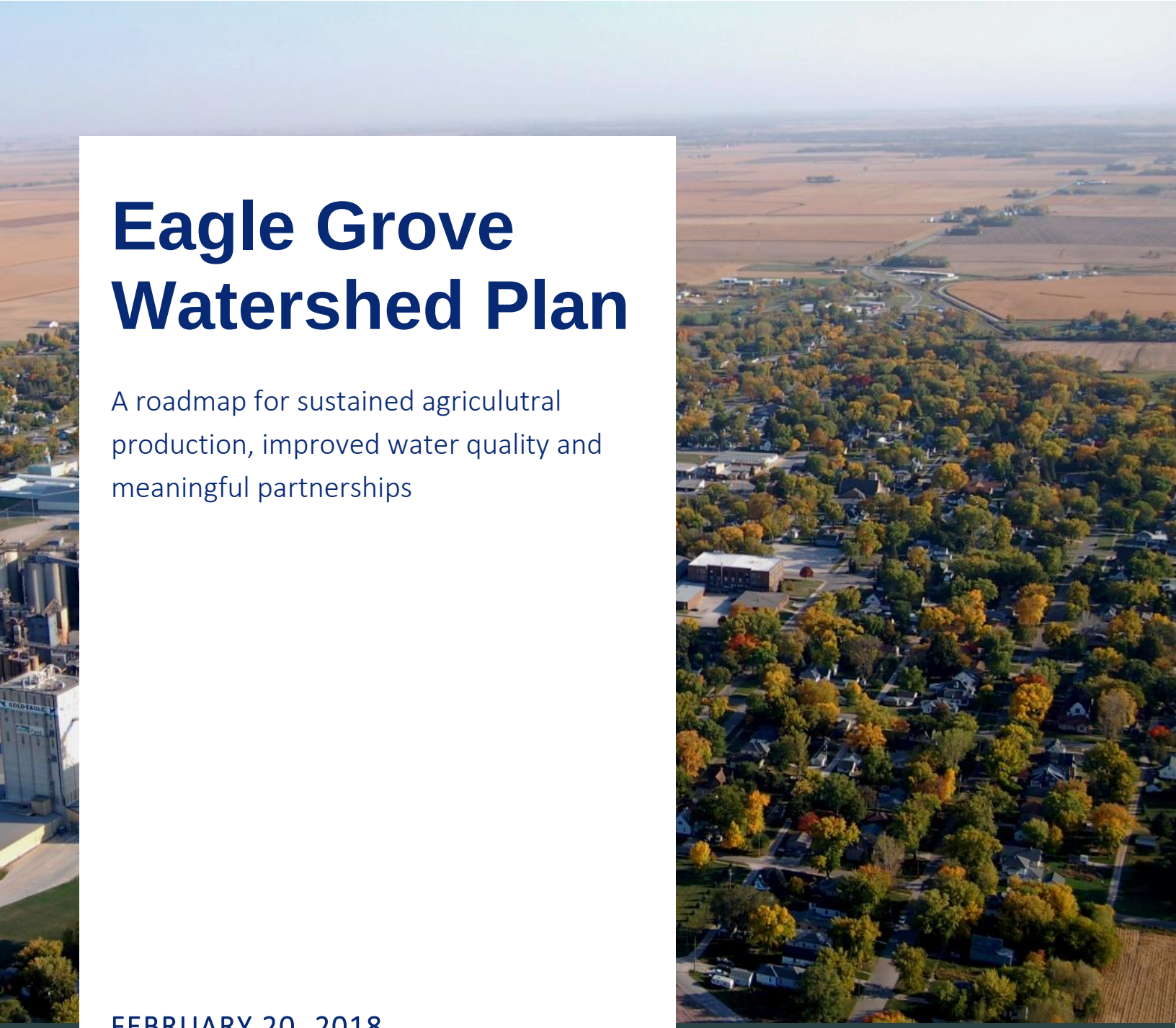


Eagle Grove Watershed Plan

A roadmap for sustained agriculutral production, improved water quality and meaningful partnerships

FEBRUARY 20, 2018

Authored by: Iowa Soybean Association – Environmental Programs & Services

Iowa Soybean Association
Environmental Programs & Services

Funding to support the development of this watershed plan document and associated watershed planning activities in the Eagle Grove Watershed has been provided by:

The WALTON FAMILY FOUNDATION

Watershed planning partners:

Watershed residents, farmers and landowners

City of Eagle Grove

Iowa Department of Agriculture and Land Stewardship

ISG Engineering Group, Des Moines

A roadmap for sustained agricultural productivity and improved water quality in the Eagle Grove Watershed.

Why was the Eagle Grove Watershed Plan developed?

This watershed plan is intended to provide a roadmap for land and water improvements in the Eagle Grove Watershed while simultaneously maintaining and improving agricultural performance and quality of life. Environmental improvements are a big task, and trying to tackle everything at once can be daunting. This plan lays out a phased approach to implementation to ensure continuous improvements are made towards achieving long-term goals for the watershed.

Who owns this watershed plan?

This plan is for all stakeholders interested in the Eagle Grove Watershed, including landowners, farmers, residents, nongovernmental organizations and local, state and federal units of government. Ultimately, successful implementation of this plan will rest with these stakeholders.

Who developed this watershed plan?

This plan was developed by the Iowa Soybean Association and input was provided by representatives of landowners, farmers, residents and city, county and federal governments.

Table of Contents

1. Executive Summary

A watershed is an area of land that drains to a single point (Figure 1.1). The Eagle Grove watershed is a combination of two small watersheds that include the City of Eagle Grove and surrounding agricultural land. For the purposes of this watershed plan, this combination of two small watersheds will be referred to as the Eagle Grove watershed. The Eagle Grove watershed is comprised of 14,240 acres in Wright County. Two small streams, Ditch Number 4 and Ditch Number 94, combine to form a stream network within the watershed. Ditch Number 4 is the northern stream and Ditch Number 94 is the southern stream. Both streams meet with the Boone River west of Eagle Grove.

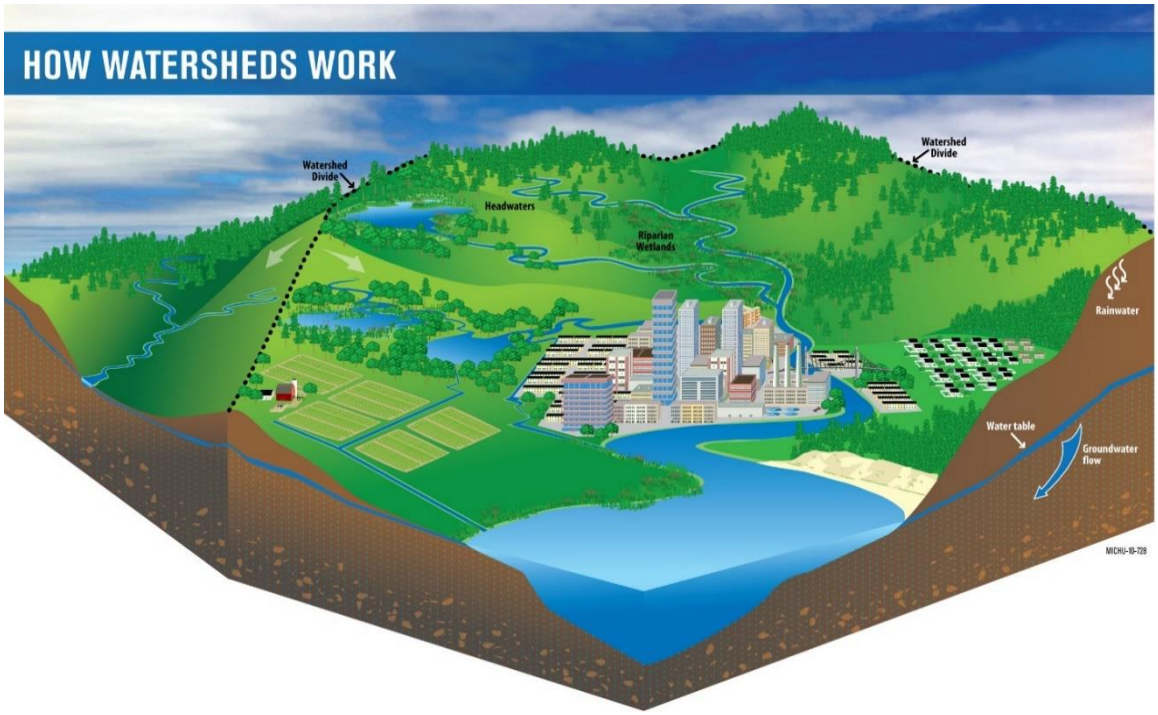


Figure 1.1. A watershed contains the land and water that flow to a common point (Michigan Sea Grant).

This watershed plan defines and addresses existing land and water quality conditions, identifies challenges and opportunities and provides a path for improvement. The watershed plan was developed according to the watershed planning process recommended by the Iowa Department of Natural Resources (Figure 1.2) and incorporated input from a variety of public and private stakeholders. The Iowa Soybean Association led development of this watershed plan with funding provided by the Walton Family Foundation. Stakeholders including watershed farmers and landowners, conservation professionals and others contributed local knowledge and insights. The Eagle Grove Watershed Plan integrates existing data, citizen and stakeholder input and conservation practice recommendations to meet the goals established through the watershed planning process.

The Eagle Grove watershed was identified for watershed planning due an interest from the City of Eagle Grove to invest in water quality and flood reduction practices. New relationships have been formed between the Iowa Soybean Association, the City of Eagle Grove and farmers and landowners in the watershed focused on the importance of water quality and increased local adoption of conservation and water quality improvement practices. Community participation proved important during the watershed planning phase. Such local engagement and leadership will be essential as the plan is implemented now and in the future.

Figure 1.2. The watershed planning process.

The Eagle Grove watershed is a subwatershed of the larger Boone River watershed, which is one of nine priority watersheds identified in the Iowa Nutrient Reduction Strategy (INRS). The INRS identifies a broad strategy to reduce nutrient loads in Iowa water bodies and downstream waters that incorporates regulatory guidelines for point sources of nutrients and a non-regulatory approach for nonpoint nutrient sources. This watershed plan was developed within the flexible nonpoint source framework to identify a locally appropriate strategy to address INRS water quality improvement goals.

A partnership between the City of Eagle Grove and agricultural producers and landowners presents a unique opportunity to bridge the gap between point and nonpoint sources of nutrients. This plan was developed while the City of Eagle Grove secured a significant State Revolving Fund Sponsored Project, the plan goes well beyond the scope of the Sponsored Project.

Goals for the Eagle Grove watershed have been identified to achieve the vision of all stakeholders. This document guides stakeholders according to a continuous improvement approach to watershed management. It is important both to adopt a long-term perspective and to realize that many small improvements must be made to cause large, lasting changes for the entire watershed. The long-term goals of the Eagle Grove Watershed Plan are to:

1. Identify cost effective solutions
2. Provide for profitable and productive agriculture
3. Create conditions for healthy soils and water
4. Minimize downstream impacts
5. Work with urban and rural stakeholders to implement conservation practices

Public involvement was a key component of the watershed planning process. Watershed planners encouraged participation throughout the planning process and sought to incorporate diverse stakeholder input from farmers, landowners, farm managers, agricultural service providers, conservation professionals and other local stakeholders to guide the development of this watershed plan.

Improving land and water resources in the Eagle Grove watershed is a complex challenge and will require substantial, long-term collaboration and partnerships. The implementation schedule in this watershed plan was developed to balance currently available resources and awareness with the need and desire to improve land and water quality. A 20-year phased implementation schedule has been designed to allow for continuous improvements that can be periodically evaluated to determine if progress is being made toward achieving the stated goals by the year 2038. The total investment necessary to accomplish the watershed plan goals is estimated to be approximately $2,104,999 for initial infrastructure costs associated with structural practices, $232,500 for annual costs associated with management practices and an additional funding to support technical assistance, practice survey and design, outreach, monitoring and equipment necessary to promote and implement conservation in the watershed.

Expenditures for watershed improvement in the Eagle Grove watershed should be viewed as long-term investments in agricultural vitality and water quality. With this perspective in mind, the cost efficiency of any purchased investments (i.e., conservation practices) should be considered along with their potential internal and external benefits and risks. This approach allows for water quality investors (i.e., public or private funding sources) to select conservation practices that align with investment preferences and goals. Table 1.1 contains estimates of annualized nitrogen and phosphorus load reduction cost efficiency for practices that are included in the Eagle Grove Watershed Plan. Many of these practices have additional on- and off-farm economic and ecosystem benefits that could also be considered as specific conservation practices are funded.

Table 1.1. Estimated nutrient reduction cost efficiency of conservation practices from the Eagle Grove watershed conceptual plan.

						Watershed load reductions		Annualized Cost per Pound of Reduction	
	Practice	Watershed plan goal	Unit	Cost per unit	Total cost	Nitrogen (lb N/yr)	Phosphorus (lb P/yr)	Nitrogen ($/lb N/yr)	Phosphorus ($/lb P/yr)
Annual costs	Cover crops	4,000	acres	$50	$200,000	32,240	165	$6.20	$0.61
	Nutrient management - MRTN	5,500	acres	($5)	($27,500)	14,300	0	($1.92)	
	Conversion of Cropland to Perennial Cover	200	acres	$300	$60,000	4,420	32	$13.57	$0.94
Initial costs	Drainage water management (50-year life)	1,000	acres	$1,000	$1,000,000	8,580	0	$2.33	
	Bioreactors (15-year life)	20	structures	$12,000	$240,000	16,125	0	$0.99	
	Saturated buffers (75-year life)	5	structures	$3,000	$15,000	2,500	0	$0.08	
	Nitrate removal wetlands (75-year life)	3	sites	$283,333	$849,999	39,819	253	$0.28	$0.02

Ultimately any land and water quality improvements made in the watershed will be driven by local desire, education and participation. The conceptual, monitoring, goal-based outreach and evaluation components of this watershed plan should provide a framework to guide efforts and focus resources in order to achieve the vision of the Eagle Grove watershed.

2. Watershed Characteristics

2.1. General Information

The Eagle Grove watershed encompasses 14,420 acres used primarily for agricultural production and the urban land use in the City of Eagle Grove. Row crop agriculture occupies 78 percent of the watershed. Terrain in the watershed is predominately flat and includes small topographic depressions and wetlands known as prairie potholes. There are areas of steeper terrain along the two small streams, especially where the streams get near the Boone River. The primary streams in the watershed are Ditch Number 4 and Ditch Number 94. Both stream have been designated by the Iowa Department of Natural Resources (IDNR) as a waterbody that should support recreation and aquatic life. Stream channels in the watershed are a mix of constructed ditches and natural stream channels. Table 2.1.1 lists general information for the stream segments and watershed.

Table 2.1.1. Watershed and stream information.

Location	Wright County
Waterbody ID (WBID)	Ditch Number 94 (IA 04-UDM-1268)
Segment classes	A1, B(WW-2)
Designated uses	Primary contact recreation, Aquatic life
WBID segment length	2.6 miles
Total length of all streams	16 miles
Watershed area	14,420 acres
Dominant land use	Row crop agriculture
Incorporated communities	Eagle Grove
HUC8 watershed	Boone
HUC8 ID	07100005
HUC10 watershed	Ditch 3 – Boone River
HUC10 ID	0710000506
HUC12 watershed	Drainage Ditch 46, Drainage Ditch 4
HUC12 ID	071000050605 & 071000050604

2.2. Water and Wetlands

Surface water in the Eagle Grove watershed includes two small streams, Ditch Number 4 and Ditch Number 94, and a few small unnamed tributary streams. Figure 2.2.1 shows the identified streams within the watershed. Figure 2.2.2 displays the wetlands in the Eagle Grove watershed as identified by the National Wetlands Inventory (NWI), which are also summarized in Table 2.2.1. The NWI dataset was developed beginning in the 1970s by the US Fish and Wildlife Service via aerial photo interpretation.

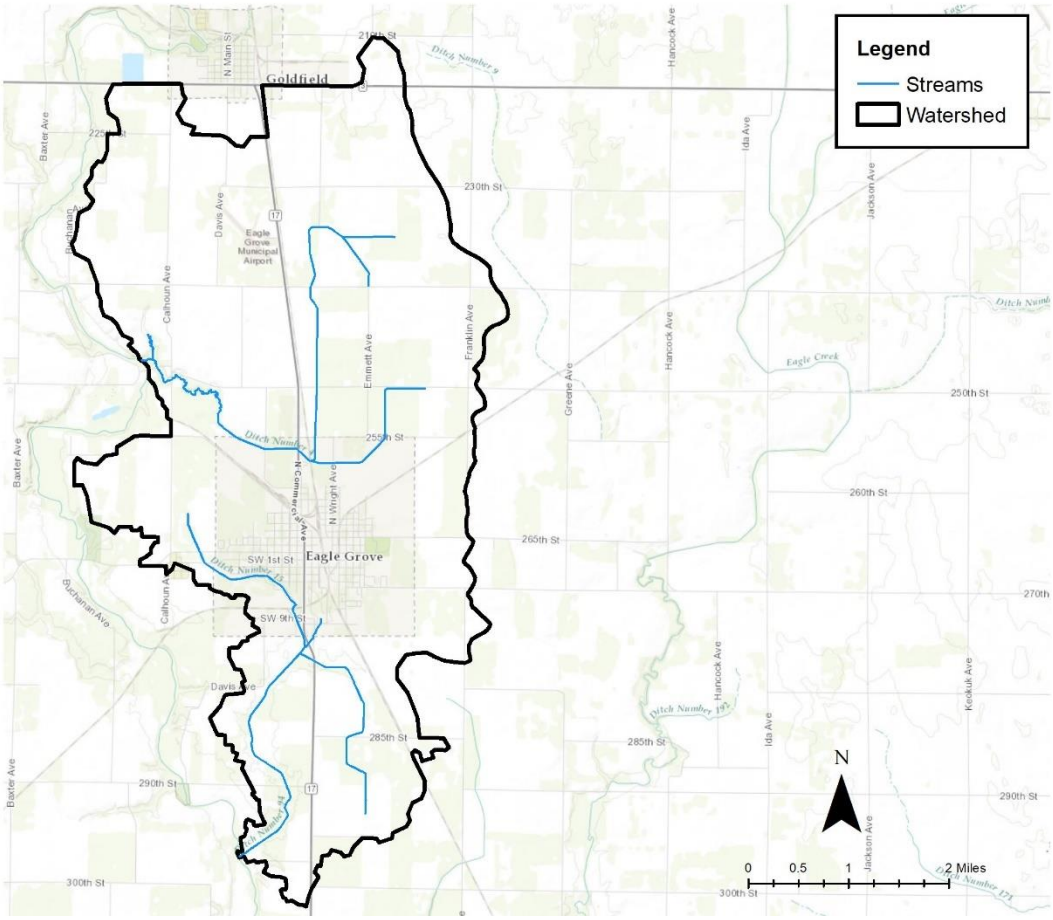


Figure 2.2.1. Streams identified in the Eagle Grove watershed.

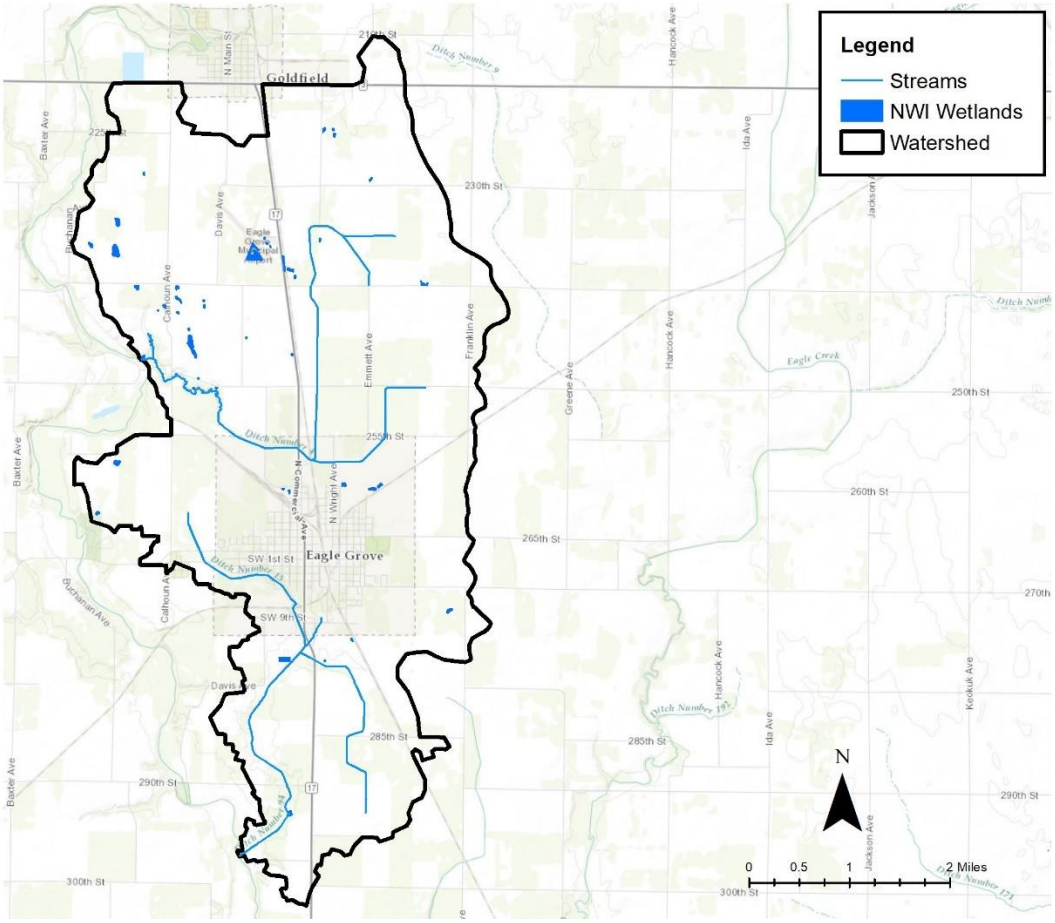


Figure 2.2.2. Wetlands in the Eagle Grove watershed mapped in the NWI.

Table 2.2.1. Classification of wetlands in the Eagle Grove watershed according to the NWI.

Type	Acres
Intermittently Exposed	.77
Artificially Flooded	2.75
Seasonally Flooded	4.8
Temporarily Flooded	35.9
Total	44.22

2.3. Climate

Precipitation data obtained from the Iowa Environmental Mesonet for the City of Clarion, the nearest long term precipitation gauge, show annual total precipitation averaged 35.6 inches per year between 2000 and 2016, but a range of 26.2 to 50.1 inches per year for that period reveals large annual variability. Annual precipitation trends are shown in Figure 2.3.1. Precipitation is seasonal in the watershed, with May through August having the highest average monthly rainfall during the most recent 15 years. Monthly precipitation averages are displayed in Figure 2.3.2.

Figure 2.3.1. Total annual precipitation for the Eagle Grove watershed from 2000 through 2016.

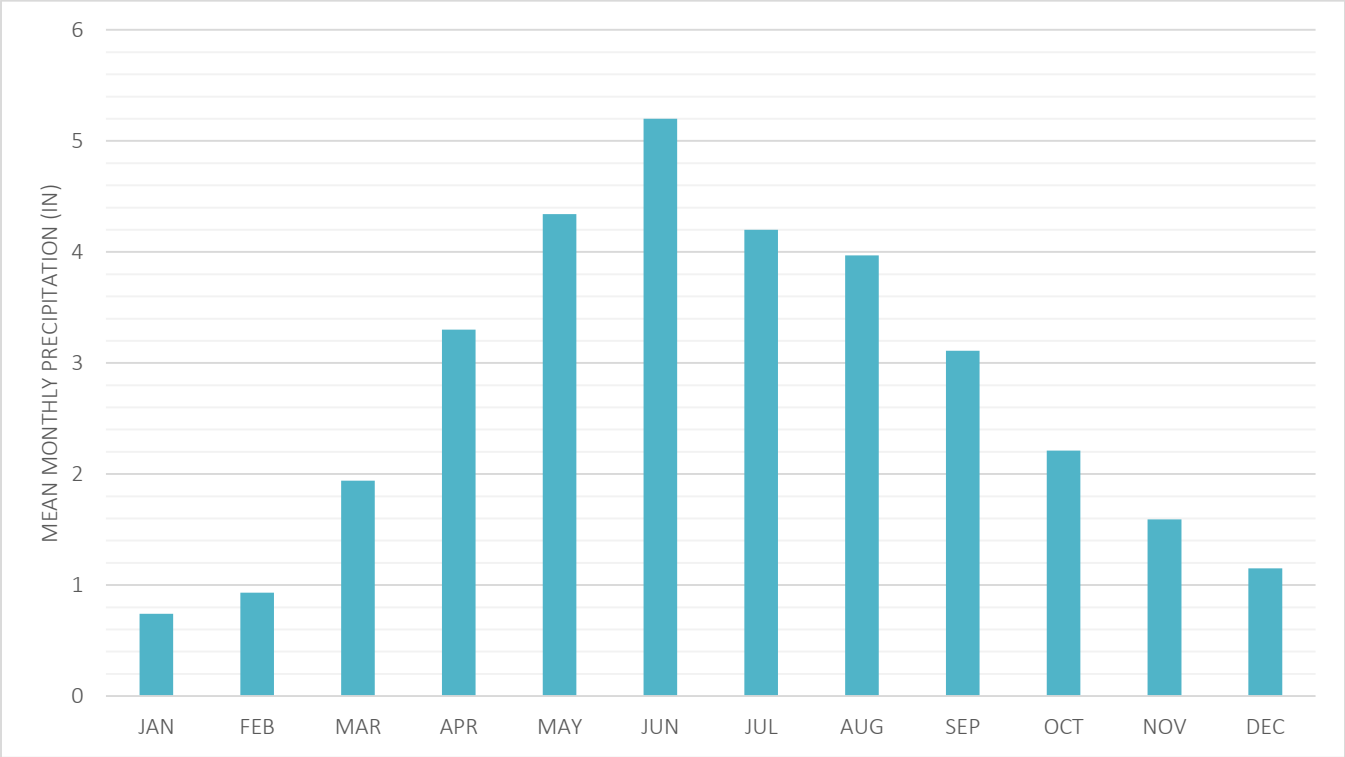


Figure 2.3.2. 2000 to 2016 average precipitation by month for the Eagle Grove watershed.

2.4. Geology and Terrain

The Eagle Grove watershed is located within the Des Moines Lobe landform region. The Des Moines Lobe was last glaciated approximately 12,000 years ago during the Wisconsin glaciation. This relatively recent glaciation is expressed on the present day landscape as poor surface drainage, limited stream network density and flat to gently rolling topography with low local relief. Commonly referred to as the Prairie Pothole region, the Des Moines Lobe is characterized by depressions and ridges. Due to the young geologic age of the region the predominant subsurface parent material is mixed glacial till. The watershed is also located within the Central Iowa and Minnesota Till Prairies Major Land Resource Area (MLRA 103). Land surface elevation in the watershed ranges from 1,060 to 1,160 feet above sea level. Figure 2.4.1 shows elevations derived from Light Detection and Ranging (LiDAR) data. Figure 2.4.2 displays the spatial distribution of slope classes within the watershed, which are also listed in Table 2.4.1. Ninety-four percent of the watershed has slopes less than 5%.

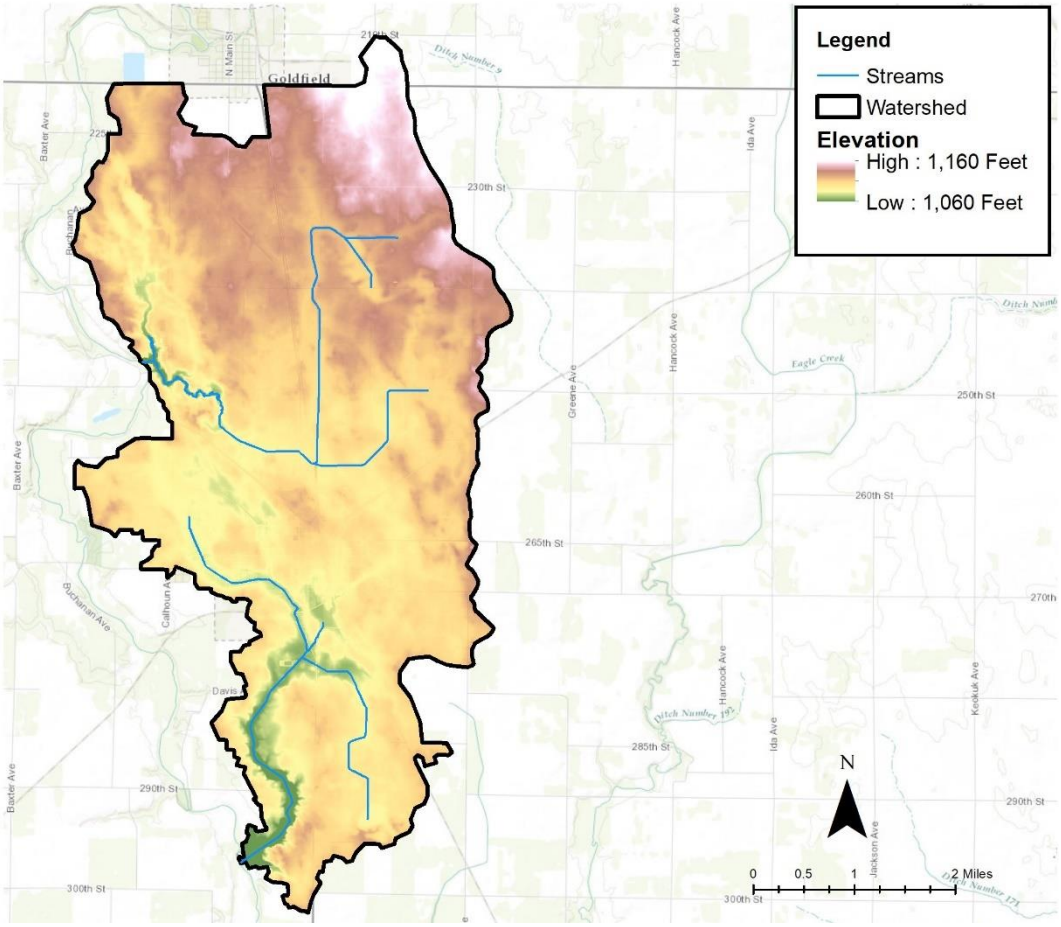


Figure 2.4.1. LiDAR-derived elevations within the Eagle Grove watershed.

