Prairie Creek Watershed Plan

A roadmap to sustain and enhance water resources, agricultural productivity, soils and habitat in the Prairie Creek Watershed

Prepared by:

Iowa Soybean Association Environmental Programs & Services

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

Watershed planning partners:

Watershed residents, farmers and landowners

Kossuth and Humboldt Soil and Water Conservation Districts

Natural Resources Conservation Service

The Nature Conservancy

Humboldt County Conservation Board

Iowa Department of Agriculture and Land Stewardship

Iowa Department of Natural Resources

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Why was the Prairie Creek Watershed Plan developed?

This watershed plan is intended to provide a roadmap for land and water improvements in the Prairie Creek 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 Prairie Creek 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. Guidance and input was provided by representatives of landowners, farmers, residents and county and federal governments. The watershed planning process was led by the Iowa Soybean Association with assistance from the Kossuth and Humboldt Soil and Water Conservation Districts, the Natural Resources Conservation Service, The Nature Conservancy, the Humboldt County Conservation Board, the Iowa Department of Agriculture and Land Stewardship and the Iowa Department of Natural Resources.

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1. Executive Summary

A watershed is an area of land that drains to a single point such as a lake or larger stream. The Prairie Creek Watershed (PCW) is comprised of approximately 90,000 acres. The PCW is located primarily in Kossuth and Humboldt counties in Iowa along with small portions in Hancock and Wright counties. The PCW is drained by Prairie Creek and its tributaries from its headwaters near Wesley to its confluence with the Boone River east of Renwick. Figure 1.1 shows the location of the PCW and Figure 1.2 illustrates how watersheds function.

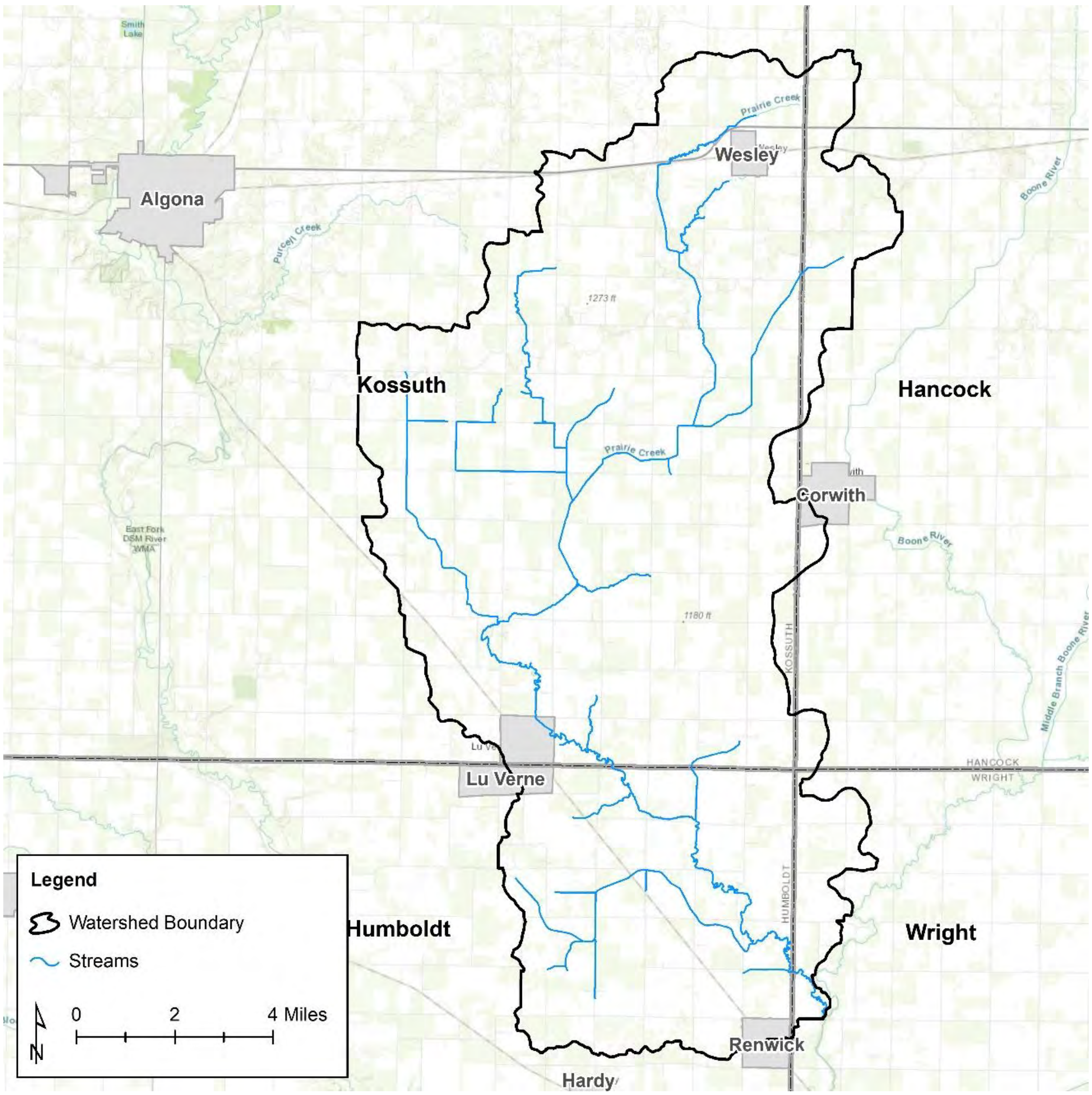

Figure 1.1. Location of the Prairie Creek Watershed in north central Iowa along with nearby cities.

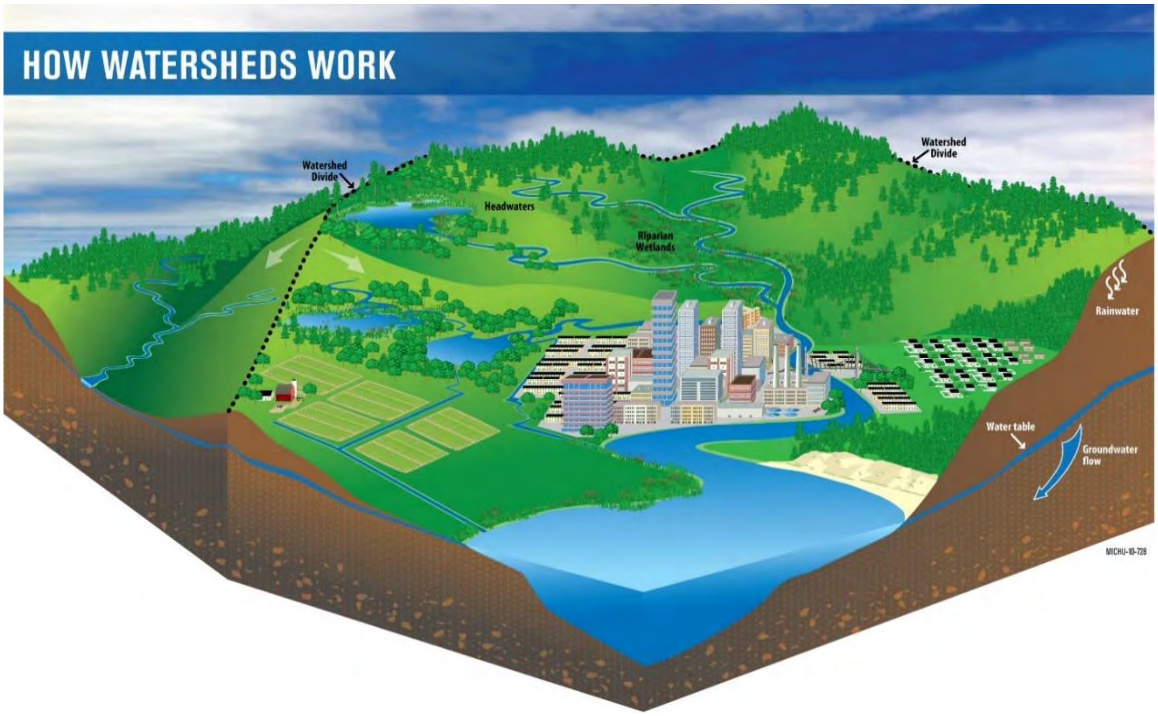

Figure 1.2. A watershed contains the land and water that flow to a common point (Michigan Sea Grant).

The Prairie Creek Watershed Plan defines and addresses existing land and water quality conditions, identifies challenges and opportunities and provides a path for improvement. The plan was developed according to the watershed planning process recommended by the Iowa Department of Natural Resources (IDNR; Figure 1.3) 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 Iowa Department of Agriculture and Land Stewardship (IDALS) via the Wright County Soil and Water Conservation District (SWCD). Local PCW stakeholders including watershed farmers, landowners, conservation professionals and others contributed knowledge and insights throughout the watershed planning process. The Prairie Creek Watershed Plan integrates existing data, citizen and stakeholder input and conservation practice recommendations to meet the goals established through the watershed planning process.

The PCW is a subwatershed of the larger **Boone River Watershed** and was identified for watershed planning to support ongoing watershed projects. The watershed is one of two focus watersheds (along with the Eagle Creek Watershed in Wright County) located within the **Boone River Watershed Nutrient Management Initiative** project area, which is a Water Quality Initiative (WQI) watershed demonstration project led by the Kossuth and Humboldt SWCDs and funded by IDALS. The Boone River Watershed Nutrient Management Initiative project was launched in 2014 to work with farmers and project partners to demonstrate, implement and evaluate conservation practices identified in the **Iowa Nutrient Reduction Strategy** (INRS). The project is building on previous successes from the Mississippi River Basin Healthy Watersheds Initiative (MRBI), a program led by the USDA-Natural Resources Conservation Service (NRCS). Previous and ongoing efforts in the Boone River Watershed also have been led by **The Nature Conservancy**. Community participation provided important insights throughout the watershed planning process. Local engagement and leadership has been and will continue to be essential as the plan is implemented.

Figure 1.3. The watershed planning process.

The Boone River Watershed is one of nine priority watersheds identified in the 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. The Prairie Creek Watershed Plan was developed within the flexible nonpoint source framework to identify a locally appropriate strategy to address INRS water quality improvement goals.

Goals for the PCW 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 Prairie Creek Watershed Plan are to:

1. Increase awareness and implementation.
2. Reduce in-stream nonpoint source nitrogen loading by 41 percent.
3. Maintain and increase agricultural profitability and sustainability.
4. Reduce soil erosion from wind and water.
5. Reduce in-stream nonpoint source phosphorus loading by 29 percent.
6. Reduce flood risk.
7. Increase soil organic matter by 1 percent.
8. Maintain and improve wildlife habitat.

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, residents, conservation and agricultural professionals and other local stakeholders to guide the development of this watershed plan.

Improving land and water resources in the PCW 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. An 18-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 2035. The total investment necessary to accomplish the watershed plan goals is estimated to be approximately $6,445,000 for initial infrastructure costs associated with structural practices, up to $2,695,500 per year for annual costs associated with management practices and an additional $120,000 per year to fund technical assistance, outreach, monitoring and equipment necessary to promote and implement conservation in the watershed.

Expenditures for watershed improvement in the PCW 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) can be considered along with their potential internal (local) and external (downstream) 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 nitrate and phosphorus load reduction cost efficiency for practices that are included in the Prairie Creek Watershed Plan. Many of these practices have additional on-farm and off-farm economic and ecosystem benefits that also could be considered as specific conservation practices are funded.

Table 1.1. Estimated annual nutrient load reductions and cost efficiency of conservation practices included in the Prairie Creek Watershed conceptual plan. Initial costs for structural practices were annualized by typical practice lifespans to facilitate comparison to management practices.

	Practice	Unit	Future Needs	Cost Per Unit	Total Cost	Nitrate Load Reduction (lb N/yr)	Phosphorus Load Reduction (lb P/yr)	Annualized N Reduction Cost ($/lb N/yr)	Annualized P Reduction Cost ($/ton P/yr)
Annual Costs	Nutrient management	acres	30,000	-$5	-$150,000	75,000	233	-	-
	No-till/Strip-till	acres	60,000	-$10	-$600,000	0	2,469	-	-
	Cover crops	acres	60,000	$50	$3,000,000	465,000	796	$6.45	$1.89
	Perennial cover	acres	1,500	$297	$445,500	127,500	206	$3.49	$1.08
Initial Costs	Bioreactors	structures	49	$10,000	$490,000	18,945	0	$1.72	-
	Saturated buffers	structures	40	$3,000	$120,000	17,983	0	$0.09	-
	Wetlands	sites	9	$625,000	$5,625,000	168,322	598	$0.22	$0.03
	Oxbow restorations	sites	21	$10,000	$210,000	8,308	0	$0.17	-

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

2. Watershed Characteristics

2.1. General Information

The Prairie Creek Watershed (PCW) encompasses 92,751 acres (145 square miles) used primarily for agricultural production. Row crop agriculture occupies 86 percent of the watershed. Terrain in the watershed is predominately flat and includes small topographic depressions and wetlands known as prairie potholes. The primary stream in the PCW is Prairie Creek, which flows generally from north to south from its headwaters in east central Kossuth County to its confluence with the Boone River in northwest Wright County. Incorporated communities within the watershed include Wesley, Corwith, Lu Verne and Renwick, along with St. Benedict, which is unincorporated. The majority of the watershed is privately owned. Rural public land in the watershed includes St. Benedict Wildlife Management Area managed by the Kossuth County Conservation Board, land along Prairie Creek managed by the Humboldt County Conservation Board and the Prairie Smoke Waterfowl Production Area owned and managed by the U.S. Fish and Wildlife Service. Table 2.1.1 lists general information for the PCW and Figure 2.1.1 displays the Hydrologic Unit Code (HUC)-12 subwatersheds.

Table 2.1.1. Watershed information for the Prairie Creek Watershed.

Location	Kossuth, Humboldt, Hancock and Wright Counties			
Watershed area	92,751 acres			
Total length of all streams	84.2 miles			
Primary land use	Row crop agriculture			
Incorporated communities	Wesley, Corwith, Lu Verne, Renwick			
Unincorporated communities	St. Benedict			
HUC-8 watershed	Boone			
HUC-8 ID	07100005			
HUC-10 watershed	Prairie Creek			
HUC-10 ID	0710000501			
HUC-12 watershed	Drainage Ditch 117	Headwaters Prairie Creek	Drainage Ditch 116-Prairie Creek	Drainage Ditch 18-Prairie Creek
HUC-12 ID	071000050101	071000050102	071000050103	071000050104
HUC-12 watershed area	11,435 acres	25,878 acres	26,117 acres	29,321 acres

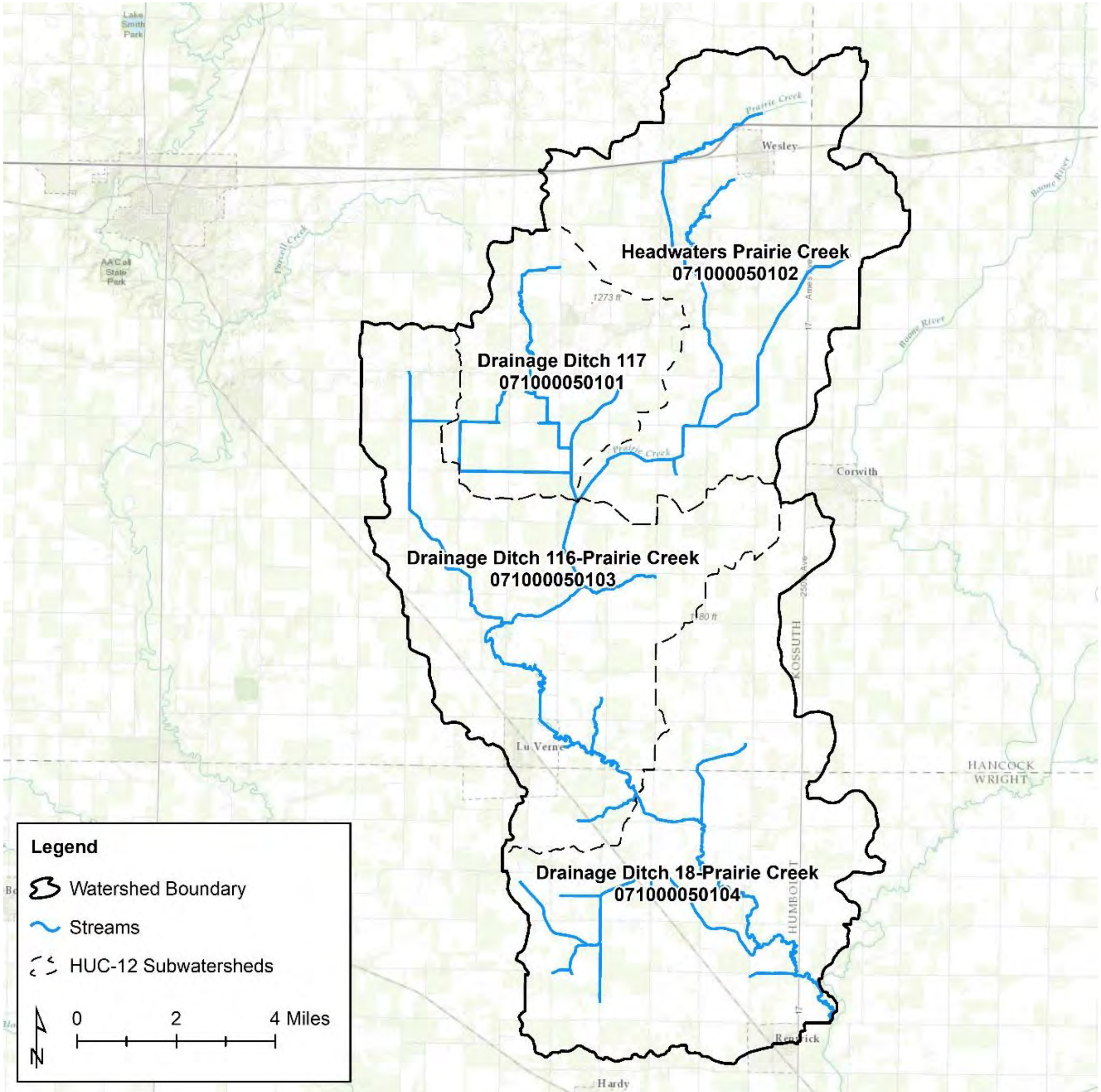

Figure 2.1.1. Prairie Creek Watershed and HUC-12 subwatersheds.

2.2. Water and Wetlands

Prairie Creek has been designated by the IDNR as a waterbody that should support recreation and aquatic life. Much of Prairie Creek is a natural stream channel, but portions of Prairie Creek—and its tributaries in particular—are channelized drainage ditches that primarily receive flow from subsurface drainage infrastructure. Table 2.2.1 contains information for the assessed stream reach within the PCW. Surface water in the PCW includes Prairie Creek, Eddy Creek, Drainage Ditch 117, Drainage Ditch 116, Drainage Ditch 18, unnamed tributary streams and small wetlands. Figure 2.2.1 shows the identified perennial stream network within the watershed. Figure 2.2.2 displays the wetlands in the PCW 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 U.S. Fish and Wildlife Service via aerial photo interpretation.

Table 2.2.1. Information for Prairie Creek stream segment from the ADBNet water quality database. Designated uses for Prairie Creek include A1 (primary contact recreation) and B(WW-2) (warm water aquatic life).

Waterbody Name	Prairie Creek
ADBCode	**04-UDM-1272**
Legacy ADBCode	IA 04-UDM-0260_0
Designated Uses	A1, B(WW-2)
Segment Length	16.7 miles
Most Recent Assessment	**Not assessed**

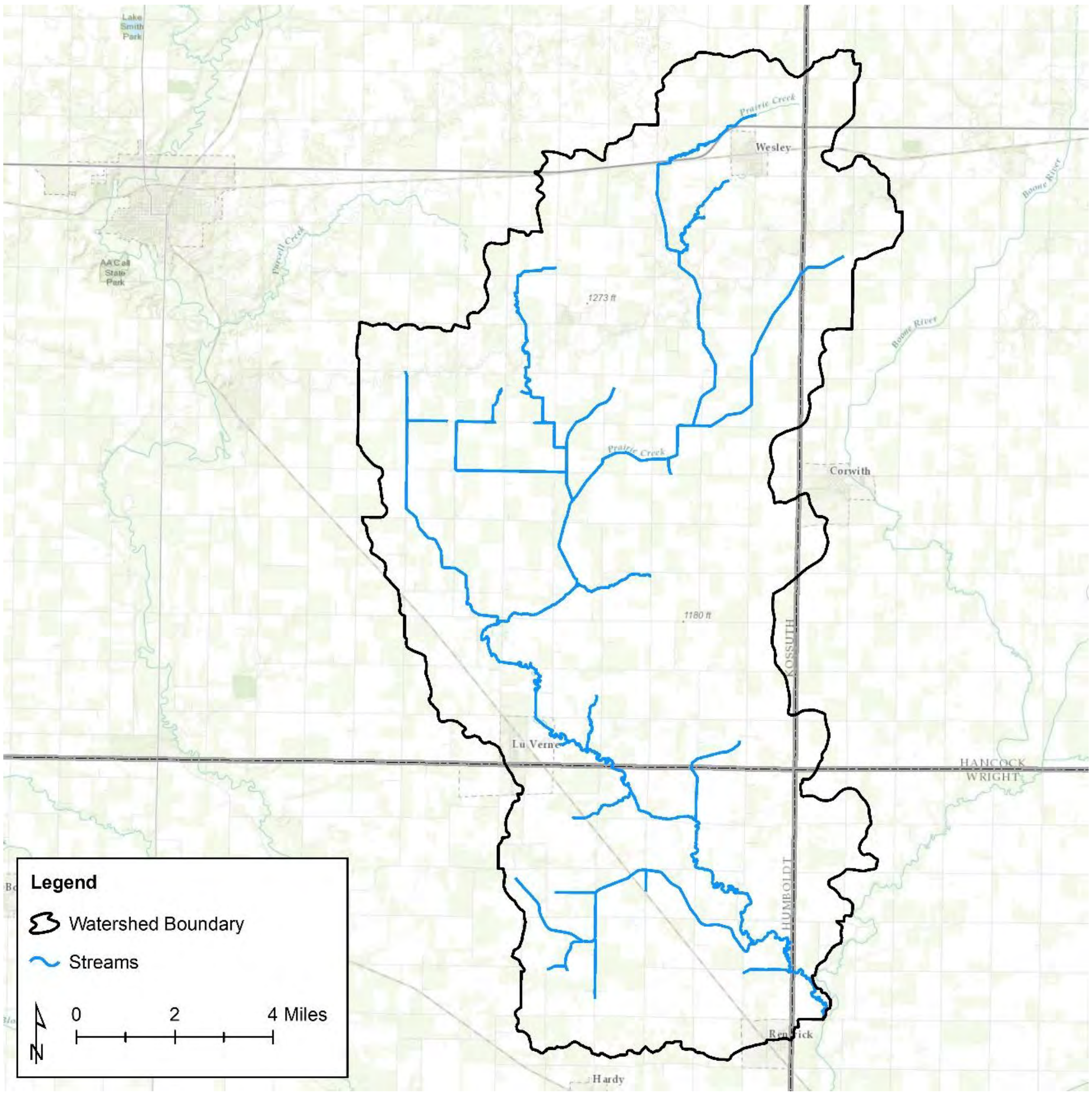

Figure 2.2.1. Streams identified in the Prairie Creek Watershed.

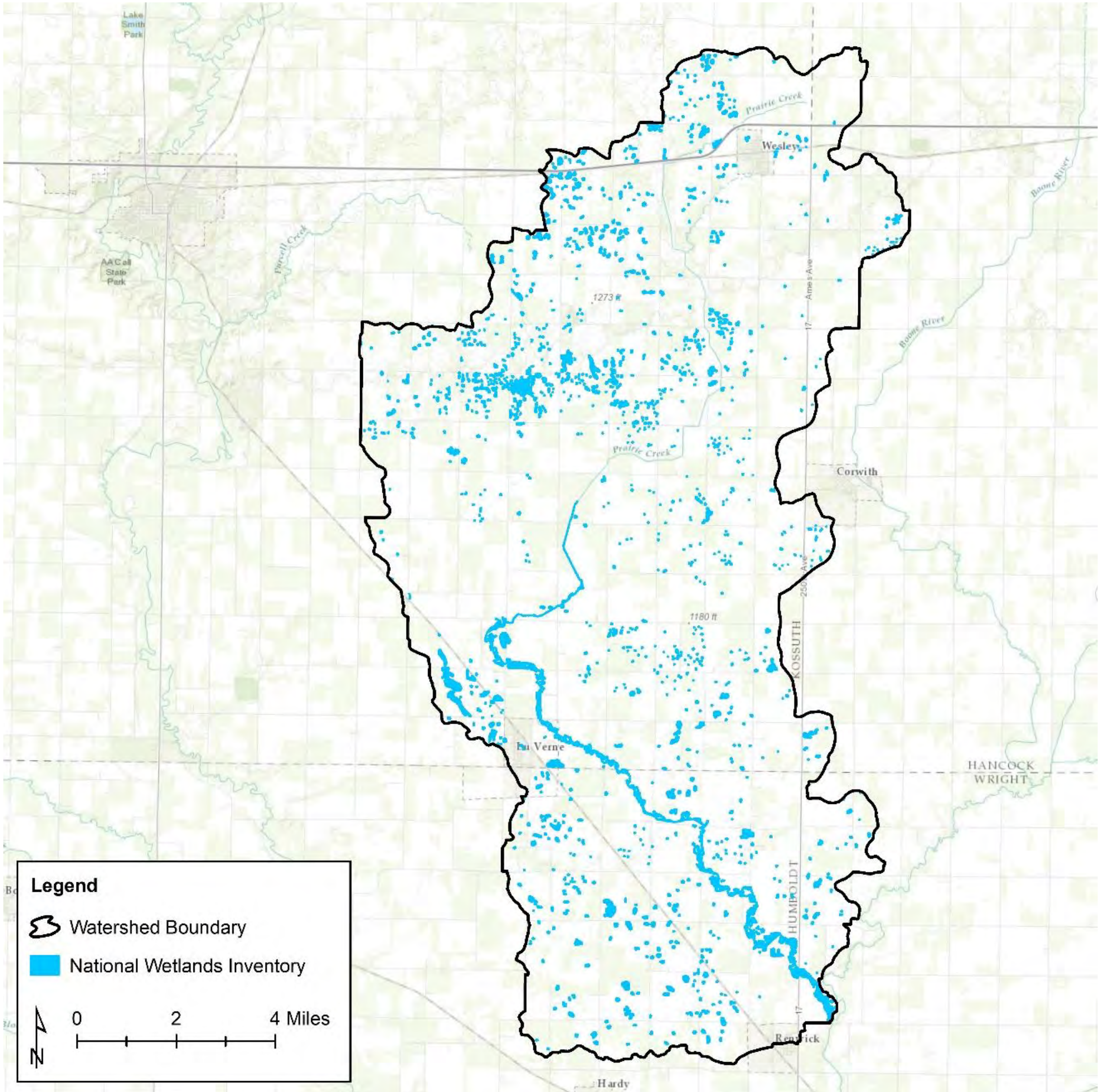

Figure 2.2.2. Wetlands in the Prairie Creek Watershed mapped in the National Wetlands Inventory.

Table 2.2.1. Classification of wetlands in the Prairie Creek Watershed according to the National Wetlands Inventory.

Type	**Acres**
Artificially Flooded	9
Intermittently Exposed	152
Intermittently Flooded	1,496
Seasonally Flooded	181
Semi-permanently Flooded	42
Temporarily Flooded	344
Other	24
Total	**2,248**

2.3. Climate

Precipitation data obtained from the **Iowa Environmental Mesonet** (IEM) for nearby the PCW show annual total precipitation at Algona averaged 30.5 inches per year between 1951 and 2016 and 33.5 inches annual from 2000 through 2016, with a range of 23.5 to 42.2 inches per year for the most recent 17-year period, which reveals large 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 66-year period of record. Monthly precipitation averages are displayed in Figure 2.3.2. Average annual air temperature for the period of record was 46 degrees Fahrenheit.

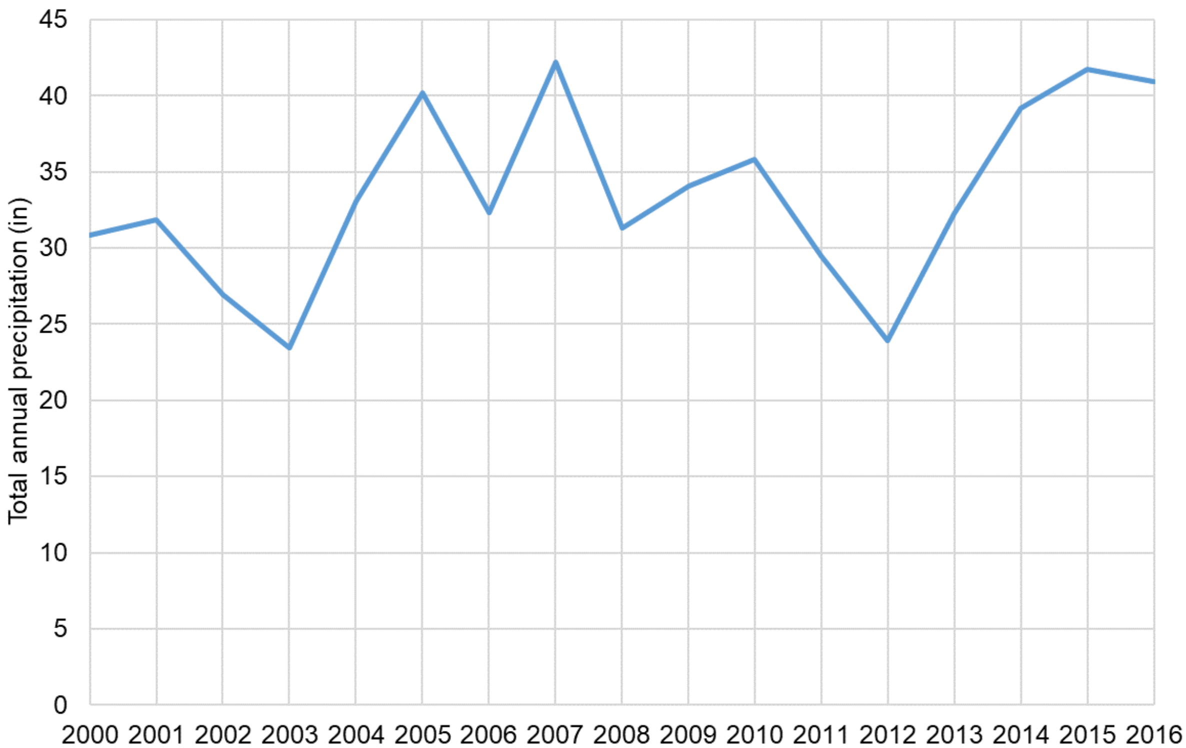

Figure 2.3.1. Total annual precipitation for the Prairie Creek Watershed from 2000 through 2016 (Iowa Environmental Mesonet).

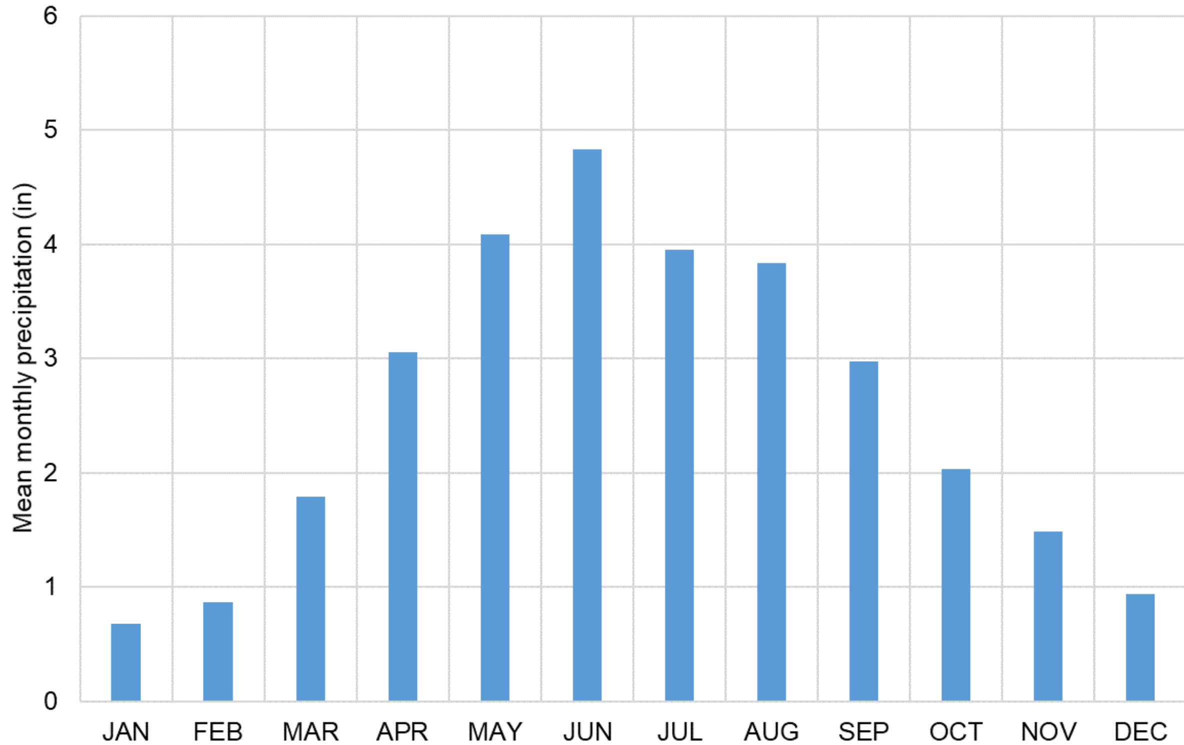

Figure 2.3.2. 1951 to 2016 average precipitation by month for the Prairie Creek Watershed (Iowa Environmental Mesonet).

2.4. Geology and Terrain

The PCW 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. The Algona Moraine is a notable geologic feature located in the northern portion of the watershed. Due to the young geologic age of the region the predominant subsurface parent material is mixed glacial till. Approximately 9 percent of the watershed contains alluvial deposits. 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 1,099 to 1,286 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-two percent of the watershed has slopes of less than 5 percent.

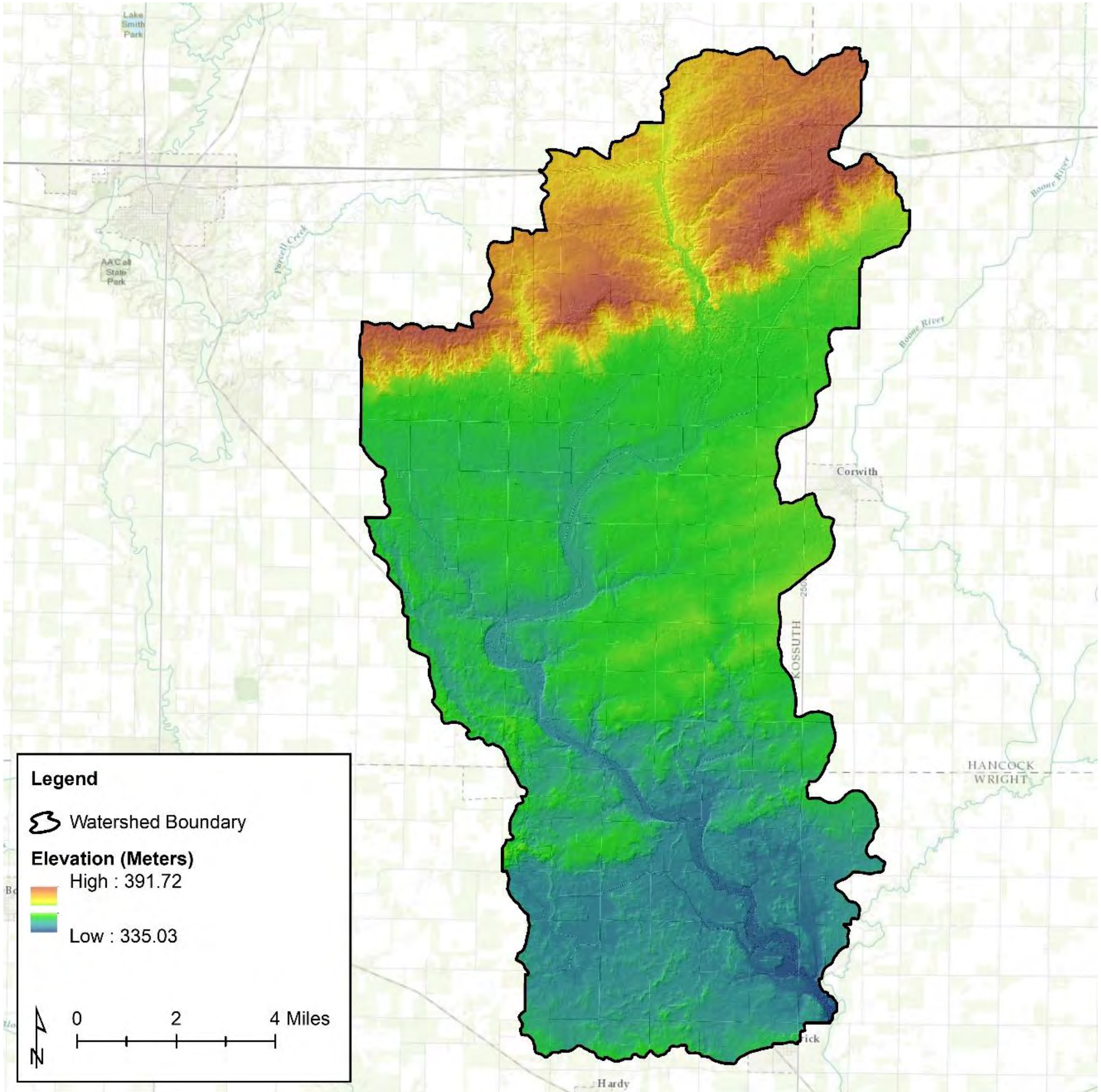

Figure 2.4.1. LiDAR-derived elevations within the Prairie Creek Watershed.

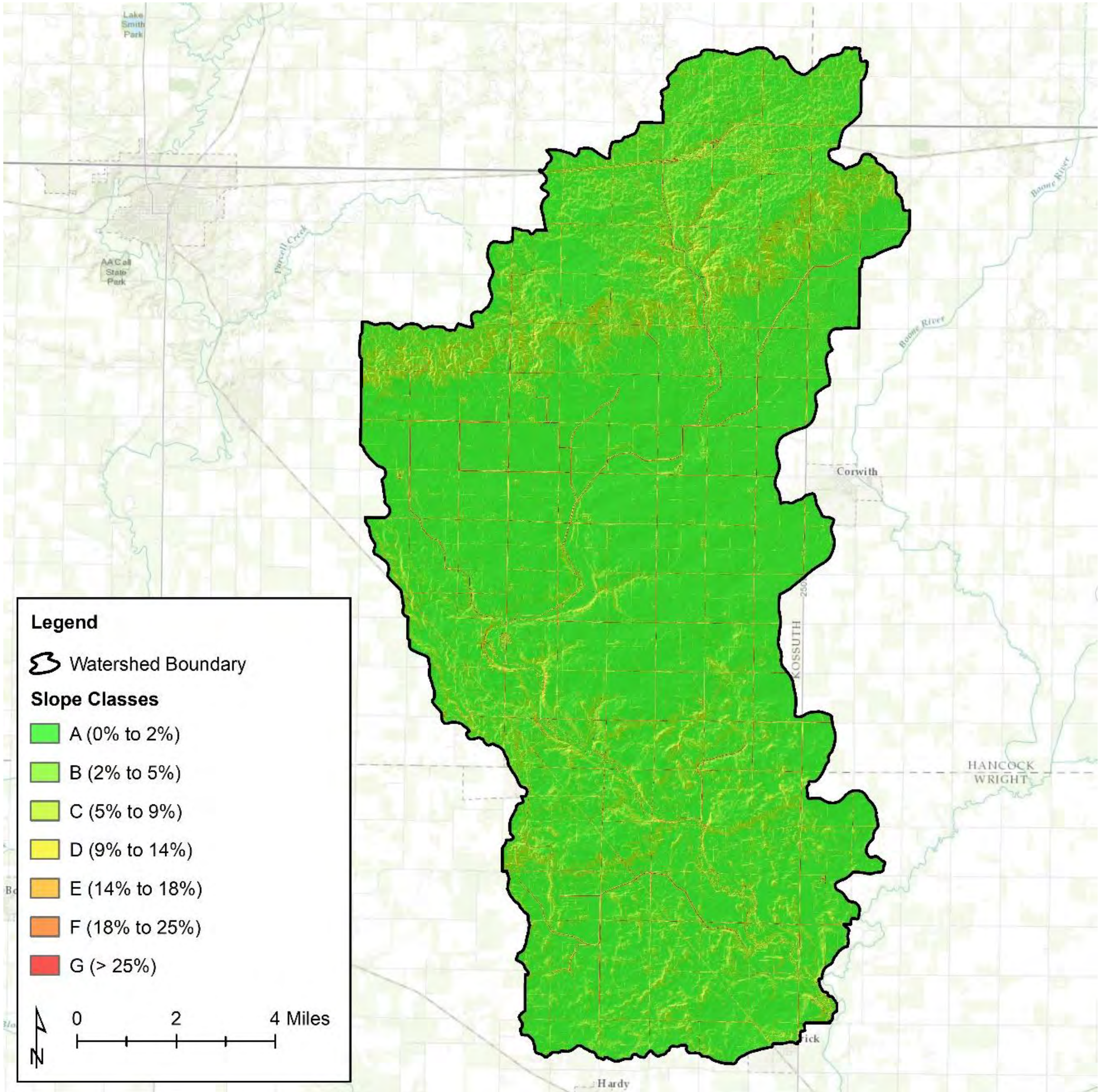

Figure 2.4.2. Prairie Creek Watershed slope classifications derived from elevation data.

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

Slope Class	Range	Acres	Percent of Watershed
A	0-2%	62,782	67.7
B	2-5%	22,470	24.2
C	5-9%	4,713	5.1
D	9-14%	1,266	1.4
E	14-18%	453	0.5
F	18-25%	519	0.6
G	> 25%	548	0.6

2.5. Soils

The most common soil association in the PCW 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 seven most prevalent soil series in the watershed are Canisteo, Nicollet, Clarion, Webster, Kossuth, Okoboji and Harps, which together comprise nearly three quarters 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 Canisteo, Nicollet, Clarion, Webster, Kossuth, Okoboji and Harps soil series are given in Table 2.5.1.

