Mud, Camp, and Spring Creek Watershed Management Plan

April 2016

SNYDER & ASSOCIATES
Engineers and Planners

Polk Soil & Water
CONSERVATION DISTRICT

RDG
PLANNING • DESIGN

Acknowledgements

The MCSCWMA would like to take the time to recognize the following individuals and organizations for their support:

Name	Organization
Jon Hanson	City of Altoona
Karen Oppelt	City of Altoona
Roy McCleary	City of Bondurant Planning and Zoning
Wayne Patterson	City of Mitchellville
Loren Lown	City of Pleasant Hill Parks & Recreation
James Martin	Iowa Department of Agriculture and Land Stewardship (IDALS)
Kyle Ament	Iowa Department of Natural Resources (IDNR)
Sheila Navis	Iowa Heartland Resource Conservation & Development
Chip Classon	Jerry's Homes
Teva Dawson	Metropolitan Planning Organization
Reo Menning	Metro Waste Authority
Rich Leopold	Polk County Conservation Board
Mike Fairchild	Polk County Planning and Zoning
Robert Rice	Polk County Public Works
Russell Wilkins	Property Owner
Mike Ugulini	Property Owner and Local Farm Bureau Representative
Sue Ugulini	Property Owner
Gary Haines	SE Polk Schools
Joe Riding	Terrace Hills Golf Course
Mark Tomer	USDA – Agricultural Research Service (ARS)
Sarah Porter	USDA – Agricultural Research Service (ARS)
David James	USDA – Agricultural Research Service (ARS)
Paul Miller	USDA – Natural Resources Conservation Service (NRCS)

Table of Contents

Executive Summary 1
1. Introduction 3
1.1 Watershed Management Authority 3
2. Watershed Characteristics 8
2.1 Watershed Data 8
2.2 Topography 16
2.3 Land Use 20
2.4 Soils 27
2.5 Hydrogeology 31
2.6 Rainfall 35
2.7 Streamflow Gage Data 37
2.8 Designated Use Classifications 39
3. Pollutants 40
3.1 Monitoring 40
3.2 Sources 41
3.3.1 Priority Pollutants 41
3.3.2 Secondary Pollutants 42
3.3 Expected Reduction 42
4. Stream Assessment 43
5. Stakeholder & Public Involvement 47
6. Implementation Plan 48
6.1 Goal 1: Develop consistent policies for storm water and flood management, water quality improvement, and a well balanced mix of land uses 48
6.1.1 Objective 1: Identify land uses within the watersheds 48
6.1.1.1 Task 1: Assign a responsible party or parties to identify land uses 49
6.1.1.2 Task 2: Meet with city and county planning staff for land use policy review on an annual basis. 49
6.1.2 Objective 2: Use the comprehensive plans of the communities and the county as a tool to guide and support the watershed management plan. 49
6.1.2.1 Task 1: Assign a responsible party or parties to review and compile information from each community's comprehensive plan. 49
6.1.2.2 Task 2: Use information from the comprehensive plans to help create development standards 50

6.1.2.3 Task 3: Meet with city and county planning staff for comprehensive plan review on an annual basis. 50
6.1.3 Objective 3: Encourage commercial, industrial, agricultural, and residential development that promotes open space and habitat protection through site design and which fits within the character of the development's proposed location. 50
6.1.3.1 Task 1A: Promote stormwater management requirements. 50
6.1.3.2 Task 1B: Require infiltration of water quality volume. 50
6.1.3.3 Task 1C: Require extended detention of channel protection volume. 51
6.1.3.4 Task 2: Promote construction of regional detention basins. 51
6.1.3.5 Task 3: Develop and promote consistent standards for development. 51
6.1.3.6 Task 4: Promote prairie pothole preservation during development. 51
6.1.3.7 Task 5: Adopt unified sizing criteria. 52
6.1.4 Objective 4: Adopt unified philosophy which would keep floodways, flood plains, and steep slopes free from development or production while integrating into green infrastructure approaches for storm water and flood management. 53
6.1.4.1 Task 1: Develop and promote consistent implementation of regional guidelines and standards. 53
6.1.4.2 Task 2: Develop an incentives program for installing/retrofitting green street infrastructure. 53
6.1.5 Objective 5: Develop conservation design guidelines and provide a "checklist" for Planning and Zoning Commissioners to use when approving developments. 53
6.1.5.1 Task 1: Create and implement a smart growth checklist. 54
6.1.5.2 Task 2: Review outcomes from Objectives 3 and 4 to help refine the checklist.54
6.2 Goal 2: Increase community awareness, support, and involvement in the Watershed Plan and its implementation. 54
6.2.1 Objective 1: Generate opportunities for citizen participation. Foster public support for storm water management practices. 54
6.2.1.1 Task 1: Develop a website and engage the schools in the watershed. 55
6.2.1.2 Task 2: Launch and maintain a stream cleanup. 55
6.2.2 Objective 2: Develop and promote educational programs to reach key stakeholders and the general public. 55
6.2.2.1 Task 1: Conduct and promote several types of educational programs. 55
6.2.2.2 Task 1A: Implementation – Work Sessions 56
6.2.2.3 Task 1B: Implementation – Field Days 56
6.2.2.4 Task 1C: Implementation – Speaker Series 56

6.2.2.5 Task 1D: Implementation – "Speed Dating" Sessions 56
6.2.2.6 Task 1E: Implementation – Current Staff Utilization 56
6.2.2.7 Task 1F: Implementation – Local Media/TV 56
6.2.2.8 Task 1G: Implementation – Panel of Experts 57
6.2.2.9 Task 1H: Implementation – Direct Mail Campaign 57
6.2.2.10 Task 1I: Implementation – Informational Meetings 57
6.2.2.11 Task 1J: Implementation – Focus Groups 57
6.2.2.12 Task 1K: Implementation – Agricultural Retail Outreach 57
6.2.2.13 Task 1L: Implementation – Surveys 57
6.2.2.14 Task 1M: Implementation – Workshops 57
6.2.2.15 Task 1N: Implementation – On Farm Learning Network 57
6.2.2.16 Task 1O: Implementation – SWCD Awards 58
6.2.2.17 Task 1P: Implementation – State Fair WMA Day 58
6.2.2.18 Task 2: Designate Outdoor Teaching Facilities. 58
6.2.3 Objective 3: Support and coordinate community outreach programs and events that encourage private stewardship of land and water resources. 58
6.2.3.1 Task 1: Assign a responsible party or parties to identify community outreach programs. 58
6.2.3.2 Task 2: Seek additional partnerships to support community outreach programs. 59
6.2.4 Objective 4: Support programs that encourage conservation practices, especially in agricultural areas. 59
6.2.4.1 Task 1: Identify funding needs to support conservation practices. 59
6.2.4.2 Task 1A: Pooled Resources 59
6.2.4.3 Task 1B: Legislative Funding 60
6.2.4.4 Task 1C: Grants 60
6.2.4.5 Task 2: Develop a conservation practice incentives program. 60
6.2.4.6 Tasks 2A, 2B, and 2C: Cover Crops, Grassed Waterways, Stream Buffers .. 60
6.2.4.7 Tasks 2D and 2E: Strip Tillage and No Tillage 62
6.2.4.8 Task 2F: Edge of Field/Tile Treatments 62
6.2.5 Objective 5: Recognize and showcase the efforts of landowners, farm operators, developers, individuals, businesses, and other who demonstrate leadership and make a commitment to land and water conservation stewardship in the watershed. 63
6.2.5.1 Task 1: Develop and implement an award/recognition program. 63
6.2.5.2 Task 2: Develop an incentives program for conservation practices 64

6.2.5.3 Task 3: Develop BMP Database/Documentation. 64
6.3 Goal 3: Maintain, preserve, and enhance natural resources character and function for habitat, recreation, and quality of life. 64
6.3.1 Objective 1: Provide incentives and options to landowners to retain contiguous natural areas, open spaces, and agricultural areas. 64
6.3.1.1 Task 1: Convene with agricultural partners to assess current incentives and determine future enhancements 64
6.3.1.2 Task 2: Develop partnership board with organizations to conduct assessments and gain support from the communities. 65
6.3.2 Objective 2: Promote conservation of open space lands not only for their economic importance, but also to retain a key measure of the area's scenic views and cultural areas 65
6.3.2.1 Task 1: Assign a responsible party or parties to identify areas in the watersheds that are likely for easement/buy-out. 65
6.3.2.2 Task 2: Review the watershed assessment work that has already been completed for identifying possible conservation open space areas. 65
6.3.3 Objective 3: Promote thoughtful consideration of land use planning to preserve rural character and encourage green infrastructure. 66
6.3.3.1 Task 1: Determine policy modifications or additions for potential broad-based adoption. 66
6.3.3.2 Task 2: Address developer ownership and the impact on future soil and water health. 66
6.3.3.3 Task 3: Establish a Natural Resources Overlay District 66
6.3.4 Objective 4: Develop and preserve open space areas to serve as buffers and habitat protection 67
6.3.4.1 Task 1: Identify sites and determine minimum buffer and/or setback limits unique to each site 67
6.3.4.2 Task 2: Assign a responsible party or parties to determine if conservation easements are needed for future protection. 67
6.3.5 Objective 5: Utilize recreational opportunities as a means to promote conservation and greenway preservation/adoption throughout the watersheds. 67
6.3.5.1 Task 1: Improve the understanding of current and potential recreation opportunities in the watersheds 68
6.3.5.2 Task 2: Establish Main Channel Greenway Network. 68
6.3.5.3 Task 3: Establish Tributary Greenway Network. 68
6.3.5.4 Task 4: Promote stream corridors. 69
6.4 Goal 4: Identify and address soil and water issues to improve flood management and water quality. 69

6.4.1 Objective 1: Establish water quality monitoring programs to identify water quality issues. 69
6.4.1.1 Task 1: Review Polk County Conservation Board's monitoring plan. 73
6.4.1.2 Task 2: Partner with PCCB, DNR, and Polk SWCD to identify sites and protocols. 73
6.4.1.3 Task 3: Conduct Habitat Assessment Methodology. 73
6.4.1.4 Task 3A: Conduct Annual Biological Assessments. 73
6.4.1.5 Task 4: Compile past information from Camp Creek projects, Metro Waste Authority, and monitoring data. 73
6.4.1.6 Task 5: Identify funding alternatives to conduct additional water quality monitoring. 74
6.4.2 Objective 2: Develop strategies to improve water quality. 74
6.4.2.1 Task 1: Modify approaches based on monitoring data. 74
6.4.2.2 Task 2: Emphasize constituent reduction. 74
6.4.2.3 Task 3: Emphasize secondary constituent reduction. 74
6.4.2.4 Task 4A: Identify bacteria sources related to septic systems. 75
6.4.2.5 Task 4B: Mitigate bacteria sources related to agricultural and rural lands. 76
6.4.2.6 Task 5: Develop a wetland mitigation bank. 76
6.4.2.7 Task 6: Promote native prairie plantings. 77
6.4.2.8 Task 7A: Implement a streambank restoration program for Mud, Camp, and Spring Creeks. 77
6.4.2.9 Task 7B: Implement a streambank restoration program for the tributaries. 78
6.4.2.10 Promote consistent implementation of water quality improvement strategies. 80
6.4.3 Objective 3: Develop water quality and quantity models in order to establish areas of potential flooding concern and develop strategies to improve flood management in the region. 80
6.4.3.1 Task 1: Assign a responsible party or parties to develop and store base water quantity and quality models. 80
6.4.3.2 Task 2: Analyze the results of the models for strategy development. 80
6.4.4 Objective 4: Identify high priority areas for flood management and future flood loss mitigation. 80
6.4.4.1 Task 1: Compile previously completed models and information available to identify any high priority areas. 81

6.4.4.2 Task 2: Hold a meeting with city and county planning staff to discuss future flood loss mitigation 81
6.4.5 Objective 5: Use data in the land use planning and decision-making process to evaluate the impact of development, visualize alternative development patterns, and combine the desired planning outcomes with relevant ordinances and building codes. 81
6.4.5.1 Task 1: Develop partnerships with cities, counties, USACE, Iowa Flood Center, among others to define and compile relevant data. 81
6.4.5.2 Task 2: Develop an education plan to present to the citizens in the watershed regarding development impacts, policies, and the future of the watershed if no changes are made. 82
6.5 Tasks That Fall Under Multiple Goals and Objectives 82
Task 1: Hire a Watershed Coordinator 82
Task 2: Assign Strategy Champions 82
Task 3: Regional Collaboration Mechanism 82
Task 4: Develop Model Ordinance 83
6.6 Schedule 83
7. Implementation Plan Prioritization 84
8. Funding Sources 85
9. References 87

Table of Figures

Figure 1-1: Jurisdictions in the Mud Creek Watershed 5
Figure 1-2: Jurisdictions in the Camp Creek Watershed 6
Figure 1-3: Jurisdictions in the Spring Creek Watershed 7
Figure 2-1: Mud, Camp, and Spring Creek Watershed River System 9
Figure 2-2: Mud Creek Stream Order 10
Figure 2-3: Camp Creek Stream Order 11
Figure 2-4: Spring Creek Stream Order 12
Figure 2-5: Mud Creek Watershed Drainage Districts 13
Figure 2-6: Camp Creek Watershed Drainage Districts 14
Figure 2-7: Spring Creek Watershed Drainage Districts 15
Figure 2-8: Slopes within the Mud Creek Watershed 17
Figure 2-9: Slopes within the Camp Creek Watershed 18
Figure 2-10: Slopes within the Spring Creek Watershed 19

Figure 2-11: Land Cover Mud Creek Watershed 21
Figure 2-12: Land Cover Camp Creek Watershed 22
Figure 2-13: Land Cover Spring Creek Watershed 23
Figure 2-14: Land Use Mud Creek Watershed 24
Figure 2-15: Land Use Camp Creek Watershed 25
Figure 2-16: Land Use Spring Creek Watershed 26
Figure 2-17: Mud Creek Watershed Soils by Hydrologic Soil Class 28
Figure 2-18: Camp Creek Watershed Soils by Hydrologic Soil Class 29
Figure 2-19: Spring Creek Watershed Soils by Hydrologic Soil Class 30
Figure 2-20: Mud Creek Watershed Depth to Groundwater 32
Figure 2-21: Camp Creek Watershed Depth to Groundwater 33
Figure 2-22: Spring Creek Watershed Depth to Groundwater 34
Figure 2-23: Iowa Average Yearly Rainfall 35
Figure 2-24: Ankeny Regional Airport Yearly Rainfall (1951-2015) 36
Figure 2-25: IFC Stream Stage Sensor Locations 38
Figure 4-1: Bank Stability on Mud Creek Watershed 44
Figure 4-2: Bank Stability on Camp Creek Watershed 45
Figure 4-3: Bank Stability on Spring Creek Watershed 46
Figure 6-1: Unified Sizing Criteria 52
Figure 6-2: Cover Crops 61
Figure 6-3: Grassed Waterway 61
Figure 6-4: Soybean Field Following Strip Tillage 62
Figure 6-5: Bioreactor Being Installed in a Field 63
Figure 6-6: Mud, Camp, and Spring Creek Water Quality Monitoring Sites 71
Figure 6-7: Top Restoration Priorities Based on RASCAL Assessment 79
Figure C-1: Mud Creek Watershed Potential Grassed Waterway and Soil Runoff Risk 92
Figure C-2: Mud Creek Watershed Potential Nutrient Removal Wetland Sites 93
Figure C-3: Mud Creek Watershed Potential Riparian Buffers 94
Figure C-4: Mud Creek Watershed Potential Sediment Basin Sites 95
Figure C-5: Camp Creek Watershed Potential Grassed Waterway and Soil Runoff Risk 96
Figure C-6: Camp Creek Watershed Potential Nutrient Removal Wetland Sites 97
Figure C-7: Camp Creek Watershed Potential Riparian Buffers 98

Figure C-8: Camp Creek Watershed Potential Sediment Basin Sites 99
Figure C-9: Spring Creek Watershed Potential Grassed Waterway and Soil Runoff Risk ...100
Figure C-10: Spring Creek Watershed Potential Nutrient Removal Wetland Sites.....101
Figure C-11: Spring Creek Watershed Potential Riparian Buffers.....102
Figure C-12: Spring Creek Watershed Potential Sediment Basin Sites.....103

Table of Tables

Table 1-1: Members of MCSCWMA 4
Table 2-1: Current Land Use of Mud, Camp, and Spring Creek Watersheds..... 20
Table 2-2: Top Ten Daily Rainfalls in Ankeny Recorded Between Jan. 1951 – Dec. 2015..... 36
Table 2-3: Iowa's Historic Rainfall Events 37
Table 3-1: Monitoring Data Compared to Water Quality Standards..... 41
Table 6-1: Monitoring Locations..... 70
Table 6-2: Water Quality Criteria for Monitored Constituents 72
Table 6-3: Desired Loading Reduction in Mud, Camp, and Spring Creek Watersheds 75

Appendices

Appendix A: Implementation Schedule

Appendix B: Mud, Camp, and Spring Creek Watershed Management Authority Chapter 28E Agreement

Appendix C: Agricultural Conservation Planning Framework Findings

Appendix D: Available Monitoring Data from IOWATER

Appendix E: Water Quality Modeling Maps

Appendix F: Sediment Delivery and RUSLE Assessment Maps

Appendix G: Streambank Restoration Priority Maps

Appendix H: Examples of the IOWATER Assessment Forms

Acronyms

ACPF	Agricultural Conservation Planning Framework
BMP	Best Management Practice
CFS or cfs	Cubic Feet per Second
CFU	Colony-Forming Unit
CREP	Conservation Reserve Enhancement Program
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
MCSCWMA	Mud, Camp, and Spring Creek Watershed Management Authority
GIS	Geographic Information System
HSG	Hydrologic Soil Group
HUC	Hydrologic Unit Code
IAC	Iowa Administrative Code
IDALS	Iowa Department of Agriculture and Land Stewardship
IDNR	Iowa Department of Natural Resources
ISMM	Iowa Stormwater Management Manual
ISWEP	Iowa Storm Water Education Program
LiDAR	Light Detection and Ranging
N	Nitrogen
NAVD	North American Vertical Datum
NGVD	National Geodetic Vertical Datum
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service (formerly known as SCS)
NRS	Nutrient Reduction Strategy
NTU	Nephelometric Turbidity Unit
P	Phosphorous
PSWCD	Polk Soil and Water Conservation District
RASCAL	Rapid Assessment of Stream Condition Along Length
RUSLE	Revised Universal Soil Loss Equation
SCS	Soil Conservation Service
SUDAS	Statewide Urban Design and Specifications
SWCD	Soil and Water Conservation District
USACE	Unites States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WMA	Watershed Management Authority

Executive Summary

The Watershed Management Plan (WMP) for Mud, Camp, and Spring Creeks was developed as a comprehensive resource with coordination from the Mud, Camp, and Spring Creek Watershed Management Authority (MCSCWMA). The development of the WMP occurred over several meetings to discuss the concerns and challenges facing the watersheds. Through the information gathered at the meetings, goals and tasks were appointed.

Watershed Characteristics
The characteristics of the watersheds are described in this section, including general information, topography, land use, soils, groundwater, and rainfall. The land cover of the watersheds is primarily agricultural, grasslands, and timber. These characteristics are some of the many that define the features of the watershed. Figures throughout the section illustrate each characteristic.

Pollutants
Based on the recommendations of the stakeholder group, the primary focus of this Watershed Management Plan is to develop a strategy to address the sediment and bacteria levels in the creeks. The Watershed Management Plan also secondarily addresses the nitrogen and phosphorous loading in the creeks. According to monitoring data collected as part of Iowa's volunteer-based water monitoring program, IOWATER, Mud, Camp, and Spring Creeks have various stream attributes that may be of concern, including low to high phosphorous, normal to high dissolved oxygen, normal to high nitrates, and low to normal chlorides.

Stream Assessment
A comprehensive stream assessment was completed by the Polk Soil & Water Conservation District (PSWCD) using the Rapid Assessment of Stream Conditions Along Length (RASCAL) tool. The tool was able to identify areas of varying stability in the streams. Overall, the assessment indicated that the streams have significant areas of erosion and these areas are being prioritized for improvements to be made.

Stakeholder Involvement
The stakeholder involvement process involved holding several meetings with individuals with varied representations across the watersheds. The group had three meetings and discussed their recommendations and strategies to address issues in the Mud, Camp, and Spring Creek Watersheds. The goals that were identified are as follows:

- Goal 1: Develop consistent policies for storm water and flood management, water quality improvement, and a well balanced mix of land uses.
- Goal 2: Increase community awareness, support, and involvement in the Watershed Plan and its implementation.
- Goal 3: Maintain, preserve, and enhance natural resources character and function for habitat, recreation, and quality of life.

- Goal 4: Identify and address soil and water issues to improve flood management and water quality.
- Goal 5: Tasks That Fall Under Multiple Goals and Objectives

Implementation Plan
In the Implementation Plan section, each goal is explained in detail with accompanying recommendations and strategies of how to achieve each one. Each goal was assigned subgoals and tasks to help track milestones and develop a schedule. See Appendix A for the complete schedule.

Implementation Plan Prioritization
The MCSCWMA met to discuss the Implementation Plan and prioritize Goals and Tasks under the categories of Funding Needs, Policy Modifications, and Education & Communication. The top priorities are listed in this section within the full WMP.

Budget/Funding
Various technical and financial opportunities that will be used to implement a successful plan are described in this section within the full WMP.

1. Introduction

The land use in the Mud, Camp and Spring Creek watersheds is mostly agricultural, however; the growth of the municipalities of Altoona and Pleasant Hill is increasing stormwater runoff in these watersheds. This runoff and accompanying pollutants drain to the streams. Flooding, nutrient pollution, and stream bank erosion are the primary concerns in the watersheds. Although there is minimal monitoring data from the watersheds, available IOWATER data indicates water quality is an important element to address in this management plan. After community members expressed their concerns and jurisdictions desired to have a better collaboration mechanism, the Mud, Camp, and Spring Creek Watershed Management Authority (MCSCWMA) was formed to address these and other challenges.

1.1 Watershed Management Authority

A Watershed Management Authority is formed when two or more eligible political subdivisions want to work together to engage in watershed planning and management. The political subdivisions can include a combination of cities, counties, and Soil and Water Conservation Districts. The MCSCWMA was formed in February of 2014 under a Chapter 28E Agreement (see Appendix B for complete agreement). This organization was established to provide a common voice and to facilitate inter-jurisdictional cooperation in working together on watershed issues and opportunities.

The WMA responsibilities may include:

- Assess the flood risk in the watershed
- Assess the water quality in the watershed
- Assess options for reducing flood risk and improving water quality in the watershed
- Monitor federal flood risk planning and activities
- Educate residents of the watershed area regarding water quality and flood risks
- Seek and allocate moneys made available to the Authority for purposes of water quality and flood risks
- Make and enter into contracts and agreements and execute all instruments necessary or incidental to the performance of the duties of the Authority. The Authority shall not have the power to acquire property by eminent domain or having taxing authority, per Iowa Code Chapter 466B.2. All interests in land shall be held in the name of the Party wherein said lands are located.

The requirements of a WMA include being located within a watershed no larger than an 8-digit Hydrologic Unit Code (HUC) watershed, notifying all eligible political subdivisions to participate within 30 days prior to establishing organization, a Chapter 28E agreement filed with the Secretary of State, and a Board of Directors. Membership in the MCSCWMA was established based on political boundaries in the watershed, which is shown in Table 1-1 and Figures 1-1, 1-2, and 1-3.