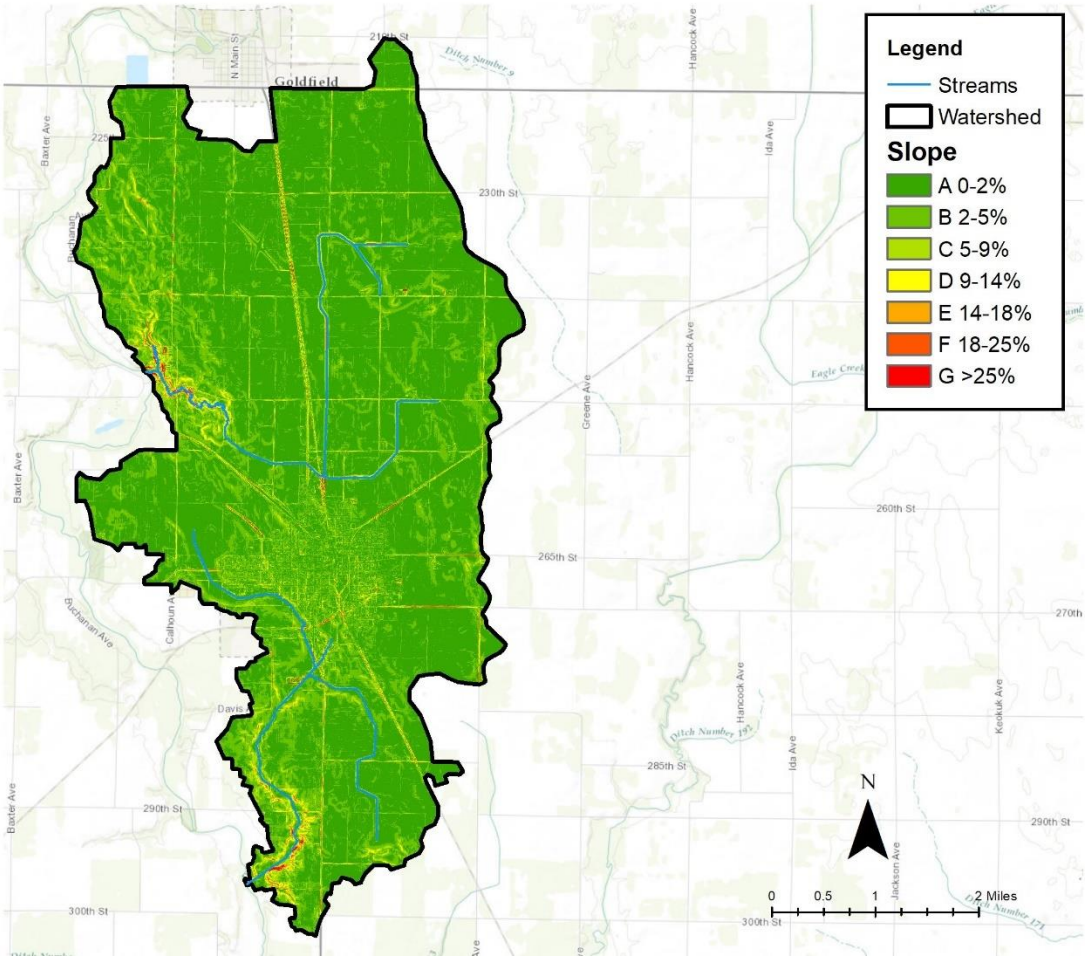


Figure 2.4.2. Eagle Grove watershed slope classifications derived from elevation data.

Table 2.4.1. Extent of each slope class within the Eagle Grove watershed.

Slope Class	Range	Acres	Percent
A	0-2%	11,824	82%
B	2-5%	1,730	12.0
C	5-9%	490	3.4
D	9-14%	202	1.4
E	14-18%	72	0.5
F	18-25%	58	0.4
G	> 25%	44	0.3

2.5. Soils

The most common soil association in the Eagle Grove watershed is the Clarion-Nicollet-Webster soil association. Parent materials include primarily glacial till and outwash along with some alluvium. Native vegetation for these soils was tall and short grass prairie. Overall these soils have poor natural drainage but are highly productive if drained, so tile drainage is common for many soils in this association. The four most prevalent soil series in the watershed are Webster, Clarion, Canisteo and Nicollet which together comprise over 81 percent of the watershed. Figure 2.5.1 is a map of the most common soils within the watershed according to the Soil Survey Geographic Database (SSURGO) coverage developed by the National Cooperative Soil Survey and the USDA-Natural Resources Conservation Service (NRCS). Descriptions of the Webster, Clarion, Canisteo and Nicollet soil series are given in Table 2.5.1.

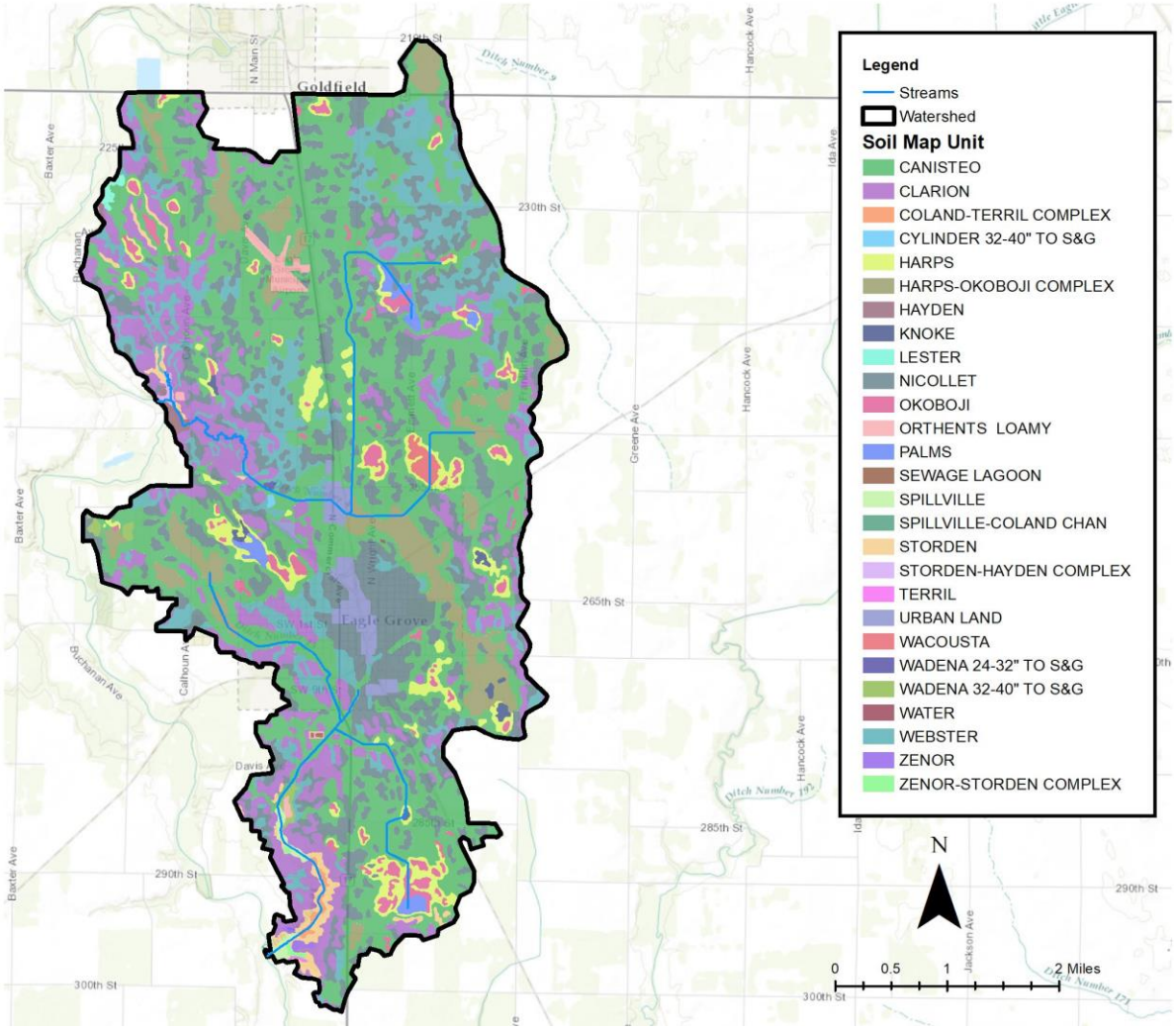


Figure 2.5.1. Eagle Grove watershed soil map derived from SSURGO data.

Table 2.5.1. Official NRCS soil series descriptions.

Soil Series	Description
Webster	Very deep, poorly drained, moderately permeable soils formed in glacial till or local alluvium derived from till on uplands. Slope ranges from 0 to 3 percent.
Clarion	Very deep, moderately well drained soils on uplands. These soils formed in glacial till. Slopes range from 1 to 9 percent.
Canisteo	Very deep, poorly and very poorly drained soils that formed in calcareous, loamy till or in a thin mantle of loamy or silty sediments and the underlying calcareous, loamy till. These soils are on rims of depressions, depressions and flats on moraines or till plains. Slope ranges from 0 to 2 percent.
Nicollet	Very deep, somewhat poorly drained soils that formed in calcareous loamy glacial till on till plains and moraines. Slopes range from 0 to 5 percent.

Soil drainage properties affect surface and subsurface water movement within the watershed. These characteristics are summarized in Table 2.5.2. Approximately 61 percent of the soils in the Eagle Grove watershed are classified as hydric, which means they are saturated, flooded or ponded during the growing season for sufficient duration to develop anaerobic conditions in the upper portion of the soil profile. An additional 20 percent of the soils are considered potentially hydric. Hydric classification is independent of soil drainage status, so tiled soils may be hydric. Hydric soils within the watershed are mapped in Figure 2.5.2.

Table 2.5.2. Drainage properties and general productivity of major soils in the Eagle Grove watershed.

Soil Series	Acres	Percent	CSR2	Drainage Class	Hydrologic Group	Hydric Class
Webster	1,453	10%	83	Poorly drained	B/D	All hydric
Clarion	2,064	14%	76	Well drained	B	Not hydric
Canisteo	5,451	38%	78	Poorly drained	B/D	All hydric
Nicollet	2,778	19%	88	Somewhat poorly drained	B	Partially hydric

As in many other watersheds in the low relief regions in Iowa, much land within the Eagle Grove watershed is likely to be artificially drained in order to make agriculture possible and productive. Public records of subsurface drainage infrastructure are nonexistent or sparse, but the USDA-Agricultural Research Service (ARS) has developed a geographic coverage of soils in Iowa that are likely to be drained. Figure 2.5.3 uses this coverage to show where tile drainage may be necessary to maximize agricultural productivity but may not reflect all areas that currently have drainage tile.

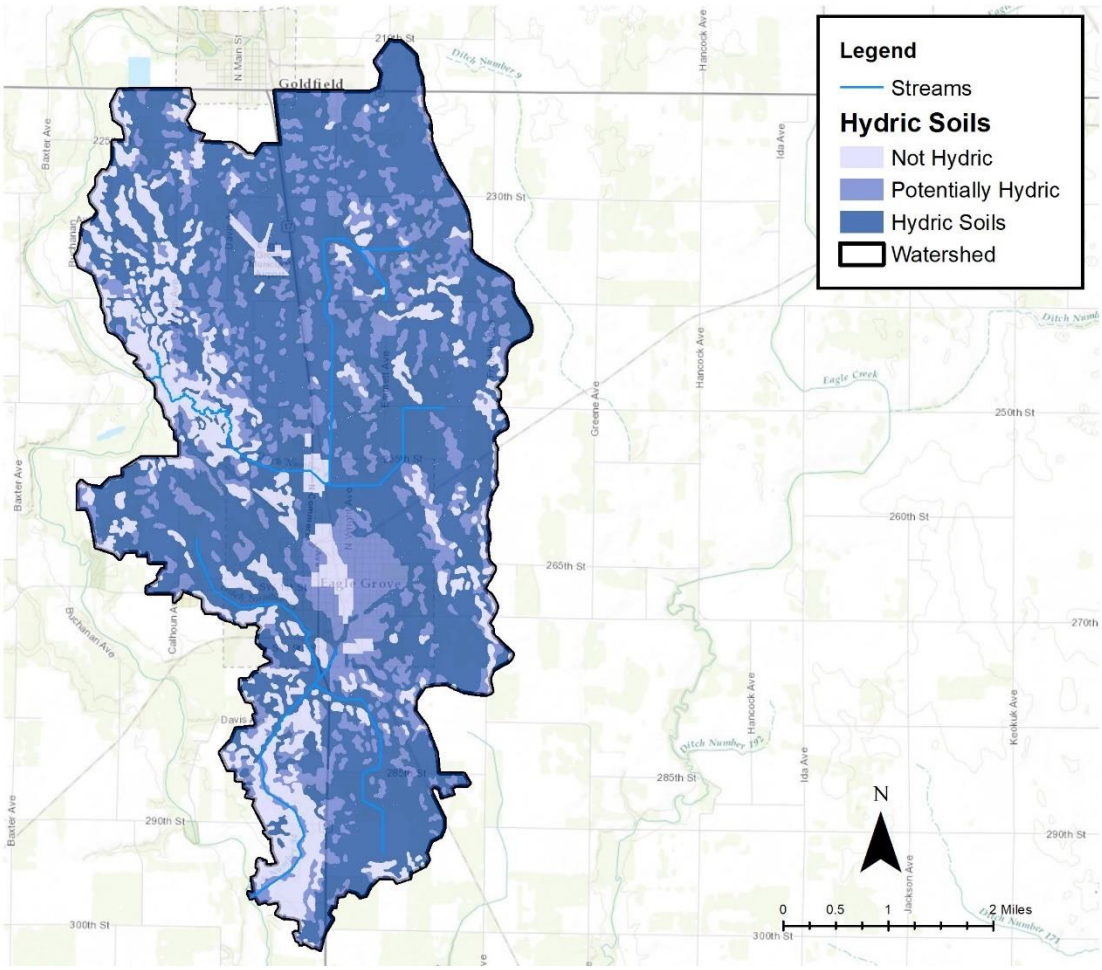


Figure 2.5.2. Soil map units in the Eagle Grove Watershed that are classified as hydric.

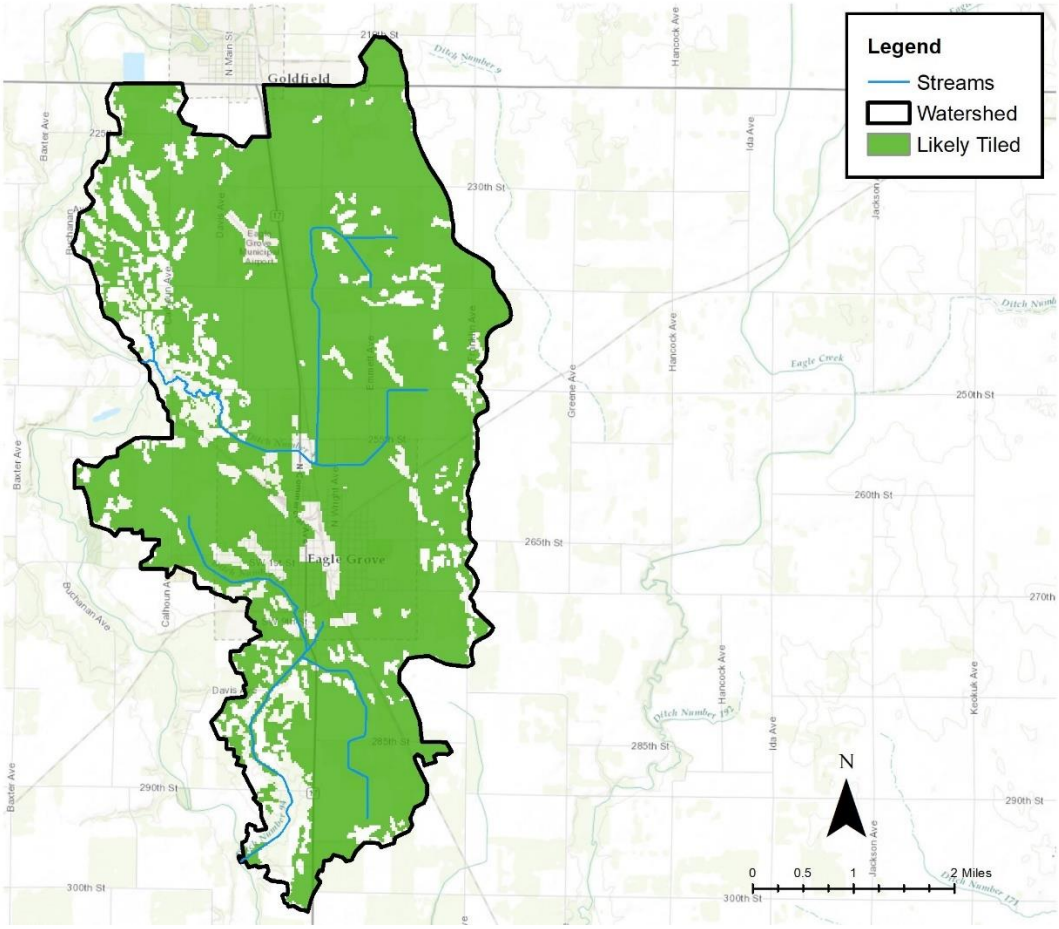


Figure 2.5.3. Areas in the Eagle Grove watershed requiring tile drainage to optimize agricultural production.

Soil map units in Iowa are assigned Corn Suitability Rating 2 (CSR2) values, which are listed for the major soil series within the watershed in Table 2.5.2. Figure 2.5.4 displays the CSR2 values for land within the Eagle Grove watershed. This map was generated by matching spatial SSURGO data to the Iowa Soil Properties and Interpretations Database (ISPAID) version 8.1. The CSR2 is an index that provides a relative ranking of soils mapped in Iowa based on their potential to be utilized for intensive row crop production and thus are sometimes used to compare yield potential. CSR2 scores range from 5 (severely limited soils) to 100 (soils with no physical limitations, no or low slope and can be continuously farmed). The rating system assumes adequate management, natural precipitation, artificial drainage where necessary, no negative effects from flooding and no land leveling or terracing.

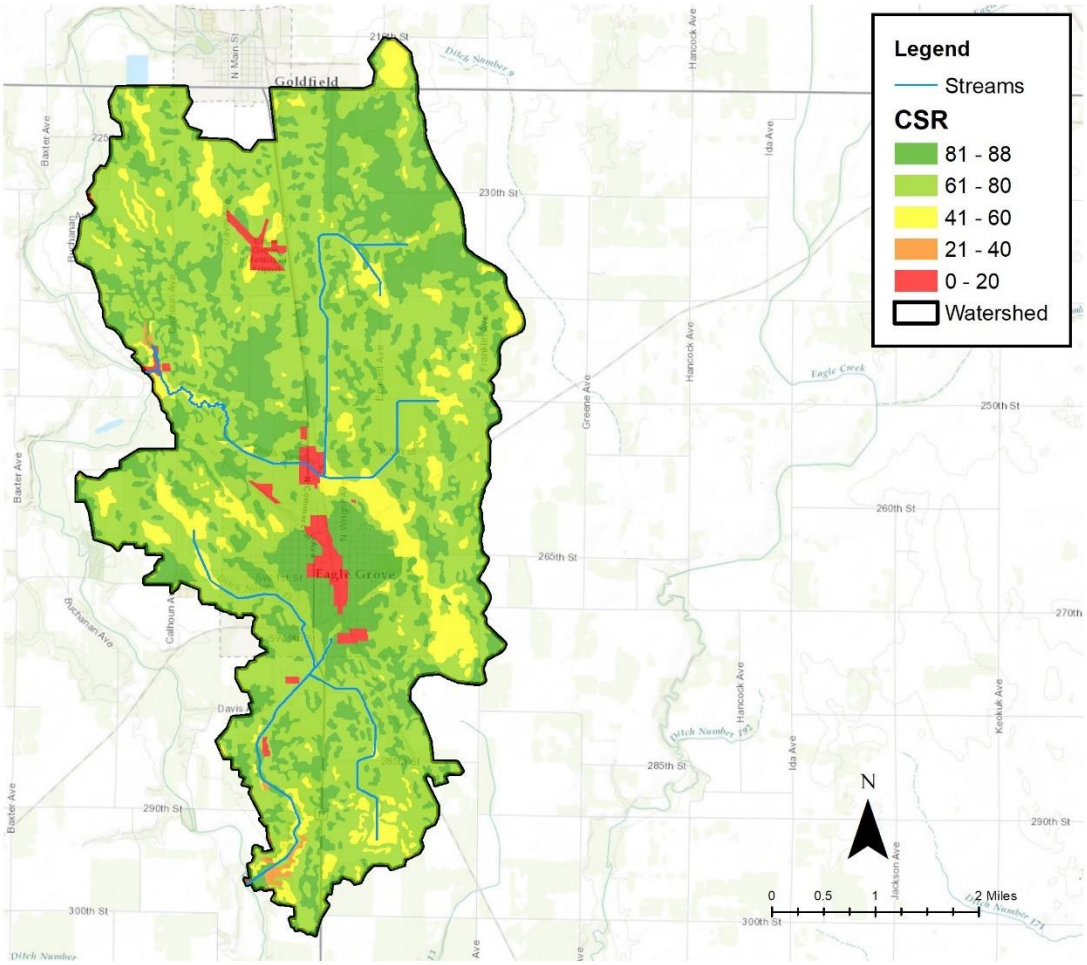


Figure 2.5.4. Corn Suitability Rating (CSR2) values for land in the Eagle Grove watershed.

2.6. Land Use and Management

Land in the Eagle Grove watershed is used primarily for row crop agriculture, which is a major change from its natural state. The General Land Office (GLO) first surveyed the land in Iowa between 1832 and 1859. Surveyors recorded descriptive notes and maps of the landscape and natural resources such as vegetation, water, soil and landform. The collection of historic GLO maps and survey notes is one of few sources of information about native vegetation before much of Iowa's landscape was converted to production agriculture. The GLO surveyors classified land within the Eagle Grove watershed as 93 percent prairie, >1 percent timber and 6 percent marsh. Figure 2.6.1 shows current streams connect and likely drain many of the historically wet portions of the watershed.

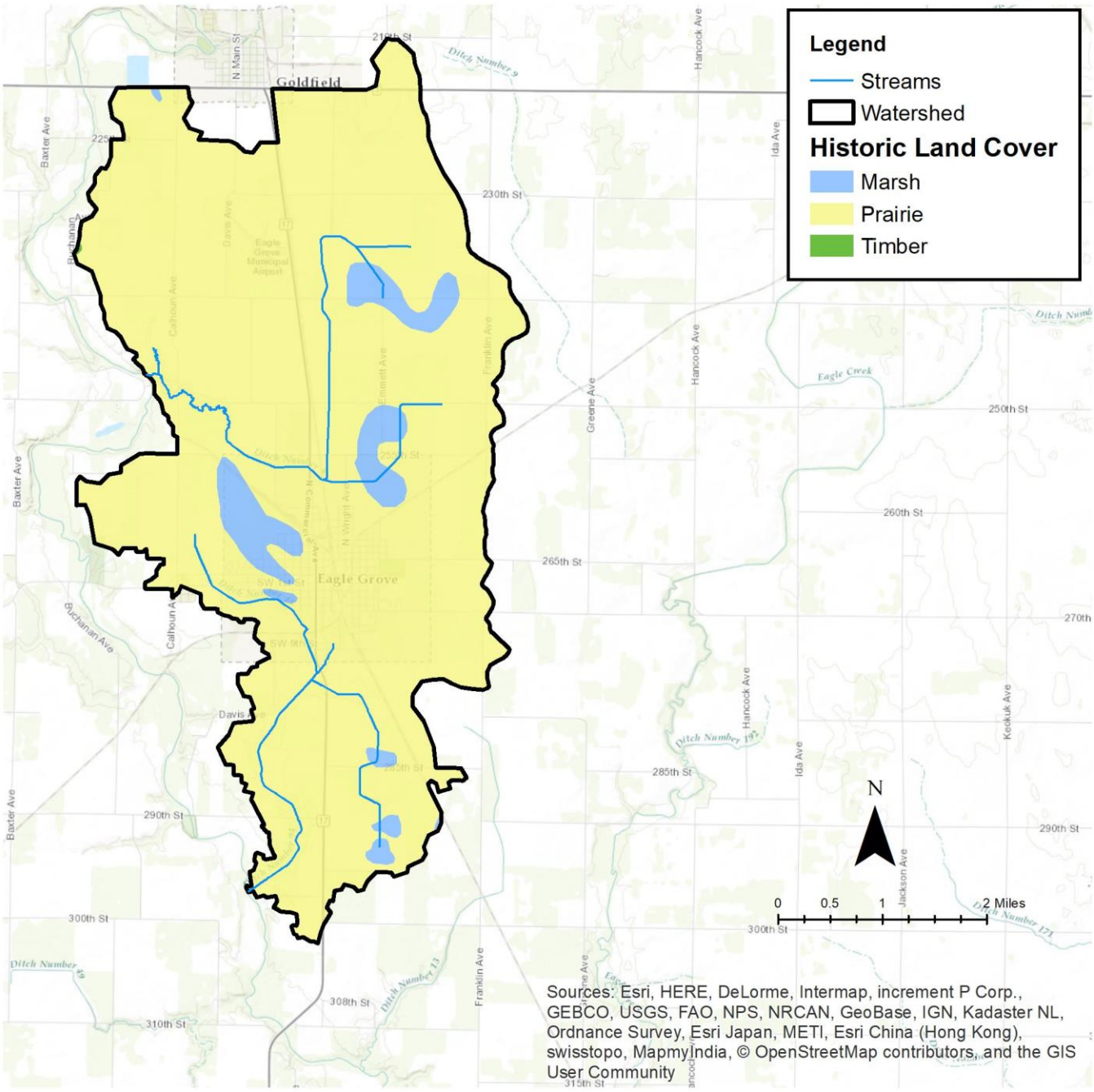


Figure 2.6.1. Pre-settlement land cover in the Eagle Grove watershed according to the GLO survey in the mid-1800s (present day streams).

Recent and current land use practices were assessed using the USDA-National Agricultural Statistics Service (NASS) Cropland Data Layer (CDL) 2003 through 2016 information and high-resolution IDNR data from 2009. Land use trends based on CDL data are shown in Figure 2.6.2. The IDNR land use information was developed from aerial imagery and LiDAR elevation data. A summary of the high-resolution IDNR land use data is presented in Table 2.6.1 and Figure 2.6.3.

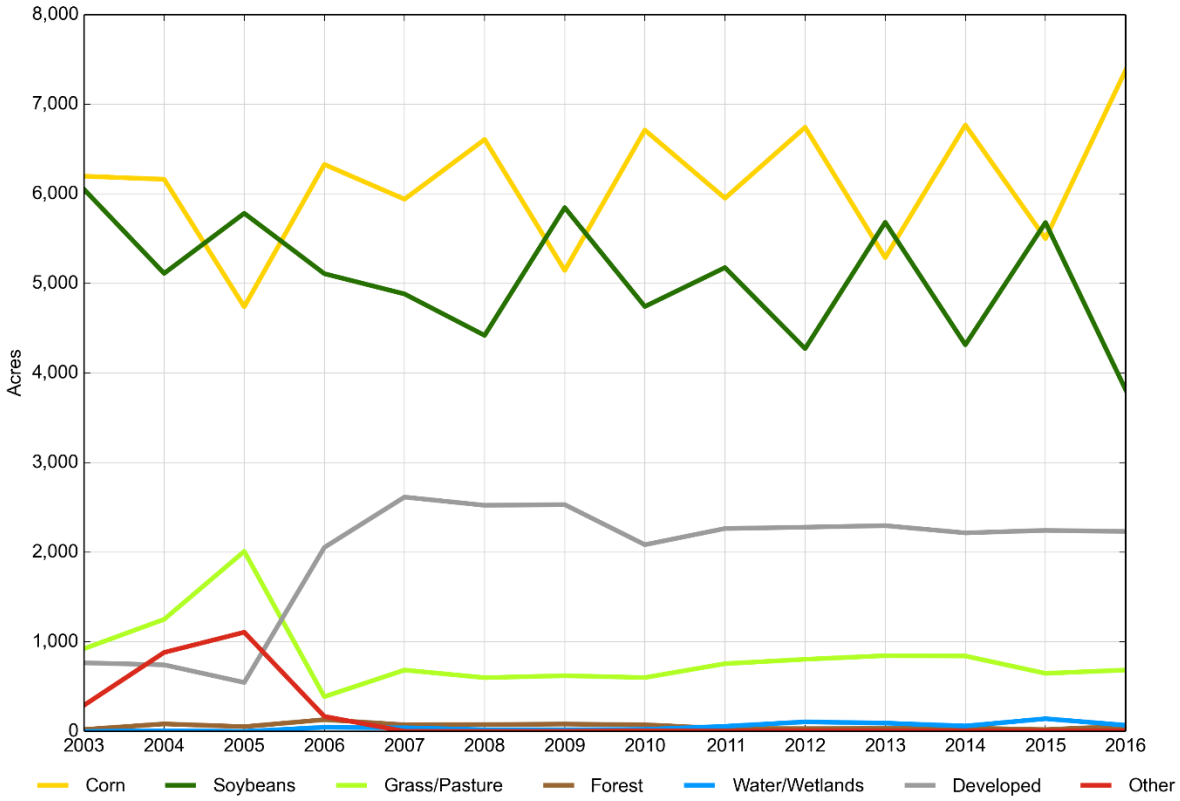


Figure 2.6.2. Eagle Grove watershed 2003 through 2015 land use according to CDL data.