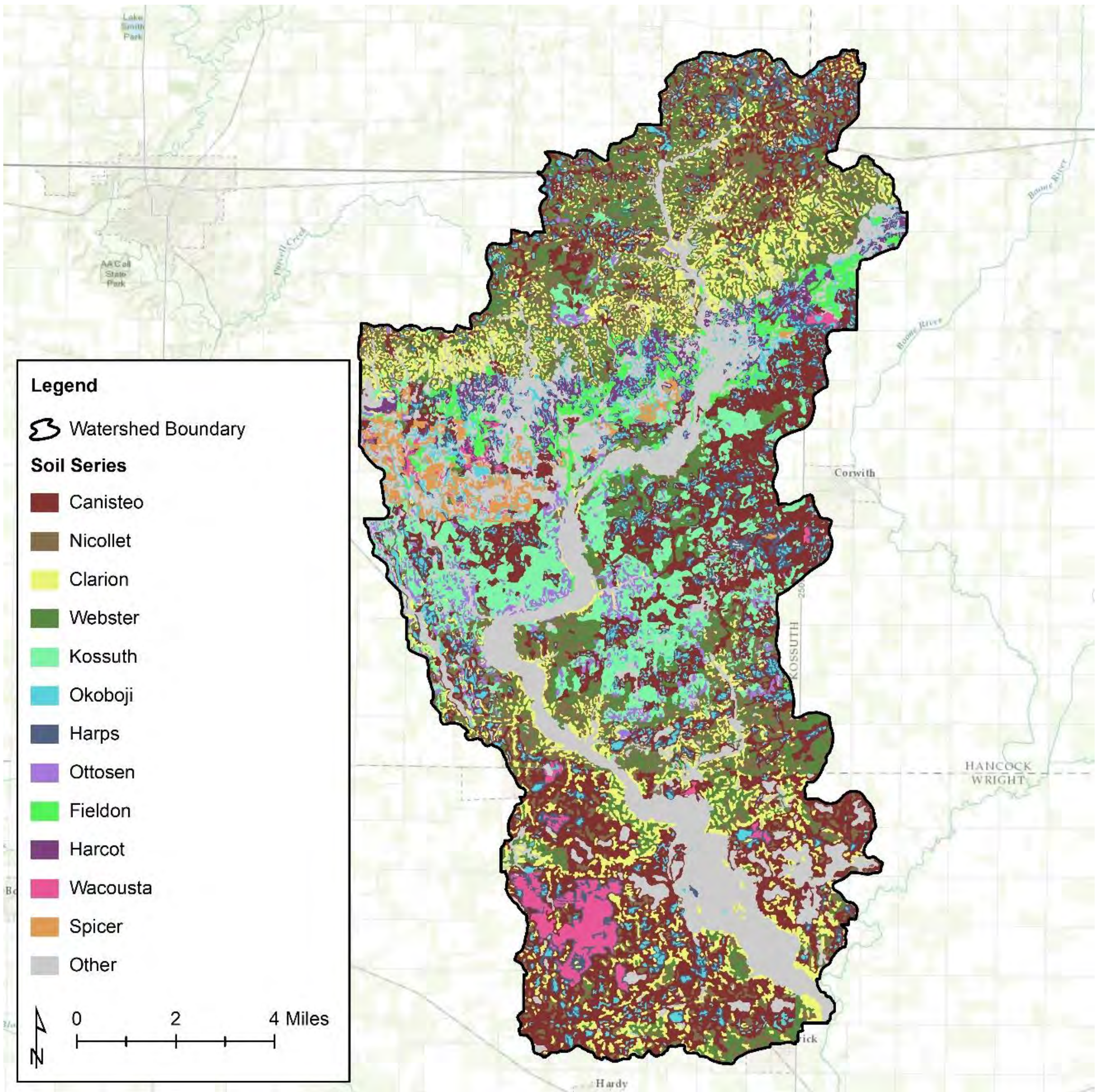

Figure 2.5.1. Prairie Creek Watershed soil map derived from Soil Survey Geographic Database data.

Table 2.5.1. Official NRCS soil series descriptions.

Soil Series	Description
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.
Clarion	Very deep, moderately well drained soils on uplands. These soils formed in glacial till. Slopes range from 1 to 9 percent.
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.
Kossuth	Deep, poorly drained soils that formed in moderately fine textured glacial or lacustrine sediments and in the underlying medium textured glacial till or sediments on ground moraines. These soils are moderately slowly permeable in the upper part and moderately permeable material. Slope ranges from 0 to 2 percent.
Okoboji	Very deep, very poorly drained soils formed in alluvium or lacustrine sediments. These soils are in closed depressions on till plains and moraines. Slope ranges from 0 to 1 percent.
Harps	Very deep, poorly drained soils formed in till or alluvium derived from till. Harps soils are on narrow rims or shorelines of depressions on till plains and moraines. Slope ranges from 0 to 3 percent.

Soil drainage properties affect surface and subsurface water movement within the watershed. These characteristics are summarized in Table 2.5.2. Approximately 87 percent of the soils in the PCW 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. 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 agricultural productivity (rated by Corn Suitability Rating 2, CSR2) of predominant soils in the Prairie Creek Watershed.

Soil Series	Acres	Percent of Watershed	CSR2	Drainage Class	Hydrologic Group	Hydric Class
Canisteo	21,751	23.5	88	Poorly drained	B/D	Hydric
Nicollet	11,856	12.8	89	Somewhat poorly drained	B	Partially hydric
Clarion	9,682	10.4	82	Well drained	B	Not hydric
Webster	9,034	9.7	88	Poorly drained	B/D	Hydric
Kossuth	7,024	7.6	88	Poorly drained	B/D	Hydric
Okoboji	4,838	5.2	55	Very poorly drained	B/D	Hydric
Harps	3,319	3.6	74	Poorly drained	B/D	Hydric

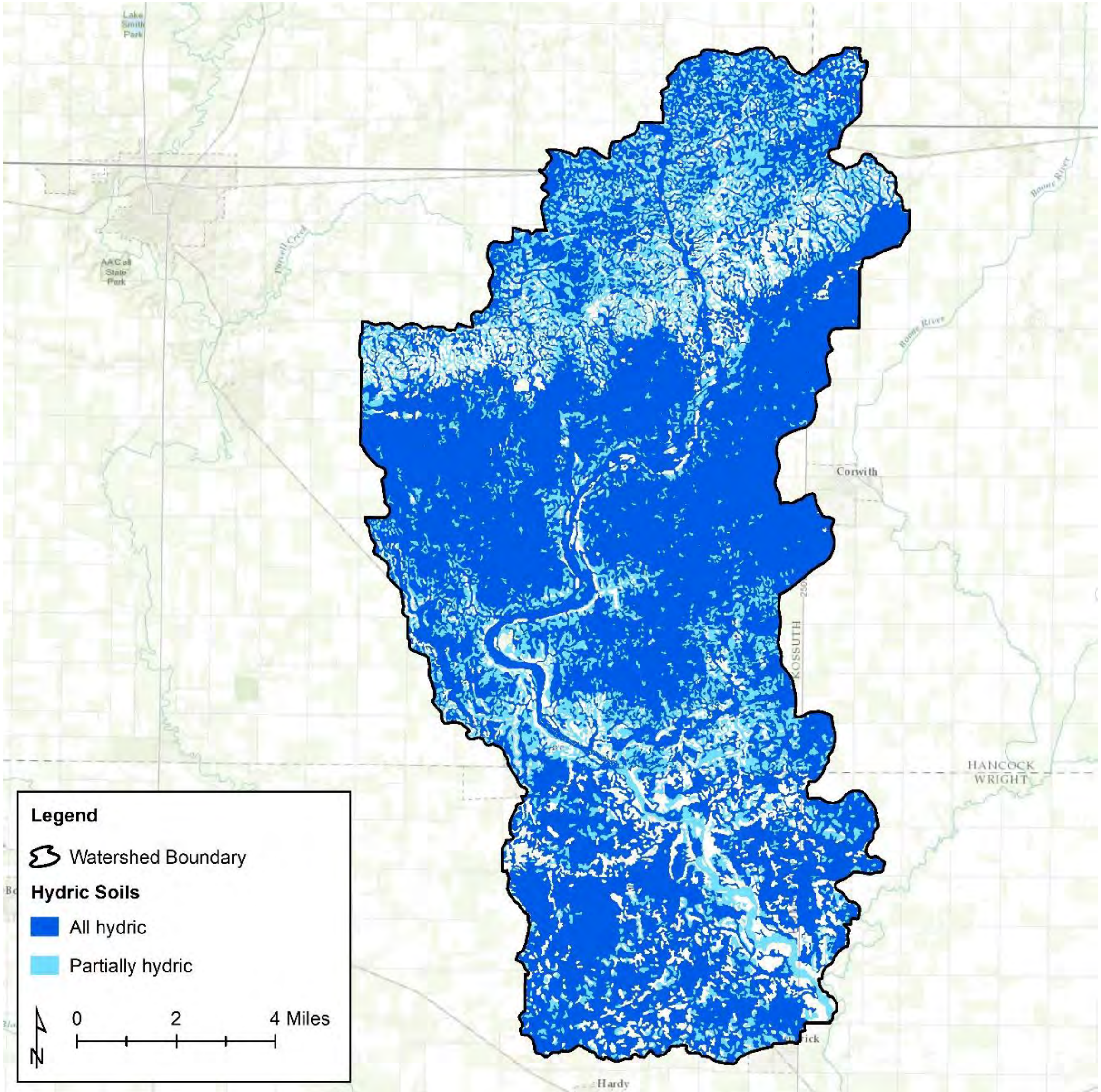

Figure 2.5.2. Soil map units in the Prairie Creek Watershed that are classified as hydric.

Agricultural land within the PCW is likely to be tile drained in order to increase agricultural productivity. Public records of subsurface drainage infrastructure are sparse, but the USDA-Agricultural Research Service (ARS) has developed a geographic coverage of soils in Iowa that are likely to be tile 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.

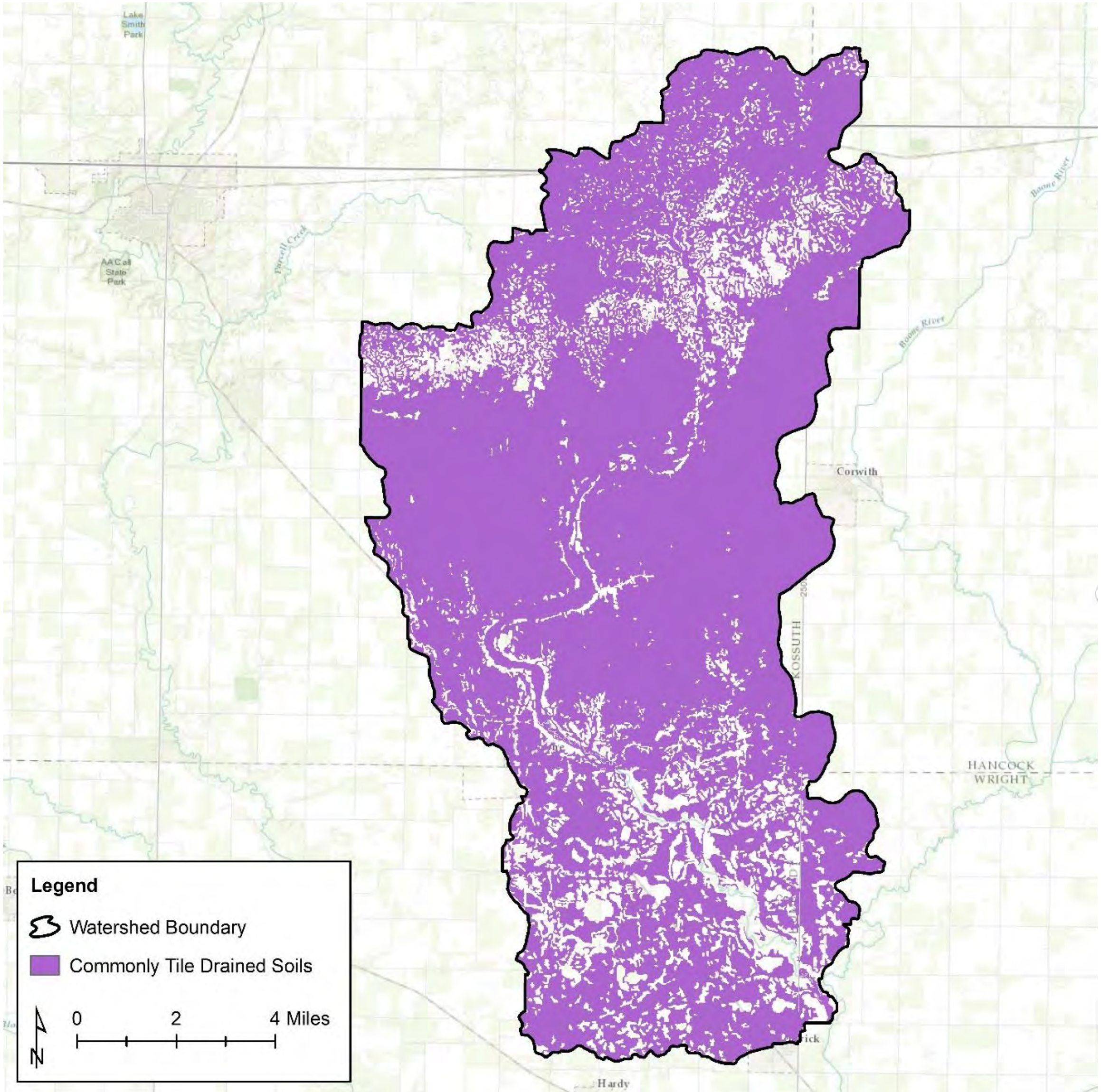

Figure 2.5.3. Areas in the Prairie Creek Watershed requiring tile drainage to optimize agricultural production.

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 PCW. This map was generated by matching spatial SSURGO data to the Iowa Soil Properties and Interpretations Database (ISPAID) version 8.1. The Iowa CSR2 is an index that provides a relative ranking of soils mapped in Iowa based on their potential to be utilized for 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.

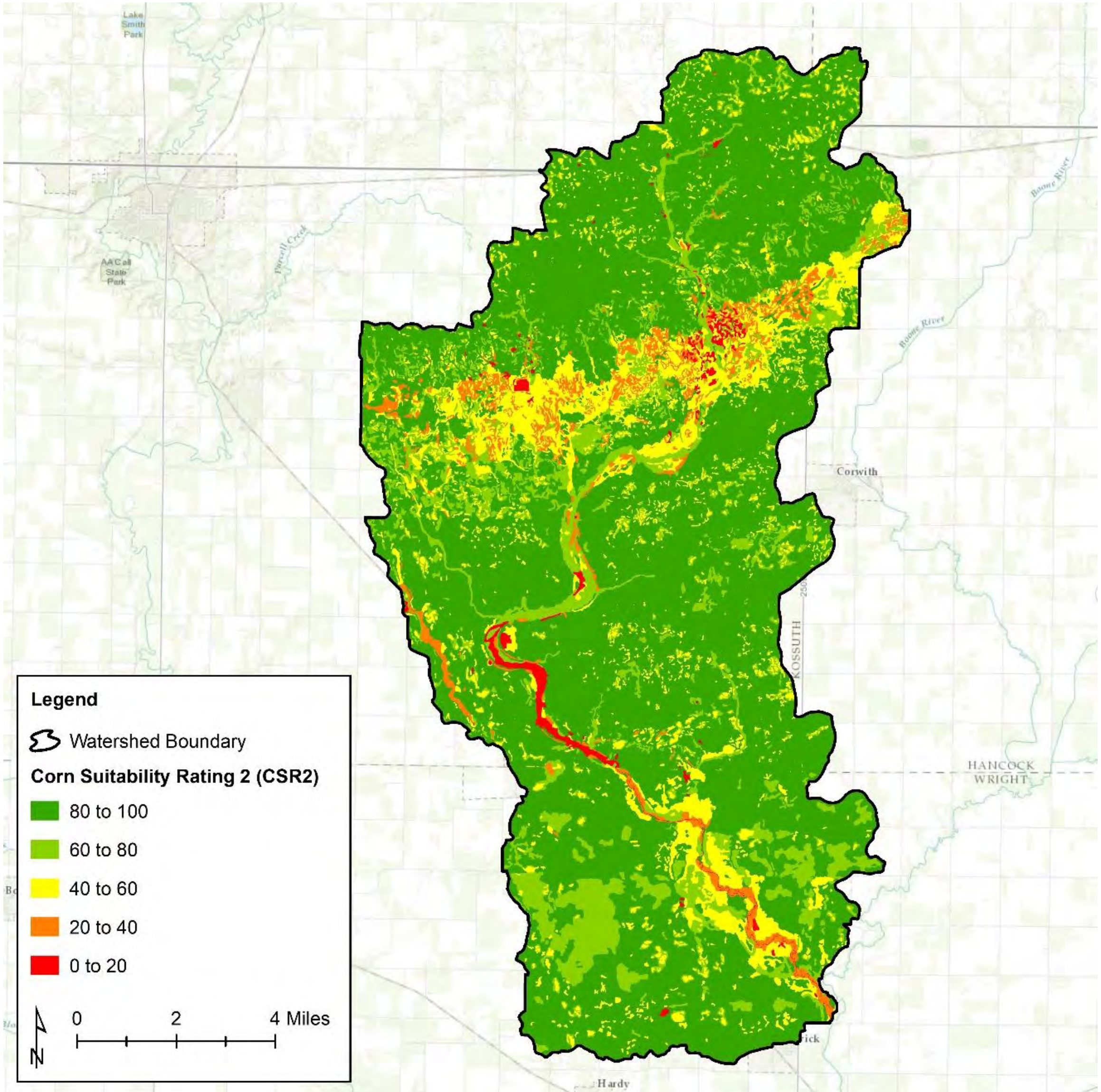

Figure 2.5.4. Corn Suitability Rating (CSR2) values for land in the Prairie Creek Watershed.

2.6. Land Use and Management

Land in the PCW is used primarily for row crop agriculture. 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 agricultural land uses. The GLO surveyors classified land within the PCW as 95 percent prairie, 5 percent water or wetlands and less than 0.1 percent forest. Figure 2.6.1 shows the distribution of these areas throughout the watershed.

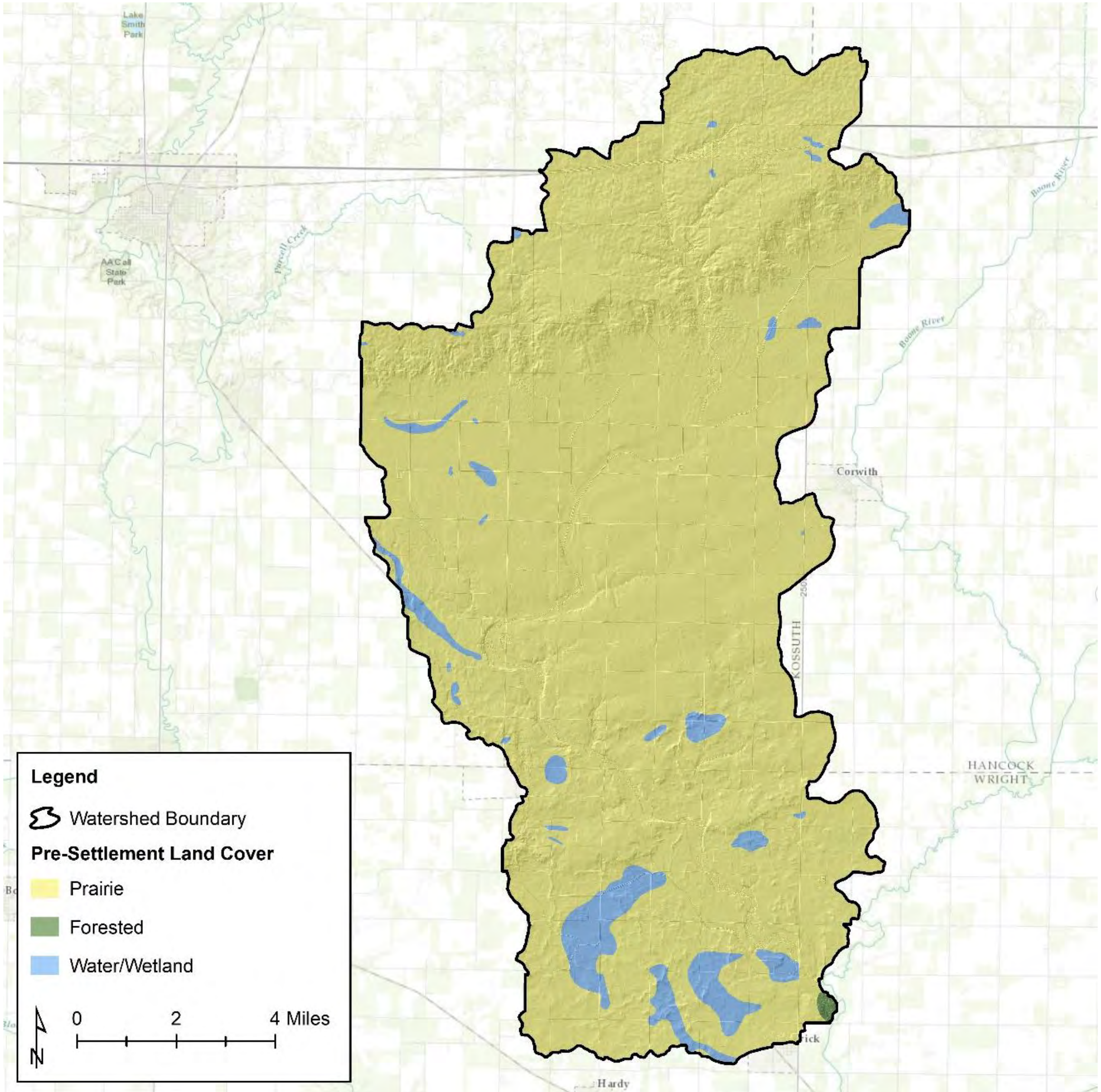

Figure 2.6.1. Pre-settlement land cover in the Prairie Creek Watershed according to the General Land Office survey in the mid-nineteenth century.

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. On average since 2003, approximately 88 percent of the watershed has been used for corn and soybean production.

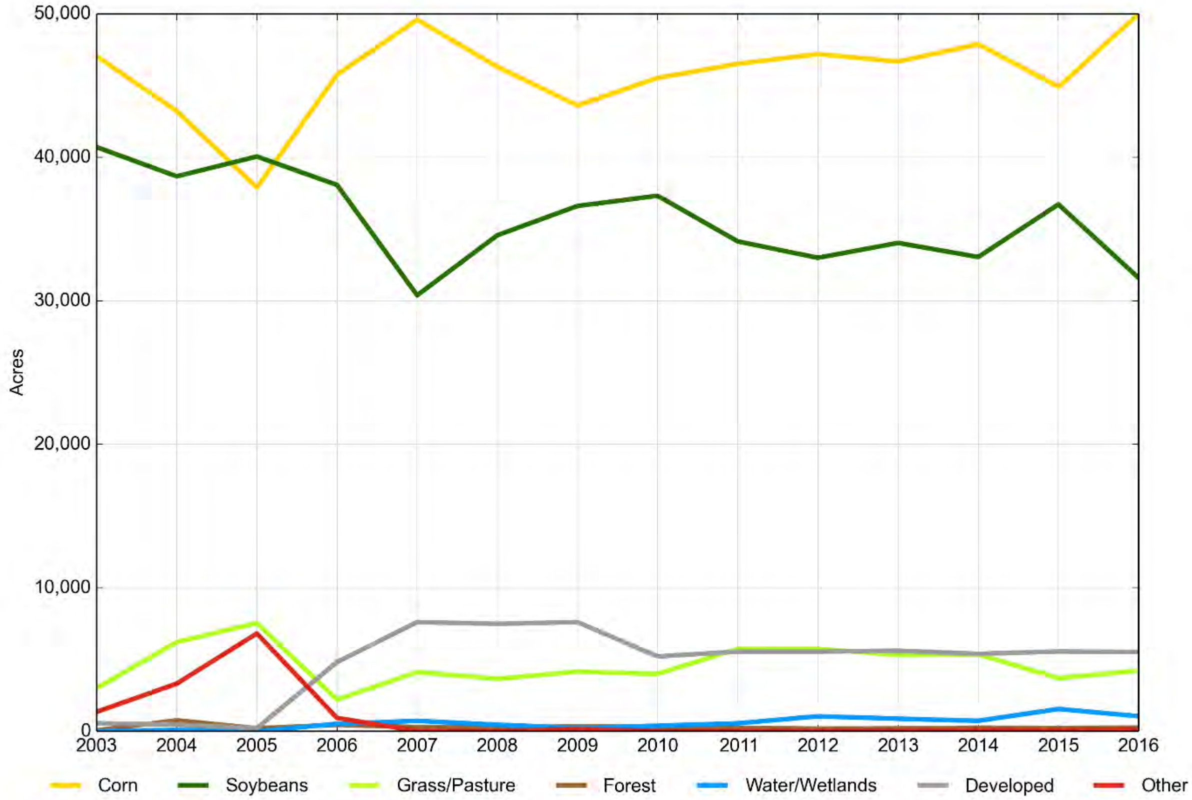

Figure 2.6.2. Prairie Creek Watershed 2003 through 2016 land use according to Cropland Data Layer data.

Table 2.6.1. Prairie Creek Watershed 2009 high-resolution land use according to Iowa Department of Natural Resources data.

Land Use	Acres	Percent of Watershed
Water	178	0.2
Wetland	2,546	2.7
Coniferous Forest	54	0.1
Deciduous Short	113	0.1
Deciduous Medium	375	0.4
Deciduous Tall	365	0.4
Grass 1	5,230	5.6
Grass 2	2,849	3.1
Corn	43,891	47.3
Soybeans	35,461	38.2
Barren / Fallow	220	0.2
Structures	124	0.1
Roads / Impervious	1,265	1.4
Shadow / No Data	82	0.1
Total	**92,751**	**100**

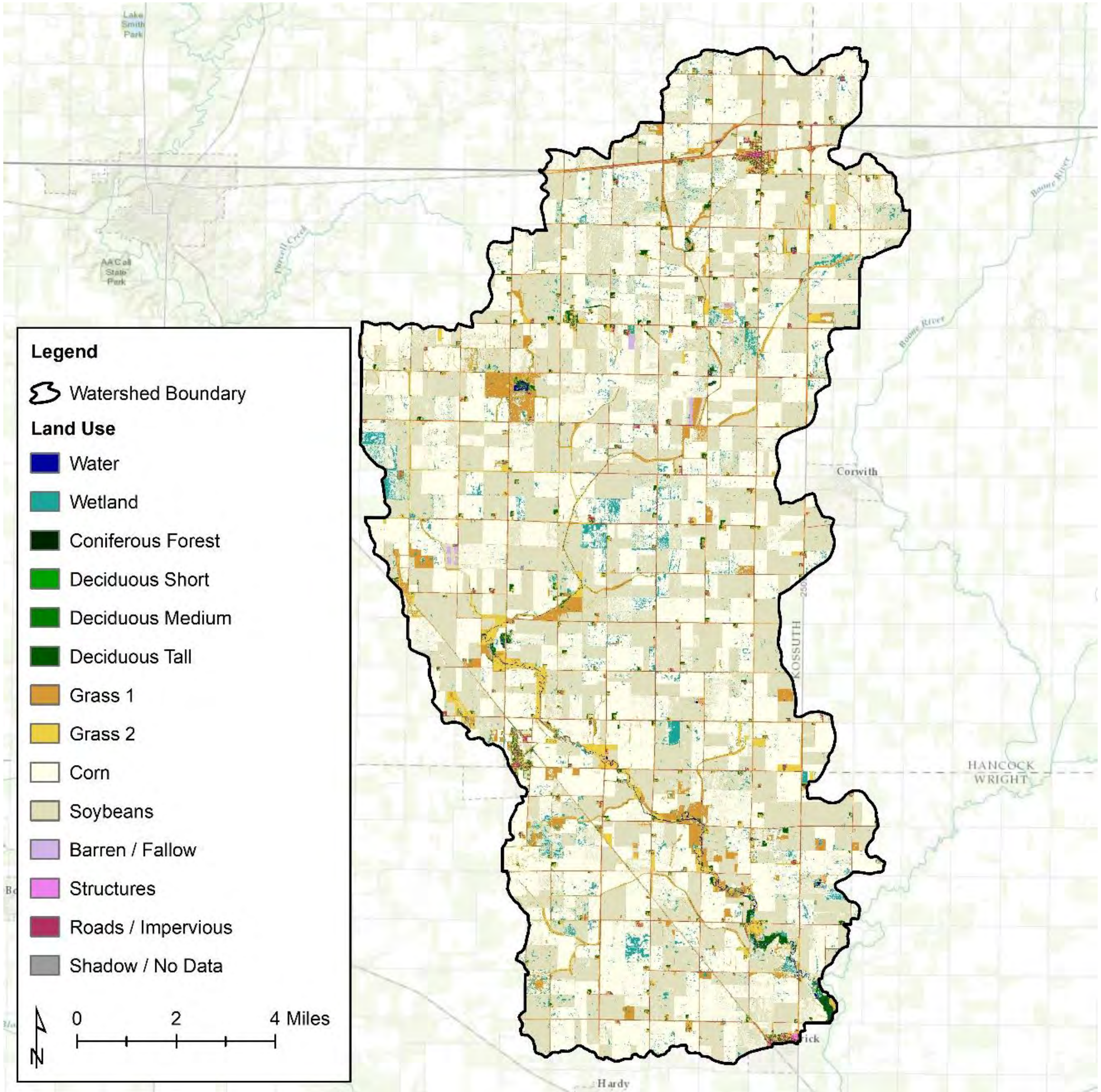

Figure 2.6.3. High-resolution 2009 land use map of the Prairie Creek Watershed derived from Iowa Department of Natural Resources data.

2.7. Population and Demographics

Wesley, Corwith, Lu Verne and Renwick are the four incorporated communities within the watershed. According to U.S. Census Bureau data, in 2010 Wesley had a population of 390, Corwith had a population of 309, Lu Verne had a population of 261, Renwick had a population of 242 and a total of 1,329 people lived in census tracts in the PCW, which equates to an average population density of 9.2 people per square mile. There are an estimated 684 housing units in the PCW. Approximately 78 percent of the land in the PCW is owned by landowners from Iowa. Table 2.7.1 contains the distribution of local, in-state and out-of-state land ownership. Additionally, the 2012 **Census of Agriculture** found that 60 percent and 66 percent of agricultural land in Kossuth and Humboldt counties, respectively, is rented.

Table 2.7.1. Locations of landowners for the Prairie Creek Watershed.

Landowner Location	Percent of Watershed
Iowa	77.6
Towns within 5 miles	57.3
Other Iowa towns	20.3
Other states	22.4

2.8. Existing Conservation Practices

Inventorying existing conservation infrastructure provides an important assessment of current conditions and is a useful exercise for determining the need for future conservation practice quantity and placement. Current conservation practices were assessed and catalogued using aerial photography, watershed surveys, stakeholder knowledge and structural practice location data provided by IDNR and Iowa State University (ISU). Many conservation practices were identified within the watershed, but determining levels of in-field management practices (e.g., nutrient management, no-till/strip-till, cover crops) can be difficult, so it is possible that this inventory does not capture all conservation within the watershed.

The PCW contains two recently installed Conservation Reserve Enhancement Program (CREP) wetlands. Perennial cover is present throughout the watershed, and there are relatively large concentrations of land enrolled in the Conservation Reserve Program (CRP) in riparian buffers planted along streams throughout the watershed. The Iowa CREP is a collaborative effort between the Natural Resources Conservation Service (NRCS) and the Iowa Department of Agriculture and Land Stewardship and the CRP is a NRCS program. 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 2017.

Table 2.8.1. Inventory of Prairie Creek Watershed existing conservation practices as of 2017.

Practice	Unit	Quantity
No-till/Strip-till	acres	2,844
Cover crops	acres	2,134
Nutrient management	acres	> 679
Grassed waterways	feet	234,254
Terraces	feet	2,389
Impoundments/Sediment basins	feet	32,555
Buffers within 100' of streams	% perennial cover	76%
CRP/WRP	acres	2,378
Oxbow restorations	sites	4
CREP wetlands	sites	2
Bioreactors	sites	1

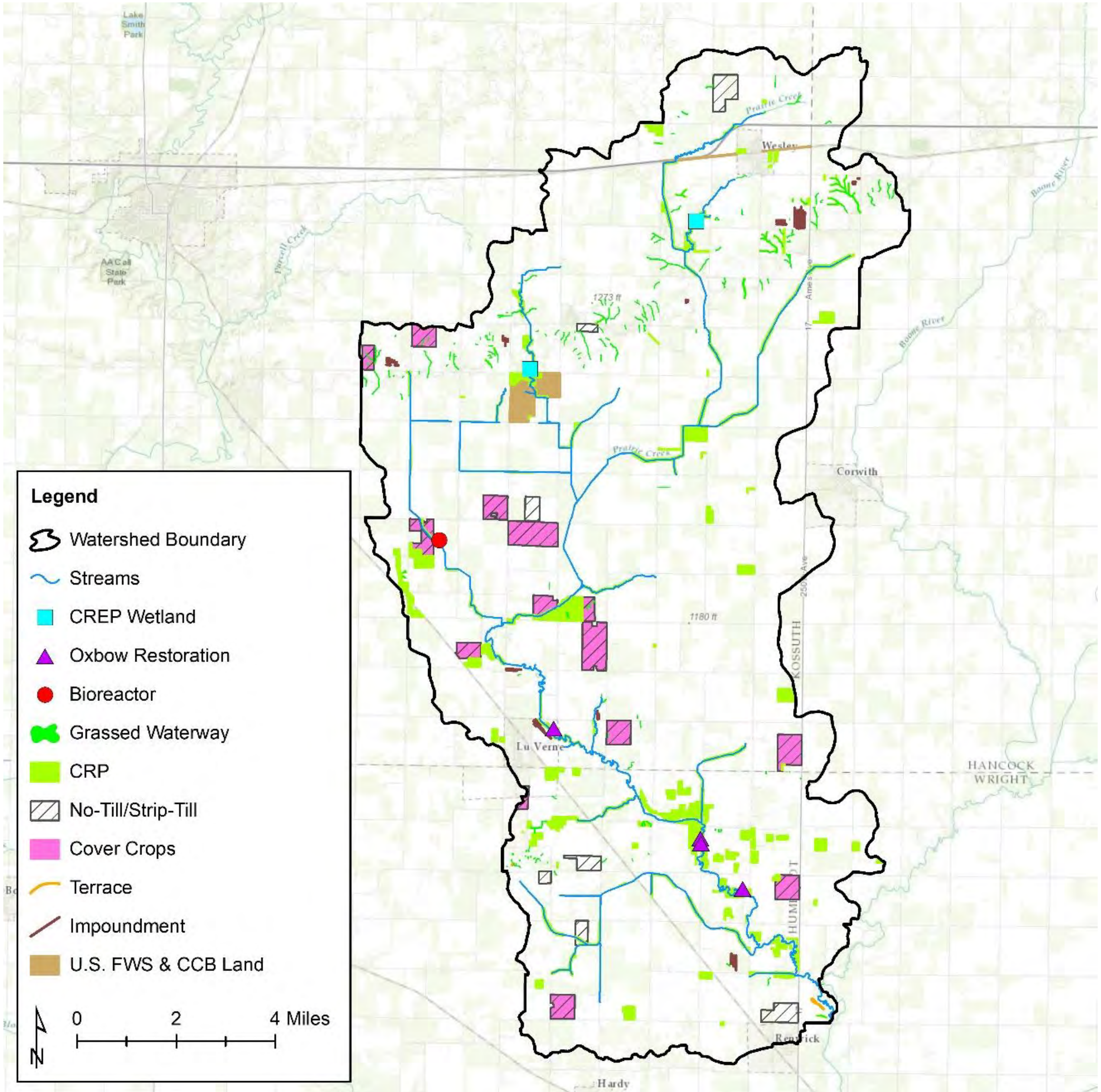

Figure 2.8.1. Conservation practices with known locations in the Prairie Creek Watershed as of 2017.

2.9. Soil and Streambank Erosion Assessment

Soil erosion for agricultural land in the PCW 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 simulation model used to evaluate the impact of different tillage and cropping systems on soil 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 typically have the largest impacts on soil loss estimates within a watershed. Model inputs for land use were developed by integrating data from watershed surveys, crop rotation information available from the ARS and satellite imagery analysis conducted by ISU. Based on the RUSLE2 analysis, sheet and rill erosion in the PCW averages an estimated 1.02 tons per acre per year. The distribution of soil erosion rates across the watershed is shown in Figure 2.9.1. This estimated sheet and rill erosion rate is approximately twice as large as 0.56 tons per acre per year of simulated hillslope soil loss from 2007 through 2013 according to the **Daily Erosion Project** (DEP), but both rates are quite low.

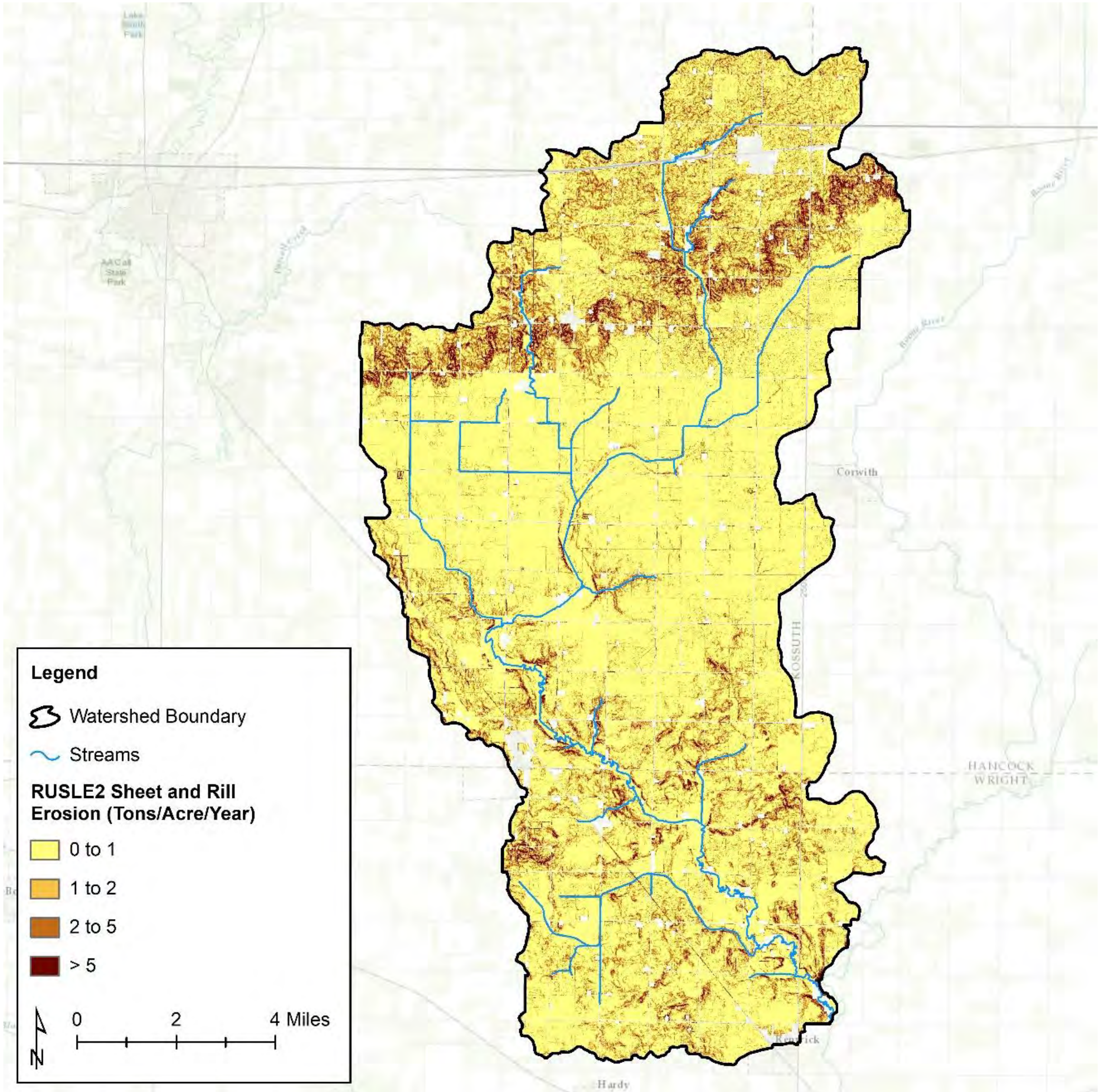

Figure 2.9.1. Estimated sheet and rill erosion rates based on soil types, topography and land use in the Prairie Creek Watershed.

RUSLE2 and DEP estimates do not include any soil loss due to concentrated runoff such as ephemeral or classical gully erosion. Terrain analysis of the watershed was conducted to identify potential locations for gully initiation, which were then cross-referenced with land use data and existing conservation practice locations. The results of this analysis revealed that approximately 31 percent of row crop fields may have elevated potential for ephemeral gully formation relative to other fields in the watershed; these locations are displayed in Figure 2.9.2.

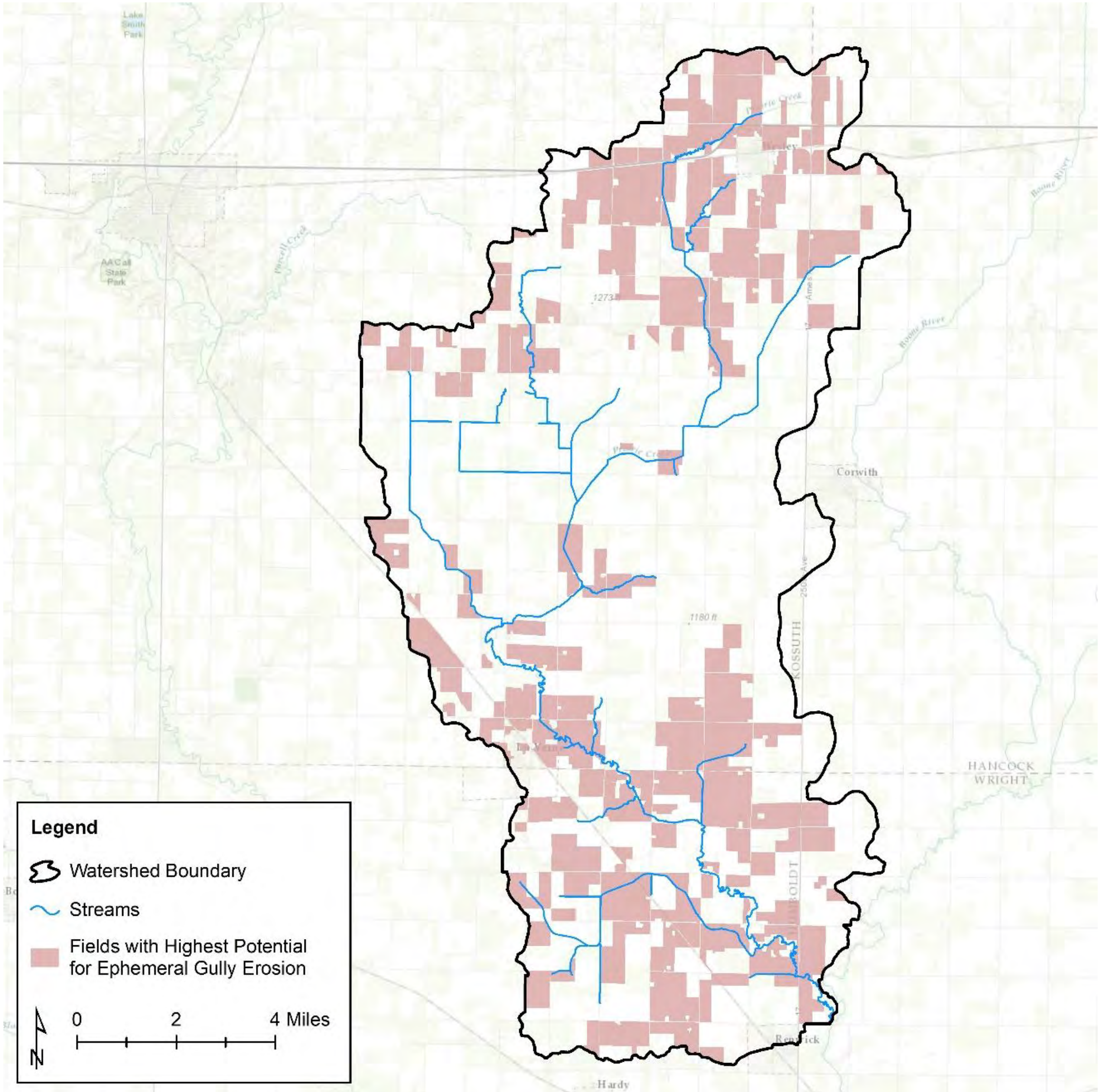

Figure 2.9.2. Locations of potential ephemeral gully erosion within the Prairie Creek Watershed.