Table 1-1: Members of MCSCWMA

Jasper County, Iowa
Marion County, Iowa
Polk County, Iowa
City of Altoona, Iowa
City of Bondurant, Iowa
City of Mitchellville, Iowa
City of Pleasant Hill, Iowa
City of Runnells, Iowa
Jasper County Soil and Water Conservation District
Marion Soil and Water Conservation District
Polk Soil and Water Conservation District

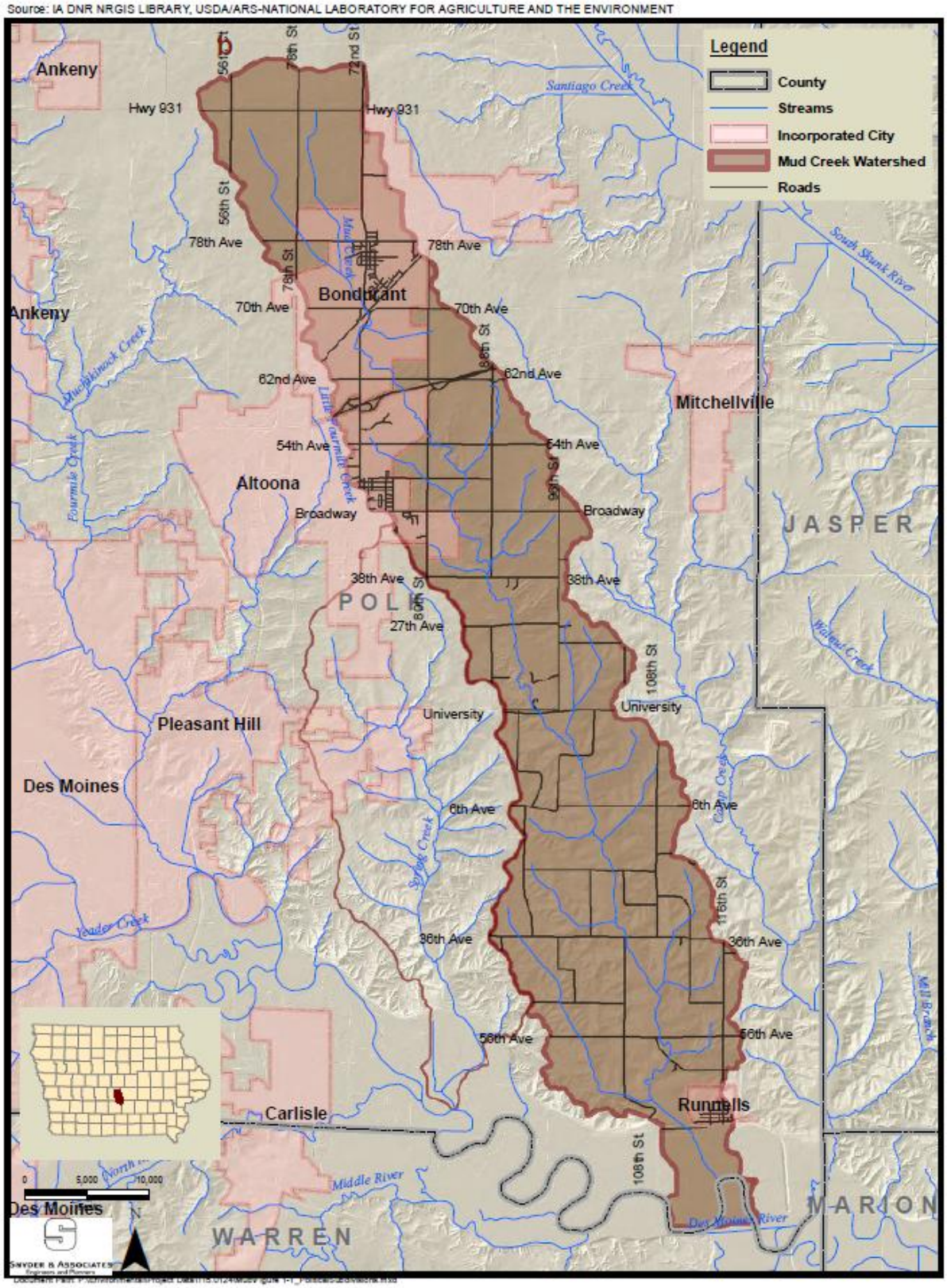


Figure 1-1: Jurisdictions in the Mud Creek Watershed

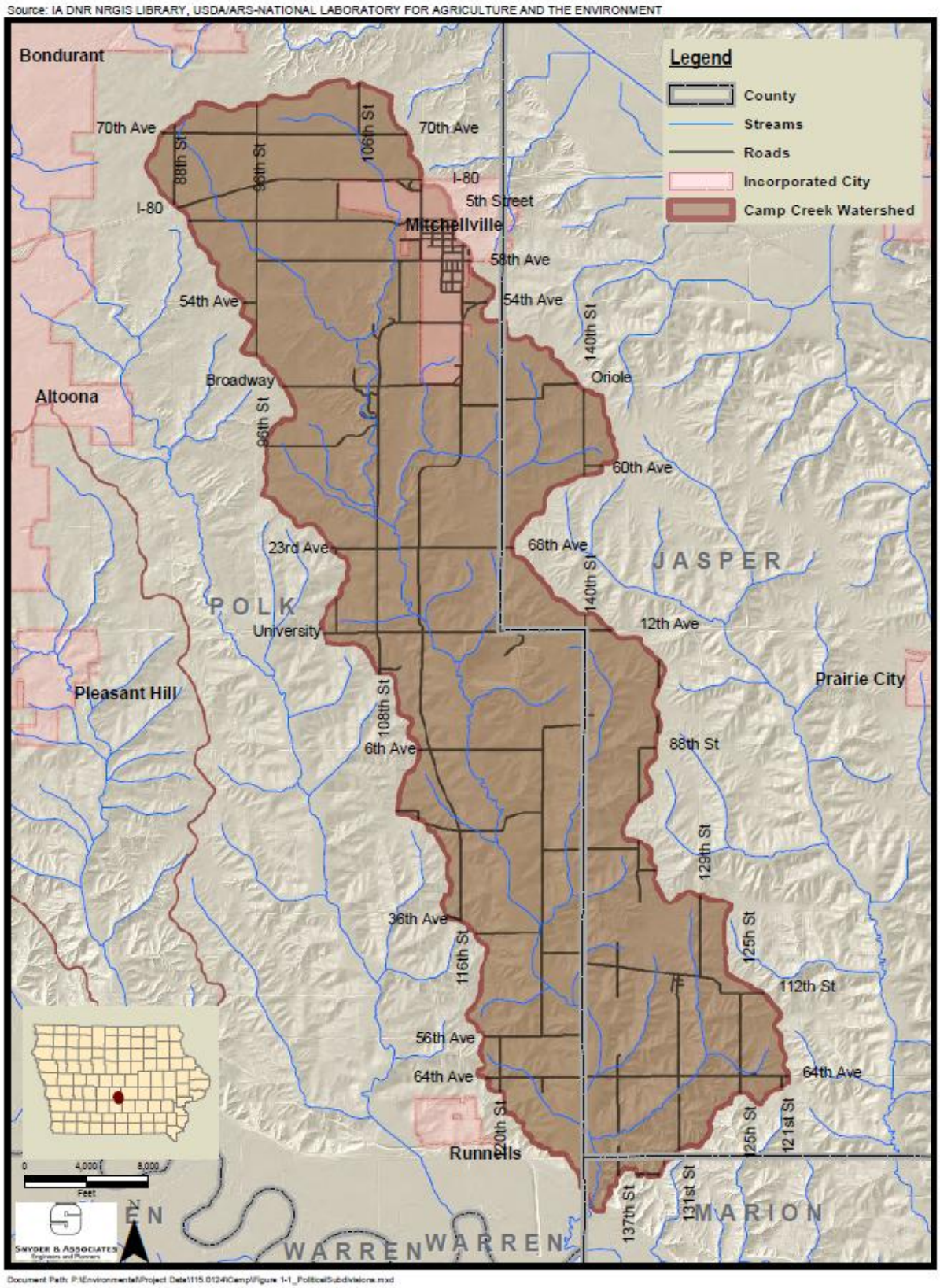


Figure 1-2: Jurisdictions in the Camp Creek Watershed

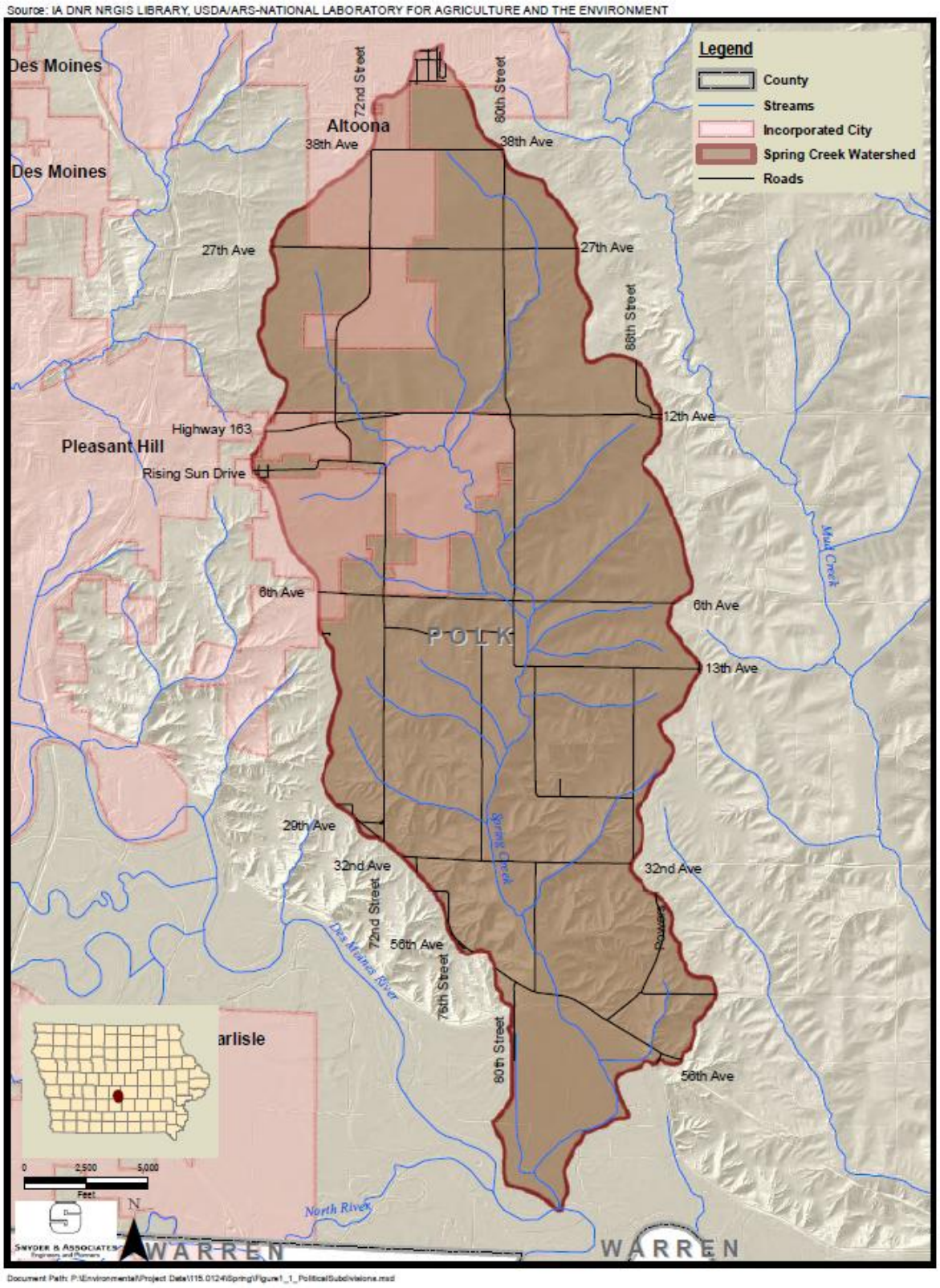


Figure 1-3: Jurisdictions in the Spring Creek Watershed

2. Watershed Characteristics

2.1 Watershed Data

The Mud, Camp and Spring Creek watersheds are located in south central Iowa, as shown in Figure 2-1. The majority of the watersheds are located in Polk County, with small areas in Jasper and Marion counties. The watersheds are made up of both rural and urban areas, including the cities of Altoona, Bondurant, Mitchellville, Pleasant Hill, and Runnells.

The Mud, Camp and Spring Creek watersheds encompass approximately 101 square miles. The three creeks run approximately parallel and drain into the Des Moines River, which flows into the Mississippi River. The watersheds are approximately 14 miles long at the longest part and 8.8 miles wide at the widest part. The watersheds are identified with a 12-digit HUC number 071000081502 (Mud), 071000081504 (Camp), and 071000081501 (Spring).

Mud, Camp, and Spring Creeks were broken up into a Stream Order system, which are also shown in Figures 2-2, 2-3, and 2-4. Stream Order systems use stream size to rank portions of a stream from smallest to largest. Stream size is important for water management and understanding the characteristics of waterways. The rankings range from first order (smallest) to twelfth order (largest). The largest stream order in the watersheds is a third order stream, as shown in all three of the watersheds.

The Mud, Camp, and Spring Creek Watersheds consist of drainage districts within Polk, Marion, and Jasper counties. Drainage districts allow for proper drainage of wetlands for farming purposes where natural drainage outlets are not available or accessible. This is done by constructing and maintaining adequate drainage outlets and levees, including both underground tile systems and open channels. There are over 3,000 drainage districts in the State of Iowa. Figures 2-5, 2-6, and 2-7 show the drainage districts throughout the watersheds.

Each watershed was also analyzed using the Agricultural Conservation Planning Framework software. This software can be used for providing information on watersheds for watershed planning purposes using digital elevation models derived from LiDAR and spatial mapping algorithms. The assessments include potential grassed waterways and soil runoff risk, potential nutrient removal wetland sites, potential riparian buffers, and potential basin sites. The maps of these assessments can be found in Appendix C.