Table 2.6.1. Eagle Grove watershed 2009 high-resolution land use according to IDNR data.

Land Use	Acres	Percent
Water	15.5	0.1%
Wetland	293.8	2.1%
Coniferous Forest	40.2	0.3%
Deciduous Short	40.7	0.3%
Deciduous Medium	151.4	1.1%
Deciduous Tall	153.8	1.1%
Grass 1	788.5	5.5%
Grass 2	765.4	5.4%
Corn	5,539.6	38.9%
Soybeans	5,536.2	38.9%
Barren / Fallow	171.7	1.2%
Structures	121.8	0.8%
Roads / Impervious	597.2	4.2%
Shadow / No Data	24.5	0.2%
Total	**14,240**	

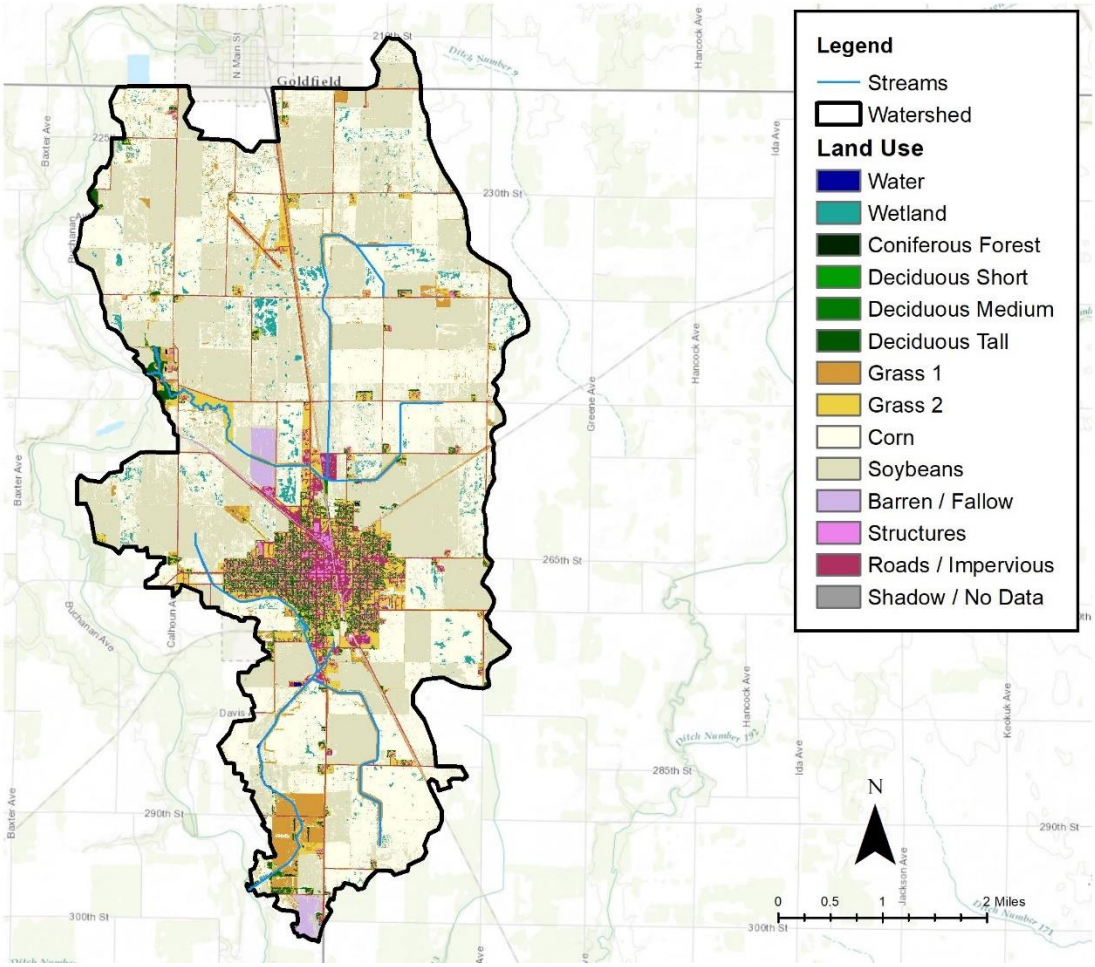


Figure 2.6.3. High-resolution 2009 land use map of the Eagle Grove watershed.

2.7. Population

Eagle Grove is the only incorporated city within the watershed. According to the 2010 census, Eagle Grove had a population of 3,583 people. The estimated population living in the watershed is 3,687, according to the 2010 census. Ninety-seven percent of watershed population lives within the city of Eagle Grove. There are approximately 1,700 housing units within the watershed area.

2.8. Existing Conservation Practices

Cataloging existing conservation infrastructure provides an important assessment of current conditions and is a useful exercise for determining the need for future conservation practice placement. Current conservation practices were assessed and catalogued using aerial photography, watershed surveys and stakeholder knowledge. Determining levels of in-field management practices (e.g., nutrient management, reduced tillage, cover crops) can be difficult, so it is possible that this inventory does not capture all conservation within the watershed. The Eagle Grove watershed contains very few existing water quality or conservation practices. Some perennial cover is present throughout the watershed, but only a couple large tracts of perennial vegetation exist. No known structural water quality practices exist in the watershed, other than a few waterways and terraces. Table 2.8.1 lists all practices and known existing implementation levels within the watershed. Figure 2.8.1 provides a map of existing conservation practices as of 2016.

Table 2.8.1. Inventory of Eagle Grove watershed existing conservation practices as of 2016.

Practice	Quantity
No-till/Strip-till	Minimal
Cover crops	None
Nutrient management	Unknown
Extended rotation	Minimal
CREP wetlands	None
Perennial Cover (Grass)	1,553 acres

2.9. Soil Erosion Assessment

Soil erosion in the Eagle Grove watershed was estimated using factors from the Revised Universal Soil Loss Equation 2 (RUSLE2) for the various combinations of soils and land use within the watershed. RUSLE2 is a computer model used to evaluate the impact of different tillage and cropping systems on sheet and rill erosion. The major RUSLE2 model factors incorporate climate, soils, topography and land management. The interactions between these factors drive the model results, but land use, crop rotation and tillage system have the largest impacts on soil loss estimates. Tillage was assessed via a watershed assessment conducted in the spring of 2017. Based on the RUSLE2 analysis, sheet and rill erosion in the Eagle Grove watershed average 1.9 tons per acre per year. The distribution of soil erosion rates across the watershed is shown in Figure 2.9.1. To put this estimate into context, most soils are assigned a maximum tolerable soil loss rate of 5 tons per acre per year by the NRCS. It is important to note that RUSLE2 estimates do not include any soil loss due to concentrated runoff such as ephemeral or classical gully erosion. However, overall risk for gully erosion within the watershed is low due to the minimally dissected landscape.

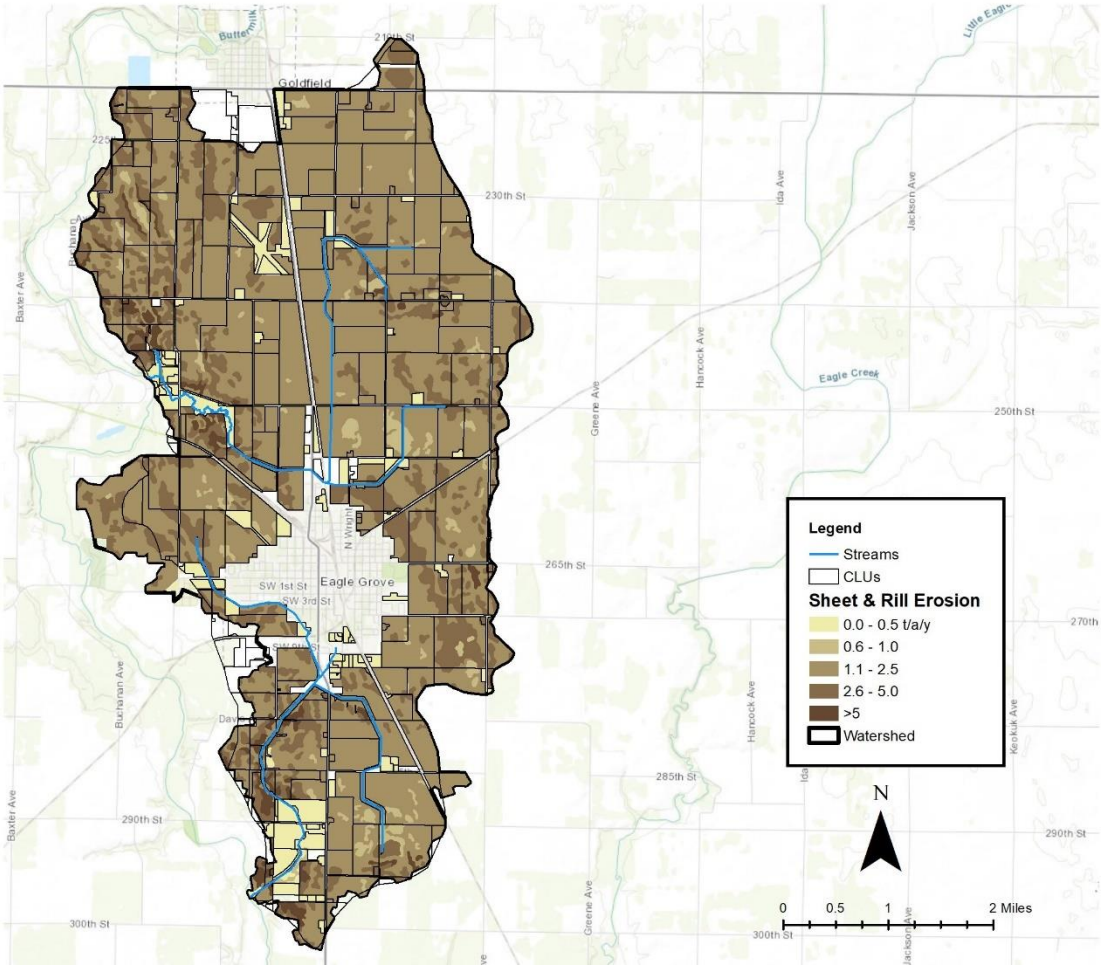


Figure 2.9.1. Estimated sheet and rill erosion rates based on soil types and land use in the Eagle Grove watershed.

Not all sediment that moves small distances due to sheet and rill erosion ultimately leaves the watershed. Total sediment yield from the watershed is influenced by upland soil erosion rates, streambank erosion and the sediment delivery ratio (SDR), which reflects the proportion of sediment that is likely to be transported through and out of the watershed. The SDR depends on watershed size and shape, stream network density and conditions and topography.

3. Water Quality and Conditions

3.1. Water Quality Impairments

The Eagle Grove watershed is a subwatershed of the Boone River Watershed and the larger Des Moines River Watershed (Figure 3.1.1). Downstream of the Eagle Grove watershed, the Boone River and the Des Moines River are listed as impaired on the 2016 Iowa 303(d) Impaired Waters List. The Boone River is impaired due to high levels of indicator bacteria and a pollutant caused fish kill. The Des Moines River is impaired by nitrate and high levels of bacteria. These impairments impact recreational uses and the drinking water source of the city of Des Moines. Due to the nitrate impairment, a Water Quality Improvement Plan (or Total Maximum Daily Load, TMDL) for nitrate was developed by the IDNR and approved by the US Environmental Protection Agency (EPA) in 2009.

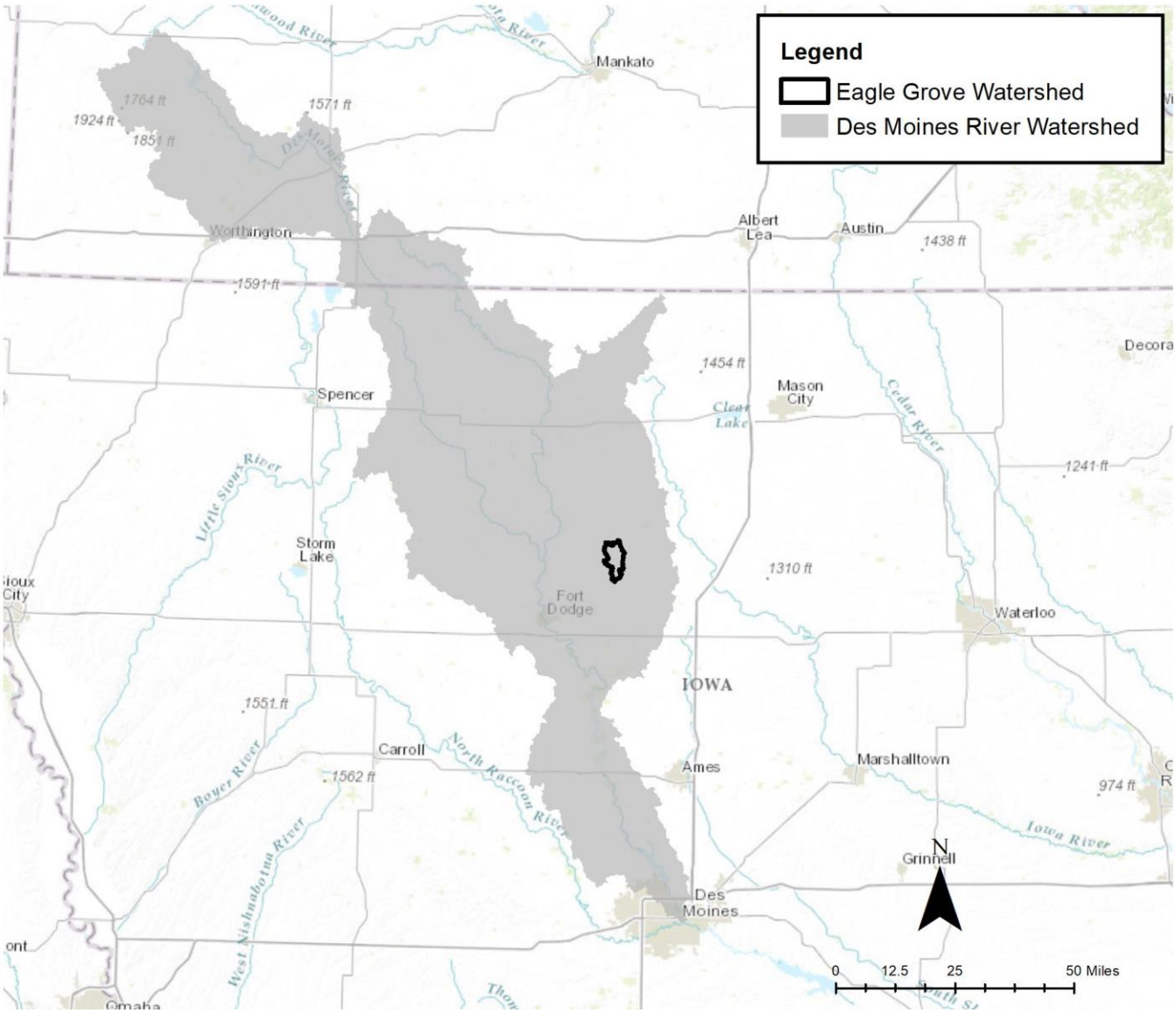


Figure 3.1.1. Location of the Eagle Grove watershed within the Des Moines River Watershed.

The Federal Clean Water Act requires the Iowa Department of Natural Resources (IDNR) to develop Water Quality Improvement Plans for waters that have been identified on the state's 303(d) list as impaired by a pollutant. The 2004 305(b) assessment reported that the designated drinking water use of the Des Moines River from Center Street dam in Des Moines to Interstate 80 bridge (segment 04-UDM-0010_2) was impaired due to nitrate-

nitrogen (nitrate) concentrations. For the impaired segment, the Class C (drinking water) uses were assessed as "not supporting" due to the level of nitrate that exceeds state water quality standards and USEPA maximum contaminant level (MCL). The applicable water quality standard for nitrate is 10 milligrams per liter (mg/l). A Water Quality Improvement Plan has been developed to calculate the maximum allowable nitrate load for the impaired segments of the Des Moines River that will ensure compliance with water quality standards.

Surface water from the Des Moines River is used by the City of Des Moines for drinking water. During the 1995 to 2006 period, nitrate concentrations in the river ranged from 0.5 to 14.5 mg/l and averaged 6.3 mg/l. Concentrations exceeded 10 mg/l approximately 16.4 percent of the time from 1995 to 2006 (719 out of 4382 values). Nitrate concentrations exhibit clear seasonality, with higher concentrations occurring during April, May and June as well as November and December. Nitrate concentrations measured in various large sub-basins in the Des Moines River watershed from 1999 to 2006 indicated substantial variation. Nitrate concentrations exceeded the maximum contamination limit in over 30 percent of the measured values in four basins, whereas nitrate concentrations in the West Fork of the Des Moines River exceeded the MCL only 6.6 percent of the time. Upstream of Saylorville Reservoir, nitrate concentrations exceeded 10 mg/l about 26 percent of the time but downstream of the reservoir, nitrate exceeded 10 mg/l only 16.6 percent of the time. The sources of nitrate can be divided into two major categories, point sources and nonpoint.

The Soil and Water Assessment Tool (SWAT) model was used to evaluate stream flow and pollutant loading patterns in the Des Moines River watershed. The model inputs included climate, topography, land use, soils, feedlots and confinements, manure application areas, wastewater treatment plants and census data. The stream flow and nitrate calibration process was completed by varying several SWAT calibration parameters within their acceptable ranges. There were a total of 173 sub-basins included in the model. Nitrate loss rates in sub-basins varied from less than 5 kilograms per hectare (kg/ha) (0.45 pounds per acre, lb/ac) to more than 20 kg/ha (18 lb/ac) in the Des Moines River watershed. Many subwatersheds of the Boone River showed losses greater than 20 kg/ha (18 lb/ac). Lowest nonpoint source loading rates in subwatershed were mainly located in the central core of the Des Moines River watershed containing the Des Moines River floodplain corridor.

Point sources contribute to 6.4 percent of the total nitrate load and nonpoint sources contribute 93.6 percent of the total nitrate load in the Des Moines River watershed.

The Des Moines River Water Quality Improvement Plan calls for a 34% reduction in nitrate levels in the Des Moines River. This watershed plan, for the Eagle Grove watershed, presents a scenario to meet the goals of the Iowa Nutrient Reduction Strategy, a 41% reduction in nitrates from non-point sources.

3.2. Water Quality

Very little water quality information is available for streams in the Eagle Grove watershed but water quality data is available from the Boone River above and below where the Eagle Grove watershed stream meet the Boone River. A partnership of 13 agricultural retailers known as Agriculture's Clean Water Alliance (ACWA) has monitored water quality in the Raccoon River and Des Moines River watersheds since 1999. Many tributaries to these rivers have been monitored, unfortunately no monitoring has occurred in the Eagle Grove watershed.

Three monitoring locations exist that provide relevant data. One location on the Boone River, BR16, is located upstream of the Eagle Grove watershed at 225th Street. A second site on the Boone River, BR14, is located at 270th Street west of Eagle Grove. This site on the Boone River includes water from the northern portion of the Eagle Grove watershed. A third site on the Boone River, BR11, is down stream of the Eagle Grove watershed at 330th Street west of Woolstock. In addition to water from the Eagle Grove watershed, this site has additional streams contributing water. Figure 3.2.1 shows the average annual nitrate concentrations at the three

monitoring locations. Figure 3.2.2 shows the monthly average nitrate concentrations at the three monitoring locations.

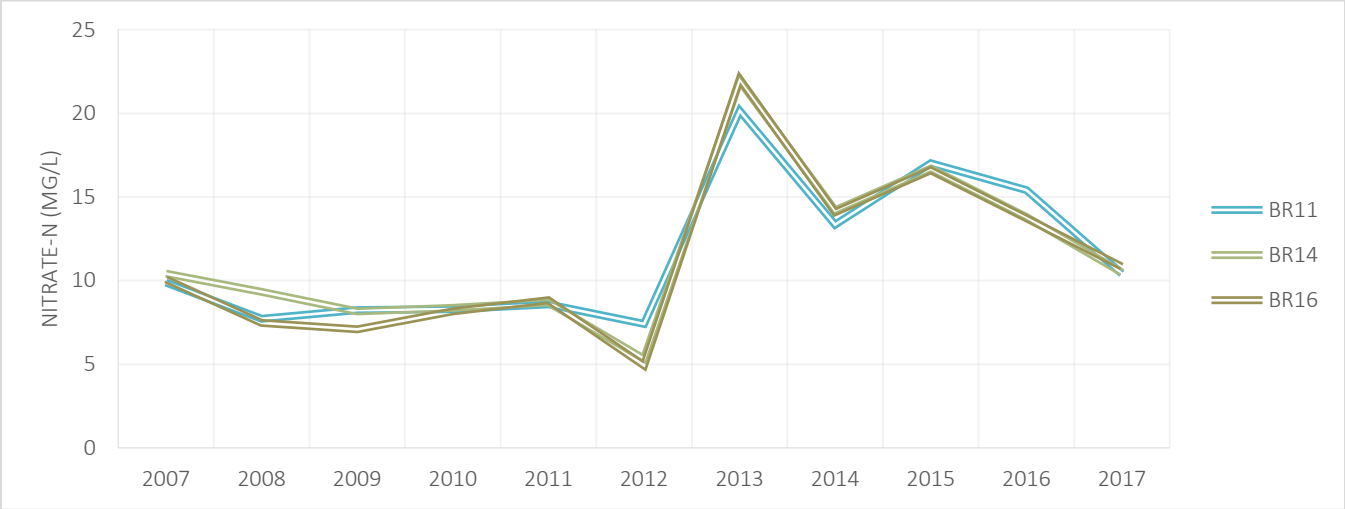


Figure 3.2.1. Average annual nitrate concentration at Boone River water quality monitoring locations.

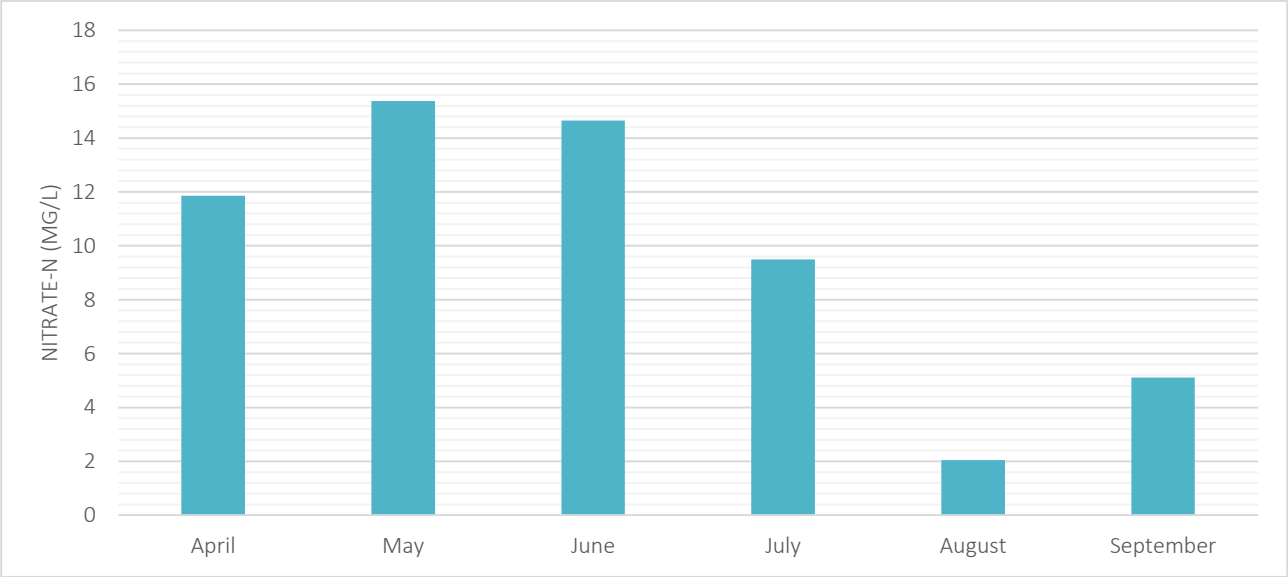


Figure 3.2.2. Boone River Nitrate-N average concentration by month 2007-2017.

3.3. Eagle Grove Watershed Point and Nonpoint Sources

The INRS incorporates both point and nonpoint sources. There are two permitted point sources in the Eagle Grove watershed, the City of Eagle Grove wastewater treatment plant and Ag Processing, Inc. The City Eagle Grove wastewater plant was identified as a priority point source in the INRS. This watershed plan addresses only nonpoint nutrient sources and prioritizes agricultural conservation practices as the best methods to improve water quality in the Eagle Grove watershed. Work is underway to update the Eagle Grove wastewater treatment plan. Those improvements will improve the treatment capability at the plan.

4. Goals and Objectives

This watershed management plan is a guiding document. Water and soil quality will only improve if watershed conservation activities and best management practices (BMPs) are implemented. This will require active engagement of diverse local stakeholders; collaboration of local, state and federal agricultural and conservation agencies; and funding. In addition to BMP implementation, water monitoring should also be increased. Monitoring is a crucial activity to assess the status of water quality goals, standards and designated uses; to determine if water quality is improving, degrading or remaining unchanged; and to assess the effectiveness of implementation activities and the possible need for additional or alternative BMPs.

This plan is designed to be used by local agencies, watershed managers and citizens for decision support and planning purposes. The BMPs listed in this plan represent a suite of tools that will help achieve water quality, soil health, agronomic and socioeconomic goals if appropriately utilized. It is up to all stakeholders to determine exactly how to best implement them. Locally driven efforts have proven to be the most successful in obtaining significant water quality improvements.

Before the watershed plan is implemented the overall goals and objectives must be identified, as they will guide implementation approaches and activities. The goals listed in this plan are not permanent. While the goals and objectives have been developed with input from local stakeholders based on the best information available and the current needs and opportunities for the watershed, changing needs and desires within the watershed, economy or Farm Bill or emerging water and soil quality improvement practices and technologies may mean that these goals and strategies will need to be reevaluated and revised. It is therefore essential to allow for sufficient flexibility to respond to changing needs and conditions while still providing a strong guiding mechanism for future conservation efforts.

The statewide goals of the INRS provided an important starting point for goal development by stakeholders in the Eagle Grove watershed. The INRS is a scientific and technological framework for nutrient reduction in Iowa waters and the Gulf of Mexico from both nonpoint and point nutrient sources. The overall goals of the INRS are to reduce nitrogen and phosphorus loads by 45 percent. The INRS states that nonpoint sources need to reduce nitrogen loading by 41 percent and phosphorus loading by 29 percent in order to achieve overall nutrient reduction goals.

The Nonpoint Source Nutrient Reduction Science Assessment component of the INRS was initiated in 2010 to support development of the INRS approach for nonpoint sources by determining the nitrogen and phosphorus reduction effectiveness of specific practices. The agricultural conservation practices identified in the science assessment were broadly classified as nutrient management, land use change and edge-of-field practices. The science assessment illustrated that a combination of practices will be required to achieve nonpoint source nitrogen and phosphorus load reduction goals. The conceptual plan for the Eagle Grove watershed identified in Section 5 incorporates many of the nonpoint source practices assessed and included in the INRS.

Through the watershed planning process the following goals addressing agriculture, soil and water have been identified:

1. Identify cost effective solutions
2. Provide for profitable and productive agriculture - The Eagle Grove watershed is agricultural. This strong social and economic identity should be sustained and enhanced.
3. Create conditions for healthy soils and water – This plan reduces soil erosion and improves water quality. A nitrogen reduction target of 41% and a 29% reduction in phosphorus are the nonpoint source reduction goals included in the Iowa Nutrient Reduction Strategy.
4. Minimize downstream impacts
5. Work with urban and rural stakeholders to implement

This watershed plan uses 2017/ 2018 as the baseline for conservation practice implementation and determining progress towards reaching goals by 2038. Watershed models were developed to determine the baseline and future nitrogen and phosphorus loads plus associated reductions in the Eagle Grove watershed. Table 4.1 provides estimates of watershed loading rates for the baseline and conditions during and after the implementation of practices identified in this watershed plan. Table 4.2 provides estimates of percent load reduction for each phase relative to the baseline. The phases and associated practices and implementation levels are detailed in Section 6. A practice-based model was used to determine the nitrogen load reductions based on practice nitrate reduction efficiencies from the Iowa Science Assessment of Nonpoint Source Practices to Reduce Nitrogen Transport in the Mississippi River Basin section of the INRS. Soil erosion projections were based on the watershed RUSLE model results. Upland sheet and rill erosion combined with and a Sediment Delivery Ratio was used to estimate total sediment delivery levels and reductions. A phosphorus enrichment ratio of 1.6 pounds of phosphorus per ton of sediment delivery was used to estimate phosphorus loading.

Table 4.1. Estimated current (2018) and future nitrogen and phosphorus export from the Eagle Grove watershed for 5-year phases until full watershed plan implementation anticipated by 2038.