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. The SDR for the PCW is estimated to be 2.81 percent.

Streambank erosion was quantified through a visual assessment of the stream channel. Estimated streambank erosion rates are displayed in Figure 2.9.3. Observed streambank erosion in the watershed totaled 788 tons. While riparian land cover does impact streambank erosion, hydrologic and hydraulic factors such as sinuosity, local stream discharge and bank morphology are often the primary factors.

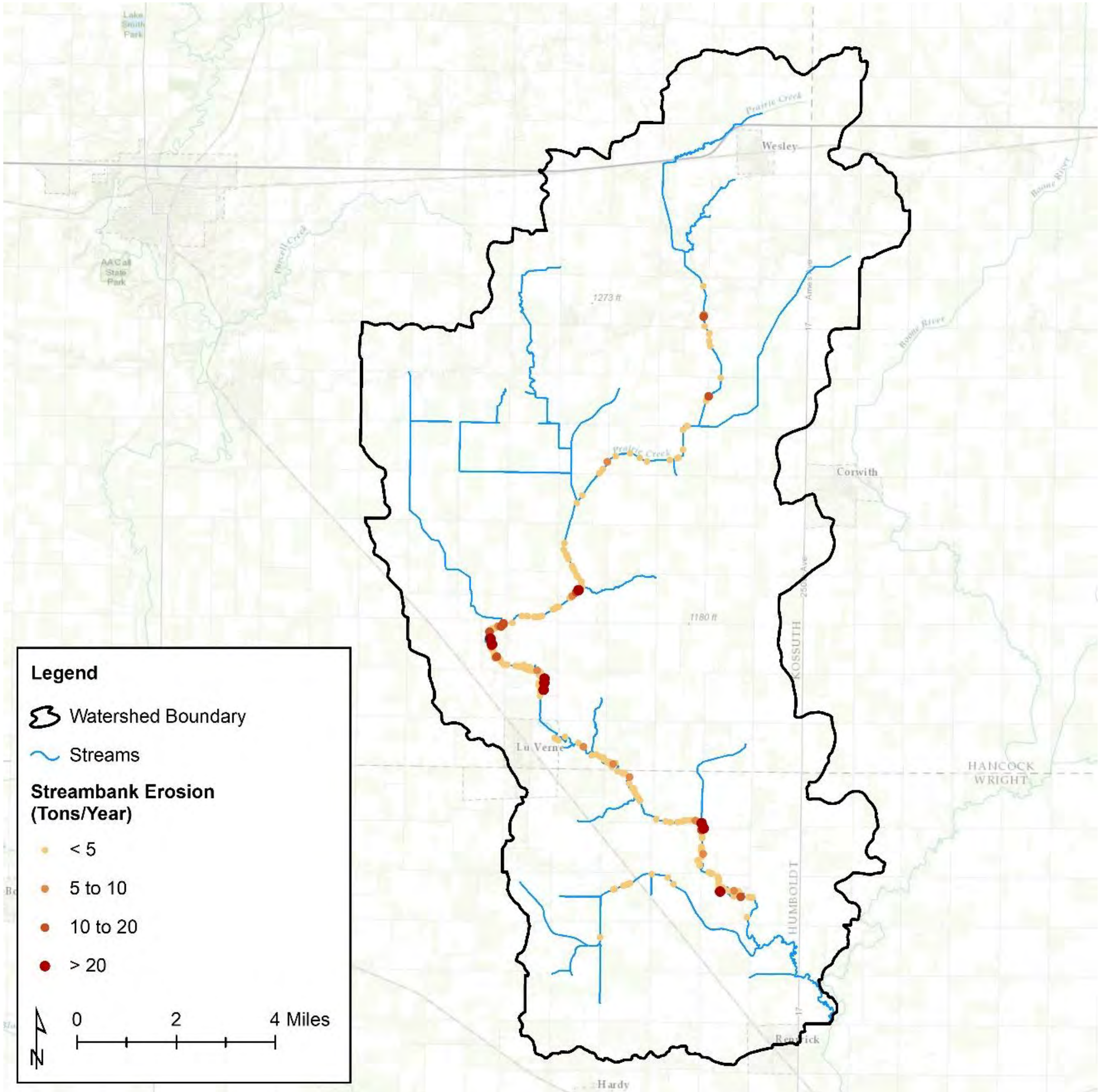

Figure 2.9.3. Estimated streambank erosion rates according to a 2017 Prairie Creek stream corridor assessment.

3. Water Quality and Conditions

3.1. Des Moines River TMDL

The Prairie Creek Watershed (PCW) is a subwatershed of the Boone River Watershed, which comprises a portion of the larger Des Moines River basin (Figure 3.1.1). Downstream of Prairie Creek and the Boone River, the Des Moines River is impaired by nitrate-nitrogen (hereafter "nitrate"). This impacts 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 U.S. Environmental Protection Agency (EPA) in 2009. See Appendix G for additional information about the nitrogen cycle.

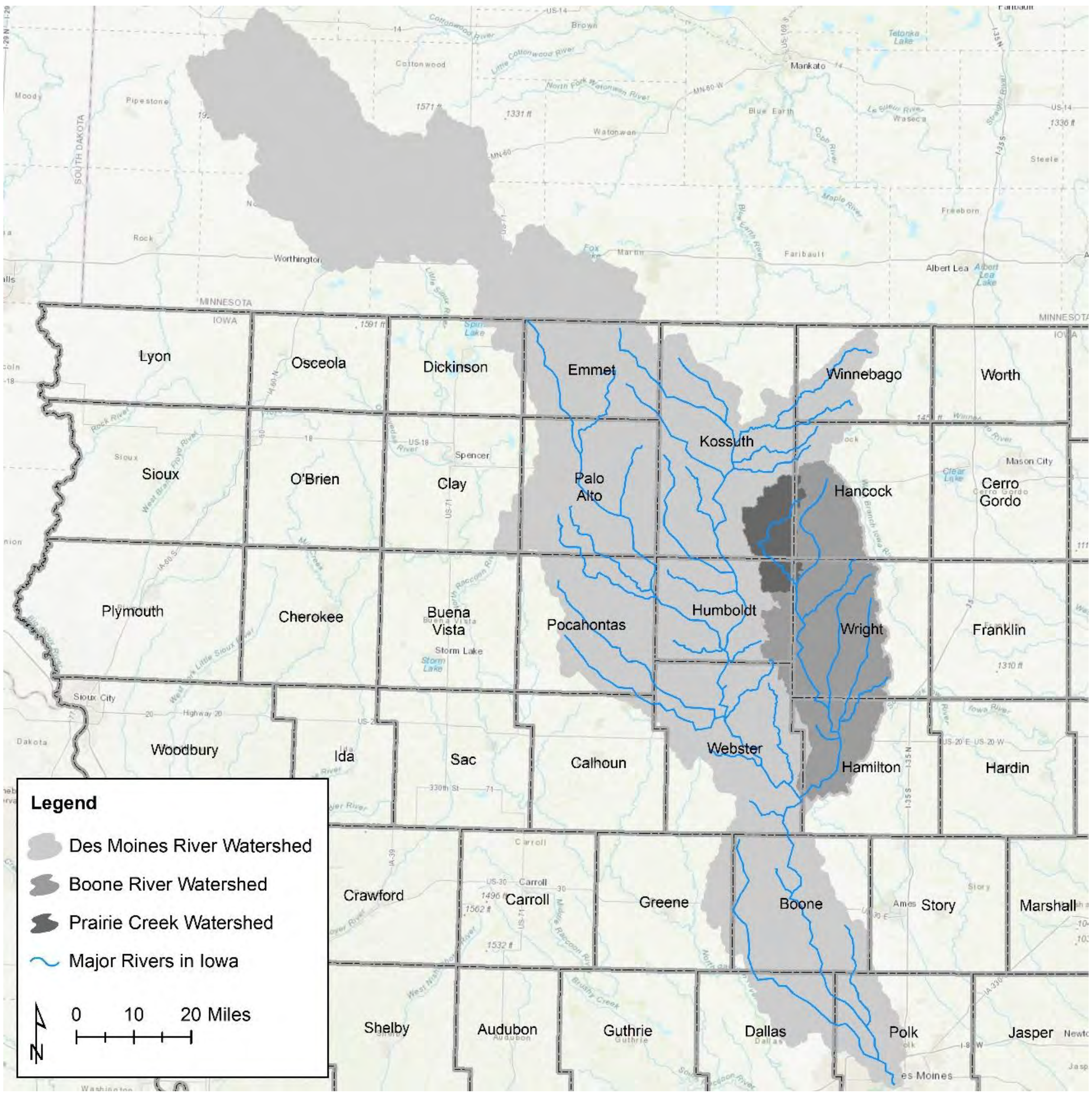

Figure 3.1.1. Extents of the Prairie Creek, Boone River and Upper and Middle Des Moines River watersheds.

The **Des Moines River TMDL** was developed to address the nitrate impairment for a 6.5-mile segment (segment ID **04-UDM-1211**; legacy waterbody ID code: IA 04-UDM-0010_2) of the Des Moines River in the city of Des Moines that was identified within the Iowa 2004 Integrated Report 305(b) assessment. The Class C designated use (drinking water) was determined to be impaired due to nitrate levels exceeding state water quality standards and the EPA maximum contaminant level (MCL). The applicable water quality standard for nitrate is 10 milligrams per liter (mg/L). Accounting for a margin of safety (MOS) of 0.5 mg/L and the MCL, the target maximum daily nitrate concentration is 9.5 mg/L.

The TMDL identified nonpoint sources of nitrate as the primary cause of the Class C impairment. Water quality modeling during TMDL development determined that point sources and nonpoint sources contribute 6.4 and 93.6 percent, respectively, to the total nitrate load within the upstream watershed. The TMDL states that up to a 34.4 percent reduction of maximum daily nitrate levels is necessary to attain the target nitrate concentration of 9.5 mg/L.

3.2. Prairie Creek Water Quality

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, including three sites within the PCW from 2007 through 2017. These sites are mapped in Figure 3.2.1 and site descriptions and locations are detailed in Table 3.2.1.

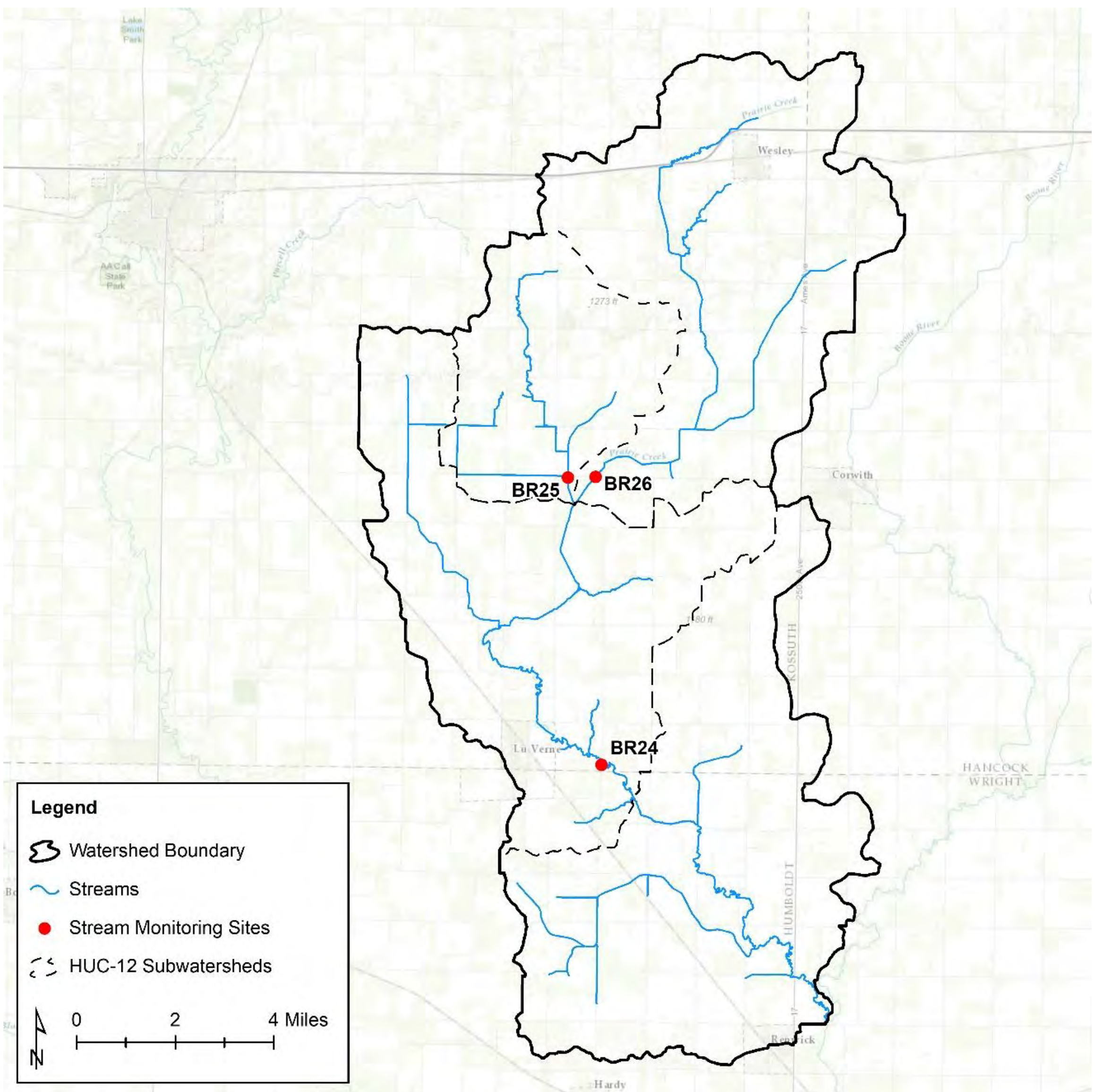

Figure 3.2.1. Agriculture's Clean Water Alliance stream monitoring sites located on Prairie Creek and its tributaries.

Table 3.2.1. Location information for three stream water monitoring sites in the Prairie Creek Watershed monitored by ACWA from 2007 through 2017.

Site ID	Latitude (°N)	Longitude (°W)
BR26	42.994356	-94.053448
BR25	42.994051	-94.064534
BR24	42.909699	-94.049583

The 2007 to 2017 average nitrate concentration from April through August at each of these monitoring sites is displayed in Figure 3.2.2. This chart shows annual variability, which is often influenced by variable precipitation. Monthly average nitrate concentrations at these sites for 2007 through 2013 (baseline period; see Section 4) are displayed in Figure 3.2.3. This chart reveals monthly trends, which are due to seasonal precipitation and landscape-scale evapotranspiration (i.e., water use by crops and other vegetation) patterns. Data for these stream sites and others are published annually by **ACWA**.

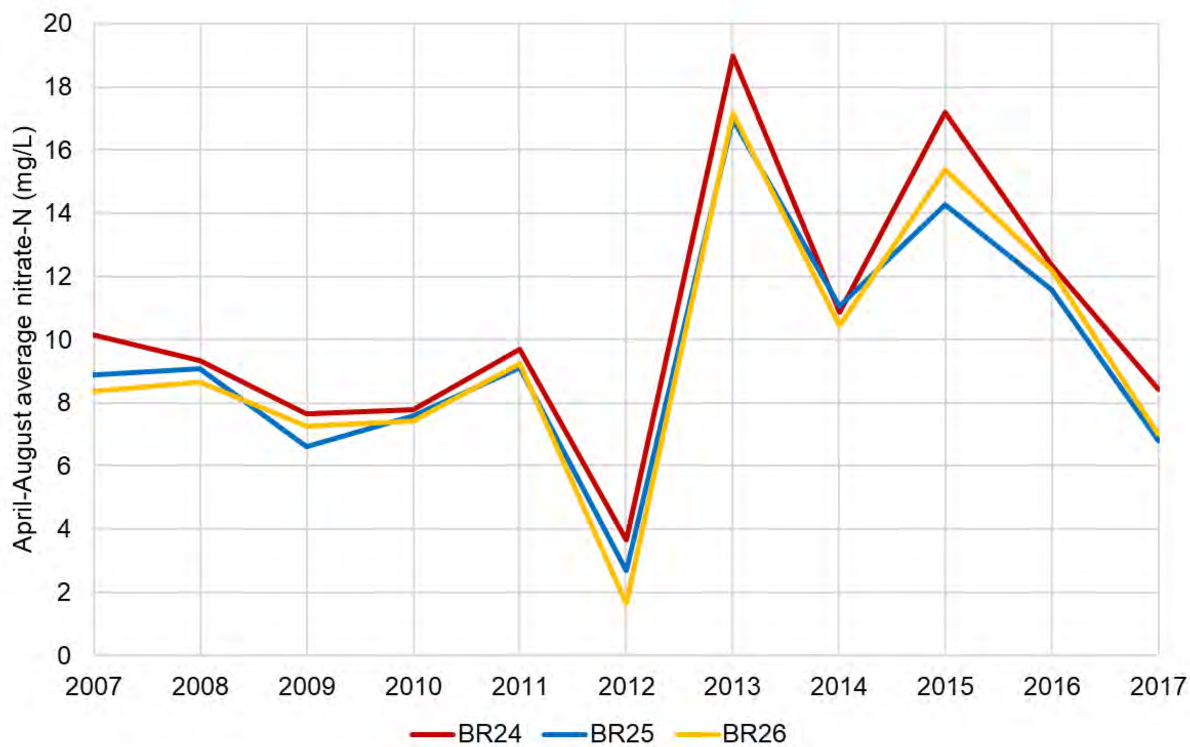

Figure 3.2.2. Average April through August nitrate concentrations for three stream sites in the Prairie Creek Watershed from 2007 through 2017.

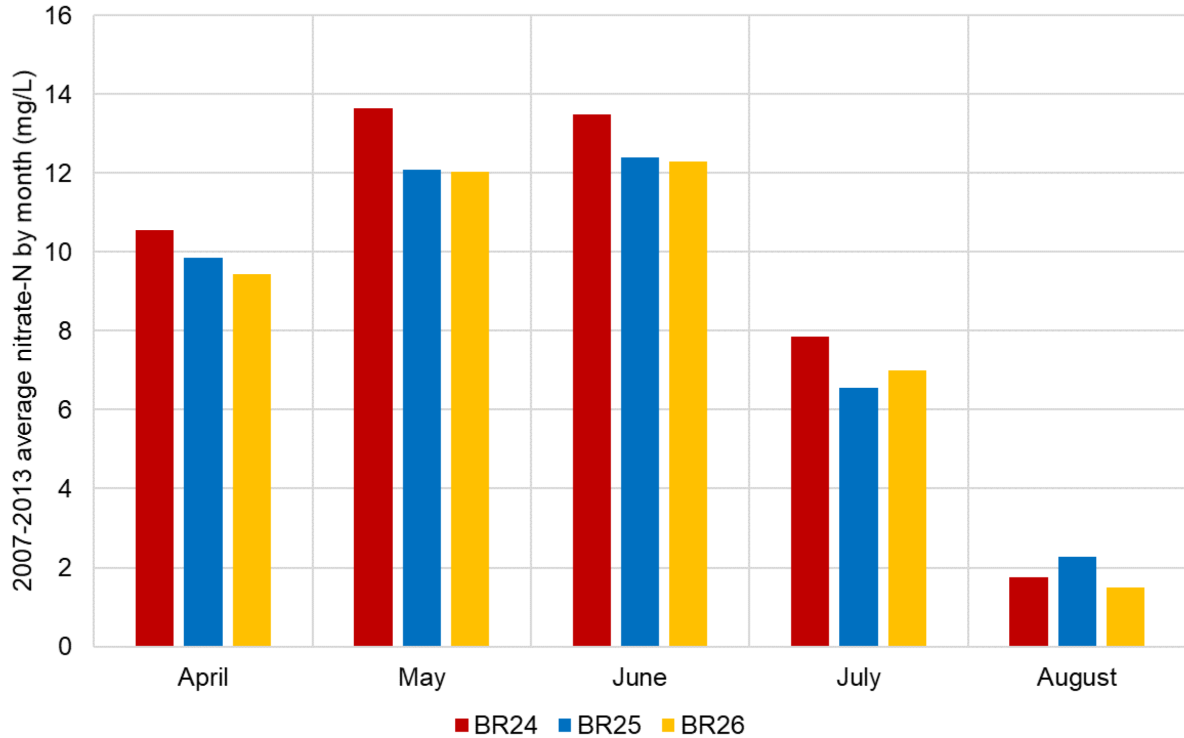

Figure 3.2.3. Monthly average nitrate concentrations at three stream sites in the Prairie Creek Watershed based on 2007 to 2013 data.

3.3. Source Water Protection

Protection of source water, or local drinking water resources, is important for human health within the PCW. The IDNR Source Water Protection Program maintains an online database of source water protection plans, assessments and other information. Ground water capture zones in **Wesley**, **Corwith** (mostly outside of the watershed), **Lu Verne** and **Renwick** are tracked through this system, and the extents of these capture zones are shown in Figure 3.3.1.

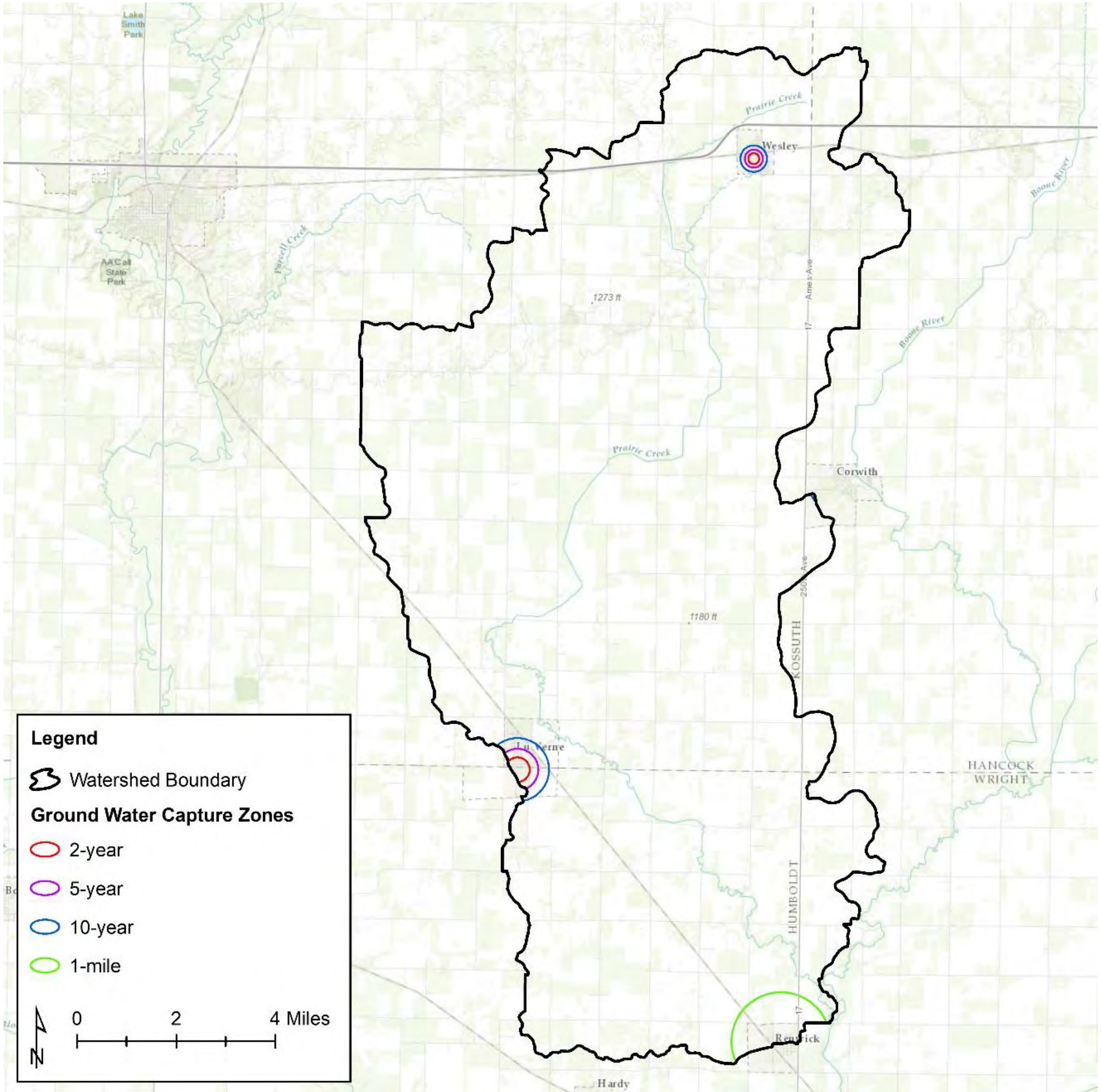

Figure 3.3.1. Priority areas for source water protection in the Prairie Creek Watershed are located near Wesley, Lu Verne and Renwick.

3.4. Point and Nonpoint Sources

The INRS incorporates both point and nonpoint sources. The cities of **Wesley** and **Lu Verne** each have a wastewater treatment facility with a federal National Pollution Discharge Elimination System (NPDES) permit. The Wesley plant is permitted to discharge up to 4,603 pounds of nitrate per year. The Lu Verne facility is not permitted to discharge nitrate. This point source nitrate loading was included in the water quality modeling results contained in Section 4. Neither facility is permitted to discharge phosphorus. The Wesley and Lu Verne wastewater treatment facilities are not identified in the INRS as priority point sources for nutrient load reduction. As these two point sources contribute a relatively small amount of nitrate (0.2 percent) compared to the total estimated watershed nonpoint source nitrate load, this watershed plan emphasizes nonpoint nutrient sources and prioritizes agricultural conservation practices as the best methods to improve water quality in the PCW, the Boone River Watershed and downstream.

4. Goals and Objectives

The Prairie Creek Watershed 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 and the continued collaboration of local, state and federal agricultural and conservation agencies, along with sustained funding. In addition to BMP implementation, water monitoring should continue as a crucial activity to assess the status of water quality goals, standards and designated uses. Water monitoring is necessary to determine if water quality is improving, degrading or remaining unchanged and is required 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 below represent a suite of tools that will help achieve the Prairie Creek Watershed (PCW) water quality, soil health, agronomic and ecosystem goals if appropriately utilized. It is up to all PCW stakeholders to determine exactly how to best implement BMPs. Locally driven efforts have proven to be the most successful in obtaining significant water quality improvements.

A key component of the watershed planning process is identification of the overall goals and objectives, as they will guide implementation approaches and activities. The goals and objectives listed in this plan are not permanent, so this plan should be considered a living document. The goals and objectives that were developed by PCW stakeholders reflect current needs and opportunities for the PCW. Changing social and economic conditions, Farm Bill revisions and new agricultural and conservation technologies may require that PCW stakeholder needs and opportunities periodically be reassessed. It is essential to allow for sufficient flexibility to respond to changing social, political and economic conditions while still providing guidance for future conservation efforts.

The statewide goals of the Iowa Nutrient Reduction Strategy (INRS) provided an important starting point for goal development by stakeholders in the PCW. 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 nitrate 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 portion 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 PCW 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 have been identified for the PCW:

1. **Increase awareness and implementation.** Broad awareness and participation in watershed efforts will be essential to increase conservation implementation and achieve other watershed goals.
2. **Reduce in-stream nonpoint source nitrogen loading by 41 percent.** Along with the INRS goal for nitrogen reduction, this goal will also exceed the Des Moines River TMDL target of 34 percent nitrate reduction.
3. **Maintain and increase agricultural profitability and sustainability.** The agricultural identity of the PCW should be embraced and enhanced to preserve local cultural and economic vitality.

4. **Reduce soil erosion from wind and water.** Soil provides the foundation for the PCW, so it is paramount to sustain this resource by minimizing erosion.
5. **Reduce in-stream nonpoint source phosphorus loading by 29 percent.** This is the INRS goal for phosphorus reduction.
6. **Reduce flood risk.** Decreasing negative impacts of excess water can be beneficial both within the PCW and downstream.
7. **Increase soil organic matter by 1 percent.** Building soil organic matter over time and measuring the changes is one way to quantify improved soil health in the watershed.
8. **Maintain and improve wildlife habitat.** More abundant and more diverse upland and aquatic life can be an indicator of high quality natural resources and habitat.

This watershed plan uses the period from 2007 through 2013 as the baseline for conservation practice implementation and determining progress towards reaching goals by 2035. Conditions during this period reflect the status of the watershed prior to release of the INRS and the current Water Quality Initiative project. Watershed stakeholders decided to use water quality monitoring data from 2007 to 2013 to establish a monthly baseline stream nitrate concentration. These levels along with 41 percent reductions are shown in Figure 4.1.

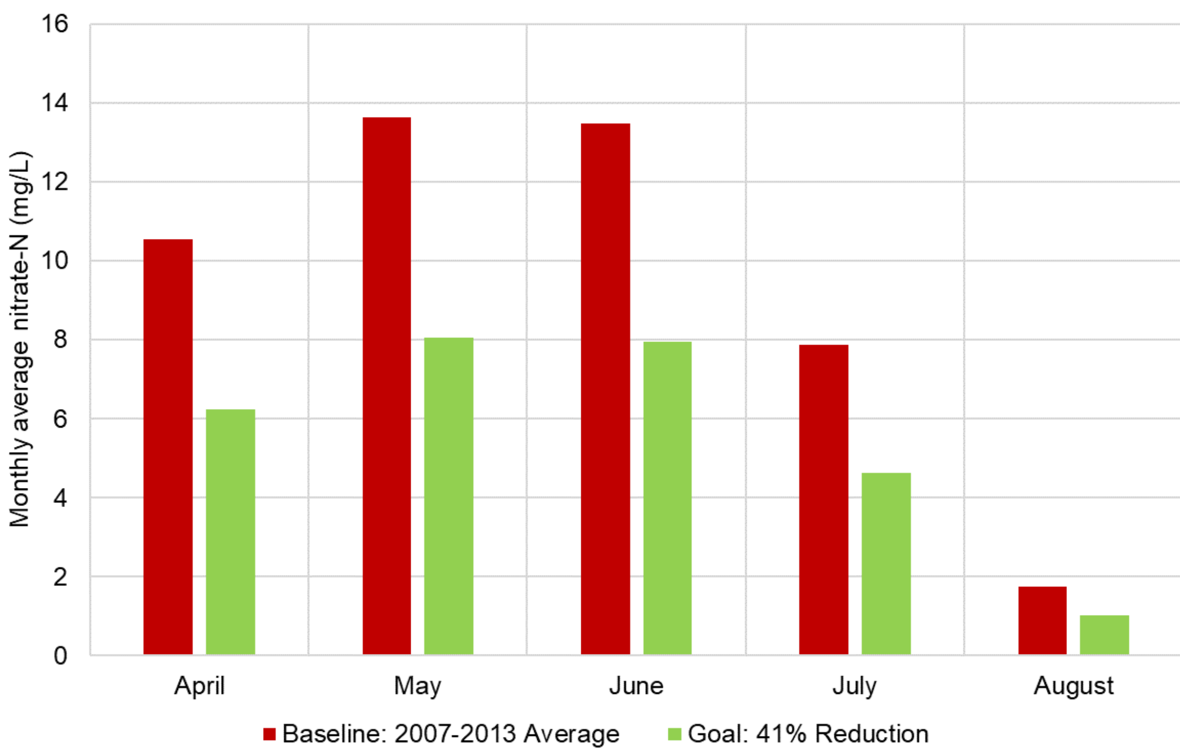

Figure 4.1. Monthly 2007 to 2013 baselines and 2035 targets for Prairie Creek stream nitrate concentrations.

Watershed models were developed to determine baseline, current and future nitrate, phosphorus and sediment loads and associated reductions in the PCW. Table 4.1 provides estimates of watershed loading rates for the 2007 to 2013 baseline and conditions during and after the implementation of practices identified in this watershed plan. Table 4.2 provides estimates of percent reductions for each parameter for each project 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 nitrate 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 results of the watershed RUSLE2 soil erosion model. Streambank erosion was estimated to be 788 tons per year based on data collected during a stream assessment of Prairie Creek. Upland sheet and rill erosion, streambank erosion and a Sediment Delivery Model were used to estimate total sediment delivery levels and reductions. Along with practice phosphorus reduction efficiencies from the Iowa Science Assessment of Nonpoint Source Practices to Reduce Phosphorus Transport in the Mississippi River Basin section of the INRS, phosphorus enrichment ratios (1.6 pounds of phosphorus per ton of upland sediment and 0.6 pounds of phosphorus per ton of streambank sediment) were used to estimate phosphorus loading.

*Table 4.1. Estimated baseline (2007 through 2013), current (2017) and future nitrate, phosphorus and sediment export from the Prairie Creek Watershed for four project phases until full watershed plan implementation anticipated by 2035. (*Baseline and 2017 May and June stream nitrate concentration values based on water quality monitoring data.)*

	Units	2007-2013 Baseline	2017 Status	2021 Target	2025 Target	2030 Target	2035 Target
Nitrate load	pounds/year	2,042,103	1,962,625	1,828,967	1,556,068	1,333,667	1,212,199
Stream nitrate conc. (May-June)	mg/L	13.6*	11.2*	12.1	10.3	8.9	8.0
Phosphorus load	pounds/year	4,346	4,101	3,656	2,533	1,552	1,125
Sheet and rill erosion	tons/year	88,491	85,827	79,035	60,122	41,210	31,754
Streambank erosion	tons/year	788	788	788	788	788	788
Sediment delivery	tons/year	3,117	2,969	2,721	2,144	1,645	1,377

Table 4.2. Modeled nutrient and sediment load reductions from the 2007 to 2013 baseline in the Prairie Creek Watershed for current 2017 conditions and each phase of watershed plan implementation.

	Units	2007-2013 Baseline	2017 Status	2021 Target	2025 Target	2030 Target	2035 Target
Nitrate load	% reduction	-	4%	10%	24%	35%	41%
Stream nitrate conc. (May-June)	% reduction	-	17%	11%	24%	34%	41%
Phosphorus load	% reduction	-	6%	16%	42%	64%	74%
Sheet and rill erosion	% reduction	-	3%	11%	32%	53%	64%
Streambank erosion	% reduction	-	0%	0%	0%	0%	0%
Sediment delivery	% reduction	-	5%	13%	31%	47%	56%

In addition to the locally adopted 2035 target to achieve watershed goals, it is important to acknowledge that this timeline aligns with that of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force (or **Hypoxia Task Force**, HTF). In a 2017 report, the HTF affirmed a deadline to achieve its Gulf of Mexico hypoxic zone goal of 45 percent reduction by 2035 and added an interim target of 20 percent nutrient load reduction by 2025. If the watershed conceptual plan (Section 5) and implementation schedule (Section 6) are implemented as planned, nitrate and phosphorus loads from the PCW are expected to be reduced by 24 percent and 42 percent, respectively, by 2025, which would exceed the interim milestone recommended by the HTF.

5. Conceptual Plan

Best management practices (BMPs) 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 Prairie Creek Watershed (PCW) 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 used an impact versus effort exercise to prioritize BMPs that provide the greatest benefits and are the most acceptable to local stakeholders. The outcomes of this assessment are charted in Figure 5.1. For the analysis, impact values were related to watershed goals based on practice nutrient reduction efficiencies along with potential impacts on productivity, erosion, flooding and habitat, and effort values were scored by watershed stakeholders.

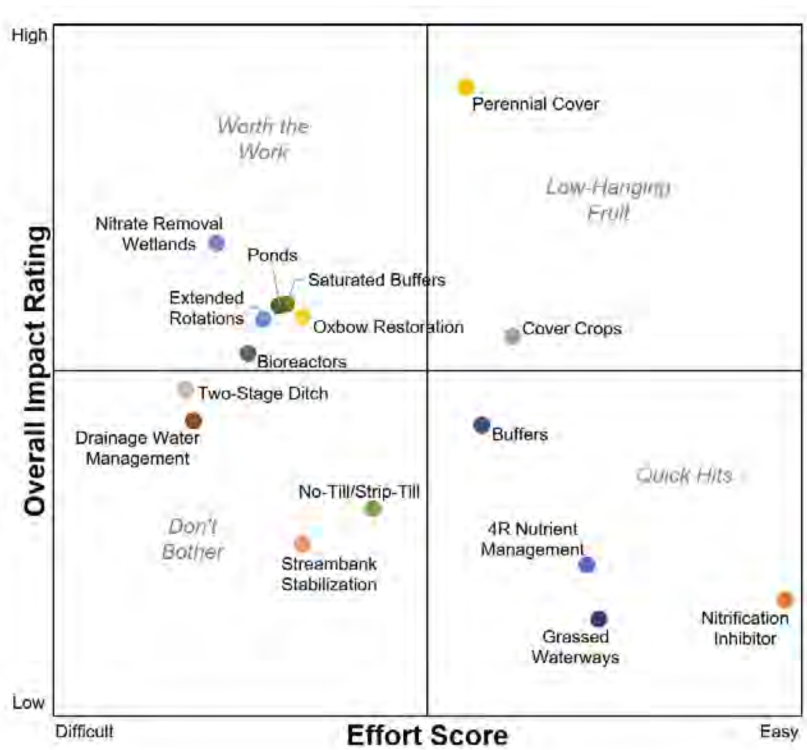

Figure 5.1. Results of impact versus effort best management practice prioritization for the Prairie Creek Watershed.

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 conceptual BMP implementation scenario that sites BMPs in locations intended to achieve maximum benefit (e.g., nitrate removal wetlands placed at strategic locations or bioreactors placed at likely drainage tile outlets). 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 practices are those included in the Prairie Creek Watershed conceptual plan.

	Practice	Soil Health/Erosion	Nitrogen Reduction	Phosphorus Reduction
In-Field	*4R Nutrient Management*	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/Near-Stream	Ponds	0	1	3
	Nitrate Removal Wetlands	0	3	1
	Streambank Stabilization	0	0	2
	Two-Stage Ditch	0	1	0
	Oxbow Restoration	1	3	2

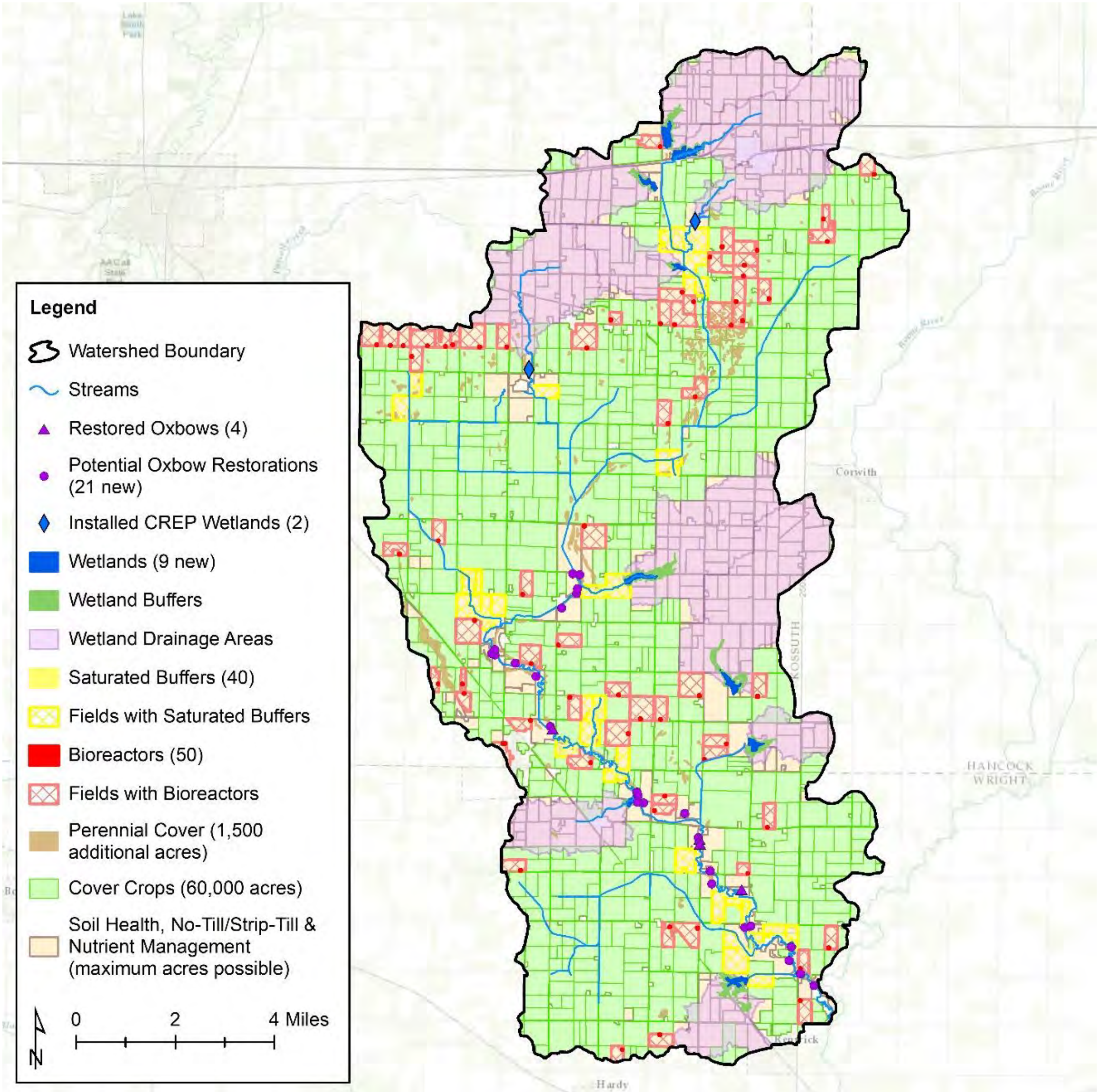

Figure 5.2. Conceptual plan for best management practice implementation in the Prairie Creek Watershed. Appendix A contains detailed, larger maps.

The BMP conceptual plan presented in Figure 5.2 is ambitious, but this level of implementation is needed to achieve the goals identified in this watershed management plan. This scenario is one of a variety of potential combinations of BMPs that would allow for this plan's goals to be reached. Watershed stakeholders also considered alternative scenarios that placed different levels of emphasis on in-field management practices, structural edge-of-field practices and the balance between them. These alternative scenarios are included in Appendix B. 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 and objectives 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 (ARS) scientists have developed the **Agricultural Conservation Planning Framework** (ACPF) to facilitate the selection and implementation of conservation practices in watersheds with predominately agricultural land uses. 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**. The priority cover crop zones delineated in Figure 5.2 have been identified for maximum water quality improvement potential at the outlet of the PCW. Practices that build soil health will support watershed goals due to improved soil function and associated benefits of erosion control, water infiltration and retention, flood reduction, increased soil organic matter and improved nutrient cycling. Management practices that build soil health such as cover crops and no-till/strip-till should be implemented on all cropland within the watershed. 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.