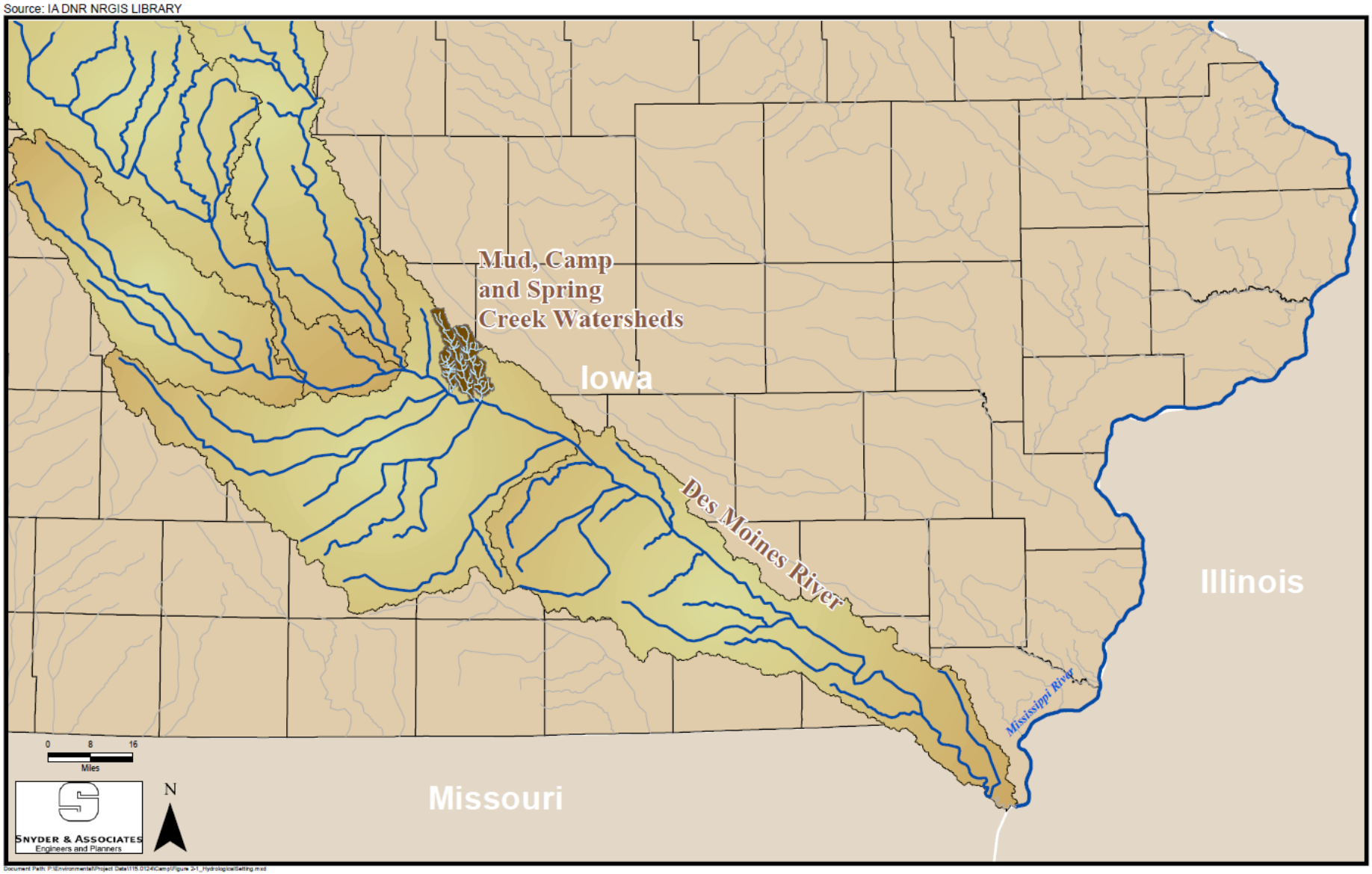


Figure 2-1: Mud, Camp, and Spring Creek Watershed River System

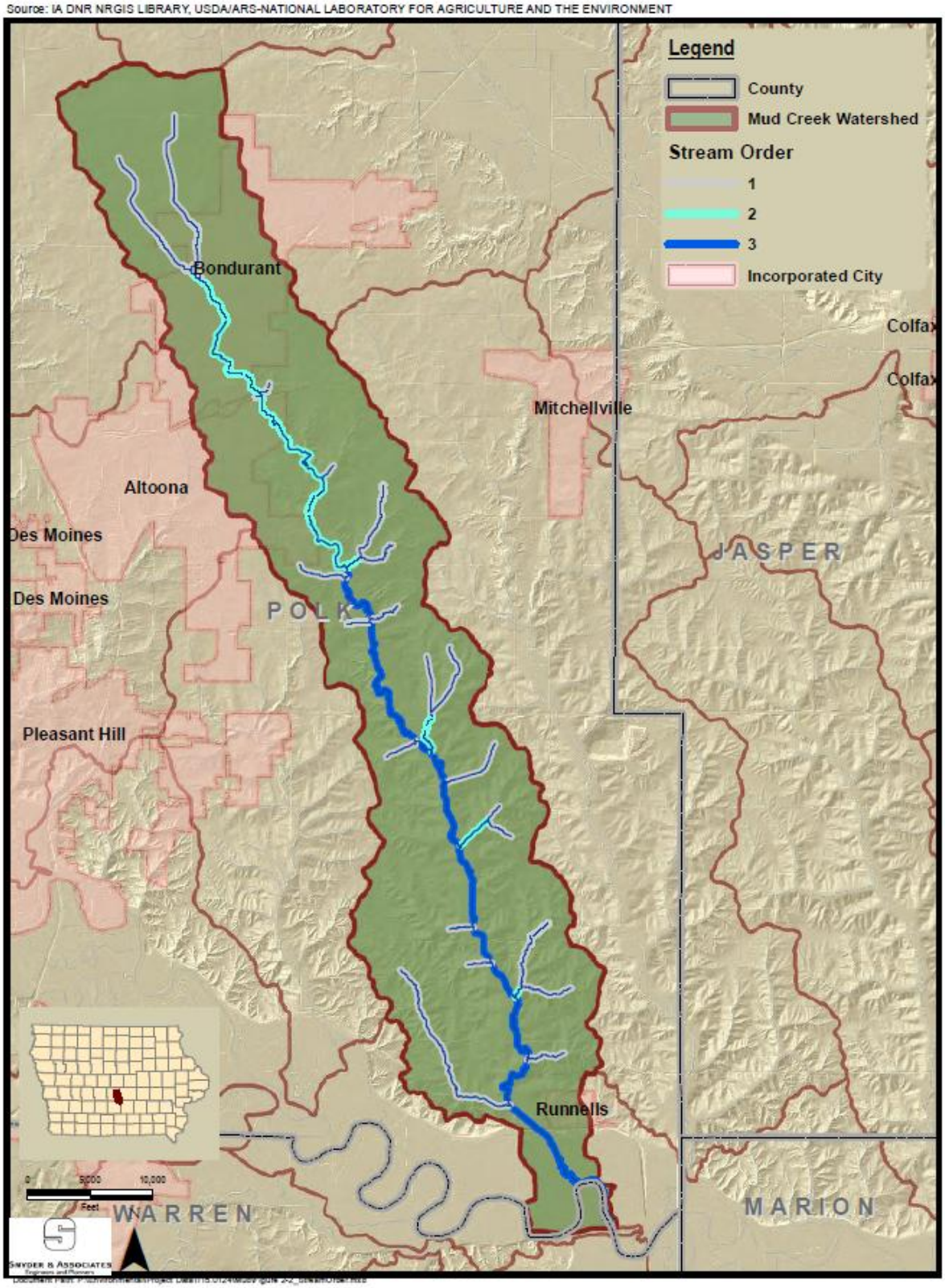


Figure 2-2: Mud Creek Stream Order

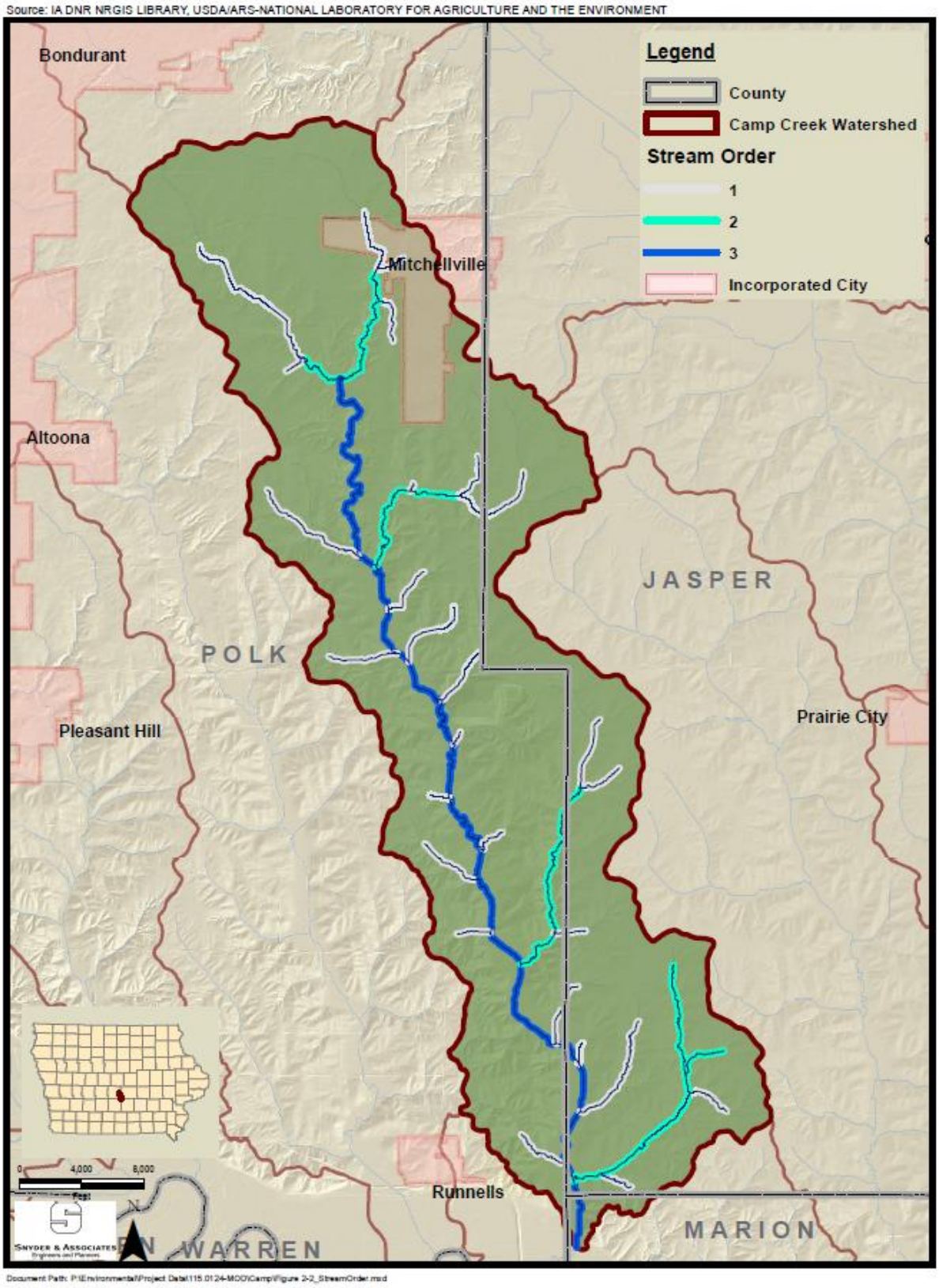


Figure 2-3: Camp Creek Stream Order

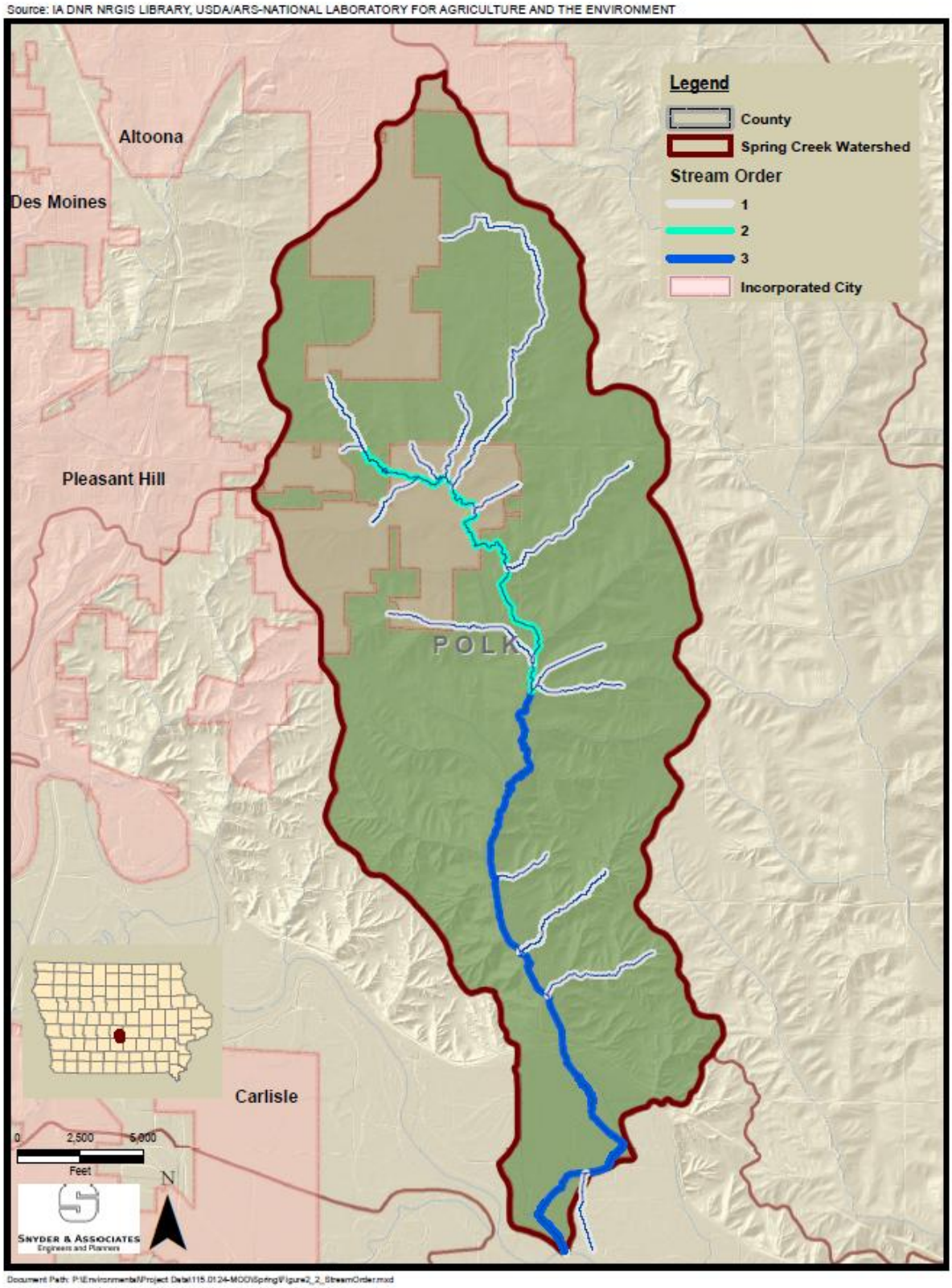


Figure 2-4: Spring Creek Stream Order

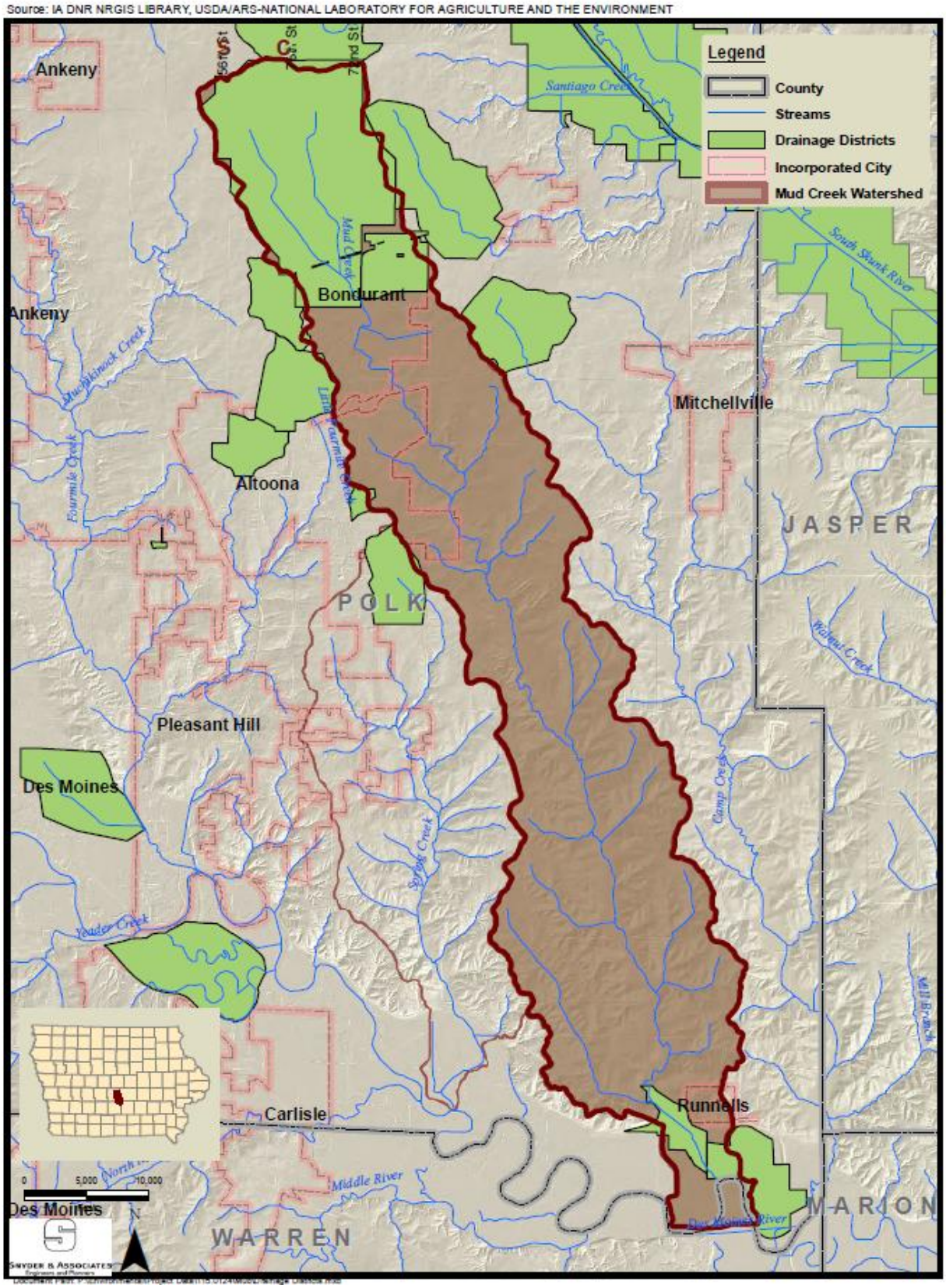


Figure 2-5: Mud Creek Watershed Drainage Districts

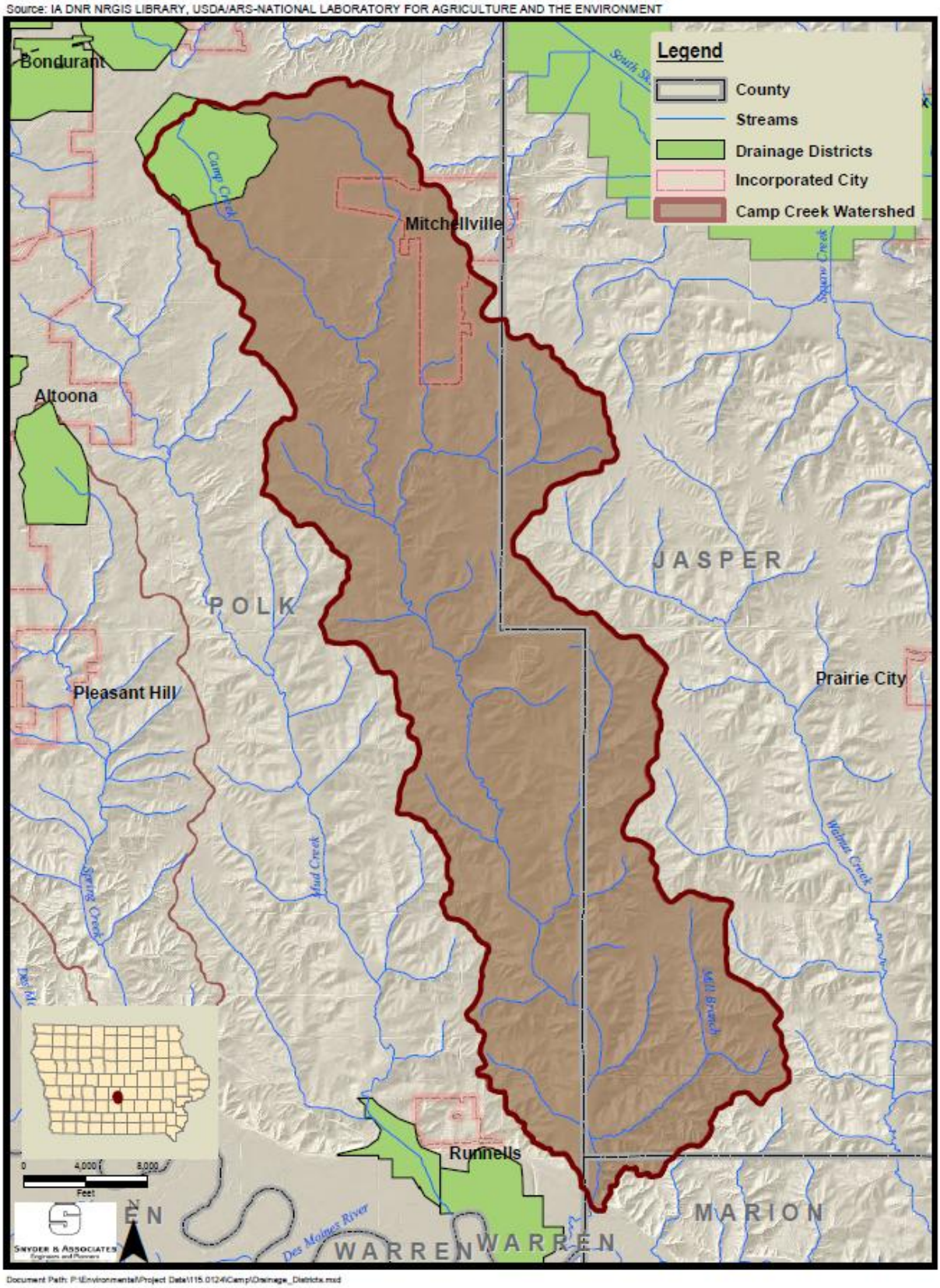


Figure 2-6: Camp Creek Watershed Drainage Districts

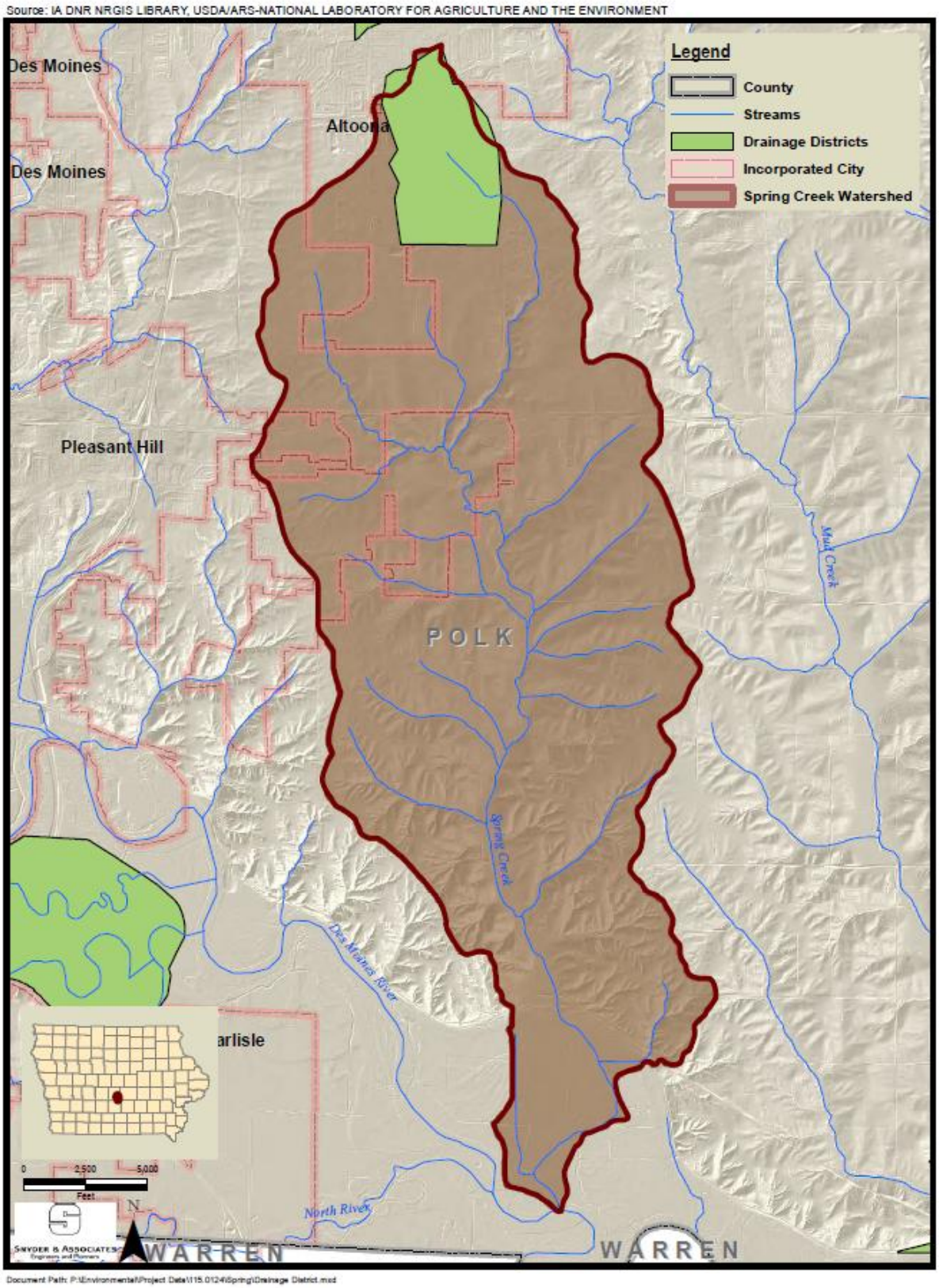


Figure 2-7: Spring Creek Watershed Drainage Districts

2.2 Topography

Figures 2-8, 2-9, and 2-10 illustrate the topography of the watersheds. As the figure demonstrates, the watersheds become steeper when moving from upstream to downstream. The drop in elevation from the highest elevation, near Mitchellville, Altoona, and Bondurant, and the lowest elevation, at the Des Moines River, is greater than 250 feet.

The majority of the Mud, Camp, and Spring Creek Watersheds are located in the Des Moines Lobe landform region, near the southern terminus of this lobe that formed during the Wisconsin Glaciation between 12,000 and 15,000 years ago. The watersheds also fall into the Southern Iowa Drift Plain landform region, which is the largest of Iowa's landforms and similar to the Des Moines Lobe because it is composed almost entirely of glacial drift. Glacial activity, other climatic events, and land use practices that followed the last glaciations have shaped the landscape, contributing to carving more defined Mud, Camp, and Spring Creek stream channels. This region has mostly level terrain and occasional bands of crooked ridges. Marshes and ponds are found between these ridges and generally have no natural drainage outlets. The landforms found in the watersheds are ground moraines on uplands, and flood plain and stream terraces. As a result, the upper portions of the watersheds have pothole characteristics, which provide depressional areas that pool runoff and help regulate flows. The lower portion of the watersheds is characterized by a gently to moderate rolling landscape and naturally well-defined drainage systems.

