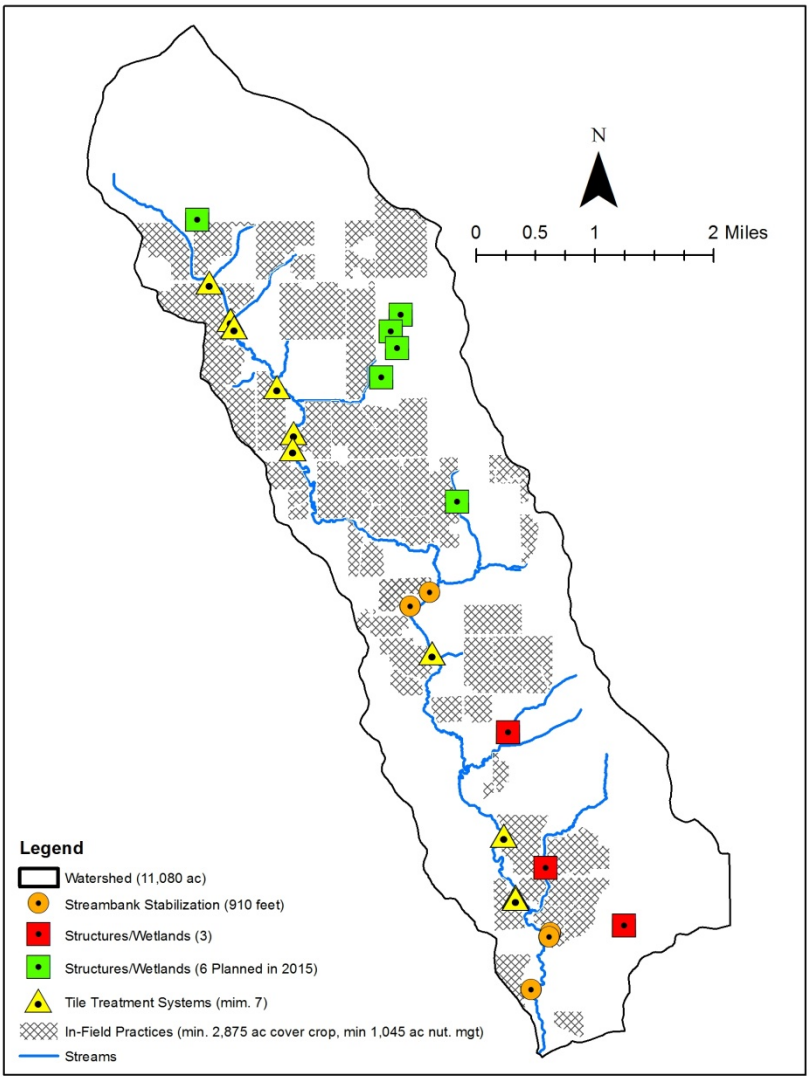
BEAVER CREEK WATERSHED IMPROVEMENT PLAN



PREPARED BY:

Environmental Programs & Services
IOWA SOYBEAN ASSOCIATION

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The Upper Cedar Watershed Management Autority

Project partners include:

Watershed residents, farmers and landowners

Floyd & Chickasaw Soil and Water Conservation Districts

Natural Resources Conservation Service

MSA Professional Services

Iowa Department of Natural Resources

Iowa Economic Development Authority

Iowa Flood Center

and others

A ROADMAP FOR IMPROVED WATER QUALITY, REDUCED FLOOD RISK, AND MAINTAINED AGRICULTURAL PRODUCTIVITY.

What is the Purpose of the Beaver Creek Watershed Land and Water Improvement Plan?
This document is intended to provide a roadmap for water, soil, and habitat improvements in the Beaver Creek watershed while at the same time maintaining or improving agronomic 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 being made towards achieving long-term goals for the watershed.

Who Owns This Plan?
This plan is for all stakeholders interested in the Beaver Creek watershed; this includes landowners, famers, residents, nongovernmental organizations, and local, state and federal units of government and others. 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 with guidance and input from representatives of landowners, famers, residents, nongovernmental organizations, local, state and federal units of government and others. The watershed planning process and document preparation was led by the Iowa Soybean Association with assistance from the Floyd and Chickasaw Soil and Water Conservation Districts and the Natural Resources Conservation Service.

Contents

1 EXECUTIVE SUMMARY

A watershed is an area of land that drains to a common point of land, in the case of the Beaver Creek watershed, 11,089 acres of land drain to the point where Beaver Creek meets the Little Cedar River near Bassett, Iowa. This document defines and addresses existing land and water quality conditions and shortfalls and provides a path for improvement. The development of this document followed the watershed planning process and incorporated input from many different stakeholders, both public and private. In 2013, the Chickasaw and Floyd Soil and Water Conservation Districts (SWCD) nominated Beaver Creek for watershed planning as part of the larger Upper Cedar watershed planning process. The Iowa Soybean Association took the lead in developing this document with input from watershed farmers and landowners, conservation professionals and others. The Beaver Creek Watershed Improvement Plan serves as the culmination of existing studies, citizen and stakeholder input, and recommendations for conservation practices aimed at meeting the goals developed through the watershed planning process.

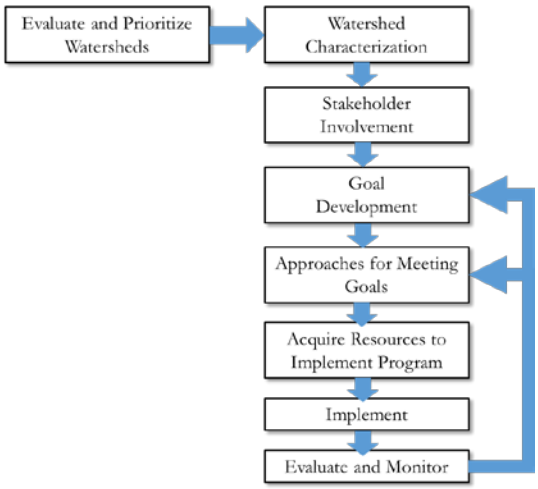


Figure 1. The watershed planning process.

Goals have been established in order to achieve the vision of all stakeholders. This document guides stakeholders through a continuous improvement approach to watershed management, understanding that big changes come from a succession of small changes. The long-term goals of the Beaver Creek Watershed Improvement Plan are to:

1. Reduce in-stream nitrogen by 41% from 2009-2011 average levels.
2. Reduce in-stream phosphorus by 29% from 2009-2011 average levels.
3. Reduce flood risk within Beaver Creek and downstream.
4. Maintain or increase agricultural productivity.

Public involvement was a very important component of the watershed planning process. Watershed planners initiated public involvement during the planning process and worked to incorporate multiple levels of involvement. A watershed advisory committee was established to provide input from the farmers, landowners and residents of the watershed. Input provided by the watershed advisory committee and other stakeholders was used to guide development of this document.

Improving land and water resources in the Beaver Creek watershed is a complex and challenging effort and will require significant collaboration and partnerships. The implementation schedule included in this document has been developed to balance current resources and the desire to make land and water improvements. A 10-year phased implementation schedule has been created to allow for continuous improvements that can be evaluated to determine if progress is being made towards achieving desired goals. The total investment needed to achieve the goals identified in this plan is estimated to be approximately $2,313,250 for structural practices and $82,325 per year for management practices.

Beaver Creek

2 WATERSHED CHARACTERISTICS

2.1 GENERAL INFORMATION

The Beaver Creek Watershed is an 11,089-acre watershed dominated by 62% row crop agriculture and relativity flat terrain with some karst influence. Beaver Creek begins near the outlet of two nitrate removal wetlands east of Colwell, the stream flows southeast into Chickasaw County where the confluence of the Little Cedar River is located. The two unincorporated communities within the watershed are Colwell, which straddles the northwestern watershed boundary and Bassett, located in the southern end of the watershed boundary. Other than 66 acres owned by the Floyd County Conservation Board and road right of ways, the watershed is entirely privately owned.

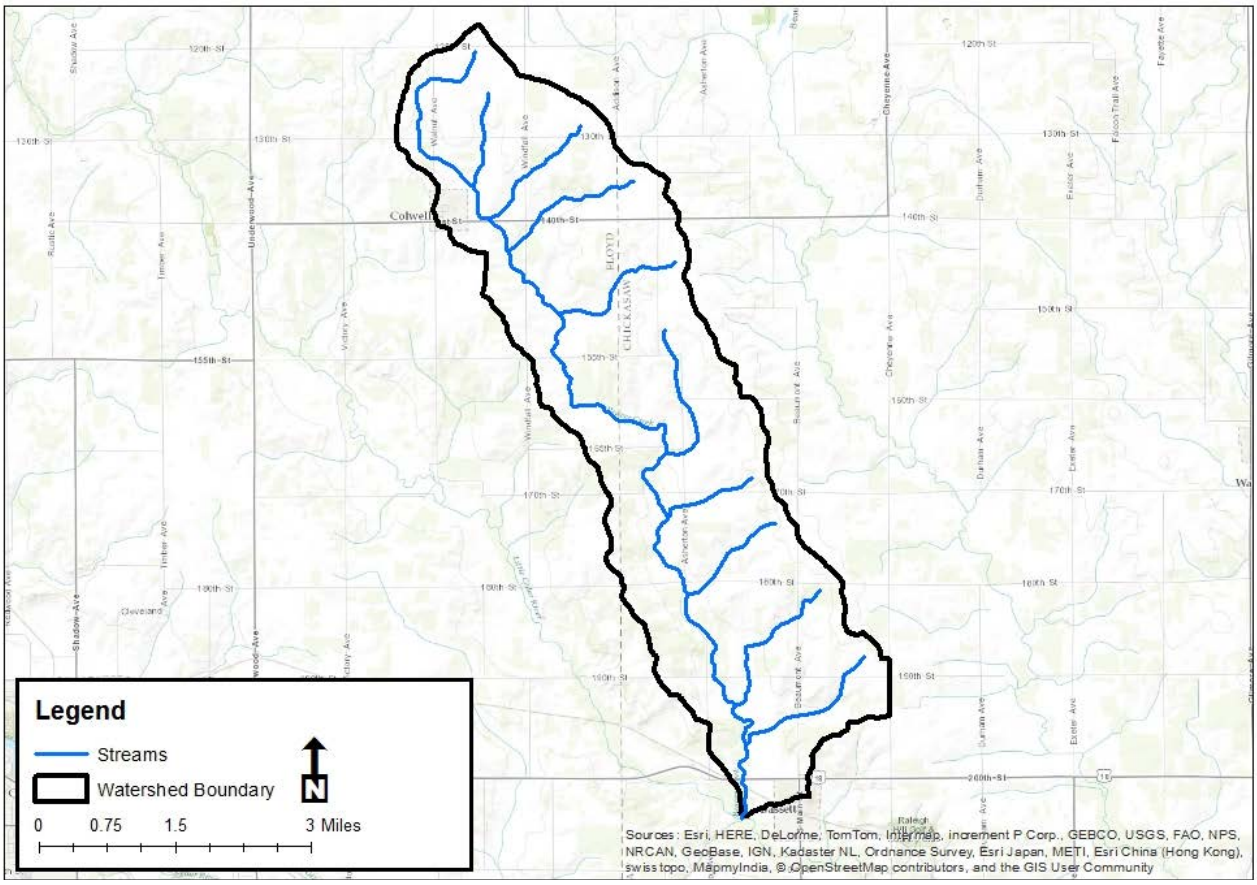


Figure 2 Beaver Creek watershed and stream

Table 1 General watershed data.

General Watershed Data – *Beaver Creek*			
Location	*Floyd and Chickasaw Counties*	**Waterbody ID Code**	*None*
		Major Cities	*None*
Waterbody Type	*Stream*		
Watershed Area	*11,089 acres*	**Stream Length**	*25.6 miles*
Dominant Land Use	*Row Crop Agriculture*		
HUC 12 Watershed	*Beaver Creek*	**HUC 12 ID**	*070802010902*
HUC 10 Watershed	*Little Cedar River*	**HUC 10 ID**	*0708020110*
HUC 8 Watershed	*Upper Cedar*	**HUC 8 ID**	*07080201*

The Beaver Creek Watershed is located on the Iowan Surface landform region. The Iowan Surface was last glaciated 16,000 to 21,000 years ago and the area is dominated by gently rolling terrain created by glacial processes. Glacial boulders lie scattered across the landscape.

2.2 WATER

A well-connected surface stream network lies within the Beaver Creek watershed. Figure 2 shows the identified streams within the Beaver Creek Watershed. The National Hydrography Dataset lists 16.02 miles of 1st order streams, and 9.58 miles of 2nd order streams in the watershed. Figure 3 is a map of the identified wetlands in the Beaver Creek watershed. The National Wetland Inventory (NWI) dataset was developed by the U.S. Fish and Wildlife Service and was derived from aerial photo interpretation. The NWI maps do not show all wetlands since the maps are derived from aerial photo interpretation with varying limitations due to scale, photo quality, inventory techniques, and other factors. Consequently, the maps tend to show wetlands that are readily photo interpreted given consideration of photo and map scale.

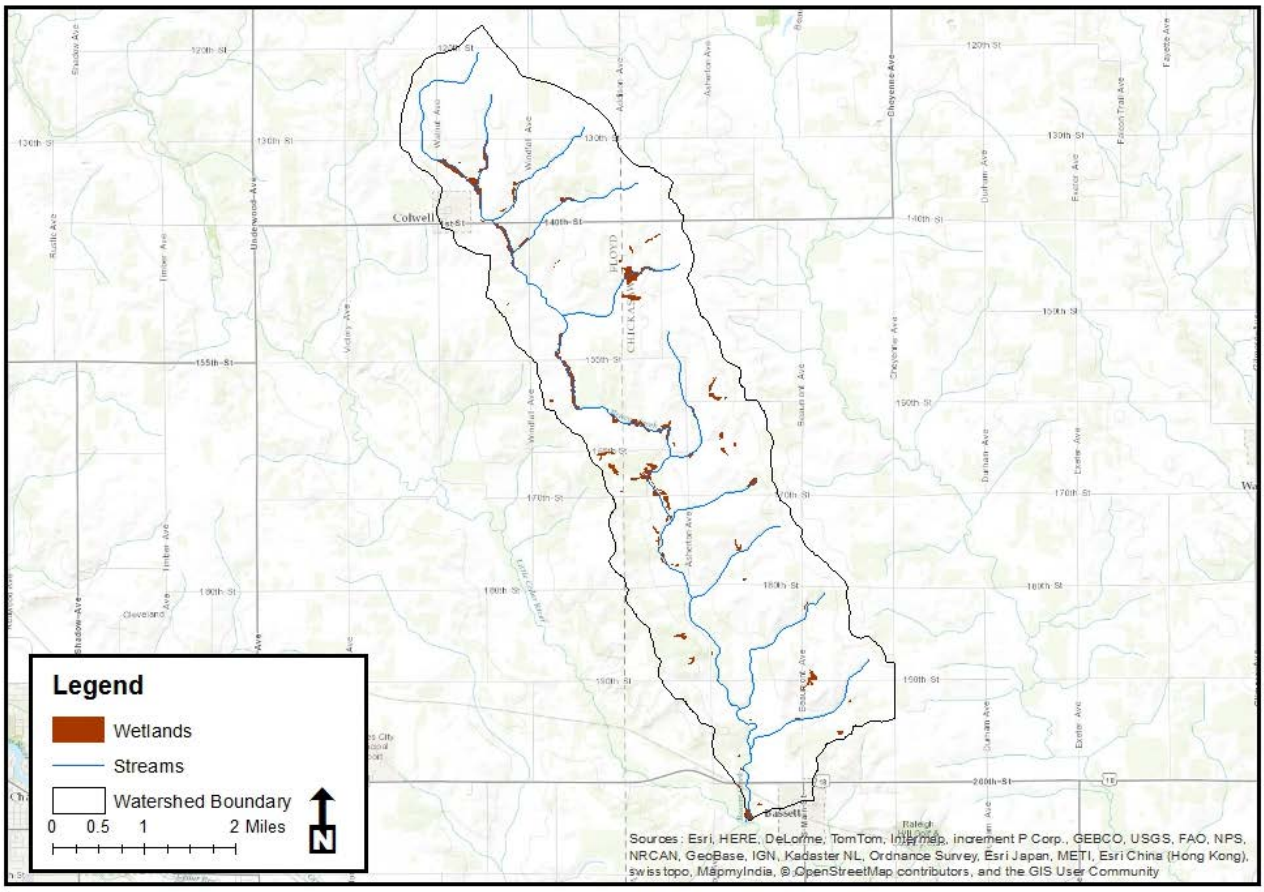


Figure 3 Wetlands within Beaver Creek Watershed according to the National Wetland Inventory.