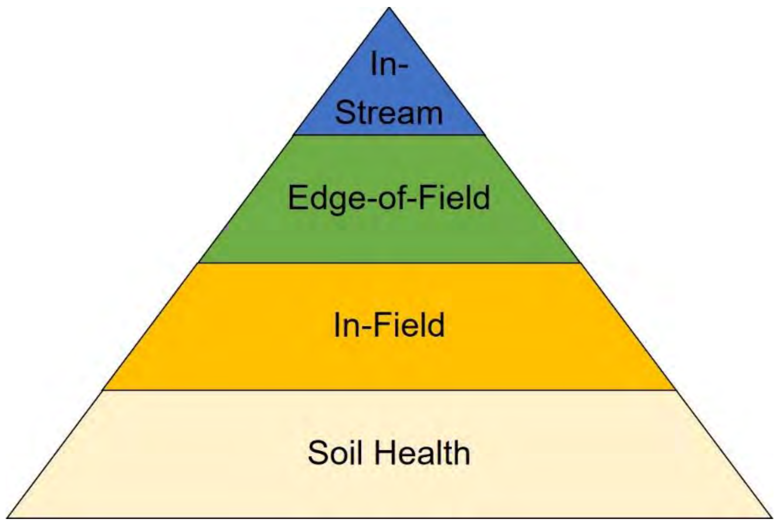

Figure 5.3. The Agricultural Conservation Planning Framework conservation pyramid adapted from the model documentation.

The ACPF includes a mapping toolbox to identify potential locations for conservation practice adoption. Selected results of applying these siting tools to the PCW have been incorporated into this conceptual plan. Appendix C 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.

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 18-year phased implementation schedule in Table 6.1 was approved by watershed stakeholders and should be used to set yearly objectives and gauge progress. The goals listed for each phase are intended to build upon existing levels and previous phases, so practice retention is also important. Practices included in the implementation schedule only include those identified to reach the watershed plan goals. Practices that are not included in the implementation schedule such as drainage water management, extended rotations, stream buffers and streambank stabilization should be promoted and implemented wherever appropriate.

Table 6.1. Watershed plan implementation schedule separated into two 4-year phases followed by two 5-year phases for the Prairie Creek Watershed.

Practice	**Unit**	**Existing**	**2018-2021 Goal**	**2022-2025 Goal**	**2026-2030 Goal**	**2031-2035 Goal**	**Watershed Plan Goal**
Nutrient management	acres	679	3,321	12,000	10,000	4,000	30,000
No-till/Strip-till	acres	2,844	*Maximum possible cropland acres*				
Cover crops	acres	2,134	7,866	20,000	20,000	10,000	60,000
Grassed waterways	feet	234,354	*As needed for erosion control*				
Perennial cover	acres	2,378	200	600	500	200	3,878
Bioreactors	structures	1	9	20	15	5	50
Saturated buffers	structures	-	10	15	10	5	40
Wetlands	sites	2	2	3	2	2	11
Oxbow restorations	sites	4	4	7	6	4	25

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. In addition to modeled nutrient reductions, water monitoring results will be key indicators of water quality improvement in the Prairie Creek Watershed (PCW). The PCW has a detailed historical water quality monitoring dataset available through Agriculture's Clean Water Alliance (ACWA).

The ACWA stream monitoring sites (see Figure 3.2.1 and Table 3.2.1) within the PCW should be maintained. (It is worth noting that there is not a stream monitoring site at the watershed outlet due to lack of safe public access to the stream. However, the three sites monitored within the watershed do provide important data that indicate overall water quality within the watershed.) Future water quality data measured at these locations will allow for water quality evaluation through direct comparison against the 2007 through 2013 baseline. This monitoring site network will continue to 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 August. 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 U.S. Geological Survey (USGS) **Water Science School** provides an overview of this process. At a minimum, streamflow should be captured near the watershed outlet.

Other existing water sampling programs offer additional data sources or opportunities to document water quality in the PCW. The Iowa **STORET** database maintained by the IDNR contains water physical, chemical, biological and habitat data. The IDNR's **ADBNet** database documents Iowa's water quality assessments for Clean Water Act section 305(b) reporting. Volunteer water quality monitoring also can be an important source of information, especially to yield a detailed, one-time "snapshot" of water quality. The **Iowa Water Quality Information System** (IWQIS) provides real-time water quality data for many streams and rivers in Iowa. The downstream IWQIS sensor closest to the PCW is a University of Iowa-IIHR gauge in the Boone River near Goldfield with station ID WQS0039. Data such as stream nitrate concentration, stream discharge and cumulative upstream nitrogen loading are available from 2016 through present.

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 PCW, water quality monitoring at finer scales should be conducted to assess the effectiveness of individual conservation practice installations. Field-scale water samples 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 irregular and often missed by a regular monitoring program. Tile water monitoring is reliable due to more consistent flow. 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. Improved soil fertility data will better inform nutrient management, which can result in increased profitability and decreased nutrient loss 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 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 can be utilized to quantify the benefits of management practices that build soil health.

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. Producers should collect samples over multiple years to account for weather and seasonal variations before modifying operations.

7.6. Social Surveys

Surveys are a tool that should periodically be used to assess awareness and attitudes regarding water quality in the PCW and whether the watershed plan goals are on schedule. Detailed surveys could be conducted during or after each phase of the implementation schedule (Table 6.1). Results could be used to modify approaches as needed during the subsequent 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. Surveys could be conducted online, which also could be a valuable resource to recruit further participation in the project.

8. Information and Education Plan

Behavior patterns of all stakeholders, and especially producers and landowners, must be considered both in designs of best management practices (BMPs) and in implementation strategies for water quality projects. To cause changes in behavior, goal-based outreach that addresses the actual and defined needs of key stakeholders is critical. It is important to leverage preexisting relationships and successes to build a community of support and knowledge around producers and landowners who will be implementing conservation practices. Barriers to conservation implementation may be overcome by providing adequate education and outreach regarding how land management practices influence the PCW and downstream water resources. Knowledge increases awareness, which may then motivate changes in behavior.

During the watershed planning process, local stakeholders identified various information-based challenges. Current needs expressed by farmers include better awareness of programs and funding available, more information about the benefits of conservation practices and success stories to highlight local improvements.

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 an 18-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.

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: Farmers, landowners and technical experts. Secondary: Watershed residents, educators, students and others.
Messages	Need to be tailored specifically for farmer engagement, general public, decision makers or 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 hours
Website and social media	Conservation practice signs	Conservation icons or graphics
Fact sheets	Volunteer workshops	Guest speakers at area events
Direct mailings	Youth outdoor learning	Individual on-farm visits
Demonstration field days	Urban/ag learning exchanges	Practice-specific outreach
Watershed boundary signs	Stream cleanup events	Farmer-led listening sessions

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

Project Partners	Agriculture's Clean Water Alliance
	Hagie Manufacturing
	Iowa Department of Agriculture and Land Stewardship
	Iowa Department of Natural Resources
	Iowa Soybean Association
	Iowa State University Extension and Outreach
	Kossuth and Humboldt Soil and Water Conservation Districts
	North Central Cooperative
	Prairie Creek Watershed farmers and landowners
	The Conservation Fund
	The Nature Conservancy
	USDA-Natural Resources Conservation Service
Other Government, Agriculture and Outdoor Organizations	Cities of Wesley, Corwith, Lu Verne and Renwick
	Ducks Unlimited
	Fishers and Farmers Partnership
	Gold-Eagle Cooperative
	Iowa Agriculture Water Alliance
	Iowa Corn Growers Association
	Iowa Farm Bureau Federation
	Iowa Geological Survey
	Iowa Natural Heritage Foundation
	Iowa Pork Producers Association
	Kossuth and Humboldt County Boards of Supervisors
	Kossuth and Humboldt County Conservation Boards
	Landus Cooperative
	National Fish and Wildlife Foundation
	NEW Cooperative
	Pheasants Forever
	Sand County Foundation
	U.S. Fish and Wildlife Service
	U.S. Geological Survey
	Youth educational groups
Media	Algona Kossuth County Advance
	Britt News Tribune
	Des Moines Register
	Eagle Grove Eagle
	Farm Bureau Spokesman
	Fort Dodge Messenger
	KHBT 97.7 FM Humboldt
	KLGA 92.7 FM Algona
	KLGZ 1600 AM / 98.5 FM Algona
	KWMT 540 AM Fort Dodge
	KZWC 1570 AM / 92.9 FM Webster City
	WHO 1040 AM Des Moines

9. Evaluation Plan

Project evaluation and recognition of successes and challenges is a critically important step in implementing the Prairie Creek Watershed Plan. This section lays out a self-evaluation process for project partners to measure project progress in four categories: project administration, attitudes and awareness, performance and results. A project evaluation worksheet can be found in Appendix D.

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 outreach, events and monitoring. If objectives are determined to not be met, amounts or types of activities may need to be adjusted. Input from farmer leaders will be an important source of feedback and ideas for the project to adapt as needed.

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 knowledge, attitudes and behaviors. Surveys should include questions to determine effectiveness of different outreach methods.
- **Field day attendance.** Field days are an important outreach component of watershed projects. To quantify 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 should be aggregated to the watershed scale and reported to partners annually.
- **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, Iowa and regional water quality efforts such as the Mississippi River Basin Healthy Watersheds Initiative.

- **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 best management 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. Appendix E can be used to estimate watershed nitrate reduction based on practice implementation levels.

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 best management practice (BMP) implementation costs are estimated at up to $2,695,500 per year and initial structural costs are estimated to be $6,445,000. A **National Association of Conservation Districts** report highlighted that practices such as nutrient management no-till/strip-till and cover crops that build soil health 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 2017 dollars.

Table 10.1. Estimated resource needs (in 2017 dollars) to reach the Prairie Creek Watershed best management practice implementation level goals.

Practice	Unit	Existing	Watershed Plan Goal	Cost Per Unit	Total Cost
Nutrient management	acres	679	30,000	-$5	-$150,000
No-till/Strip-till	acres	2,844	*Maximum possible*	-$10	-$600,000
Cover crops	acres	2,134	60,000	$50	$3,000,000
Grassed waterways	feet	234,354	*As needed*	-	-
Perennial cover (additional)	acres	2,378	3,878	$297	$445,500
Bioreactors	structures	1	50	$10,000	$490,000
Saturated buffers	structures	-	40	$3,000	$120,000
Wetlands	sites	2	11	$625,000	$5,625,000
Oxbow restorations	sites	4	25	$10,000	$210,000

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). Cost savings for no-till/strip-till are expected due to decreased fuel use. Cover crop costs include seed, labor and termination cost estimates from Iowa State University Extension and Outreach Ag Decision Maker and Iowa Learning Farms tools. The perennial cover annual cost is the watershed weighted average Conservation Reserve Program (CRP) soil rental rate. Costs for bioreactors, saturated buffers and oxbow restorations are based on typical total installation costs but can vary depending on timing, material availability and contractor experience. Wetland costs were estimated from Iowa Conservation Reserve Enhancement Program (CREP) data and Agricultural Conservation Planning Framework (ACPF) model outputs.

The initial investment needed to construct all proposed edge-of-field structural practices (bioreactors, saturated buffers, wetlands and oxbow restorations) is estimated at $6,445,000. Annual investments are necessary to increase and maintain adoption and implementation of in-field management practices (nutrient management, no-till/strip-till, cover crops and perennial cover). The estimated yearly total for these practices fully implemented is $2,695,500 per year. Cost-share payments may not be permanently available, so alternative funding sources for management practices may need to be pursued. The dollars necessary to fund structural and management practices could fully or partially come from many different sources including farmers and landowners, downstream municipalities, other local or regional stakeholders and conservation organizations. Section 11 describes additional potential funding sources.

Additional costs associated with watershed improvement are estimated to begin at approximately $120,000 per year to fund salary, benefits and training for a watershed coordinator; 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 the Prairie Creek 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 F 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 funding 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 Soil and Water Conservation District (SWCD), County Conservation Board or local farm cooperatives. For example, some SWCDs around Iowa have 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 Prairie Creek Watershed (PCW).
- **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 in 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 (see Table 8.3). 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. The **Iowa League of Cities** is leading a pilot program in Iowa that is testing this nutrient reduction exchange model. Trading within the larger Des Moines 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 PCWmay prove to be more successful than existing groups working together without formal organization. (The Boone River Watershed organization may be appropriate for this purpose.) At a minimum, the farmers and landowners involved in the development of this watershed plan should convene regularly to discuss and evaluate project progress, continually develop innovative outreach and implementation strategies and set specific work plans to support steady progress towards the 2035 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 no or negative return on investment.
- **Sponsored projects.** Iowa administrative code authorizes use of the Clean Water **State Revolving Fund** (SRF) to implement water resource restoration sponsored projects, or **sponsored projects**, in order to develop watershed-based approaches to water quality improvement. Wastewater treatment facility upgrades are very expensive, and the SRF provides a source of capital for these infrastructure improvements. In a sponsored project, an overall interest rate reduction on the SRF loan allows the utility to use saved capital to fund nonpoint source water quality improvement practices within the same watershed as the wastewater facility. Use of a sponsored project to fund agricultural/rural practices that improve water quality requires coordination with a wastewater treatment plant upgrade, but can provide two projects for the price of one and establish and strengthen upstream-downstream partnerships within the watershed.

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 Prairie Creek Watershed. An organizational chart is shown in Figure 12.1 to illustrate the relationships between all project stakeholders and partners.

- **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.
- **Kossuth and Humboldt Counties 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 State University Extension and Outreach.** Engage farmers and landowners through agronomic and water quality programming, provide outreach opportunities to project and promote relevant university research.
- **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.
- **Kossuth and Humboldt County Conservation Boards.** Provide project partnership, easement management and public education.
- **County supervisors.** Engage with project to determine and pursue mutual benefits.
- **Agribusinesses.** Engage project partners and promote project goals and opportunities to members and customers. Agriculture's Clean Water Alliance should continue to fund stream water quality monitoring.
- **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.

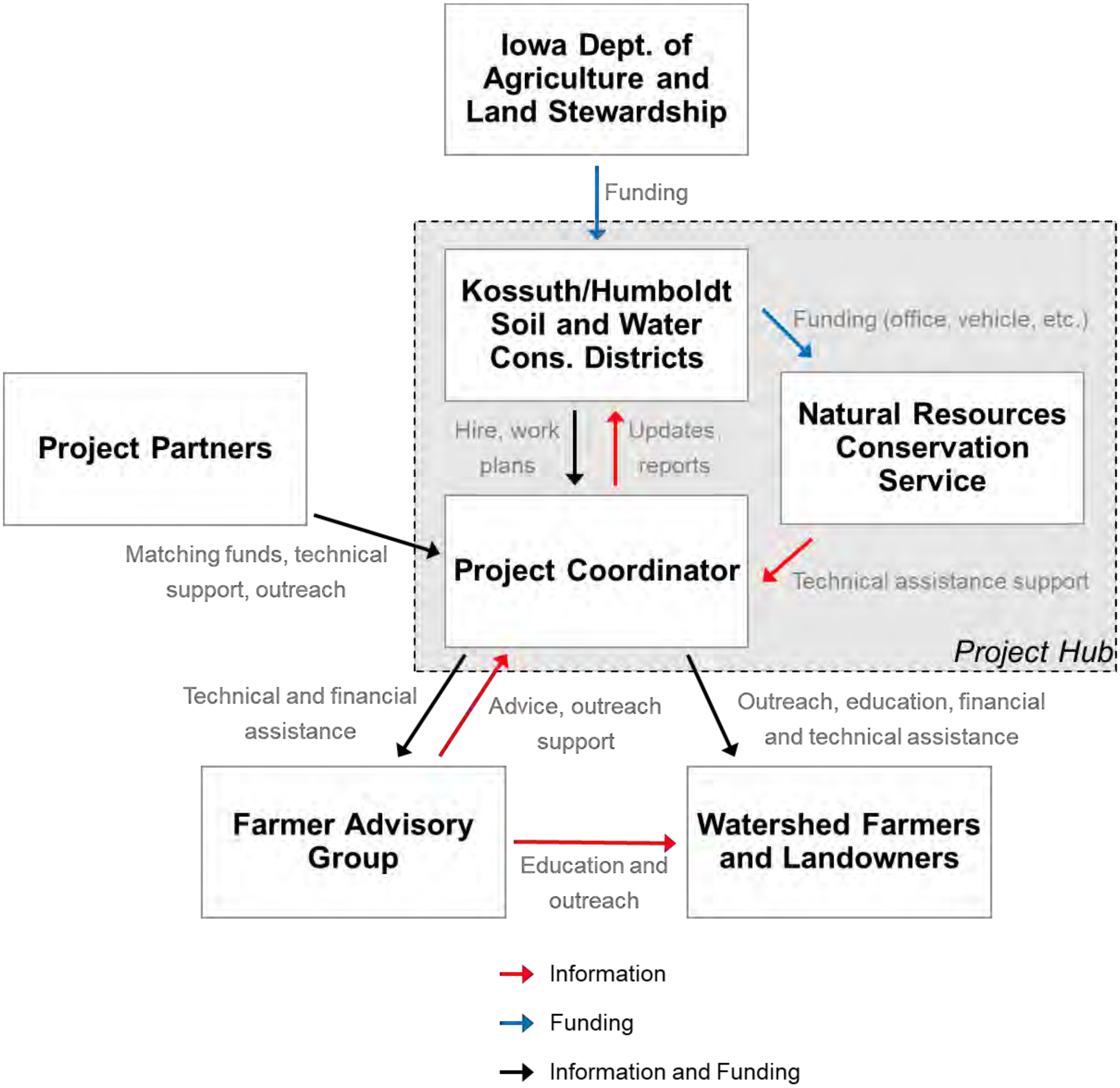

Figure 12.1. Organizational chart for the Prairie Creek Watershed project. Red, blue and black arrows denote flow of information, funds and both, respectively.

Appendix A: Conceptual Plan Maps

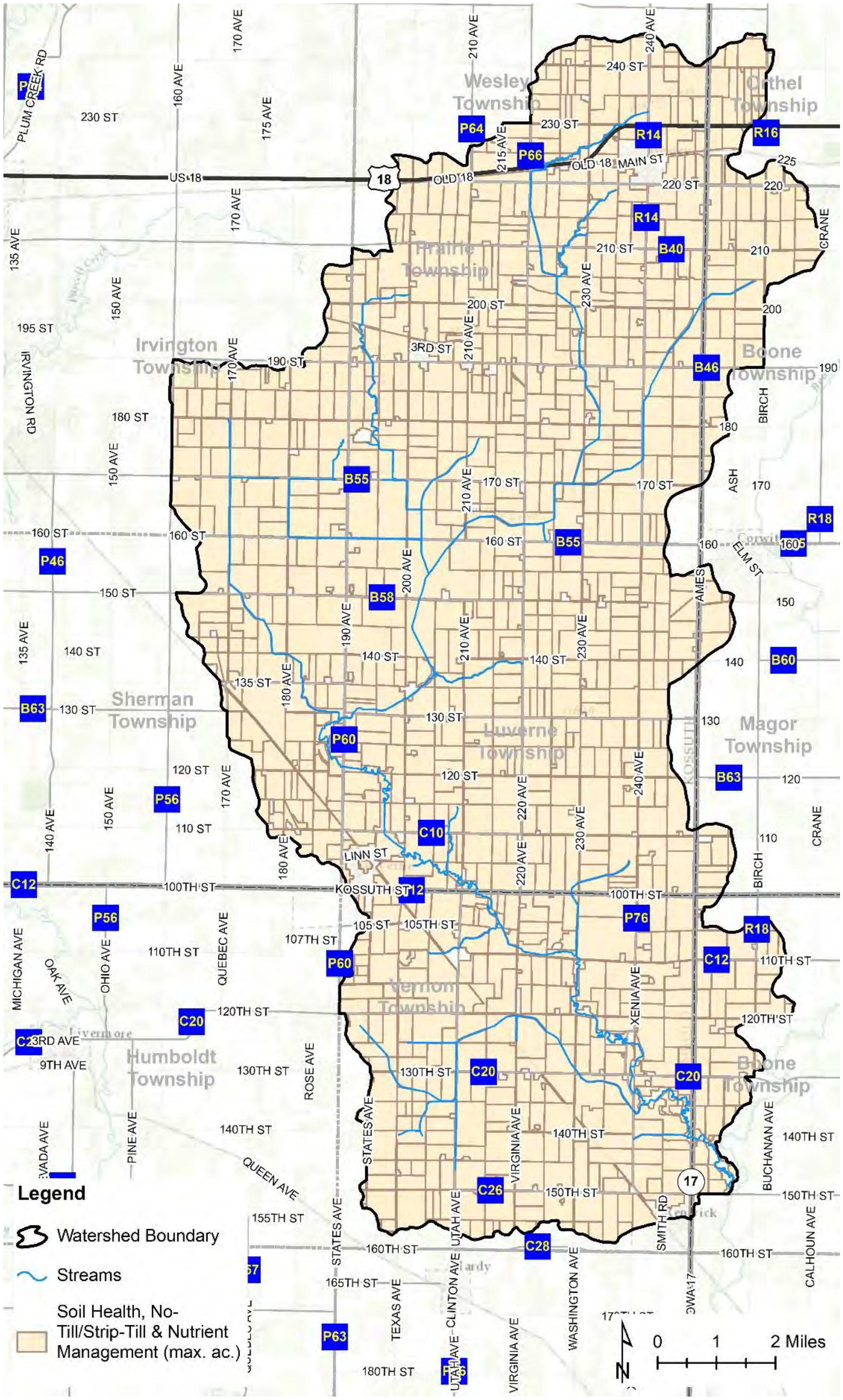

Figure A.1. Soil health, reduced tillage and nutrient management are priorities for all land in the Prairie Creek Watershed.

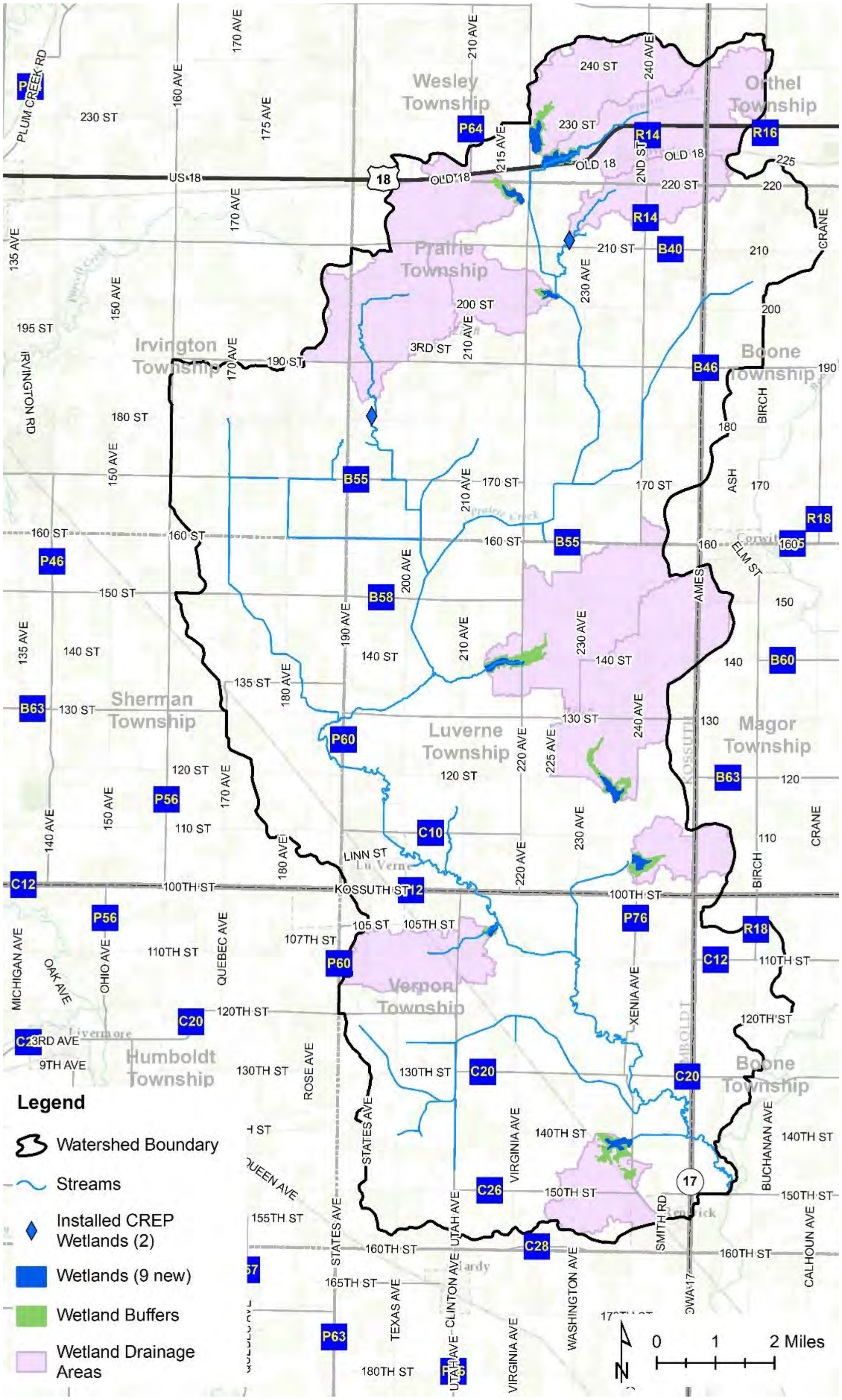

Figure A.2. Priority locations for restored and constructed wetlands.

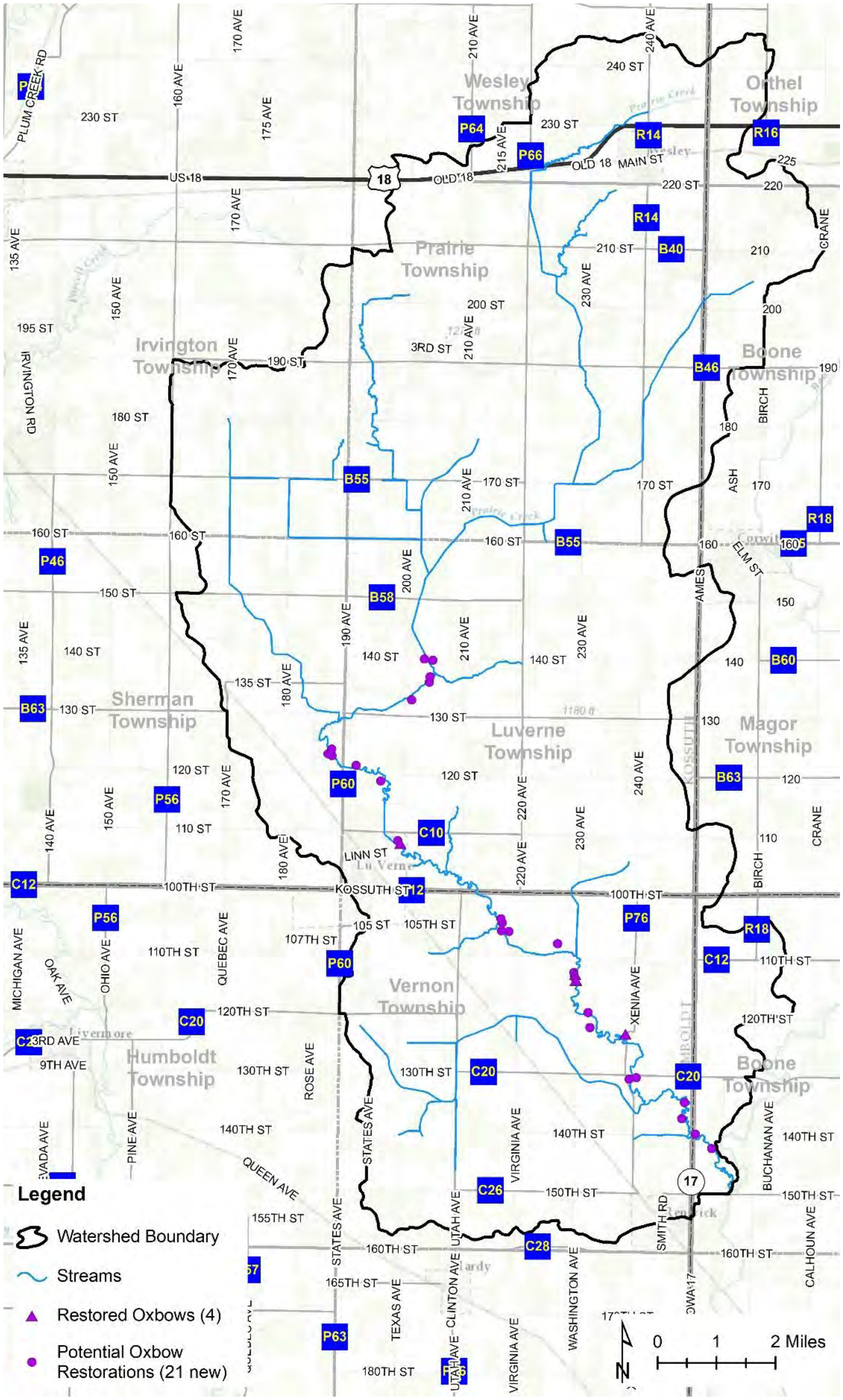

Figure A.3. Priority locations for oxbow restoration.

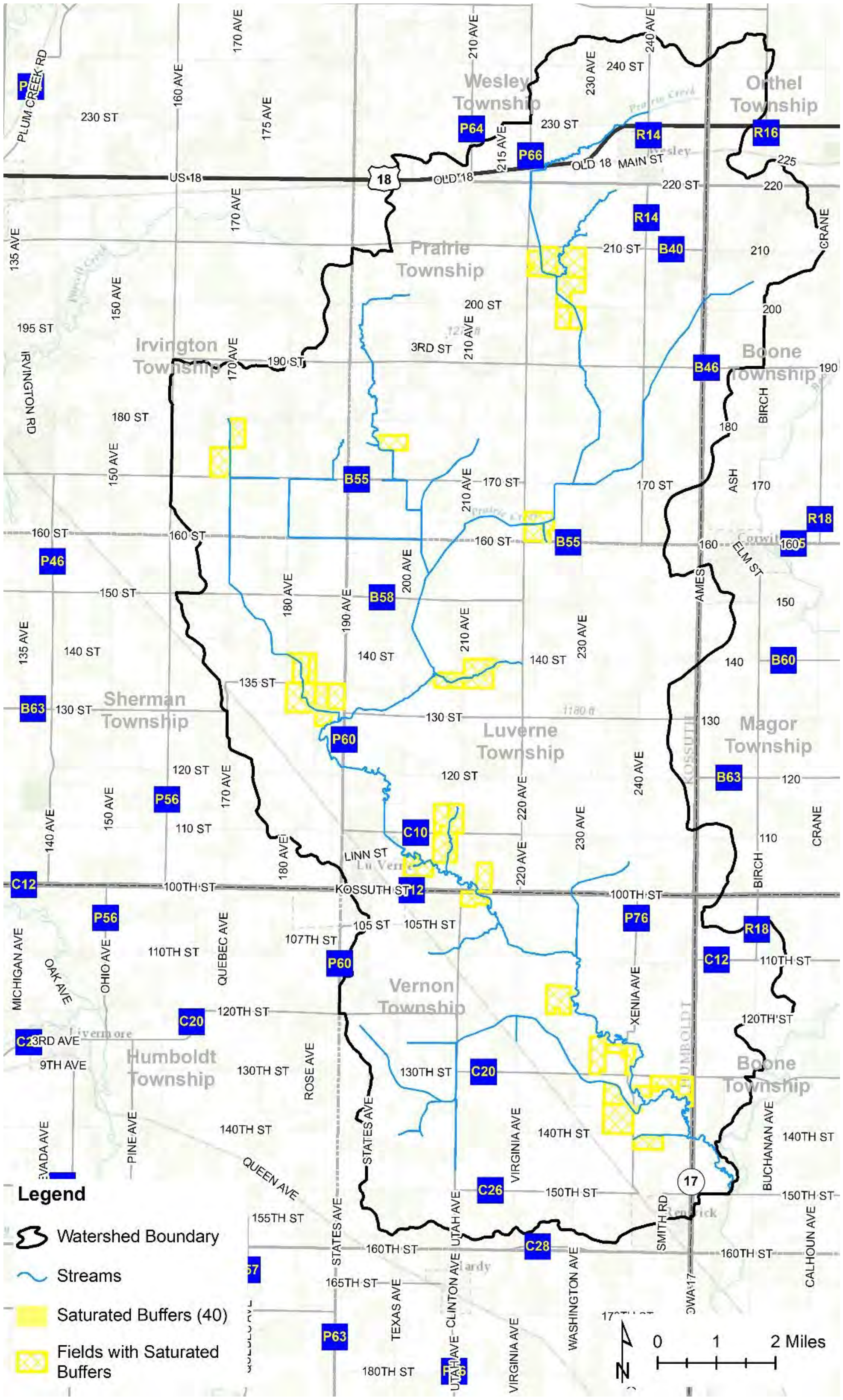

Figure A.4. Priority locations for saturated buffers.

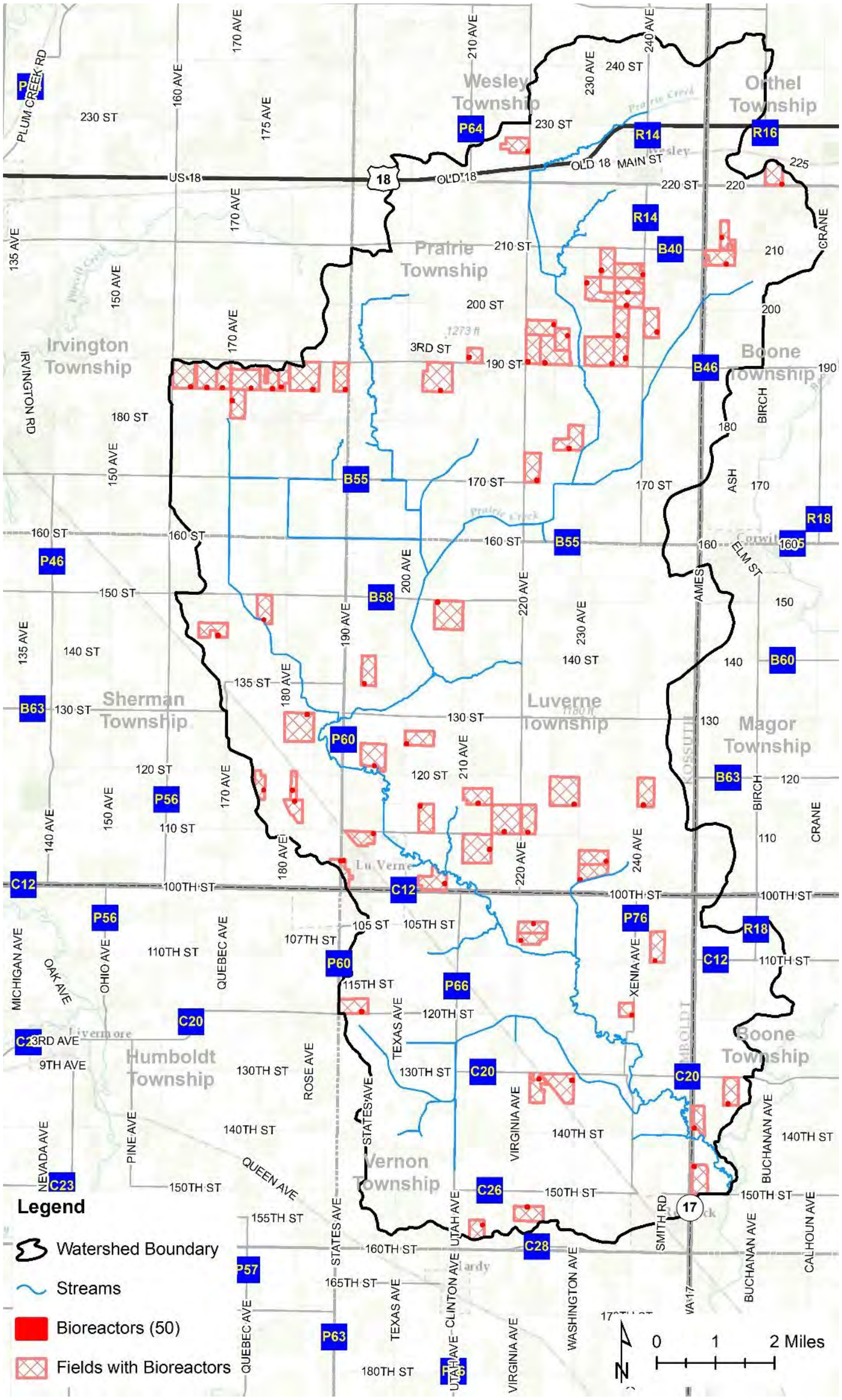

Figure A.5. Priority locations for bioreactors.

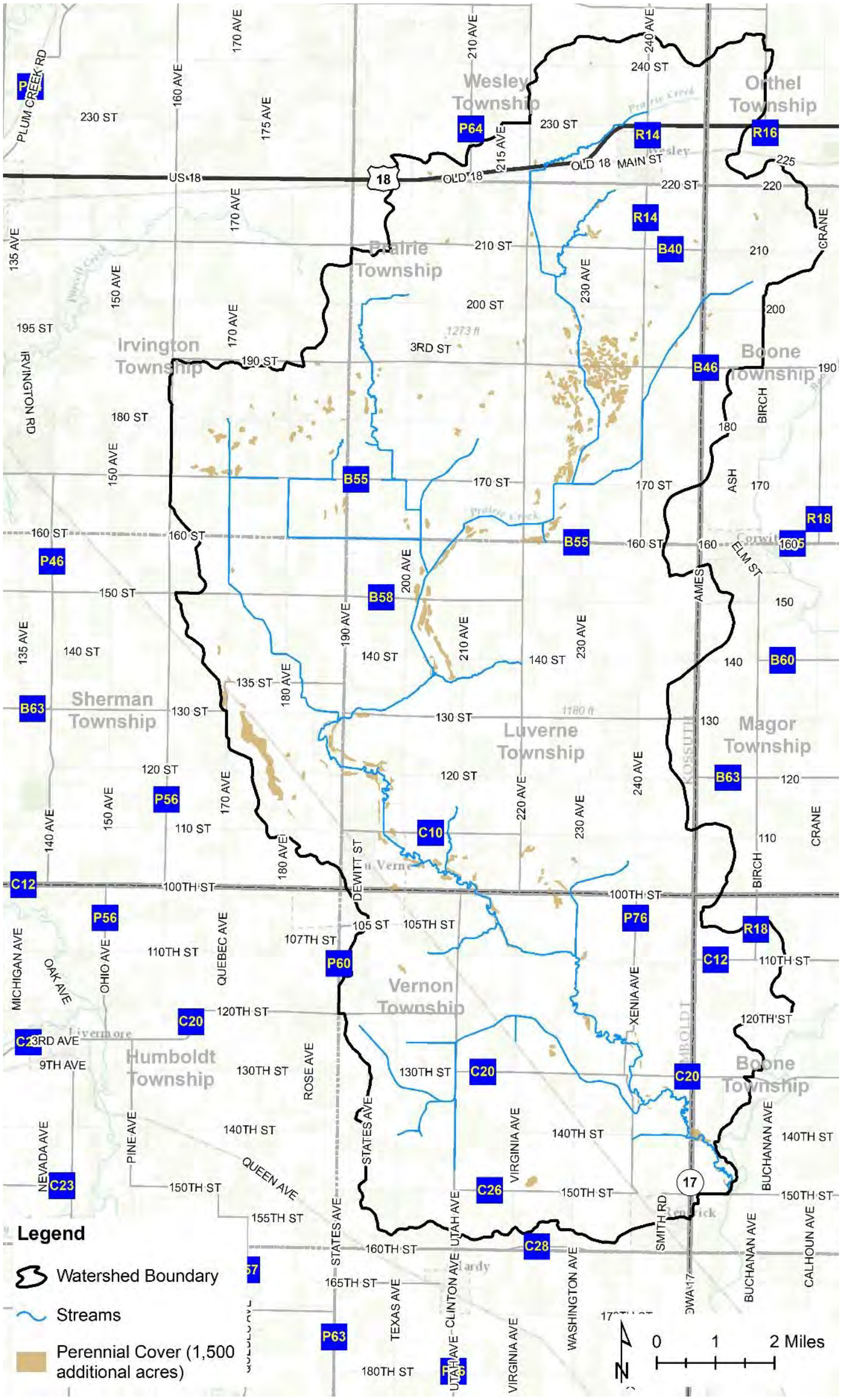

Figure A.6. Priority locations for perennial cover.

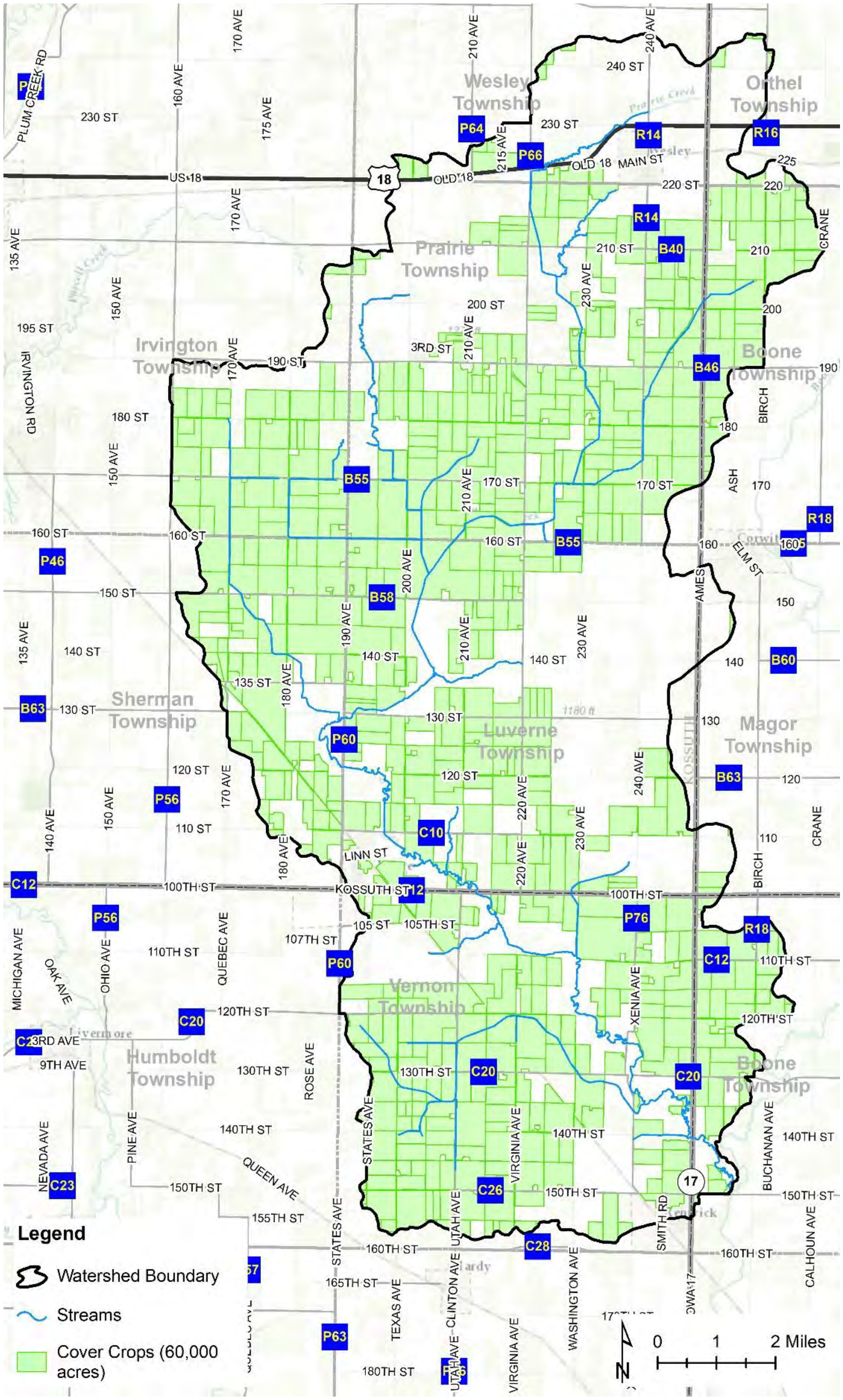

Figure A.7. Priority locations for cover crops.