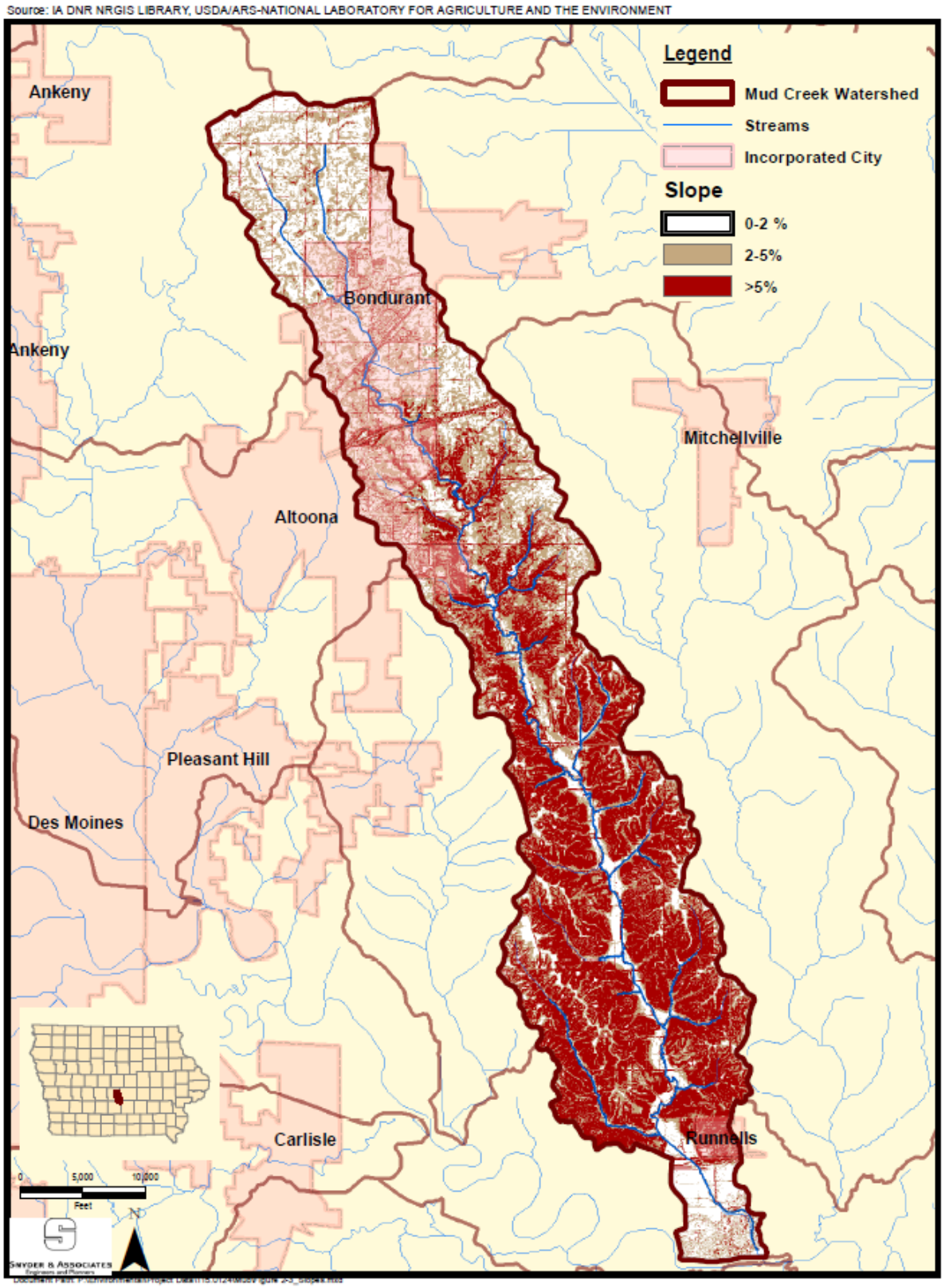


Figure 2-8: Slopes within the Mud Creek Watershed

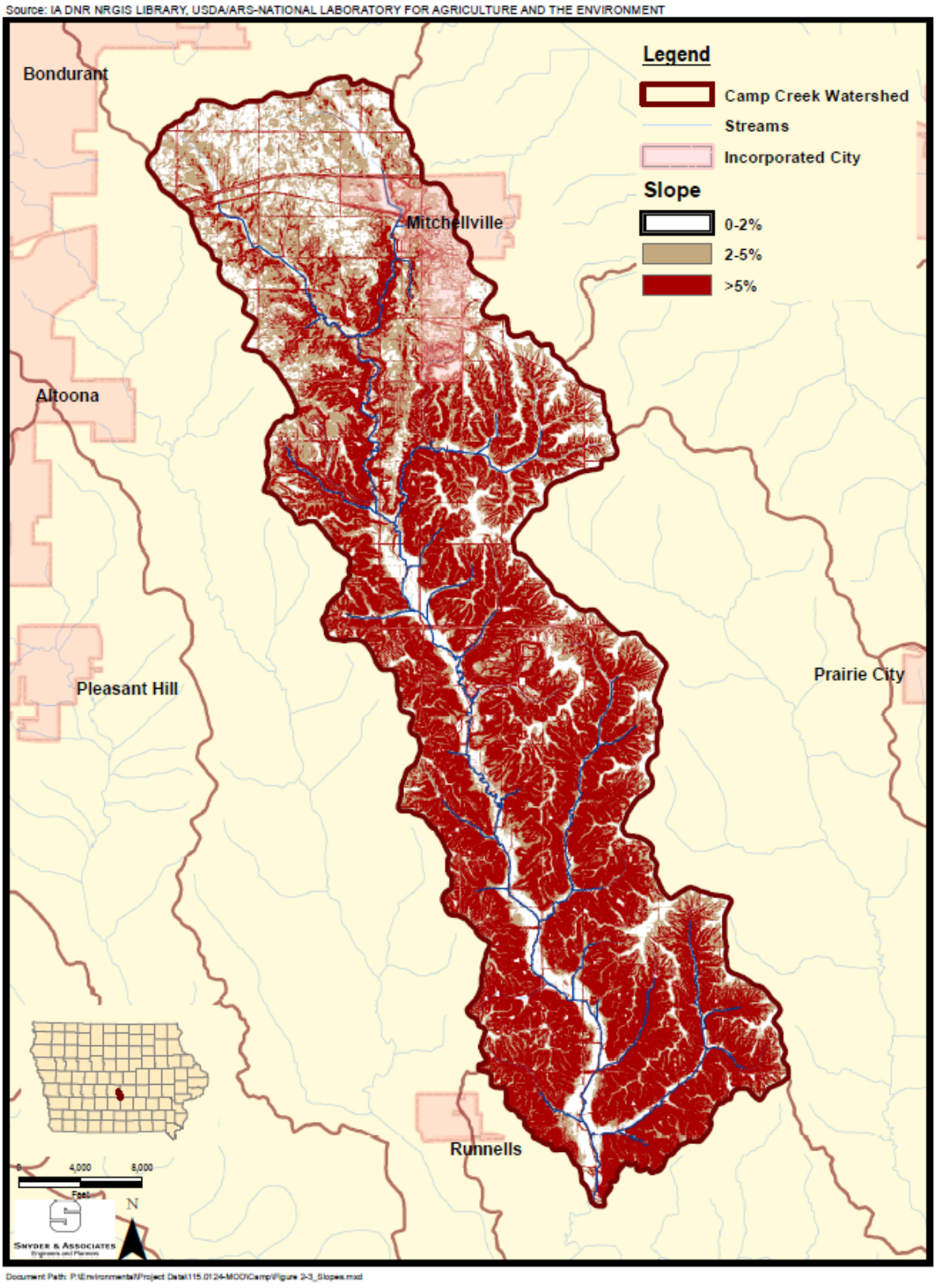


Figure 2-9: Slopes within the Camp Creek Watershed

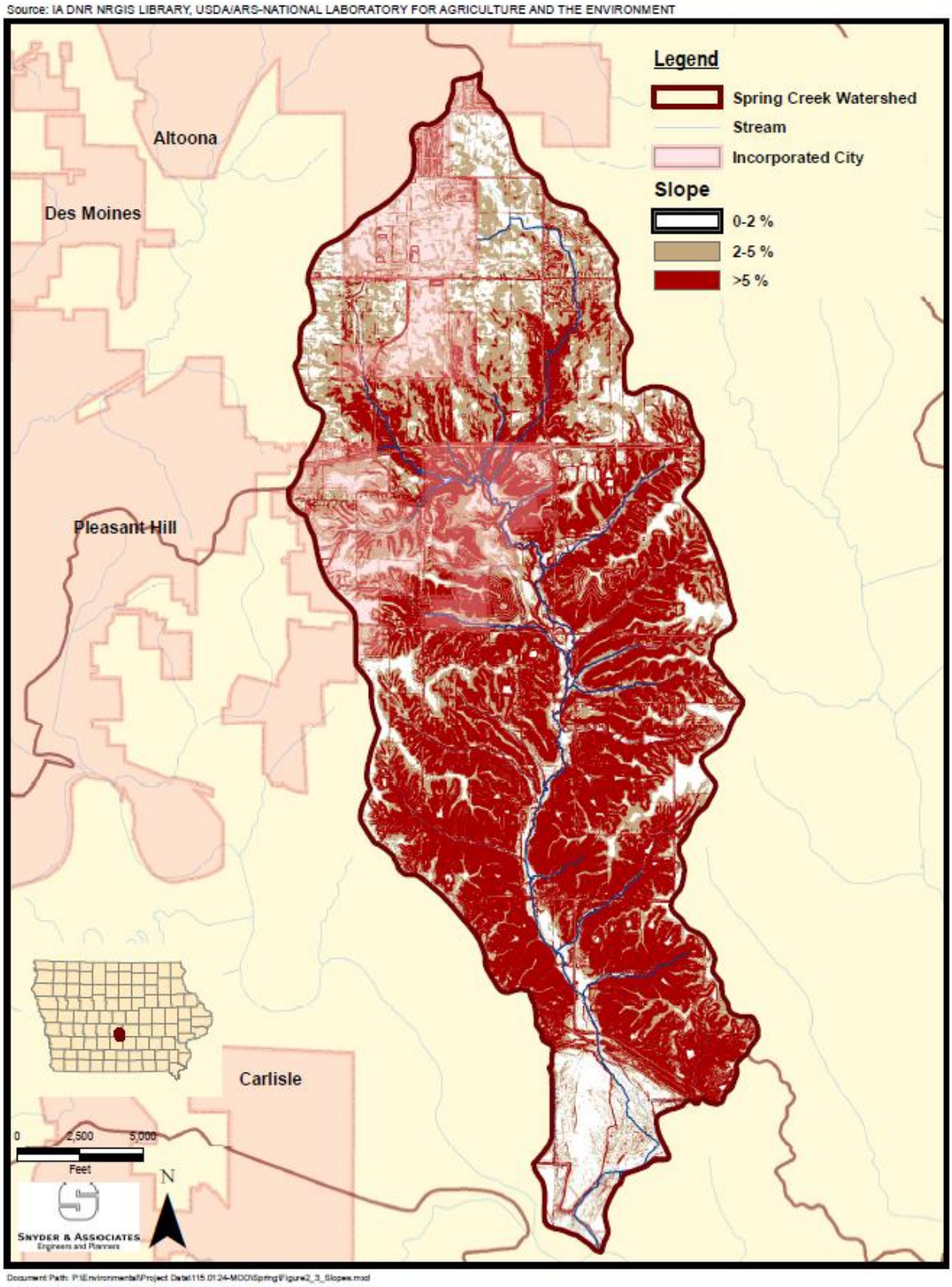


Figure 2-10: Slopes within the Spring Creek Watershed

2.3 Land Use

Primary land use varies across the Mud, Camp, and Spring Creek Watersheds. Table 2-1 gives detail to the land use of the overall watershed. As shown in the table, the watersheds are largely agricultural, grassland, and timber.

Table 2-1: Current Land Use of Mud, Camp, and Spring Creek Watersheds

Land Use	Mud Creek		Camp Creek		Spring Creek	
	Area (Sq. Mi.)	Percentage	Area (Sq. Mi.)	Percentage	Area (Sq. Mi.)	Percentage
Alfalfa	0.3	0.6%	0.3	0.7%	0.1	0.3%
Barren	0.8	1.8%	0.0	0.0%	0.0	0.0%
Corn	13.1	30.7%	14.0	34.4%	4.1	23.7%
Farmstead, Abandoned	0.0	0.0%	0.0	0.0%	0.0	0.1%
Farmstead, Active	1.4	3.3%	1.0	2.4%	0.2	1.1%
Grassland	3.5	8.2%	2.2	5.5%	2.0	11.3%
Oats	0.0	0.0%	0.3	0.8%	0.0	0.0%
Pasture	1.9	4.3%	3.8	9.2%	0.9	5.0%
Road	1.9	4.5%	1.6	4.0%	0.7	4.3%
Shrub/Scrub	0.1	0.2%	0.3	0.7%	0.6	3.2%
Soybeans	12.2	28.6%	11.9	29.2%	3.1	18.1%
Timber	4.1	9.5%	4.0	9.8%	3.2	18.4%
Urban/Residential	3.4	7.9%	1.1	2.8%	2.4	13.8%
Water	0.2	0.4%	0.2	0.4%	0.1	0.7%
Wetland	0.0	0.0%	0.0	0.1%	0.0	0.0%
Total	**42.7**	**100%**	**40.7**	**100%**	**17.3**	**100%**

Source: Polk Soil & Water Conservation District, 2014

Figures 2-11, 2-12 and 2-13 show the land cover in the watersheds and Figures 2-14, 2-15, 2-16 show the land use in the watersheds.