Table 2 Classification of wetlands within the Beaver Creek Watershed.

TYPE	Percent	Acres
Intermittently Exposed - Diked	0.3%	0.7
Intermittently Exposed - Excavated	1.0%	2.1
Seasonally Flooded	50.9%	109.1
Seasonally Flooded - Farmed/Drained	15.2%	32.6
Temporarily Flooded	25.4%	54.5
Semipermanently Flooded	0.3%	0.7
Semipermanently Flooded - Diked	0.5%	1.1
Saturated	6.3%	13.5
Permanently Flooded	<0.1%	<0.1
Total	*100%*	*214.3*

Like many other watersheds in the flat landscapes of Iowa, much of the land within the Beaver Creek watershed is artificially drained in order to make agriculture possible and productive. Figure 4 shows soil types where tile drainage is needed to achieve full agricultural productivity. This map may not capture all areas currently having subsurface tile drainage infrastructure.

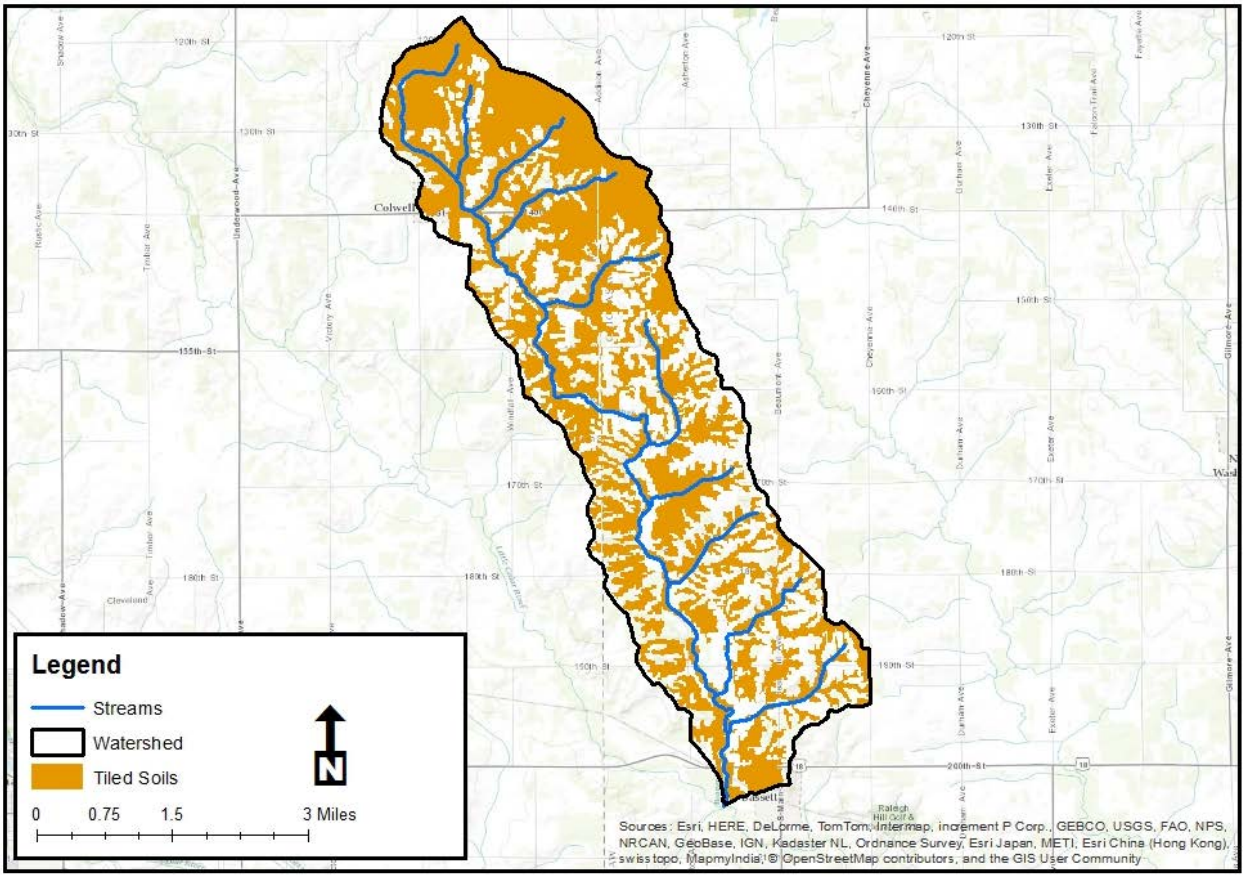


Figure 4 Areas needing tiling to achieve full agricultural productivity.

2.3 SOILS

The Beaver Creek Watershed is dominated by the Bassett, Clyde, Floyd, Kenyon, Lourdes, Oran, Ostrander and Readlyn soil associations, these eight soil types make up over 64% of the watershed. Figure 5 shows the soil map generated from the SSURGO coverage developed by the National Cooperative Soil Survey from the USDA-NRCS.

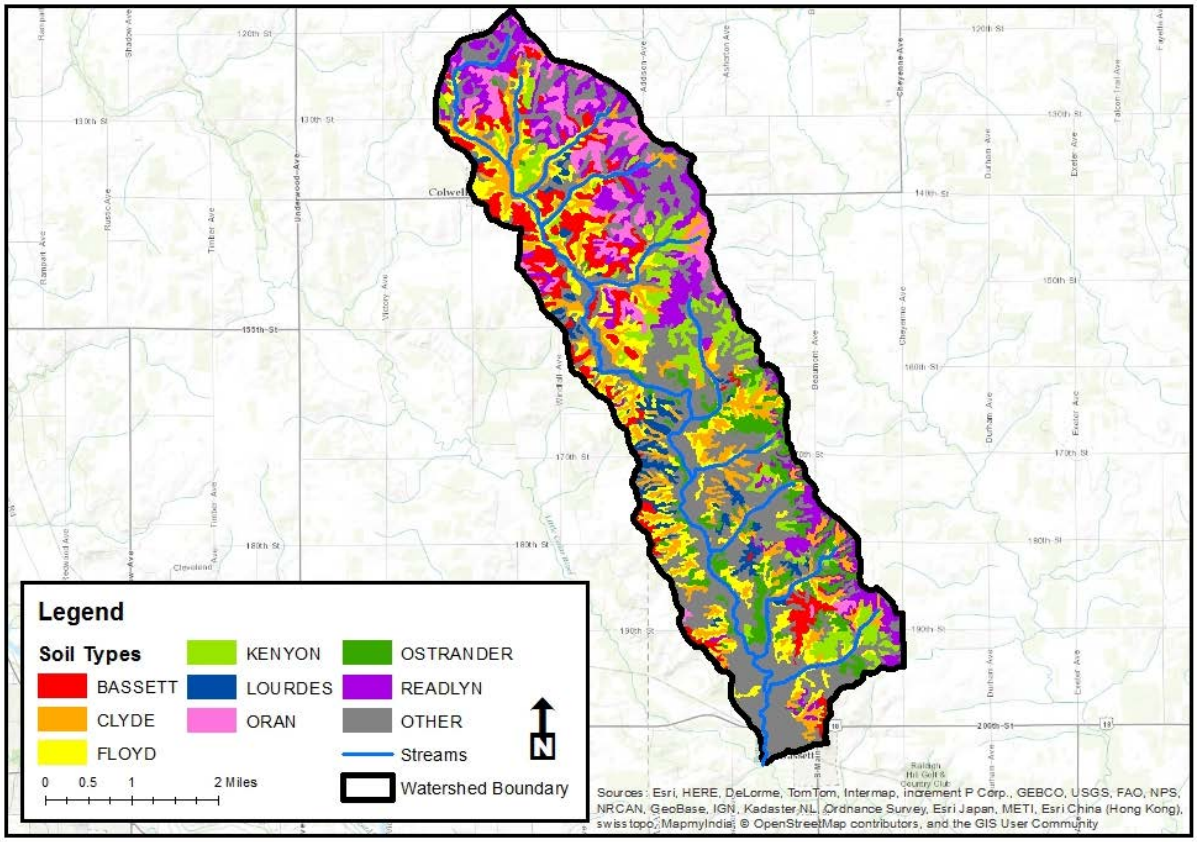


Figure 5 Beaver Creek watershed soil map derived from the National Cooperative Soil Survey, USDA-NRCS.

The Bassett series consists of very deep, moderately well drained soils formed in 30 to 75 centimeters of silty or loamy sediments and the underlying till. These soils are on interfluves and side slopes on dissected till plains on the Iowan Erosion Surface. Slope ranges from 2 to 35 percent. The Clyde series consists of very deep, poorly and very poorly drained soils formed in 75 to 150 centimeters of loamy glacial outwash or erosional sediments and the underlying loamy till. These soils are on nearly level positions, swales and concave drainage ways on interfluves on dissected till plains. Slope ranges from 0 to 4 percent. The Floyd series consists of very deep, somewhat poorly drained soils formed in 75 to 150 centimeters of loamy sediments and in the underlying till. These soils are on concave foot slopes adjacent to upland drainage ways on dissected till plains. Slope ranges from 0 to 5 percent. The Kenyon series consists of very deep, moderately well drained soils formed in 30 to 75 centimeters of silty or loamy sediments and the underlying till. These soils are on interfluves and side slopes on dissected till plains on the Iowan Erosion Surface. Slope ranges from 2 to 35 percent. The Lourdes series consists of very deep, moderately well drained soils formed in 30 to 56 centimeters (12 to 22 inches) of loamy sediments and the underlying glacial till. Lourdes soils are on convex ridges and long convex side slopes on dissected till plains. Slopes range from 2 to 14 percent. The Oran series consists of very deep, somewhat poorly drained soils formed in 30 to 66 centimeters of silty or loamy sediments and the underlying loamy glacial till. These soils are on interfluves and long side slopes on dissected till plains on the Iowan Erosion Surface. Slope ranges from 0 to 9 percent. The Ostrander series consists of very deep, well drained soils that formed in 75 to 150 centimeters of silty or loamy sediments and in the underlying till. These soils are on summits, side slopes, or shoulder slopes on dissected till plains. Slope ranges from 0 to 18 percent. The Readlyn series consists of very deep, somewhat poorly drained soils

that formed in 30 to 75 centimeters of loamy sediments and the underlying till. Readlyn soils are on slightly convex side slopes on dissected till plains of low relief on the Iowan Erosion Surface.
Slope ranges from 0 to 5 percent.
Table 3 summarizes the soil characteristics which affect water movement within the watershed. Approximately 11.6% of the soils are considered to be a hydric soil. A hydric soil is described as being saturated, flooded, or ponded, long enough during the growing season to develop anaerobic conditions in the upper part of the soil structure. Soil series which may or may not have been drained are both included in hydric soils. A majority (40%) of the soils within watershed are considered somewhat poorly drained to very poorly drained.

Table 3 Summary of soil characteristics found in the Beaver Creek Watershed.

Dominant Soil	SMU	Acres	Percent of Total Area	Slope	Hydrologic Group	Hydric Soil	Drainage Class
Bassett	0171B	950	8.6%	2-5%	B	No	Mod. Well
Clyde	0084A	1,282	11.6%	0-3%	B/D	Yes	Poor/ Very Poor
Floyd	0198B	1,215	11.0%	1-4%	B	No	Somewhat Poor
Kenyon	0083B	762	6.9%	2-5%	B	No	Mod. Well
Lourdes	0781C	336	3.0%	5-9%	C	No	Mod. Well
Oran	0471A	686	6.2%	0-2%	B	No	Somewhat Poor
Ostrander	0394B	665	6.0%	2-5%	B	No	Well
Readlyn	0399A	1,280	11.5%	0-2%	B	Yes	Somewhat Poor

Figure 6 shows a map of highly erodible land (HEL) within Beaver Creek Watershed. Approximately 26.4% of the watershed is considered HEL or potential HEL. A majority of the HEL land is located along stream channels or in the southern portion of the watershed where slopes tend to be steeper.

Figure 7 displays the corn suitability rating (CSR) for land within the Beaver Creek Watershed. CSR's provide a relative ranking of soils mapped in the state based on their potential to be utilized for intensive row crop production. The CSR is an index that can be used to rank one soil's yield potential against another. Ratings range from 100 for soils that have no physical limitations, occur on minimal slopes, and can be continuously row cropped to as low as 5 for soils with severe limitations for row crops. The ratings assume a) adequate management, b) natural weather conditions, c) artificial drainage where required, d) that soils lower on the landscape are not affected by frequent floods, and e) no land leveling or terracing.

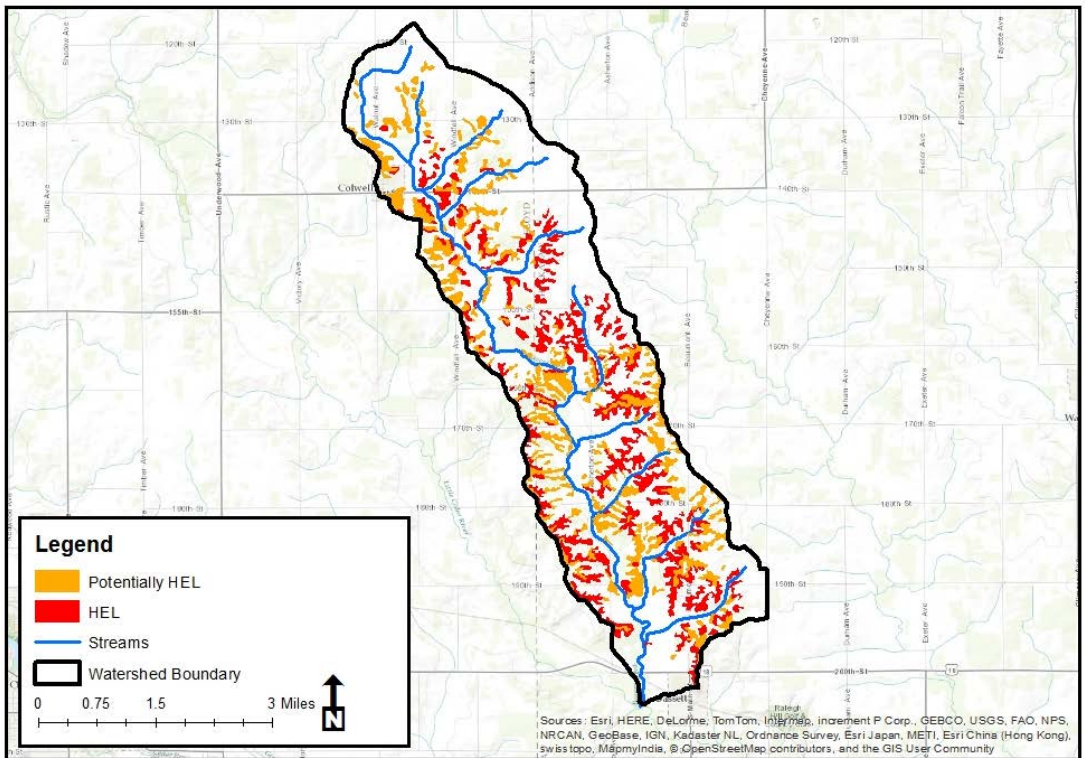


Figure 6 Highly erodible land classification (SSURGO, USDA-NRCS).