	Units	Baseline conditions	2023 target	2028 target	2033 target	2038 target
Nitrogen load	pounds/year	287,950	248,038	217,511	192,132	169,966
Phosphorus load	pounds/year	1,576	1,377	1,260	1,198	1,124

Table 4.2. Modeled nutrient load reductions from the 2018 baseline in the Eagle Grove watershed for current 2018 conditions and each 5-year phase of watershed plan implementation.

	Units	Baseline conditions	2023 target	2028 target	2033 target	2038 target
Nitrogen load	% reduction	0%	14%	24%	33%	41%
Phosphorus load	% reduction	0%	12.6	20%	24%	29%

5. Conceptual Plan

Best management practices are part of the foundation for achieving water quality, soil health and flood reduction goals. BMPs include practices and programs designed to improve water quality and other natural resource concerns such as changes in land use or management, structural pollutant control and changes in social norms and human behavior pertaining to watershed resources along with their perception and valuation. Efforts are made to encourage long-term BMPs, but this depends upon landscape characteristics, land tenure, commodity prices and other market trends that potentially compete with conservation efforts. With this in mind, it is important to identify all possible BMPs needed to achieve the watershed goals. From an initial list of potential practices, priority practices were identified by narrowing the list to those practices most acceptable to watershed stakeholders. Watershed planning facilitators asked advisory group members to score practices based on the likelihood farmers and landowners in the watershed would implement each practice.

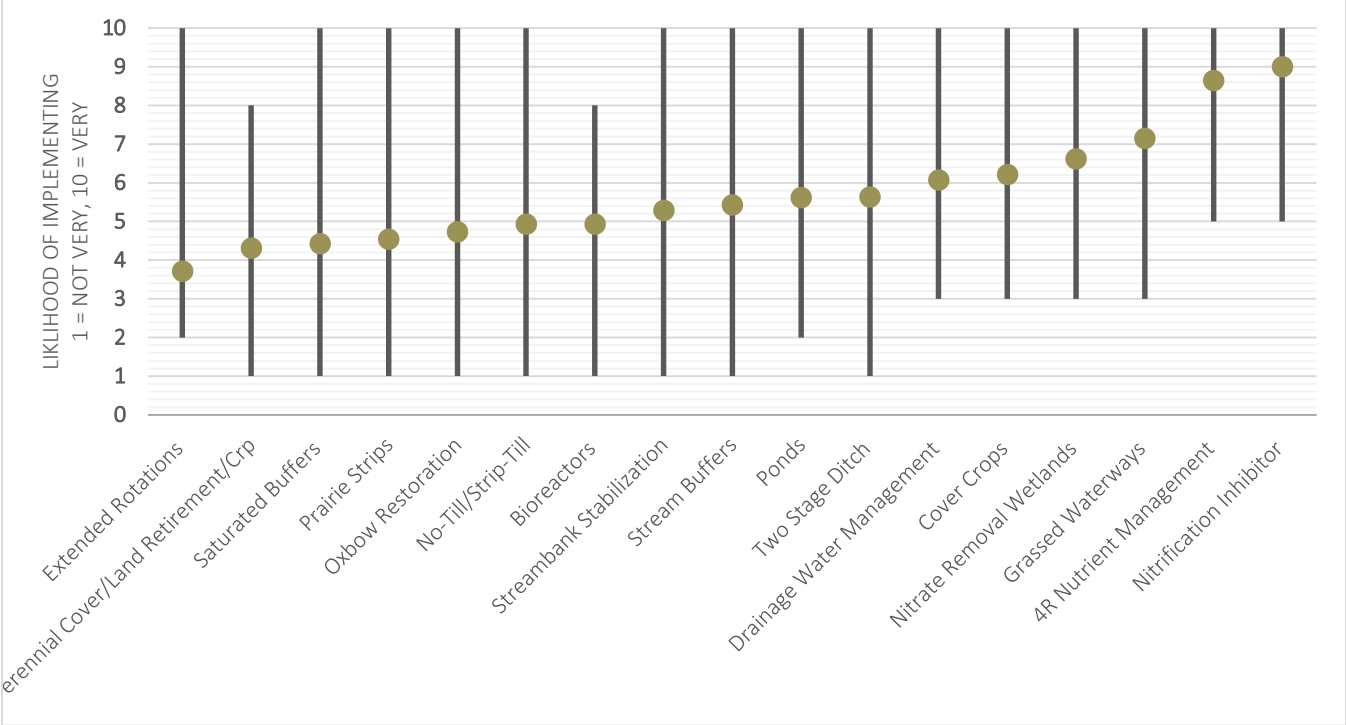


Figure 5.1. Illustration of likelihood of practice implementation.

When selecting and implementing BMPs, it is important to identify if a particular practice is feasible in a given location. Site feature suitability and practice alignment with stakeholder values should be considered. It also is important to determine how effective the practice will be at achieving goals, objectives and targets. Table 5.1 provides a list of BMPs identified by watershed stakeholders and a rating of each practice's efficacy to address identified water and soil goals. While only the practices italicized in Table 5.1 are included in the conceptual plan and nutrient reduction calculations, the other practices will be important to consider when making decisions about water and soil improvement. Figure 5.2 provides a map of a structural and management BMP implementation opportunities identified via watershed modeling. See Appendix A for larger conceptual plan maps.

Table 5.1. Best management practices and relative impact scores (3 = High impact, 2 = Moderate impact, 1 = Low impact, 0 = No impact). Italicized BMPs are those included in the conceptual plan.

	Practice	Soil health	Nitrogen reduction	Phosphorus reduction
In-field	*Nutrient Management - MRTN*	*1*	*1*	*1*
	Nitrification Inhibitor	*0*	*1*	*0*
	Cover Crops	*3*	*3*	*3*
	Perennial Cover	*3*	*3*	*3*
	Extended Rotations	3	2	2
	No-Till/Strip-Till	*3*	*0*	*3*
	Grassed Waterways	1	0	2
	Drainage Water Management	*0*	*3*	*0*
Edge-of-field	*Bioreactors*	*0*	*3*	*1*
	Saturated Buffers	*0*	*3*	*1*
	Buffers	0	1	3
In-stream	Ponds	0	1	3
	Nitrate Removal Wetlands	*0*	*3*	*1*
	Streambank Stabilization	0	0	2
	Two-Stage Ditch	0	1	0

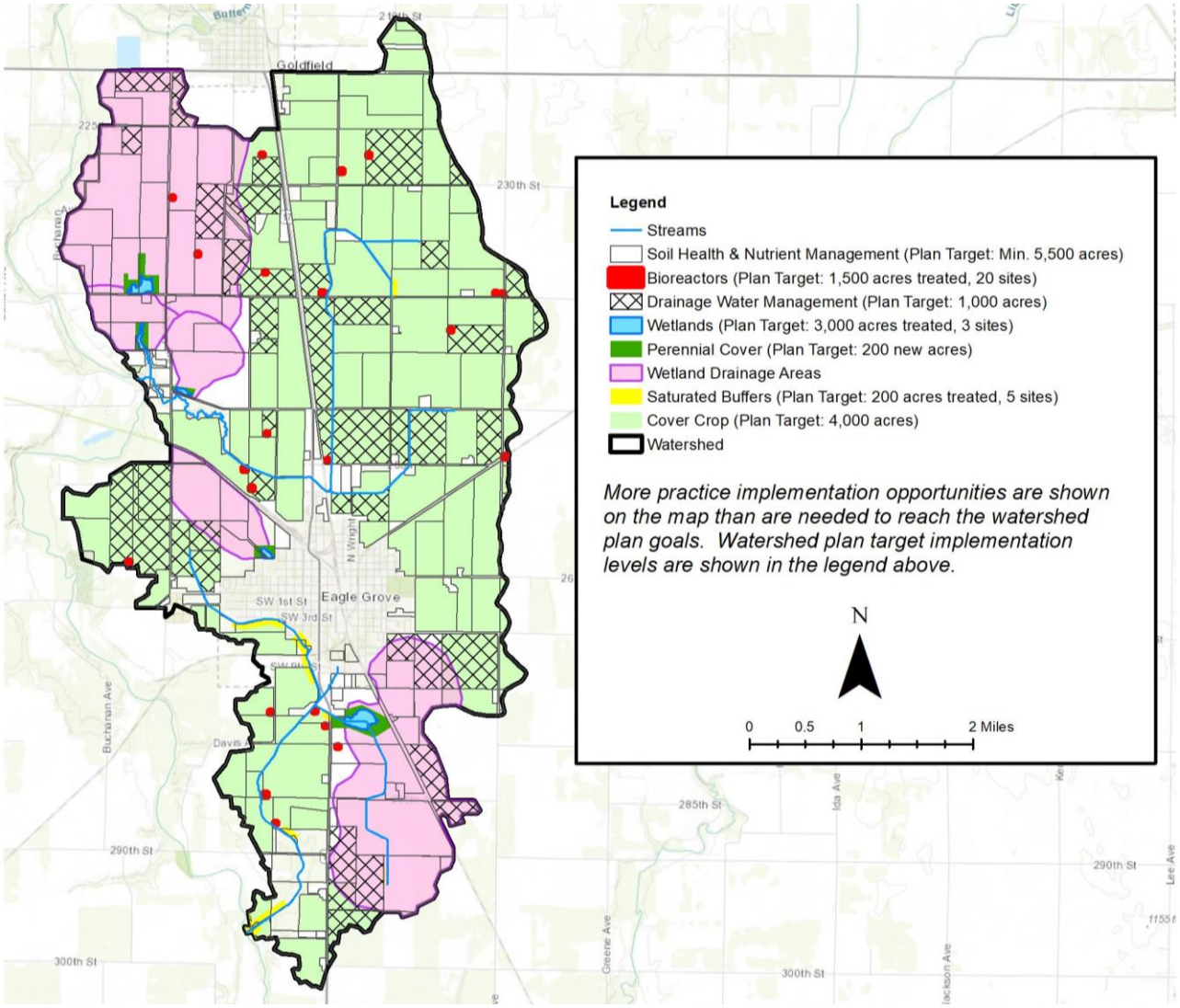


Figure 5.2. Conceptual plan for BMP implementation in the Eagle Grove watershed. Appendix A contains detailed, larger maps.

The BMP opportunities presented in Figure 5.2 6 is one of a variety of potential combinations of BMPs that would allow for this plan's goals to be reached. Deviations from the proposed implementation plan should be made with the knowledge that additional or alternative practices may then be needed in other locations within the watershed to ensure that goals are met. For example, cover crops grown within a wetland drainage area may not result in the same water quality benefit at the watershed outlet as cover crops grown downstream of a wetland.

A team of USDA-Agricultural Research Service scientists have developed the Agricultural Conservation Planning Framework (ACPF) to facilitate the selection and implementation of conservation practices in watersheds with predominately agricultural land use. The ACPF outlines an approach for watershed management and conservation. The framework is conceptually structured as a pyramid (Figure 5.3). This conservation pyramid is built on a foundation of soil health. Management practices that improve soil health like cover cropping and reducing tillage should be promoted and implemented on all cropland within the watershed. The implementation numbers presented in Chapter 6 represent the minimum amount of practices necessary to reach the water quality goals. Additional practice implementation, especially in-field improvements, could provide additional benefits. Following the conservation pyramid concept, structural practices to control and treat water should then

be targeted to specific in-field, edge-of-field and in-stream locations where maximum water quality benefits can be realized.

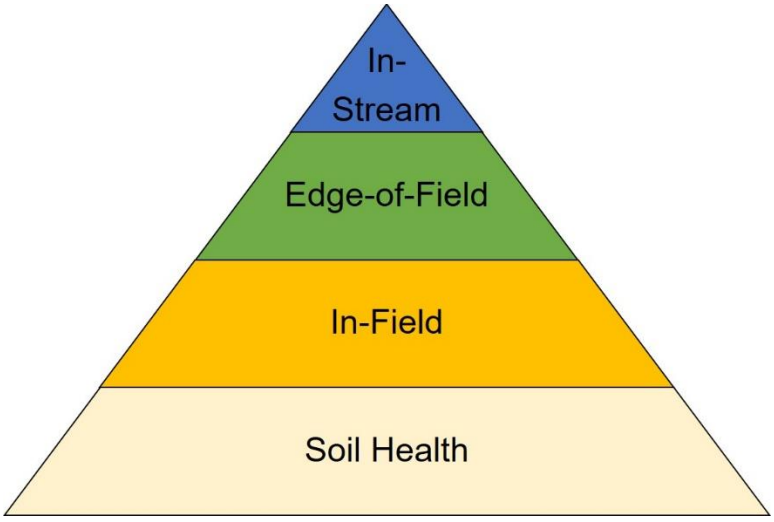


Figure 5.3. The Agricultural Conservation Planning Framework conservation pyramid adapted from the ACPF documentation.

The ACPF includes a mapping toolbox to identify potential locations for conservation practice adoption. Selected results of applying these siting tools to the Eagle Grove watershed have been incorporated into this conceptual plan. Appendix B contains detailed ACPF maps for all potential BMPs within the watershed. The ACPF maps contain many practices in more locations than necessary to achieve water quality goals, so along with the conceptual plan displayed in Figure 5.2 serving as the overarching guide, the ACPF results can be used to adapt practice adoption as needed during the implementation phase of the watershed project.

The practices proposed in this conceptual plan were selected primarily for their soil health and water quality impacts to maintain focus on the watershed plan goals for the Eagle Grove watershed. The recommended practices will mitigate some risk of bacteria transport to streams in the Eagle Grove watershed and the Boone River downstream, but additional practices should be adopted where applicable in order to address the bacteria impairments in the Boone and Des Moines River. Such practices include adhering to manure management plans, maintaining manure applicator certifications, using setback distances for manure application, updating septic systems, constructing monoslope buildings for livestock, maintaining or planting stream buffers, constructing stream crossings for cattle and taking precautions to avoid over-application of manure or equipment failure. Together with the practices identified in the conceptual plan and implementation schedule, these practices should contribute to reduced nutrient and bacteria loads in both streams in the Eagle Grove watershed and the downstream rivers.

6. Implementation Schedule

Implementation schedules are intended to serve as a reference tool to recognize tasks scheduled for the upcoming year and to identify and focus the necessary resources for the current phase of the project. The implementation schedule should be adaptable and updated on a regular basis due to shifting priorities, unexpected delays and new opportunities.

The 20-year phased implementation schedule should be used to set yearly objectives and gauge progress. It should be noted that practices included in the implementation schedule only include those identified to reach the watershed plan goals. Other practices such as structural runoff control (e.g., grassed waterways, contour filter strips), extended rotations, stream buffers and streambank stabilization should be promoted wherever appropriate. Existing perennial cover should be maintained to continue provision of diverse water quality, soil health and wildlife and pollinator habitat benefits.

Table 6.1. Watershed plan implementation schedule separated into four 5-year phases for the Eagle Grove watershed.

Practice	Existing level	Unit	2018-2023 goal	2023-2028 goal	2028-2033 goal	2033-2038 goal	Total watershed plan goal
Cover crops	0	acres	500	500	1,500	1,500	**4,000**
Nutrient management - MRTN	Unknown	acres	500	1500	2,000	1,500	**5,500**
Row Crop -> Perennial cover	1,553	acres	Add 200 acres to existing levels				**1,753**
Drainage water management	0	acres	100	250	400	250	**1,000**
Bioreactors	0	sites	5	5	5	5	**20**
Saturated buffers	0	sites	1	2	1	0	**4**
Nitrate removal wetlands	0	sites	2	1	0	0	**3**

7. Monitoring Plan

Monitoring is an essential component of watershed plan implementation and provides an opportunity to assess progress. Monitoring can come in many different forms including water monitoring, biological surveys, soil and plant tissue sampling as well as social assessments. This section describes recommendations for future monitoring actions to document improvements resulting from watershed plan implementation.

7.1. Stream Monitoring

Perhaps the most important monitoring activity is stream monitoring due to the watershed plan goals of reducing nitrogen and phosphorus loads. Along with modeled nutrient reductions, water monitoring results will be key indicators of water quality improvement in the Eagle Grove watershed. Monitoring data within the watershed is sparse. A small network of stream sites could be established to build a baseline database and track water quality trends as the watershed plan is implemented.

Location information for three potential sites in the watershed where stream water samples may be collected is contained in Table 7.1.1. Additional sites in the watershed may allow for greater precision in water quality analysis and could be used to prioritize subwatersheds for intensified BMP implementation. The three proposed sites and their drainage areas are displayed in Figure 7.1.1.

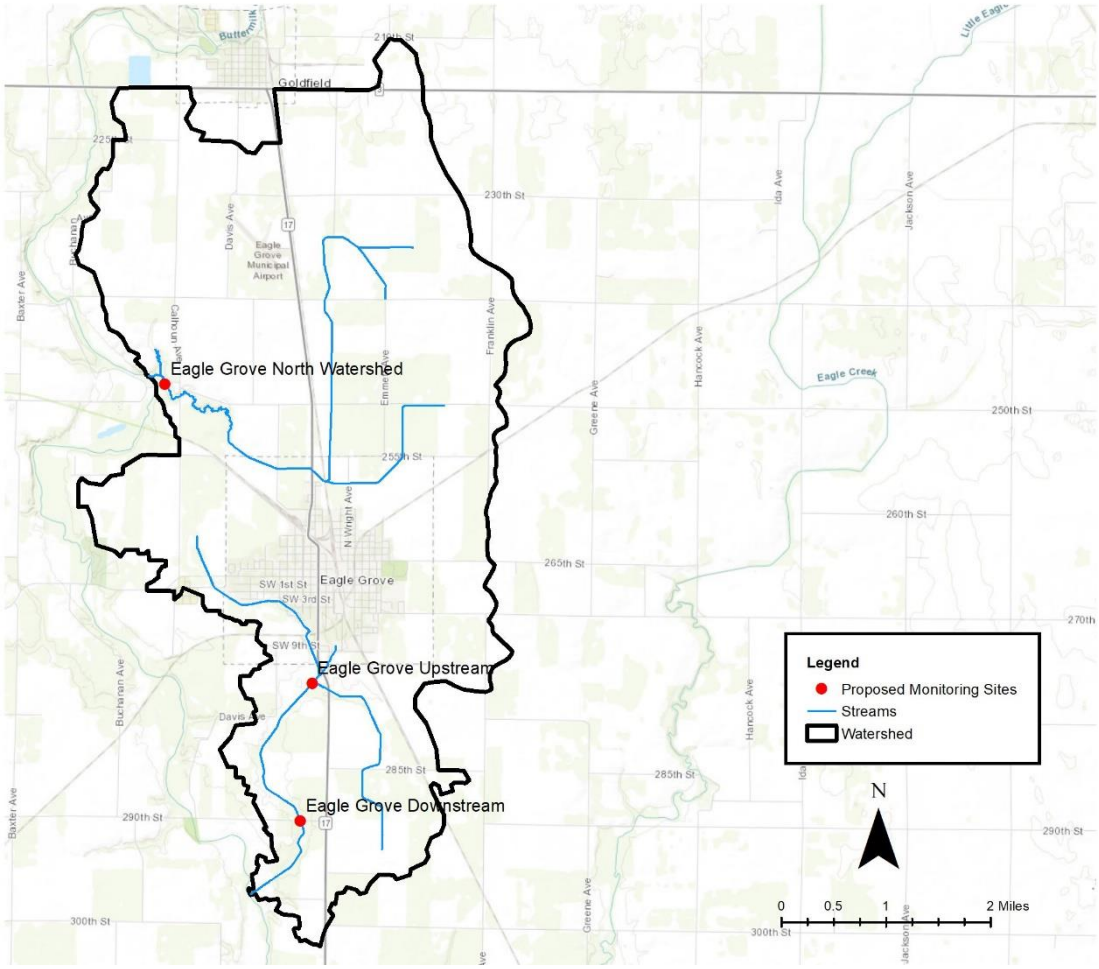


Figure 7.1.1. Potential Eagle Grove watershed stream monitoring sites and subwatersheds.

Table 7.1.1. Location information for a proposed stream water monitoring network within the Eagle Grove watershed.

Site ID	Longitude	Latitude	Notes
Eagle Grove Downstream	-93.9074	42.6303	Downstream of wastewater outfall
Eagle Grove North Watershed	-93.9337	42.6906	Water from northern portion of the watershed
Eagle Grove Upstream	-93.9055	42.6493	Upstream of wastewater outfall

This monitoring site network would allow for consistent water quality information to be gathered throughout the entire watershed. Ideally, bi-weekly samples should be collected beginning in April and extending through October. At a minimum, the samples should be analyzed for nitrate, phosphorus and sediment.

In addition to water grab sampling, stream discharge also should be recorded in order to determine nitrogen, phosphorus and sediment loading. One method to capture stream discharge is to measure the stream stage and use a hydrograph to calculate discharge. The US Geological Survey (USGS) Water Science School provides an overview of this process.

7.2. Biological Monitoring

In addition to chemical and physical indicators of water quality, the biological community of a stream reflects its overall health. Surveys of benthic macroinvertebrate species in streams are excellent biological indicators of water quality. More diverse communities and presence of sensitive species reflect good quality streams. The IOWATER program provides protocols and recommendations for assessing the stream biological community in its Biological Monitoring Manual. Existing biological monitoring data are stored in the IDNR BioNet database.

7.3. Field Scale Water Monitoring

In addition to monitoring streams in the Eagle Grove watershed, water quality monitoring at finer scales should be conducted to assess the effectiveness of individual conservation practice installations. Water samples at this scale should be collected from either tile water exiting subsurface drainage systems or surface runoff from a targeted area. Monitoring surface runoff is difficult because runoff events are episodic and often missed via regularly scheduled monitoring programs. Tile water monitoring is easier because tiles tend to flow more consistently. However, monitoring tile water may only provide data on nitrate loss because the majority of phosphorus and sediment loss occurs via surface runoff.

Tile monitoring should be targeted to drainage systems that drain a single field to allow for changes in management practices to be isolated and detectable. Tile outlets that are easily accessible and provide the opportunity to capture sufficient tile flow should be selected for monitoring. Flow volume from tiles can be calculated by measuring the time needed to fill a container of known volume or by using flow sensors such as pressure transducers. Tile flow, nutrient concentration and tile system drainage area can be used to calculate the nutrient loading rate (e.g., pounds of nitrate loss per acre per year) at a tile outlet.

7.4. Soil Sampling

Agricultural soils contain many nutrients, especially where fertilizer or manure have been applied. At a minimum, soil samples should be analyzed for phosphorus, potassium, nitrogen and organic matter, which affects nutrient cycling. Improved soil fertility data will better inform nutrient management, which can result in the multiple benefit scenario of increased profitability and decreased nutrient export due to improved nutrient application. Additionally, collection of soil samples in coordination with field scale water monitoring could improve

understanding of the relationship between nutrient management practices, soil fertility, soil health and water quality. Soil samples should be collected for multiple years, particularly if agronomic management practices are altered or in-field conservation practices such as cover crops, are implemented. In-season soil nitrate testing can be used to inform adaptive nutrient management practices with the goals of improving agronomic production and reducing nutrient losses. Tests to measure soil health and biological activity also could be utilized to quantify additional benefits of management practices that build soil health like no-till and cover crops.

7.5. Plant Tissue Sampling

The end-of-season corn stalk nitrate test is a tool used to evaluate the availability of nitrogen to the corn crop. Nitrate concentrations measured from stalk sections for the lower portion of a corn plant taken after the plant reaches maturity are indicative of nitrogen available to the plant. The corn plant will move available nitrogen to the grain first. By measuring the amount of nitrogen left after grain fill, a determination can be made as to how much nitrogen was left in the plant relative to what was needed for optimal grain yield. This is a very basic and easy management evaluation tool. It should be noted the test is a point in time and producers should collect samples over multiple years to account for weather and seasonal variations before modifying operations.

7.6. Social Surveys

Biophysical assessments are useful benchmarks of natural resource quality, but conservation practices only will be adopted and implemented in the Eagle Grove watershed if local stakeholders recognize and value the necessary alignment of BMPs with both individual farming operations and broader watershed goals. Surveys are one tool that should be used to periodically assess awareness and attitudes regarding the general issue of water quality and the goals of this watershed plan. For example, a detailed survey could be conducted during or after each 5-year phase of the implementation schedule (Table 6.1). Results could be used to modify approaches as needed during the subsequent 5-year implementation phase. Surveys also could be paired with specific educational events like field days to assess the effectiveness of different outreach formats, which could improve information and education strategies as the project proceeds.

8. Information and Education Plan

Behavior patterns of all stakeholders, and especially producers and landowners, must be considered in both BMP design and implementation strategies for water quality projects. To affect changes in behavior, goal-based outreach that addresses the actual and defined needs of key stakeholders is critical. It will also be important to leverage preexisting relationships and previous successes to build a community of support and knowledge around producers and landowners who will actively be adjusting their operations. Many obstacles to the adoption of conservation practices may be overcome by providing adequate education and outreach regarding how land management practices influence nonpoint source pollutant losses to surface water resources. Knowledge increases awareness, which may then motivate changes in behavior.

As with any watershed project, a goal-based outreach plan will need to be designed to facilitate the goals set by stakeholders and to support the timeline defined in this watershed plan. With a 20-year implementation schedule, progress can be hindered if expectations are not managed both initially and throughout the project. First, awareness and participation should be raised among farmers, landowners and conservation experts to build community confidence that action is being taken. Next, the broader community should be invited to learn about and participate in the watershed project. The following tables summarize an information and education approach, outreach tools and potential partners. Potential project partners and media outlets were identified by during the watershed planning process.

Table 8.1. Components of the information and education plan.

Goal	Increase awareness and adoption of practices to achieve watershed social, land and water goals.
Target audiences	Primary: Producers, landowners and technical experts. Secondary: Residents, educators, students, others.
Messages	Need to be tailored for farmer engagement, public, decision makers and media. Different audiences respond differently to specific messages, so an outreach plan that incorporates an understanding of what motivates each audience to engage will help the project be successful.

Table 8.2. Outreach strategies and tools.

Logo and other branding	Stream signs	Coffee shop fliers
Website and social media	Conservation practice signs	Conservation icons or graphics
Fact sheets	IOWATER volunteer workshops	Guest speakers at other events
Direct mailings	Youth outdoor learning	
Demonstration field days	Urban/ag learning exchanges	
Watershed boundary signs	Stream cleanup events	

Table 8.3. Potential project partners, contacts and local media.

Potential project partners	Wright Soil and Water Conservation District Commissioners Gold-Eagle Cooperative Iowa Agriculture Water Alliance Iowa Department of Natural Resources Iowa Farm Bureau Federation Iowa Pork Producers Association Iowa Soybean Association Iowa State University Extension Cities of Eagle Grove USDA-Agricultural Research Service USDA-Natural Resources Conservation Service Iowa Corn Growers Association The Nature Conservancy
Other government, agriculture & outdoor groups	Youth educational groups Ducks Unlimited Pheasants Forever Iowa Natural Heritage Foundation Wright County Board of Supervisors Wright County Conservation Board County Drainage Districts
Media	The Eagle Grove Eagle The Wright County Monitor Des Moines Register Farm Bureau Spokesman WHO 1040 AM Des Moines KIAQ FM 96.9 FM Clarion KJYL 100.7 FM Eagle Grove

9. Evaluation Plan

Project evaluation and recognition of successes and challenges is a critically important step in implementing any watershed plan. This section lays out a self-evaluation process for project partners to gauge project progress in four categories: project administration, attitudes and awareness, performance and results. These four indicator categories are described in the following sections. A project evaluation worksheet can be found in Appendix C.

9.1. Project Administration

- Yearly partner review meeting. Watershed project partners should host an annual review meeting. This will provide an opportunity to evaluate project progress using an evaluation matrix.
- Quarterly project partner update. Each quarter, project leadership should ensure project goals and objectives are being accomplished, plan logistics and coordinate field days, events and monitoring.

9.2. Attitudes and Awareness

- Farmer and landowner surveys. Periodically a survey should be conducted with a statistically valid sample of farmers and landowners in the watershed. Results of the surveys should be used to determine changes in attitudes and behaviors.
- Field day attendance. Field days are an important outreach component of watershed projects. To gauge the impact of the field days, a short survey should be administered at the conclusion of each field day. The goal of the surveys will be to determine if understanding or attitudes were changed or practices have been or will be adopted as a result of the field day events.
- Regional and statewide media awareness. Media awareness and promotion of the project should be tracked by collecting and cataloging all articles and stories related to the project.

9.3. Performance

- Practice adoption. Locations of implemented practices should be tracked over the life of the project. Practice adoption rates will be aggregated to the watershed scale and reported to partners.
- Practice retention. Retention of management practices, such as cover crops, should be emphasized. Yearly follow-up with farmers implementing practices will help gauge practice retention trends.

9.4. Results

- Practice scale monitoring. Tile water or edge-of-field monitoring results should be used to gauge water quality improvements at the field scale. Individual results should be provided to farmer participants. All monitoring data should be aggregated to the watershed scale and shared with other famers, landowners and partners. This aggregated data also may be used in a publication to bring broader recognition to local and other Iowa water quality efforts.
- Stream scale monitoring. In-stream water monitoring sites should be used to determine if long-term water quality improvements are being realized. Year to year improvements will likely be undetectable but long-term progress on the order of 10 years or more may be measurable if significant practice implementation occurs in the watershed.
- Soil and agronomic tests. Scientifically valid methods should be used to determine soil and agronomic impacts of practice adoption. These results will be shared with farmer participants. All soil and agronomic results should be aggregated to the watershed scale and shared with other farmers, landowners and partners.
- Modeled improvements. The project should work with appropriate groups or individuals to estimate soil and water improvements resulting from practice implementation.