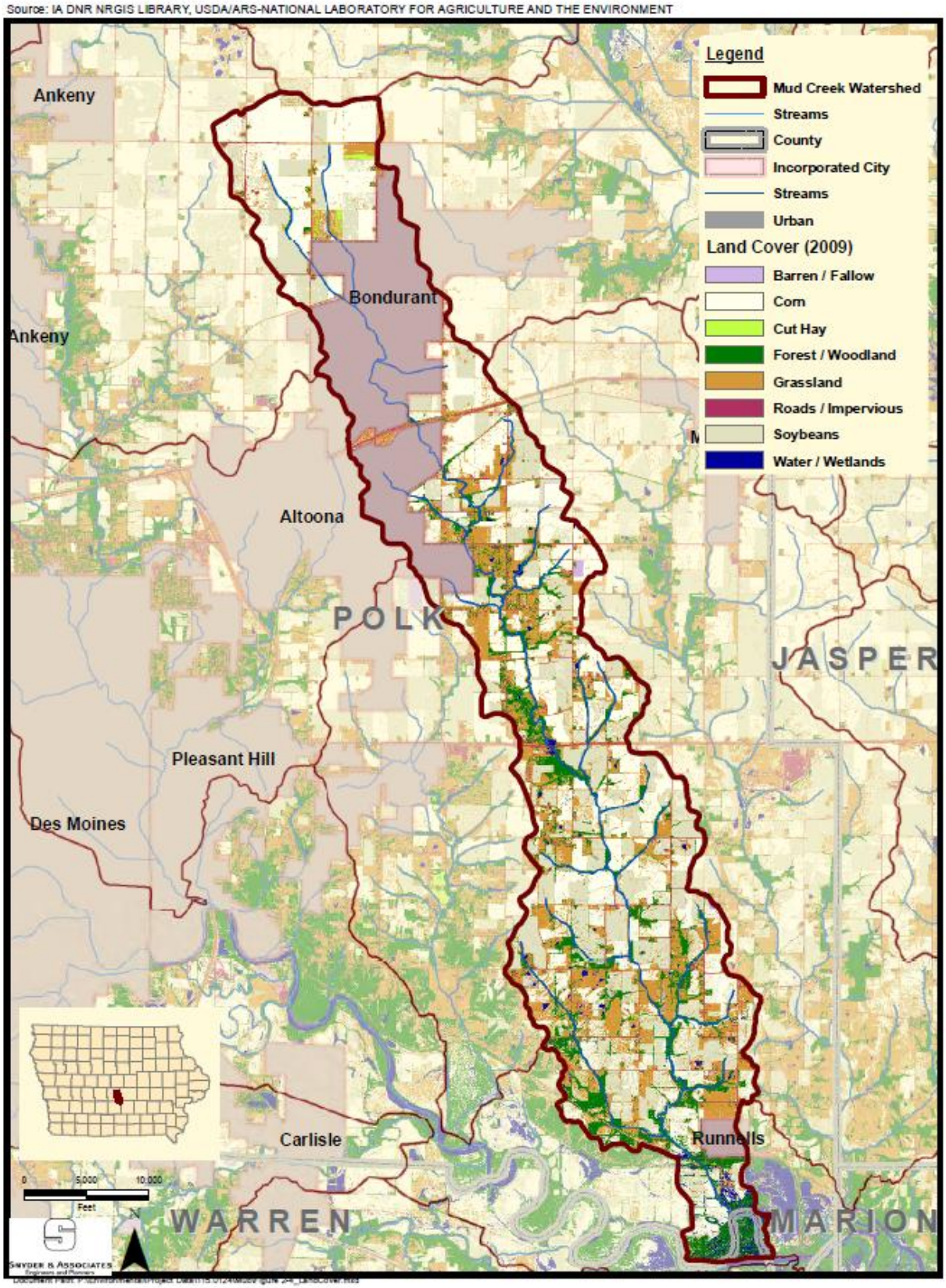


Figure 2-11: Land Cover Mud Creek Watershed

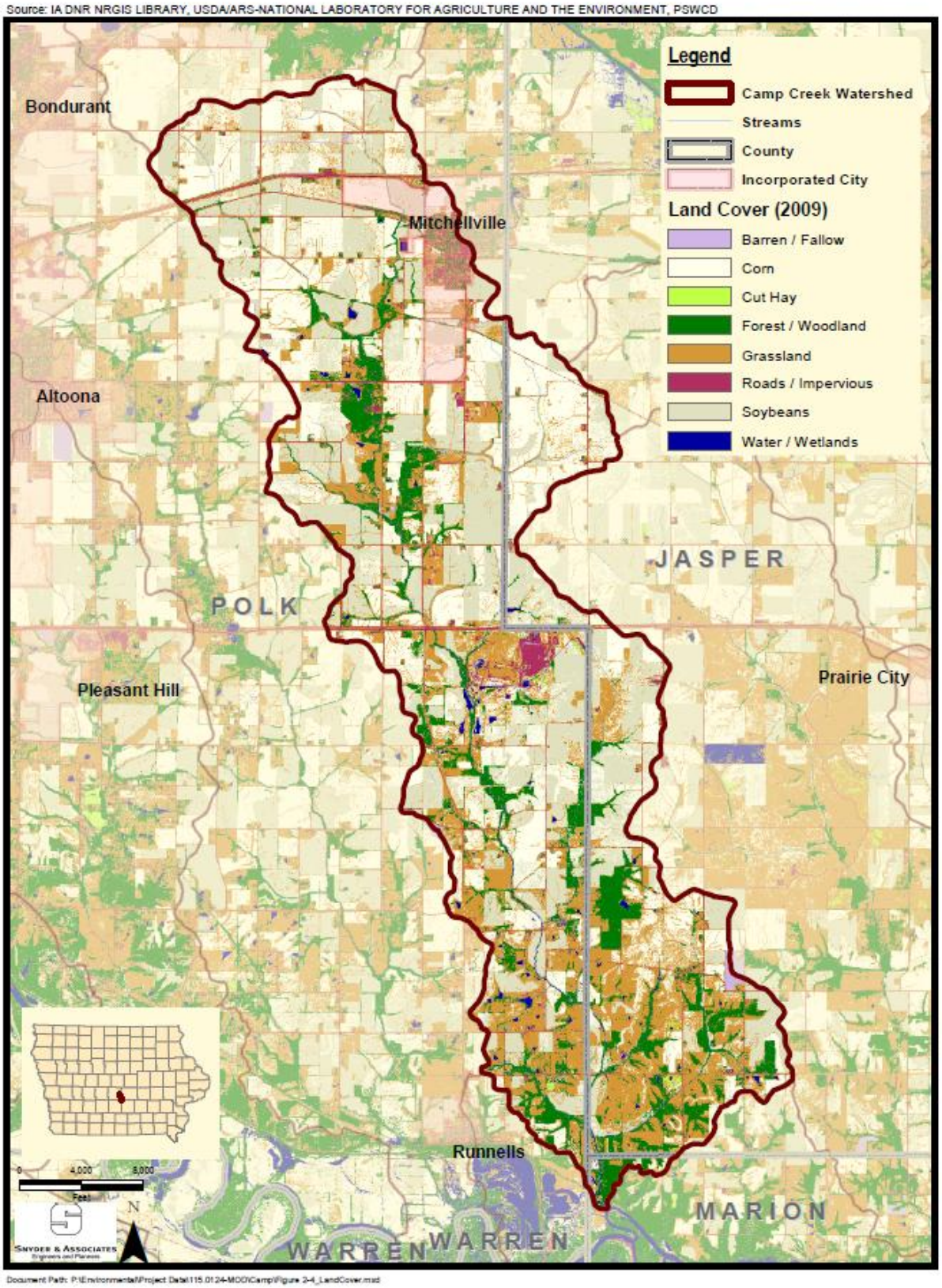


Figure 2-12: Land Cover Camp Creek Watershed

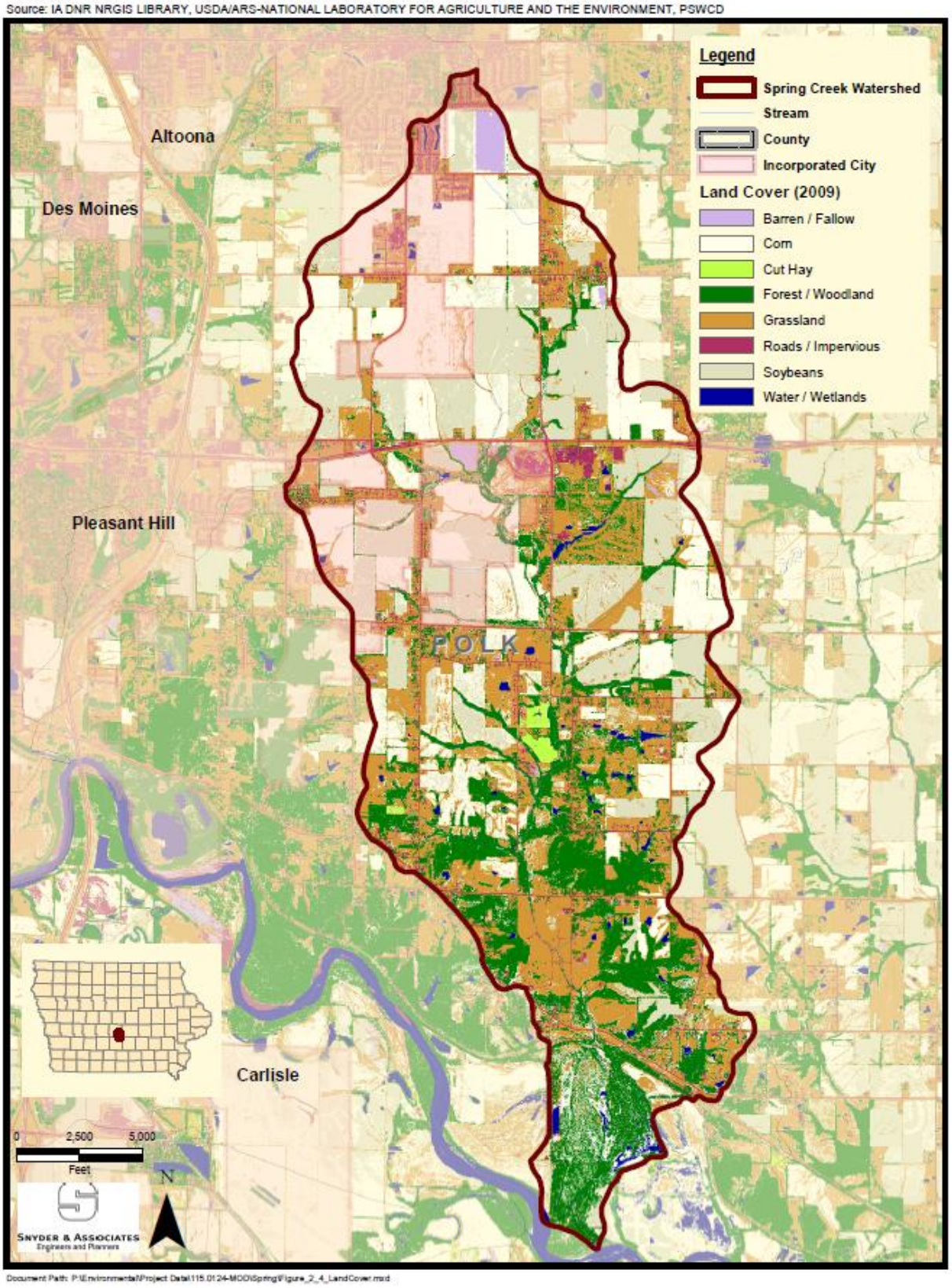


Figure 2-13: Land Cover Spring Creek Watershed

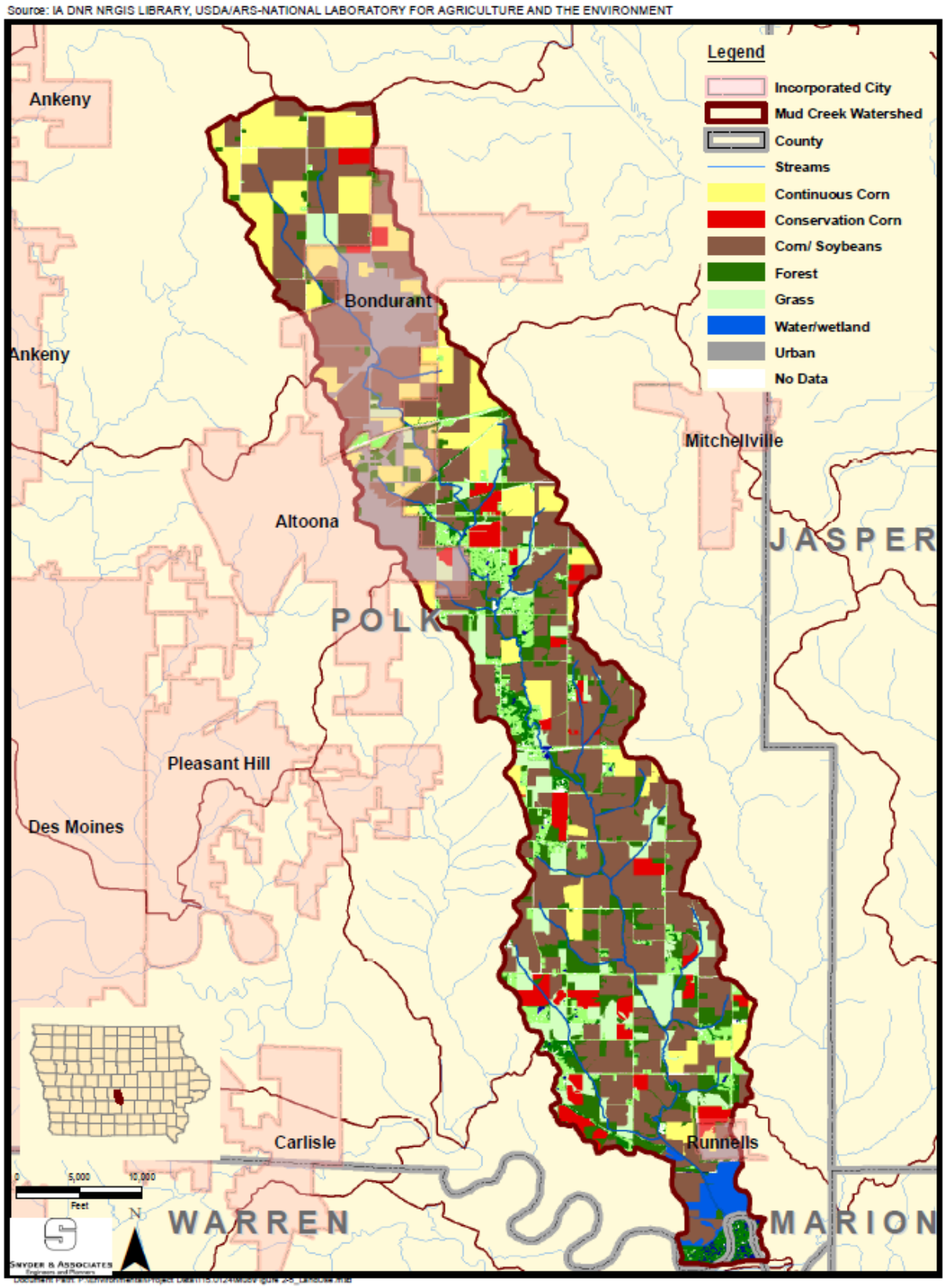


Figure 2-14: Land Use Mud Creek Watershed

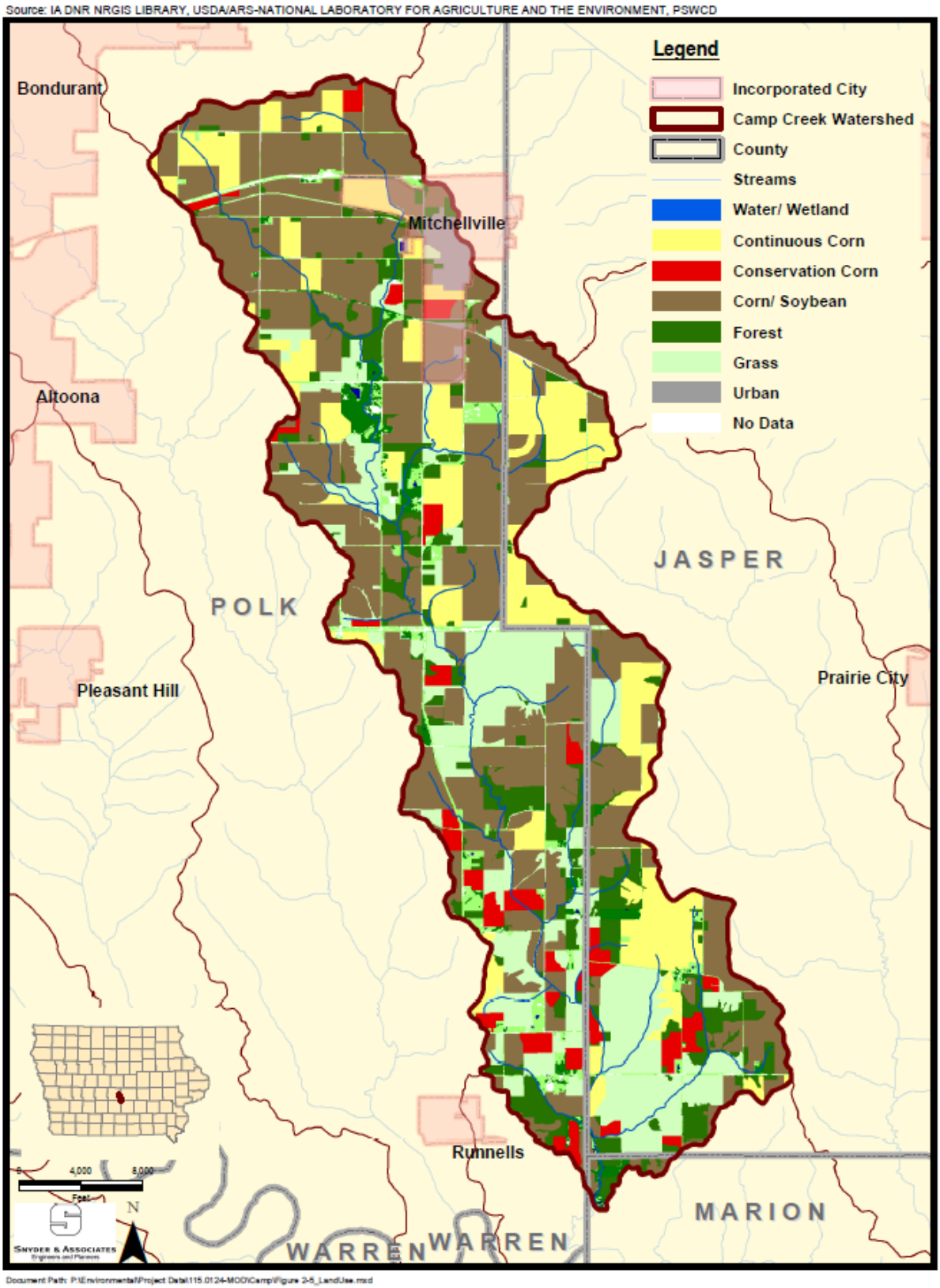


Figure 2-15: Land Use Camp Creek Watershed

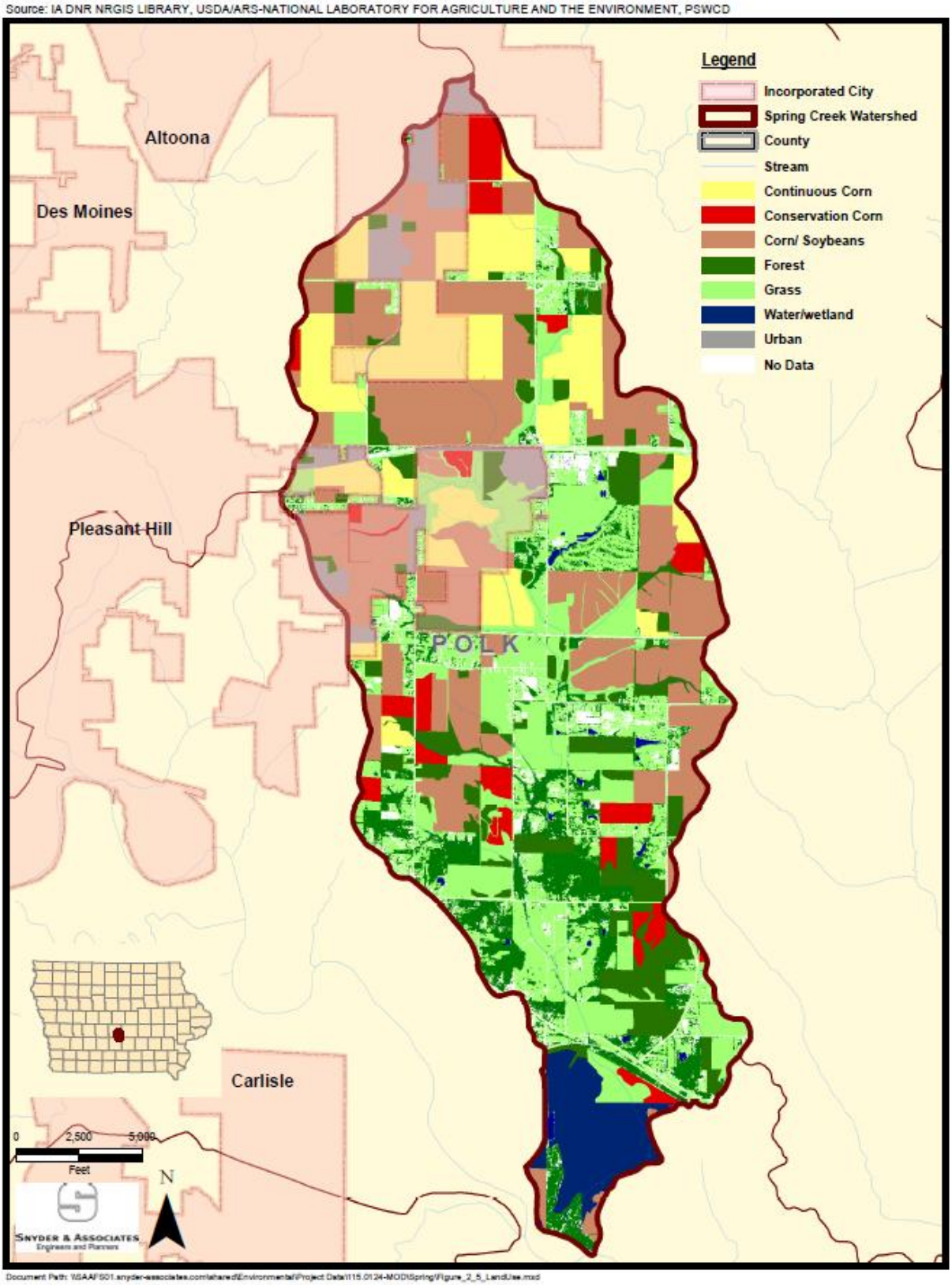


Figure 2-16: Land Use Spring Creek Watershed

2.4 Soils

The primary soils in the Mud, Camp, and Spring Creek Watersheds are the Canisteo-Clarion-Nicollet association. Other portions of the watersheds are composed of the Tama-Muscatine association, Hayden-Storden-Lester association, the Downs-Fayette association, and the Nodaway-Colo-Nevin association. These soils range from silty clay loam to sandy loam. The majority of the watersheds are used for cropland, woodland, pasture, and hay.

The primary hydrologic soil groups (HSG) are B, C, and C/D, as shown by the distribution in Figures 2-17, 2-18, and 2-19. Group C and D soils typically have the lowest infiltration rates, while group B soils have moderate infiltration rates and are generally well drained.

Group A soils have low runoff potential and high infiltration rates when thoroughly wet. These soils typically consist of deep, well to excessively drained sands or gravels and contain less than 10 percent clay.

Group B soils have moderately low runoff potential when thoroughly wet. These soils typically consist of 10 to 20 percent clay with loamy sand or sandy loam textures.

Group C soils have low infiltration rates when thoroughly wet and typically consist of soils with less than 50 percent sand and 20 to 40 percent clay. These soils have loam, sandy clay loam, silt loam, clay loam, and silty clay loam textures.

Group D soils have the highest runoff potential. These soils have very low infiltration rates when thoroughly wet and typically consist of greater than 40 percent clay and less than 50 percent sand with a clayey texture.

(USDA – NRCS)

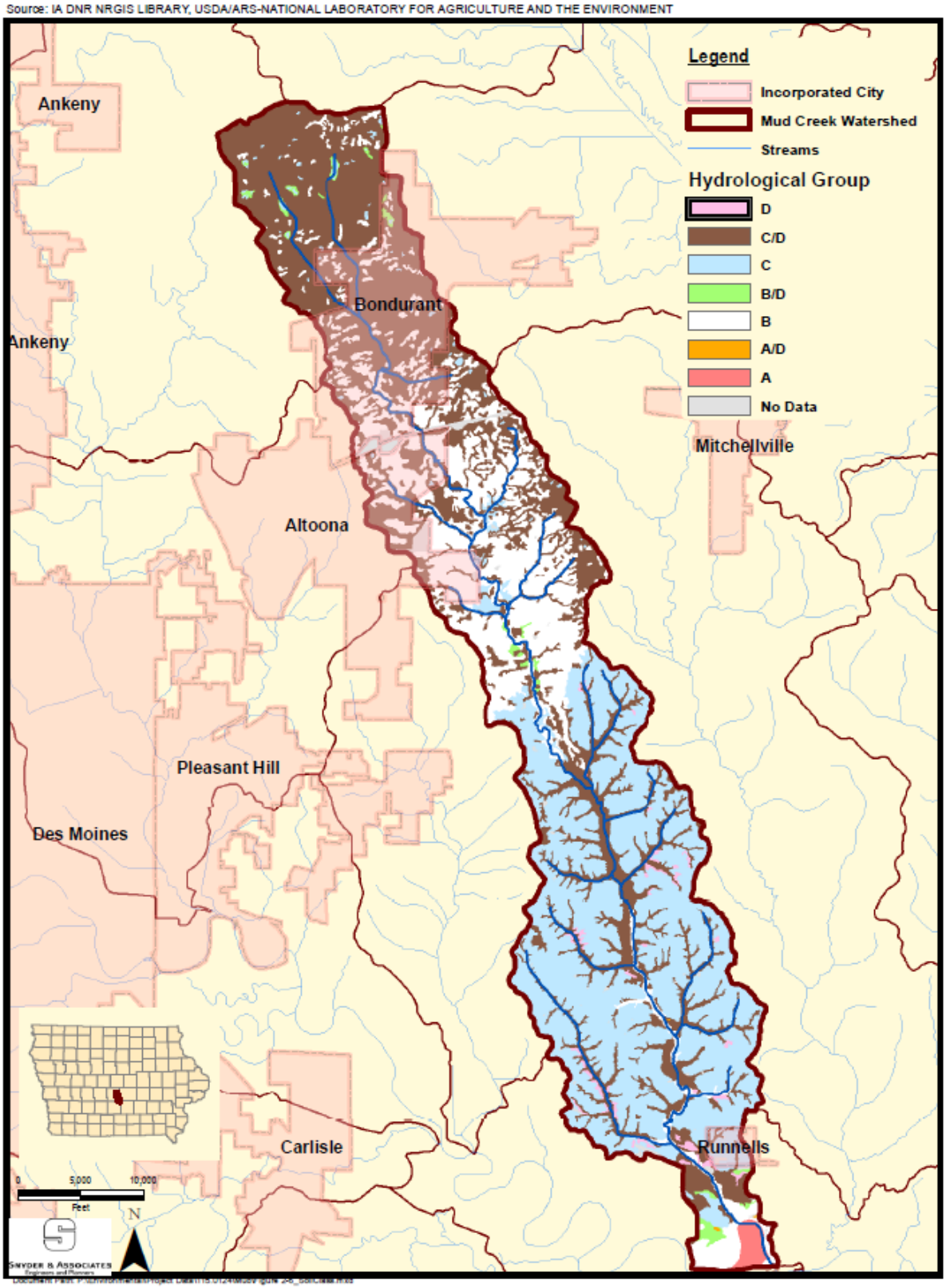


Figure 2-17: Mud Creek Watershed Soils by Hydrologic Soil Class

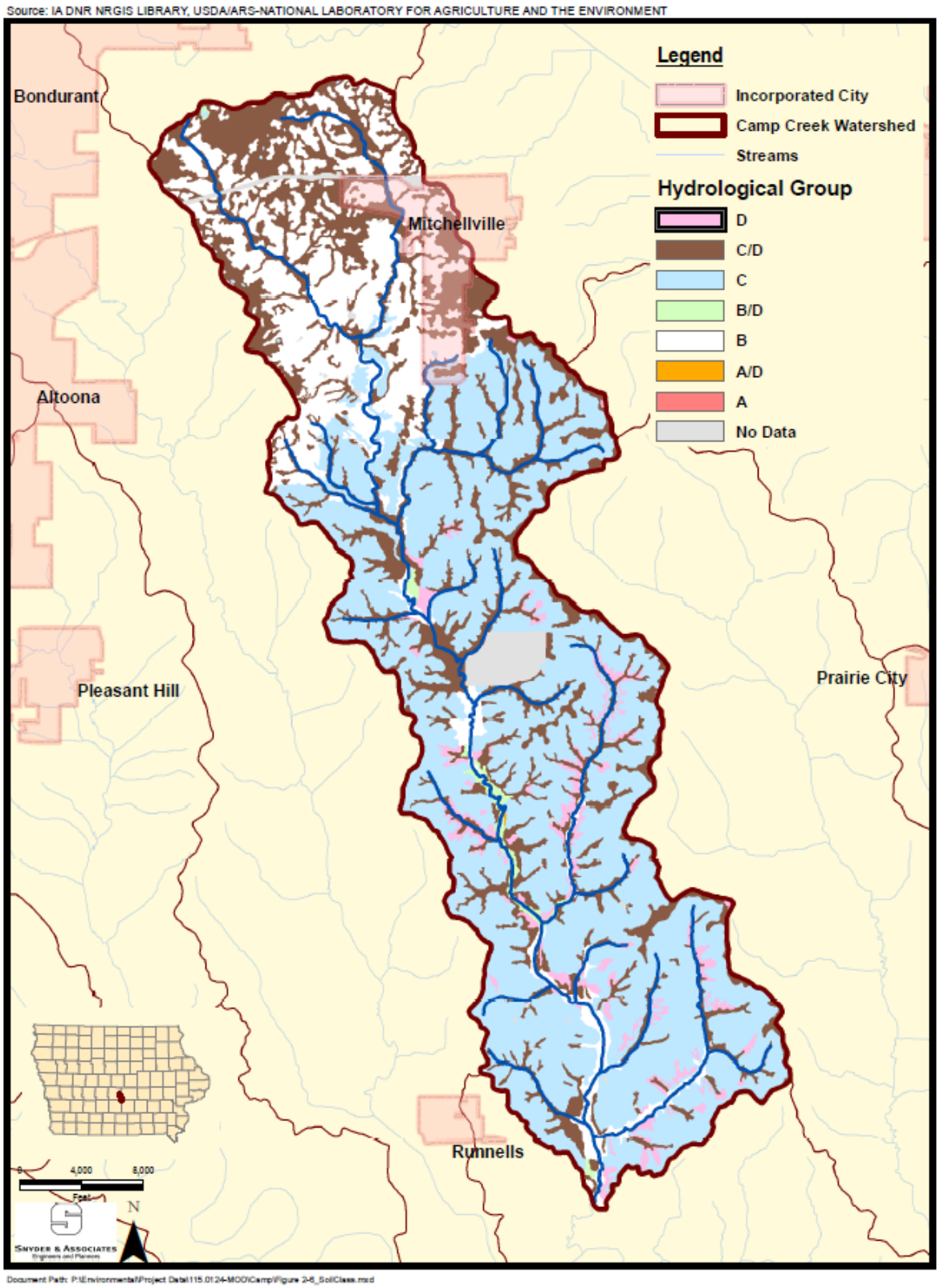


Figure 2-18: Camp Creek Watershed Soils by Hydrologic Soil Class

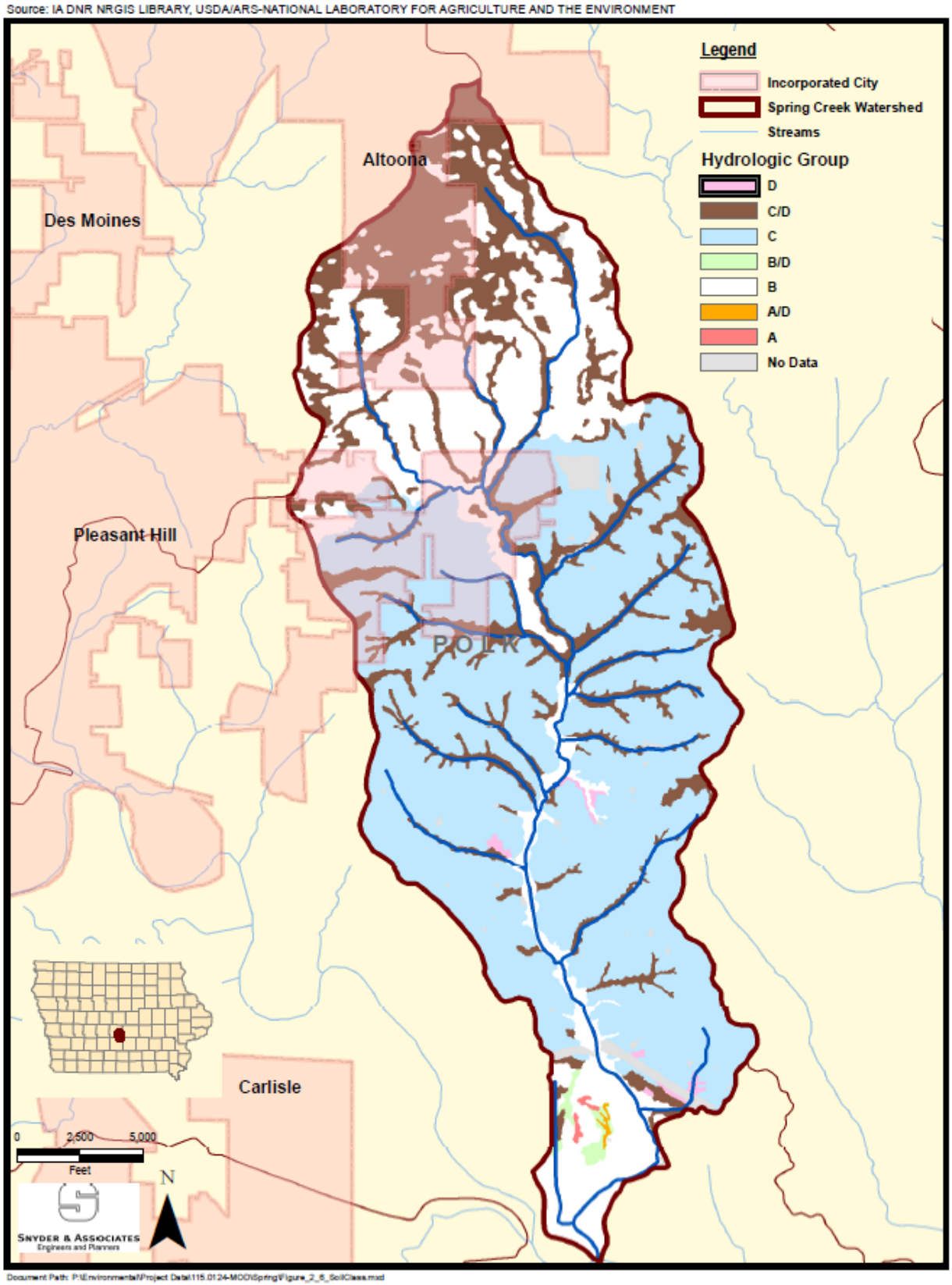


Figure 2-19: Spring Creek Watershed Soils by Hydrologic Soil Class

2.5 Hydrogeology

The bedrock of the Mud, Camp, and Spring Creek Watersheds consists of marine sedimentary rocks, including: sandstones, shales, mudstones, limestones, and dolomites. These rocks were deposited during the Carboniferous period, 354 to 290 million years ago. This period was further divided into two times periods: the Mississippian and the Pennsylvanian. Shallow seas covered the Midwest during the Mississippian and deposited clays, sands, and carbonate materials. The seas receded, allowing water and wind to erode the surfaces of the Mississippian rocks. The seas returned and again receded during the Pennsylvanian. For much of Polk County, Pennsylvanian bedrock is found (Polk County Comprehensive Plan, URS, February 2005).

According to an Iowa Department of Natural Resources (IDNR) geological survey completed in 2008, the depth to bedrock in Polk County ranges from less than 50 feet to over 200 feet to the bedrock.

Figures 2-20, 2-21, and 2-22 show the water table depth in the watersheds. As the figure illustrates, the majority of the watersheds have a deep water table with a shallower water table prevalent in areas closer to the creek channels.