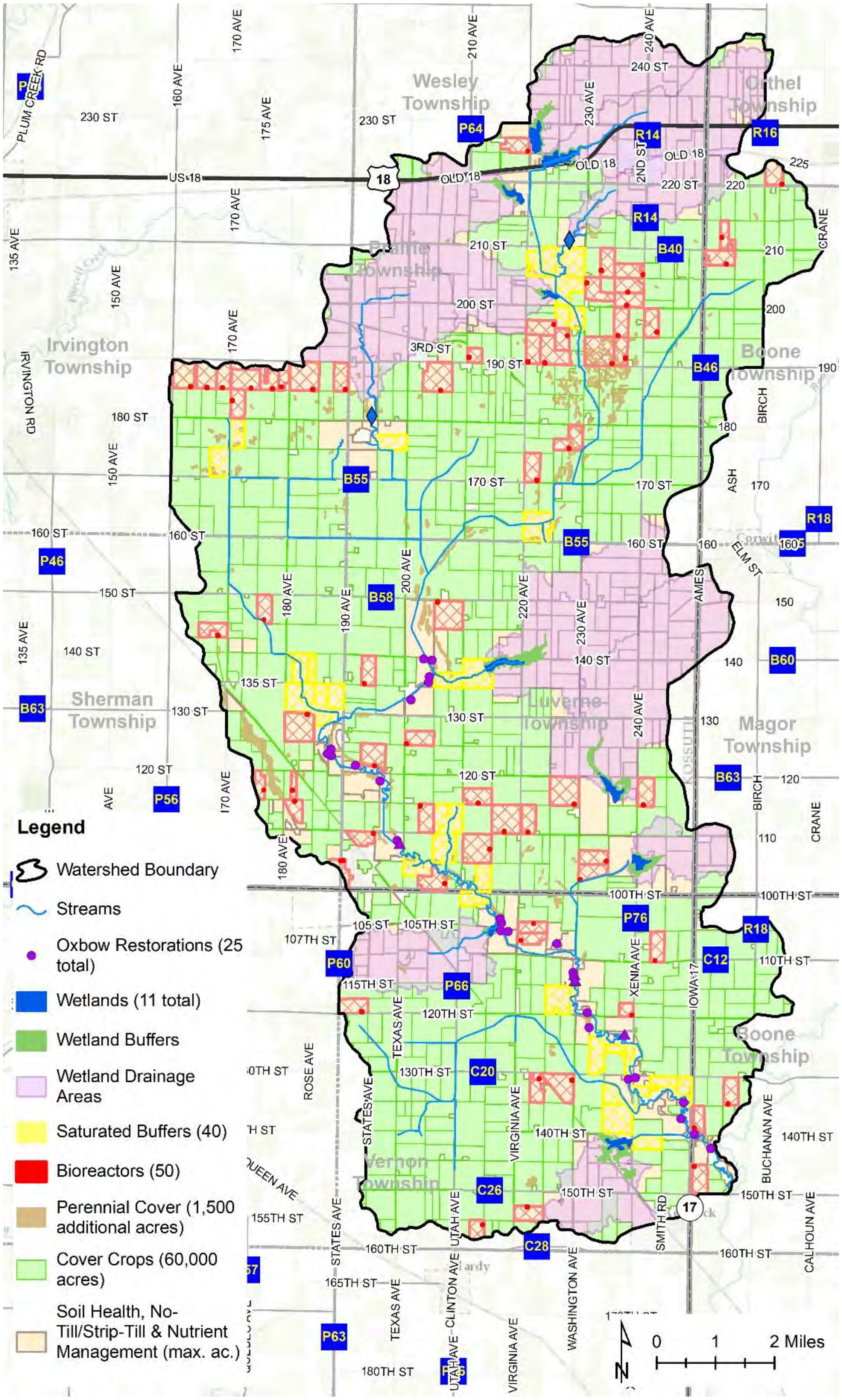

Figure A.8. Prairie Creek Watershed conceptual plan.

Appendix B: Additional Watershed Conceptual Scenarios

In addition to the conceptual plan (Figure 5.2) and implementation schedule (Table 6.1) included in the final watershed plan, watershed stakeholders also considered alternative future scenarios. Alternatives were developed using priority conservation practices, Agricultural Conservation Planning Framework mapping results (see Appendix C) and water quality models.

Three alternatives were developed and presented to watershed stakeholders. Alternatives were designed to meet Iowa Nutrient Reduction Strategy goals and verified with water quality models. Each alternative included both in-field management practices and structural edge-of-field practices, but the balance between these two categories was varied for each scenario. Watershed stakeholders selected a watershed conceptual scenario with a blended emphasis on both in-field and edge-of-field conservation practices. The other scenarios considered are presented below.

Alternative 1: Emphasize Structural Edge-of-Field Practices

Table B.1. Estimated annual management costs of up to $2,292,500 and initial construction costs of $9,980,000.

Practice	Unit	Existing	Implementation Goal	Cost Per Unit	Total Cost
Nutrient management	acres	679	20,000	-$5	-$100,000
No-till/Strip-till	acres	2,844	*Maximum possible*	-$10	-$600,000
Cover crops	acres	2,134	45,000	$50	$2,250,000
Grassed waterways	feet	234,354	*As needed*	-	-
Perennial cover (additional)	acres	2,378	2,500	$297	$742,500
Bioreactors	structures	1	70	$10,000	$690,000
Saturated buffers	structures	-	60	$3,000	$180,000
Wetlands	sites	2	22	$445,000	$8,900,000
Oxbow restorations	sites	4	25	$10,000	$210,000

Alternative 2: Emphasize In-Field Management Practices

Table B.2. Estimated annual management costs of up to $2,650,000 and initial construction costs of $3,590,000.

Practice	Unit	Existing	Implementation Goal	Cost Per Unit	Total Cost
Nutrient management	acres	679	50,000	-$5	-$250,000
No-till/Strip-till	acres	2,844	*Maximum possible*	-$10	-$600,000
Cover crops	acres	2,134	70,000	$50	$3,500,000
Grassed waterways	feet	234,354	*As needed*	-	-
Perennial cover (additional)	acres	2,378	-	$297	-
Bioreactors	structures	1	30	$10,000	$290,000
Saturated buffers	structures	-	20	$3,000	$60,000
Wetlands	sites	2	6	$800,000	$3,200,000
Oxbow restorations	sites	4	8	$10,000	$40,000

Appendix C: 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.

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
1. Watershed Overview
2. Land Use: Watershed & HUC-12 Subwatersheds
3. Tile Drainage: Watershed & HUC-12 Subwatersheds
4. Runoff Risk: Watershed & HUC-12 Subwatersheds
5. Drainage Treatment Practices: Entire Watershed & Individual Townships
6. Runoff Control Practices: Entire Watershed & Individual Townships
7. Riparian Management Practices: Entire Watershed & Individual Townships

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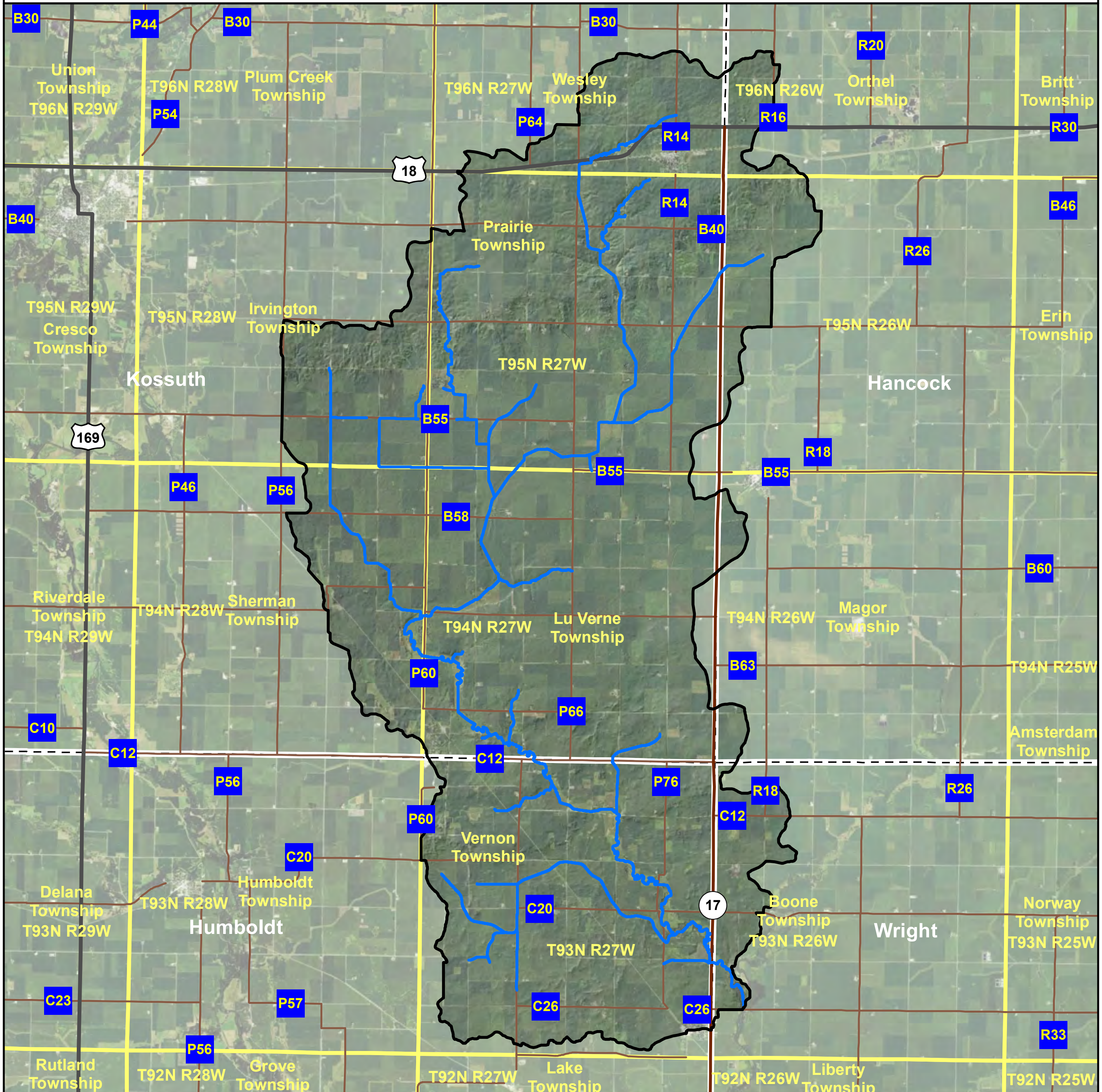
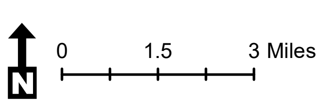
Prairie Creek Watershed (0710000501)
Agricultural Conservation Planning Framework Results Atlas



Watershed Boundary

Streams

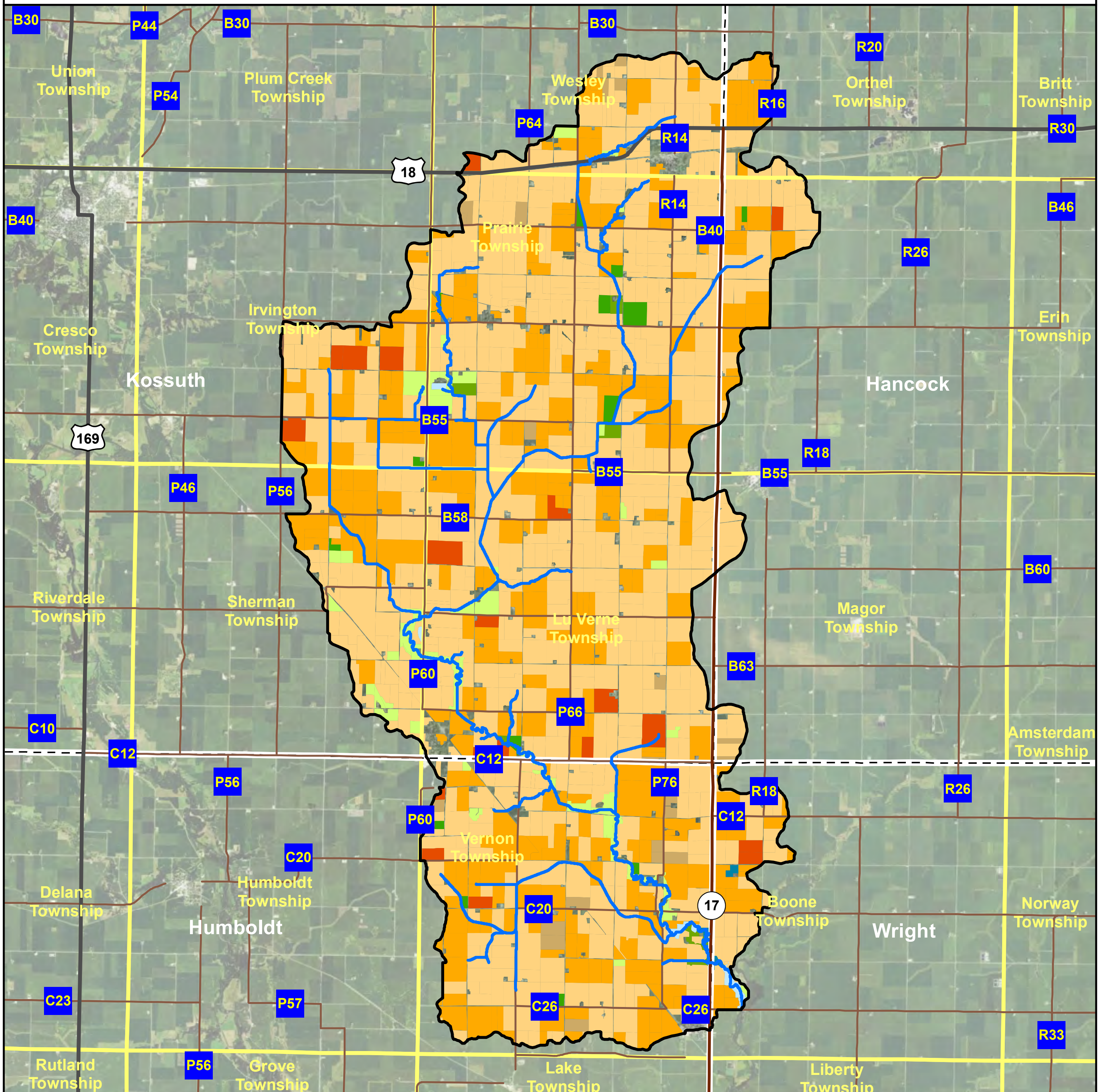


Analysis performed by

Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501)
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
- C/S/Perennial Rotation
- Corn/Perennial Rotation
- Flood-prone Cropland
- Water/wetland
- Pasture
- Urban

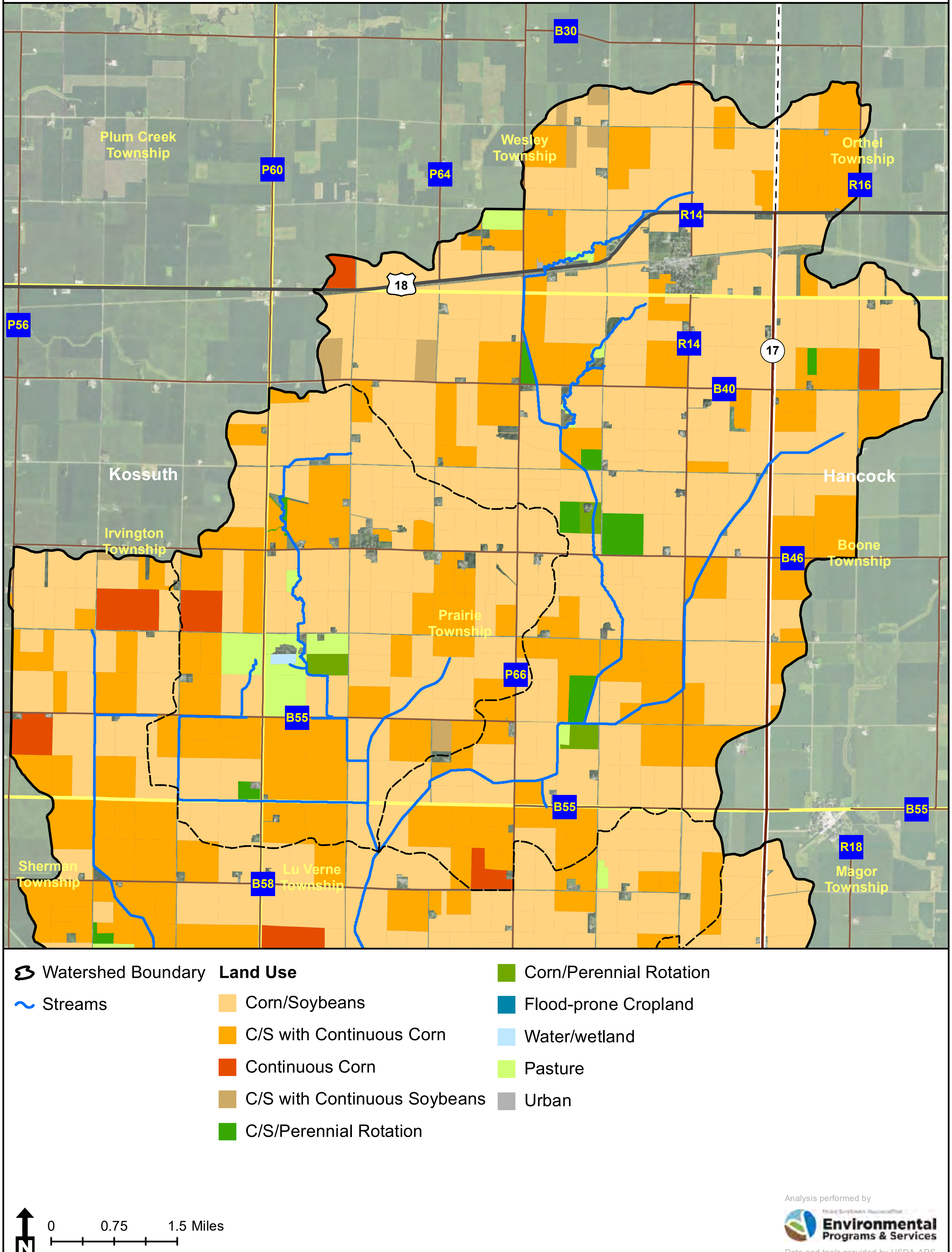
N

0 1.5 3 Miles

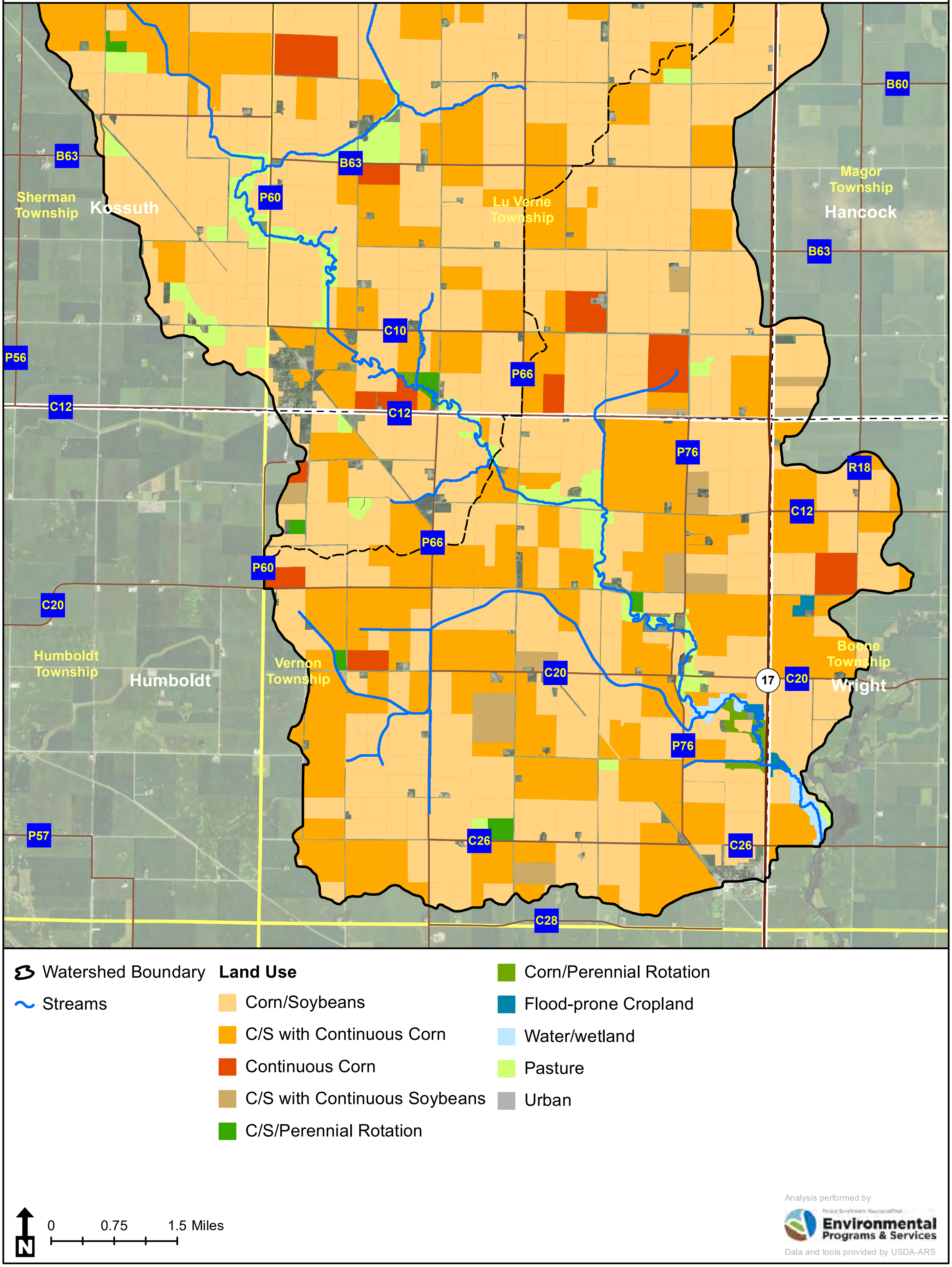
Analysis performed by Environmental Programs & Services

Data and tools provided by USDA-ARS

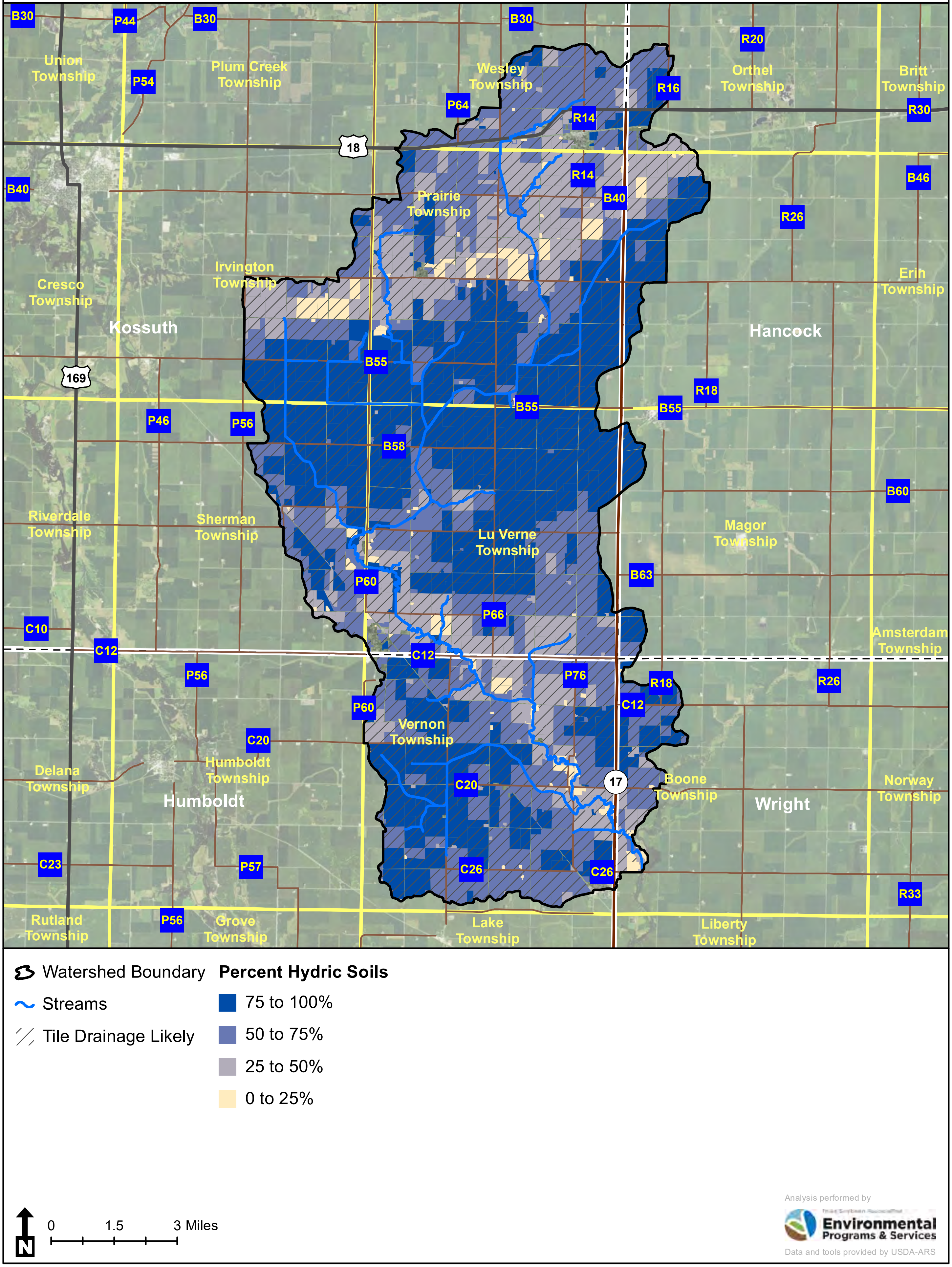
Drainage Ditch 117 & Headwaters Prairie Creek (07100005001 & 07100005002)
Agricultural Conservation Planning Framework Land Use



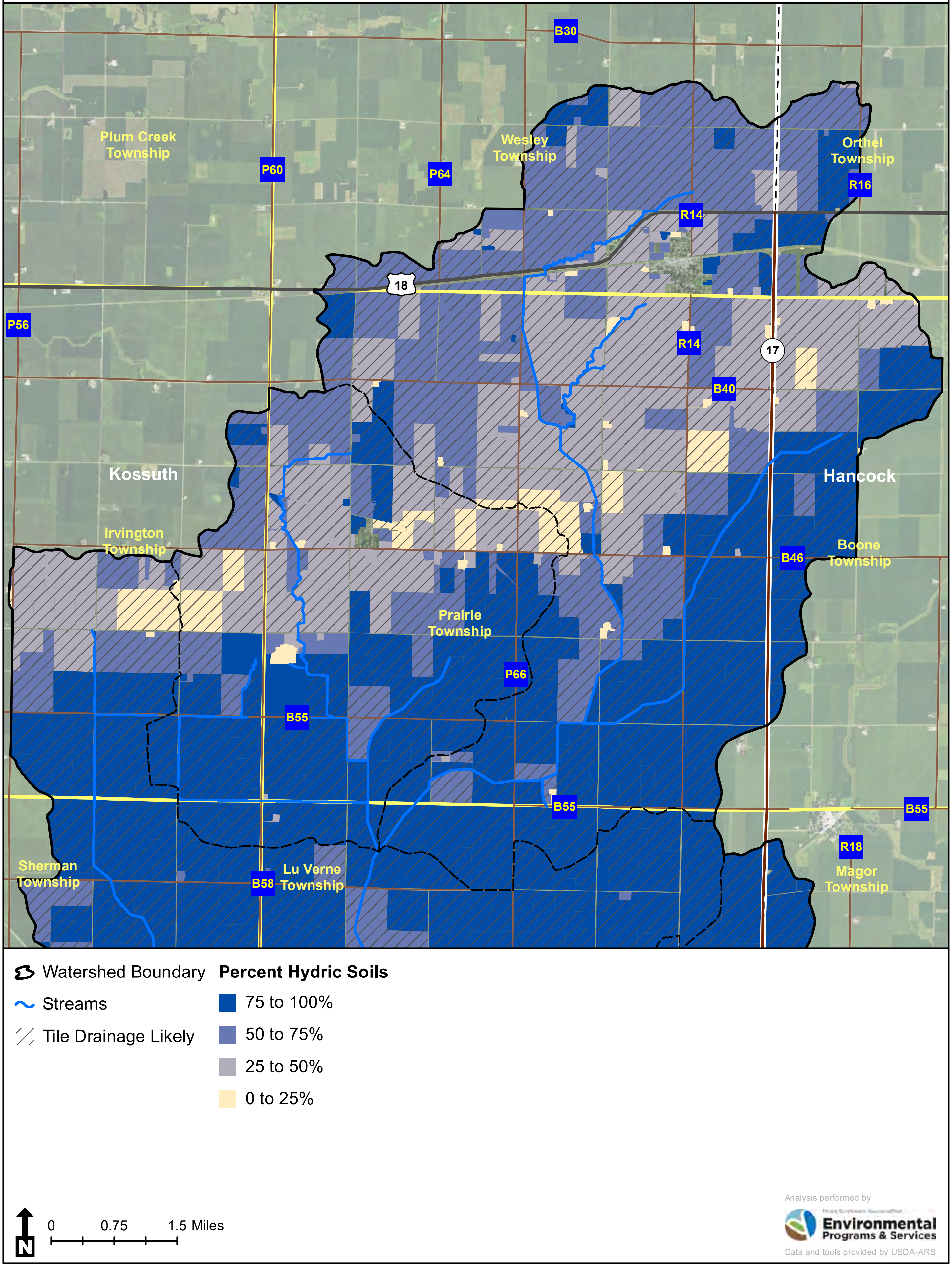
Drainage Ditch 116 & Drainage Ditch 18 (07100005003 & 07100005004) Agricultural Conservation Planning Framework Land Use



Prairie Creek Watershed (0710000501)
Agricultural Conservation Planning Framework Tile Drainage



Drainage Ditch 117 & Headwaters Prairie Creek (07100005001 & 07100005002) Agricultural Conservation Planning Framework Tile Drainage



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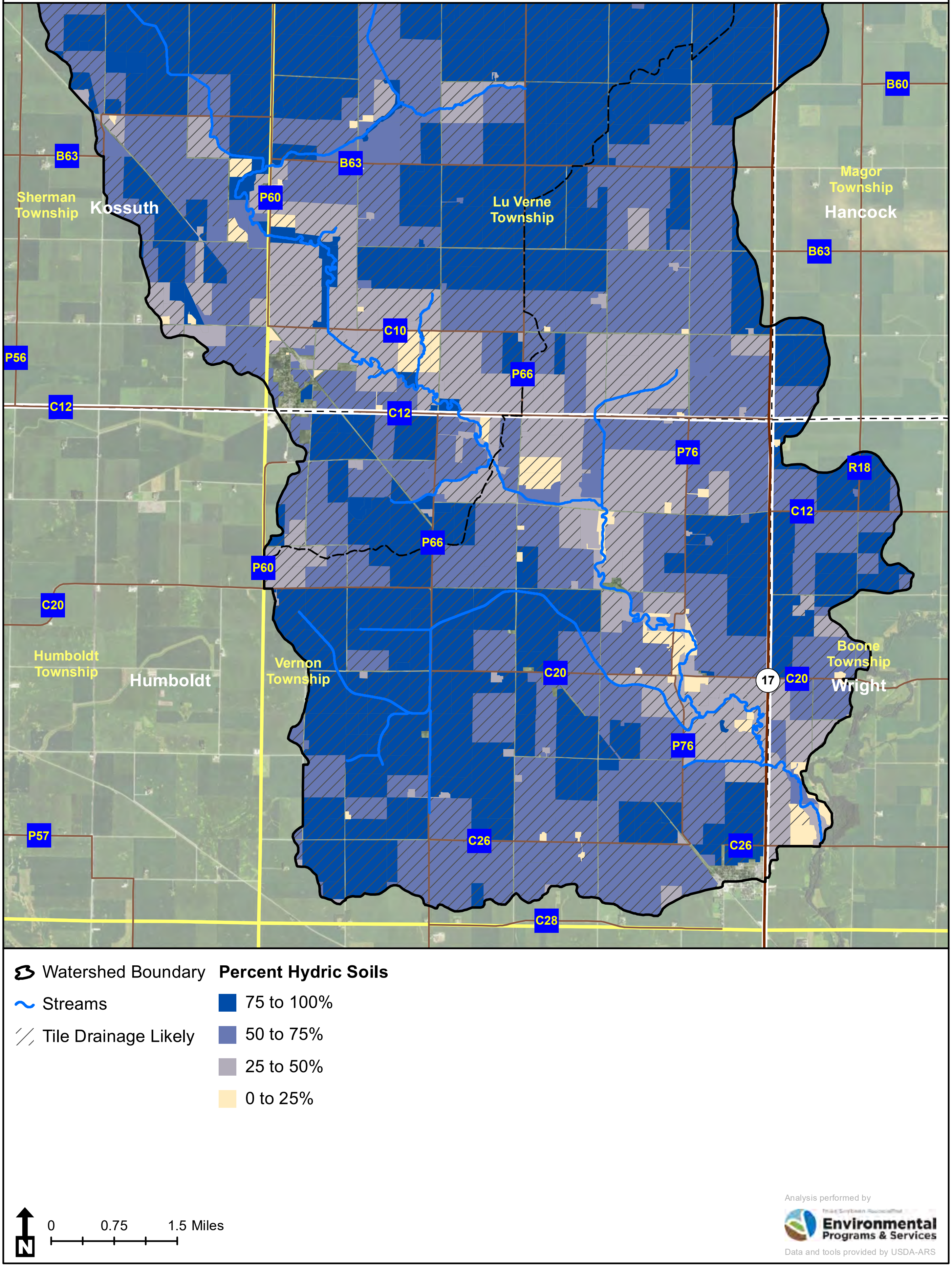
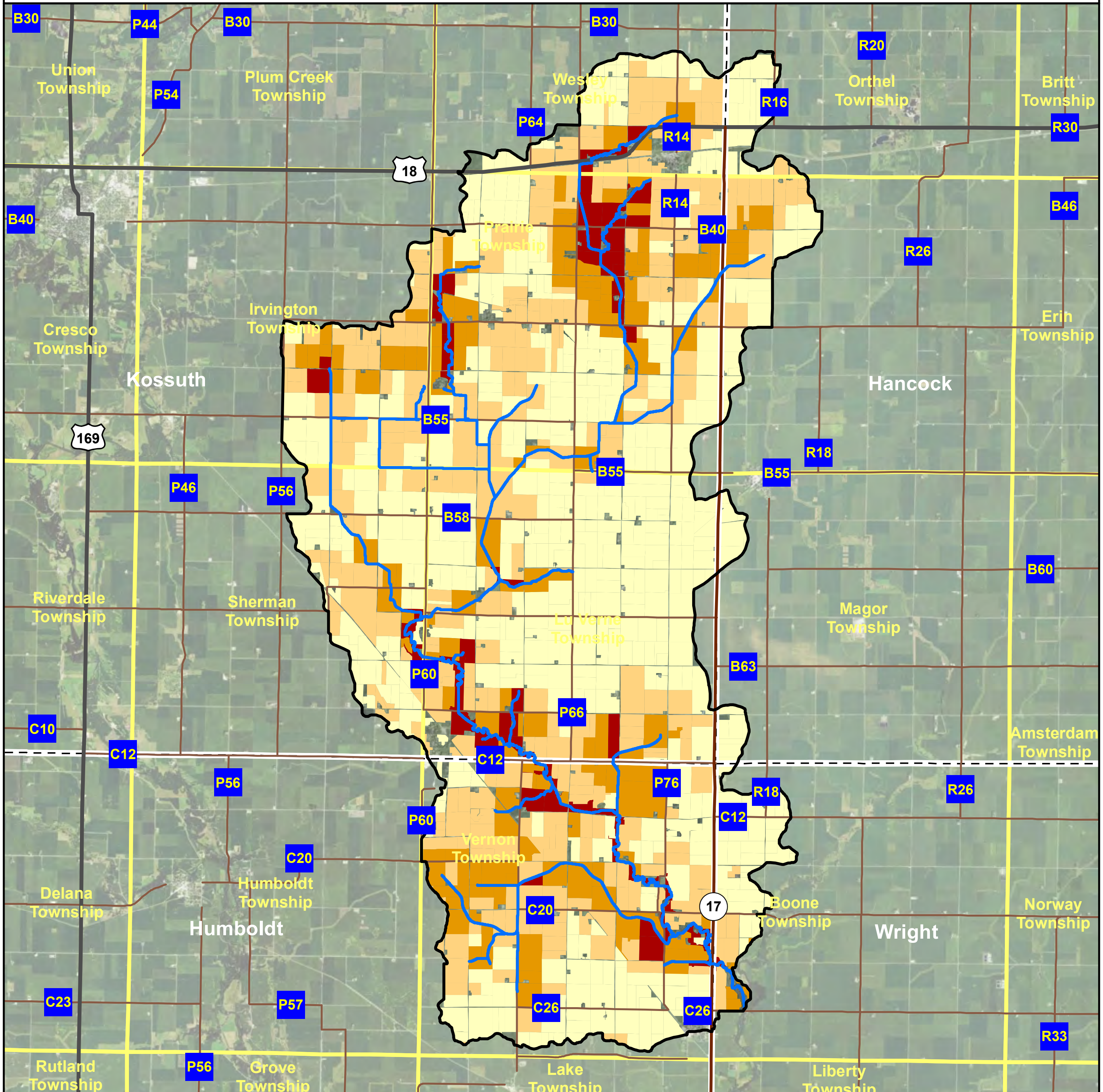
Agricultural Conservation Planning Framework Tile Drainage



Prairie Creek Watershed (0710000501)
Agricultural Conservation Planning Framework Runoff Risk



Watershed Boundary

Streams

Runoff Risk

- Critical
- Very High
- High
- Present

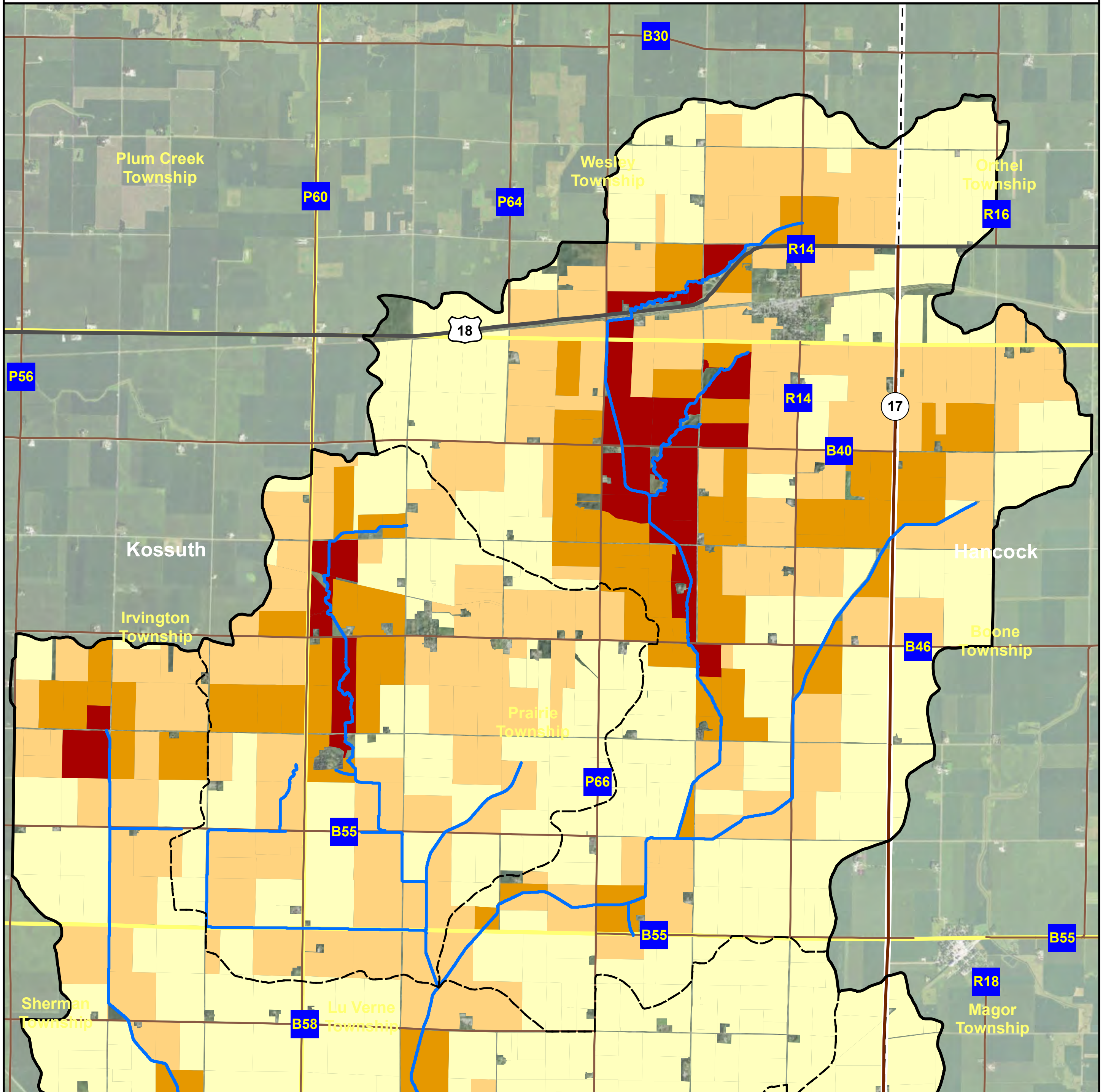
0 1.5 3 Miles

N

Analysis performed by Environmental Programs & Services

Data and tools provided by USDA-ARS

Drainage Ditch 117 & Headwaters Prairie Creek (07100005001 & 07100005002)
Agricultural Conservation Planning Framework Runoff Risk