10. Estimated Resource Needs

An estimate of resource needs is crucial to maintain current financial support and to gain support from potential funding sources. Table 10.1 provides an estimate of the total cost to implement conservation practices identified in this plan. Annual BMP implementation costs are estimated to be a minimum of $232,500 per year and initial structural costs are estimated to be $2,104,999. Some practices, such as nutrient management, reduced tillage and cover crops, may result in long-term cost savings to farmers and landowners. Therefore, cost-share or incentive payment rates may need to be evaluated during the implementation phase of this plan. These cost estimates are in 2018 dollars; so actual water quality investment needs likely will be higher due to inflation.

Table 10.1. Estimated resource needs (in 2018 dollars) to reach the Eagle Grove watershed BMP implementation level goals.

	Practice	Watershed plan goal	Unit	Cost per unit	Total cost
Annual costs	Cover crops	4,000	acres	$50	$200,000
	Nutrient management - MRTN	5,500	acres	($5)	($27,500)
	Conversion of Cropland to Perennial Cover	200	acres	$300	$60,000
Initial costs	Drainage water management (50-year life)	1,000	acres	$1,000	$1,000,000
	Bioreactors (15-year life)	20	structures	$12,000	$240,000
	Saturated buffers (75-year life)	5	structures	$3,000	$15,000
	Nitrate removal wetlands (75-year life)	3	sites	$283,333	$849,999

Cover crop costs include seed, labor and termination cost estimates from Iowa State University Extension and Outreach Ag Decision Maker tools. Nutrient management, which includes application of nitrogen at the maximum return to nitrogen (MRTN) rate and phosphorus and potassium application tailored to site specific soil fertility and crop nutrient uptake, can result in decreased nutrient application or improved crop utilization and therefore a net economic benefit (negative cost). The estimated perennial cover annual cost is the watershed weighted average Conservation Reserve Program (CRP) soil rental rate. Costs for drainage water management, bioreactors and saturated buffers are based on typical total installation costs but can vary depending on timing, material availability and contractor experience. Nitrate removal wetland costs were estimated from Iowa CREP data.

The initial investment needed to construct all proposed structural practices (drainage water management, bioreactors, saturated buffers and wetlands) is estimated at $2,104,999. Annual investments are necessary to increase and maintain adoption and implementation of management practices (cover crops, nutrient management, and perennial cover). The estimated yearly total for these practices fully implemented is $232,500 per year. Cost-share payments may not be permanently available, so alternative funding sources for management practices may need to be pursued or developed or individuals may need to realize the long-term economic and environmental value of such practices to justify costs. For example, cover crop cost estimates do not account for improved soil health and nutrient use efficiency and associated short- and long-term benefits. The dollars necessary to fund structural and management practices could come from many different sources including farmers and landowners, downstream municipalities, other local or regional stakeholders and conservation organizations.

Additional costs associated with watershed improvement are necessary to fund salary, benefits and training for project administrators; information and education supplies and events; monitoring activities; and office space, computer, phone and vehicle.

11. Funding Opportunities and Approaches

To achieve the goals of this watershed plan, significant resources will be needed. Current funding mechanisms provided by local, state and federal units of government may not be adequate to address all goals outlined in this plan, so creative approaches to secure sustainable funding may be needed. Appendix D provides a listing of current local, state and federal programs and grants that may be able to provide resources for plan implementation. The following list provides ideas to leverage nontraditional resources. Further research is needed to determine feasibility.

- Locally organized cover crop seeding programs. Farmers and landowners are often busy with harvest during the prime cover crop seeding time period. To simplify cover crop adoption, cover crop seeding programs could be developed at the SWCD, County Conservation Board or local farm cooperatives. For example, the Mitchell SWCD has developed a "One Stop Cover Crop Shop" program to facilitate and expedite the cover crops cost-share application, planning and planting process for farmers.
- Local cover crop seed production. Access to and cost of cover crop seed may become problematic as adoption of cover crops increases in Iowa and the Upper Mississippi River Basin. A solution to this problem is to promote local production of cover crop seed, such as cereal rye. Typical yield of rye is 30 to 50 bushels per acre, so a seeding rate of 1.5 bushels per acre means that every acre of rye grown for seed would allow a rye cover crop to be planted on 20 to 33 acres of row crop land. To avoid taking productive land out of corn and soybean production, rye plantings could be targeted to marginal soils or lands.
- Conservation addendums to agricultural leases. More than half of Iowa's farmland is cash rented or crop shared, and an increase in this trend presents issues for ensuring proper conservation measures are in place on Iowa farms. Conservation addendums may be a way to ensure both the landowner and the tenant agree on conservation. Addendums could include any conservation measure, but the practices included in this plan would be of most benefit. A standard conservation addendum could be developed and shared with all absentee landowners in the Eagle Grove watershed.
- Conservation easements. Land easements have proven successful in preservation of conservation and recreation land in Iowa (e.g., Iowa Natural Heritage Foundation, Wetland Reserve Enhancement Program). Some landowners may be interested in protecting sensitive land for extended periods of time or into perpetuity. For these landowners, long-term conservation easements may be a good fit.
- Nontraditional watershed partners. Traditional watershed partners (e.g., IDALS, IDNR, SWCD, NRCS) likely will not have the financial resources to fully implement this plan, so local project partners should seek nontraditional partners to assist with project promotion and funding. Involvement could be in the form of cash or in-kind donations.
- Nutrient trading. Water quality trading programs are market-based programs involving the exchange of pollutant allocations between sources within a watershed. The most common form of trading occurs when trading nutrient credits between point and nonpoint sources. Trading programs could be established to trade nutrient credits. Trading within the larger Raccoon River Watershed may be appropriate to increase potential nutrient trading partners.
- Recreational leases. Recreational leases, such as hunting leases, may be promoted as a tool to increase landowner revenue generated from conservation lands, particularly those in perennial cover such as wetlands or grasslands.
- Equipment rental programs. Farmers are often hesitant to invest in new conservation technologies that require new equipment or implements. Project partners could invest in conservation equipment, such as a strip-till bar or cover crop drill, and then rent the equipment to interested farmers. In addition to building community support for the watershed project, such cooperation can lower overall practice costs.
- Reverse auctions. Reverse auctions, or pay for performance programs, can be a cost-effective way to allocate conservation funding. In some watersheds where reverse auctions have been used, the environmental benefits per dollar spent have been significantly more efficient than traditional cost-share programs such as the USDA-NRCS Environmental Quality Incentives Program (EQIP). In a reverse auction,

landowners or farmers compete to provide a service (or conservation practice) to a single buyer (e.g., SWCD). All bids are analyzed for their environmental benefits and the organizer (e.g., SWCD) begins providing funds to the most efficient bids (environmental benefit per dollar) until all available resources have been allocated.

- Watershed organization. Often the most successful watershed projects are led by formal watershed organizations. Groups can be formed via a nonprofit organization, 28E intergovernmental agreement, Watershed Management Authority or other agreement or organization. Most watershed projects have significant partner involvement, each with an existing mission or goal. A watershed organization with a dedicated mission to improve land and water quality in the Eagle Grove watershed may prove to be more successful than existing groups working together without formal organization. If established, a local watershed organization should convene regularly to evaluate progress, strategize and set specific work plans to ensure progress is made towards the 2038 watershed plan goals.
- Subfield profit analysis. Farmers understand some locations within a field produce higher yields and profits, so analyzing the distribution of long-term profitability within fields may be an important selling point for conservation. Technology to analyze profitability within crop fields is available and has been used in Iowa. Incorporating profitability analysis into conservation planning could result in higher profit margins and increased conservation opportunities on land that consistently yields zero or lost revenue.

12. Roles and Responsibilities

Watershed improvement is an ambitious undertaking that requires commitment, collaboration and coordination among multiple entities. Clearly defined roles and duties can facilitate task assignments and improve the efficiency and effectiveness of the watershed project. The following list describes the general responsibilities of various groups in the Eagle Grove watershed.

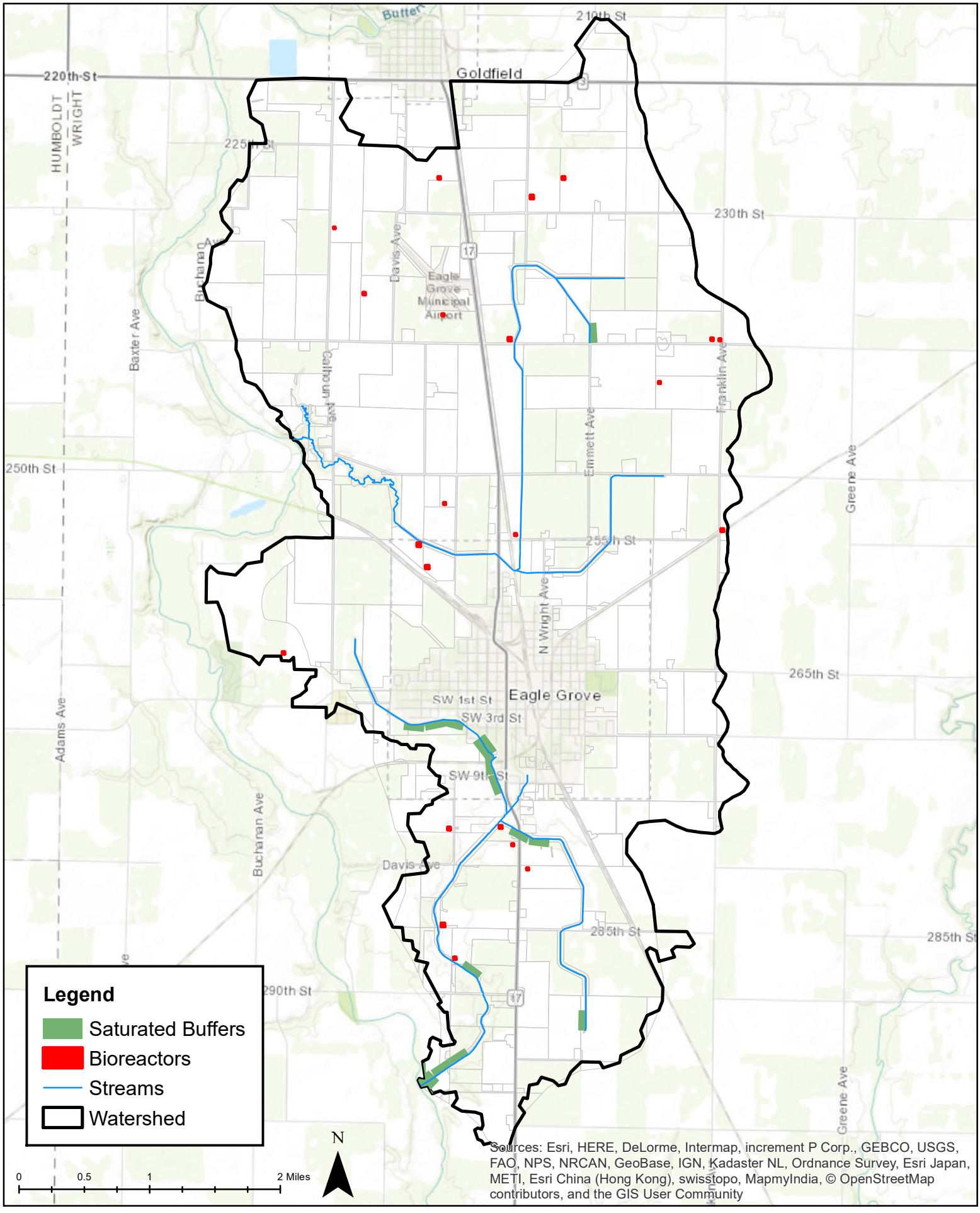
- Farmers. Engage with watershed plan implementation; farm, field and subfield evaluation; conservation practice implementation; and knowledge sharing.
- Landowners. Engage with tenants on conservation planning, incorporation of conservation addendums to lease agreements and conservation practice implementation.
- City of Eagle Grove: Secure funding, likely via a Sponsored Project, to support conservation practice implementation in both the urban and agricultural areas of the watershed area. Promote opportunities to farmers and landowners.
- Soil and Water Conservation District commissioners. Provide project leadership, participate in project meetings and events, hire staff, advocate for project goals and promote project locally and regionally.
- Natural Resources Conservation Service. Provide conservation practice design and engineering services, project partnership, house project staff and provide office space, computer, phone and vehicle.
- Iowa Department of Agriculture and Land Stewardship. Provide technical support to project, provide the opportunity to receive state funding for soil and water conservation and provide a contact for the Iowa CREP program.
- Iowa Department of Natural Resources. Provide technical assistance and advice and water quality monitoring as necessary.
- Dallas County Conservation Board. Provide project partnership, easement management and public education.
- Wright County supervisors. Engage with project to determine and pursue mutual benefits. Integrate Wright County Sponsored Project into watershed plan implementation.
- Agribusinesses. Engage project partners and promote project goals and opportunities to members and customers.
- Commodity groups. Engage project partners, promote project goals and opportunities to members and provide agronomic and environmental services as appropriate.
- Conservation groups. Engage project partners, provide planning services and promote practices that have habitat and water quality benefits.
- Media. Develop stories related to the watershed project and maintain contact with local sources of information.
- Engineering Consultants: Provide survey, design and construction support for practices implemented with the City of Eagle Grove.

Appendix A

Conceptual Plan Maps

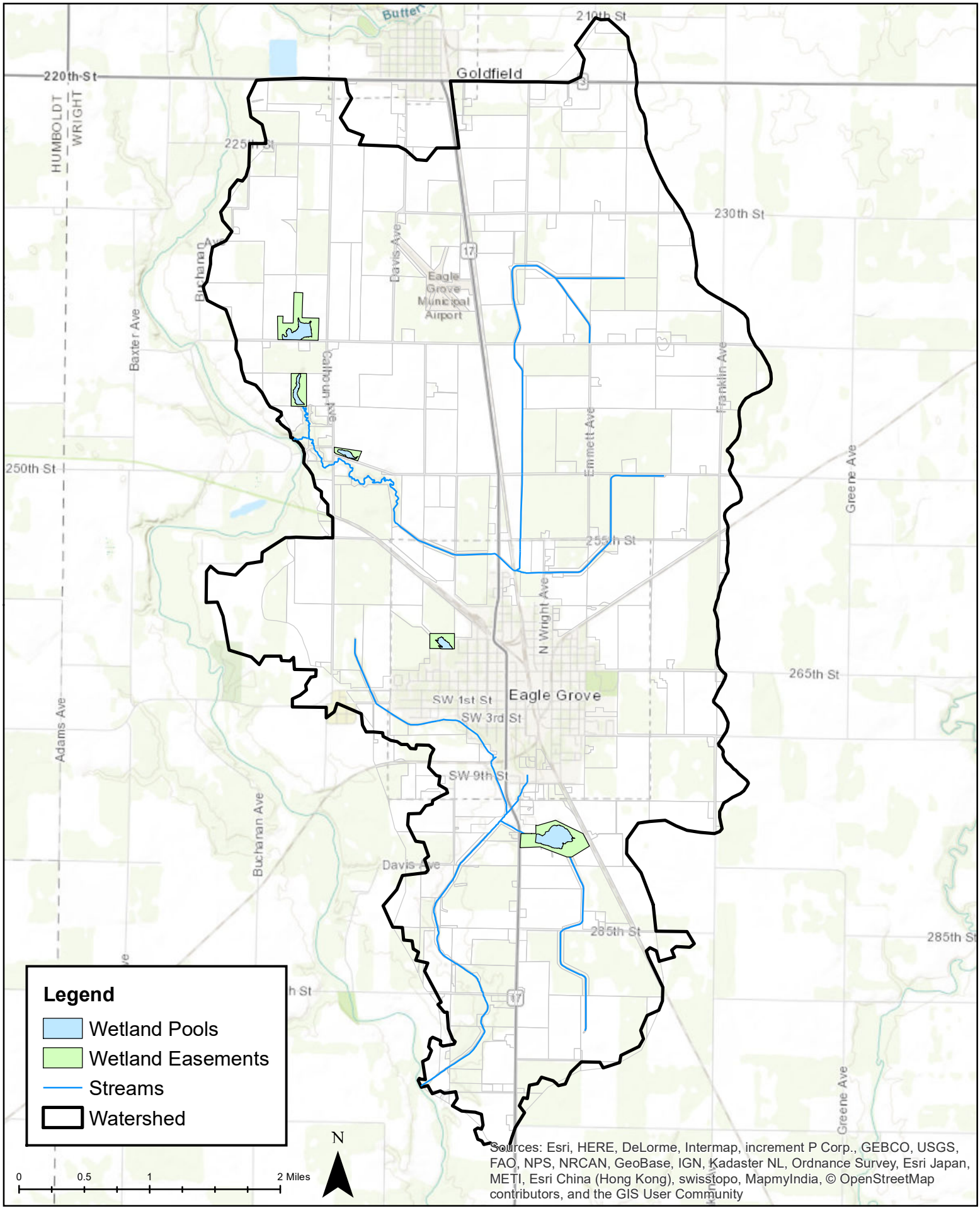
Bioreactors & Saturated Buffers

Watershed plan goal is 20 bioreactors and 5 saturated buffers. More opportunites may exist than shown on map.



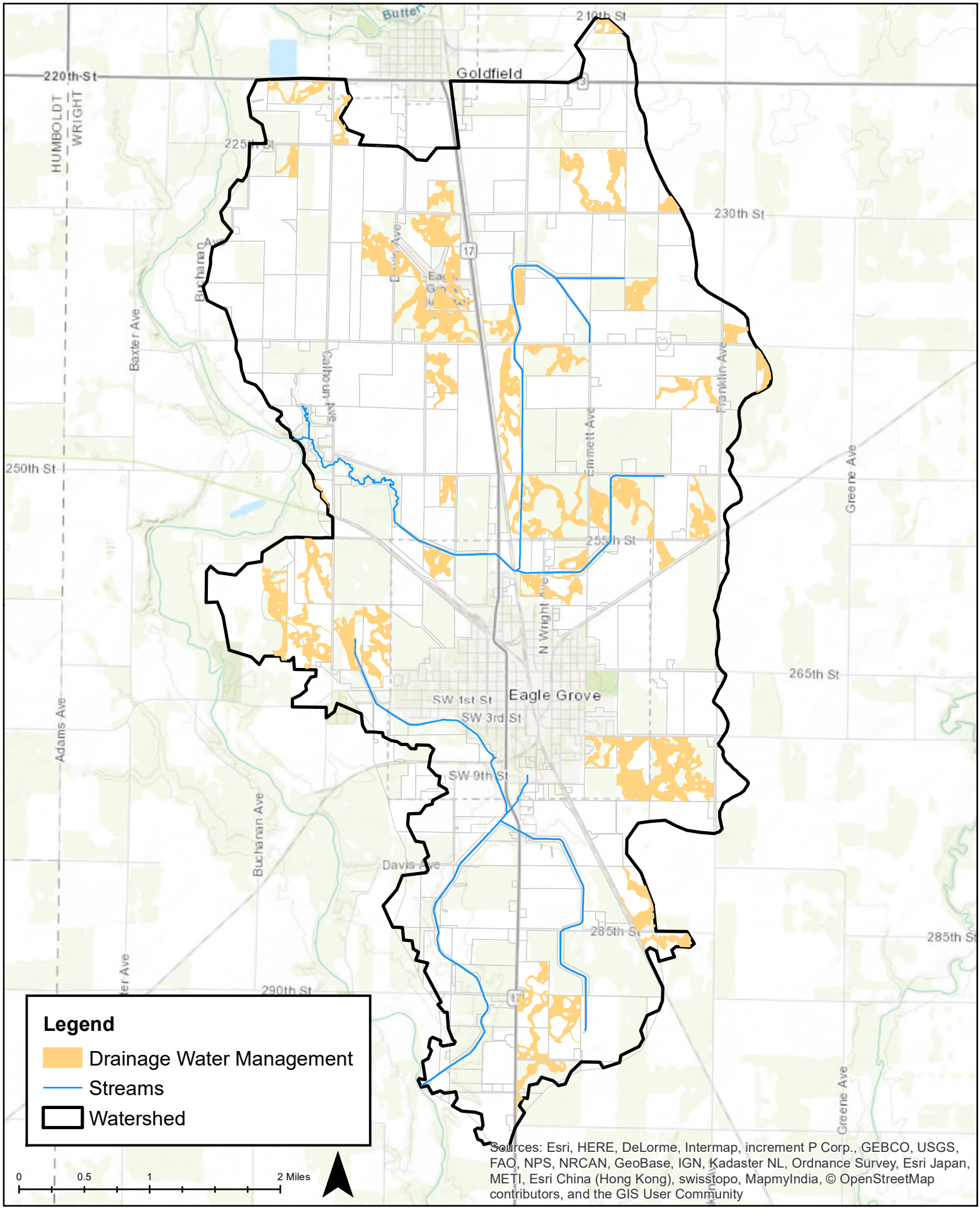
Nitrate Removal Wetlands

Watershed plan goal is 3 wetlands. More opportunites may exist than shown on map.



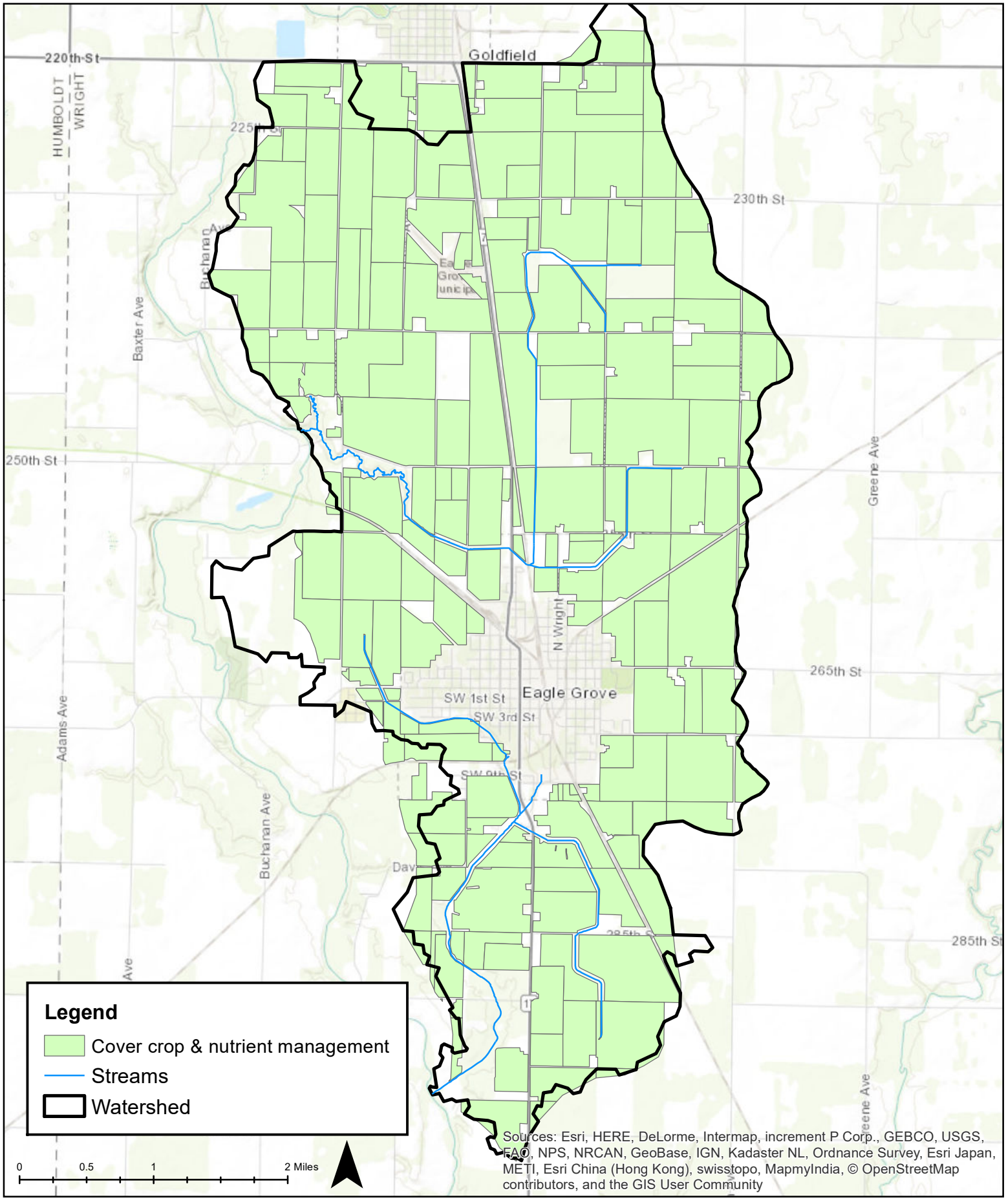
Drainage Water Management

Watershed plan goal is 1,000 acres. More opportunites may exist than shown on map.



Cover Crops and Nutrient Management

Watershed plan goal is 4,000 acres of cover crop and 5,500 acres of nutrient management (MRTN). More opportunites are shown on map than are necessary to meet watershed goals, however, soil heath and nutrient management practices can be promoted anywhere.



Appendix B

Agricultural Conservation Planning Framework Results Atlas

Eagle Grove Watershed
Agricultural Conservation Planning Framework Results Atlas

Overview

The Agricultural Conservation Planning Framework (ACPF) provides datasets and mapping tools that can be used to identify suitable locations for agricultural conservation practices. The geographic information system (GIS) tools utilize inputs including elevation, land use, and soils data to characterize watersheds and identify appropriate sites for practices that enhance soil health and water quality by improving drainage, runoff, and riparian management. The ACPF was developed by the USDA-Agricultural Research Service National Laboratory for Agriculture and the Environment.

Results

The results of applying ACPF tools to a watershed provide a suite of potential conservation practice opportunities. Results should be refined based on local and expert input to develop actionable watershed plans that address local conditions and goals. ACPF output is therefore best utilized as scientific data to support decision making and planning in agricultural watersheds. The following atlas of ACPF result maps for this watershed display all conservation practice outputs derived from analysis of the watershed with the GIS toolbox. Practices are mapped based on site suitability and may or may not reflect existing conservation infrastructure. Results are mapped for portions of two HUC-12 watersheds (071000050604 and 071000050605) in the vicinity of Eagle Grove, Iowa.

The following maps include watershed assessments of land use, tile drainage, and runoff risk derived with ACPF tools. The remaining maps are arranged into three sections: drainage practices, runoff practices, and riparian management. For each section, one map displays a watershed overview and the subsequent pages contain detailed maps for each township that contains a portion of the watershed. Conservation drainage practices include bioreactors, saturated buffers, carbon-enhanced saturated buffers, drainage water management, nitrate removal wetlands, and perennial cover or tile intake buffers in topographic depressions. Runoff control practices include contour buffer strips, grassed waterways, and water and sediment control basins. Practices such as nutrient management, no-till/reduced tillage, and cover crops are not explicitly mapped by ACPF tools according to the philosophy that such soil health building practices are appropriate for all agricultural land. The final section of maps includes the results of applying the ACPF riparian function assessment to the stream channels in the watershed. Recommended riparian functions are classified as critical zone (high potential for runoff control and denitrification), multi-species buffer (moderate potential for both runoff control and denitrification), deep-rooted vegetation (denitrification prioritized), stiff stemmed grasses (runoff control prioritized), and streambank stabilization.