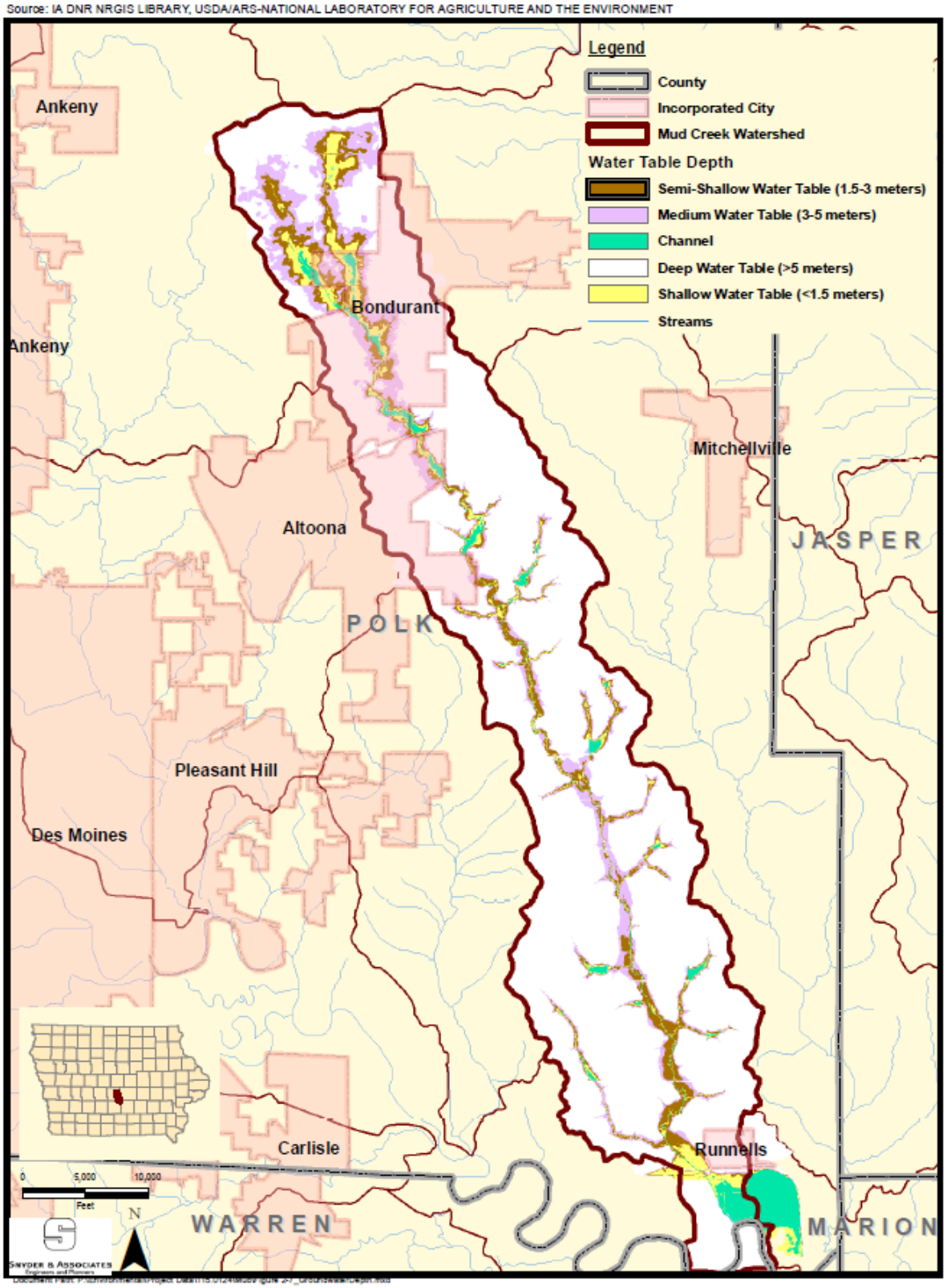


Figure 2-20: Mud Creek Watershed Depth to Groundwater

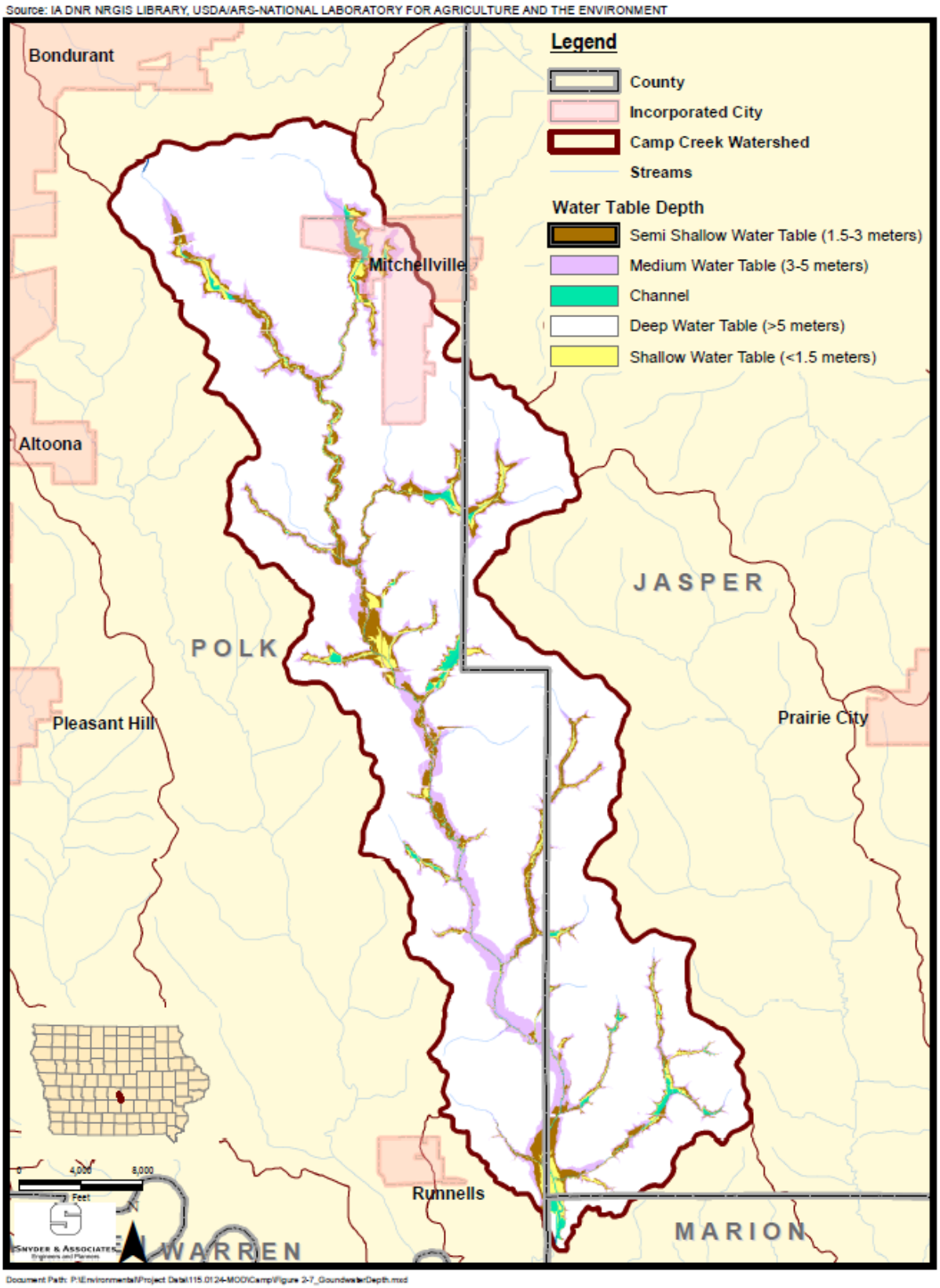


Figure 2-21: Camp Creek Watershed Depth to Groundwater

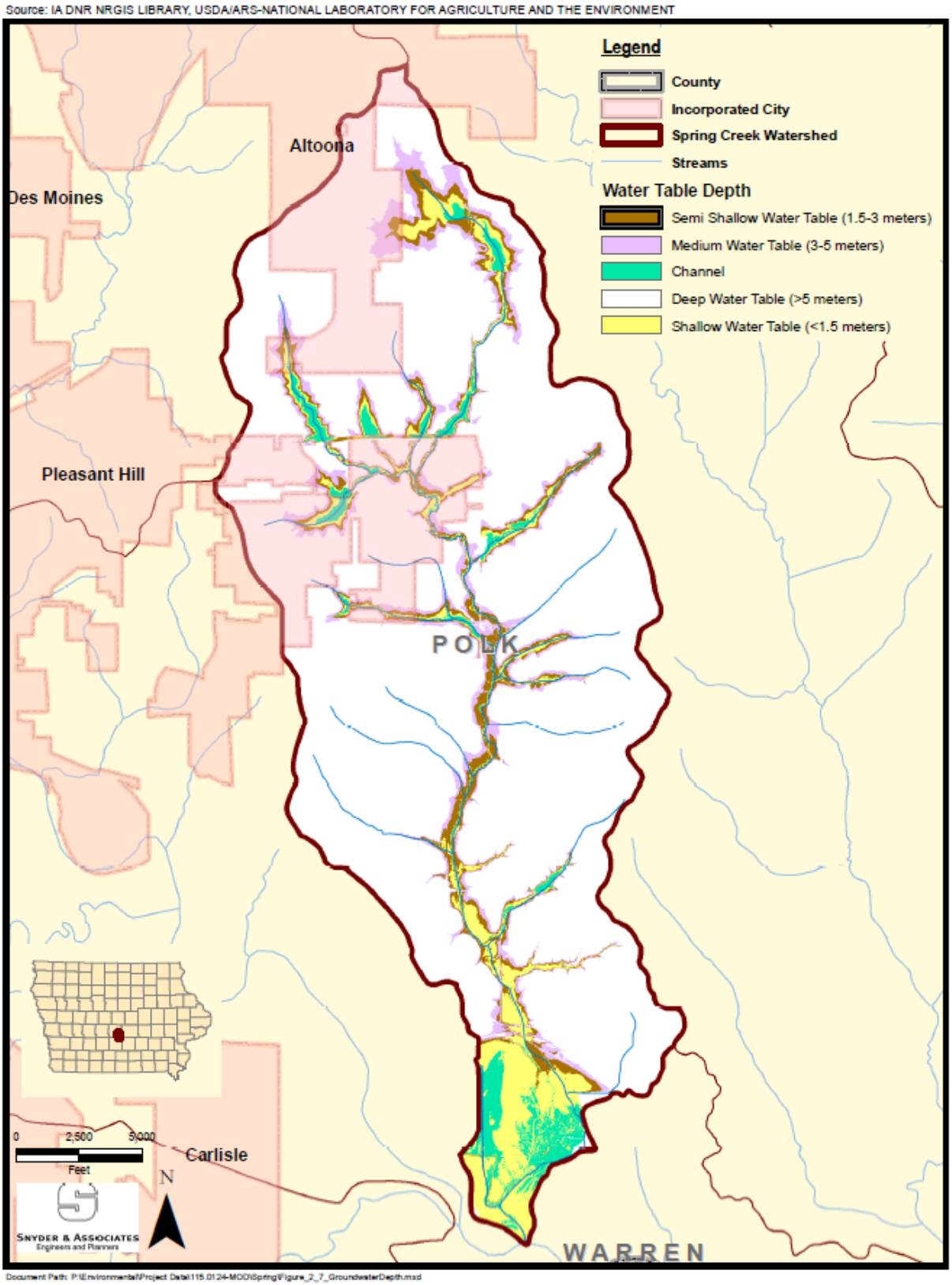
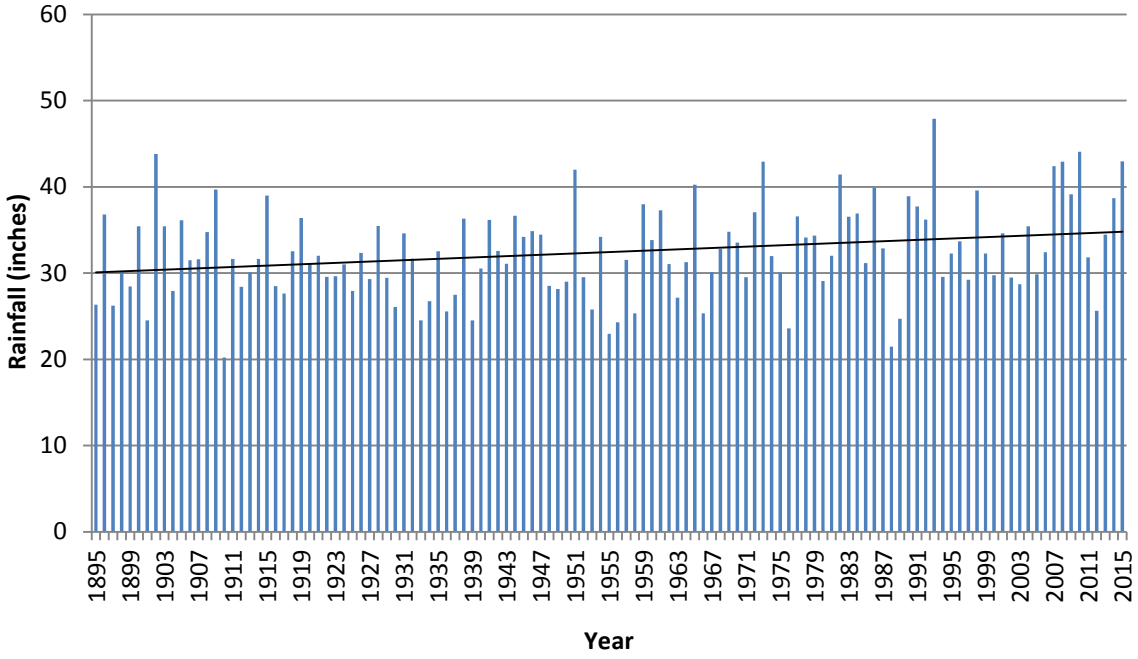


Figure 2-22: Spring Creek Watershed Depth to Groundwater

2.6 Rainfall

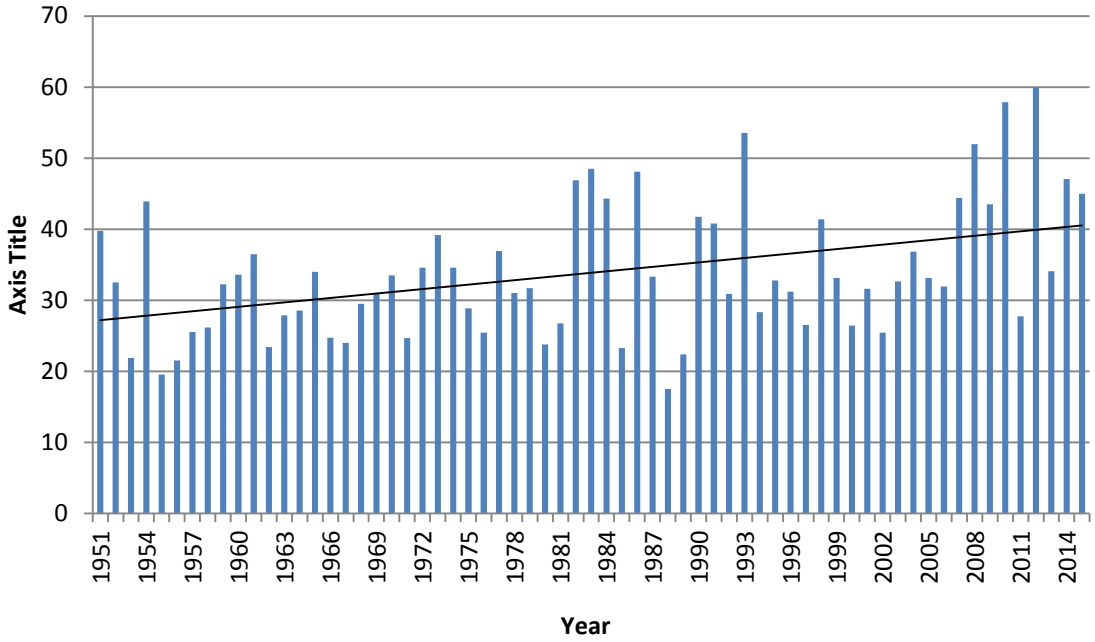
Annual precipitation in the state of Iowa averages approximately 33 inches. However, precipitation is highly variable across the state and averages have been recorded in areas as little as 20 inches per year to as much as 47 inches per year. Figure 2-23 displays the variability of the average annual rainfall in Iowa.



Source: National Climatic Data Center (NCDC) – National Oceanic and Atmospheric Administration (NOAA)

Figure 2-23: Iowa Average Yearly Rainfall

Ankeny, Iowa is located near the Mud, Camp, and Spring Creek Watersheds and averages 33.88 inches of rainfall per year. Figure 2-24 depicts the variability of annual rainfall totals at the Ankeny Regional Airport. The gage at the Ankeny Regional Airport recorded over 50 inches of annual rainfall in the years 1993, 2008, 2010, and 2012 with the largest yearly rainfall in 2012 recording 59.92 inches. Table 2-2 ranks the top ten recorded daily rainfalls at the Ankeny airport between January 1951 and December 2015.



Source: http://mesonet.agron.iastate.edu/request/coop/fe.phtml

Figure 2-24: Ankeny Regional Airport Yearly Rainfall (1951-2015)

Table 2-2: Top Ten Daily Rainfalls in Ankeny Recorded Between Jan. 1951 – Dec. 2015

Rank	Date	Rain (inches)
1	6/20/1954	5.25
2	6/17/1990	4.63
3	8/28/1977	4.59
4	4/30/1986	4.50
5	7/28/2008	3.93
6	9/7/2007	3.92
7	6/28/1983	3.90
8	6/15/2015	3.87
9	7/9/1993	3.70
10	9/12/1961	3.69

Source: http://mesonet.agron.iastate.edu/request/coop/fe.phtml

Des Moines, Iowa, which is also located in Polk County near the watersheds, averages approximately 105 days of measurable rainfall per year (defined as at least 0.01 inches). Most rainfall events are small, as demonstrated by information presented in the Iowa Stormwater Management Manual, Section 2C-2, Table 1 (IDNR, 2009). The data shows that 90.60% of the measurable rainfall events were 1.25 inches or less. On average, Des Moines has 20 days per year in which rainfall exceeds 0.5 inches and 7 days per year in which rainfall exceeds 1 inch. However, large localized rainfall events do occur, on occasion, and

amounts in excess of 12 inches per day have been recorded. Table 2-3 includes a few of Iowa's largest daily rainfall events.

Table 2-3: Iowa's Historic Rainfall Events

Daily Rainfall	Location	Date
13.18	Atlantic, IA	6/14/1998
12.53	Audubon, IA	7/2/1958
12.02	Castana, IA	7/17/1996
10.62	Dubuque, IA	7/27/2011-7/28/2011 (24 Hours)

Source: National Climatic Data Center (NCDC) – National Oceanic and Atmospheric Administration (NOAA)

2.7 Streamflow Gage Data

No streamflow data for Mud, Camp, and Spring Creeks are available via United States Geological Survey (USGS) gages. There is an Iowa Flood Center bridge sensor on each of the creeks to monitor water levels for flooding concerns. Their locations are listed below and also shown in Figure 2-25.

- Mud Creek: Highway 163/NE 12th Ave in Pleasant Hill
- Camp Creek: Highway 163/NE 12th Ave in Mitchellville
- Spring Creek: SE 32nd Ave in Pleasant Hill

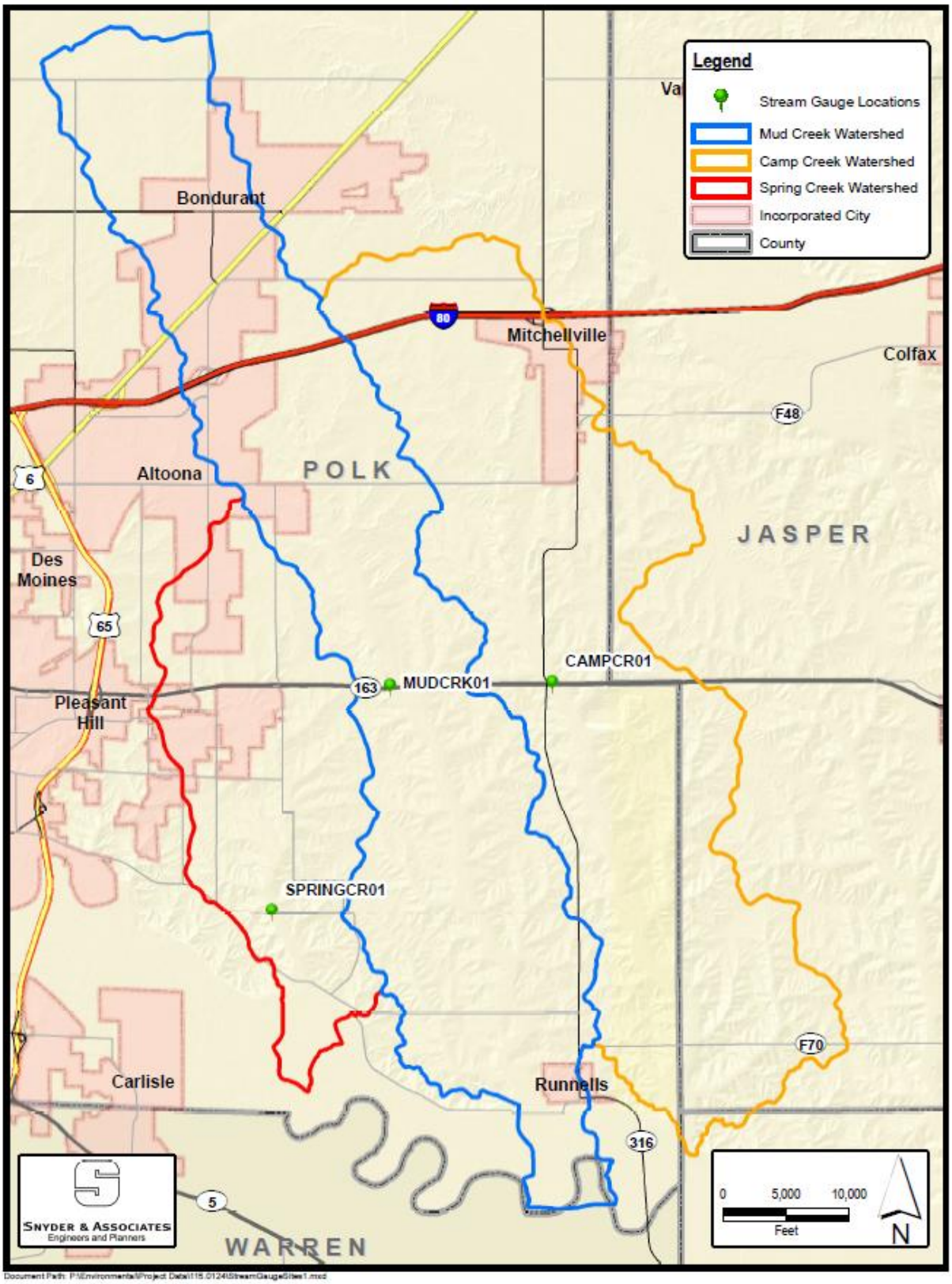


Figure 2-25: IFC Stream Stage Sensor Locations

2.8 Designated Use Classifications

Listed below are the definitions for the surface water classifications of designated use segments, according to Iowa Administrative Code 567, Chapter 61. The designated uses of each creek are as follows: Mud Creek – Classes A2 and B(WW-2); Camp Creek – Classes A2, A3, and B(WW-2); and Spring Creek – Classes A1 and B(WW-2).