Watershed Boundary

Streams

Runoff Risk

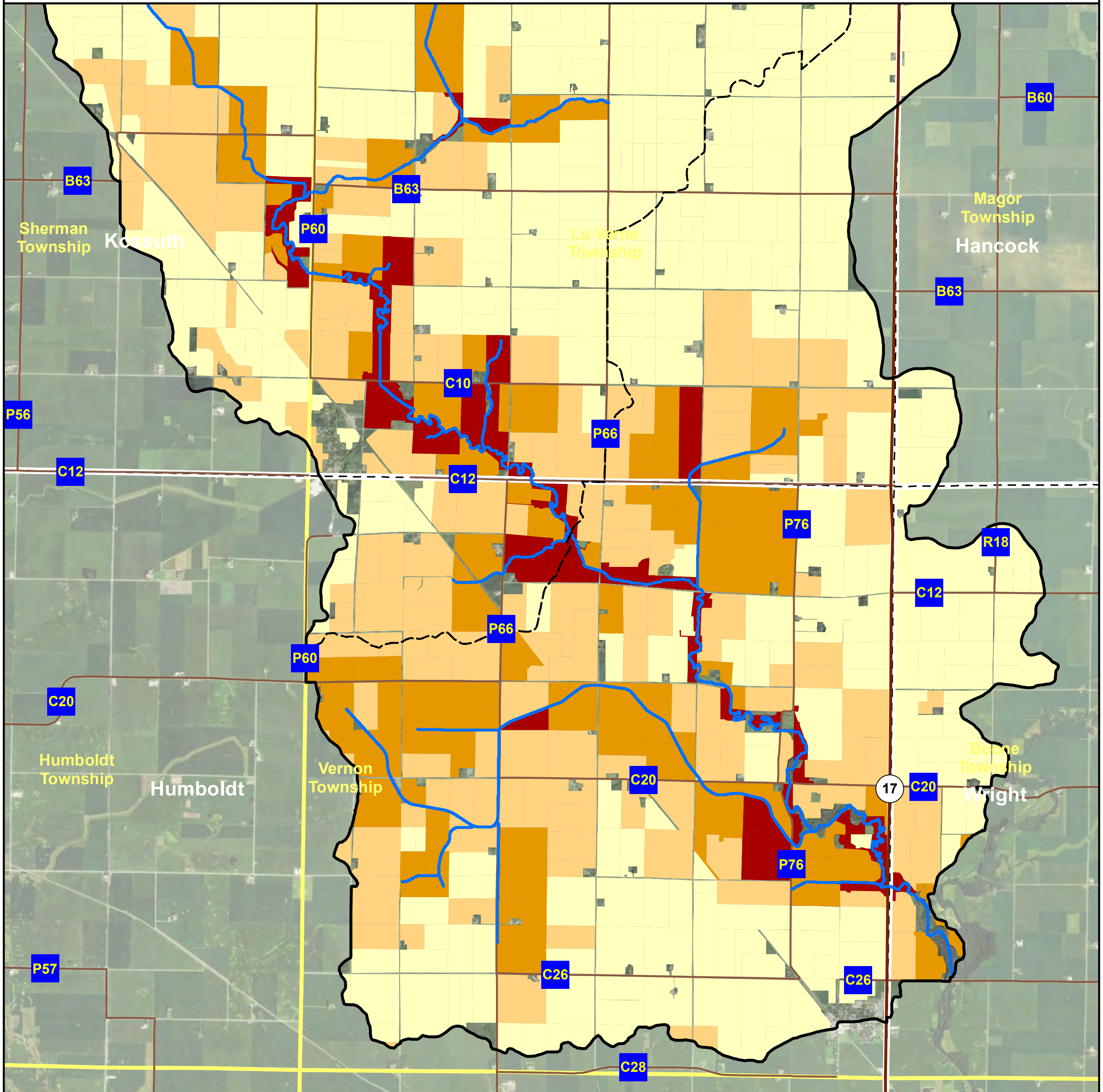
- Critical
- Very High
- High
- Present

0 0.75 1.5 Miles

Analysis performed by Environmental Programs & Services

Data and tools provided by USDA-ARS

Drainage Ditch 116 & Drainage Ditch 18 (07100005003 & 07100005004)
Agricultural Conservation Planning Framework Runoff Risk



Watershed Boundary

Streams

Runoff Risk

Critical

Very High

High

Present

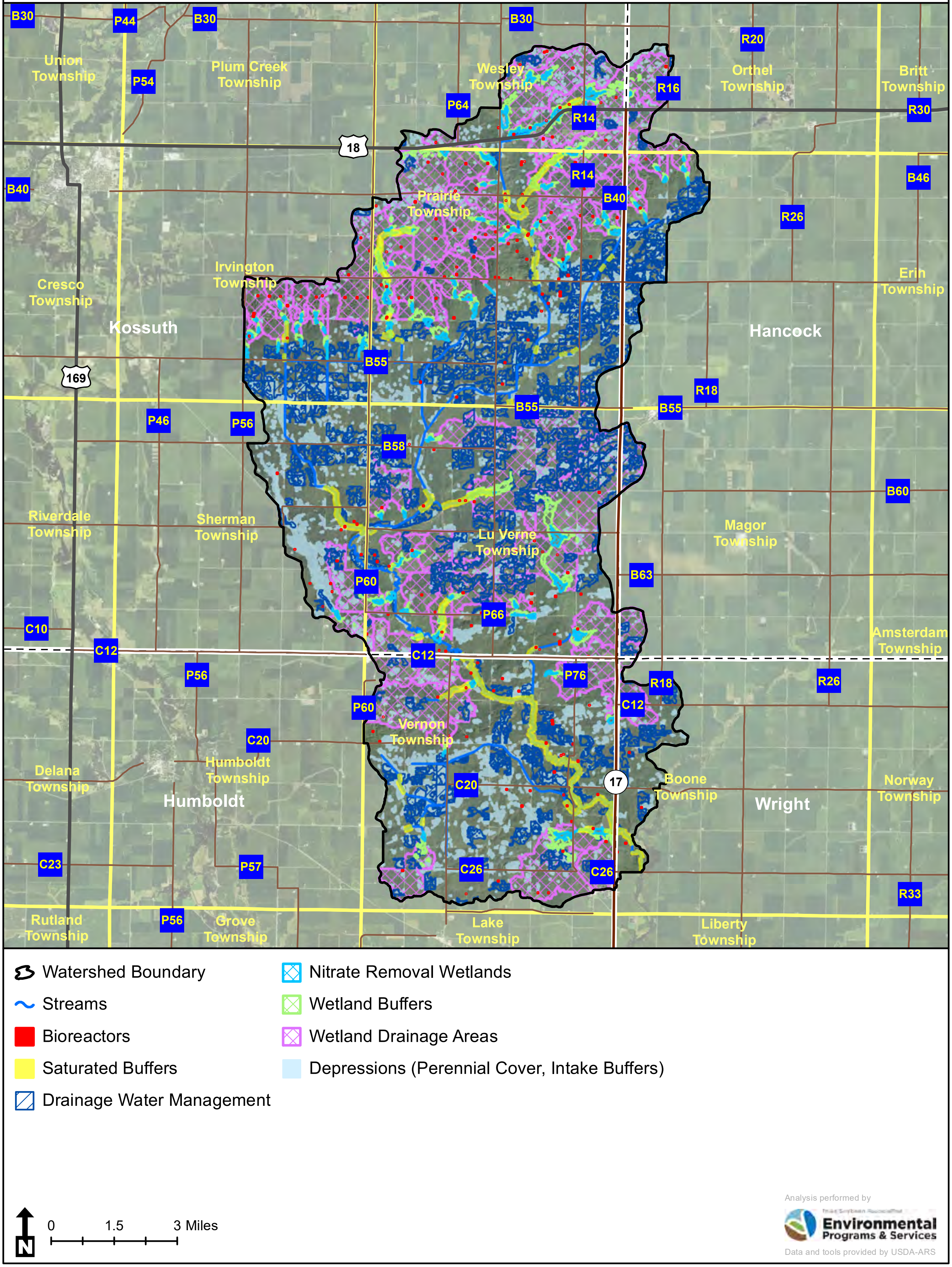
N

0 0.75 1.5 Miles

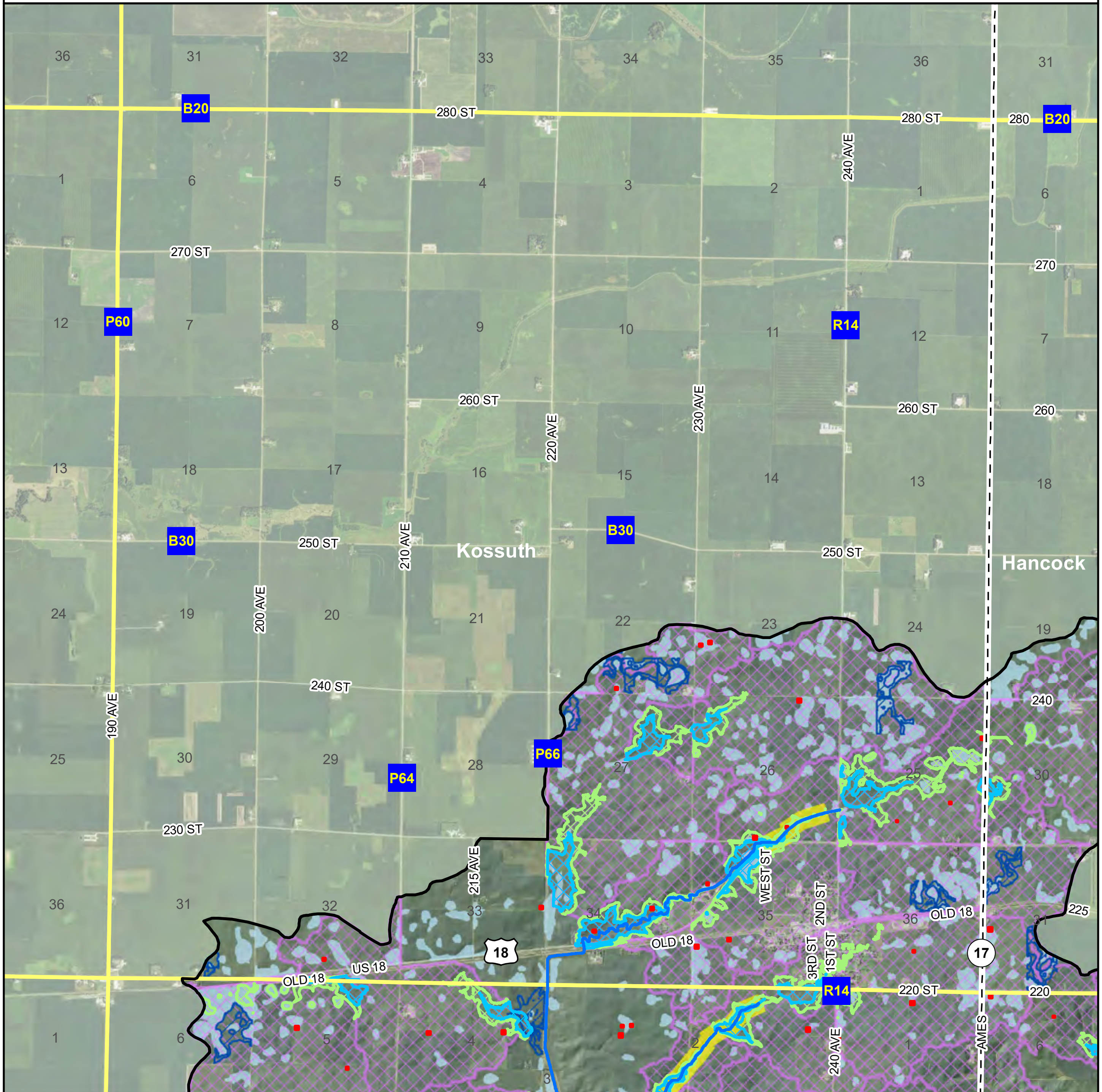
Analysis performed by Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501)
Agricultural Conservation Planning Framework Drainage Treatment Practices



Prairie Creek Watershed (0710000501) T96N R27W
Agricultural Conservation Planning Framework Drainage Treatment Practices



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

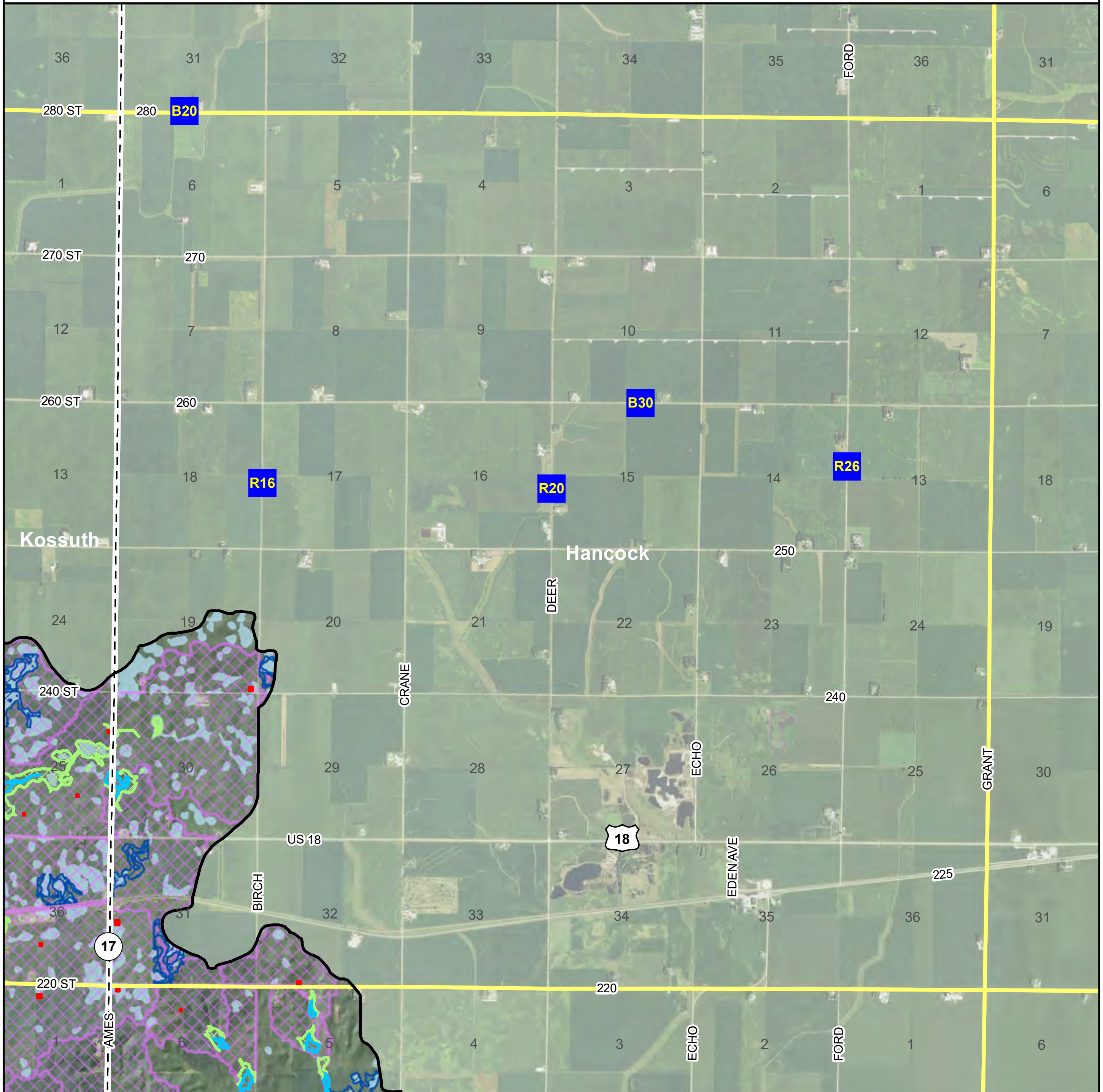
0 0.5 1 Miles

N

Analysis performed by Iowa Soybean Association Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501) T96N R26W
Agricultural Conservation Planning Framework Drainage Treatment Practices

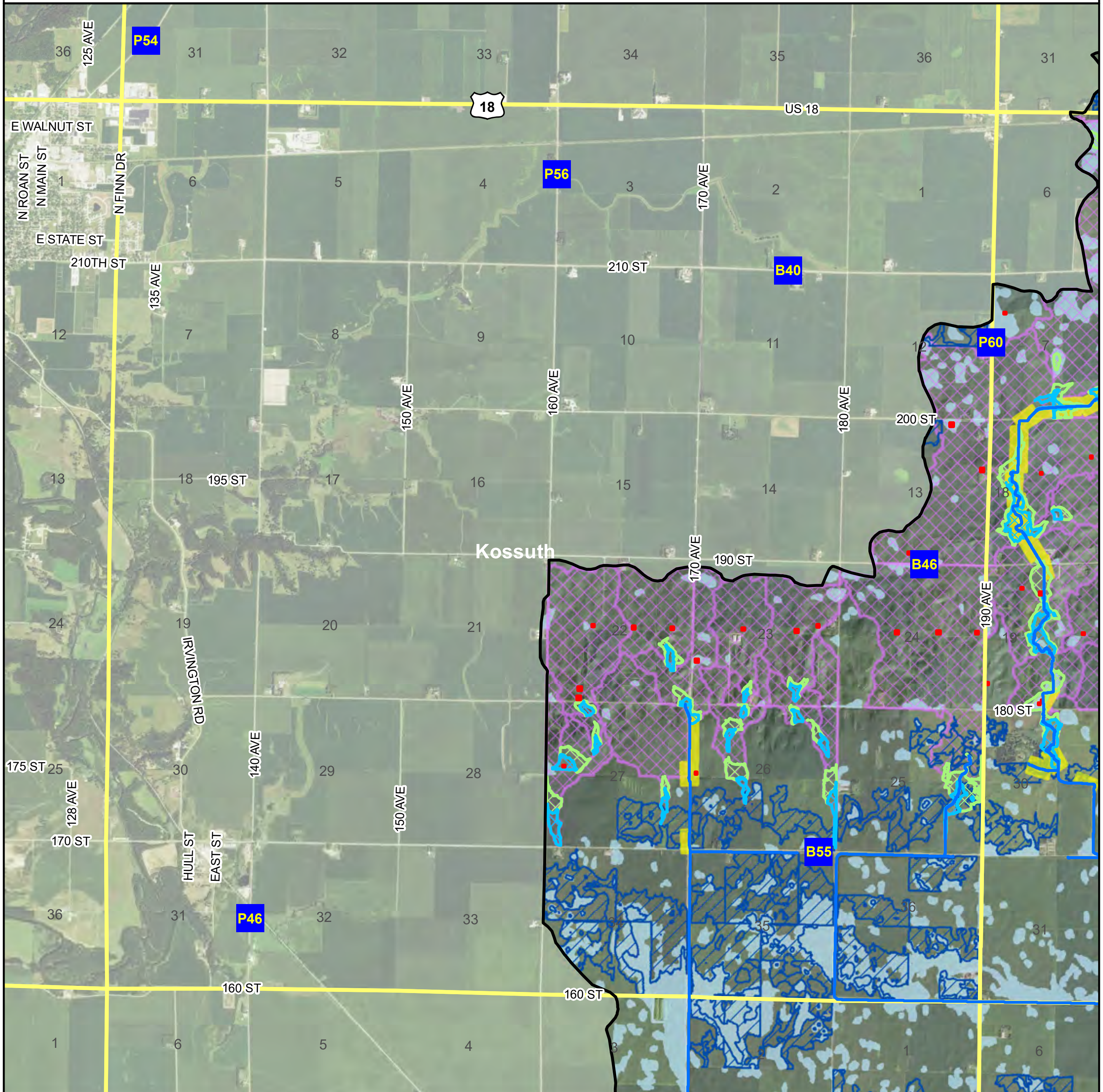


Watershed Boundary
Streams
Bioreactors
Saturated Buffers
Drainage Water Management
Nitrate Removal Wetlands
Wetland Buffers
Wetland Drainage Areas
Depressions (Perennial Cover, Intake Buffers)

N
0 0.5 1 Miles

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

Prairie Creek Watershed (0710000501) T95N R28W
Agricultural Conservation Planning Framework Drainage Treatment Practices

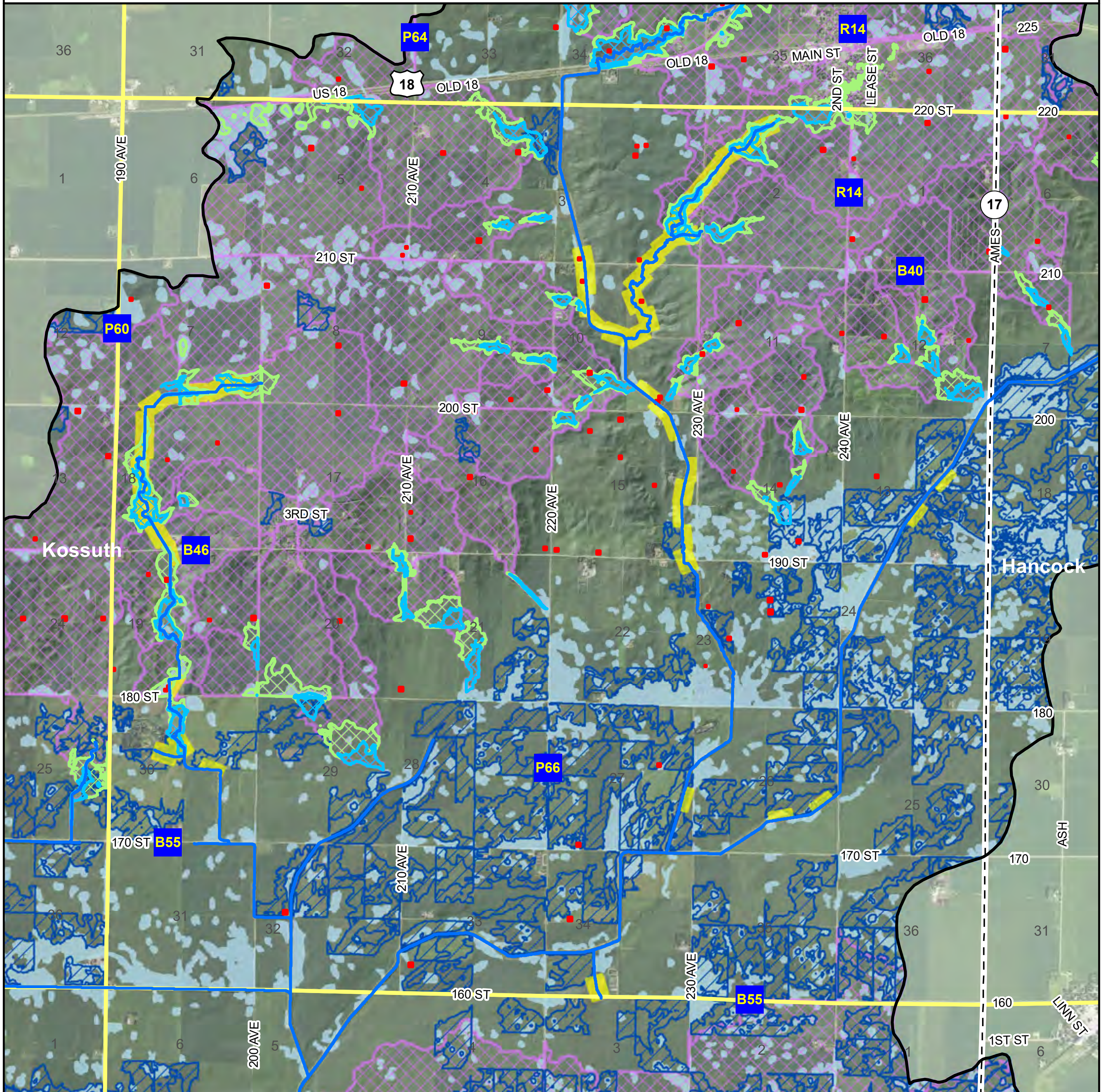


Watershed Boundary
Streams
Bioreactors
Saturated Buffers
Drainage Water Management
Nitrate Removal Wetlands
Wetland Buffers
Wetland Drainage Areas
Depressions (Perennial Cover, Intake Buffers)

N 0 0.5 1 Miles

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

Prairie Creek Watershed (0710000501) T95N R27W
Agricultural Conservation Planning Framework Drainage Treatment Practices

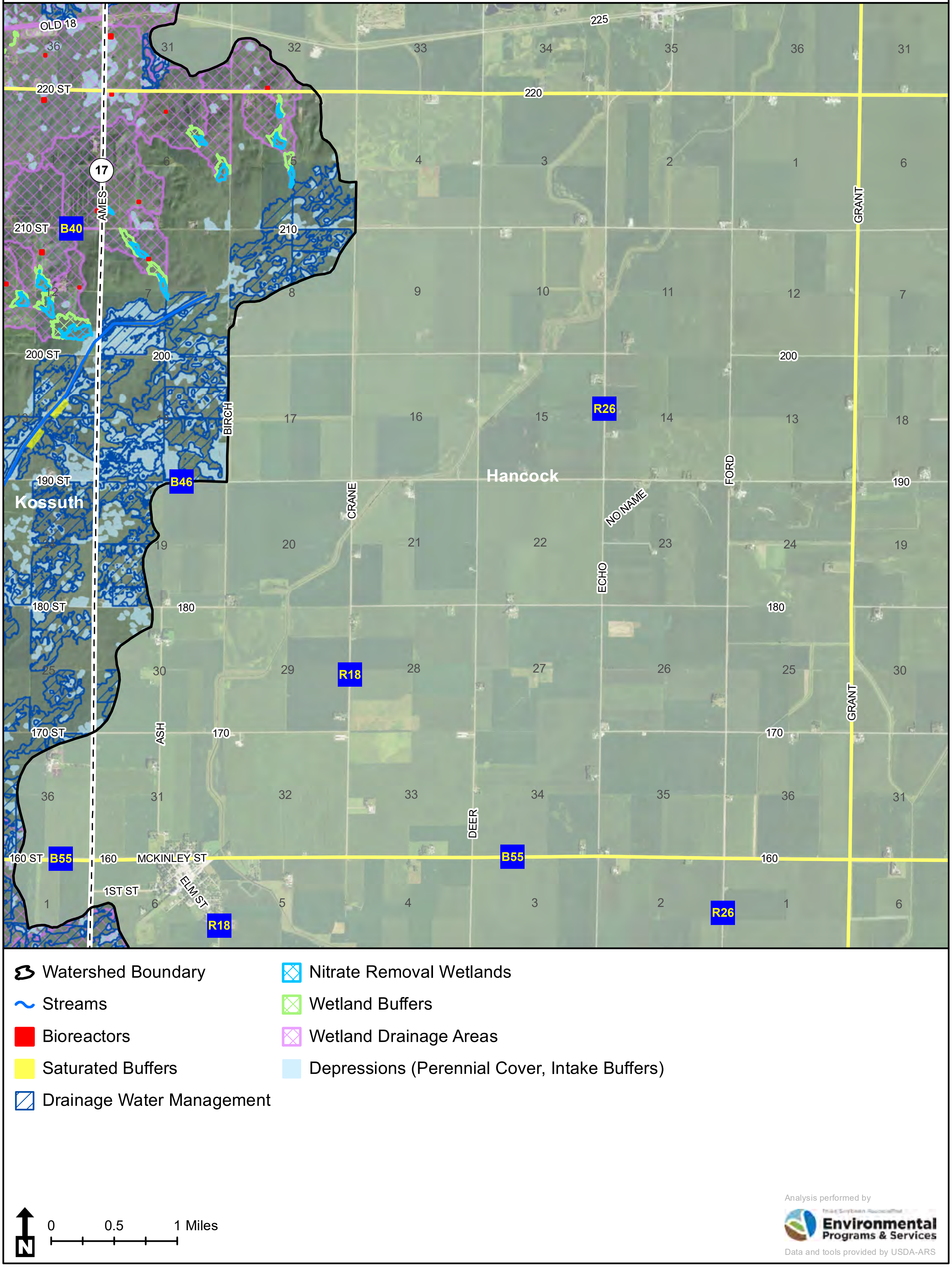


Watershed Boundary
Streams
Bioreactors
Saturated Buffers
Drainage Water Management
Nitrate Removal Wetlands
Wetland Buffers
Wetland Drainage Areas
Depressions (Perennial Cover, Intake Buffers)

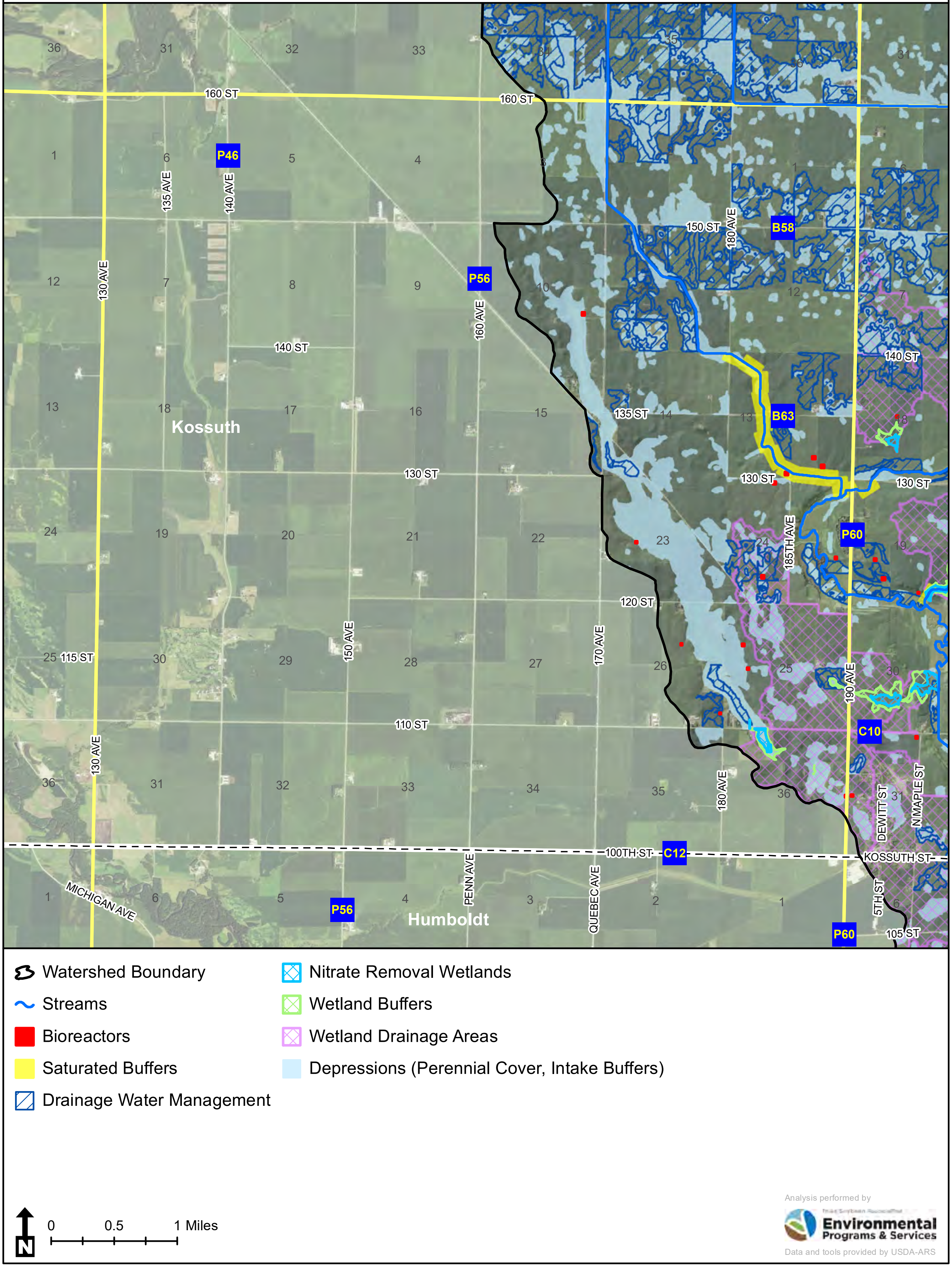
0 0.5 1 Miles

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

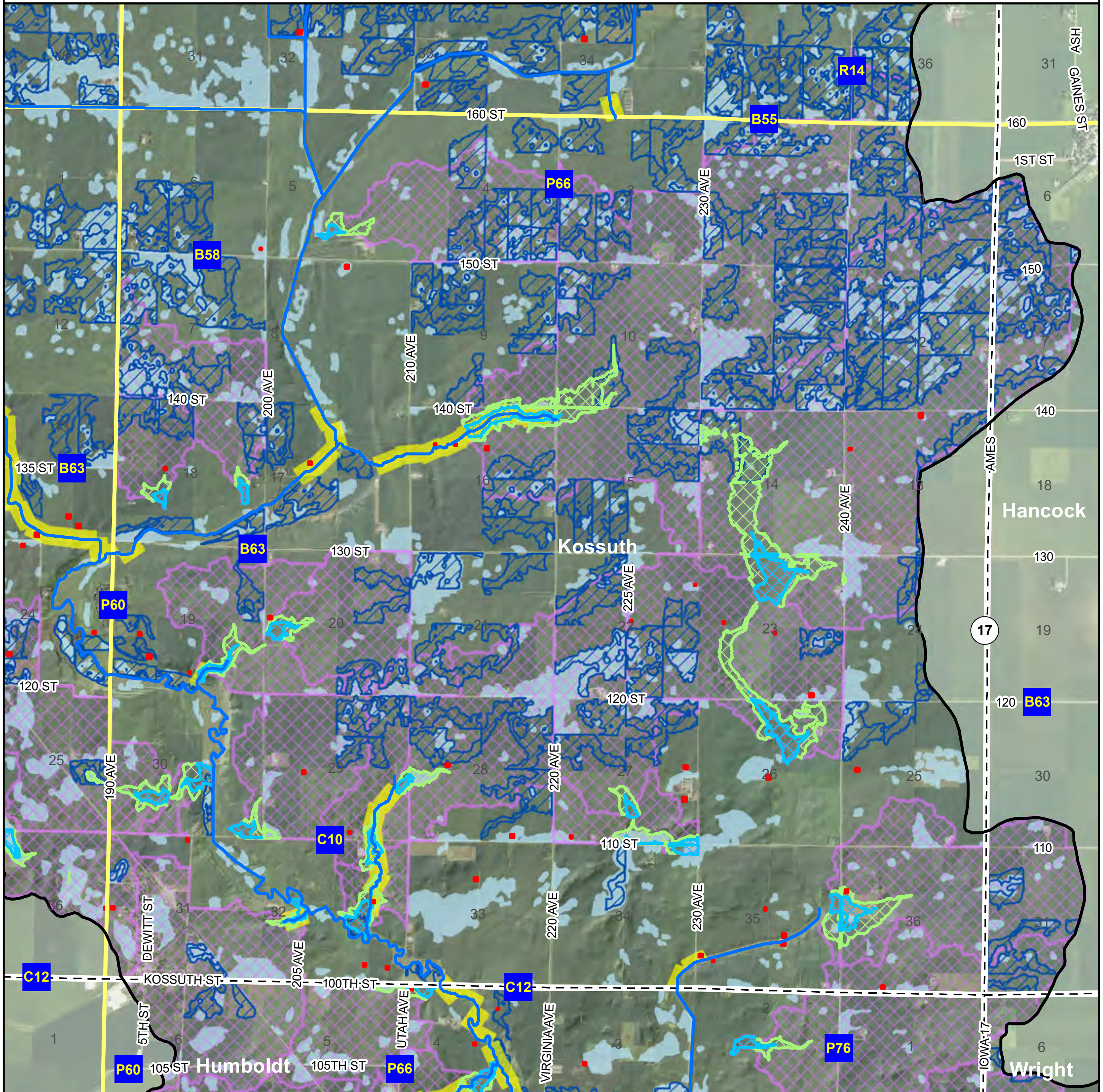
Prairie Creek Watershed (0710000501) T95N R26W
Agricultural Conservation Planning Framework Drainage Treatment Practices



Prairie Creek Watershed (0710000501) T94N R28W
Agricultural Conservation Planning Framework Drainage Treatment Practices



Prairie Creek Watershed (0710000501) T94N R27W
Agricultural Conservation Planning Framework Drainage Treatment Practices



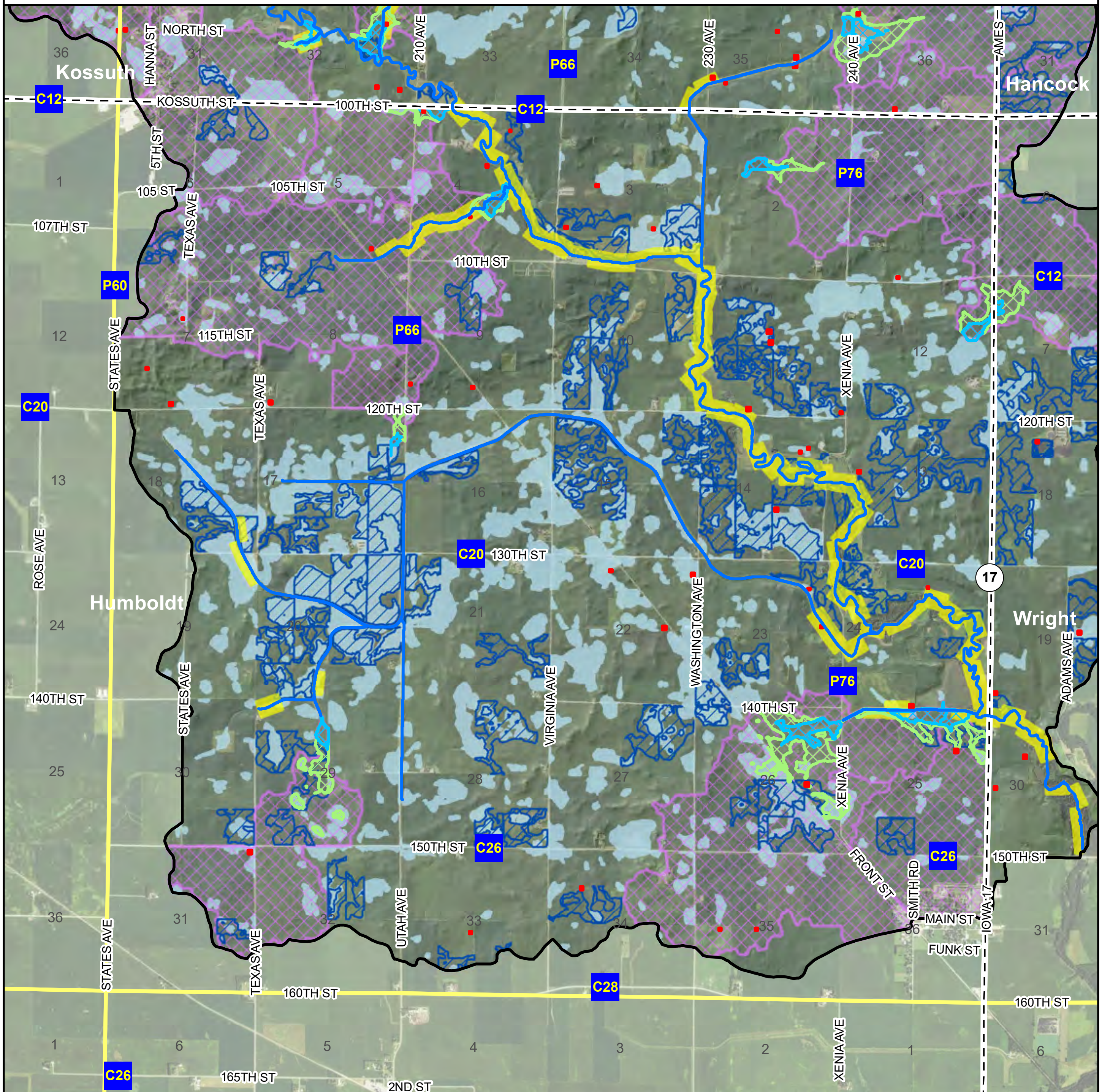
Watershed Boundary
Streams
Bioreactors
Saturated Buffers
Drainage Water Management
Nitrate Removal Wetlands
Wetland Buffers
Wetland Drainage Areas
Depressions (Perennial Cover, Intake Buffers)

0 0.5 1 Miles

N

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

Prairie Creek Watershed (0710000501) T93N R27W
Agricultural Conservation Planning Framework Drainage Treatment Practices



Watershed Boundary

Streams

Bioreactors

Saturated Buffers

Drainage Water Management

Nitrate Removal Wetlands

Wetland Buffers

Wetland Drainage Areas

Depressions (Perennial Cover, Intake Buffers)

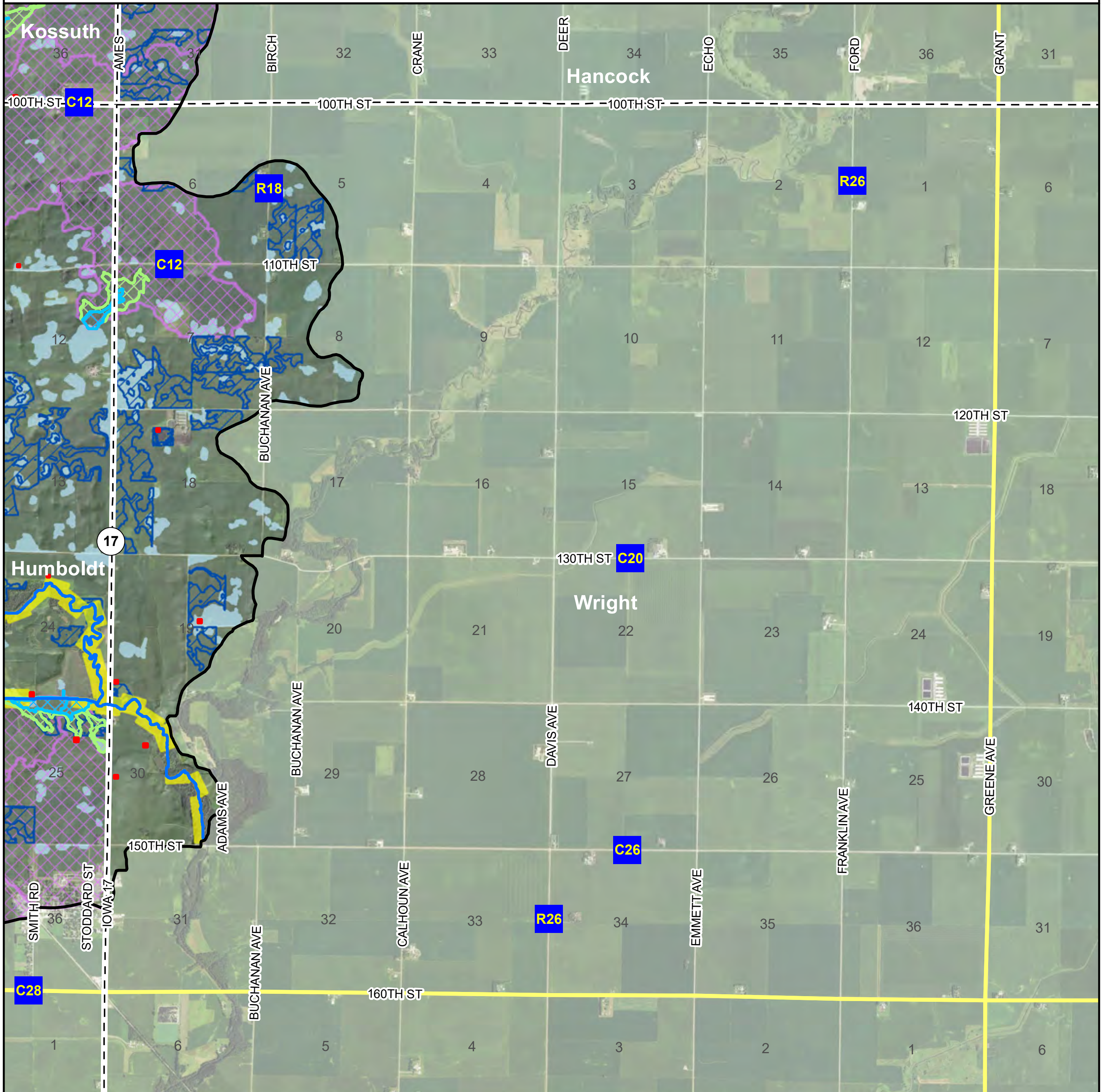
0 0.5 1 Miles

N

Analysis performed by Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501) T93N R26W
Agricultural Conservation Planning Framework Drainage Treatment Practices