Map Index

References

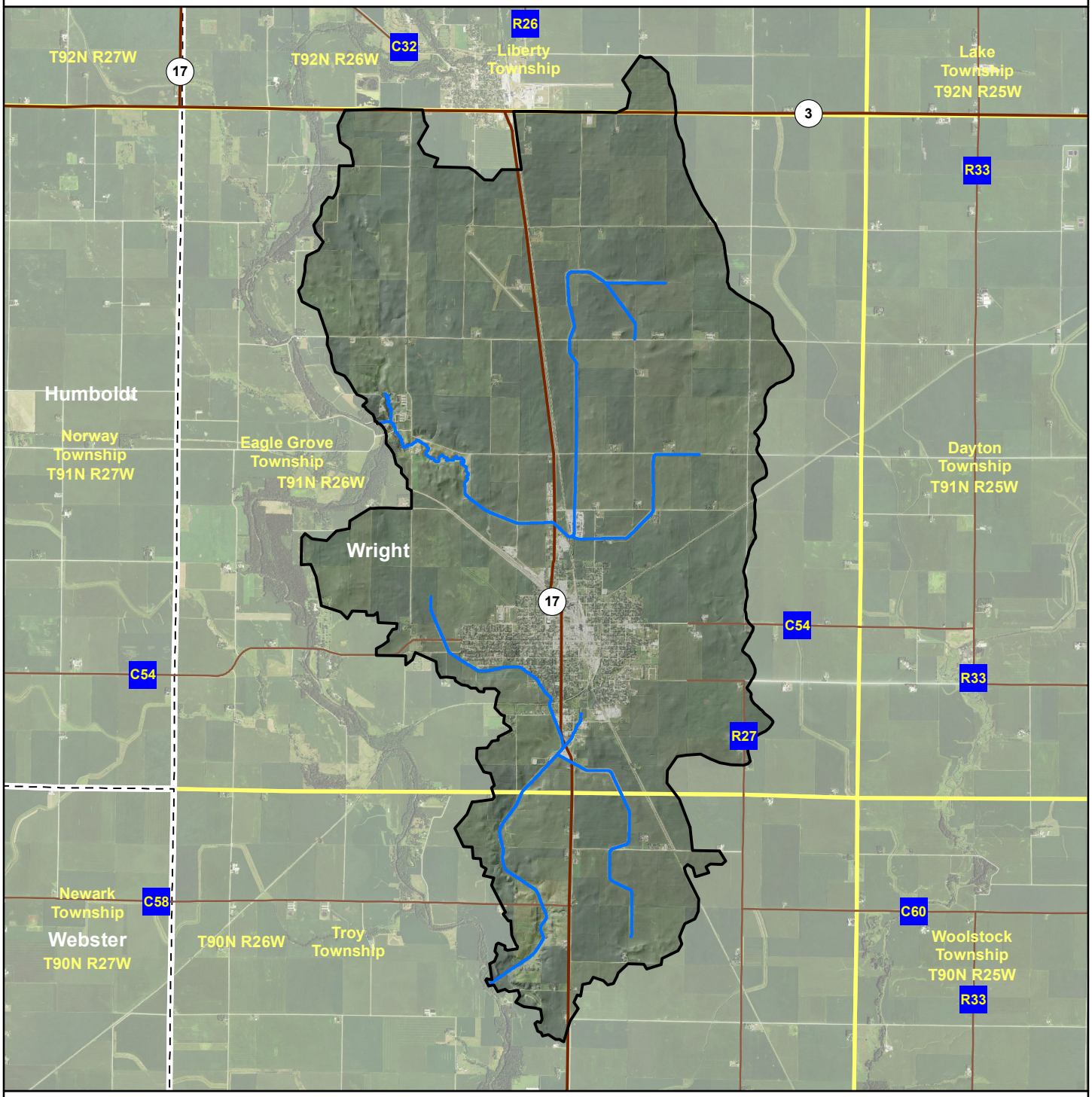
ACPF manual: Porter, S.A., M.D. Tomer, D.E. James, and K.M.B. Boomer. 2015. Agricultural Conservation Planning Framework: ArcGIS®Toolbox User's Manual. USDA Agricultural Research Service, National Laboratory for Agriculture and the Environment, Ames Iowa. http://northcentralwater.org/acpf/

General concepts behind the ACPF: Tomer, M.D., S.A. Porter, D.E. James, K.M.B. Boomer, J.A. Kostel, and E. McLellan. 2013. Combining precision conservation technologies into a flexible framework to facilitate agricultural watershed planning. Journal of Soil and Water Conservation 68:113A-120A. http://www.jswconline.org/content/68/5/113A.full.pdf+html

Development of specific practice siting tools: Tomer, M.D., S.A. Porter, K.M.B. Boomer, D.E. James, J.A. Kostel, M.J. Helmers, T.M. Isenhart, and E. McLellan. 2015. Agricultural Conservation Planning Framework: 1. Developing multi-practice watershed planning scenarios and assessing nutrient reduction potential. J. Environ. Qual. 44(3):754-767. https://dl.sciencesocieties.org/publications/jeq/articles/44/3/754

Development of the riparian classification scheme: Tomer, M.D., K.M.B. Boomer, S.A. Porter, B.K. Gelder, D.E. James, and E. McLellan. 2015. Agricultural Conservation Planning Framework: 2. Classification of riparian buffer design-types with application to assess and map stream corridors. J. Environ. Qual. 44(3):768-779. https://dl.sciencesocieties.org/publications/jeq/articles/44/3/768

Eagle Grove Watershed (071000050604 & 071000050605)
Agricultural Conservation Planning Framework Results Atlas



Watershed Boundary

Streams

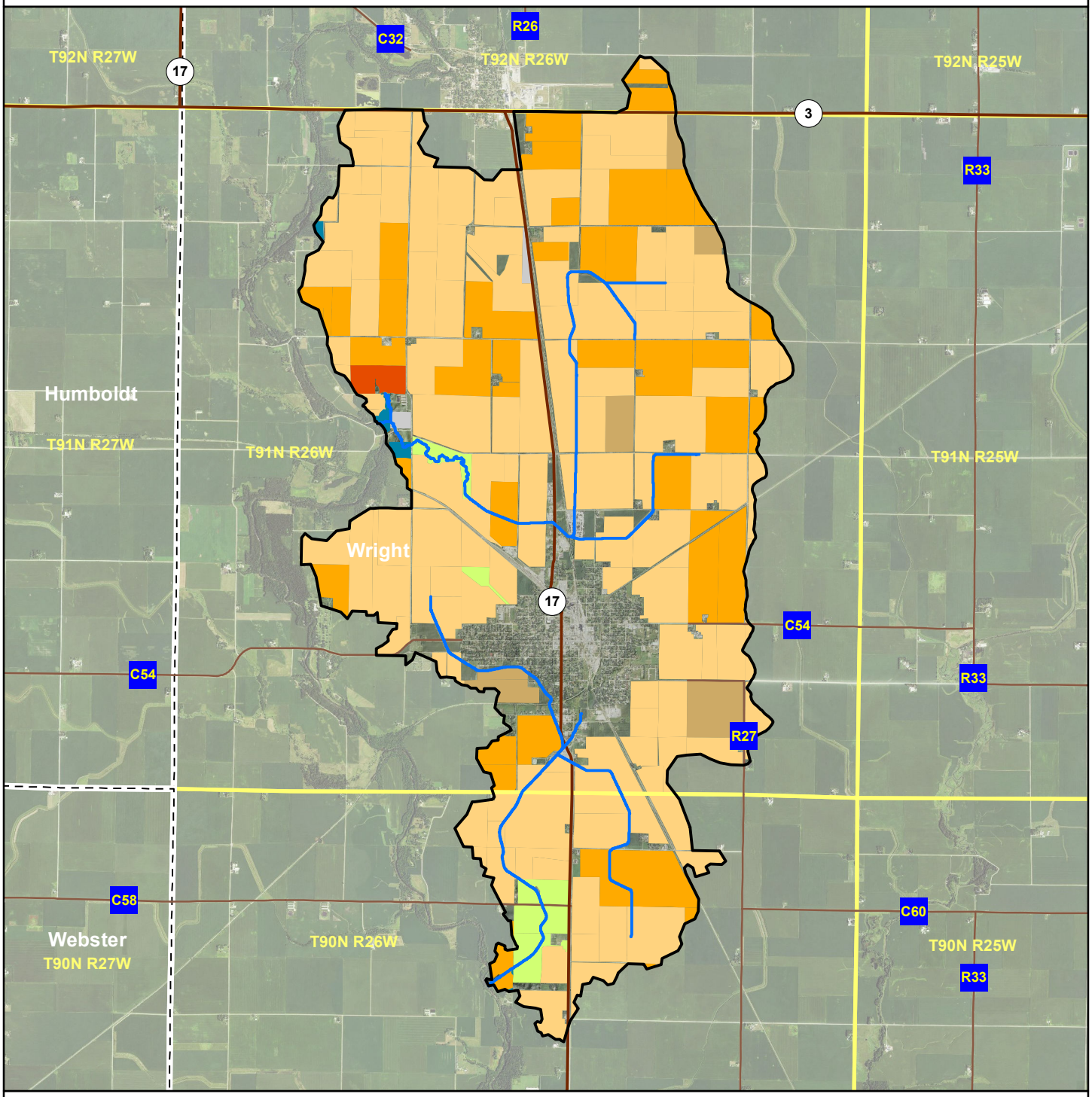
0 1 2 Miles

N

Analysis performed by
Iowa Soybean Association
Environmental Programs & Services

Data and tools provided by USDA-ARS

Eagle Grove Watershed (071000050604 & 071000050605)
Agricultural Conservation Planning Framework Land Use



Watershed Boundary

Streams

Land Use

- Corn/Soybeans
- C/S with Continuous Corn
- Continuous Corn
- C/S with Continuous Soybeans
- Pasture
- Water/wetland
- Urban

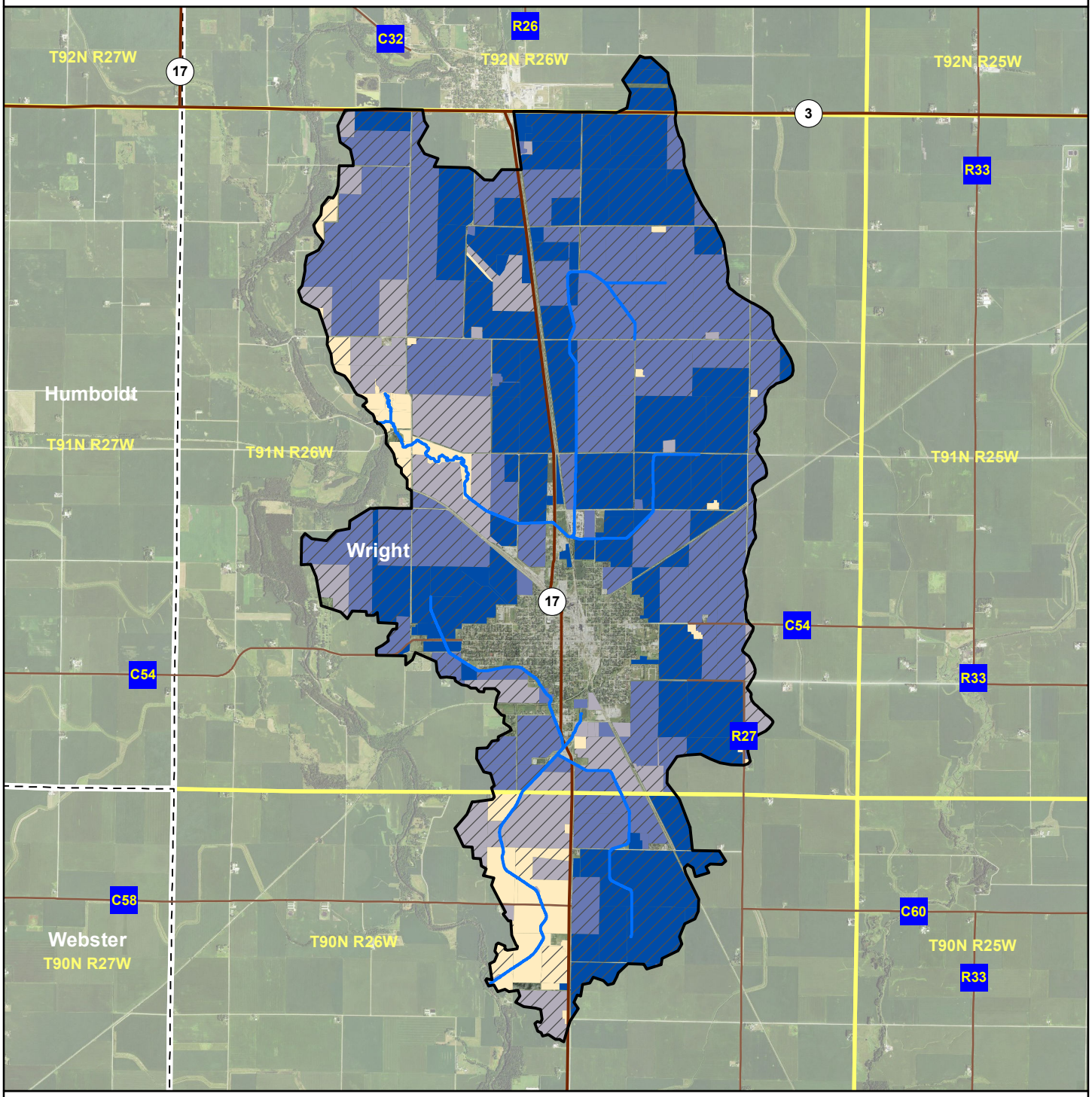
N

0 1 2 Miles

Analysis performed by
Iowa Soybean Association
Environmental Programs & Services

Data and tools provided by USDA-ARS

Eagle Grove Watershed (071000050604 & 071000050605)
Agricultural Conservation Planning Framework Tile Drainage



Watershed Boundary

Streams

Tile Drainage Likely

Percent Hydric Soils

- 75 to 100%
- 50 to 75%
- 25 to 50%
- 0 to 25%

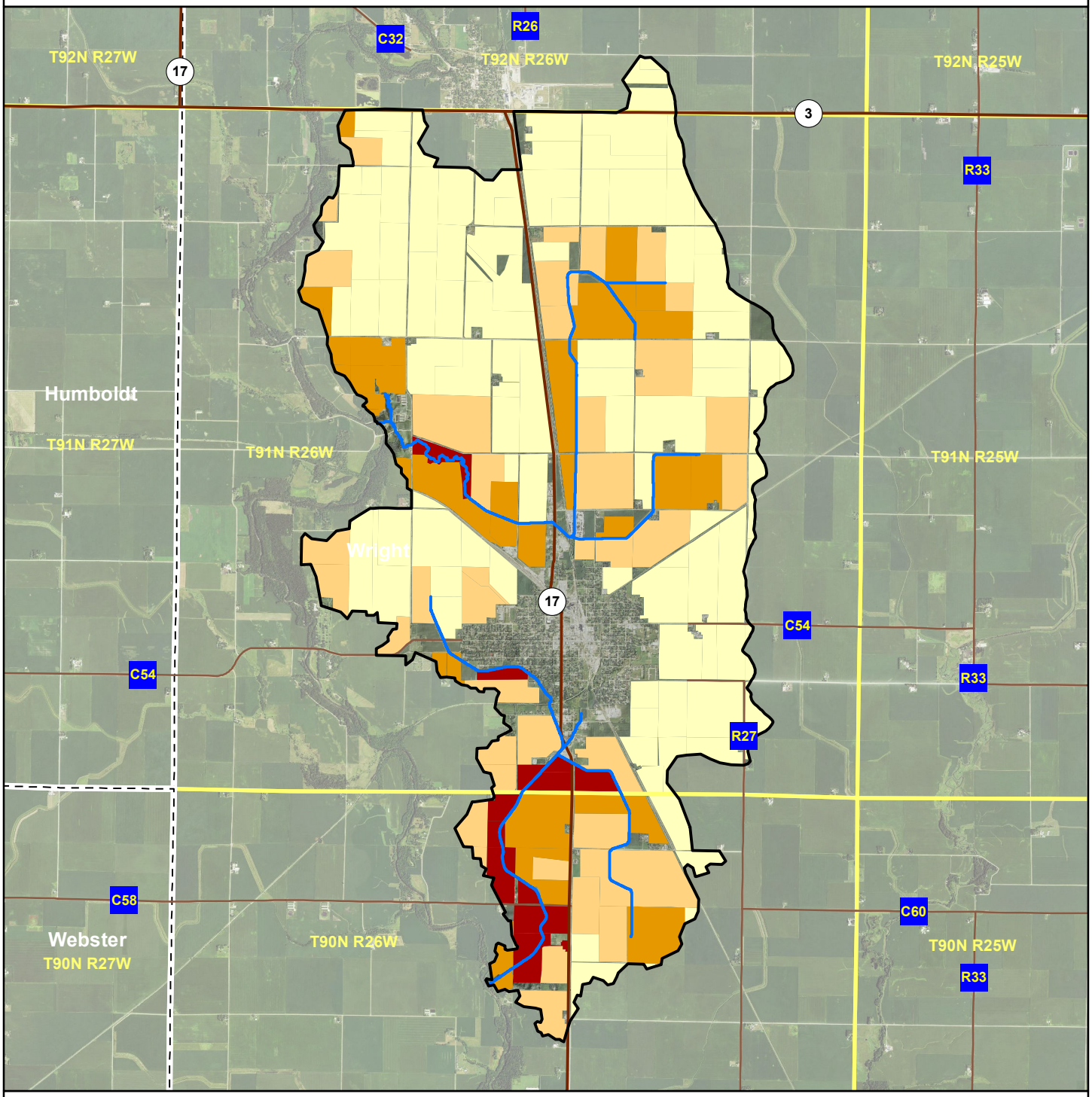
N

0 1 2 Miles

Analysis performed by
Iowa Soybean Association
Environmental Programs & Services

Data and tools provided by USDA-ARS

Eagle Grove Watershed (071000050604 & 071000050605)
Agricultural Conservation Planning Framework Runoff Risk



Watershed Boundary

Streams

Runoff Risk

- Critical
- Very High
- High
- Present

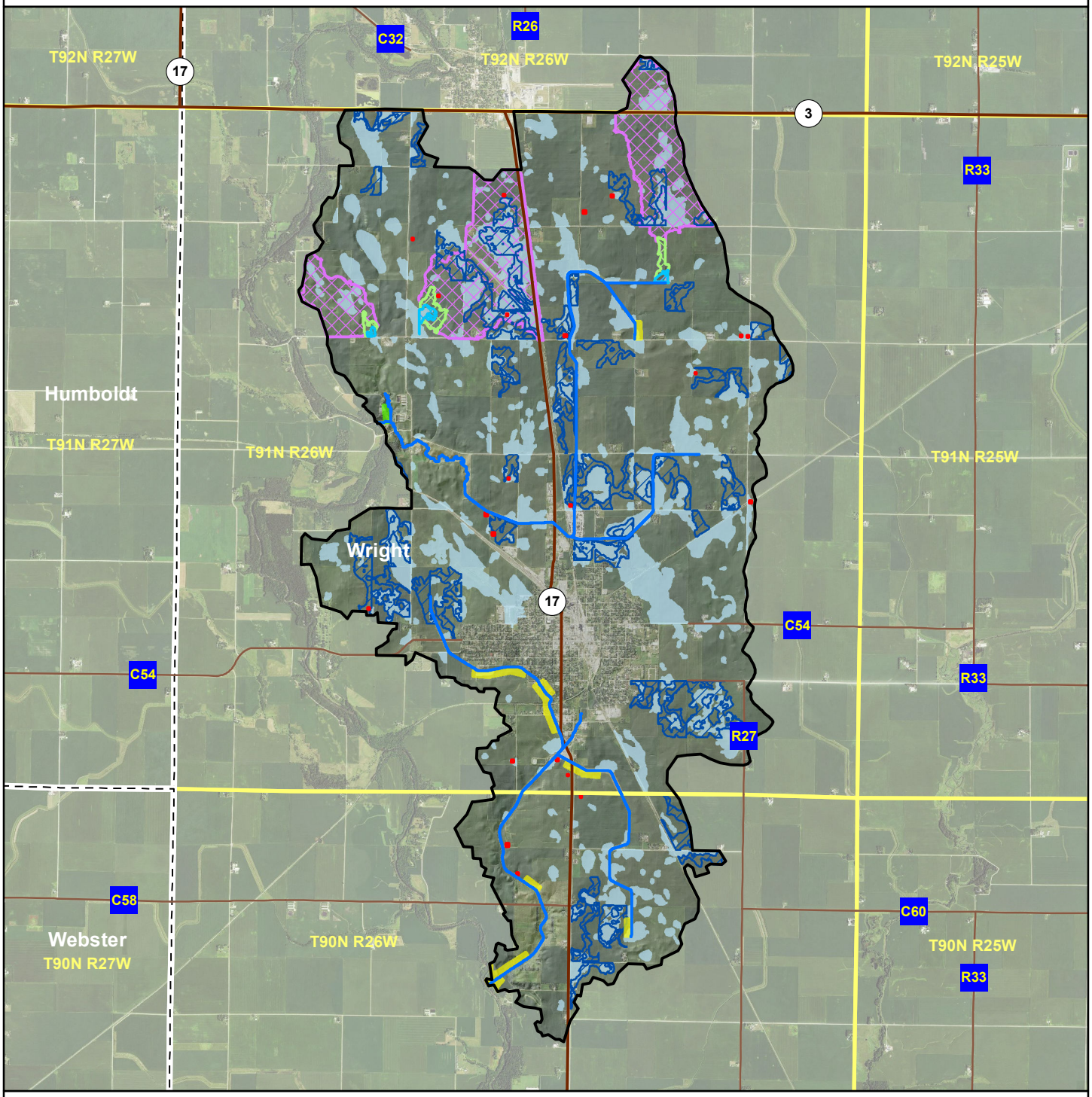
N

0 1 2 Miles

Analysis performed by
Iowa Soybean Association
Environmental Programs & Services

Data and tools provided by USDA-ARS

Eagle Grove Watershed (071000050604 & 071000050605)
Agricultural Conservation Planning Framework Drainage Treatment Practices



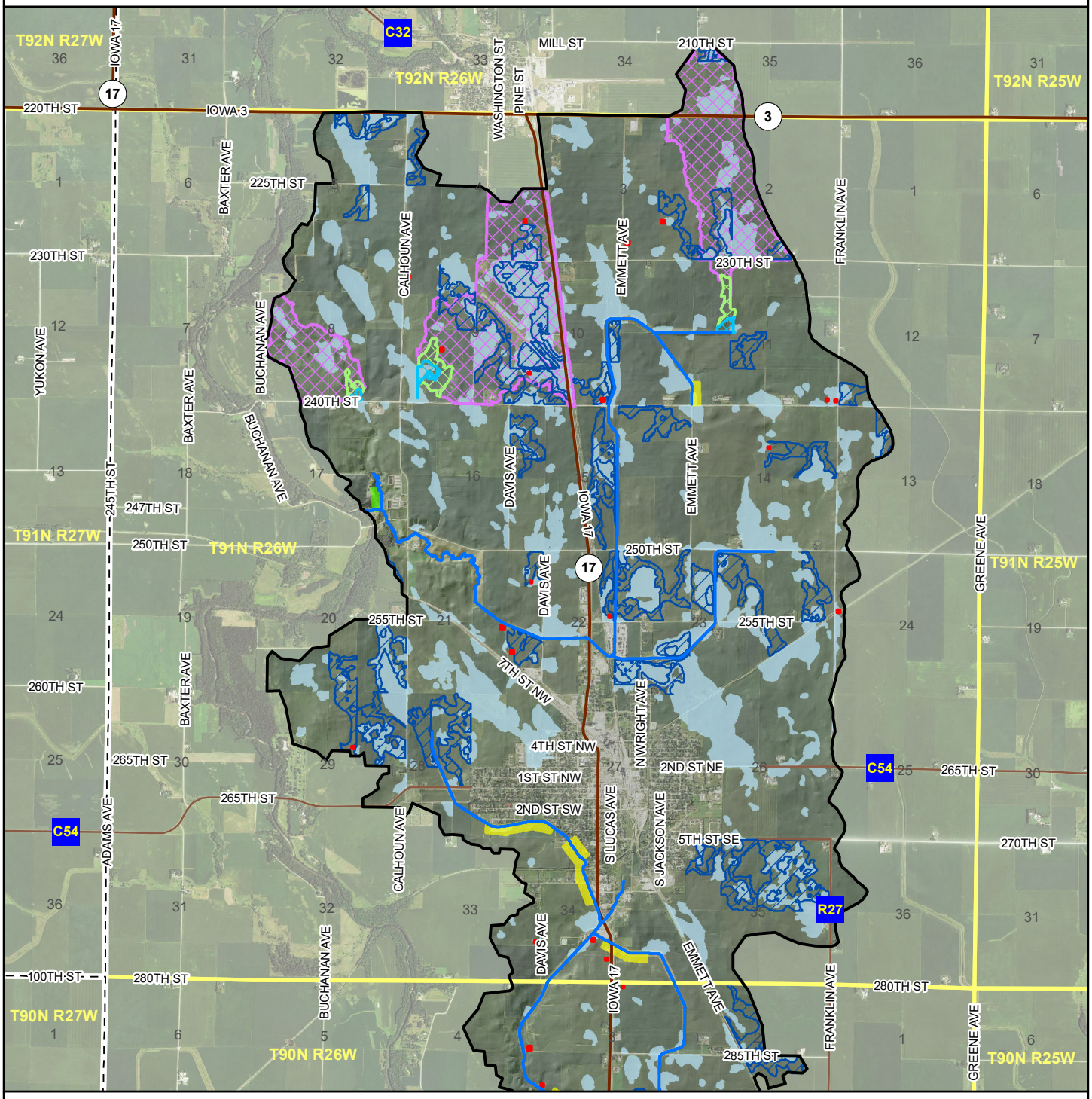
- Watershed Boundary
- Streams
- Bioreactors
- Saturated Buffers
- Carbon-Enhanced Saturated Buffers
- Drainage Water Management
- Nitrate Removal Wetlands
- Wetland Buffers
- Wetland Drainage Areas
- Depressions (Perennial Cover, Intake Buffers)

N

0 1 2 Miles

Analysis performed by
Iowa Soybean Association
Environmental Programs & Services
Data and tools provided by USDA-ARS

Eagle Grove Watershed (071000050604 & 071000050605) T91N R26W
Agricultural Conservation Planning Framework Drainage Treatment Practices



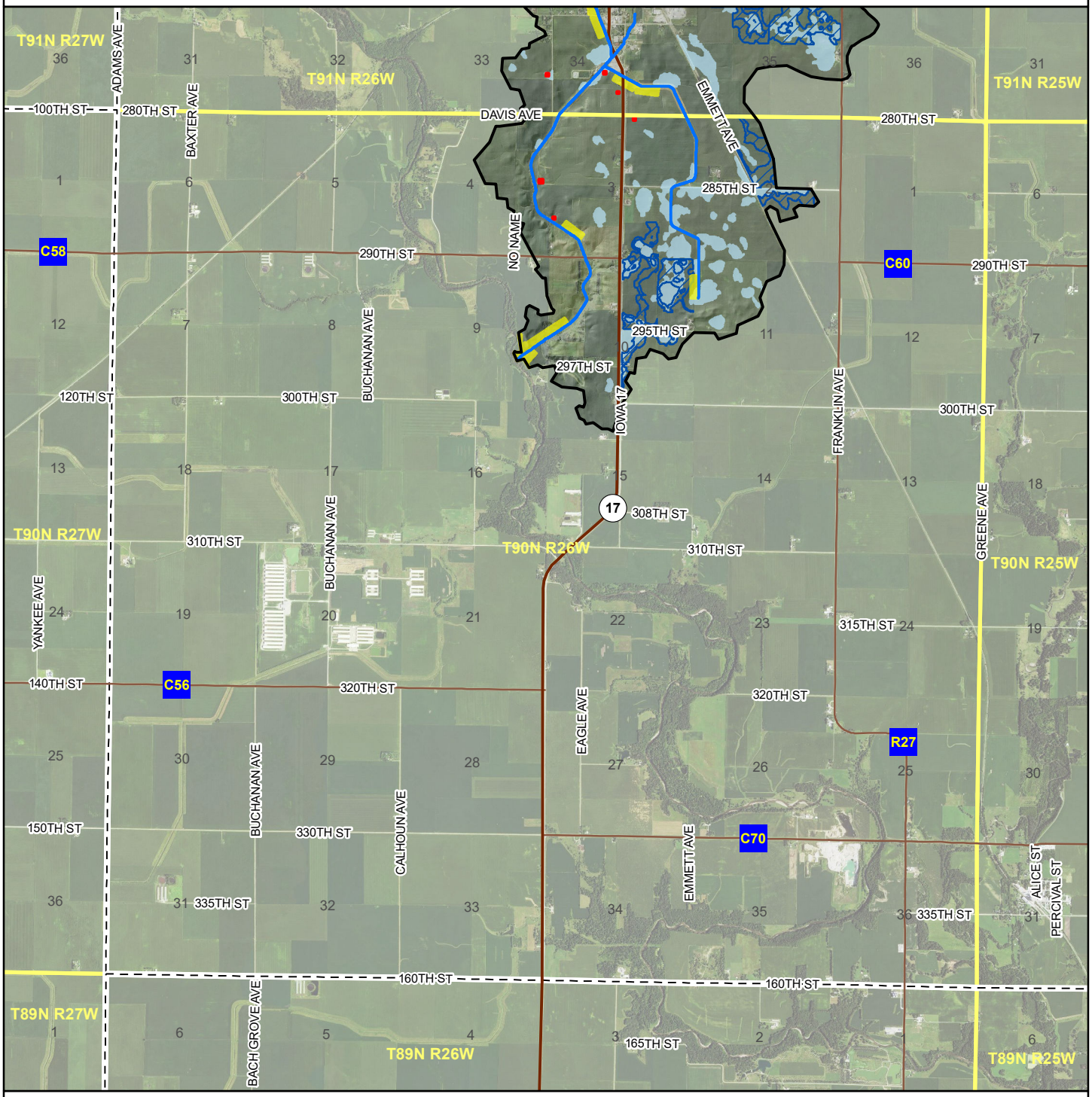
- Watershed Boundary
- Streams
- Bioreactors
- Saturated Buffers
- Carbon-Enhanced Saturated Buffers
- Drainage Water Management
- Nitrate Removal Wetlands
- Wetland Buffers
- Wetland Drainage Areas
- Depressions (Perennial Cover, Intake Buffers)

N

0 0.5 1 Miles

Analysis performed by
Iowa Soybean Association
Environmental Programs & Services
Data and tools provided by USDA-ARS

Eagle Grove Watershed (071000050604 & 071000050605) T90N R26W
Agricultural Conservation Planning Framework Drainage Treatment Practices