- **Primary contact recreational use (Class "A1"):** Waters in which recreational or other uses may result in prolonged and direct contact with the water, involving considerable risk of ingesting water in quantities sufficient to pose a health hazard, including swimming, diving, water skiing, and water contact recreational canoeing.
- **Secondary contact recreational use (Class "A2"):** Waters in which recreational or other uses may result in contact with the water that is either incidental or accidental, including fishing, commercial and recreational boating.
- **Children's recreational use (Class "A3"):** Waters in which recreational uses by children are common, which would primarily occur in urban or residential areas.
- **Cold water aquatic life – Type 1 (Class "B(CW1)"):** Waters in which the temperature and flow are suitable for the maintenance of a variety of cold water species.
- **Cold water aquatic life – Type 2 (Class "B(CW2)"):** Waters that include small, channeled streams, headwaters, and spring runs that possess natural cold water attributes of temperature and flow.
- **Warm water – Type 1 (Class "B(WW-1)"):** Waters in which temperature, flow and other habitat characteristics are suitable to maintain warm water game fish populations along with a resident aquatic community that includes a variety of native nongame fish and invertebrate species.
- **Warm water – Type 2 (Class "B(WW-2)"):** Waters in which flow or other physical characteristics are capable of supporting a resident aquatic community that includes a variety of native nongame fish and invertebrate species.
- **Warm water – Type 3 (Class "B(WW-3)"):** Waters in which flow persists during periods when antecedent soil moisture and groundwater discharge levels are adequate; however, aquatic habitat typically consists of nonflowing pools during dry periods of the year.
- **Lakes and wetlands (Class "B(LW)"):** Waters that are artificial and natural impoundments with hydraulic retention times and other physical and have chemical characteristics suitable to maintain a balanced community normally associated with lake-like conditions.
- **Human health (Class "HH"):** Waters in which fish are routinely harvested for human consumption or waters both designated as a drinking water supply and in which fish are routinely harvested for human consumption.
- **Drinking water supply (Class "C"):** Waters which are used as a raw water source of potable water supply.

3. Pollutants

3.1 Monitoring

Monitoring on Mud, Camp, and Spring Creeks is currently being done through the IOWATER program, a voluntary water monitoring program supported with expertise and resources through the IDNR and local partners, including Polk County Conservation. Field measurements were taken for nitrate, nitrite, phosphorous, chloride, dissolved oxygen, and water transparency. Additional tests have been run on Camp Creek through the STORET program (STOrage and RETrieval). There are 9 IOWATER monitoring sites on Mud Creek, 6 IOWATER monitoring sites and 3 STORET monitoring sites on Camp Creek, and 4 IOWATER monitoring sites on Spring Creek. Each creek has been intermittently sampled between 2001 and 2015 and twice a month starting in 2015 with the sites identified in Section 6.

The general findings of the analyzed data are as follows:

- phosphorous levels range from low to high throughout the watersheds
- dissolved oxygen levels are generally normal to high
- nitrate concentrations are typically normal to high
- chloride concentrations range from low to normal

The general findings were developed from monitoring results, which are dependent on the date of monitoring. Monitoring data can be found in Appendix D. The combination of monitoring results from both sources is summarized in Table 3-1, which compares the Iowa Water Quality Standards to the Monitoring Data Averages.

Table 3-1: Monitoring Data Compared to Water Quality Standards

Parameter	Monitoring Data Averages	Iowa Water Quality Standard	Mud, Camp, and Spring Creek Designated Use Classification(s)
Total Phosphorus	Mud: 0 to 7 mg/L	None	None
	Camp: 0 to 6 mg/L		
	Spring: 0 to 5 mg/L		
Nitrite + Nitrate as Nitrogen	Mud: 0 to 20 mg/L	10 mg/L	C
	Camp: 0 to 20 mg/L		
	Spring: 0 to 20 mg/L		
Dissolved Oxygen	Mud: 3 to 12 mg/L	5.0 mg/L[1] 4.0 mg/L[2]	B(WW-2)
	Camp: 4 to 12 mg/L		
	Spring: 4 to 12 mg/L		
Chloride	Mud: <25 to 94 mg/L	389 mg/L (chronic) 629 mg/L (acute)	B(WW-2)
	Camp: <25 to 383 mg/L		
	Spring: <25 to 247 mg/L		

Source: Iowa Administrative Code [567], Chapter 61
** Depends on pH and temperature of water
[1] Minimum value for at least 16 hours of every 24-hour period
[2] Minimum value at any time during every 24-hour period

3.2 Sources

Based on the monitoring results available and assessments conducted on the creeks, the pollutants of concern in the watershed were prioritized by stakeholders and the WMA. These include groups of both primary and secondary pollutants. Primary pollutants include sediment and bacteria and secondary pollutants include phosphorous and nitrogen. Although the Rapid Assessment of Stream Conditions Along Length (RASCAL) and Revised Universal Soil Loss Equation (RUSLE) assessments (discussed in detail in Section 4) provided ample information on a watershed level, monitoring data can provide targeted information on a local level for priority areas to implement water quality projects. Currently, there is inadequate monitoring data available for the needs of this plan. This proves difficult to determine the origin of the pollutants and quantities present. More robust monitoring of these parameters is addressed in a later section.

3.3.1 Priority Pollutants

Sediment loading and bacteria levels were prioritized as the primary pollutants in the Mud, Camp, and Spring Creek Watersheds because of the recreational contact concerns. Even though Mud, Camp, and Spring Creeks are not a drinking water source, there is still a pollutant concern due to human contact with the water.

Sources of sediment loading could be from any combination of streambank erosion and stormwater runoff from the surrounding rural and urban land uses. Excess amounts of sediment can cloud the stream and harm underwater organisms.

Sources of bacteria could be from any combination of pet waste, wildlife, agriculture, leaking or overflowing septic systems, and failing infrastructure. Bacteria levels can fluctuate greatly based on storm runoff, leaking sewage lines, the time of day, and the time of year. Elevated nutrients and water temperatures also have an effect on bacteria levels. Increased bacteria levels can cause health risks to anyone coming into contact with the water.

The next step would be to monitor the pollutants and determine mitigation actions from the results.

3.3.2 Secondary Pollutants

Phosphorous and nitrogen were set as secondary constituents of concern in the Mud, Camp, and Spring Creek Watersheds, since Mud, Camp, and Spring Creeks are not a drinking water source but high levels of these pollutants have a negative impact on the stream. These nutrients are essential for plant and animal growth and naturally abundant in the environment. Elevated nutrient levels can cause overstimulation of growth of plants and algae. Overgrowth can cause decrease dissolved oxygen in a stream, block light to deeper water, and clog water intakes. Both constituents are being considered for further monitoring and mitigation, if and when funding would be available.

3.3 Expected Reduction

The expected reduction of each pollutant is described in the Desired Outcome column under each goal of the Implementation Schedule in Appendix A. Several tasks have been identified as reducing sediment loading, bacteria, phosphorous, and nitrogen and are discussed in the Implementation Plan section.

4. Stream Assessment

A comprehensive stream assessment was completed by the PSWCD using the RASCAL tool, which is one way to gain firsthand knowledge of the existing conditions in a stream. This tool allows priority areas in the stream to be identified for targeted conservation practices. These practices would reduce pollutant loading by amending adjacent land use, restoring habitat, and stabilizing banks. Data was collected including observed gullies, exposed utilities, tile outfalls, and storm sewers. A GPS camera was frequently used to document these points of interest and keep track of stream conditions.

The stream assessment was broken down into each of the three watersheds, as shown in Figures 4-1, 4-2, and 4-3. Each figure shows the portions of the stream that are stable or eroding and to what degree. All three watersheds show large portions of erosion and very few stable areas. The red areas, showing severe erosion, are the priority areas of concern. Section 6 discusses the implementation of the priority areas.

The PSWCD also conducted assessments on sediment delivery and RUSLE. These maps can be found in Appendix F.

Spring Creek
Source: PSWCD

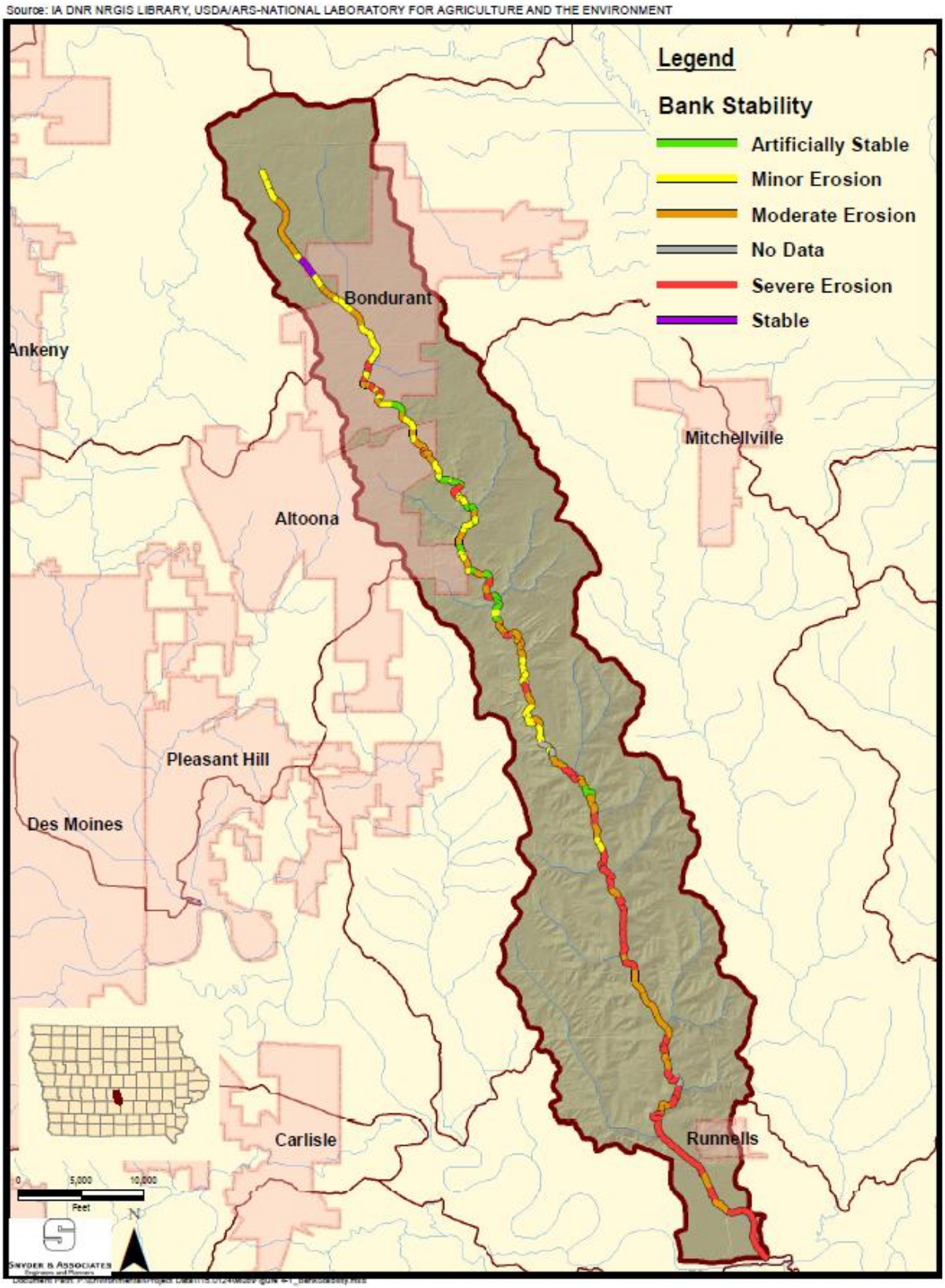


Figure 4-1: Bank Stability on Mud Creek Watershed

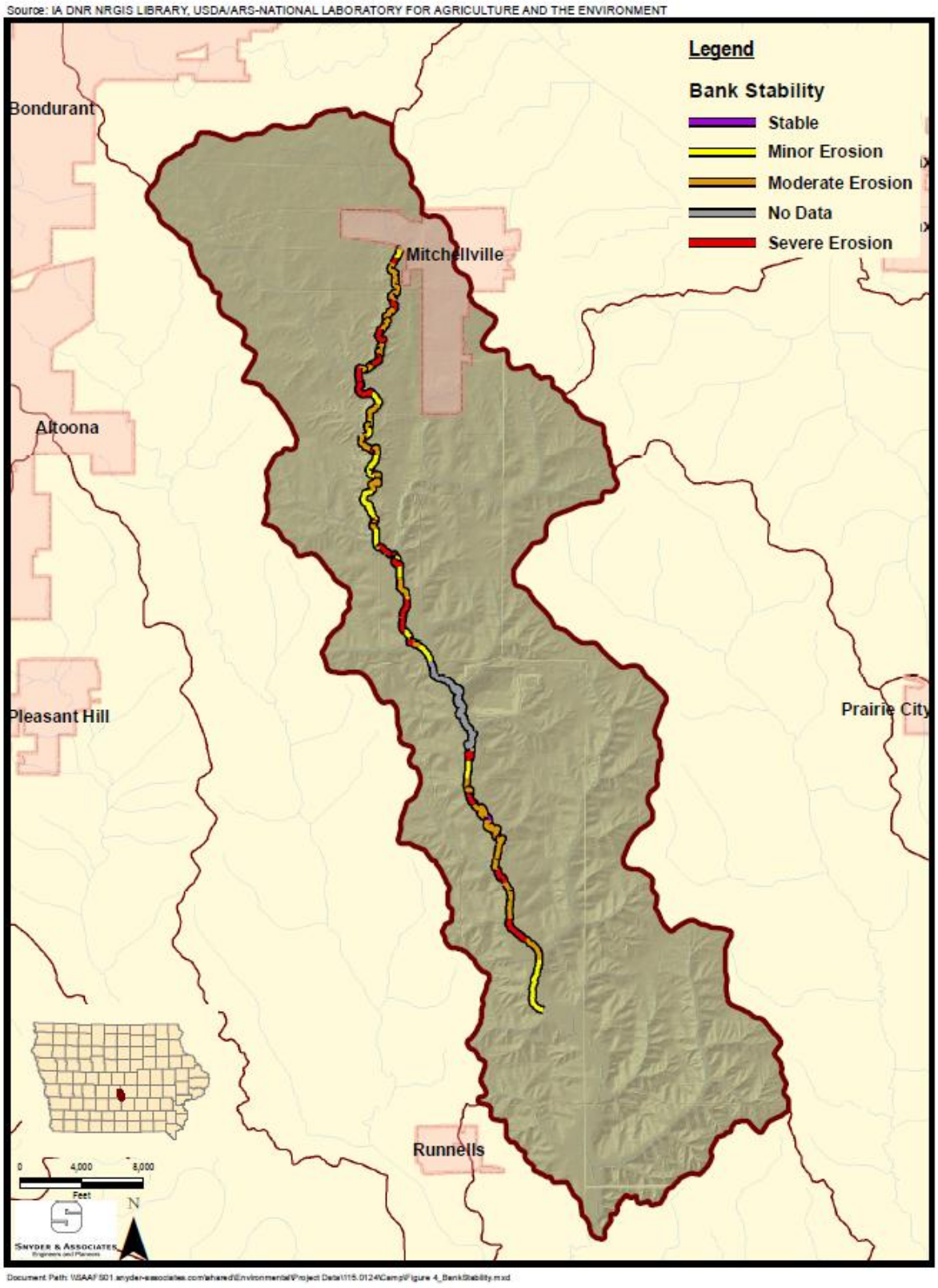


Figure 4-2: Bank Stability on Camp Creek Watershed

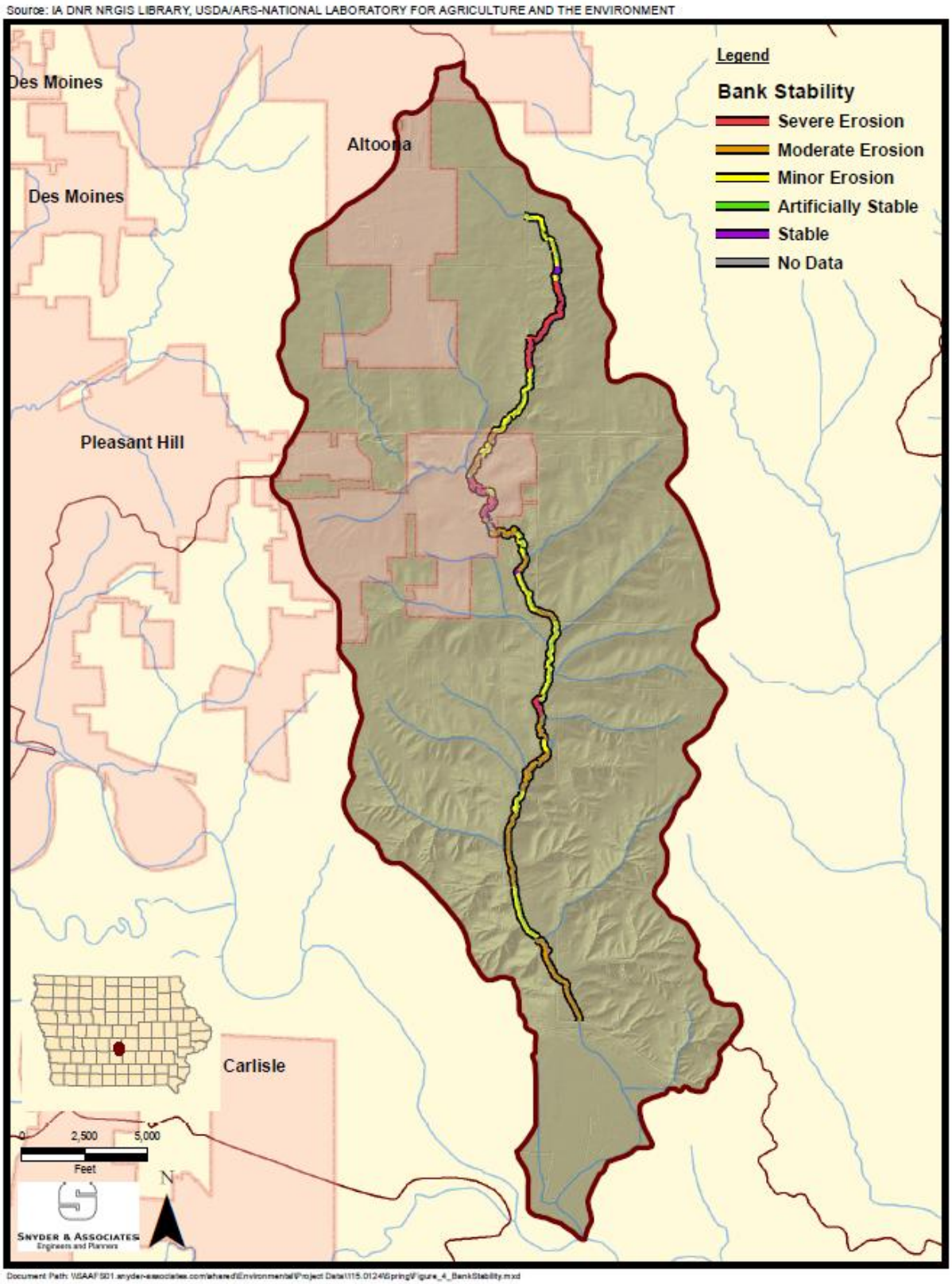


Figure 4-3: Bank Stability on Spring Creek Watershed

5. Stakeholder & Public Involvement

A group of stakeholders with various representations across the watersheds was formed and invited to a series of meetings. The group's purpose was to discuss recommendations to address issues in the watersheds, including storm water and flood management, water quality improvement, public health, recreation, natural resources protection and preservation of the agricultural landscape.

Dates for Meetings

First Stakeholder Meeting:
June 22, 2015

Second Stakeholder Meeting:
September 29, 2015

Third Stakeholder Meeting:
December 14, 2015

Public Open House:
March 8, 2016

Public Meeting:
May 7, 2016

The first stakeholder meeting was focused on discussing the watersheds' features, strengths, and challenges, which led to further discussion on coming up with goals and initiatives for the watersheds by breaking up into small groups. The second meeting was held to discuss work done on stream assessment data collection, as well as address priority areas on each of the creeks that should be focused on for streambank restoration. The group also assigned action items to the goals for the beginning of the Implementation Plan phase.

During the third stakeholder meeting, the group reviewed video of the priority areas and maps identifying water quality modeling results. Also, the group was asked to look more in depth at the Implementation Plan to ensure it was accurate and what the overall group wanted. The fourth meeting was designed to discuss the priorities and recommendations of the Implementation Plan and the planning for the public meetings. Their recommendations were vetted through the Watershed Management Authority and are discussed in the Implementation Plan section.

A public open house was held at the Bondurant Community Library to informally gather opinions from the community about the future of Mud, Camp, and Spring Creeks, as well as discuss the formation of the MCSCWMA and the development of the WMP. Many watershed residents were in attendance. A public meeting is also scheduled for May 7, 2016 at the Victorian Acres Greenhouses in Altoona to promote urban education in the watersheds and present the final WMP to the public, as well as the planning process.

6. Implementation Plan

During the stakeholder involvement process, the group developed recommendations over several meetings, using work completed from the RAMP-UP project in 2005 as the basis for this plan. The RAMP-UP (Runnells, Altoona, Mitchellville, Pleasant Hill, and Unincorporated Polk County) project provided education and outreach about how to incorporate green infrastructure into developing communities in the Mud, Camp, and Spring Creek Watersheds. These recommendations were brought to the Mud, Camp and Spring Creek WMA and the WMA finalized the recommendation documents to be incorporated into the final Implementation Plan.

This strategic framework reflects the work ahead for all landowners within the Mud, Camp, and Spring Creek Watersheds as they address storm water and flood management, water quality improvement, public health, recreation, natural resources protection and preservation of the agricultural landscape. At the same time, the WMA recognizes that increased urban and residential development is also likely in the watershed. The strategic directions presented here are intended to help the watersheds prepare for the increase in development, as well as engage current landowners. A detailed plan on when certain goals and tasks will be implemented is as follows.

6.1 Goal 1: Develop consistent policies for storm water and flood management, water quality improvement, and a well balanced mix of land uses.

The first goal the stakeholder group identified was related to developing consistent policies throughout the watersheds. The majority of hesitation from developers for the adoption of different strategies and practices originates from inconsistency of stormwater guidelines and standards between jurisdictions within a watershed. Stakeholder implementation can be achieved by the adoption of consistent stormwater standards on a watershed or region-wide basis. Implementation of strategies and practices within the Mud, Camp, and Spring Creek Watersheds on a consistent basis will help ensure a positive response from citizens, jurisdictions, and other stakeholder groups. A Watershed Coordinator should be hired to oversee the implementation of developing consistent policies and ensuring the right groups are getting involved.

6.1.1 Objective 1: Identify land uses within the watersheds.

Land uses within each watershed should be identified to help determine what policies should be developed and ensure there is a balanced mix of land uses within the watersheds. Current land use identification will help plan for future land use and guide the planning for any conservation practices that could be implemented. This will help prioritize and meet the needs of all affected parties in the watersheds. Land use, cover, and management should be assessed every year, similar to RASCAL assessments, RUSLE assessments, and other assessments in the watersheds completed by Polk SWCD, to evaluate the information and track that the efforts are successful. This information can be

used to help determine sheet and rill erosion and sediment delivery rates for the watersheds. The RASCAL tool also gives the MCSCWMA information on the existing conditions in a stream based on several factors, such as bank stability, bank height, stream habitat, and vegetation, among others. A GIS database is one way to track the land use information and can be used to make future decisions and property rights discussions.

