools, and technologies should be used to estimate the environmental benefits of all conservation practices adopted across the watershed. |