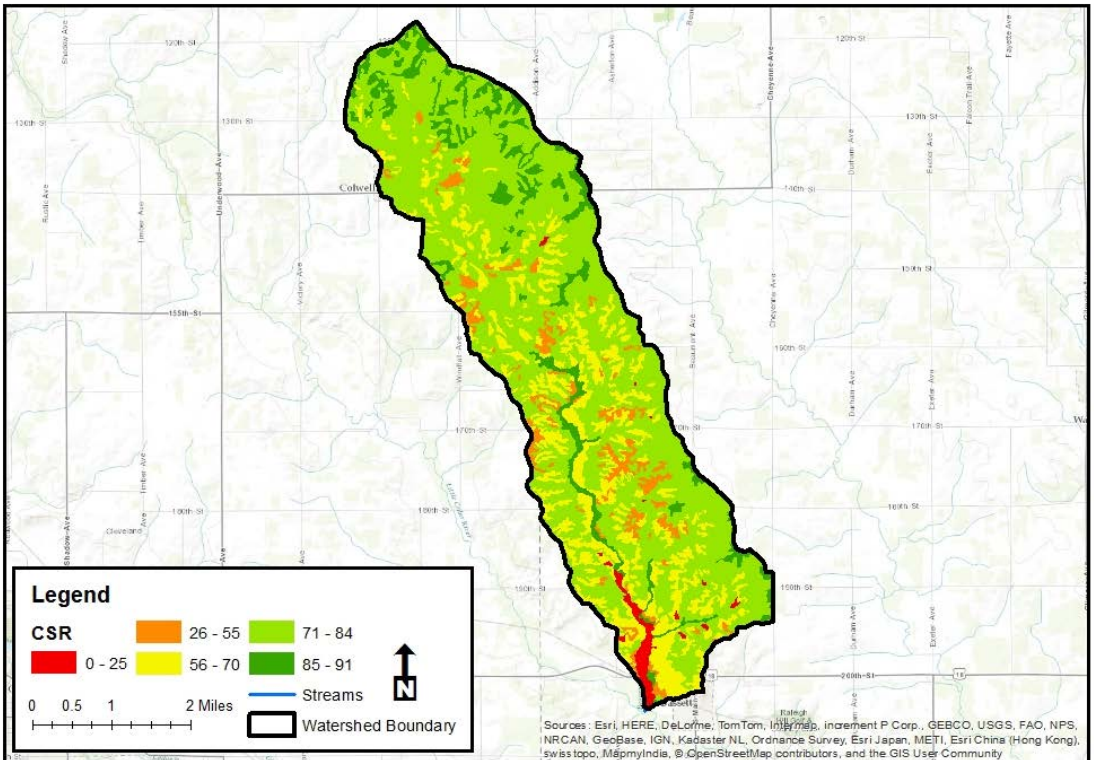


Figure 7 Corn suitability rating (SSURGO, USDA-NRCS).

2.4 GEOLOGY

The entire watershed is part of the larger Iowan Surface Landform Region. The watershed is also a part of the Eastern Iowa and Minnesota Till Prairies Major Land Resource Area. One rock quarry mine exists in the south eastern portion of the watershed. 2,197.3 acres or 19.8% of the watershed has alluvial deposits. In the watershed, 2,520 acres are within 1,000-5,280 feet of a known sinkhole or have soils with a depth to carbonate bedrock of 50 feet or less.

2.5 CLIMATE

Climate data from Charles City, approximately 6 miles west of the Beaver Creek watershed, shows average precipitation to be 33.8 inches per year, however year to year precipitation totals vary widely. Monthly temperature averages are showing in Figure 9.

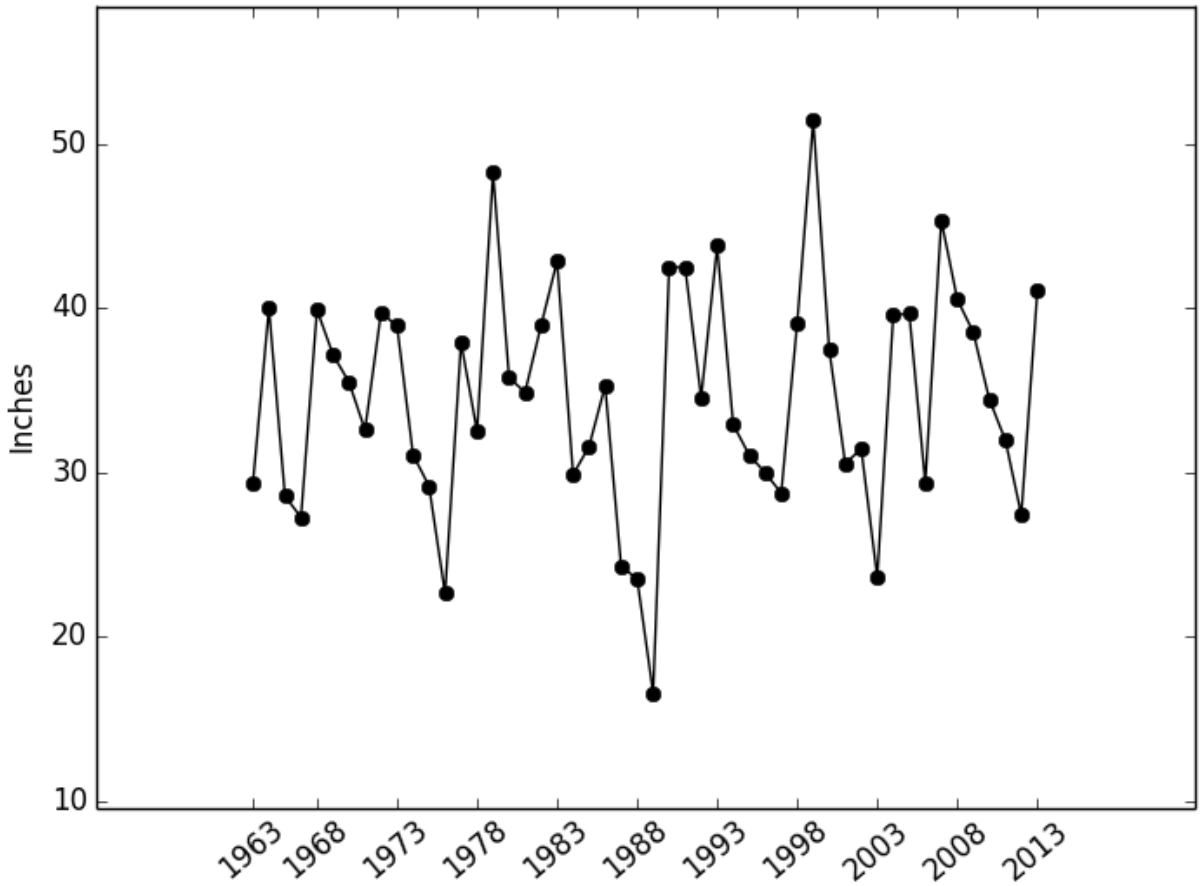


Figure 8 Charles City, IA annual precipitation (1954 - 2013).

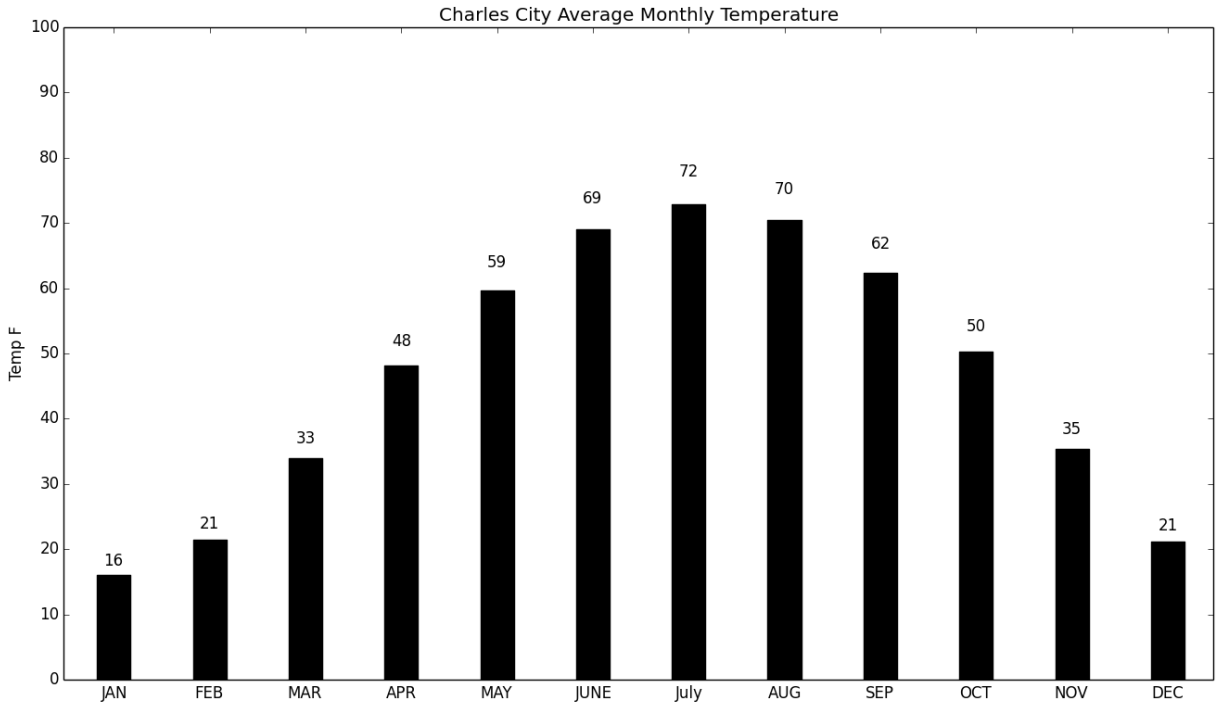


Figure 9 Charles City, IA monthly average temperature (1954-2013).

2.6 ELEVATION/SLOPE

Figure 10 displays the slope classification of the Beaver Creek watershed, the slope information was derived from LiDAR elevation data. The highest elevation in the watershed is 363 meters above sea level, and the lowest elevation within the watershed is 304 meters. Table 4 shows the slope classifications within the watershed. Approximately 31.4% of the watershed has a slope classification of A which has a range of slopes from 0-2%. Forty-five percent of the watershed has slope classifications of B. Seventeen of the watershed has slope classifications of C. The remaining land area has slopes of D or greater.

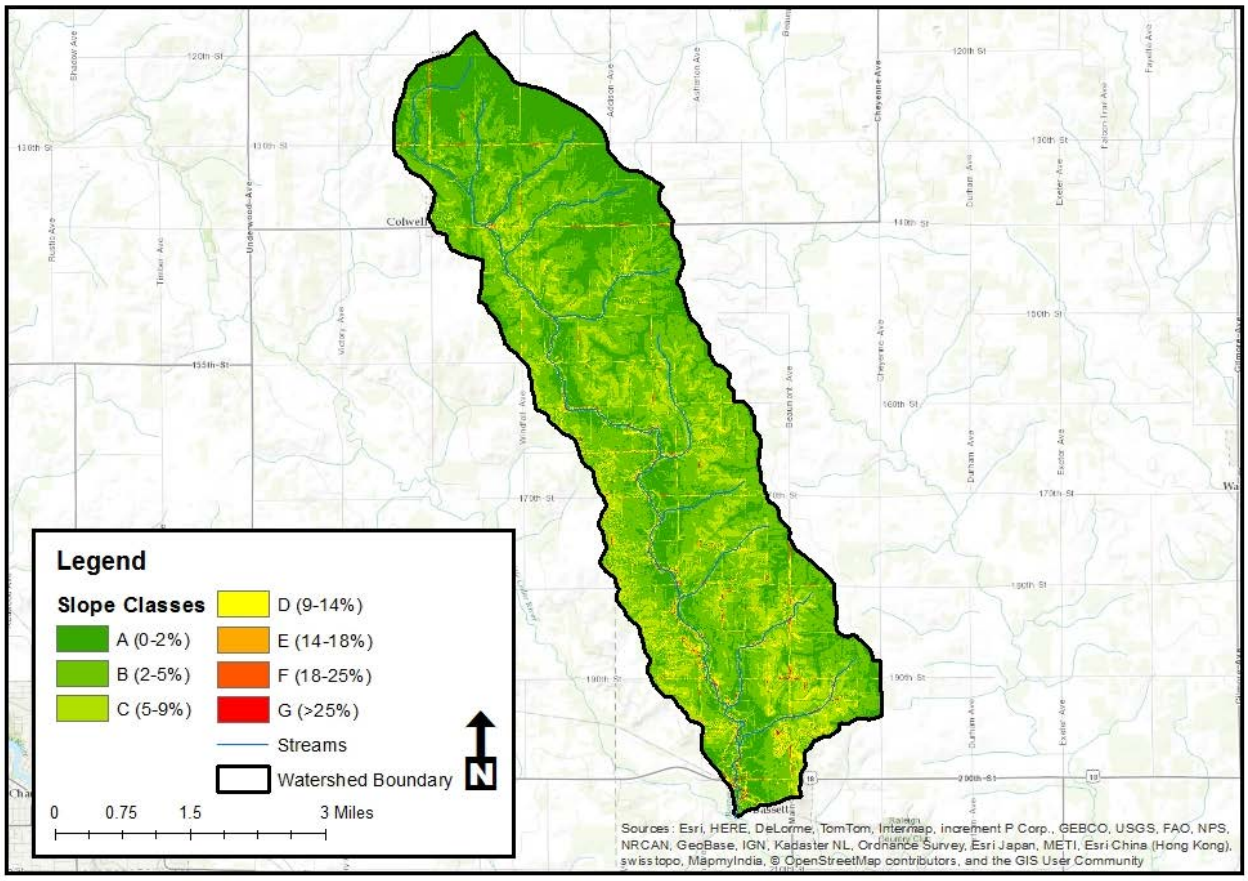


Figure 10 Beaver Creek Watershed slope classification from LiDAR Elevation Data.

Table 4 Slope classifications of Beaver Creek derived from LiDAR data.

Slope Classification	Range	Area, acres	% of Total
A	0 – 2%	3,483	31.4
B	2 – 5%	5,064	45.7
C	5 – 9%	1,940	17.5
D	9 – 14%	309	2.8
E	14 – 18%	96	0.9
F	18 – 25%	59	0.5
G	> 25%	130	1.2

2.7 LAND USE & MANAGEMENT

An assessment of land use practices was conducted using USDA data from 2007 to 2013. The data, collected as part of the USDA Cropland Data Layer project, was grouped into eight land use categories, summaries of the land use data are presented in Figure 11 and Table 5.