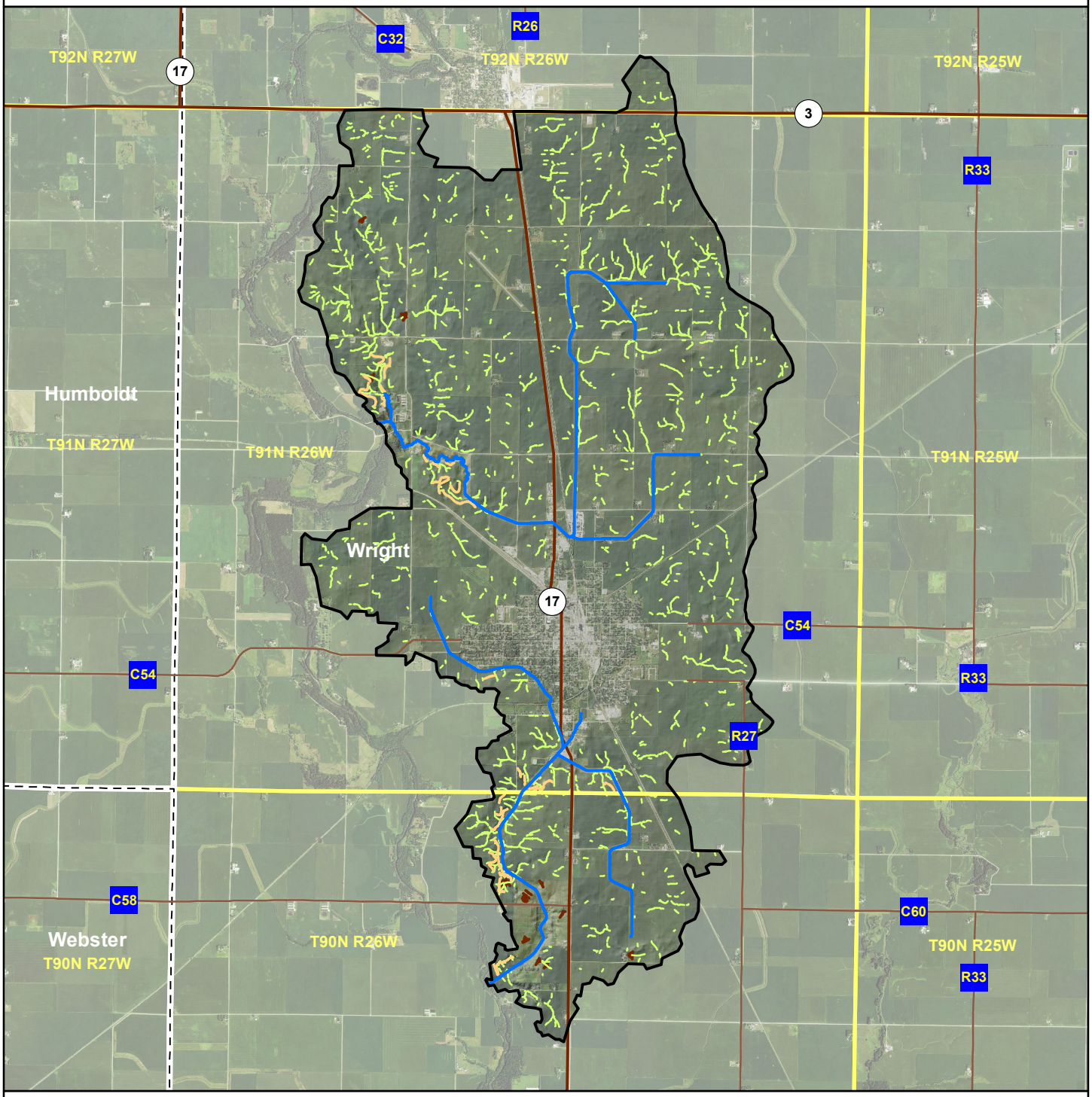
- Watershed Boundary
- Streams
- Bioreactors
- Saturated Buffers
- Carbon-Enhanced Saturated Buffers
- Drainage Water Management
- Nitrate Removal Wetlands
- Wetland Buffers
- Wetland Drainage Areas
- Depressions (Perennial Cover, Intake Buffers)

N

0 0.5 1 Miles

Analysis performed by
Iowa Soybean Association
Environmental Programs & Services
Data and tools provided by USDA-ARS

Eagle Grove Watershed (071000050604 & 071000050605)
Agricultural Conservation Planning Framework Runoff Control Practices



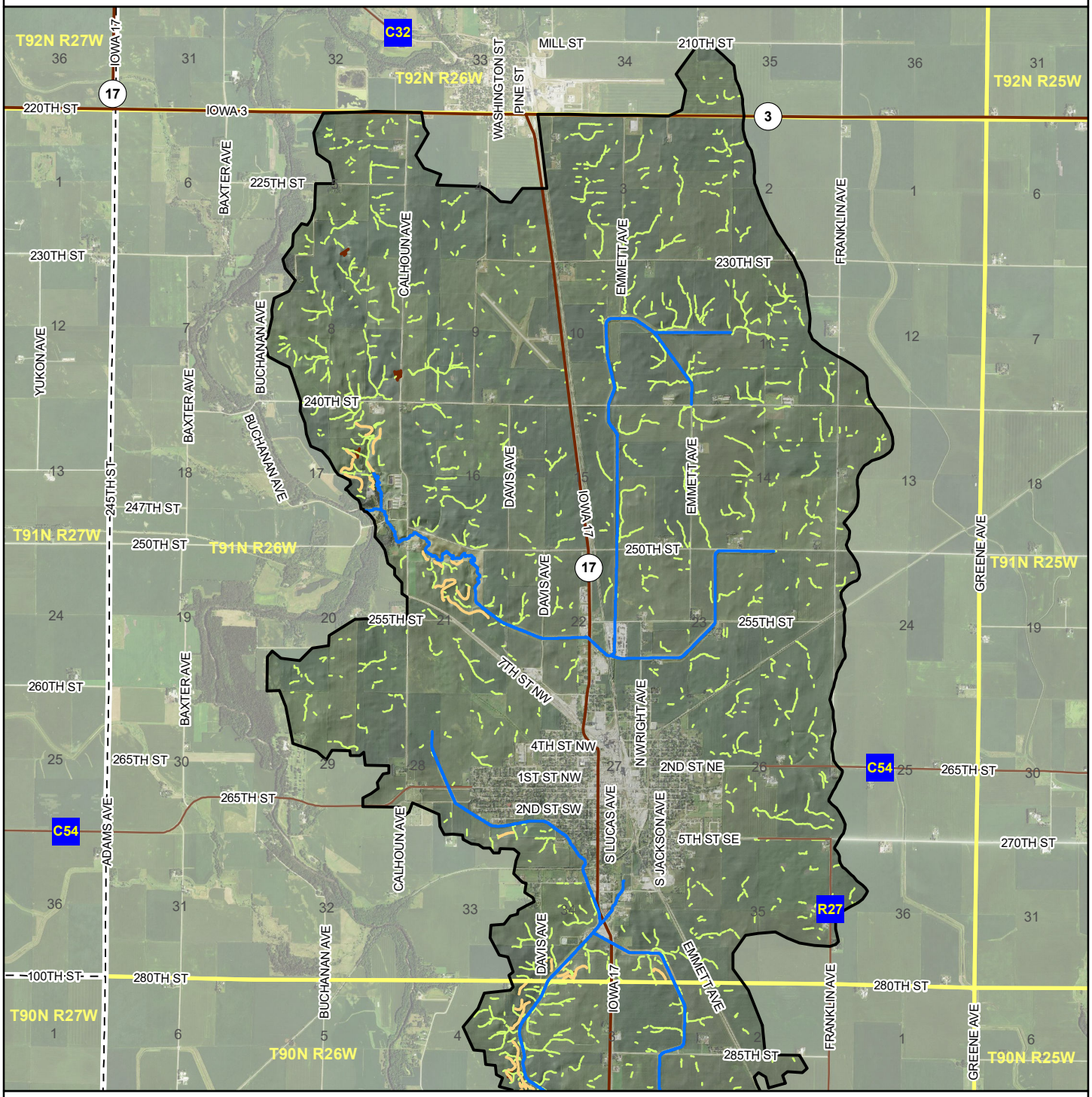
- Watershed Boundary
- Streams
- Contour Buffer Strips
- Grassed Waterways
- Water and Sediment Control Basins

N

0 1 2 Miles

Analysis performed by
Iowa Soybean Association
Environmental Programs & Services
Data and tools provided by USDA-ARS

Eagle Grove Watershed (071000050604 & 071000050605) T91N R26W
Agricultural Conservation Planning Framework Runoff Control Practices



- Watershed Boundary
- Streams
- Contour Buffer Strips
- Grassed Waterways
- Water and Sediment Control Basins

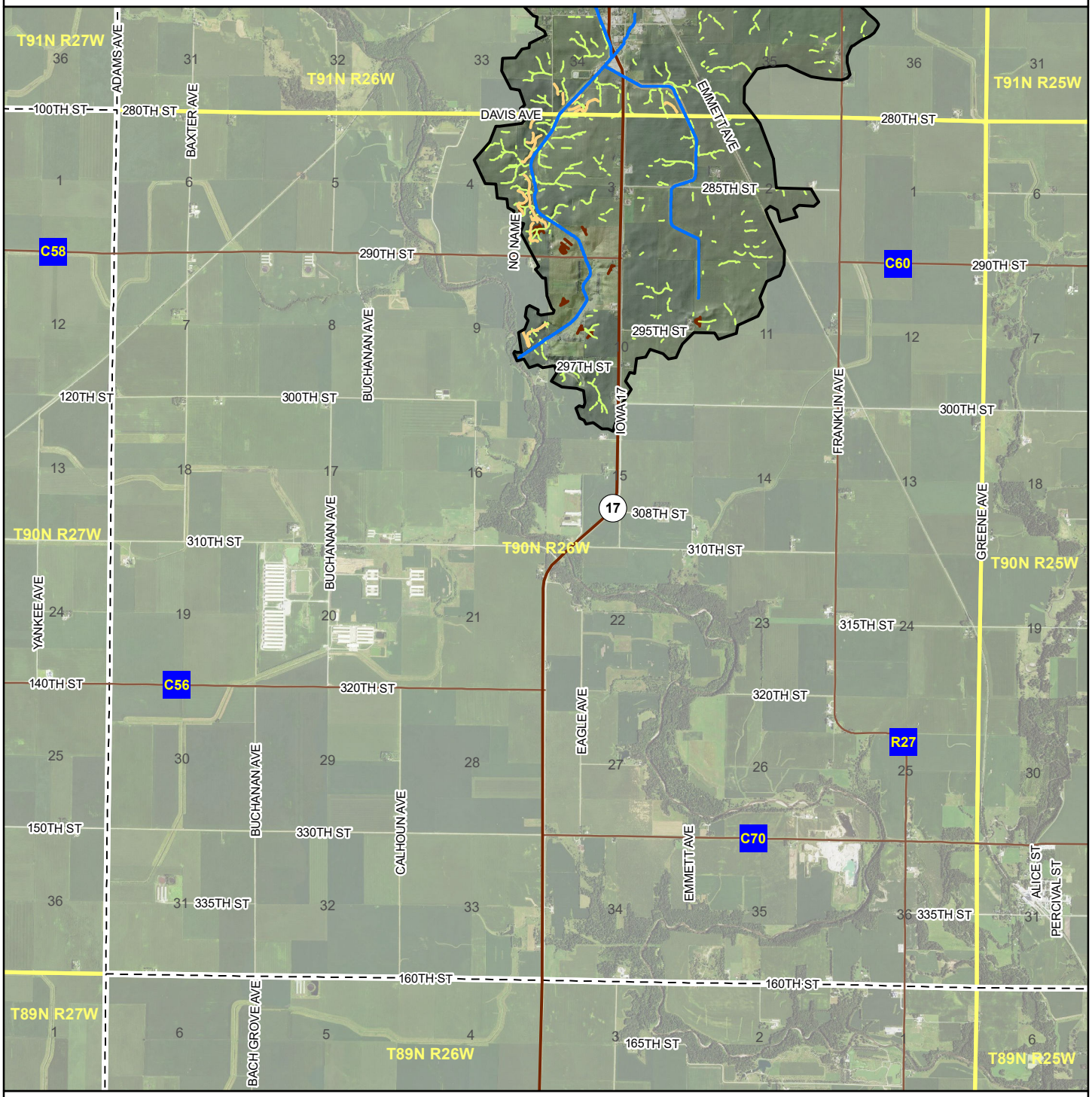
0 0.5 1 Miles

N

Analysis performed by
Iowa Soybean Association
Environmental Programs & Services

Data and tools provided by USDA-ARS

Eagle Grove Watershed (071000050604 & 071000050605) T90N R26W
Agricultural Conservation Planning Framework Runoff Control Practices



- Watershed Boundary
- Streams
- Contour Buffer Strips
- Grassed Waterways
- Water and Sediment Control Basins

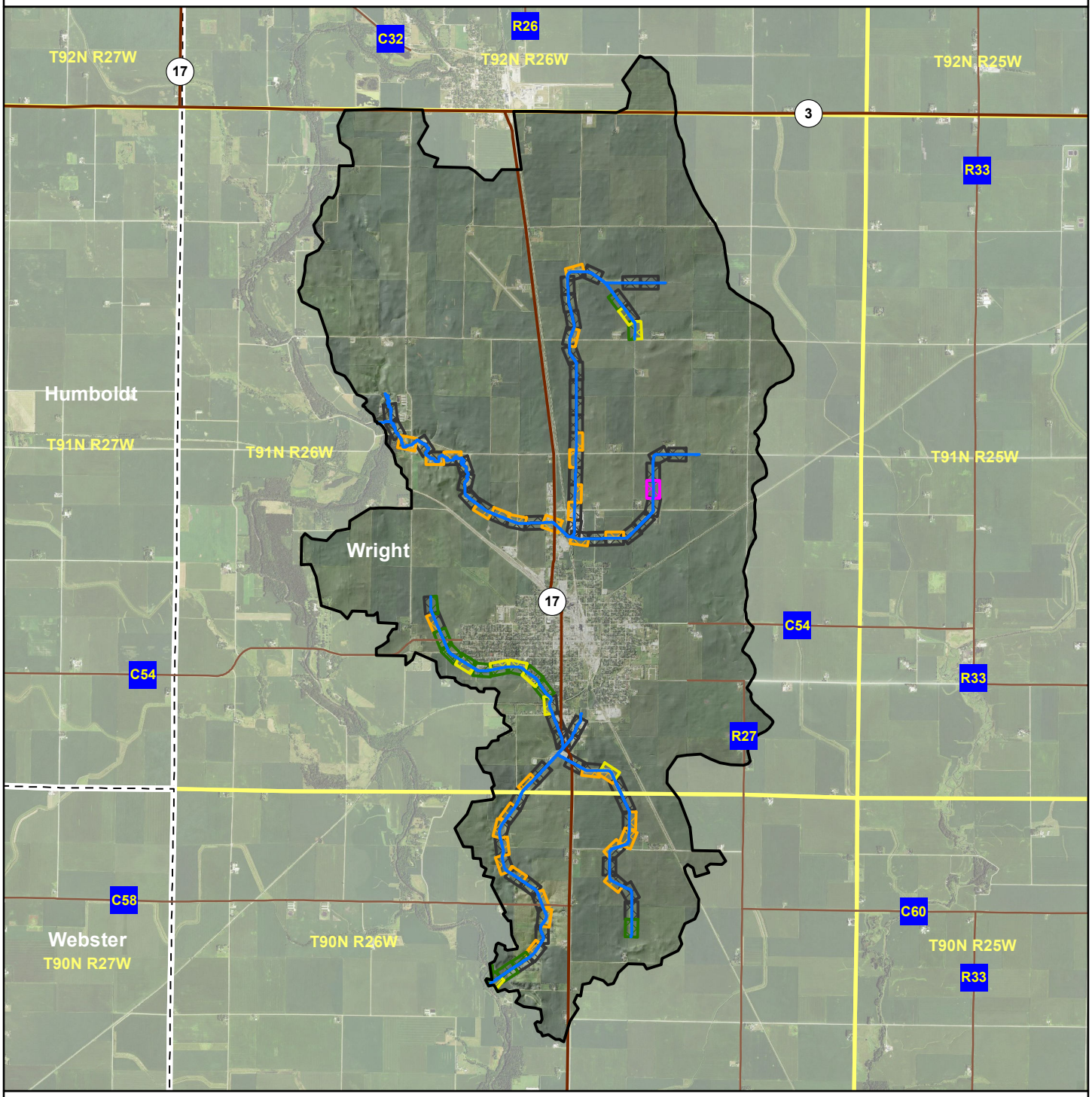
N

0 0.5 1 Miles

Analysis performed by
Iowa Soybean Association
Environmental Programs & Services

Data and tools provided by USDA-ARS

Eagle Grove Watershed (071000050604 & 071000050605)
Agricultural Conservation Planning Framework Riparian Management Practices



Watershed Boundary

Streams

Riparian Function

- Critical Zone
- Multi Species Buffer
- Deep Rooted Vegetation
- Stiff Stemmed Grasses
- Stream Bank Stabilization

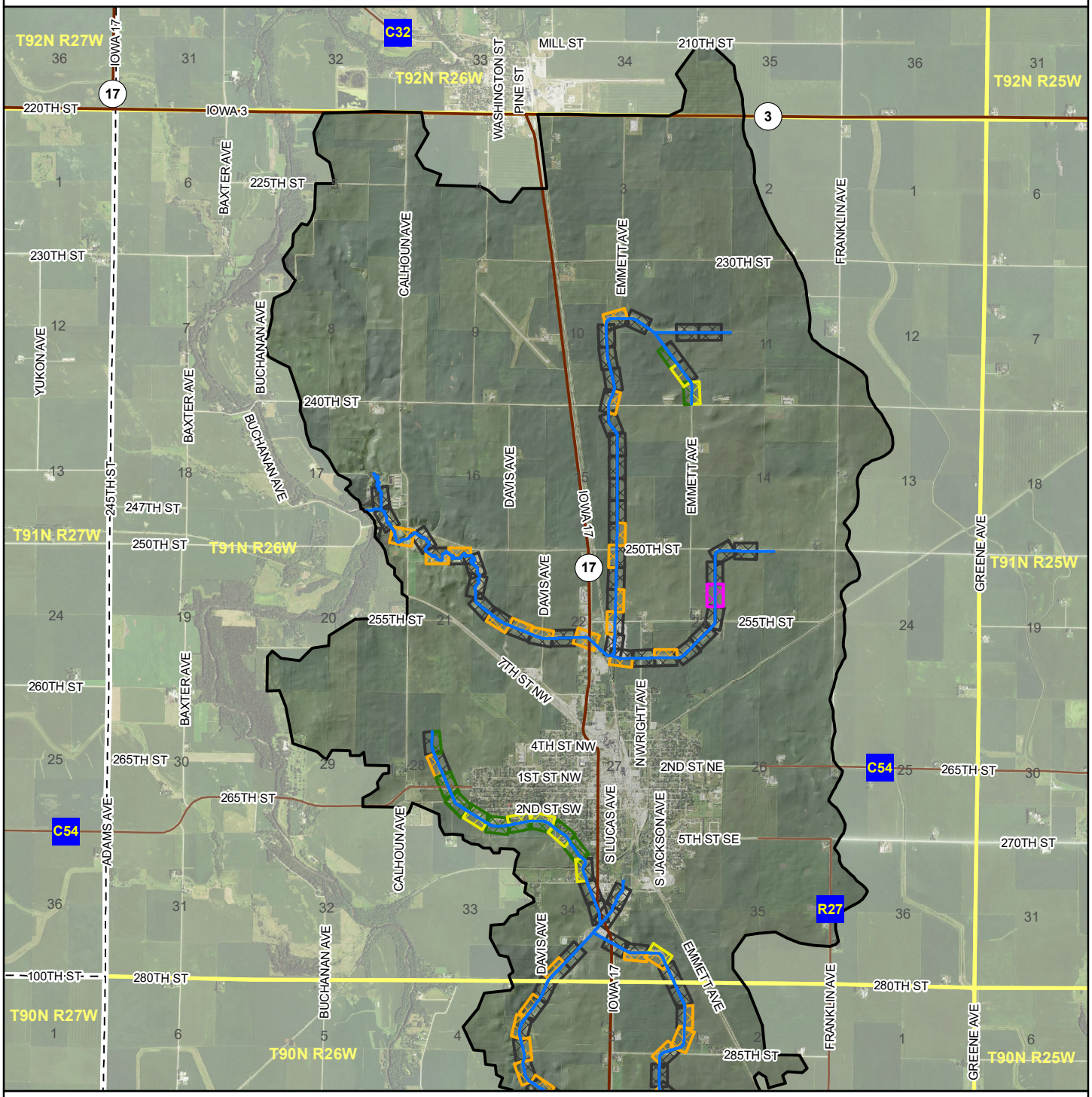
N

0 1 2 Miles

Analysis performed by
Iowa Soybean Association
Environmental Programs & Services

Data and tools provided by USDA-ARS

Eagle Grove Watershed (071000050604 & 071000050605) T91N R26W
Agricultural Conservation Planning Framework Riparian Management Practices



Watershed Boundary

Streams

Riparian Function

- Critical Zone
- Multi Species Buffer
- Deep Rooted Vegetation
- Stiff Stemmed Grasses
- Stream Bank Stabilization

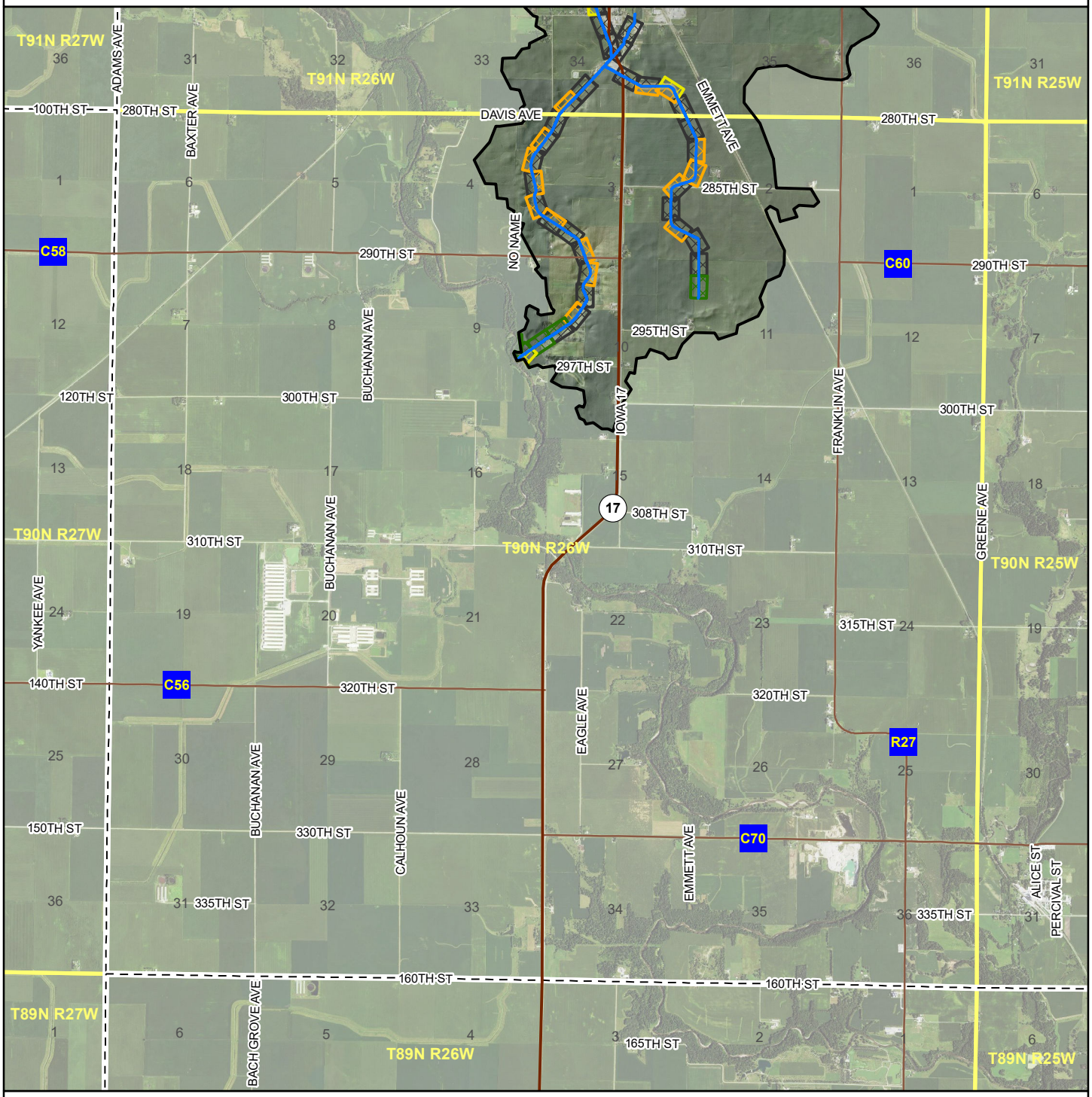
N

0 0.5 1 Miles

Analysis performed by
Iowa Soybean Association
Environmental Programs & Services

Data and tools provided by USDA-ARS

Eagle Grove Watershed (071000050604 & 071000050605) T90N R26W
Agricultural Conservation Planning Framework Riparian Management Practices



Watershed Boundary

Streams

Riparian Function

- Critical Zone
- Multi Species Buffer
- Deep Rooted Vegetation
- Stiff Stemmed Grasses
- Stream Bank Stabilization

N

0 0.5 1 Miles

Analysis performed by
Iowa Soybean Association
Environmental Programs & Services

Data and tools provided by USDA-ARS

Appendix C

Watershed Project Self-Evaluation Worksheet

Appendix C: Watershed Project Self-Evaluation Worksheet

Purpose
This self-evaluation worksheet is a means to assess annual watershed project progress and to identify areas of strength and weakness. The evaluation worksheet should be completed annually by project leaders and partners. Results should be compiled and shared with all project partners.

Evaluation Watershed Project: _____

Evaluator Name: _____

Evaluation Date: _____

Evaluation Time Period: _____ to _____

Project Administration	**Exceeds**	**Meets**	**Partially Meets**	**Does Not Meet**	**NA**
Project annual review meeting held.					
Watershed partners represent a broad and diverse membership and most interests in the watershed.					
Watershed partners understand their responsibilities and roles.					
Watershed partners share a common vision and purpose.					
Watershed partners are aware of and involved in project activities.					
Watershed partners understand decision making processes.					
Watershed meetings are well-organized and productive.					
Watershed partners advocate for the mission.					

Attitudes and Awareness	**Exceeds**	**Meets**	**Partially Meets**	**Does Not Meet**	**NA**
Positive changes in attitudes, beliefs and practices have occurred in the watershed.					
Field days and other events have been held in the watershed.					
Watershed project has received publicity via local and regional media outlets.					

Performance	Exceeds	Meets	Partially Meets	Does Not Meet	NA
Yearly _____ (insert conservation practice) implementation goals have been met.					
Yearly _____ (insert conservation practice) implementation goals have been met.					
Yearly _____ (insert conservation practice) implementation goals have been met.					
Yearly _____ (insert conservation practice) implementation goals have been met.					
Yearly _____ (insert conservation practice) implementation goals have been met.					
Yearly _____ (insert conservation practice) implementation goals have been met.					
Yearly _____ (insert conservation practice) implementation goals have been met.					
Yearly _____ (insert conservation practice) implementation goals have been met.					
The majority of implemented conservation practices have been retained after cost-share payments ended.					

Results	Exceeds	Meets	Partially Meets	Does Not Meet	NA
Monitoring of _____ (insert variable) has shown progress towards reaching plan goals.					
Monitoring of _____ (insert variable) has shown progress towards reaching plan goals.					
Monitoring of _____ (insert variable) has shown progress towards reaching plan goals.					
Impact (financial or other) to farmers and landowners has been positive or minimal.					
Modeled impacts on _____ (insert variable) have shown progress towards reaching plan goals.					
Modeled impacts on _____ (insert variable) have shown progress towards reaching plan goals.					
Modeled impacts on _____ (insert variable) have shown progress towards reaching plan goals.					

Strengths, Weaknesses, Opportunities and Threats Analysis

Thinking about the goals of the watershed plan, brainstorm the strengths, weaknesses, opportunities and threats (SWOTs) relevant to the project. Identification of SWOTs is important as they help shape successful watershed plan implementation.