Watershed Boundary

Streams

Bioreactors

Saturated Buffers

Drainage Water Management

Nitrate Removal Wetlands

Wetland Buffers

Wetland Drainage Areas

Depressions (Perennial Cover, Intake Buffers)

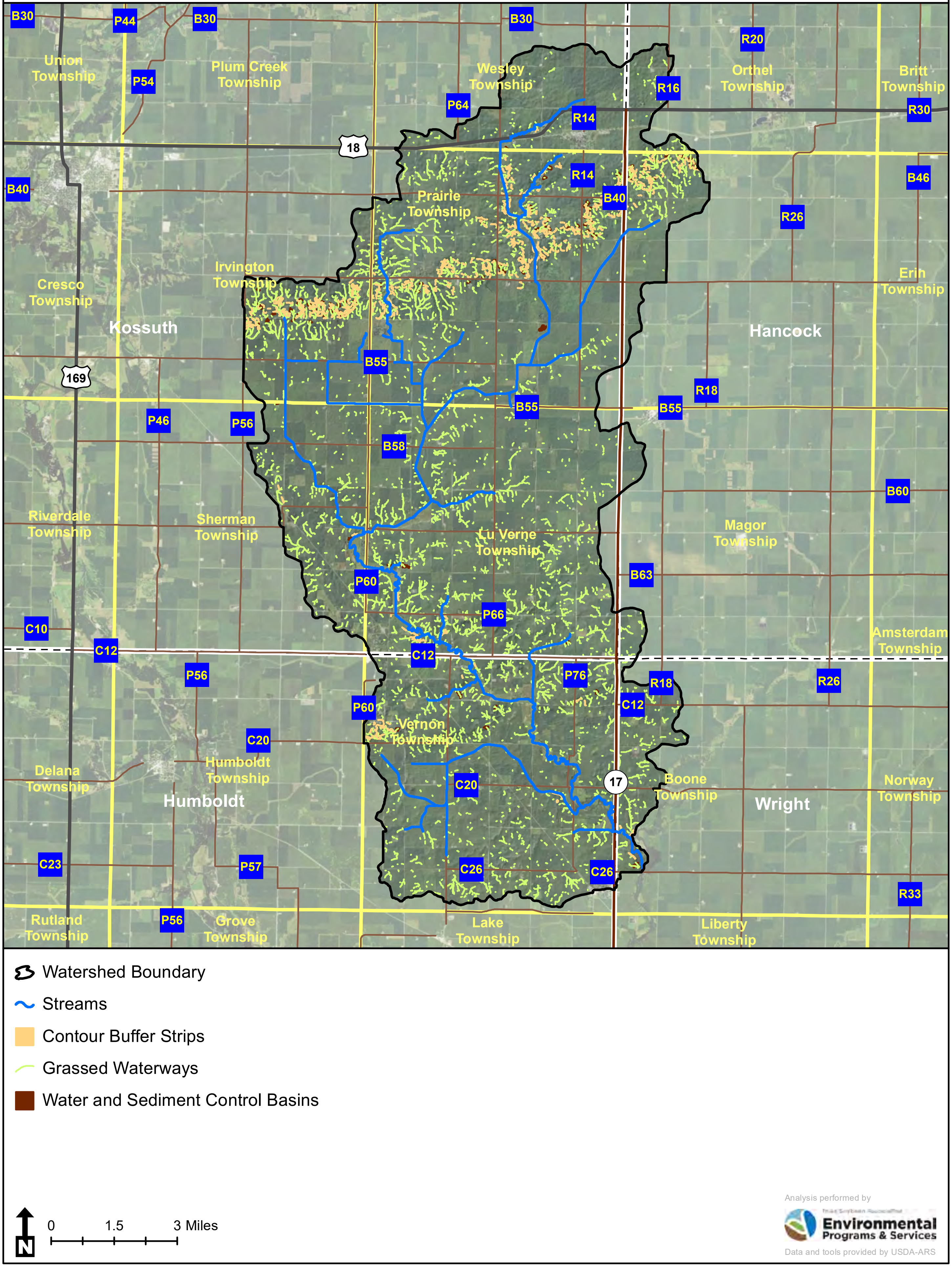
N

0 0.5 1 Miles

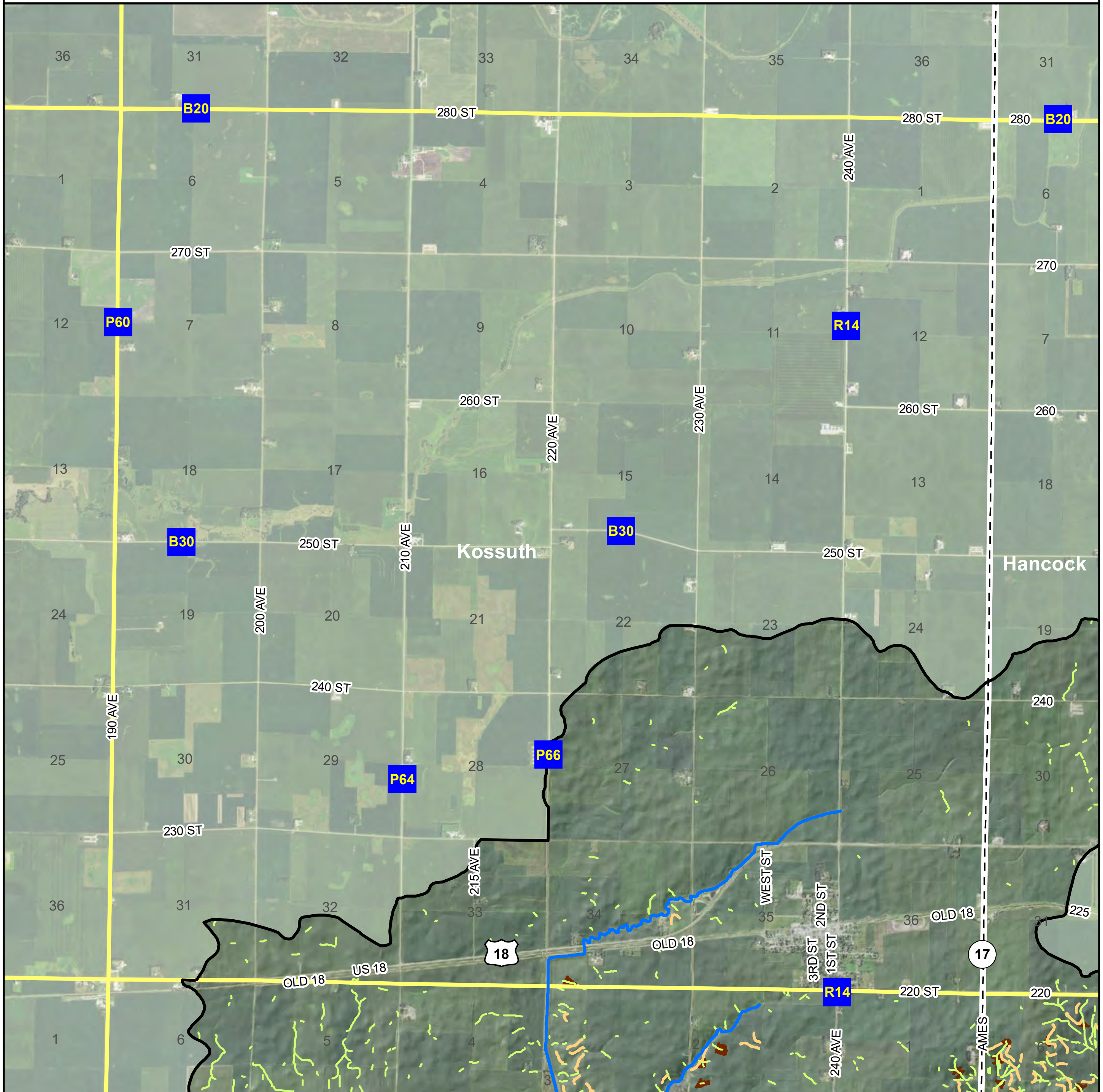
Analysis performed by Iowa Soybean Association Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501)
Agricultural Conservation Planning Framework Runoff Control Practices



Prairie Creek Watershed (0710000501) T96N R27W
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

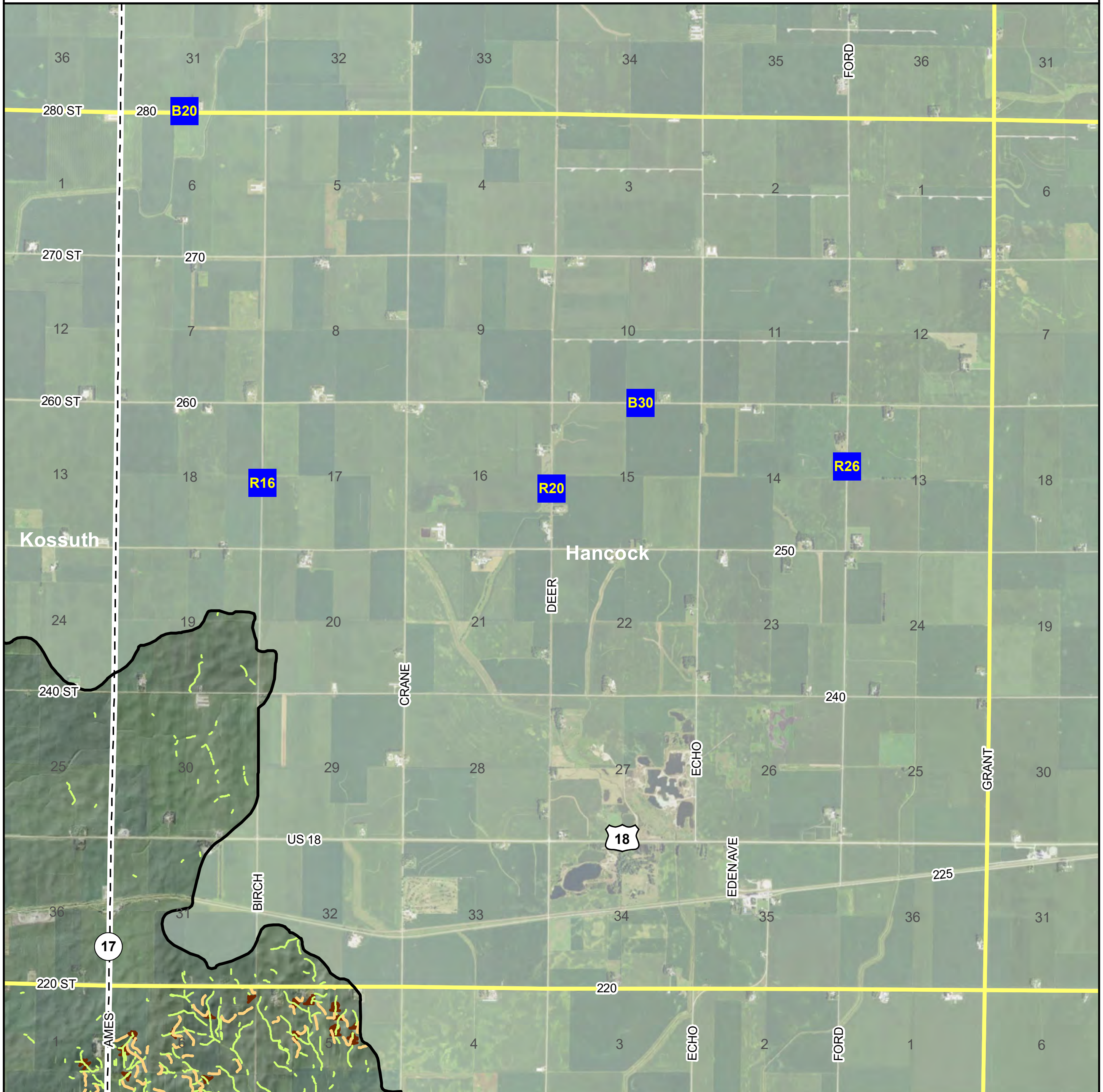
N

Analysis performed by

Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501) T96N R26W
Agricultural Conservation Planning Framework Runoff Control Practices



Watershed Boundary

Streams

Contour Buffer Strips

Grassed Waterways

Water and Sediment Control Basins

N

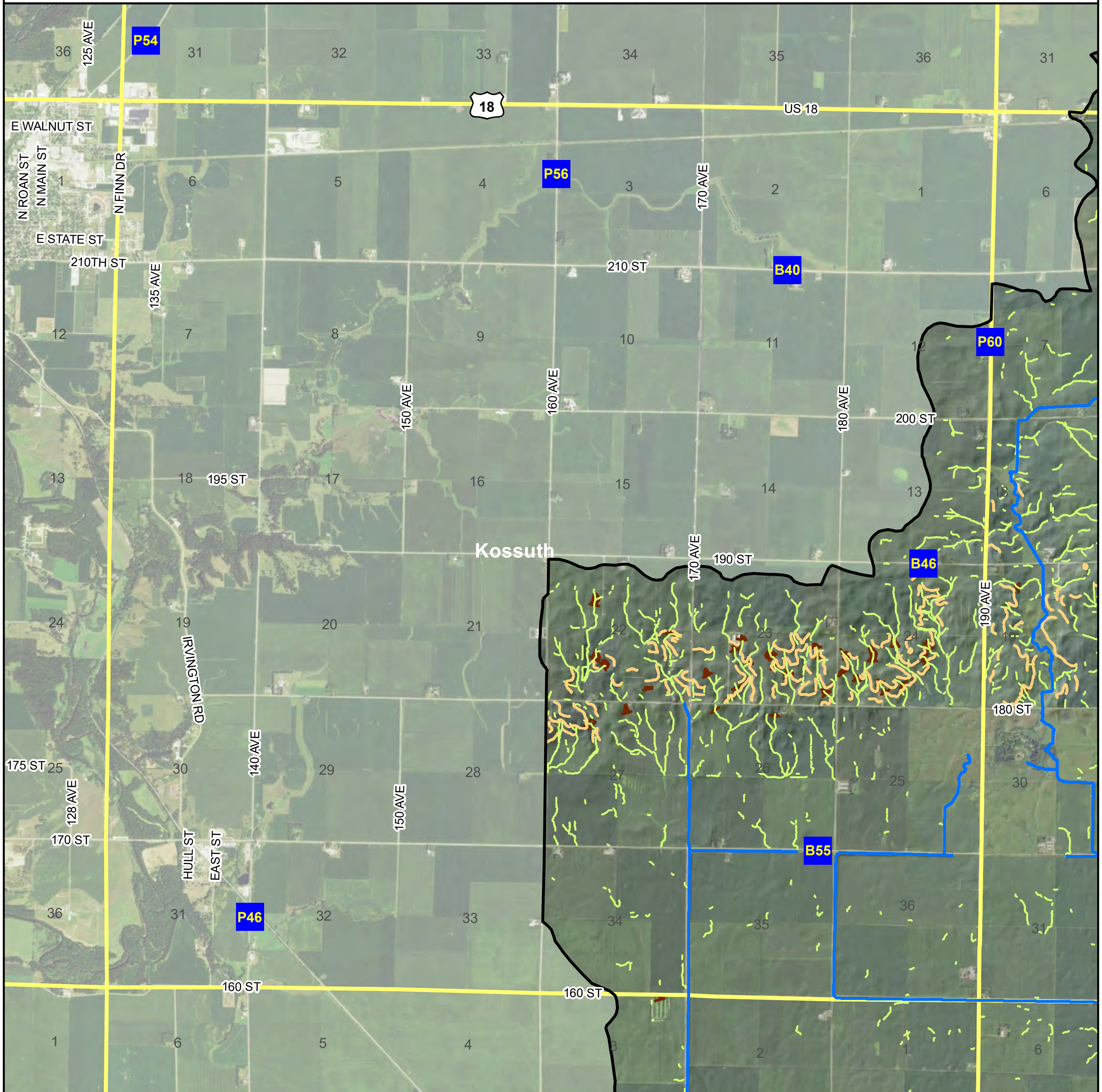
0 0.5 1 Miles

Analysis performed by

Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501) T95N R28W
Agricultural Conservation Planning Framework Runoff Control Practices



Watershed Boundary

Streams

Contour Buffer Strips

Grassed Waterways

Water and Sediment Control Basins

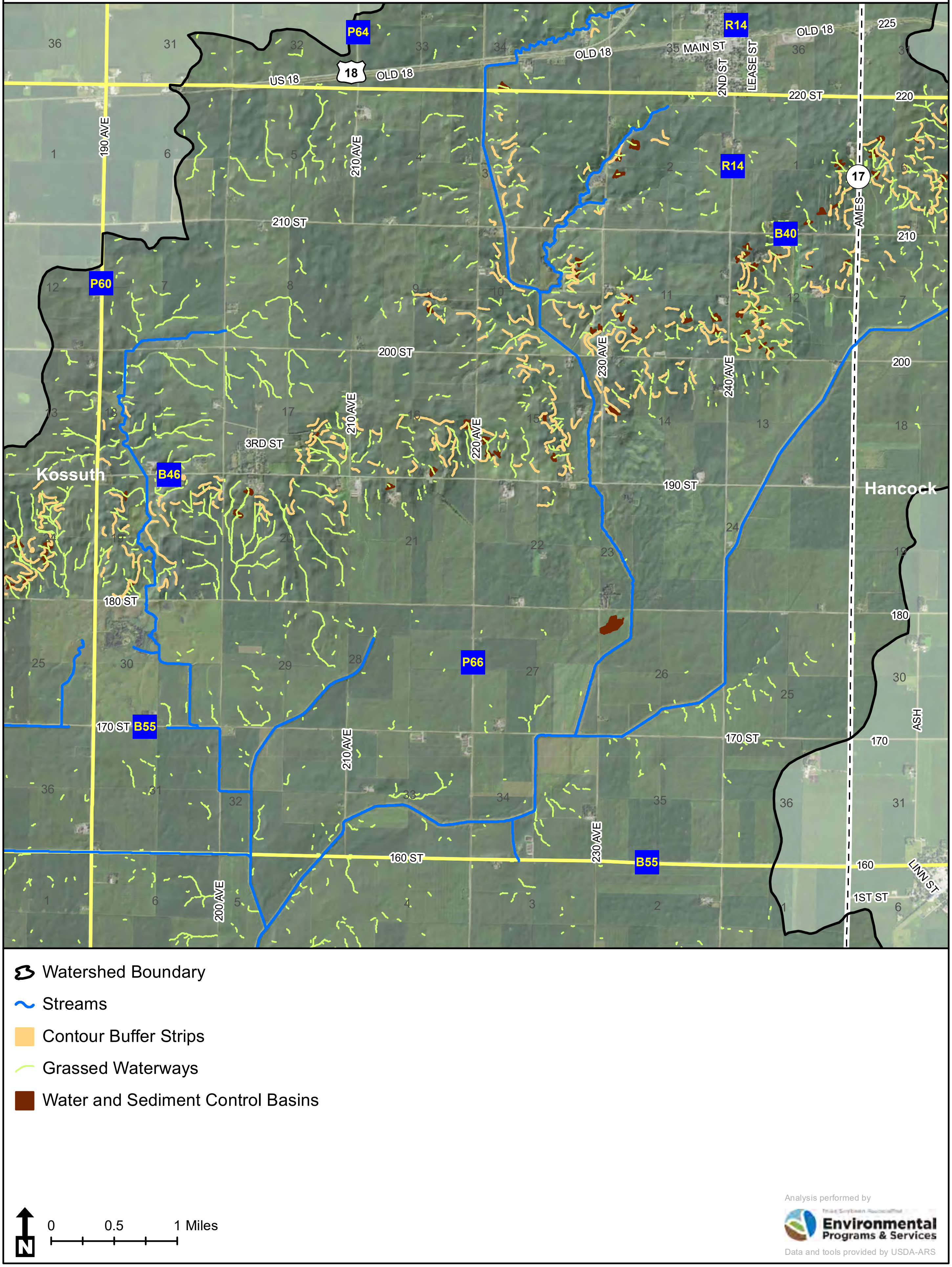
N

0 0.5 1 Miles

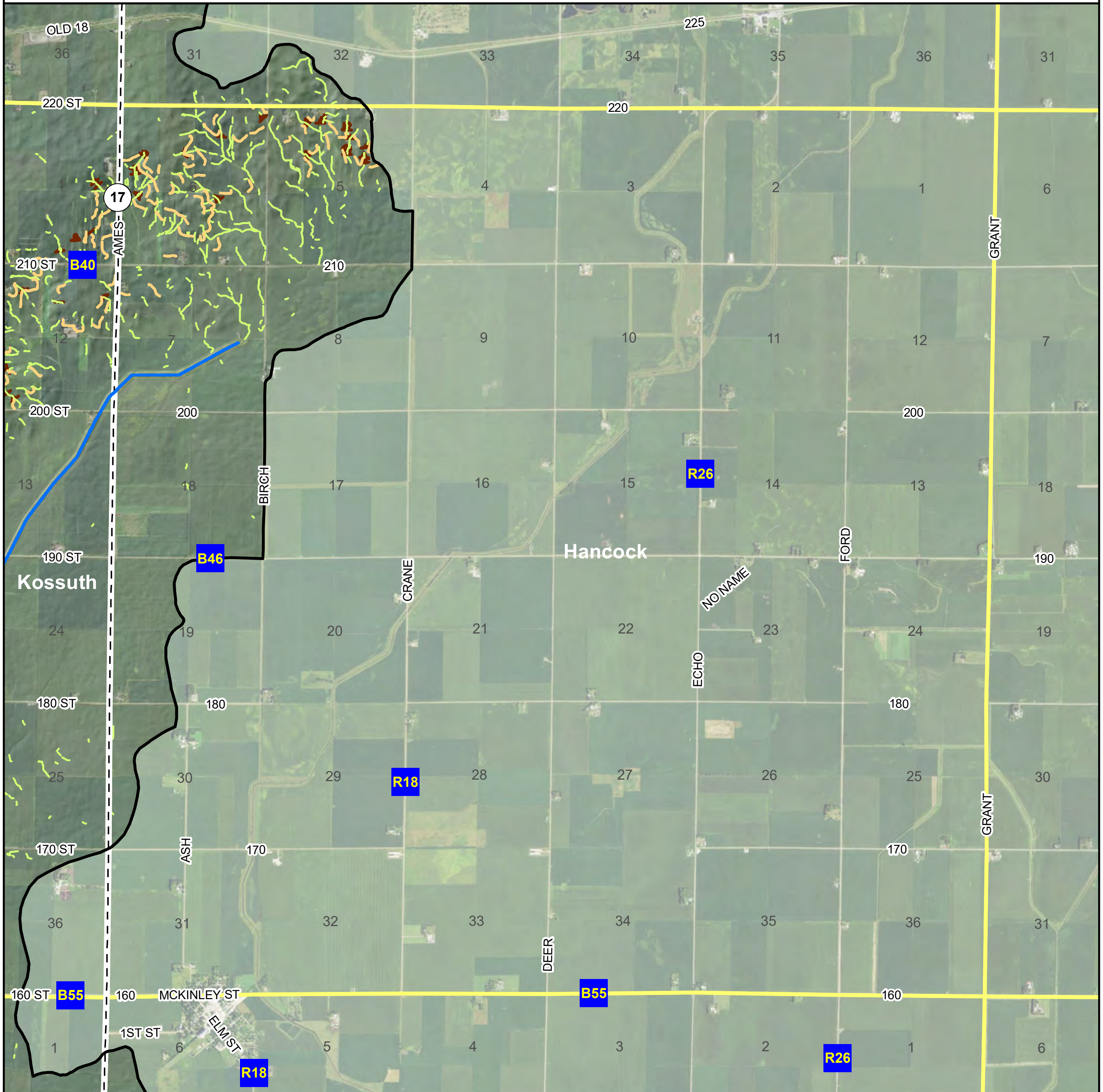
Analysis performed by Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501) T95N R27W
Agricultural Conservation Planning Framework Runoff Control Practices



Prairie Creek Watershed (0710000501) T95N R26W
Agricultural Conservation Planning Framework Runoff Control Practices

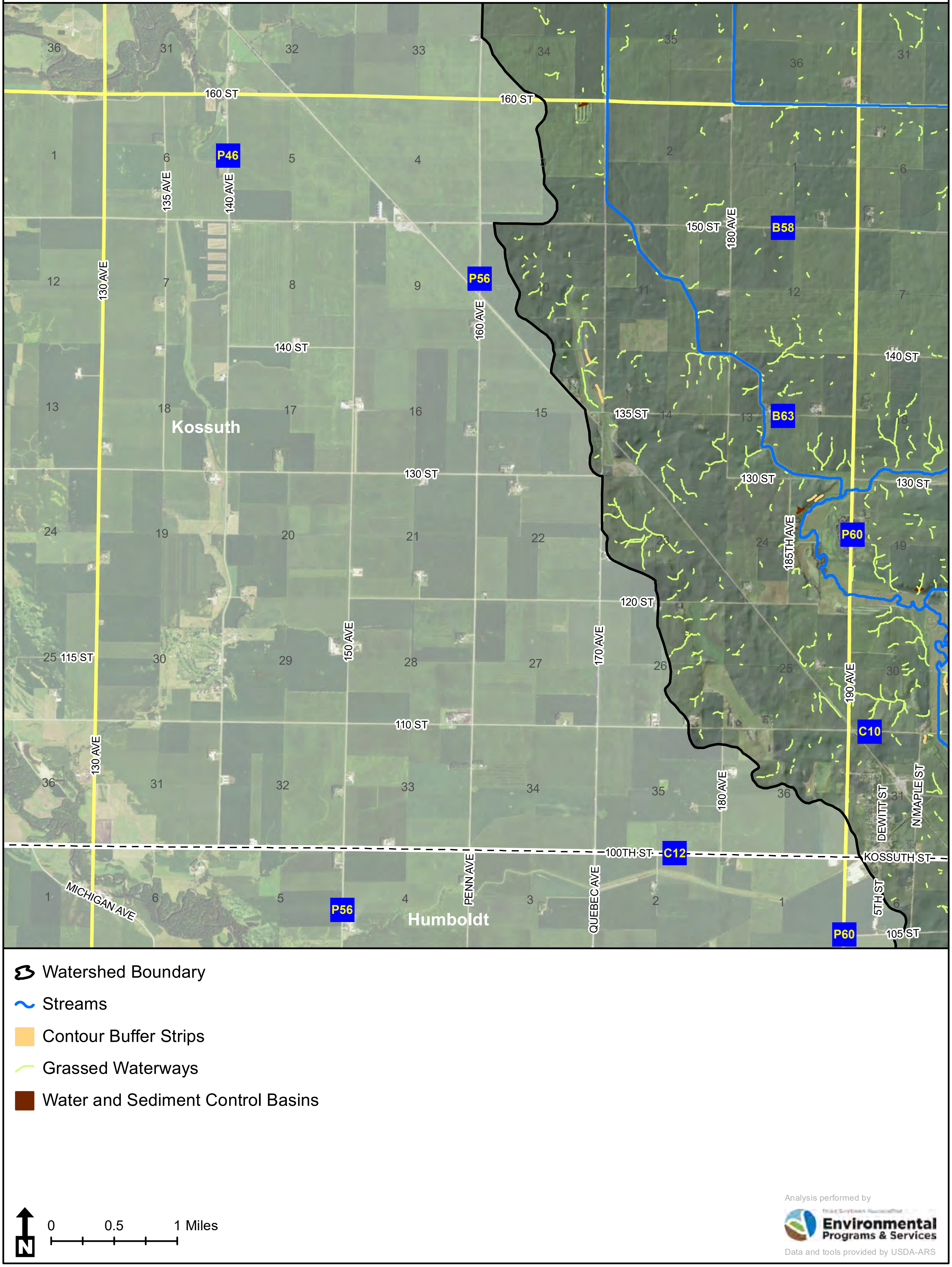


Watershed Boundary
Streams
Contour Buffer Strips
Grassed Waterways
Water and Sediment Control Basins

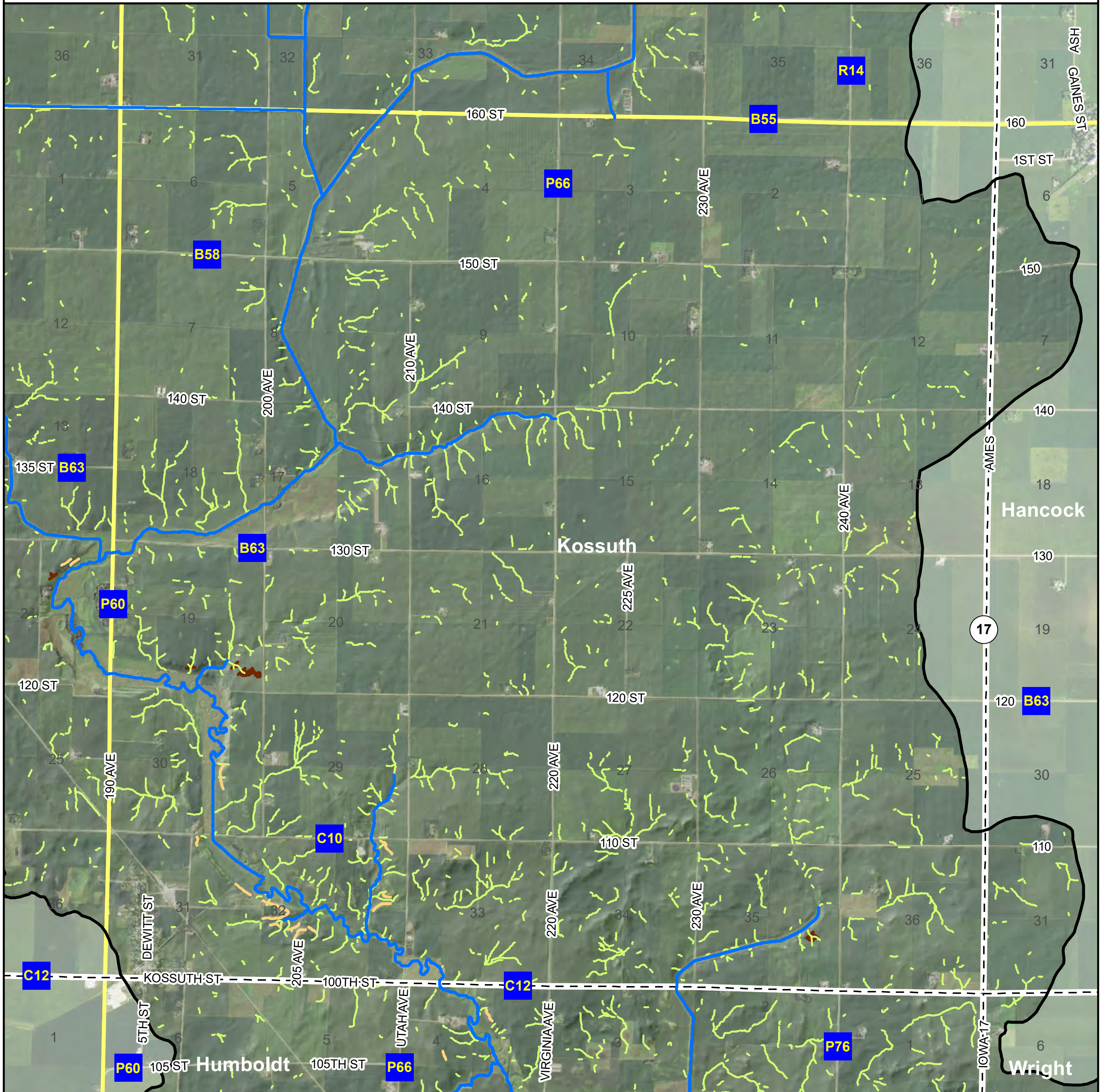
0 0.5 1 Miles

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

Prairie Creek Watershed (0710000501) T94N R28W
Agricultural Conservation Planning Framework Runoff Control Practices



Prairie Creek Watershed (0710000501) T94N R27W
Agricultural Conservation Planning Framework Runoff Control Practices



Watershed Boundary

Streams

Contour Buffer Strips

Grassed Waterways

Water and Sediment Control Basins

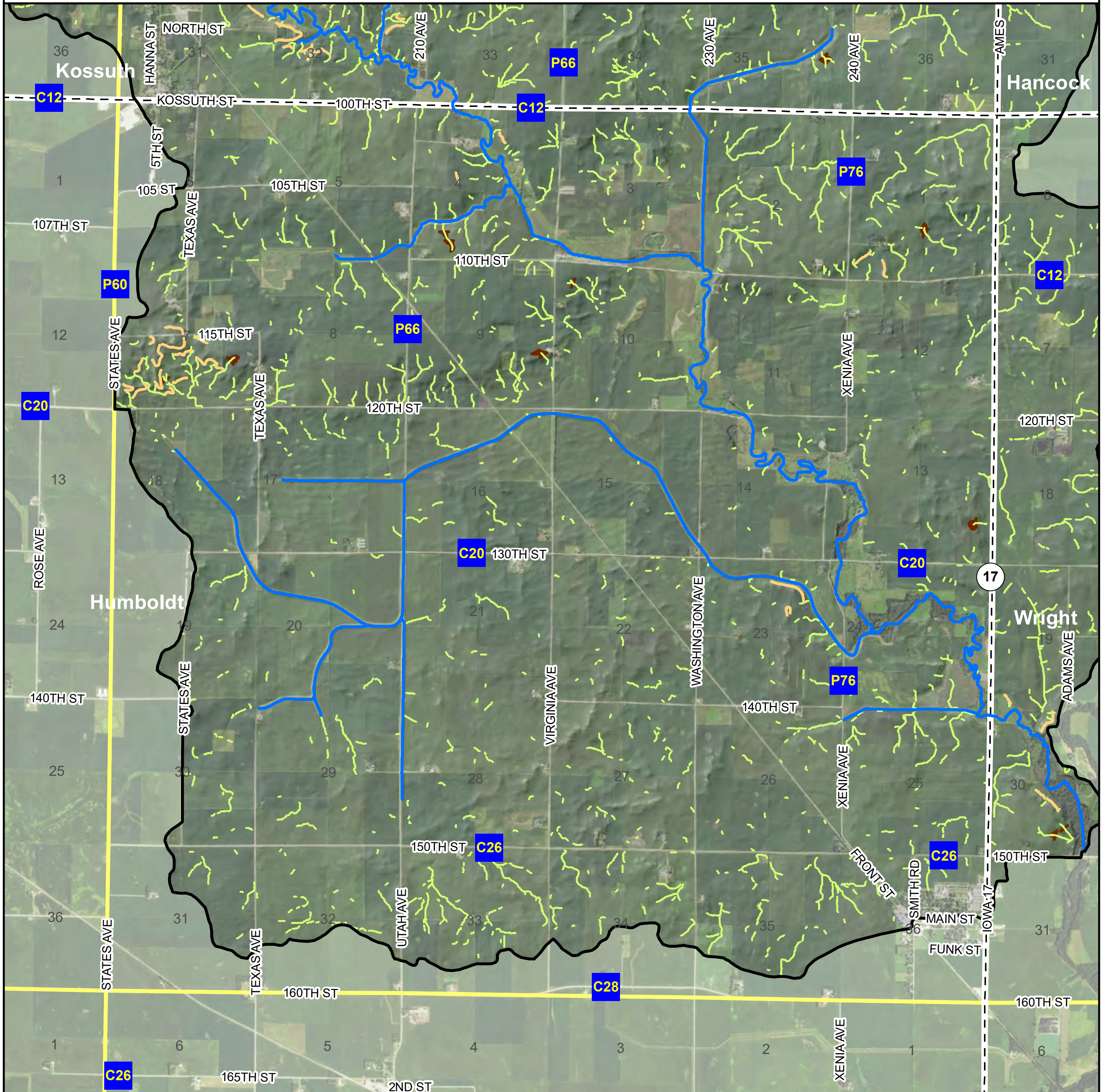
0 0.5 1 Miles

N

Analysis performed by Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501) T93N R27W
Agricultural Conservation Planning Framework Runoff Control Practices



Watershed Boundary

Streams

Contour Buffer Strips

Grassed Waterways

Water and Sediment Control Basins

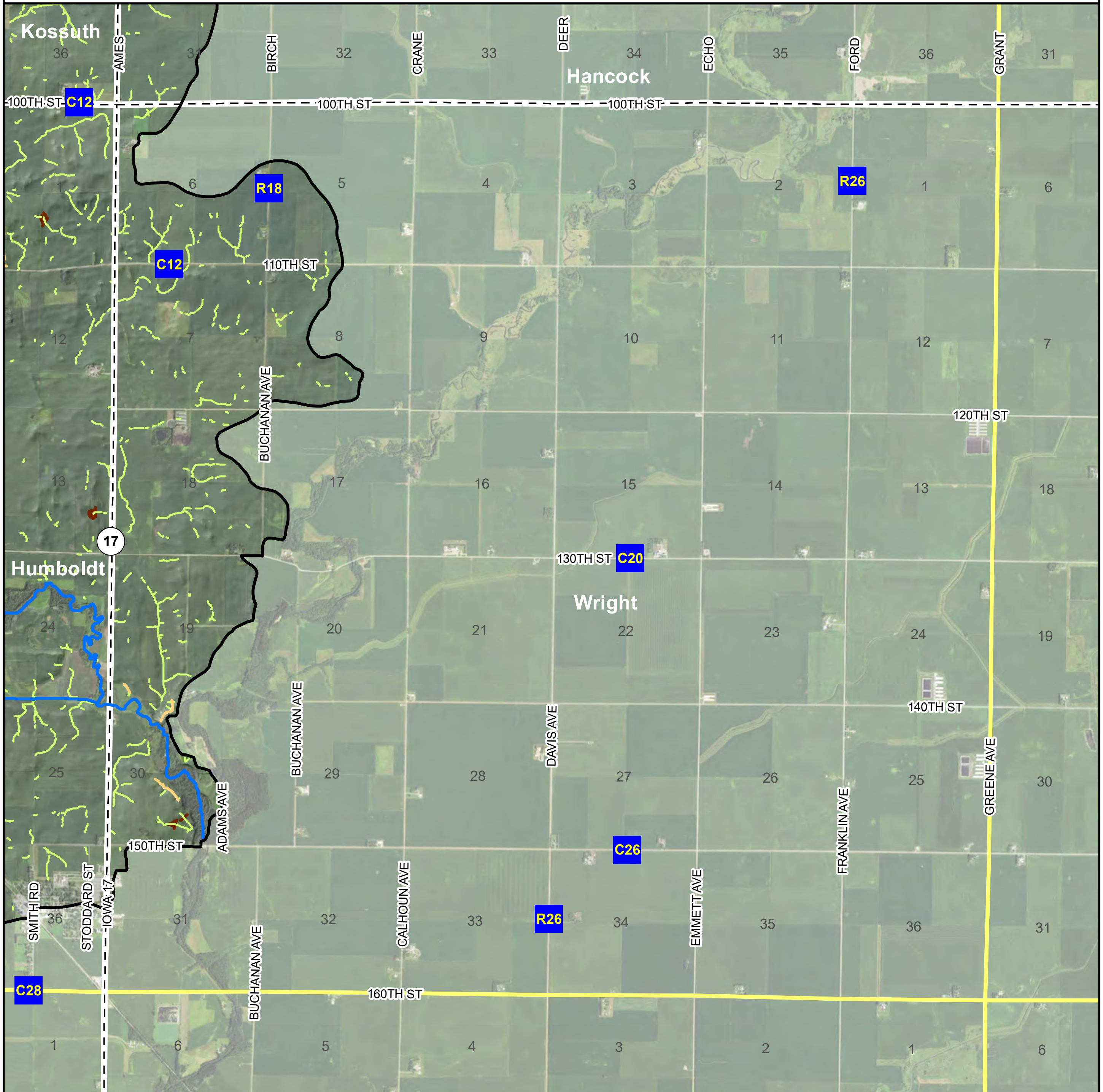
0 0.5 1 Miles

N

Analysis performed by Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501) T93N 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