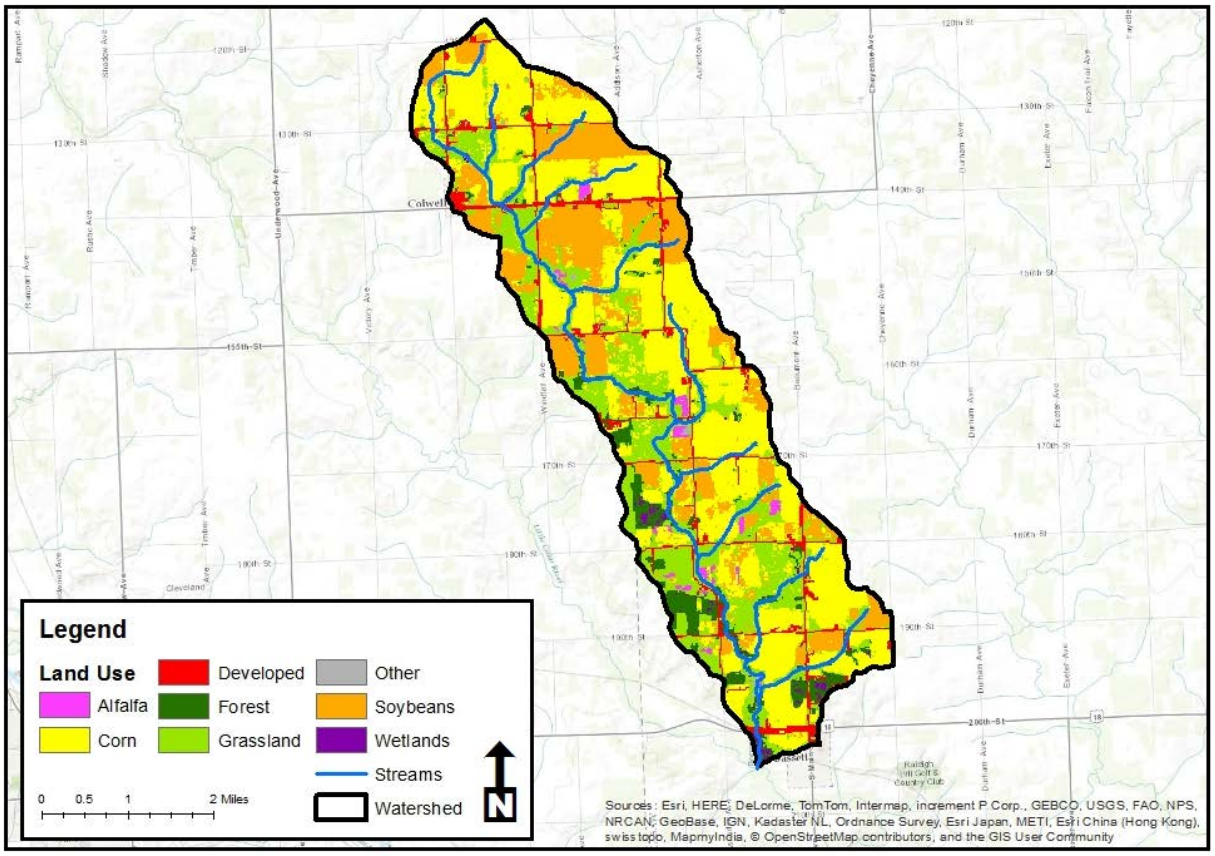


Figure 11 2013 USDA Cropland data layer of Beaver Creek.

Table 5 Beaver Creek land use 2007-2012.

Land Use	2007	2008	2009	2010	2011	2012	2013
Alfalfa	65	43	39	89	106	64	113
Corn	4731	5,206	4,817	5,292	5,520	5,025	4,631
Forest	732	709	544	74	595	699	610
Developed	880	828	805	601	673	689	690
Grassland	2,065	1,593	1,562	1,702	1,685	2,045	2,745
Soybeans	2,576	2,646	3,107	2,642	2,294	2,423	2,166
Wetlands	45	67	154	58	141	83	99
Other	1	4	67	27	2	58	2

The Government Land Office (GLO) conducted the original public land survey of Iowa during the period 1832 to 1859. Surveyors and their assistants produced both field notes and township maps that briefly described the land and its natural resources (vegetation, water, soil, landform, and so on) at the time of the survey. These maps and survey notes are one of few data sources about vegetation distribution before much of Iowa changed to a landscape of intensive agriculture. This data represents the observed vegetation by the deputy surveyors when laying out the public land surveys in Floyd and Chickasaw counties. The Beaver Creek watershed was classified as 82.7% prairie, 8.1% timber, 6.8% openings, 2.0% thicket, 0.2% slue and a 0.2% mix of timber/scattering/opening.

2.8 POPULATION & DEMOGRAPHICS

According to United States Census Bureau approximately 240 people live in the Beaver Creek watershed, this equates to approximately 13.7 people per square mile. Within Chickasaw County the median age in 2012 was 43.9 years old. In Floyd County the median age in 2012 was 43.6. The population of Chickasaw County has declined by 28% since reaching its highest numbers in 1900. Since its peak in 1950 the population of Floyd County has declined by 25%. Estimates are not available for the Beaver Creek watershed but similar trends are expected to have occurred.

2.9 CONSERVATION INFRASTRUCTURE

Cataloging existing conservation infrastructure is an important assessment of current conditions as well as a useful exercise for determining the need for future conservation practice placement. Aerial photography and watershed surveys revealed many conservation practices currently in place within the watershed. Determining levels of in-field management practices (e.g. nutrient management, etc.) can be difficult. To aid in the process NRCS provided maps of nutrient management and cover crops in the Beaver Creek watershed. Table 6 lists all practices and existing implementation levels within the watershed. Figure 12 provides a map of existing conservation practices, as of 2014. See Appendix B for a detailed map of existing conservation implementation.

Table 6 Beaver Creek watershed existing conservation practices.

Practice	Quantity
Terraces	26,000 feet
Grassed Waterway	63,000 feet
60’ Stream Buffer	100% of Beaver Creek
Cover Crops	1,125 acres
No-Till/Strip-Till	Minimal
Nitrate Treatment Wetlands	2 active
Nutrient Management	955 acres

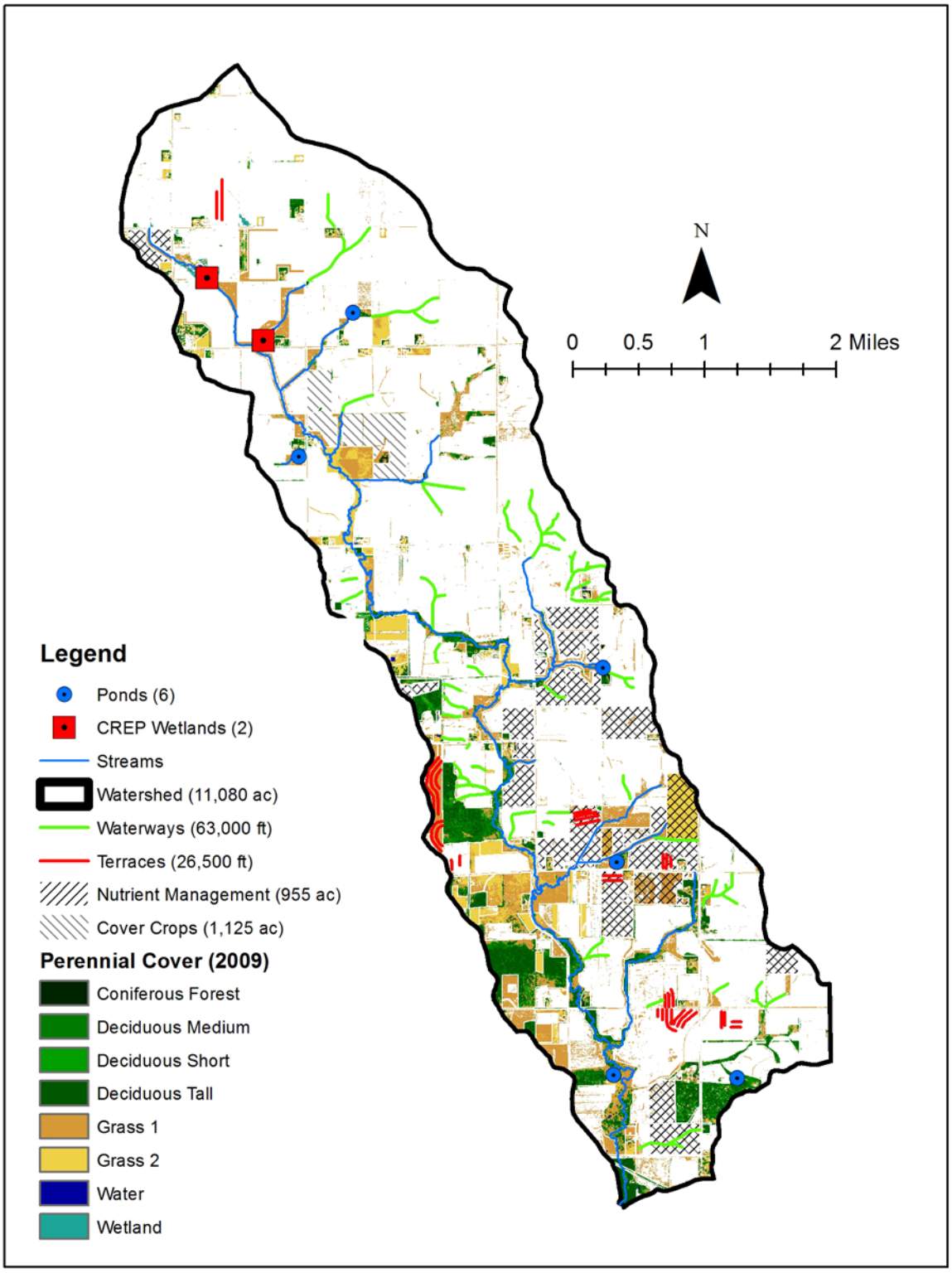


Figure 12 2014 Existing conservation practices

3 STREAM PHYSICAL, WATER & BIOLOGICAL CONDITIONS

Prior to work initiated in 2014, very little physical, chemical or biological monitoring occurred in the Beaver Creek watershed. As a result, very little is known about Beaver Creek and its watershed. Beaver Creek has had no long-term water monitoring and as a result is not listed on Iowa's 305(b) or 303(d) Integrated Report or Impaired Waters List.

3.1 CEDAR RIVER NITRATE IMPAIRMENT

The Beaver Creek watershed is part of the larger Cedar River watershed, the Cedar River near Cedar Rapids is impaired for elevated levels of nitrate that impact the drinking water source of the City of Cedar Rapids. Because of this impairment a Water Quality Improvement Plan (aka TMDL) was developed and approved by the EPA in 2006.

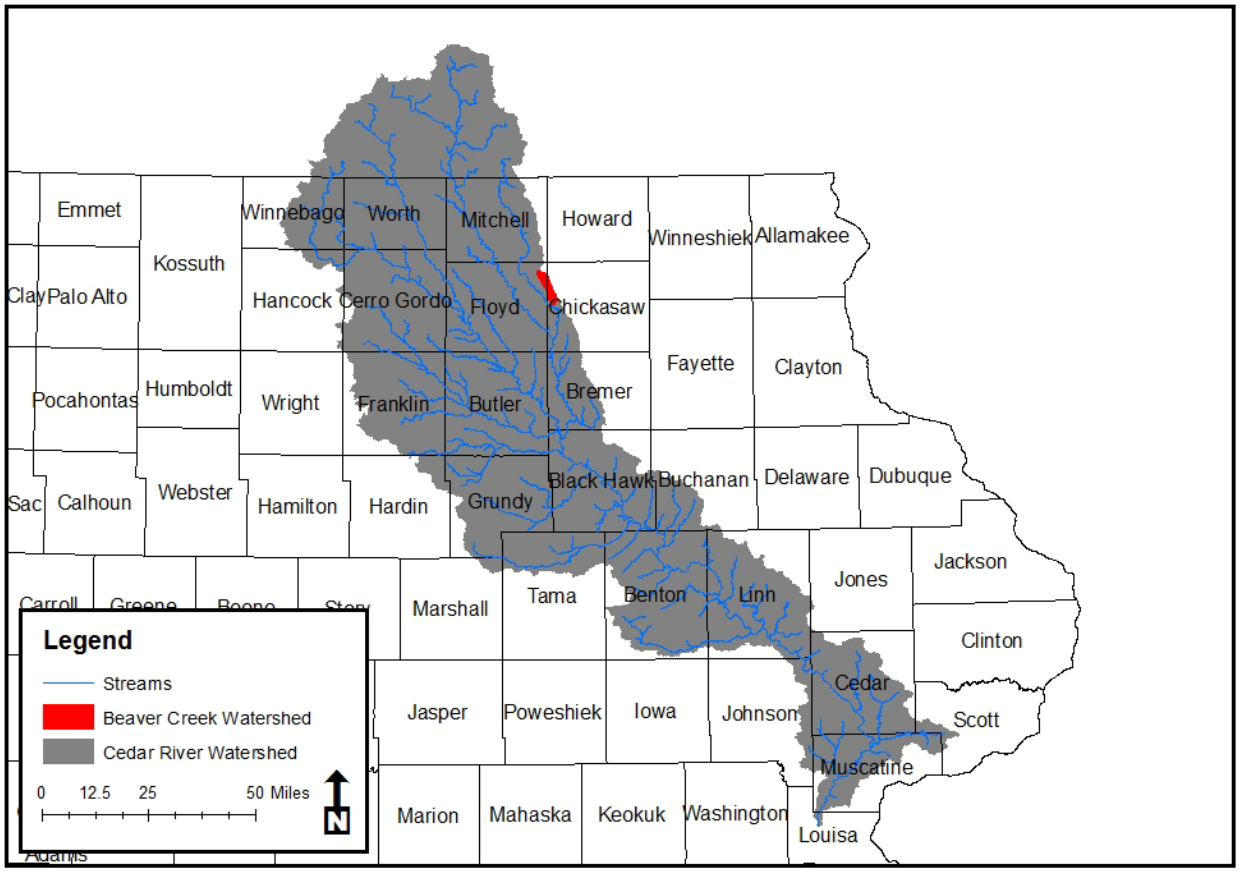


Figure 13 Cedar River Basin (above city of Cedar Rapids) and the Beaver Creek Watershed.

The 2004 305(b) Iowa Integrated Report showed the designated drinking water use of the Cedar River in Cedar Rapids (segment IA 02-CED-0030_2) was impaired due to nitrate-nitrogen (nitrate) concentrations exceeding state water quality standards. For the impaired segment, the Class C (drinking water) uses were assessed as “not supporting” due to the level of nitrate that exceeds state water quality standards and EPA maximum contaminant level (MCL). The applicable water quality standard for nitrate is 10 milligrams per liter (mg/l). A Water Quality Improvement Plan was developed to calculate the maximum allowable nitrate load for the impaired segments of the Cedar River that will ensure compliance with water quality standards.

The Cedar River in Cedar Rapids drains a watershed of 6,530 square miles flowing from its headwaters in Minnesota through north-central and northeast Iowa. The watershed is located primarily within the Iowa Surface landform region of Iowa characterized by gently rolling landscapes and mature drainage patterns. Land cover in the Cedar River watershed is predominantly agricultural, consisting of 73 percent row crops, 18 percent grass, 4 percent forest, 4 percent urban, and 1.2 percent water and wetlands.

Surface water from the Cedar River is used by the City of Cedar Rapids to provide drinking water to over 120,000 residents. The TMDL reported from 2001 to 2004, nitrate concentrations in the river ranged from 0.36 to 14.6 mg/l and averaged 6.75 mg/l. Nitrate concentrations exhibit clear seasonality, with higher concentrations occurring during April, May and June as well as November and December. The sources of nitrate can be divided into two major categories, point sources and nonpoint. The Cedar River TMDL reports 91% of the nitrates in the Cedar River can be attributed to nonpoint sources, while the remaining 9% are from point sources.