Strengths	Opportunities
Weaknesses	**Threats**

Appendix D

Potential Funding Sources

Appendix D: Potential Funding Sources

Public Funding Sources

Program	Description	Agency/Organization
Iowa Financial Incentives Program	50 percent cost-share available to landowners through 100 SWCDs for permanent soil conservation practices.	IDALS-DSCWQ
No-Interest Loans	State administered loans to landowners for permanent soil conservation practices.	IDALS-DSCWQ
District Buffer Initiatives	Funds for SWCDs to initiate, stimulate, and incentivize signup of USDA programs, specifically buffers.	IDALS-DSCWQ
Iowa Watershed Protection Program	Funds for SWCDs to provide water quality protection, flood control, and soil erosion protection in priority watersheds; 50-75 percent cost-share.	IDALS-DSCWQ
Conservation Reserve Enhancement Program	Leveraging USDA funds to establish nitrate removal wetlands in north central Iowa with no cost to landowner.	IDALS-DSCWQ
Soil and Water Enhancement Account - REAP Water Quality Improvement Projects	REAP funds for water quality improvement projects (sediment, nutrient and livestock waste) and wildlife habitat and forestry practices; 50-75 percent cost-share. Used as state match for EPA 319 funding. Tree planting, native grasses, forestry, buffers, streambank stabilization, traditional erosion control practices, livestock waste management, ag drainage well closure and urban storm water.	IDALS-DSCWQ
State Revolving Loans	Low interest loans provided by SWCDs to landowners for permanent water quality improvement practices; subset of DNR program.	IDALS-DSCWQ
Watershed Improvement Fund	Local watershed improvement grants to enhance water quality for beneficial uses, including economic development.	IDALS-DSCWQ
General Conservation Reserve Program	Encourages farmers to convert highly erodible land or other environmentally sensitive land to vegetative cover; farmers receive annual rental payments.	USDA-FSA
Continuous Conservation Reserve Program	Encourages farmers to convert highly erodible land or other environmentally sensitive land to vegetative cover, filter strips or riparian buffers; farmers receive annual rental payments.	USDA-FSA
Farmable Wetland Program	Voluntary program to restore farmable wetlands and associated buffers by improving hydrology and vegetation.	USDA-FSA
Grassland Reserve Program	Provides funds to grassland owners to maintain, improve and establish grass. Contracts of easements up to 30 years.	USDA-FSA
Environmental Quality Incentives Program	Provides technical and financial assistance for natural resource conservation in environmentally beneficial and cost-effective manner; program is generally 50 percent cost-share.	USDA-NRCS
Wetland Reserve Program	Provides restoration of wetlands through permanent and 30 year easements and 10 year restoration agreements.	USDA-NRCS
Emergency Watershed Protection Program	Flood plain easements acquired via USDA designated disasters due to flooding.	USDA-NRCS
Wildlife Habitat Incentives Program	Cost-share contracts to develop wildlife habitat.	USDA-NRCS
Farm and Ranchland Protection Program	Purchase of easements to limit conversion of ag land to non-ag uses. Requires 50 percent match.	USDA-NRCS
Cooperative Conservation Partnership Programs	Conservation partnerships that focus technical and financial resources on conservation priorities in watersheds and airsheds of special significance.	USDA-NRCS
Conservation Security Program	Green payment approach for maintaining and increasing conservation practices.	USDA-NRCS
Conservation Innovation Grants	National and state grants for innovative solutions to a variety of environmental challenges.	USDA-NRCS

Regional Conservation Partnership Program	Grants from national, state or Critical Conservation Area funding pools to promote formation of partnerships to facilitate conservation practice implementation. Each partner within a project must make a significant cash or in-kind contribution.	USDA-NRCS
Conservation Stewardship Program	Encourages farmers to begin or continue conservation through five-year contracts to install and maintain conservation practices and adopt conservation crop rotations.	USDA-NRCS
Aquatic Ecosystem Restoration — Section 206	Restoration projects in aquatic ecosystems such as rivers, lakes and wetlands.	US Army Corps
Habitat Restoration of Fish and Wildlife Resources	Must involve modification of the structures or operations of a project constructed by the Corps of Engineers.	US Army Corps
Section 319 Clean Water Act	Grants to implement NPS pollution control programs and projects in watersheds with EPA approved watershed management plans.	EPA/DNR
Iowa Water Quality Loan Fund	Source of low-cost financing for farmers and landowners, livestock producers, community groups, developers, watershed organizations and others.	DNR
Sponsored Projects	Wastewater utilities can finance and pay for projects, within or outside the corporate limits, that cover best management practices to keep sediment, nutrients, chemicals and other pollutants out of streams and lakes.	DNR/Iowa Finance Authority
Resource Enhancement and Protection Program	Provides funding for enhancement and protection of State's natural and cultural resources.	DNR
Streambank Stabilization and Habitat Improvement	Penalties from fish kills used for environmental improvement on streams impacted by the kill.	DNR/IDALS-DSCWQ
State Revolving Fund	Provides low interest loans to municipalities for waste water and water supply; expanding to private septics, livestock, storm water and NPS pollutants.	DNR
Watershed Improvement Review Board	Comprised of representatives from agriculture, water utilities, environmental organizations, agribusiness, the conservation community and state legislators and provides grants to watershed and water quality projects.	WIRB
Iowa Water Quality Initiative	Initiated by IDALS-DSCWQ as a demonstration and implementation program for the Nutrient Reduction Strategy. Funds are targeted to 9 priority HUC-8 watersheds.	IDALS-DSCWQ
Fishers and Farmers Partnership	Fishers & Farmers Partnership for the Upper Mississippi River Basin is a self-directed group of nongovernmental agricultural and conservation organizations, tribal organizations and state and federal agencies working to achieve the partnership's mission "… to support locally-led projects that add value to farms while restoring aquatic habitat and native fish populations."	US Fish and Wildlife Service and others

Private Funding Sources

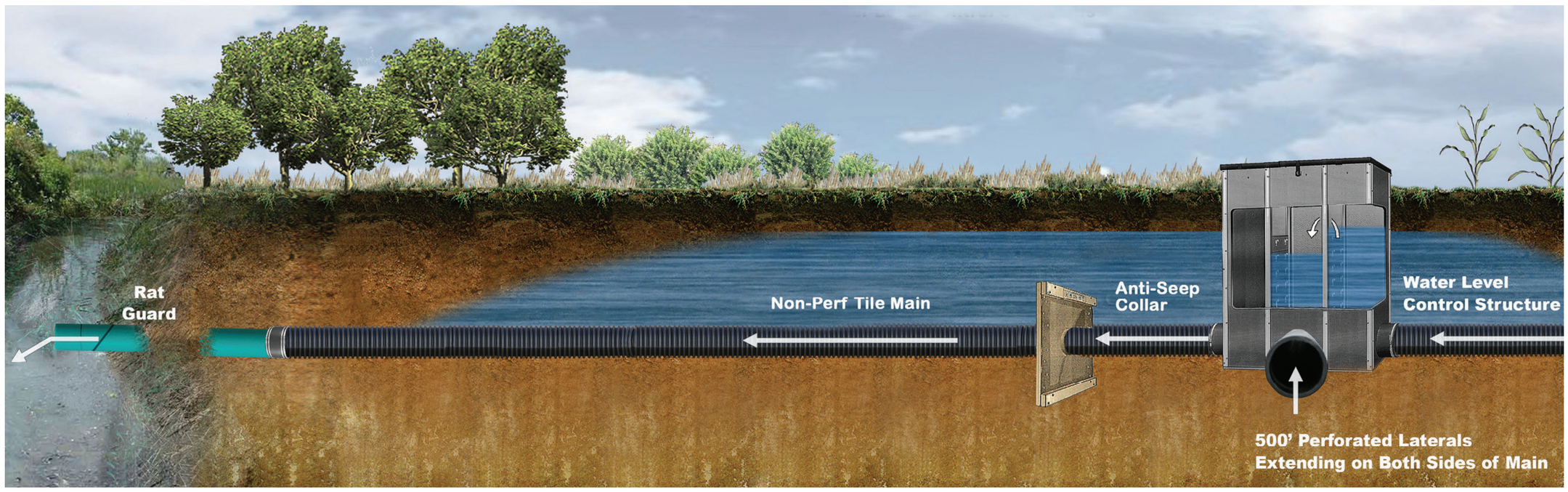
Program	Description	Website
Field to Market® Alliance	Field To Market® is a diverse alliance working to create opportunities across the agricultural supply chain for continuous improvements in productivity, environmental quality and human well-being. The group provides collaborative leadership that is engaged in industry-wide dialogue, grounded in science and open to the full range of technology choices.	https://www.fieldtomarket.org/members/
International Plant Nutrition Institute (IPNI)	The IPNI is a not-for-profit, science-based organization dedicated to the responsible management of plant nutrition for the benefit of the human family.	http://www.ipni.net
Iowa Community Foundations	Iowa Community Foundations are nonprofit organizations established to meet the current and future needs of our local communities.	http://www.iowacommunityfoundations.org/
Iowa Natural Heritage Foundation	Private nonprofit conservation organization working to ensure Iowans will always have beautiful natural areas — to bike, hike and paddle; to recharge, relax and refresh; and to keep Iowa healthy and vibrant.	http://www.inhf.org
McKnight Foundation — Mississippi River Program	Program goal is to restore the water quality and resiliency of the Mississippi River.	www.mcknight.org/grant-programs/mississippi-river
National Fish and Wildlife Foundation (NFWF)	NFWF provides funding on a competitive basis to projects that sustain, restore and enhance our nation's fish, wildlife and plants and their habitats.	www.nfwf.org
National Wildlife Foundation	Works to protect and restore resources and the beneficial functions they offer.	www.nwf.org
The Fertilizer Institute (TFI)	TFI is the leading voice in the fertilizer industry, representing the public policy, communication and statistical needs of producers, manufacturers, retailers and transporters of fertilizer. Issues of interest to TFI members include security, international trade, energy, transportation, the environment, worker health and safety, farm bill and conservation programs to promote the use of enhanced efficiency fertilizer.	http://www.tfi.org
The Nature Conservancy (TNC)	TNC is the largest freshwater conservation organization in the world — operating in 35 countries with more than 300 freshwater scientists and 500 freshwater conservation sites globally. TNC works with businesses, governments, partners and communities to change how water is managed around the world.	http://www.nature.org
Trees Forever — Working Watersheds Program	Annually work with 10-15 projects in Iowa that emphasize water quality through our Working Watersheds: Buffers and Beyond program.	www.treesforever.org/
Walton Family Foundation — Environmental Program	Work to achieve lasting change by creating new and unexpected partnerships among conservation, business and community interests to build durable solutions to big problems.	www.waltonfamilyfoundation.org/environment

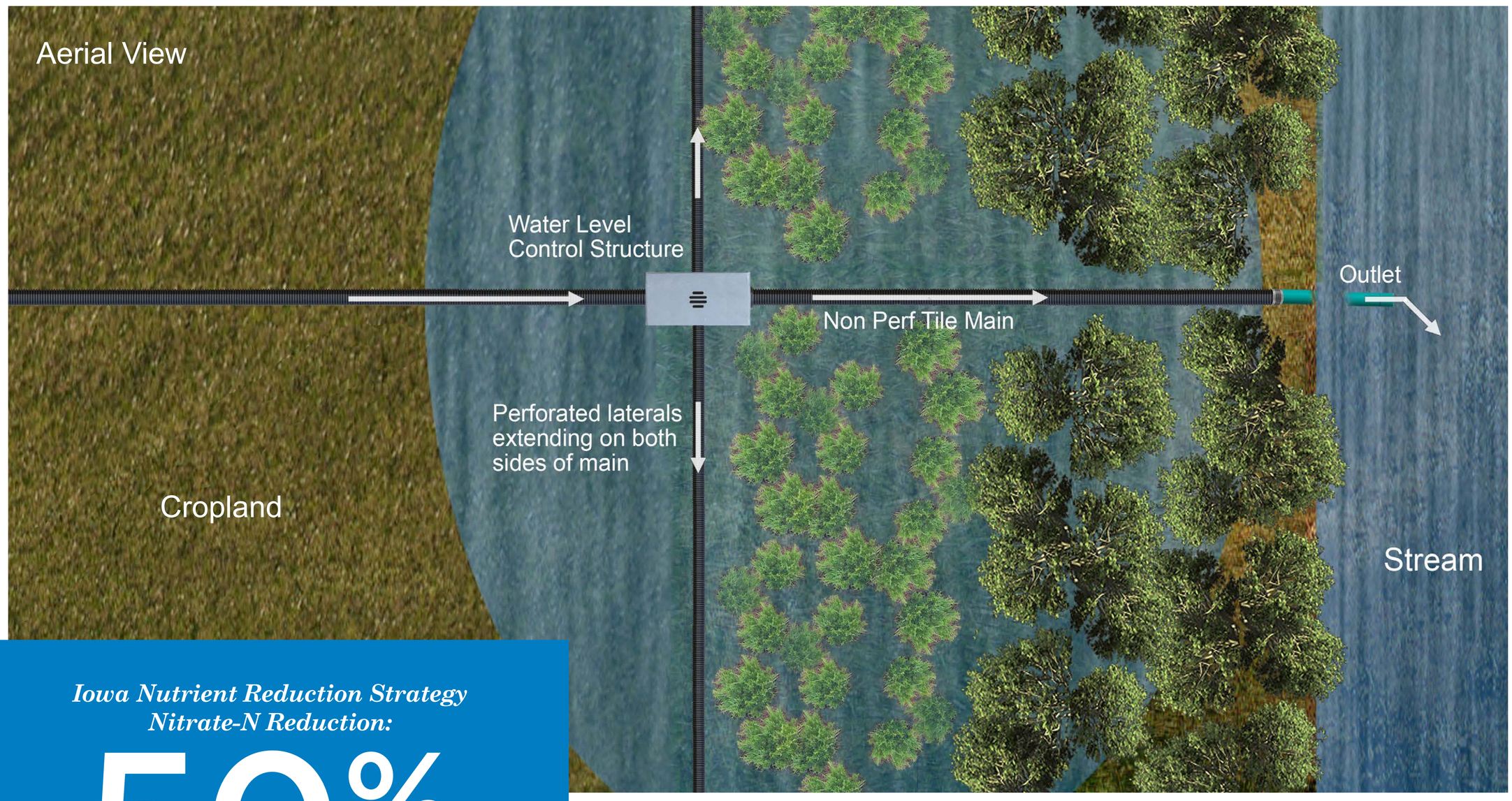
Appendix E

Practice Informational Flyers

SATURATED BUFFER

Saturated buffers allow nutrients to be removed by redistributing tile water into the riparian buffer soil profile before reaching the stream.





Iowa Nutrient Reduction Strategy
Nitrate-N Reduction:

50%

on average

images courtesy of Agri Drain

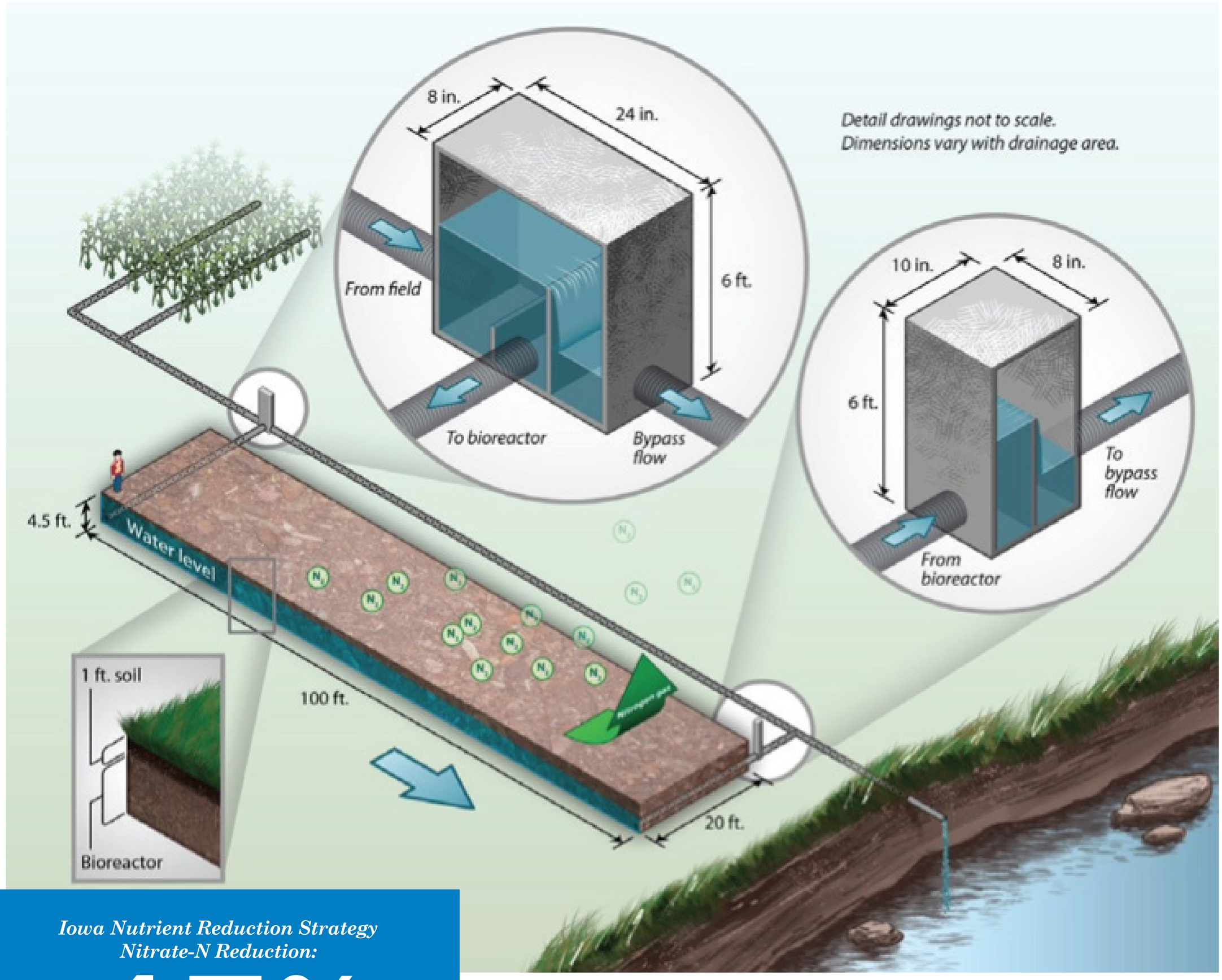
IOWA SOYBEAN Association

Expanding Opportunities. Delivering Results.

funded in part by the soybean checkoff

BIOREACTOR

Bioreactors redirect tile water to an underground bed of woodchips, spurring nitrate removal.



Iowa Nutrient Reduction Strategy
Nitrate-N Reduction:

43%

on average

image courtesy of Iowa State University

IOWA SOYBEAN Association

Expanding Opportunities. Delivering Results.

funded in part by the soybean checkoff

WETLAND

A wetland is a shallow vegetated pool that helps filter pollutants, control flooding and provide wildlife habitat.

Iowa Nutrient Reduction Strategy
Nitrate-N Reduction:

52%

on average

IOWA SOYBEAN Association

Expanding Opportunities. Delivering Results.

funded in part by the soybean checkoff

DRAINAGE WATER MANAGEMENT

Drainage water management uses a series of control structures to manage field drainage on flat land (0.5-1 percent slope) by storing water in the soil profile when drainage is not beneficial to crop production.

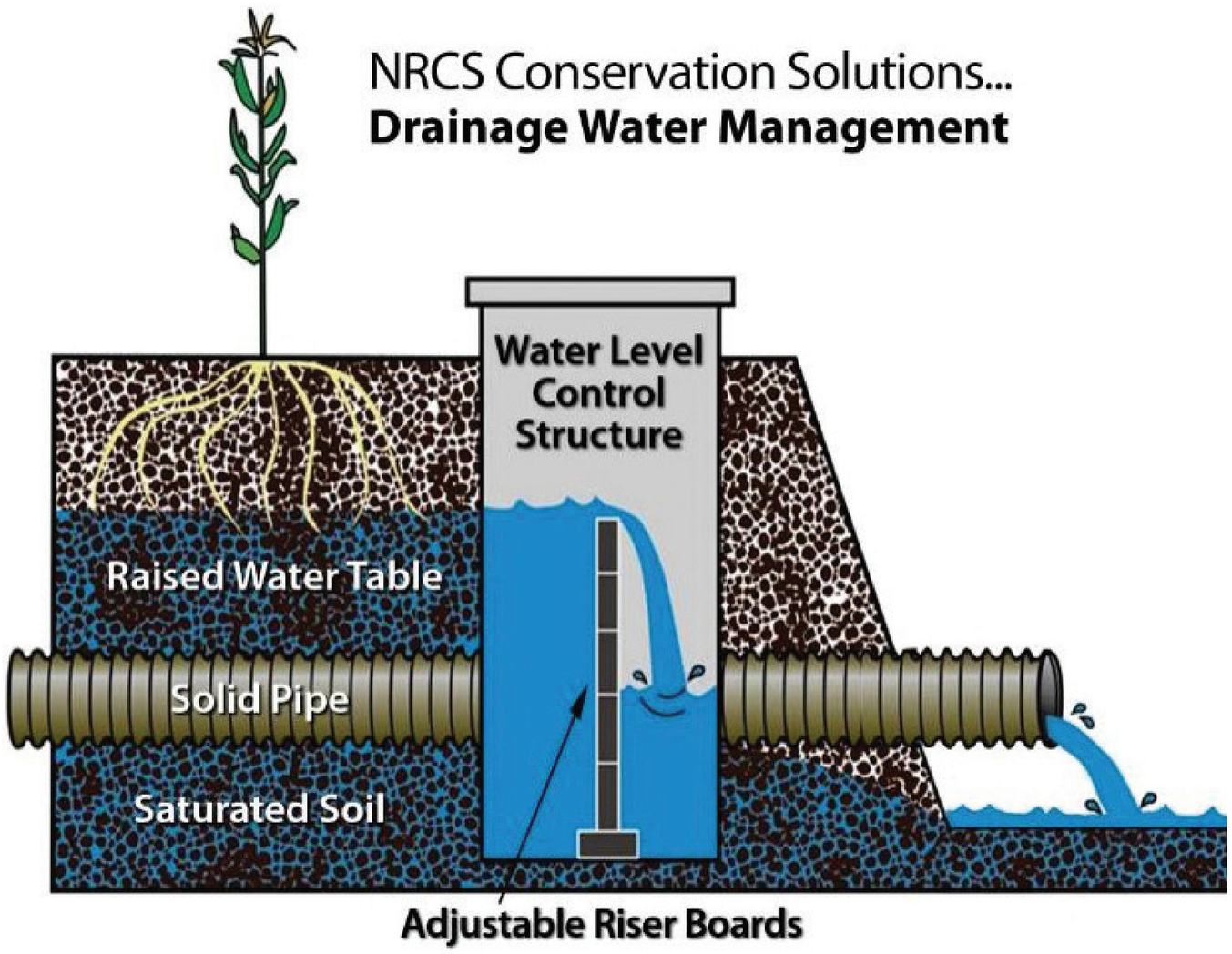


image courtesy of USDA-NRCS

Iowa Nutrient Reduction Strategy
Nitrate-N Reduction:

33%

on average

IOWA SOYBEAN Association
Expanding Opportunities. Delivering Results.

funded in part by the soybean checkoff

COVER CROPS

Cover crops are grown during the fall and spring between corn and soybeans to reduce nitrogen loss and erosion.

Iowa Nutrient Reduction Strategy Nitrate-N Reduction:

28-30%

on average

Iowa Nutrient Reduction Strategy Phosphorus Load Reduction:

29%

on average

IOWA SOYBEAN Association

Expanding Opportunities. Delivering Results.

funded in part by the soybean checkoff

POLLINATOR & WILDLIFE HABITAT

Habitat restoration transitions environmentally sensitive land from agricultural production to diverse native plant species that improve environmental quality as well as pollinator and wildlife habitat.

Iowa Nutrient Reduction Strategy
Nitrate-N Reduction:

85%

on average

Iowa Nutrient Reduction Strategy
Phosphorus Load Reduction:

75%

on average

IOWA SOYBEAN Association

Expanding Opportunities. Delivering Results.

funded in part by the soybean checkoff

Appendix F

Watershed Plan 2-Page Factsheet

Eagle Grove
Watershed Plan

What is a watershed?

A watershed is an area of land that drains to a common point. The Eagle Grove watershed includes two streams; the total watershed area is 14,240 acres of Wright county. The watershed meets with the Boone River west of Eagle Grove.

Why is there a watershed plan for the Eagle Grove Watershed?

The Eagle watershed was selected by the Iowa Soybean Association as priority area for an upstream-downstream partnership between farmers and landowners and the City of Eagle Grove. The first step was to develop a watershed plan to identify conservation practice opportunities in the watershed. Farmers and landowners from the watershed along with assistance from the Iowa Soybean Association developed a watershed plan to address the following goals by 2037:

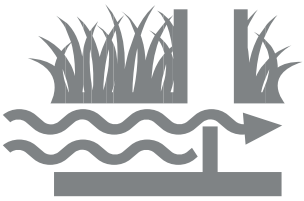
1. Identify cost effective solutions
2. Provide for profitable and productive agriculture
3. Create conditions for healthy soils and water
4. Minimize downstream impacts
5. Work with urban and rural stakeholders to implement conservation practices

What conservation practices are included in the watershed plan?

Due to the ambitious watershed plan goals, conservation practice adoption will be necessary throughout the entire watershed. The following practices along with their target implementation levels are included in the watershed conceptual plan (see map on reverse).

Saturated Buffers (5 structures) Tile water is routed into a riparian buffer. Plants and microbes in the buffer naturally remove nitrates from water as it percolates towards the stream.

Bioreactors (20 structures) Tile water is routed into a trench filled with wood chips. Microbes living in the wood chips remove nitrates from the water through a process called denitrification. The treated water is then returned to the stream with less nitrates.



Drainage Water Management (1,000 acres) A control structure is used to temporarily raise the water table. This reduces the overall amount of drainage throughout the year. Excess water can be drained before field operations by managing the control structure.

Nitrate Removal Wetlands (3 sites) Restored or constructed wetlands can benefit water quality by removing nitrates and sediment. Wetlands also reduce flooding by temporarily holding excess water during and after major precipitation events.

Cover Crops (4,000 acres) Cover crops sequester nitrogen when cash crops are not actively growing. Cover crops also reduce soil erosion and phosphorus loss.

No-Till/Strip-Till (All cropland) Reducing or eliminating tillage improves soil health, reduces soil erosion and decreases phosphorus loss.

Nutrient Management (At least 5,500 acres, preferably all cropland) Managing the rate, timing, source and stability of nutrient applications can simultaneously improve both return on investment through increased yield and water quality through decreased nutrient loss.

Perennial Cover (maintain existing acres plus 200 additional acres) Perennial grasses, shrubs and trees provide many benefits including wildlife habitat and reduced nutrient loss. Existing cover should be maintained to continue these ecosystem services.

Conservation isn't cheap! How much will it cost?

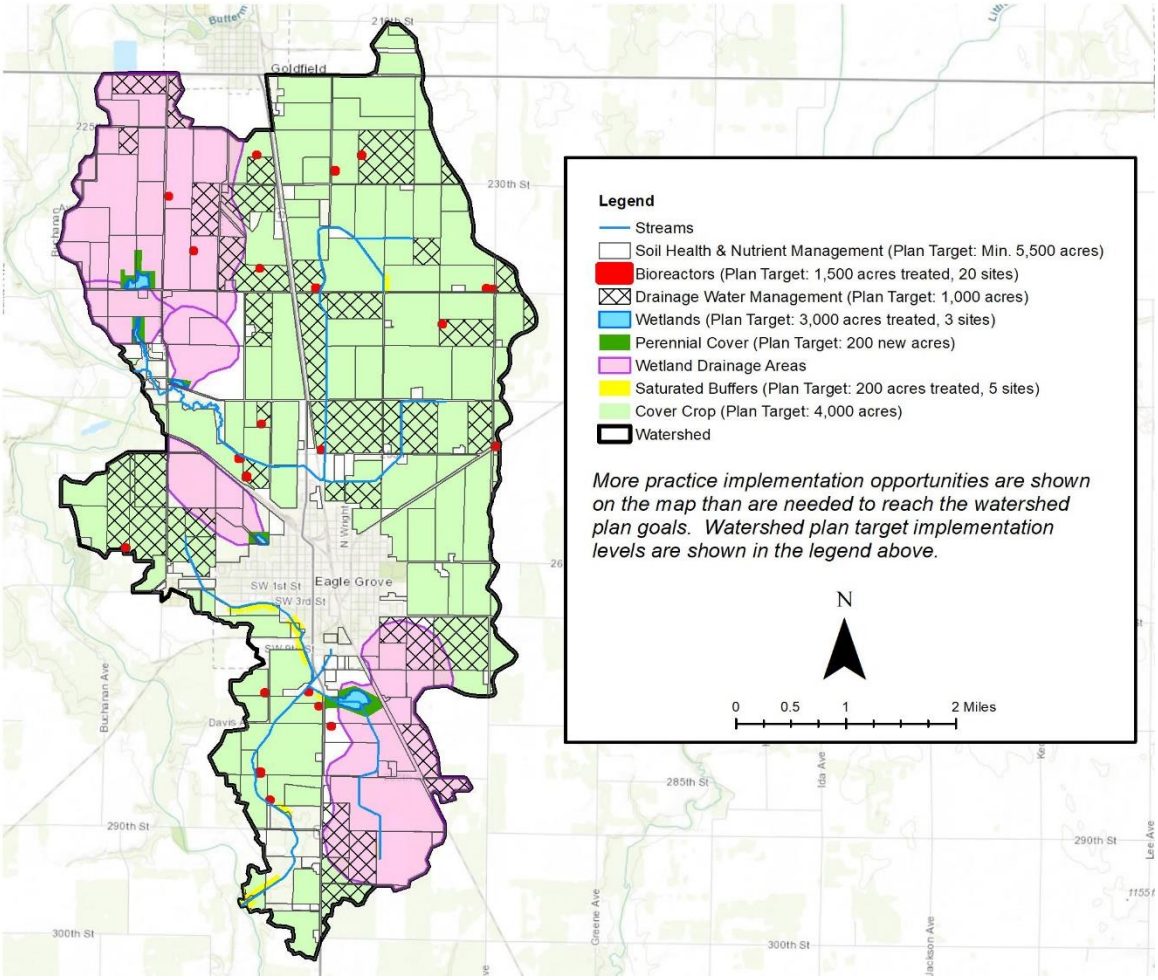
While some changes may result in cost savings, others can impose significant one-time or annually recurring costs.

						Watershed load reductions		Annualized Cost per Pound of Reduction	
	Practice	Watershed plan goal	Unit	Cost per unit	Total cost	Nitrogen (lb N/yr)	Phosphorus (lb P/yr)	Nitrogen ($/lb N/yr)	Phosphorus ($/lb P/yr)
Annual costs	Cover crops	4,000	acres	$50	$200,000	32,240	165	$6.20	$0.61
	Nutrient management - MRTN	5,500	acres	($5)	($27,500)	14,300	0	($1.92)	
	Conversion of Cropland to Perennial Cover	200	acres	$300	$60,000	4,420	32	$13.57	$0.94
	Drainage water management (50-year life)	1,000	acres	$1,000	$1,000,000	8,580	0	$2.33	
Initial costs	Bioreactors (15-year life)	20	structures	$12,000	$240,000	16,125	0	$0.99	
	Saturated buffers (75-year life)	5	structures	$3,000	$15,000	2,500	0	$0.08	
	Nitrate removal wetlands (75-year life)	3	sites	$283,333	$849,999	39,819	253	$0.28	$0.02

Total estimated cost to fully implement the Eagle Grove Watershed plan are $232,500 for annual management costs plus $2,104,999 for one-time infrastructures costs. Cost share is available for many of the practices.

Where are practices needed?

The conceptual plan shown below is one of a variety of potential combinations of practices to reach the watershed plan goals. The locations shown on the map are believed to be the most suitable for practice installation, especially for the structural practices. Site surveys will be required to determine true installation potential.



Who do I contact for more information about the watershed plan?

The key contact for the Eagle Grove Watershed Plan is Adam Kiel, Operations Manager of Water Resources at the Iowa Soybean Association. Adam can be reached at 515-334-1022 or akiel@iasoybeans.com