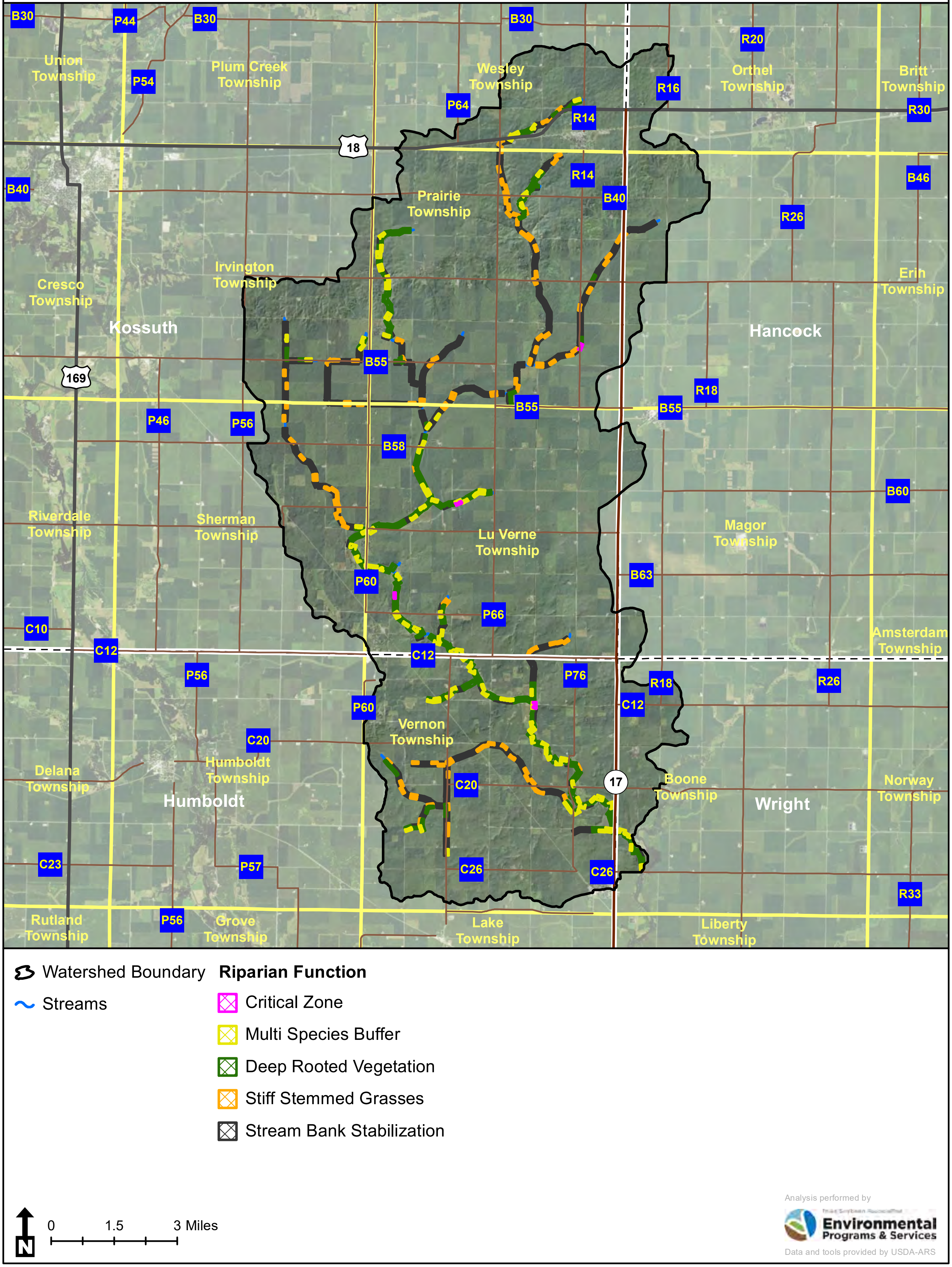
N

Analysis performed by

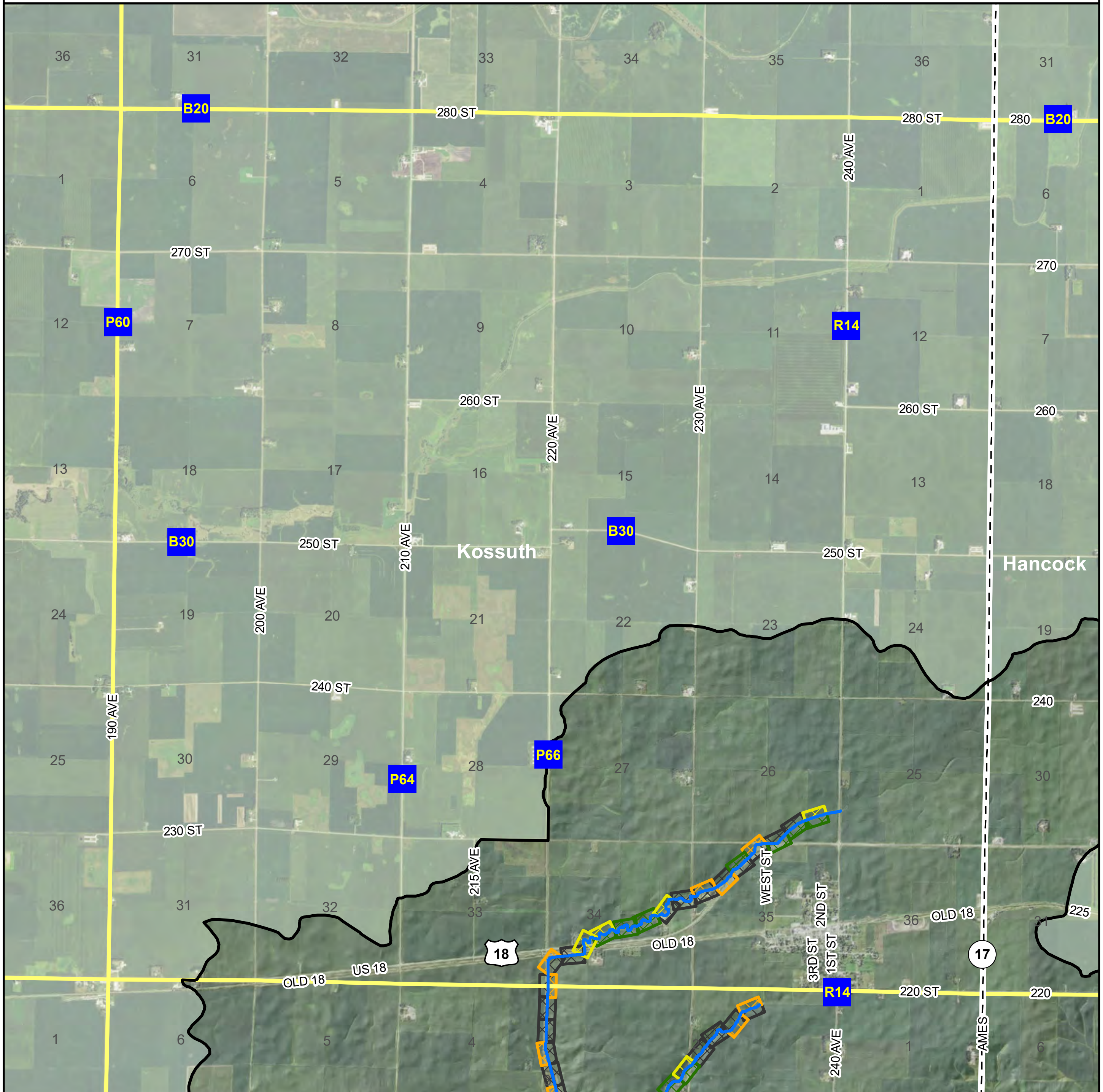
Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501)
Agricultural Conservation Planning Framework Riparian Management Practices



Prairie Creek Watershed (0710000501) T96N R27W
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

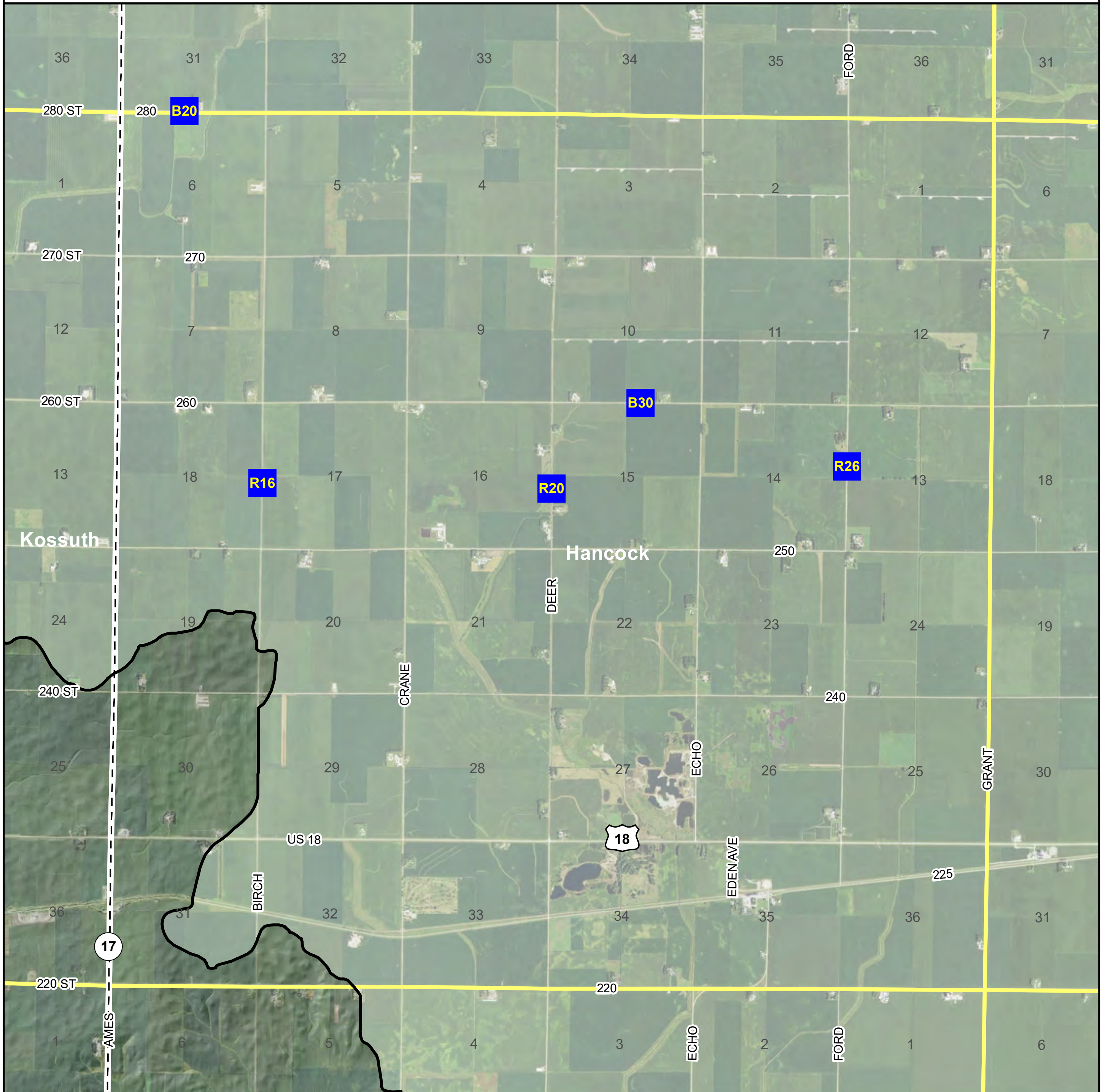
0 0.5 1 Miles

N

Analysis performed by Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501) T96N 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

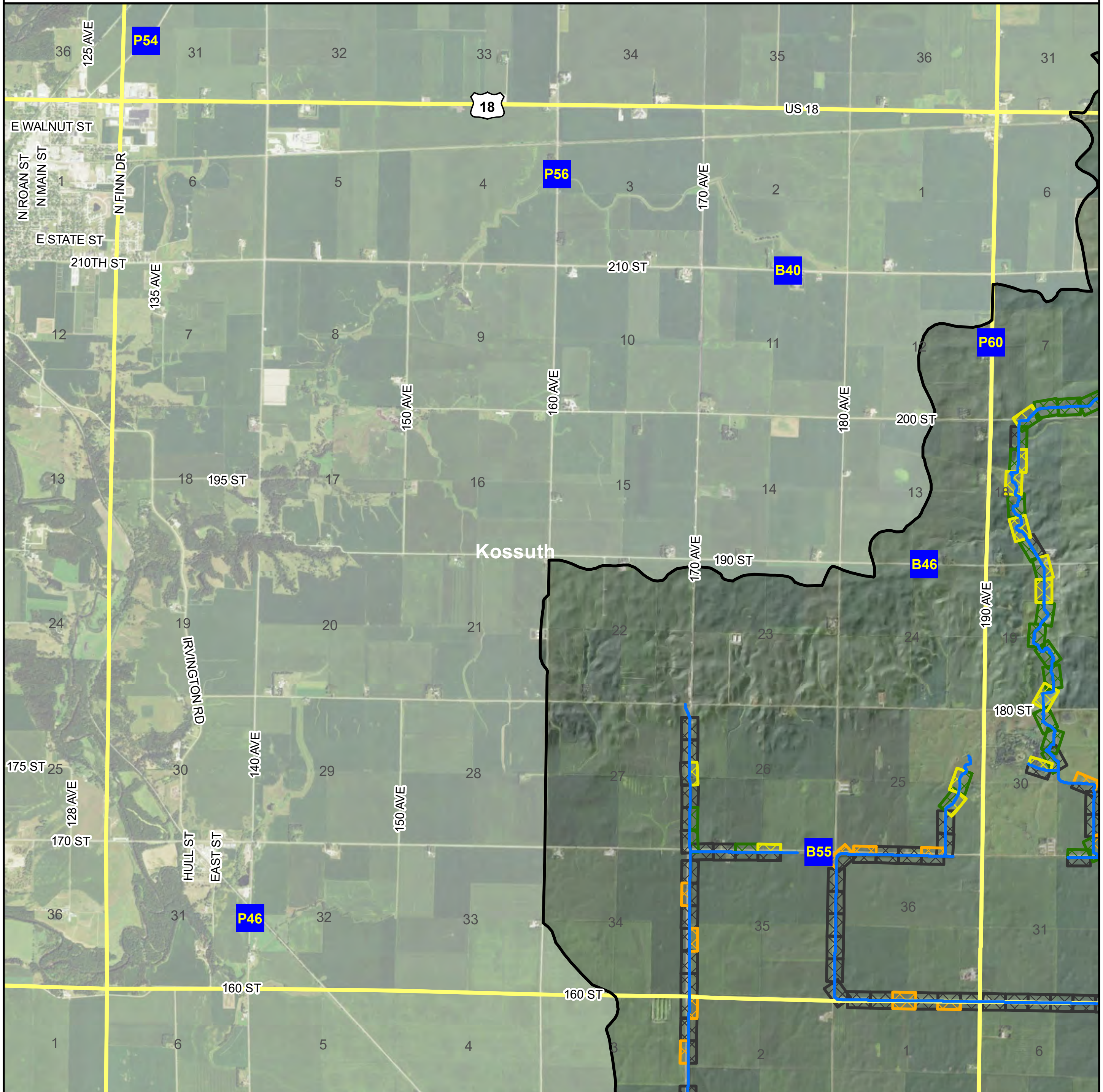
0 0.5 1 Miles

Analysis performed by

Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501) T95N R28W
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

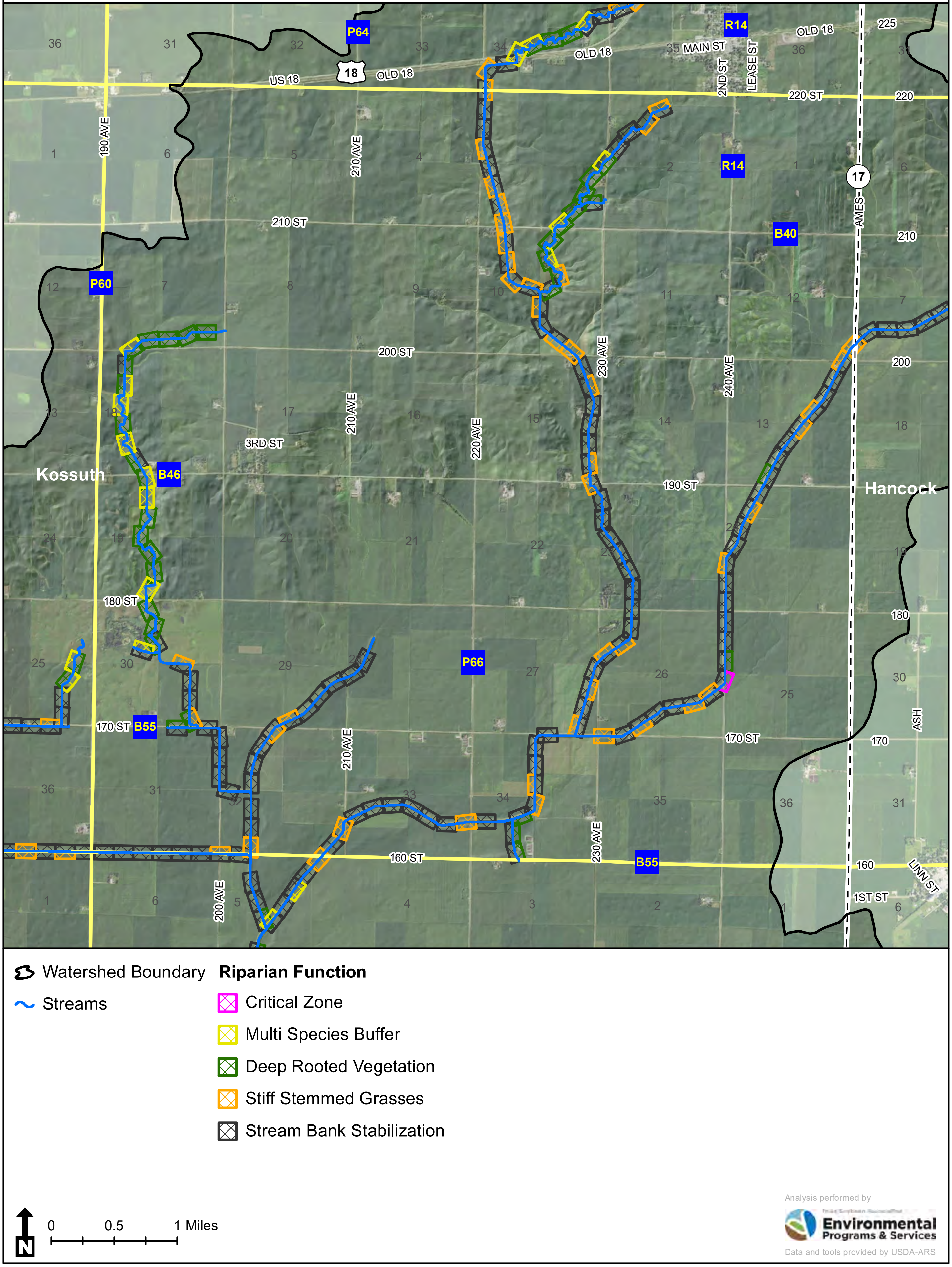
0 0.5 1 Miles

N

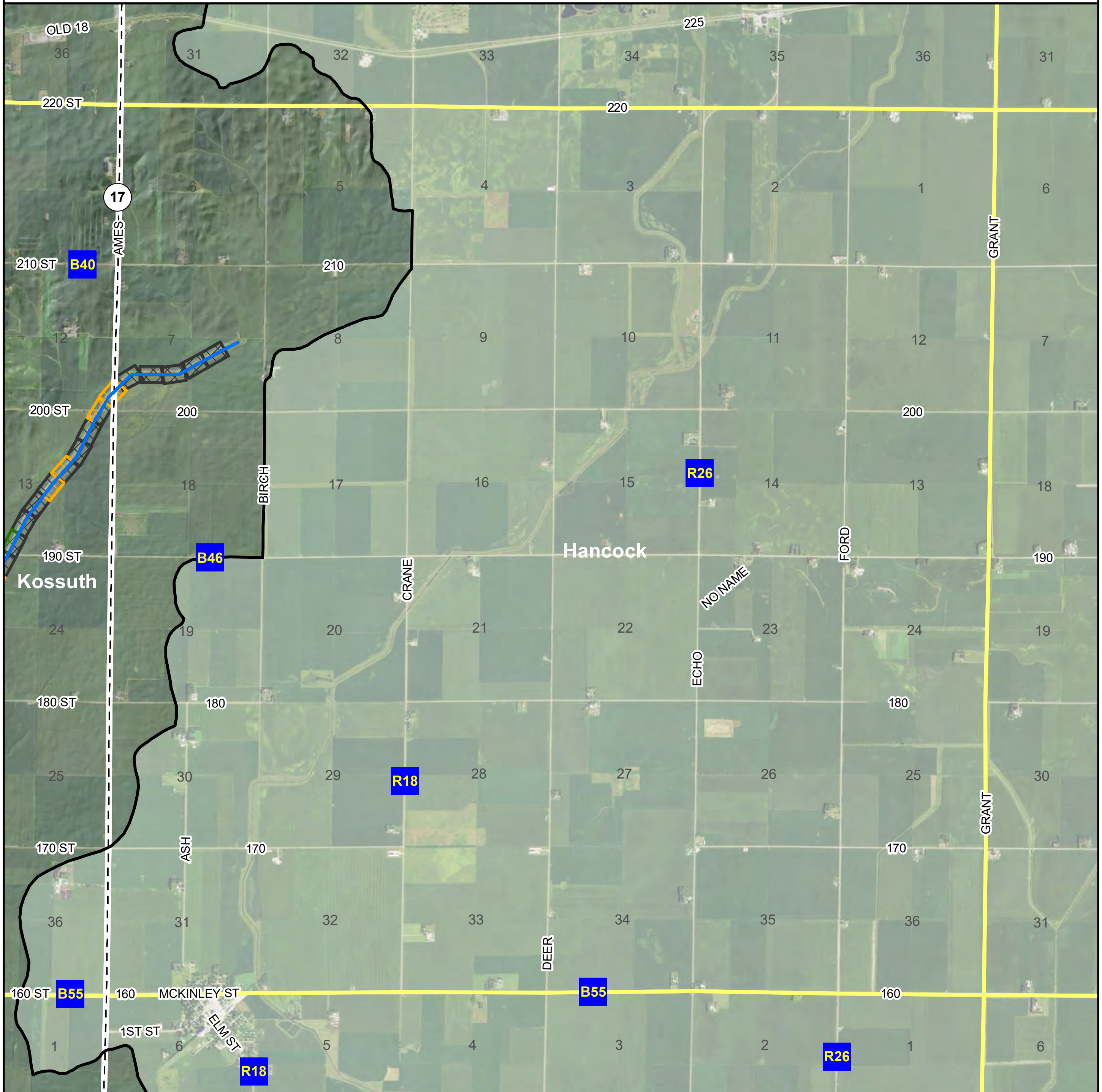
Analysis performed by Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501) T95N R27W
Agricultural Conservation Planning Framework Riparian Management Practices



Prairie Creek Watershed (0710000501) T95N 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

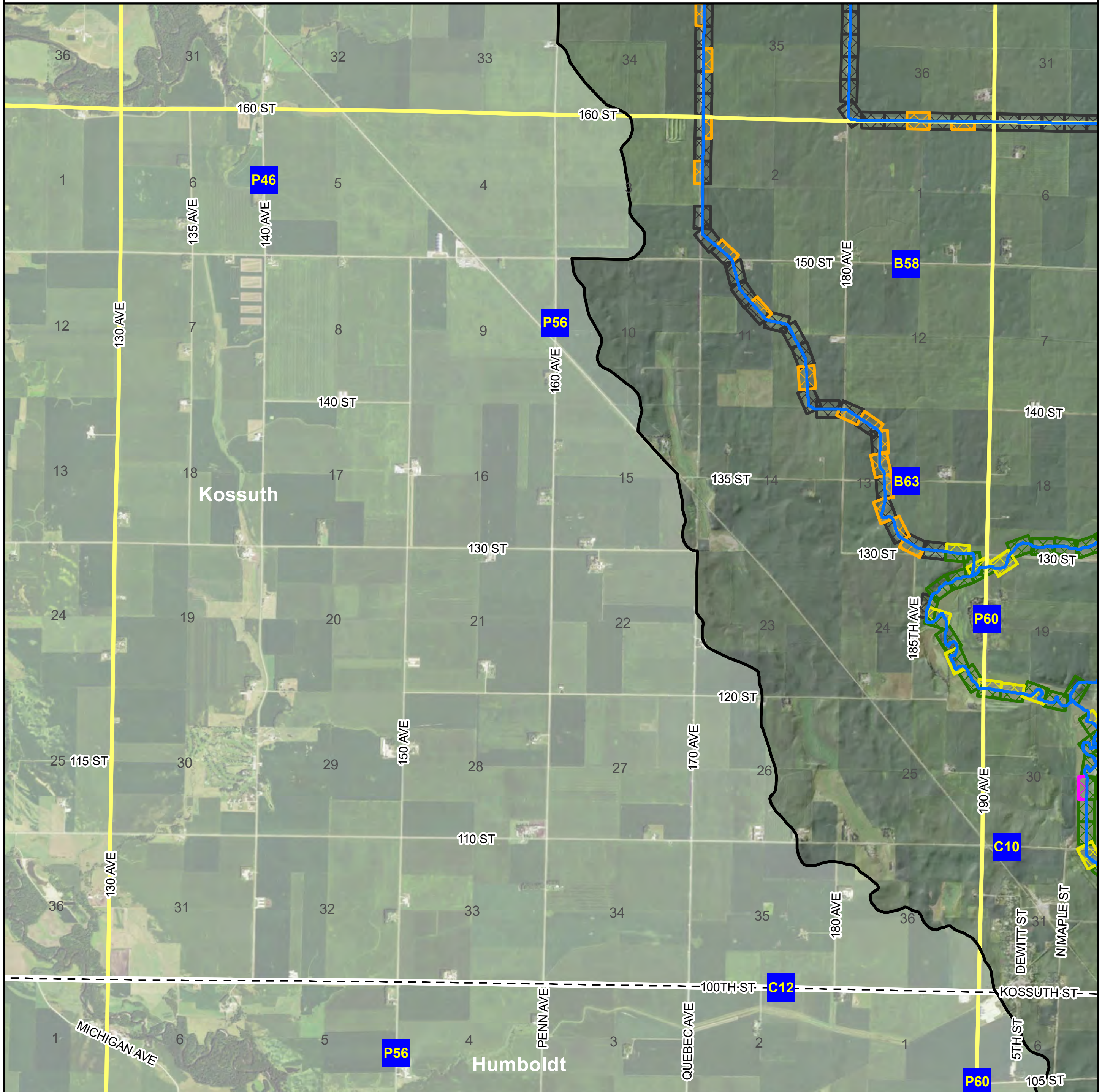
N

0 0.5 1 Miles

Analysis performed by Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501) T94N R28W
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

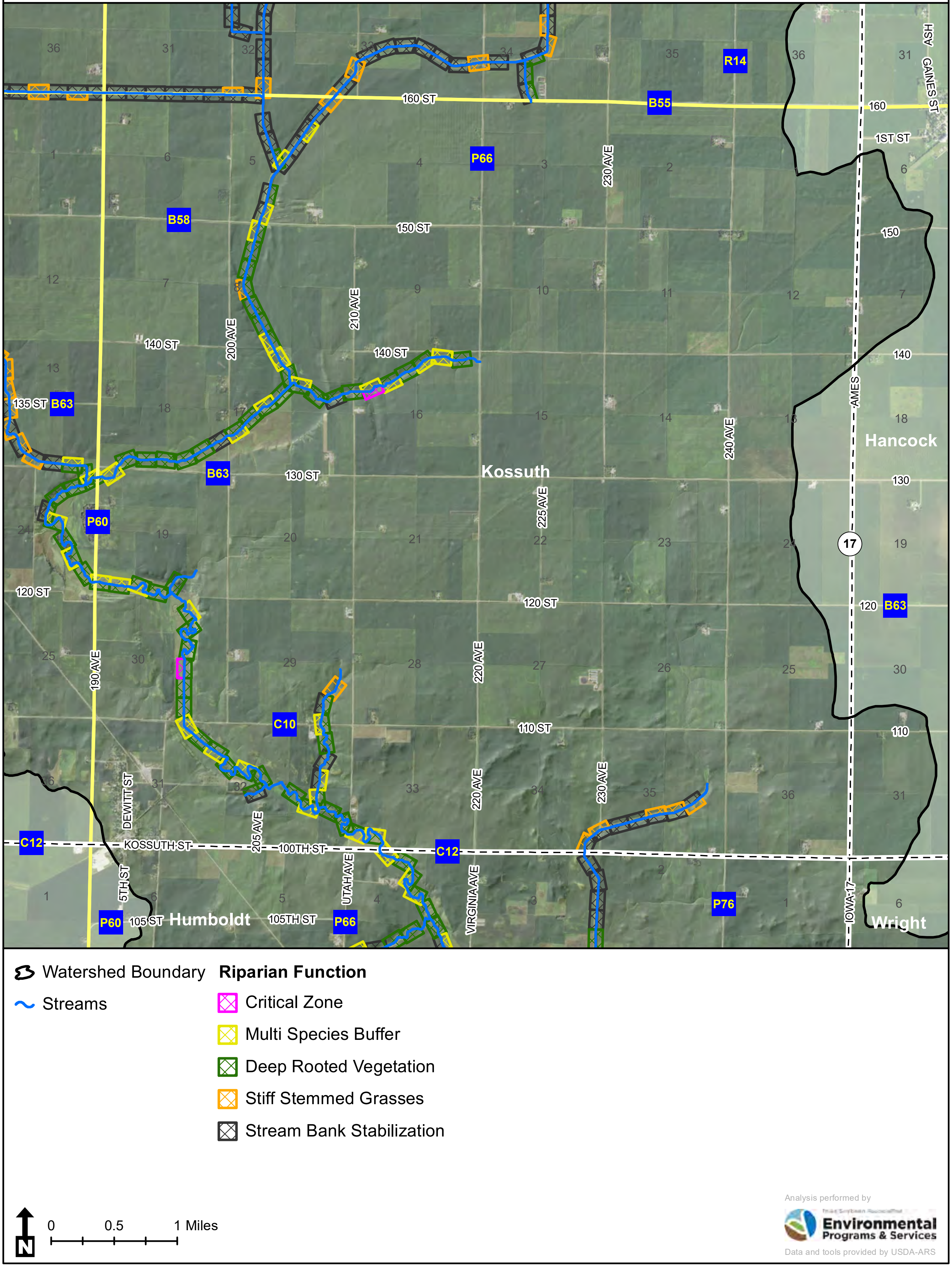
N

0 0.5 1 Miles

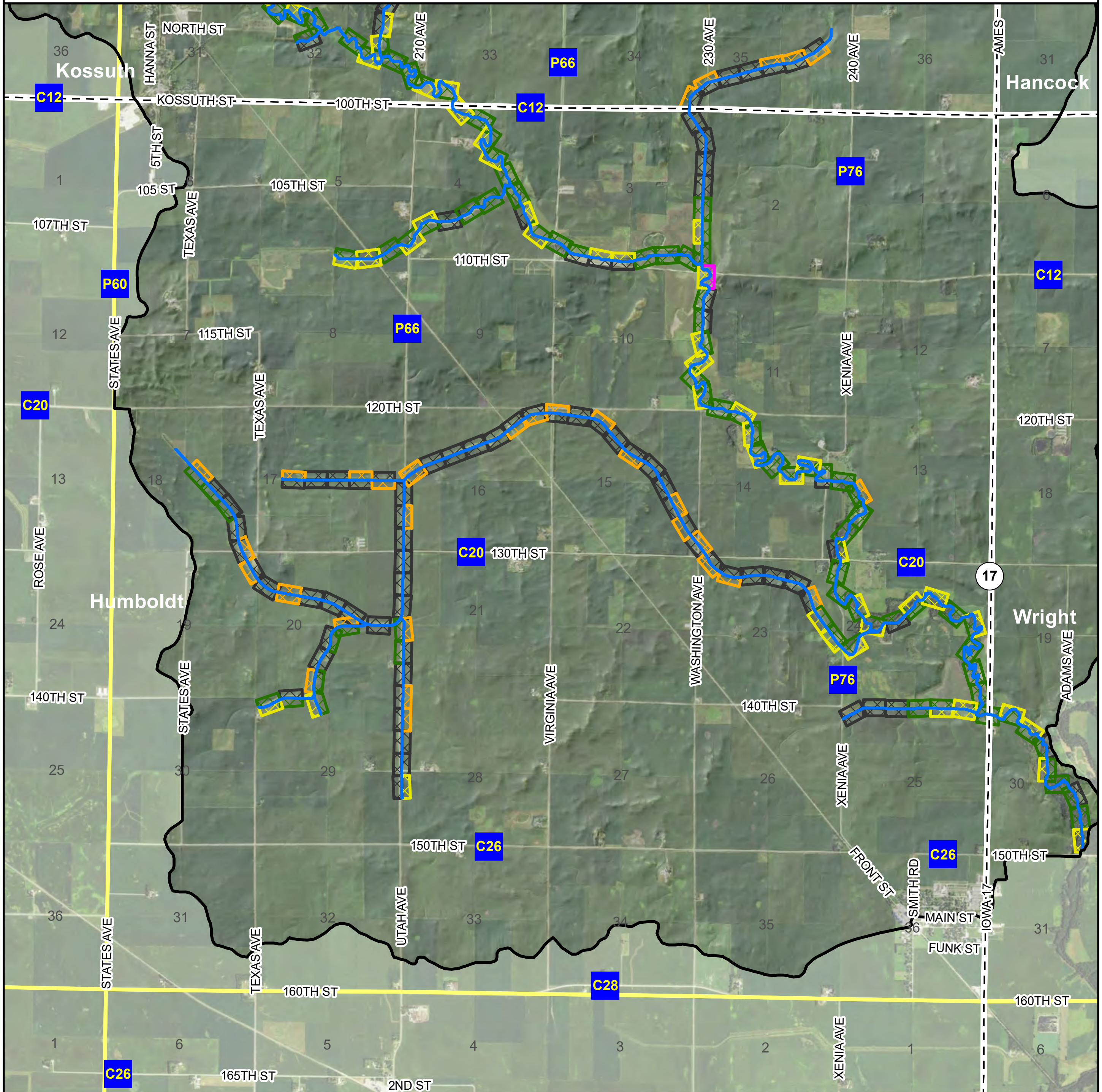
Analysis performed by Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501) T94N R27W
Agricultural Conservation Planning Framework Riparian Management Practices



Prairie Creek Watershed (0710000501) T93N R27W
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

0 0.5 1 Miles

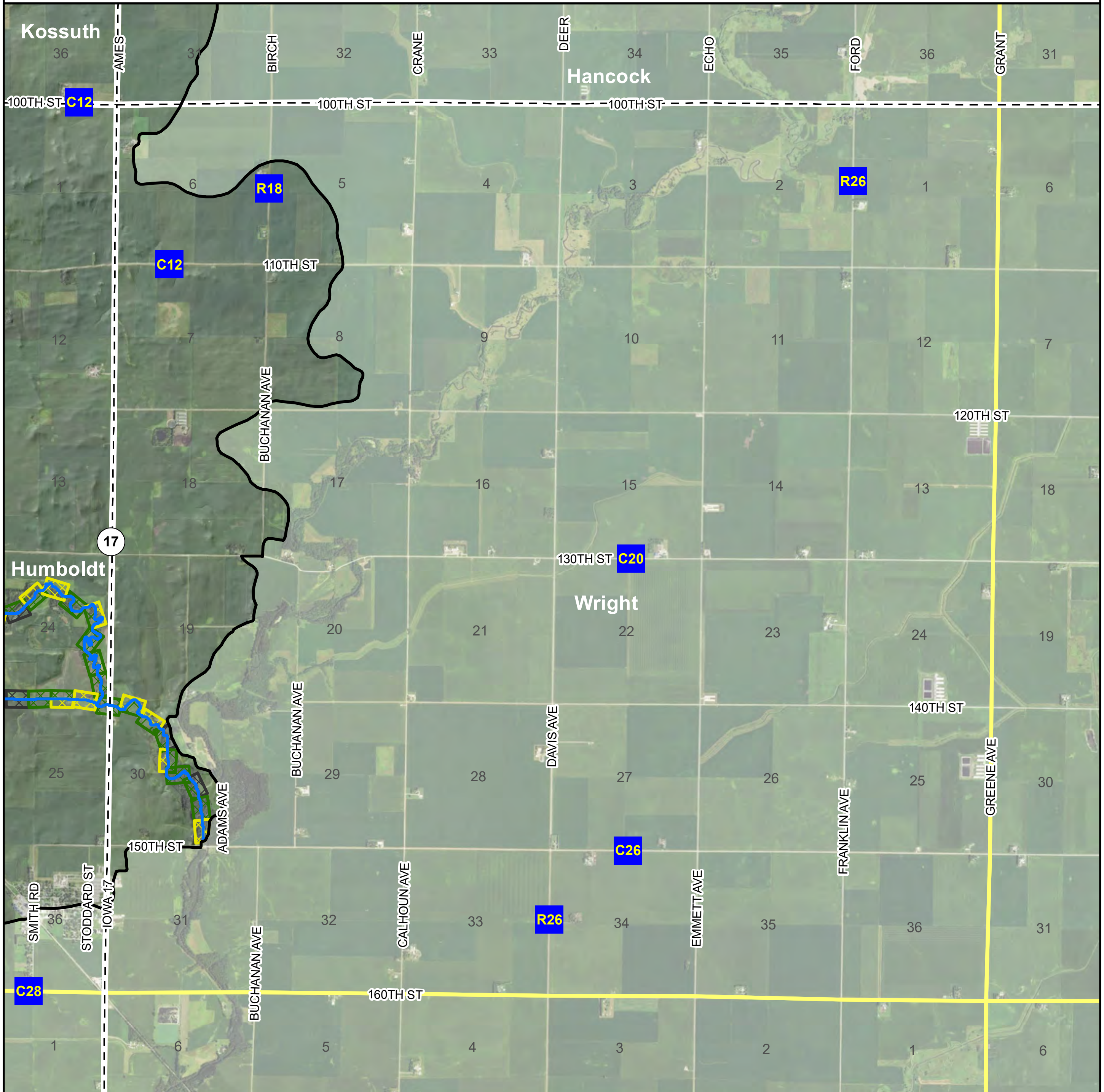
N

Analysis performed by

Environmental Programs & Services

Data and tools provided by USDA-ARS

Prairie Creek Watershed (0710000501) T93N 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

0 0.5 1 Miles

Analysis performed by Environmental Programs & Services

Data and tools provided by USDA-ARS

Appendix D: 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 E: Nitrogen Reduction Calculation Worksheet

This worksheet can be used to estimate nitrate load reduction at the watershed outlet based on the number of acres treated with best management practices (BMPs). Along with water monitoring results, this estimate can give an indication of water quality trends.

Instructions

1. Enter acres treated with or drained into BMPs into "Acres Treated" column for each BMP.
2. Multiply "Acres Treated" by "Multiplier" for each BMP and enter result into "N Load Reduction" column.
3. "Total N Load Reduction" equals the sum of the BMP rows in the "N Load Reduction" column.
4. Obtain "Baseline N Load" value from watershed plan document (Table 4.1).
5. Calculate "Percent N Reduction" as "Total N Load Reduction" divided by "Baseline N Load" multiplied by a factor of 100.

Best Management Practice	**Acres Treated**	**Multiplier**	**N Load Reduction**
Cover crops, below EOF*		7.8	
Cover crops, above EOF*		4.0	
Nutrient management**		2.5	
Perennial cover		21.3	
Drainage water management		8.3	
Bioreactors		10.8	
Saturated buffers		12.5	
Wetlands		13.0	
Oxbow restorations		11.0	
Total N Load Reduction			
Baseline N Load			
Percent N Reduction			

*The location of cover crops relative to edge-of-field (EOF) practices is important. Cover crops "below", or downstream of, EOF practices result in greater nitrate-nitrogen reduction than cover crops located "above", or upstream of, EOF practices.

**Include only acres treated with nutrient management (e.g., MRTN application rate, nitrification inhibitor) that do not also have cover crops.

Appendix F: 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 Collaboration 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 the 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 septic systems, livestock, storm water and nonpoint source pollutants. Sponsored Projects can be used to leverage wastewater infrastructure investments to create additional funding for nonpoint source/agricultural water quality improvement.	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 nine 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.	http://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.	http://www.nfwf.org
National Wildlife Foundation	Works to protect and restore resources and the beneficial functions they offer.	http://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.	http://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.	http://www.waltonfamilyfoundation.org/environment

Appendix G: The Nitrogen Cycle

The nitrogen cycle is the set of processes that convert nitrogen between its various forms in the environment. These transformations are shown by the orange (inputs), green (outputs to plants and air) and blue (outputs to water) arrows in Figure G.1. These processes are explained in greater detail in the **Ten Ways to Reduce Nitrogen Loads from Drained Cropland in the Midwest** publication from University of Illinois Extension. Through fixation, atmospheric nitrogen gas is converted to plant usable forms (ammonium and nitrate) by atmospheric, biological or industrial processes. Mineralization converts organic forms of nitrogen (from soil organic matter and manure) into ammonium, and nitrifying bacteria convert ammonium into nitrate through the process of nitrification. Nitrate is the primary form of nitrogen that is lost through subsurface drainage tile in agricultural systems because it is easily dissolved and highly mobile. These losses are typically measured as nitrate as nitrogen (nitrate-nitrogen), which is commonly referred to as nitrate. Nitrate can also be expressed as the concentration of the entire nitrate molecule (rather than only the nitrogen component of nitrate). When evaluating nitrate levels, it is important to clarify the form (i.e., nitrate-nitrogen or nitrate) under consideration. Nitrate is also removed from agricultural soils through plant uptake and denitrification, and practices that encourage these processes will reduce the amount of nitrate lost through drainage.

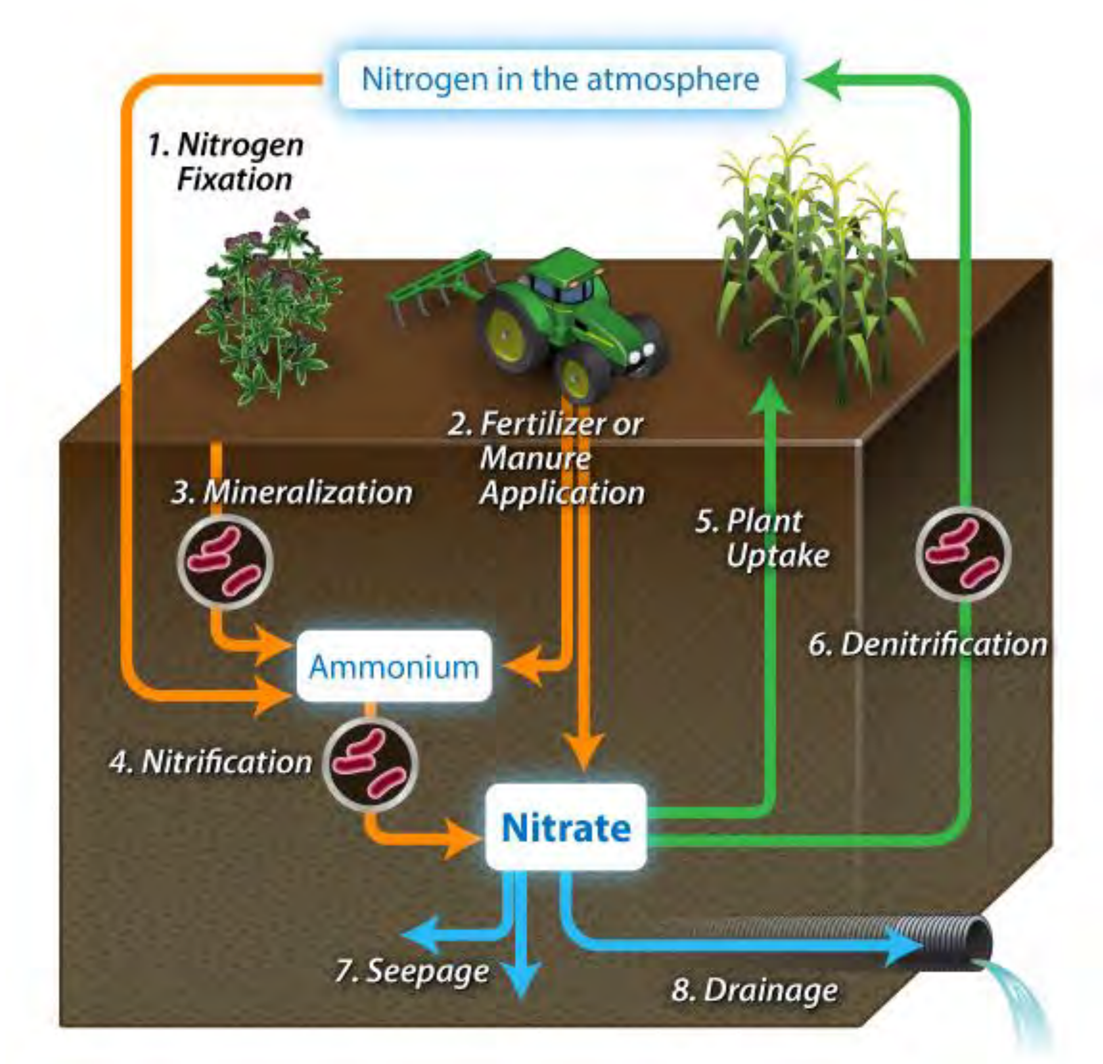


Figure G.1. The nitrogen cycle (University of Illinois Extension).

Not funded by the soybean checkoff.

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