The TMDL incorporated two water quality models to evaluate stream flow and pollutant loading patterns in the Cedar River watershed. The Diffusion Analogy Surface Water Flow (DAFLOW) model was used to route and estimate stream flows. A second model, Water Quality Simulation Program (WASP), was used to interpret and predict water quality parameters in aquatic systems such as the Cedar River. The model inputs included climate, topography, land use, soils, feedlots and confinements, manure application areas, waste water treatment plants and census data. The Cedar River watershed was divided up into six sub-basins for the modeling effort. The sub-basins included the Upper Cedar (the location of the Beaver Creek watershed), Shell Beaver, West Fork, Beaver, Black Hawk and Wolf subbasins. Nitrate loss rates in the subbasins varied from around 10 pounds per acre in the Beaver Creek subbasins to more than 25 pounds per acre in the Upper Cedar sub-basin. When combined with stream flow information it was found that the Upper Cedar subbasin contributes 42% of the nitrate load, the Shell Beaver 29%, West Fork 16%, Black Hawk 5%, Beaver 4% and Wolf 4%.

Sources of nitrates can be divided into two categories, point and nonpoint sources. The TMDL further divides the nonpoint sources into wildlife, septic, atmospheric deposition, manure application, legume fixation, and fertilizer application. The relative nitrate contribution of these sources is shown in table 7.

Table 7 Nitrate contributions in the Cedar River watershed.

Subbasins	Point Sources (t/yr)	Wildlife (t/yr)	Septic Systems (t/yr)	Atmospheric Deposition (t/yr)	Manure (t/yr)	Legume (t/yr)	Fertilizer (t/yr)
Upper Cedar River	794	105	114	4,117	13,070	22,201	33,061
Shell Beaver River	464	64	90	4,312	9,629	23,183	38,822
West Fork Cedar	45	31	36	2,097	9,298	11,364	18,702
Beaver Creek	29	12	22	976	4,169	5,567	8,684
Black Hawk Creek	28	9	15	828	2,264	4,835	8,574
Wolf Creek	30	12	15	812	1,260	4,692	7,694
Middle Cedar	1,132	149	131	2,989	5,957	15,034	27,136
Total	**2,522**	**382**	**423**	**16,131**	**45,647**	**86,876**	**142,673**

The TMDL reports that a 35% reduction in nitrate concentrations is necessary to meet water quality standards. The Beaver Creek watershed, being in the Upper Cedar subbasin, lies in the highest nitrate contributing area of the Cedar River watershed.

4 GOALS AND OBJECTIVES

This plan will be of little value to real water and soil quality improvement unless watershed improvement activities and BMPs are implemented. This will require the active engagement of local stakeholders and the collaboration of local, state and federal agricultural and conservation agencies. In addition to the implementation of Best Management Practices (BMPs), continued monitoring is necessary. Monitoring is a crucial element to assess the attainment of water quality standards and designated uses, to determine if water quality is improving, degrading, or remaining unchanged, and to assess the effectiveness of implementation activities and the possible need for additional BMPs.

This plan is intended to be used by local agencies, watershed managers, and citizens for decision-making support and planning purposes. The best management practices listed below represent a package of tools that will help achieve water quality, soil health, wildlife habitat, agronomic and quality of life goals if appropriately utilized. It is up to all stakeholders to determine exactly how to best implement them. Locally-driven efforts have proven to be the most successful in obtaining real and significant water quality improvements.

The last element of the planning process, which is the implementation of the plan, begins once the goals, objectives, and action statements have been identified. Plan implementation continues through adherence to the goals, objectives, and action statements set forth in this plan. However, it should be emphasized that these goals, objectives, and action statements are not "cast in concrete." While the these goals, objectives have been developed with input from local stakeholders based on the best information available, and the needs/opportunities of the watershed at a point in time, changing needs and desires within the watershed or economy (or Farm Bill) may mean that these goals, objectives, and action statements will need to be re-evaluated. This plan must remain flexible enough to respond to changing needs and conditions, while still providing a strong guiding mechanism for future work.

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

1. **Reduce non-point nitrogen loads by 41% from 2009-2011 levels.** (This goal will reach targets for both the Iowa Nutrient Reduction Strategy (41%) and the Cedar River Nitrate TMDL (35%))
2. **Reduce in-stream phosphorus loads by 29% from 2009-2011 levels**. (This goal will reach target for the Iowa Nutrient Reduction Strategy)
3. **Maintain or increase agricultural productivity.**
4. **Reduce flood risk within Beaver Creek and downstream.**

This watershed plan uses the year 2009 as a baseline for practice implementation and determining progress towards reaching set goals. Watershed models were developed by the Iowa Soybean Association to determine the baseline, current and future nitrogen, phosphorus and sediment loads and reductions in the Beaver Creek watershed. Table 8 provides estimates of watershed loading rates for the 2009 baseline, 2014 conditions, conditions after the construction of planned practices in 2015, and conditions after the implementation of practices identified in the watershed plan. Table 9 provides percent reduction estimates from the 2009 baseline. A practice-based model was used to determine the nitrogen load reductions. The Nutrient Reduction Strategy Science Assessment provided the practice efficiencies. A RUSLE and Sediment Delivery Model was developed to estimate erosion and sediment delivery levels and reductions. A phosphorus enrichment ratio of 1.6 pounds of phosphorus per ton of sediment delivery was used to estimate the phosphorus load.

Table 8 Baseline, Existing and Future Loading

	Units	2009 Baseline Conditions	2014 Conditions	2015 Planned Construction	Watershed Plan Implementation
Nitrogen	pounds/year	160,000	139,500	133,000	93,900
Phosphorus	pounds/year	3,867	3,564	3,324	2,648
Sheet & Rill Erosion	tons/year	17,080	16,040	16,040	13,100
Streambank Erosion	tons/year	197	197	197	117
Sediment Delivery	tons/year	2,417	2,227	2,077	1,655

Table 9 Reduction Estimates from 2009 Baseline Conditions

	Units	2009 Baseline Conditions	2014 Conditions	2015 Planned Construction	Watershed Plan Implementation
Nitrogen	% reduction	-	13%	17%	41%
Phosphorus	% reduction	-	8%	14%	32%
Sheet & Rill Erosion	% reduction	-	6%	6%	23%
Streambank Erosion	% reduction	-	0%	0%	41%
Sediment Delivery	% reduction	-	8%	14%	32%

5 CONCEPTUAL PLAN

Best management practices are part of the foundation for achieving water, soil, and flood reduction goals. BMPs include practices and programs designed to improve water quality and other identified resource concerns. BMPs may include changes in land management or land use, physical structures to mitigate against pollutant sources, or changes in human behavior or attitudes about the resources in the watershed and how they are perceived or valued (Watershed Management Action Plan–Iowa DNR, 2009). Efforts made to encourage BMPs that are long-term but this is often dependent 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 goals of the watershed project. From an initial list of potential practices, priority practices were narrowed down to those that were the most acceptable to watershed stakeholders. Watershed planning facilitators used an effort versus impact exercise to prioritize best management practices which provide the greatest benefit and yet are the most acceptable to local stakeholders.

When selecting and implementing BMPs it is important to identify if the practice is feasible in a given location (e.g.–are the site features suitable or does it match stakeholder values). It is also important to determine how effective the practice will be at achieving goals, objectives, and targets. Table 10 provides a list of BMPs identified by watershed stakeholders, BMPs in bold font show those practices included in the conceptual plan. Included in the table is a rating of each practice's efficacy at addressing identified water, soil, or habitat goals. While only the practices in bold were included in the conceptual plan and reduction calculations the other practices will be important to consider when making decisions about water and soil improvement. Figure 14 provides a map of a conceptual BMP implementation scenario, this scenario places BMPs in locations intended to achieve maximum benefit (e.g. nitrate removal wetlands being placed at strategic locations or bioreactors placed at drainage tile outlets).

Table 10 Best Management Practices. (3 = high impact, 2 = moderate impact, 1 = low impact, 0 = no impact).

	Practice	***Water Quality Nitrogen***	***Water Quality Phosphorus***	***Soil Health***	***Water Quantity (Flood Reduction)***
In-Field	*Perennial Cover (including CRP)*	*3*	*3*	*3*	*3*
	Cover Crops	***3***	***3***	***3***	***1***
	No-Till/Strip-Till	*0*	*3*	*3*	*1*
	Grassed Waterways	*0*	*2*	*1*	*1*
	4R Nutrient Management	***2***	***2***	***1***	***0***
	Drainage Water Management	*3*	*0*	*0*	*2*
	Nitrification Inhibitor	*1*	*0*	*0*	*0*
Edge of Field	*Streamside Buffers*	*1*	*3*	*0*	*1*
	Bioreactors	***3***	***1***	***0***	***0***
	Saturated Buffers	***3***	***0***	***0***	***0***
In-Stream	*Ponds*	*1*	*3*	*0*	*3*
	Nitrate Removal Wetlands (CREP)	***3***	***1***	***0***	***2***
	Streambank Stabilization	***0***	***2***	***0***	***0***

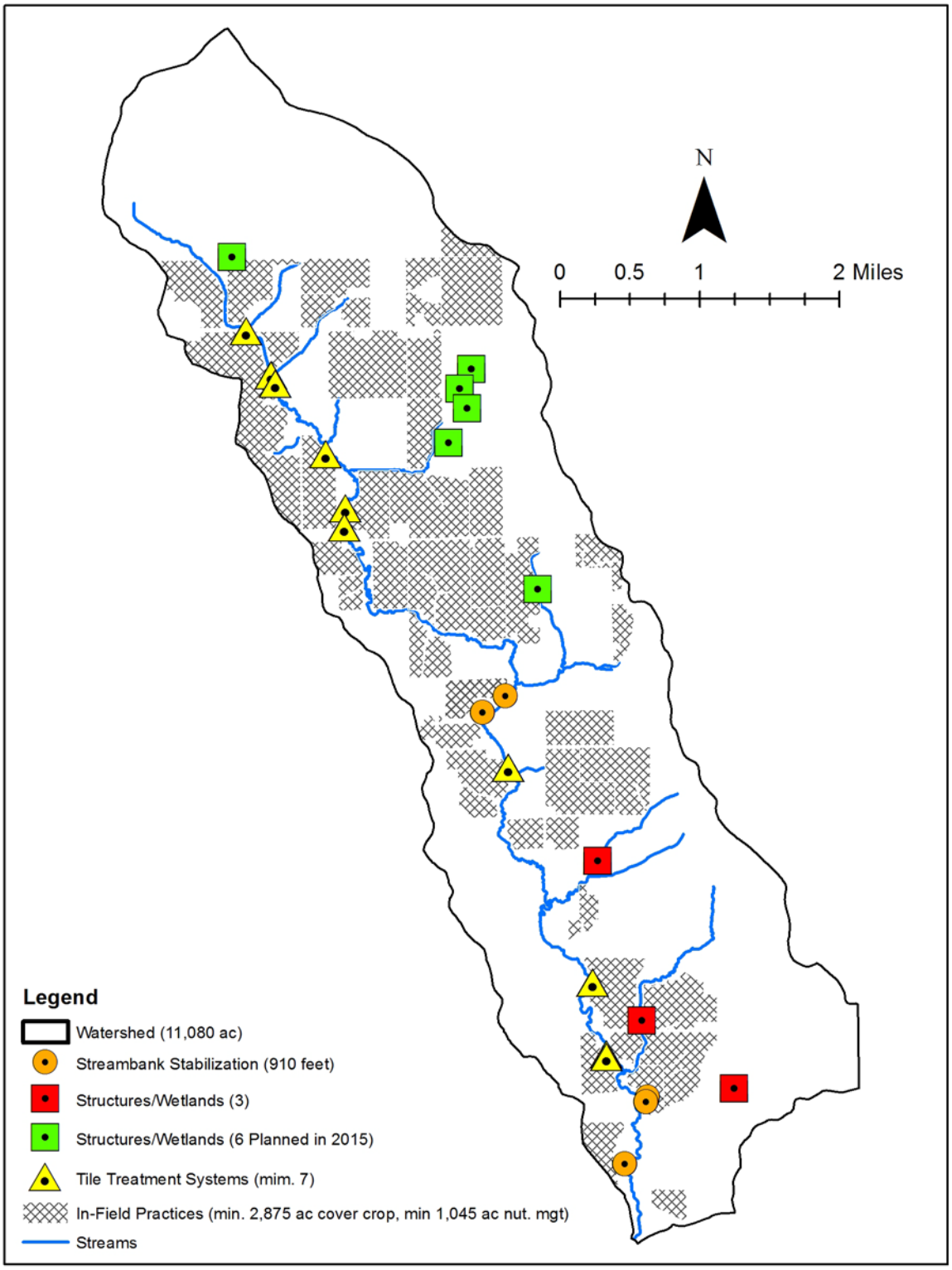


Figure 14 BMP Conceptual Implementation Plan

The BMP conceptual plan presented in Figure 14 is aggressive but this level of implementation is needed to achieve the goals identified in this plan. Appendix C provides a detailed version of the conceptual implementation plan.

6 IMPLEMENTATION SCHEDULE

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

The following schedule was established by watershed stakeholders and should be used to set yearly goals and gauge progress. It should be noted practices included in the implementation table only include those identified to reach the watershed plan goals. Other practices such as reduced tillage, stream buffers, perennial vegetation, and other best practices should be promoted whenever possible.

Table 11 Targeted implementation schedule.

Practice	***Units***	***Existing Level (2014)***	***2015 Watershed Target***	***2020 Watershed Target***	***2025 Watershed Target***	***End of Plan Target***
Cover Crops	*Acres*	*1,125+*	*1,125+*	*2,500*	*4,000*	*4,000*
Bioreactors/Saturated Buffers	*Number*	*0*	*0*	*3*	*7*	*7*
Nutrient Management	*Acres*	*955+*	*955+*	*1,500*	*2,000*	*2,000*
Wetlands/Structural Practices	*Number*	*2*	*8*	*9*	*11*	*11*
Streambank Stabilization	*Feet*	*0*	*0*	*500*	*410*	*910*

7 MONITORING PLAN

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

Much of the onging water quality monitoring in the Beaver Creek watershed is led by the Iowa Flood Center. As of 2015, two in-stream stage and nutrient sensors were installed in the watershed. One was located at the intersection of 155th Street and Beaver Creek, the other installed at the intersection of Highway 18 and Beaver Creek. Both of these sensors provide real-time stream stage and nutrient levels. The Iowa Flood Center also maintains three weather stations in the watershed monitoring soil moisutre and rainfall. Results for the Iowa Flood Center sensors can be accessed by clicking here.

IFC Monitoring Station

In addition to monitoring the main channel of Beaver Creek additional water quality monitoring should be conducted at finer scales to assess the benefits of individual conservation practice installation. Monitoring at this scale can be conducted many different ways. The easisest method is to monitoring water entering and leaving a structural conservation practice, such as a bioractor or wetland. Additional evaluation could be conducted by monitoring tile water leaving subsurface drainage systems or by monitoring surface runoff from a targeted area. Monitoring surface runoff proves to be extremely difficult as runoff events are very episodic and are often missed via regularly scheduled monitoring programs. Monitoring of tile water is much easier as tiles tend to have flow that is more consistent.

Tile monitoring should be targeted to drainage systems that drain a single field. This approach allows for changes in field management to be isolated and detected through the monitoring program. Monitoring locations should be targeted to tile outlets which are easily accessible and provide the opportunity to capture tile flow. Flow from tiles can be easily calculated by measuring how long it takes to fill a known volume (e.g. how many seconds it takes to fill a 3-gallon container). Tile flow along with pollutant concentration can be combined to calculate the pollutant loading.

8 INFORMATION AND EDUCATION PLAN

Results from past research indicate the producers' actual behavior patterns must be brought into the design of both best management practices and implementation strategies for water quality programs. (Dinnes, 2002). To effect changes in behavior there must be strategies in place to direct education and outreach to the target audience. Many obstacles to the adoption of conservation practices may be overcome by providing adequate education, outreach, and awareness of how land management practices influence non-point source losses to surface water resources. Knowledge becomes awareness, which may then motivate changes in behavior.

As with any watershed project, an education, communication, and outreach program will need to be designed to teach producers and other stakeholders about the resource issues within the Beaver Creek watershed. The outcome of this education and outreach is to bring attention to what impact their land use and management decisions might be, how they can effectively address those impacts, and what opportunities and innovative solutions exist.

Goal: Increase awareness and adaptation of practices to achieve watershed land and water goals.

Target Audience: Watershed community, including farmers, local landowners, absentee landowners, residents, educators, students, and others.

Message: Recent studies have shown farmers and landowners share a sense of shared responsibility while at the same time valuing individualism and personal responsibility, studies also reveal a concern for future generations (Comito 2011). Messaging should attempt to capture these beliefs while at the same time promoting the project goals. For example, *"Be a part of the cover crop movement, do your share to protect land and water for the future."*

Key Partners/Contacts:

<u>Project Partners (Current and Potential)</u>
Soil and Water Conservation District Commissioners
County Conservation Boards
Natural Resources Conservation Service
Iowa Department of Agriculture and Land Stewardship
Iowa Department of Natural Resources
Agri-Businesses
Farm Cooperatives

<u>Local Agricultural and Outdoor Groups</u>
Pheasants Forever
Ducks Unlimited
4-H
FFA
Farm Bureau

<u>Newspapers</u>
Waterloo Courier
Nashua Reporter

New Hampton Tribune
Mason City Globe Gazette
Charles City Press

Radio Stations
KQOP FM 94.7 Charles City
KCHA AM 1580 Charles City
KCHA FM 95.9 Charles City

Outreach Strategies and Tools:

Branding development (e.g. logo)
Website
Fact sheets
Direct mailings
Watershed boundary signs
Stream signs
Conservation practice signage
IOWATER volunteer workshop
Conservation field days
Youth outdoor learning opportunities
Urban-Ag learning exchanges
Stream clean-up events

9 EVALUATION

Evaluating project success or failure is a critically important step in implementing a watershed plan such as this. This section lays out a self-evaluation process for project partners to use to gauge project progress in four categories, 1) project administration, 2) attitudes and awareness, 3) performance, and 4) results. These four indicator categories are described in in the bullet points below, a project evaluation worksheet can be found in Appendix X.

Project Administration

- Yearly Partner Review Meeting: Project partners should host an annual review meeting. This will provide an opportunity to evaluate project progress using the evaluation matrix.
- Quarterly Project Partner Update: Each quarter a project meeting will be held to ensure project goals and objectives are being accomplished. The meeting will also be an opportunity to plan logistics and coordinate field days, events, trials, etc.

Attitudes & Awareness

- Farmer and Landowner Surveys: Periodically a survey should be conducted with a statistically valid sample of farmers and landowners in the watershed. Results of the surveys should be used to determine changes in attitudes and behaviors.
- Field Day Attendance: Field days are an important outreach component watershed projects, to gauge the impact of the field days a short survey should be administered at the conclusion of each field day. The goal of the surveys will be to determine if attitudes were changed 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 watershed project.

Performance

- Practice Adoption Levels: Locations of implemented practices should be tracked over the life of the project. Practice adoption rates will be aggregated to the watershed scale and reported to partners.
- Practice Retention: The project will place an emphasis on retention of management practices such as cover crops. Yearly follow-up with farmers implementing practices will help gauge practice retention expansion.

Results

- Practice Scale Monitoring: Tile water or edge of field monitoring results should be used to gage 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 and landowners, partners. This aggregated data may also be used in a publication to bring broader recognition to these and other Iowa water quality efforts.
- Stream Scale Monitoring: In-stream water monitoring sites should be used to determine if long-term water quality improvements are being realized. Year to year improvements will likely be undetectable but long-term (10 years+) may be evident if significant practice adoption takes place in the watershed.
- Soil and Agronomic Analysis: Scientifically valid methods will be used to determine soil and agronomic impacts of practice adoption, the results will be shared with farmer participants. All soil and agronomic results will be aggregated to the watershed scale and shared with the other farmers, landowners, and partners.

- Modeled Improvements: The project should work with appropriate groups or individuals to estimate soil and water improvements resulting from practice implementation.

10 ESTIMATED RESOURCE NEEDS

An estimate of resource needs is crucial to gain support from potential funding sources. Table 12 provides an estimate, in 2014 dollars, of the total cost to implement conservation practices identified in this plan. Some practices, such as nutrient management and cover crops, may result in cost savings to farmers and landowners, therefore cost share and/or incentive payment rates will need to be evaluated during the implementation phase of this plan.

Table 12 Estimated resource needs.

Practice	***Units***	***Existing Level (2014)***	***Implementation Goal (Beyond 2015)***	***Est. Cost /Unit***	***Total Cost***
Cover Crops	*Acres*	*1,125+*	*2,875*	*$25*	*$71,875*
Bioreactors/Saturated Buffers	*Number*	*0*	*7*	*$10,000*	*$70,000*
Nutrient Management	*Acres*	*955+*	*1,045*	*$10*	*$10,450*
Wetlands/Structural Practices	*Number*	*2*	*3*	*$725,000*	*$2,175,000*
Streambank Stabilization	*Feet*	*0*	*910*	*$75*	*$68,250*

The estimated investment needed necessary to construct structural practices (wetlands, bioreactors and saturated buffers) is estimated at **$2,313,250**. Yearly investments are needed to continue implementation of practices such as cover crops and nutrient management. The estimated yearly total for these practices is **$82,325**. This estimate does not include investments necessary to keep existing acres of cover crops and nutrient management. The dollars necessary to fund these practices could come from many different sources, including farmers and landowners.

Additional costs are associated with watershed improvement projects, these costs include salary and benefits for a coordinator, information and education activities, monitoring, office space, computer, phone, and vehicle.

11 FUNDING OPPORTUNITIES & APPROACHES

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

- **Locally Organized Cover Crop Seeding Programs**. Farmer and landowners are often busy with harvest during the prime cover crop seeding time period, to simply cover crop adoption cover crop seeding programs could be developed at the SWCD, County Conservation Board, or local farm cooperatives. Seeding programs have been established in Allamakee and Sac Soil and Water Conservation Districts, these programs have resulted in a simplified process for farmers and expanded cover crop adoption.
- **Local Cover Crop Seed Production**. Access to, and cost of cover crops seed will likely become problematic as acceptance of cover crops increases in Iowa and the Upper Mississippi Basin. A solution to this problem is to promote local production of cover crop seed, such as cereal rye. Typical yield of rye is 30-50 bushels per acre, at seeding rate of 1.5 bushels per acre every acre of rye grown for seed can plant cover crops on 20-33 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.
- **Property or Income Tax Deductions**. Currently, some income tax deductions are available to landowners implementing soil and water conservation programs, more details can be found in the publication Implications of Soil and Water Conservation Programs. Additional local property tax deductions could be developed that promote the adoption of cover crops.
- **Conservation Addendum to Agricultural Leases.** More than half of Iowa's farmland is cash rented or crop shared, this increasing 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 are on the same page in terms of conservation. Addendums could include just about 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 Beaver Creek watershed.
- **Conservation Easement Programs**. Land easements have proven successful in preservation conservation and recreation land in Iowa (e.g. Iowa Natural Heritage Foundation, Wetland Reserve Enhancement Program, others). Some landowners may be interested in protecting sensitive land for extended periods of time or into perpetuity, for these landowners long-term conservation easements may be a good fit.
- **Non-Traditional Watershed Partners**. Traditional watershed partners (e.g. IDALS, DNR, SWCD, and NRCS) likely will not have the financial resources to fully implement this plan, local project partners should seek non-traditional partners to assist with project promotion. Involvement could be in the form of cash or in-kind donations.
- **Nutrient or Flood Reduction Trading.** Trading programs are market-based programs involving the exchange of pollutant allocations between sources. The most common form of trading

occurs when trading nutrient credits between point and non-point sources. Trading programs could be established to trade nutrient or flood impact credits.

- **Recreational Leases**. Recreation leases, such as hunting leases, may be promoted as a tool to increase landowner revenue generated from conservation lands, 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 strip-till bar or cover crop drill, and then rent the equipment to interested farmers.
- **Reverse Auctions.** Reverse auctions or pay for performance programs can be a cost-effective way to allocation conservation funding. In some watersheds were reverse auctions have been used the environmental benefits per dollar spent have been significantly more efficient than traditional programs such as the 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 environment benefits and the organizer (e.g. SWCD) begins providing funds to the most efficient bids (environmental benefit per dollar).
- **Watershed Organization.** Often the most successful watershed projects are those that are led by formalized watershed organizations. Groups can be formed via a non-profit organization, 28E intergovernmental agreement, Watershed Management Authority, or other agreement or organization. Most watershed project have significant partner involvement, each with an existing mission or goal, creating a watershed organization with a mission to improve land and water quality in Beaver Creek may prove to be more successful than existing groups working together without formal organization.
- **Land CSR Increases.** Land values in Iowa are often based on the Corn Suitability Rating (CSR), increasing the CSR by increasing the quality of the soil may be a selling point for conservation practices such as cover crops and no-till or strip-till. The new method for determining CSR has been developed (CSR2) and allows for site specific conditions that might occur with intense conservation practice adoption. Cover crops have been shown to increase soil organic matter and water holding capacity, both have the potential to increase CSR2 input variables.
- **Sub-Field Profit Analysis.** Farmers understand some locations within a field produce higher yields and profits, understanding long-term profitability within fields may be an important selling point for conservation. Private companies in Iowa (e.g. Praxik) are developing tools to analyze profitability within crop fields. Incorporating profitability into conservation could result in higher profit margins and increased conservation opportunities on land resulting is lost revenue.

12 ROLES AND RESPONSIBILITIES

Role	Responsibility
Upper Cedar Watershed Management Authority	Support the Beaver Creek watershed project by seeking funding to continue implementation of this watershed plan.
Farmers	Engage with watershed plan implementation, farm, field and subfield evaluation, conservation practice implementation, and knowledge sharing.
Landowners	Engagement with tenants on conservation practices, incorporation of conservation addendums to lease agreements, conservation practice implementation.
Absentee Landowners	Engagement with tenants on conservation practices, incorporation of conservation addendums to lease agreements, conservation practice implementation.
Natural Resources Conservation Service District Conservationist	Provide conservation practice design and engineering services, project partnership, house project staff, provide computer and office space.
Soil and Water Conservation District Commissioners	Provide project leadership, participate in project meetings and events, hire staff, advocate for project goals, promote project locally and regionally.
County Conservation Board, Director, and Staff	Project partnership, easement management, public education, and water monitoring support.
Department of Natural Resources	In-stream monitoring of biological community (fish), project partnership, and technical advice.
Iowa Department of Agriculture and Land Stewardship	Provide technical support to project via a regional coordinator, provide the opportunity to receive state funding for soil and water conservation, and provide a contact for the Iowa CREP program.
County Supervisors	Engage with project to determine mutual benefits.
Agri-Business	Engage project partners, promote project goals to members and/or customers.
Commodity Groups	Engage project partners, promote project goals to members and/or customers, provide agronomic and environmental services when appropriate.
Conservation Groups	Engage project partners, provide habitat-planning services, and promote practices that have a habitat and water quality benefit.
Media	Develop and distribute news stories related to project activities and/or goals, attend project events.

Appendix A

Glossary of Terms and Acronyms

GLOSSARY OF TERMS AND ACRONYMS

303(d) list: Refers to section 303(d) of the Federal Clean Water Act, which requires a listing of all public surface water bodies (creeks, rivers, wetlands, and lakes) that do not support their general and/or designated uses. Also called the state's "Impaired Waters List."

305(b) assessment: Refers to section 305(b) of the Federal Clean Water Act, it is a comprehensive assessment of the state's public water bodies ability to support their general and designated uses. Those bodies of water which are found to be not supporting or just partially supporting their uses are placed on the 303(d) list.

319: Refers to Section 319 of the Federal Clean Water Act, the Nonpoint Source Management Program. Under this amendment, States receive grant money from EPA to provide technical & financial assistance, education, & monitoring to implement local nonpoint source water quality projects.

AFO: Animal Feeding Operation. A livestock operation, either open or confined, where animals are kept in small areas (unlike pastures) allowing manure and feed become concentrated.

Base flow: The fraction of discharge (flow) in a river which comes from ground water.

Benthic: Of or relating to or happening on the bottom under a body of water

BMIBI: Benthic Macroinvertebrate Index of Biotic Integrity. An index-based scoring method for assessing the biological health of streams and rivers (scale of 0-100) based on characteristics of bottom-dwelling invertebrates.

BMP: Best Management Practice. A general term for any structural or upland soil or water conservation practice. For example terraces, grass waterways, sediment retention ponds, reduced tillage systems, etc.

CAFO: Confinement Animal Feeding Operation. An animal feeding operation in which livestock are confined and totally covered by a roof, and not allowed to discharge manure to a water of the state.

Designated use(s): Refer to the type of economic, social, or ecologic activities that a

specific water body is intended to support. See Appendix B for a description of all general and designated uses.

DNR (or IDNR): Iowa Department of Natural Resources.

Ecoregion: A system used to classify geographic areas based on similar physical characteristics such as soils and geologic material, terrain, and drainage features.

EPA (or USEPA): United States Environmental Protection Agency.

FIBI: Fish Index of Biotic Integrity. An index-based scoring method for assessing the biological health of streams and rivers (scale of 0-100) based on characteristics of fish species.

FSA: Farm Service Agency (United States Department of Agriculture). Federal agency responsible for implementing farm policy, commodity, and conservation programs.

General use(s): Refer to narrative water quality criteria that all public water bodies must meet to satisfy public needs and expectations. See Appendix B for a description of all general and designated uses.

GIS: Geographic Information System(s). A collection of map-based data and tools for creating, managing, and analyzing spatial information.

Gully erosion: Soil movement (loss) that occurs in defined upland channels and ravines that are typically too wide and deep to fill in with traditional tillage methods.

HEL: Highly Erodible Land. Defined by the USDA Natural Resources Conservation Service (NRCS), it is land which has the potential for long term annual soil losses to exceed the tolerable amount by eight times for a given agricultural field.

Integrated report: Refers to a comprehensive document which combines the 305(b) assessment with the 303(d) list, as well as narratives and discussion of overall water quality trends in the state's public water bodies. The Iowa Department of Natural Resources submits an integrated report to the EPA biennially in even numbered years.

LA: Load Allocation. The fraction of the total pollutant load of a water body which is assigned to all combined *nonpoint sources* in a watershed. (The total pollutant load is the sum of the waste load and

load allocations.)

Load: The total amount (mass) of a particular pollutant in a waterbody.

MOS: Margin of Safety. In a total maximum daily load (TMDL) report, it is a set-aside amount of a pollutant load to allow for any uncertainties in the data or modeling.

Nonpoint source pollution: A collective term for contaminants which originate from a diffuse source.

NPDES: National Pollution Discharge Elimination System, which allows a facility (e.g. an industry, or a wastewater treatment plant) to discharge to a water of the United States under regulated conditions.

NRCS: Natural Resources Conservation Service (United States Department of Agriculture). Federal agency which provides technical assistance for the conservation and enhancement of natural resources.

Phytoplankton: Collective term for all self-feeding (photosynthetic) organisms which provide the basis for the aquatic food chain. Includes many types of algae and cyanobacteria.

Point source pollution: A collective term for contaminants which originate from a specific point, such as an outfall pipe. Point sources are generally regulated by an NPDES permit.

PPB: Parts per Billion. A measure of concentration which is the same as micrograms per liter (µg/l).

PPM: Parts per Million. A measure of concentration which is the same as milligrams per liter (mg/l).

Riparian: Refers to site conditions that occur near water, including specific physical, chemical, and biological characteristics that differ from upland (dry) sites.

RUSLE: Revised Universal Soil Loss Equation. An empirical model for estimating long term, average annual soil losses due to sheet and rill erosion.

Secchi disk: A device used to measure transparency in water bodies. The greater

	the secchi depth (measured in meters), the more transparent the water.
Sediment delivery ratio:	A value, expressed as a percent, which is used to describe the fraction of gross soil erosion which actually reaches a water body of concern.
Seston:	All particulate matter (organic and inorganic) in the water column.
Sheet & rill erosion	Soil loss which occurs diffusely over large, generally flat areas of land.
SI:	Stressor Identification. A process by which the specific cause(s) of a biological impairment to a water body can be determined from cause-and-effect relationships.
Storm flow (or stormwater):	The fraction of discharge (flow) in a river which arrived as surface runoff directly caused by a precipitation event. *Storm water* generally refers to runoff which is routed through some artificial channel or structure, often in urban areas.
STP:	Sewage Treatment Plant. General term for a facility that processes municipal sewage into effluent suitable for release to public waters.
SWCD:	Soil and Water Conservation District. Agency which provides local assistance for soil conservation and water quality project implementation, with support from the Iowa Department of Agriculture and Land Stewardship.
TMDL:	Total Maximum Daily Load. As required by the Federal Clean Water Act, a comprehensive analysis and quantification of the maximum amount of a particular pollutant that a water body can tolerate while still meeting its general and designated uses.
TSI (or Carlson's TSI):	Trophic State Index. A standardized scoring system (scale of 0-100) used to characterize the amount of algal biomass in a lake or wetland.
TSS:	Total Suspended Solids. The quantitative measure of seston, all materials, organic and inorganic, which are held in the water column.
Turbidity:	The degree of cloudiness or murkiness of water caused by suspended particles.
UAA:	Use Attainability Analysis. A protocol used to determine which (if any) designated uses apply to a particular water body. (See Appendix B for a description of all general and designated uses.)

UHL: University Hygienic Laboratory (University of Iowa). Provides physical, biological, and chemical sampling for water quality purposes in support of beach monitoring and impaired water assessments.

USGS: United States Geologic Survey (United States Department of the Interior). Federal agency responsible for implementation and maintenance of discharge (flow) gauging stations on the nation's water bodies.

Watershed: The land (measured in units of surface area) which drains water to a particular body of water or outlet.

WLA: Waste Load Allocation. The fraction of waterbody loading capacity assigned to point sources in a watershed. Alternatively, the allowable pollutant load that an NPDES permitted facility may discharge without exceeding water quality standards.

WQS: Water Quality Standards. Defined in Chapter 61 of Environmental Protection Commission [567] of the Iowa Administrative Code, they are the specific criteria by which water quality is gauged in Iowa.

WWTP: Waste Water Treatment Plant. General term for a facility which processes municipal, industrial, or agricultural waste into effluent suitable for release to public waters or land application.

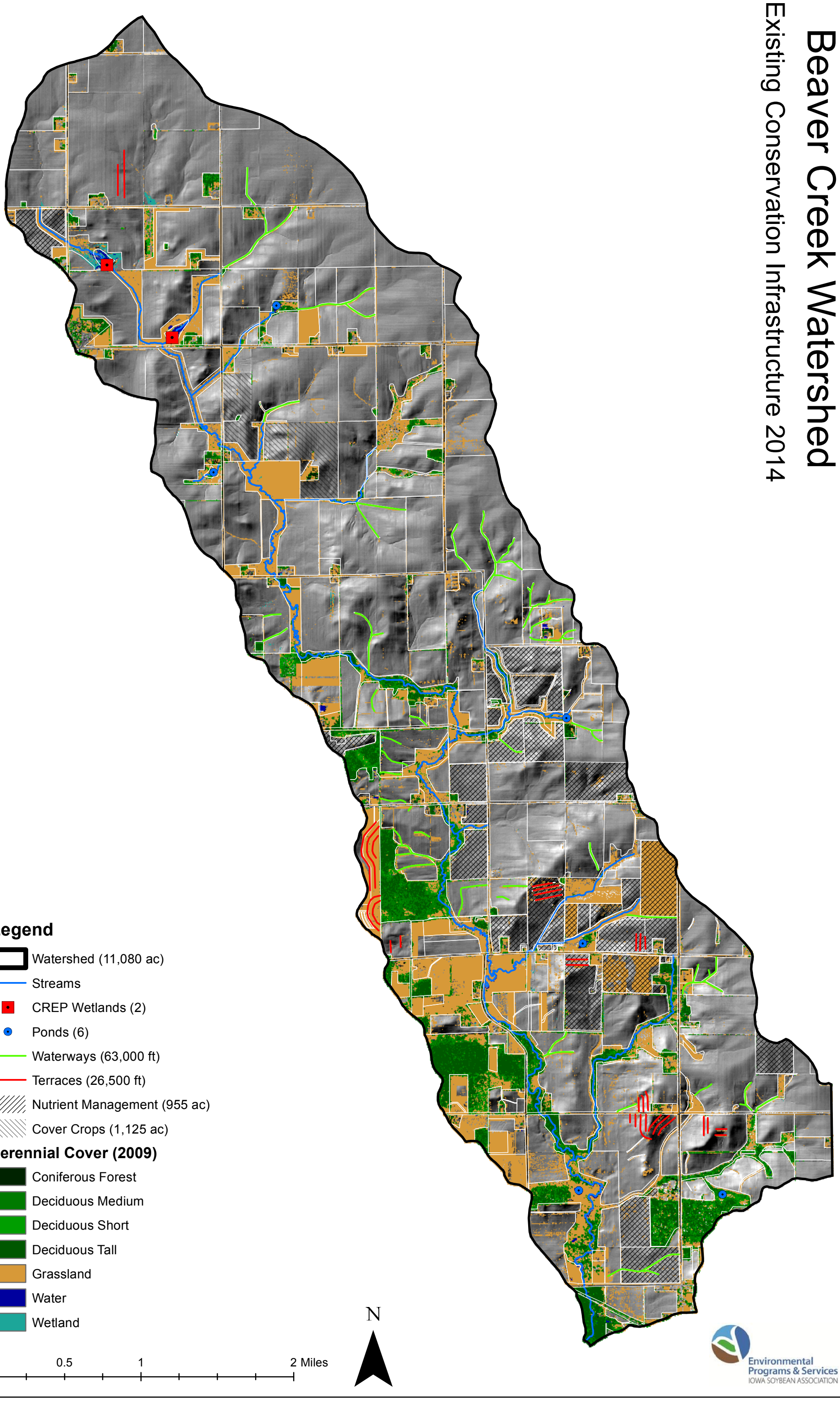
Zooplankton: Collective term for all animal plankton which serve as secondary producers in the aquatic food chain and the primary food source for larger aquatic organisms.

Appendix B

Existing Conservation Practices

Beaver Creek Watershed

Existing Conservation Infrastructure 2014

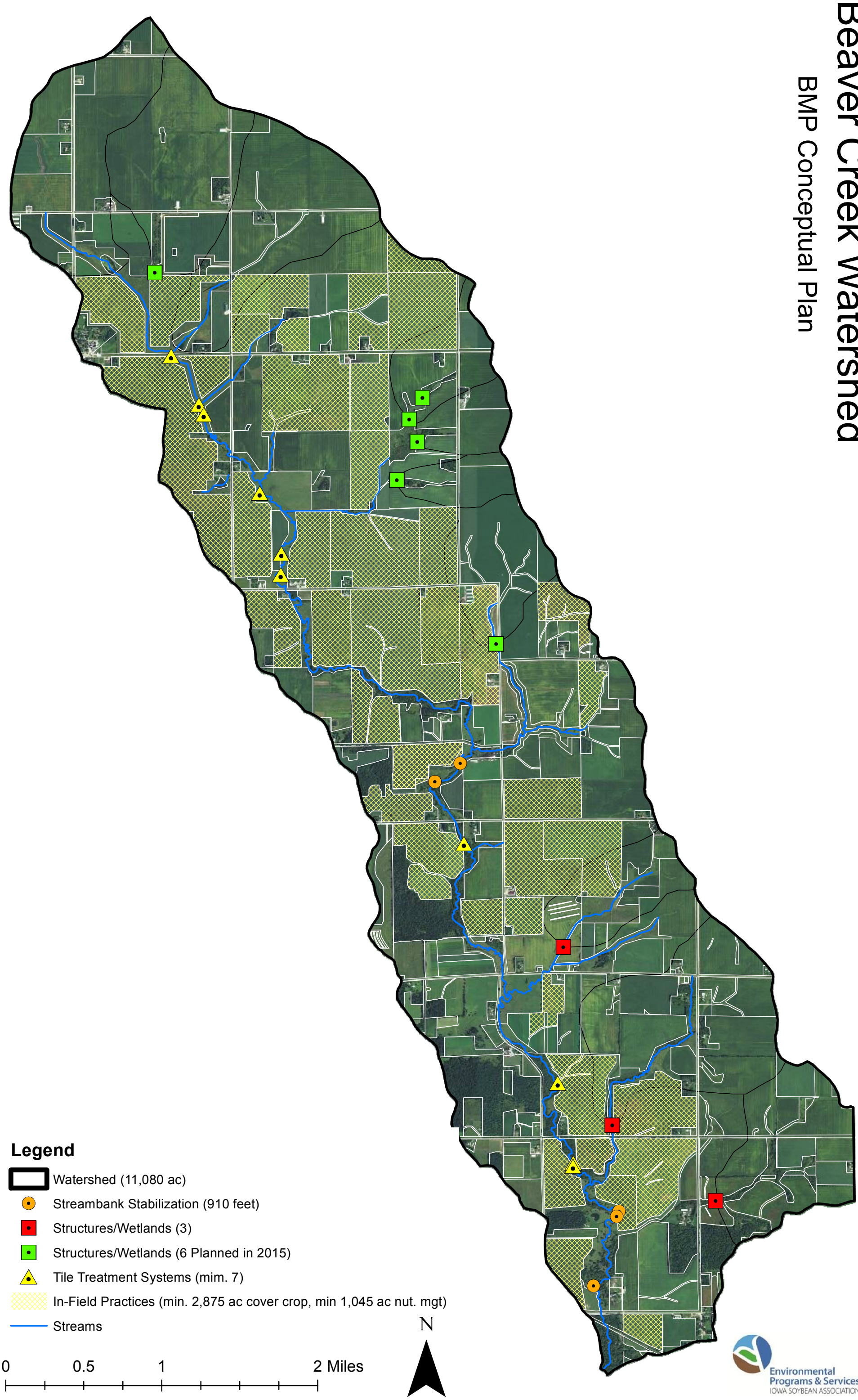


Appendix C

Conceptual Plan

Beaver Creek Watershed

BMP Conceptual Plan



Legend

- Watershed (11,080 ac)
- Streambank Stabilization (910 feet)
- Structures/Wetlands (3)
- Structures/Wetlands (6 Planned in 2015)
- Tile Treatment Systems (mim. 7)
- In-Field Practices (min. 2,875 ac cover crop, min 1,045 ac nut. mgt)
- Streams

0 0.5 1 2 Miles

N

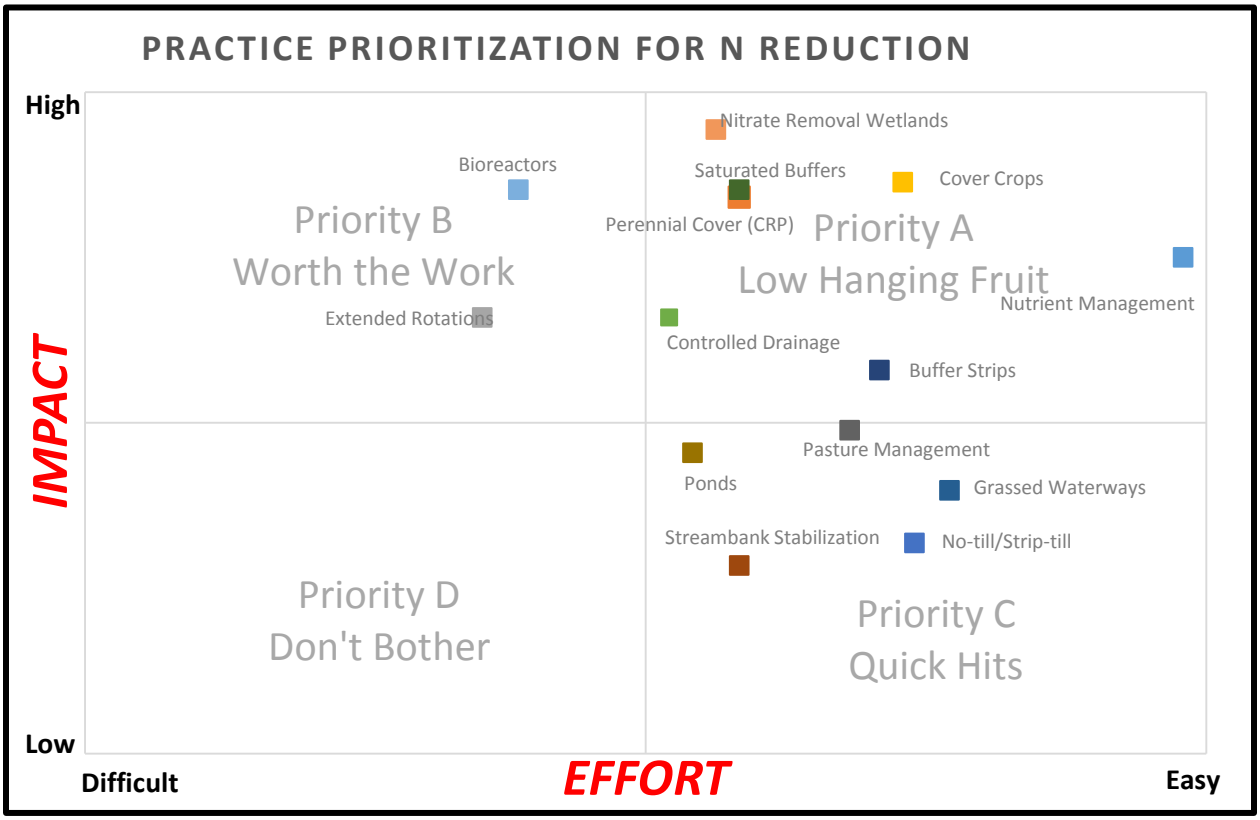
Environmental Programs & Services
IOWA SOYBEAN ASSOCIATION

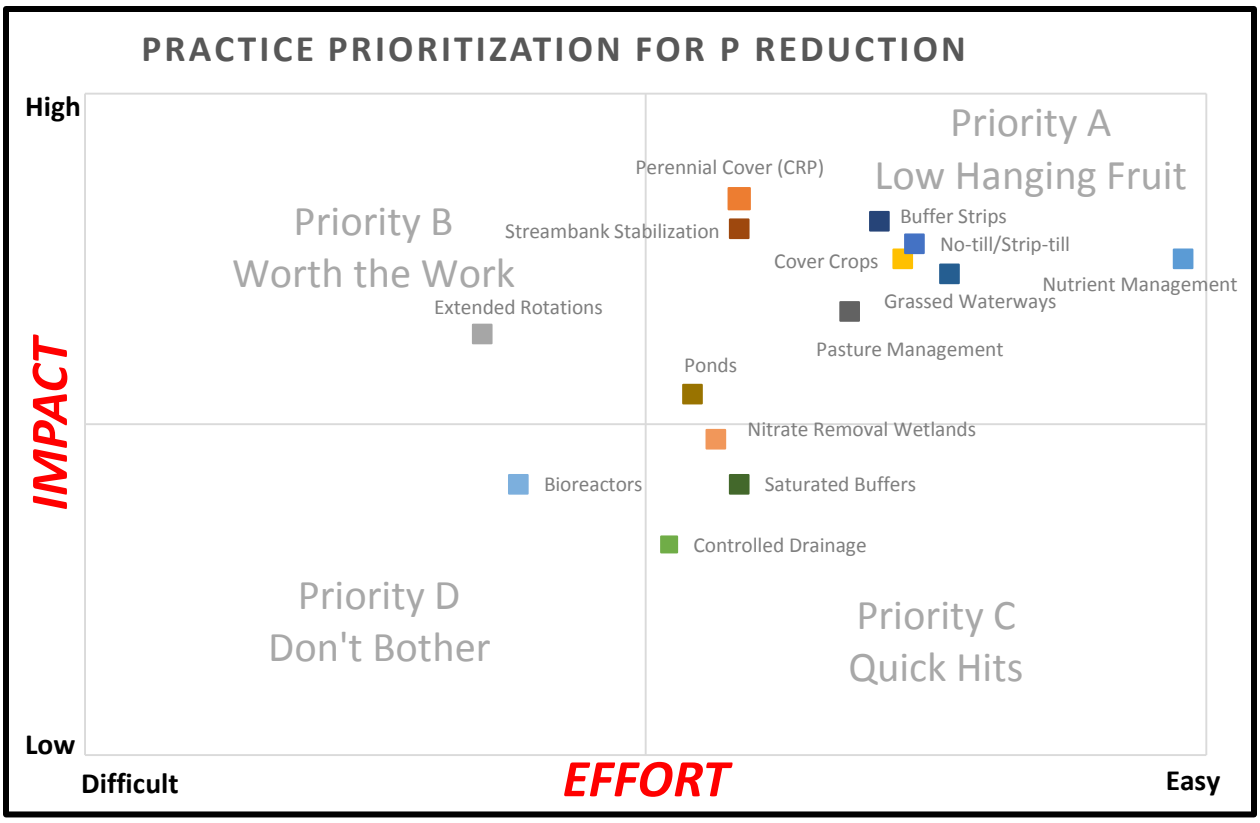
Appendix D

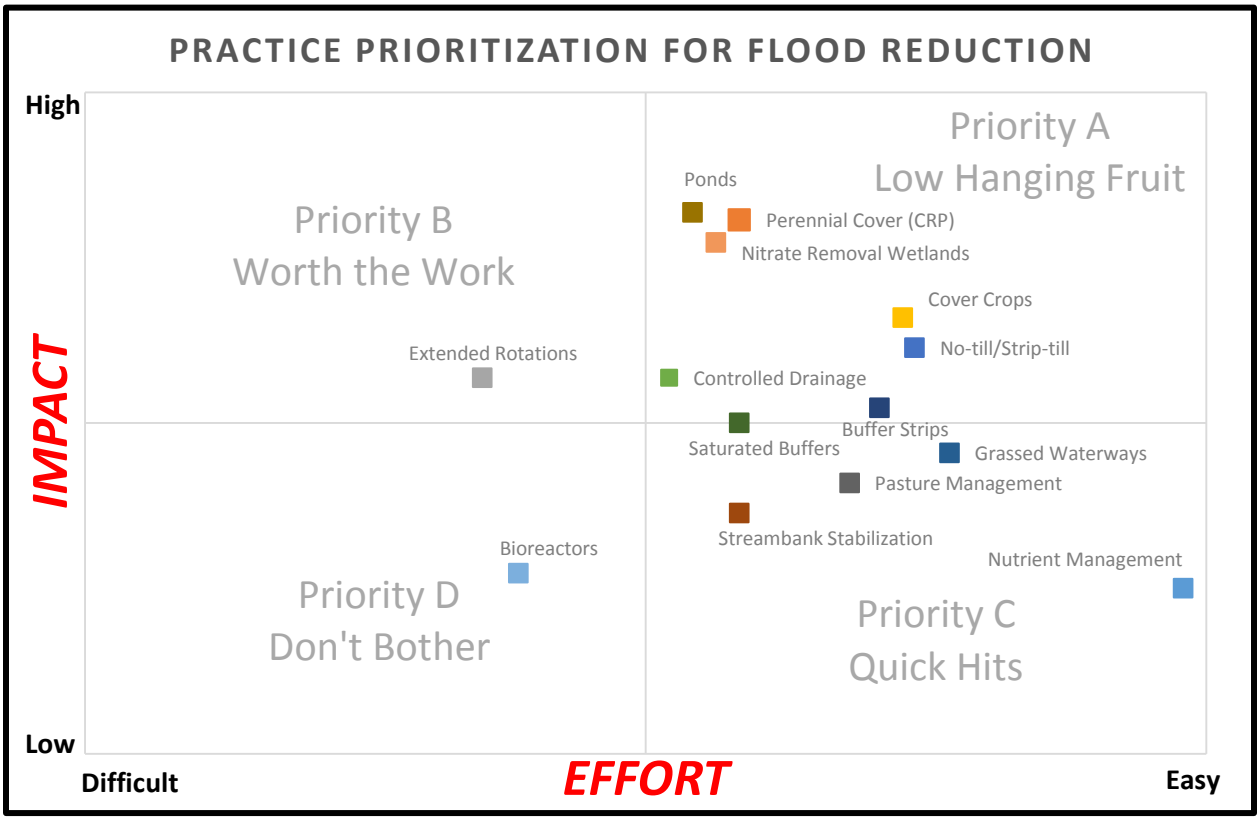
Impact vs Effort Report

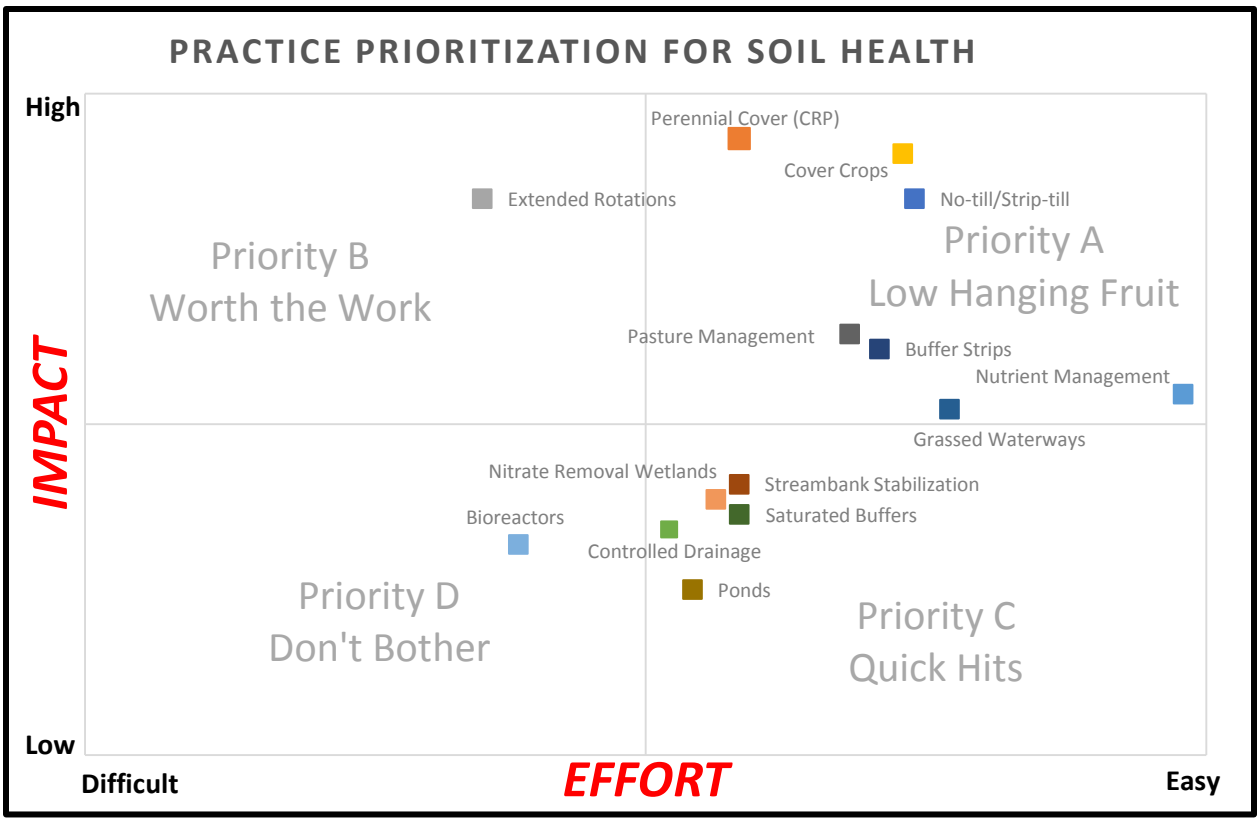
Impact/Effort Conservation Practice Matrix

The Impact/Effort Matrix was an exercise used during the Beaver Creek watershed planning process to help watershed stakeholder determine which conservation practices should be the focus of the watershed plan. The impact/effort exercise was lead by staff from the Iowa Soybean Association. Farmer and landowner participants were asked to rate the "effort" they thought it would take to accomplish an action, such as install a pond. The "effort" included all components of installation, including time, lost productivity, cost, maintenance, etc. Water quality experts for the Iowa Flood Center, Iowa DNR, NRCS, SWCD and other groups then rated each practice's impact relative to each goal included in the Beaver Creek Watershed Plan, the higher the impact score the more benefit that practice provides. A matrix has been developed for each goal showing conservation practice's scores for both effort and impact. The matrices were used to identify practices most suited for the best management practice implementation scenario. Practices in the "Priority A" category are those that will make the most difference for the least amount of effort. Practices in "Priority B" provide benefit but the effort is greater. Practices in "Priority C" provide little benefit but may be easily implemented. Practices in "Priority D" should not be implemented relative that that particular goal, these practices are difficult and provide little benefit.




PRACTICE PRIORITIZATION FOR P REDUCTION
High
IMPACT
Low
Difficult
EFFORT
Easy
Priority A
Low Hanging Fruit
Priority B
Worth the Work
Priority C
Quick Hits
Priority D
Don't Bother
Perennial Cover (CRP)
Streambank Stabilization
Buffer Strips
No-till/Strip-till
Cover Crops
Nutrient Management
Grassed Waterways
Extended Rotations
Pasture Management
Ponds
Nitrate Removal Wetlands
Bioreactors
Saturated Buffers
Controlled Drainage


PRACTICE PRIORITIZATION FOR FLOOD REDUCTION
High
IMPACT
Low
Difficult
EFFORT
Easy
Priority A
Low Hanging Fruit
Priority B
Worth the Work
Priority C
Quick Hits
Priority D
Don't Bother
Ponds
Perennial Cover (CRP)
Nitrate Removal Wetlands
Cover Crops
No-till/Strip-till
Extended Rotations
Controlled Drainage
Buffer Strips
Saturated Buffers
Grassed Waterways
Pasture Management
Streambank Stabilization
Nutrient Management
Bioreactors


PRACTICE PRIORITIZATION FOR SOIL HEALTH
High
IMPACT
Low
Difficult
EFFORT
Easy
Perennial Cover (CRP)
Cover Crops
Extended Rotations
No-till/Strip-till
Priority B
Worth the Work
Priority A
Low Hanging Fruit
Pasture Management
Buffer Strips
Nutrient Management
Grassed Waterways
Nitrate Removal Wetlands
Streambank Stabilization
Saturated Buffers
Bioreactors
Controlled Drainage
Ponds
Priority D
Don't Bother
Priority C
Quick Hits

Appendix E

Potential Funding Sources

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-DSC
No-Interest Loans	State administered loans to landowners for permanent soil conservation practices	IDALS-DSC
District Buffer Initiatives	Funds for SWCDs to initiate, stimulate and incentivize signup of USDA programs, specifically buffers	IDALS-DSC
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-DSC
Conservation Reserve Enhancement Program	Levering USDA funds to establish nitrate removal wetlands in north central Iowa with no cost to landowner	IDALS-DSC
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	IDALS-DSC
Soil and Water Enhancement Account - REAP Water Quality Improvement Projects	Tree planting, native grasses, forestry, buffers, streambank stabilization, traditional erosion control practices, livestock waste management, ag drainage well closure, urban stormwater	IDALS-DSC
State Revolving Loans	Low interest loans provided by SWCDs to landowners for permanent water quality improvement practices; subset of DNR program	IDALS-DSC
Watershed Improvement Fund	Local watershed improvement grants to enhance water quality for beneficial uses, including economic development	IDALS-DSC
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, 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 no-ag uses. Requires 50 percent match	USDA-NRCS
Cooperative Conservation Partnership Programs	Conservation partnerships that focus technical and financial resources on conservation priorities in watersheds and airsheds of special significance	USDA-NRCS
Conservation Security Program	Green payment approach for maintaining and increasing conservation practices	USDA-NRCS
Conservation Innovation Grants	National and state grants for innovative solutions to a variety of environmental challenges	USDA-NRCS
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	DNR/Iowa Finance Authority

	lakes.	
Resource Enhancement and Protection Program	Provides funding for enhancement and protection of State's natural and cultural resources	DNR
Streambank Stabilization and Habitat Improvement	Penalties from fish kills used for environmental improvement on streams impacted by the kill	DNR/IDALS-DSC
State Revolving Fund	Provides low interest loans to municipalities for waste water and water supply; expanding to private septics, livestock, stromwater, and NPS pollutants	DNR
Watershed Improvement Review Board	The Watershed Improvement Review Board (WIRB) was established in 2005 by the Iowa Legislature to provide grants to watershed and water quality projects. The Board is comprised of representatives from agriculture, drinking water and wastewater utilities, environmental organizations, agribusiness, the conservation community along with two state senators and two state representatives.	WIRB
Iowa Water Quality Initiative	Initiated by IDALS-DSC as a demonstration and implementation program for the Nutrient Reduction Strategy. Funds are targeted to 9 priority HUC-8 watersheds.	IDALS-DSC
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."	U.S Fish and Wildlife Service and others

Private Funding Sources (Not Inclusive)

Program	**Description**	**Website**
International Plant Nutrition Institute	The International Plant Nutrition Institute (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	http://www.inhf.org

	refresh – to keep Iowa healthy and vibrant.	
McKnight Foundation - Mississippi River Program	Program goal is to restore the water quality and resilience of the Mississippi River.	www.mcknight.org/grant-programs/mississippi-river
National Fish and Wildlife Foundation	NFWF provides funding on a competitive basis to projects that sustain, restore, and enhance our nation's fish, wildlife, and plants and their habitats.	www.nfwf.org
National Wildlife Foundation	Works to protect and restore resources and the beneficial functions they offer.	www.nwf.org
The Fertilizer Institute	TFI 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	The Nature Conservancy is the largest freshwater conservation organization in the world – operating in 35 countries with more than 300 freshwater scientists and 500 freshwater conservation sites globally. TNC works with businesses, governments, partners and communities to change how water is managed around the world.	http://www.nature.org
Trees Forever - Working Watersheds Program	Annually work with 10-15 projects in Iowa that emphasize water quality through our Working Watersheds: Buffers and Beyond program	www.treesforever.org/
Walton Family Foundation - Environmental Program	Work to achieve lasting change by creating new and unexpected partnerships among conservation, business and community interests to build durable solutions to big problems.	www.waltonfamilyfoundation.org/environment

Appendix F

Watershed Project Self-Evaluation

WATERSHED 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 which represents most interests in the watershed.					
Watershed partners represent a broad and diverse membership which represents 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 have 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) that are relevant to the project. Identification of SWOTs is important as they can help shape successful watershed plan implementation.

Strengths	**Opportunities**
Weaknesses	**Threats**