6.1.1.1 Task 1: Assign a responsible party or parties to identify land uses.

A responsible party or parties must be assigned by the MCSCWMA to help identify the land uses within the watersheds. This will ensure accurate planning and policy development in each watershed. When a Watershed Coordinator is hired, part of their role would be to help facilitate this process and assign a responsible party or parties. During the 2014 growing season, land cover was observed and documented for the watersheds by Polk SWCD. The land uses within the watersheds should be reevaluated on a regular basis to ensure accuracy.

6.1.1.2 Task 2: Meet with city and county planning staff for land use policy review on an annual basis.

The MCSCWMA should hold a meeting with all of the planning staff involved in activities in the watersheds. This will ensure an accurate representation of all land uses and policies in the watersheds, as well as ensure consistency between cities and counties. The meeting will also ensure the land use policy development considers preservation and other factors that will benefit the watersheds. All of the information gathered will be compiled and used to help provide a successful planning process. Because the watersheds are largely agriculture and not heavily developed, future planning of land uses is critical to the soil and water quality of the watersheds.

6.1.2 Objective 2: Use the comprehensive plans of the communities and the county as a tool to guide and support the watershed management plan.

Comprehensive plans were developed with large amounts of research and significant public participation. For this reason, comprehensive plans play an important role in meeting the future needs of each community, which includes identifying current and future land uses within the watersheds. The plans can be a tool for planning in the future growth or change of a community. This plays a crucial role in targeting a well balanced mix of land uses and developing consistent policies.

6.1.2.1 Task 1: Assign a responsible party or parties to review and compile information from each community's comprehensive plan.

As discussed earlier, a responsible party or parties should be assigned by the MCSCWMA to gather information regarding comprehensive plans for communities in the watersheds. This will allow the MCSCWMA to make policy decisions and strengthen the watershed's consistency. These policies will have long-term impacts and the comprehensive plan

information will help make sure the decisions that are made have the best interest of the communities in the watershed.

6.1.2.2 Task 2: Use information from the comprehensive plans to help create development standards.

All comprehensive plans have some aspect of urban design and housing/neighborhood planning. The information from all of the comprehensive plans should be compiled and examined for consistency. This will be the basis for creating development standards. These standards will give developers guidance on stormwater management and other zoning options, which will help lower the current frustrations of developers.

6.1.2.3 Task 3: Meet with city and county planning staff for comprehensive plan review on an annual basis.

Similarly to meeting with city and county planning staff on land use policy review, the comprehensive plan for each jurisdiction should be reviewed on an annual basis. The information discussed will include any similarities or differences between the plans. Since the watersheds will be developed in the future, it is crucial to identify future plans for the best interest for the quality of the watersheds.

6.1.3 Objective 3: Encourage commercial, industrial, agricultural, and residential development that promotes open space and habitat protection through site design and which fits within the character of the development's proposed location.

The Mud, Camp, and Spring Creek Watersheds are unique in that the majority of the watersheds are not yet developed. As the communities continue to develop, they should be protecting open space and environmental resources, such as trees, drainage ways, natural areas, and other forms of wildlife habitat. It will be crucial to balance the growth of the urban and agricultural land and educate the developers on these issues.

6.1.3.1 Task 1A: Promote stormwater management requirements.

Ensure all communities within the Mud, Camp, and Spring Creek Watersheds adopt stormwater management requirements. These management requirements should address both water quality and quantity concerns to maximize benefits in the watersheds as a whole.

6.1.3.2 Task 1B: Require infiltration of water quality volume.

Ensure all communities within the Mud, Camp, and Spring Creek Watersheds adopt standards that require infiltrating the water quality volume on site (as opposed to detaining and releasing that volume). The water quality volume in central Iowa is defined as the runoff that occurs during a 1.25" rainfall event. Infiltration practices have a high removal rate for suspended solids. This removal rate can be between 65%-100%

depending on the practice as suggested in the Iowa Stormwater Management Manual (ISMM). Removal of suspended solids also helps remove metals, bacteria, hydrocarbons, and phosphorus that may be adhered or bonded to sediment particles suspended in stormwater.

6.1.3.3 Task 1C: Require extended detention of channel protection volume.

Ensure all communities within the Mud, Camp, and Spring Creek Watersheds adopt standards that require the detention of the channel protection runoff volume and release this volume slowly over a 24 hour period. The channel protection volume is defined as the runoff that occurs from a 2.4" rainfall event. Detaining this additional runoff volume and releasing it slowly allows for a reduced, although sustained, flow that would otherwise be released into a drainage way. This helps reduce the depth of flow in the channel. This, in turn, reduces the saturated condition of the channel banks and thereby decreases the likelihood of channel bank sloughing. In other words, this runoff control practice reduces stream bank erosion.

6.1.3.4 Task 2: Promote construction of regional detention basins.

Regional stormwater detention basins will provide stormwater storage benefits for reducing flooding risks. The basins can also integrate water quality or recreational amenity aspects. The possible sites for the detention basins will depend on the water quality and quantity goals for the specific location. Once a site has been identified, it will need to be evaluated to identify the optimal locations and size based on topography, land ownership, and future development, as well as any constraints. The benefits of the construction of the basins should be promoted to developers and landowners in the watersheds.

6.1.3.5 Task 3: Develop and promote consistent standards for development.

Consistent standards should be developed using information gathered from the tasks discussed earlier in the section. Once consistency in implementation throughout the watersheds is achieved, developers will enjoy an increased efficiency when navigating standards and submittals. Consistent standards will also assist with streamlining the review process. The current policies should be reviewed and developed with the MCSCWMA and the development community involved to help educate the group, as well as give ownership and involvement to the overall process.

6.1.3.6 Task 4: Promote prairie pothole preservation during development.

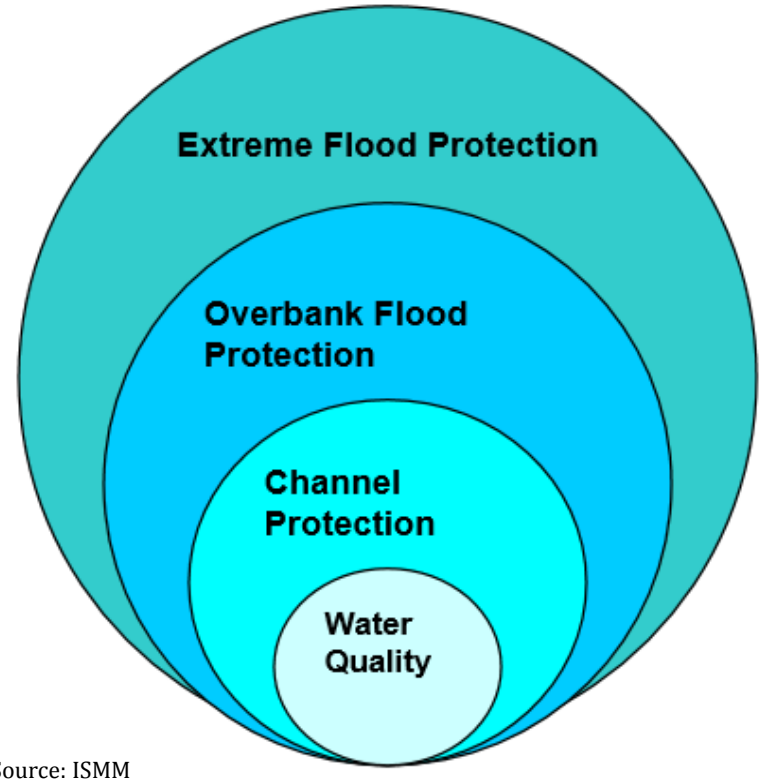
Prairie potholes and other depressions occur naturally within the landscape and can serve as small detention basins for water quality and water quantity improvements. For example, during a 1.25" rainfall event, the same (or greater) runoff volume that would need to be infiltrated in an urban detention basin could be captured in a prairie pothole. This volume would then soak through the soil profile, feeding the native prairie vegetation surrounding the depression and filtering any contaminants present in the runoff entering

the pothole. This naturally occurring process will also attenuate flow and lower peak discharges that reach streams and rivers until the depression is full and runoff begins to flow downstream. The volume of storage could be mitigated in a different location in the same watershed should the current location be unable to work.

As shown on previous figures, natural depressions are located in the watersheds. When a parcel of land is developed, these features are usually filled in and forgotten. This task helps to ensure the preservation of existing depression areas and incorporate the volume lost into the development design. This volume can be added to the water quality volume detention requirement, added to the development in other methods elsewhere in the development, or mitigated for this storage in a banking site within the Mud, Camp, and Spring Creek Watersheds.

6.1.3.7 Task 5: Adopt unified sizing criteria.

A unified approach for sizing stormwater and green infrastructure BMPs should be adopted. These criteria will be used to meet specific goals, such as pollutant removal, reducing channel erosion, prevent overbank flooding, and help control flooding. The criteria should be adopted on a local, regional basis and then considered for more widespread adoption, based on the lessons learned from implementation. Figure 6-1 below illustrates the various levels of stormwater detention that will benefit both water quality and quantity concerns.



Source: ISMM

Figure 6-1: Unified Sizing Criteria

6.1.4 Objective 4: Adopt unified philosophy which would keep floodways, flood plains, and steep slopes free from development or production while integrating into green infrastructure approaches for storm water and flood management.

Another important piece of developing consistent standards is to develop a unified philosophy targeted towards development or production. This philosophy would keep critical areas free of development and also encourage green infrastructure implementation. The MCSCWMA and all communities in the watersheds should be involved in the development process.

6.1.4.1 Task 1: Develop and promote consistent implementation of regional guidelines and standards.

As discussed previously, consistent standards are crucial for guidance among all communities in the watersheds. The standards will be used by developers, city and county officials, agricultural and rural land owners, urban land owners, and others. Each group should be involved in the development of the standards to promote a sense of ownership and heighten the education of issues within the watershed. There are opportunities for partnerships among these groups and maximizing the benefits that the community can provide for the watersheds, which will be facilitated by the MCSCWMA.

6.1.4.2 Task 2: Develop an incentives program for installing/retrofitting green street infrastructure.

An incentives program should be developed by the MCSCWMA to help promote and provide the benefits of green infrastructure. A green streets strategy helps reduce runoff from impervious surfaces associated with urban and suburban streetscapes. This approach uses vegetation, soils, and other natural processes to manage stormwater via infiltration. Stormwater is managed and/or treated where it lands to create healthier urban environments. Practices such as permeable pavers, pervious asphalt, and infiltration ditches (installed in the street median or at the back of curb) help to reduce contaminants entering waterways with the street runoff. These practices also enhance the aesthetics of streetscapes and can often be integrated into other safety and traffic calming measures.

6.1.5 Objective 5: Develop conservation design guidelines and provide a "checklist" for Planning and Zoning Commissioners to use when approving developments.

The MCSCWMA should work with Planning and Zoning Commissioners and other community planning staff to develop guidelines to refer to when deciding to approve a development. A brief summary or outline of the guidelines should also be developed as a resource for planning staff to utilize. This will help ensure consistency and equality between the decisions made and ensure that the appropriate choices are being made for the enhancement of the watersheds.

6.1.5.1 Task 1: Create and implement a smart growth checklist.

A smart growth checklist should be developed for proposed development projects within the watersheds. The checklist will be prepared with guidance from each of the members of the MCSCWMA and the Watershed Coordinator to determine whether a proposed project is likely to have any impact on the overall watershed health. Since the watersheds are certain to grow, the growth needs to be carefully planned and make sure there are no negative impacts.

6.1.5.2 Task 2: Review outcomes from Objectives 3 and 4 to help refine the checklist.

After the smart growth checklist has been reviewed and implemented, the results should be monitored based on the outcomes desired from Objectives 3 and 4. The smart growth checklist should then be assessed for effectiveness and edits could be made to obtain the desired results, if necessary. This should be done on a regular basis to ensure the checklist is relevant and serving its purpose to provide the most benefit to the watersheds.

6.2 Goal 2: Increase community awareness, support, and involvement in the Watershed Plan and its implementation.

Another important goal the stakeholder group identified was to increase community awareness and involvement in the watershed plan to help support its implementation. The support of the communities and residents within the watersheds is crucial to the success of the implementation. A Watershed Coordinator should be hired to help keep the community engaged and oversee the implementation of the plan. This could be done by several different methods, including educational programs, public meetings, or professional organization meetings. The Watershed Coordinator and MCSCWMA will work together to determine the best course of action for the success of the watershed's implementation.

Educational programs are important to present key messages for different audiences, such as agricultural and urban groups. These educational programs should be developed to promote best management practices. Key messages should include the concerns with land, the importance of developing partnerships and collaborating, a range of best management practice solutions, the resources available, why they should care, the impacts on other community systems, and public health impacts, among others. These are just some of the examples of key messages that should be targeted to encourage best management practices.

6.2.1 Objective 1: Generate opportunities for citizen participation. Foster public support for storm water management practices.

One objective of the MCSCWMA is to increase the opportunities for residents within the watersheds to be engaged in implementation efforts. The involvement of the communities will provide a sense of ownership and pride and help support the success of the plan's implementation. Part of the success of implementation is to encourage and educate

residents about stormwater management practices and contribute to the overall improvement of the watersheds.

6.2.1.1 Task 1: Develop a website and engage the schools in the watershed.

One way to engage the residents in the watersheds is to coordinate with the school districts in the watersheds to volunteer their time to develop a website and incorporate the watershed into their classes. The schools could incorporate the development and maintenance of the website specific to the watershed. The schools could also incorporate a hands-on component by incorporating water monitoring, using guidance from IOWATER, or field trips to conservation practices that have been implemented.

6.2.1.2 Task 2: Launch and maintain a stream cleanup.

Another example of a hands-on educational program that residents might be interested in is the Adopt a Stream program, which was established by the Metro Waste Authority. For the Adopt a Stream program, the intent is to have every mile of stream covered by an individual, group, or organization. The section of stream that is adopted will be cleaned up on a regular basis. Additional information can be found at http://www.goadoptastream.com/. Another hands-on educational program could be involving students at the schools in the watersheds and engage them in water quality monitoring. Residents could help participate in events organized by the MCSCWMA or Watershed Coordinator and gain a sense of ownership in taking care of the watershed and community that they live in. This will help increase community awareness and gain support for the plan's implementation.

6.2.2 Objective 2: Develop and promote educational programs to reach key stakeholders and the general public.

Ongoing education efforts are crucial to develop relationships and enhance education among residents within the watersheds. Different types of education efforts should be explored to cater to all audiences' interests and encourage participation. Intended audiences include Chamber of Commerce, retail and industry, garden clubs, residential groups, agricultural groups, co-ops, and schools, among others. Circulation media in the watershed includes the Altoona Herald, the Des Moines Register Eastside, the Living magazines for each jurisdiction, and libraries within the watershed. The people interested in the watershed efforts will want to see real life facts that they can relate to and understand. In addition, Metro Waste Authority has an indoor/outdoor Environmental Learning Center that hosts learning opportunities through a partnership with SE Polk School District and Drake University. This entire effort will have to be ongoing to reach the appropriate people and provide education in different settings.

6.2.2.1 Task 1: Conduct and promote several types of educational programs.

Some examples of educational programs that have worked for other WMAs include Bus Tours, Field Days, Workshops, and Speaker Series. Bus Tours consist of taking a group of

people, such as government officials or residents of neighboring communities, on a tour around the watersheds to see several different conservation practices and areas of concern in the watersheds. Field Days, Workshops, and Speaker Series involve having outside resources come in to present to a similar group of people. These activities can be more hands on than just a tour and a different way to engage the public and other groups involved in the watershed plan's implementation. The Watershed Coordinator would be the lead on implementing education programs, i.e., reaching the agricultural, rural, residential, and developer landowner audience, as well as city council members, county board members, and other civic officials with key messages. Tactics to employ for message delivery include those listed below.

6.2.2.2 Task 1A: Implementation – Work Sessions

Work sessions could be held by any interested party to discuss issues in the watershed and ensure those interested are educated about the topics of concern.

6.2.2.3 Task 1B: Implementation – Field Days

Field days include taking different groups of people into the field to see the successful implementation of various best management practices.

6.2.2.4 Task 1C: Implementation – Speaker Series

A speaker series entails having a variety of speakers at different organization's meetings. These would include outside resources that could provide information to benefit the organization.

6.2.2.5 Task 1D: Implementation – "Speed Dating" Sessions

"Speed dating" sessions are one way to get face-to-face contact between watershed residents, farmers, elected officials, developers, etc. People would have the opportunity to sit down with others and have an open discussion.

6.2.2.6 Task 1E: Implementation – Current Staff Utilization

The current staff could be utilized to educate watershed residents by attending meetings and conferences.

6.2.2.7 Task 1F: Implementation – Local Media/TV

Local media, such as TV, newspapers, or magazines, could be utilized to spread the word about the final Watershed Management Plan and any updates or informational meetings.

6.2.2.8 Task 1G: Implementation – Panel of Experts

A panel of experts could be set up to be a resource to anyone interested. The experts would provide face-to-face interaction with watershed residents and be available to answer any questions.

6.2.2.9 Task 1H: Implementation – Direct Mail Campaign

A direct mail campaign is another way to inform and educate watershed residents about anything going on.

6.2.2.10 Task 1I: Implementation – Informational Meetings

Informational meetings, similar to the public open house and meetings held by the MCSCWMA, could be a beneficial way to routinely keep watershed residents updated and educated about what is relevant in their watershed.

6.2.2.11 Task 1J: Implementation – Focus Groups

Focus groups can be utilized to emphasize specific topics and ease the pressure of a large group setting.

6.2.2.12 Task 1K: Implementation – Agricultural Retail Outreach

Agricultural retail outreach is another method to promote and educate watershed residents related to agricultural issues.

6.2.2.13 Task 1L: Implementation – Surveys

Surveys could be mailed or emailed out to obtain feedback from a variety of watershed residents.

6.2.2.14 Task 1M: Implementation – Workshops

Workshops could be formed around a theme through organizations or sponsors utilizing other relevant organizations for information.

6.2.2.15 Task 1N: Implementation – On Farm Learning Network

An on farm learning network should be formed to facilitate a hands-on experience to those interested. Farms that have implemented conservation practices would be available for tours and hands-on demonstrations to help increase the education and awareness or various practices.

6.2.2.16 Task 1O: Implementation – SWCD Awards

Several county Soil Water and Conservation Districts (SWCD) have expressed interest in forming an awards program, where each county could acknowledge county residents or watershed members for having the best conservation practices in the county. This would highlight practices that residents are having success with and possibly inspire other residents to do the same.

6.2.2.17 Task 1P: Implementation – State Fair WMA Day

Another idea the stakeholders presented was to have a State Fair WMA Day, with partnership together with Iowa DNR. Representatives from different WMAs could set up booths and displays at the DNR building at the fairgrounds. It will be open to the public and could be used to educate residents about what is going on in their watershed and other watersheds and the practices that are being implemented. This could also be utilized as an educational opportunity between WMAs to collaborate and share ideas of lessons learned in their own watersheds.

6.2.2.18 Task 2: Designate Outdoor Teaching Facilities.

As discussed in a previous section, early adopters and advocates for a given practice need to be secured as champions for this work. Within this assessment and search, the practices that they are adopting need to be investigated for possible outdoor teaching and tour sites. Many individuals or organizations with interest in a particular practice may be hesitant to implement it. They may be unsure of how to install and/or maintain a particular practice. Teaching and model implementation sites would allow these interested parties to tour a practice in the field and interact with one or more advocates regarding installation procedures and actual (rather than perceived) maintenance requirements. Metro Waste Authority has an indoor/outdoor Environmental Learning Center that hosts learning opportunities through a partnership with SE Polk School District and Drake University.

6.2.3 Objective 3: Support and coordinate community outreach programs and events that encourage private stewardship of land and water resources.

In addition to the educational programs discussed in earlier sections, another opportunity to develop support in the watersheds is to provide programs that promote private property owners to be responsible for the planning and management of natural resources on their land. These programs should be targeted toward both agricultural and urban landowners. Both small scale and large scale projects have the opportunity to make a positive impact on the watersheds.

6.2.3.1 Task 1: Assign a responsible party or parties to identify community outreach programs.

A responsible party or parties should be assigned the task of identifying the best community outreach programs that would benefit the watersheds. This could also align

with any partnerships that are formed during the process or with the hiring of a Watershed Coordinator. Community outreach programs will reach a wide variety of watershed residents and help make the plan's implementation successful.

6.2.3.2 Task 2: Seek additional partnerships to support community outreach programs.

Community outreach programs develop support, provide educational opportunities, and also provide benefits throughout a community to the residents or the natural resources in the watershed. Additional partnerships should be sought out to help facilitate and coordinate resources. This could include collaborative program development or additional funding sources, among other ways to support community outreach programs. This would fall under the responsibility of a Watershed Coordinator or someone assigned by the MCSCWMA.

6.2.4 Objective 4: Support programs that encourage conservation practices, especially in agricultural areas.

Conservation practices, including cover crops, stream buffers, grassed waterways, end of field treatments, and no till, are important in agricultural areas to allow sediment in surface runoff to settle out, increase infiltration, and control excess nutrients contained within the runoff. Soil disturbance should be minimized to reduce erosion and sediment loading to waterways. Other conservation practices are equally important in urban areas, but the stakeholders identified the need to target agricultural areas, mainly because the watersheds are largely agricultural.

6.2.4.1 Task 1: Identify funding needs to support conservation practices.

Funding of the implementation is a critical element of the overall success of the management plan. As jurisdictional funding abilities are limited, innovative methods of cultivating funding is required. Funding alternatives that will need to be identified to assist in generating the funding required for implementation of the management plan. Incentive programs have been successful with implementing conservation practices and sources of funding will need to be identified to develop and grow a program. Partnerships will also need to be developed as possible sources of funding or matching. A responsible party or parties should also be assigned to identify these needs.

6.2.4.2 Task 1A: Pooled Resources

Many of the costs associated with this Watershed Management Plan have watershed wide benefits. Pooling resources on a project by project basis or as an annual appropriation will allow the costs for all the priorities to be shared more equitably among the jurisdictions. This pool could also be used as a grant match in cases where that is required. This shows that jurisdictions are invested in the plan elements and improves opportunities for funding. Examples where this would assist include funding for a monitoring program, streambank restoration program, and the hiring of a Watershed Coordinator.

6.2.4.3 Task 1B: Legislative Funding

The state level funding of water quality initiatives is relatively small, as compared to the overall needs. Obtaining grant funding to address many of the elements of this plan, in a timely fashion, is unlikely. There is currently an opportunity within the State of Iowa to increase funding for water quality. If the state sales tax is increased, the first 3/8 of one cent will be allocated to the Natural Resources and Outdoor Recreation Trust Fund. This funding would not be solely for the purpose of water quality, but it would "move the needle" toward having a steady funding stream to watershed management authorities for water quality improvement within Iowa. Actively advocating for the sales tax increase will assist in making this funding stream a reality.

6.2.4.4 Task 1C: Grants

There are several grant sources available for funding. Many grant applications will match funds using in-kind and monetary contributions. Several projects have been funded via this method in the watersheds and will continue to be a tool to successful implementation. Several organizations offer various grant opportunities, which can be found discussed in more detail in Section 7.

6.2.4.5 Task 2: Develop a conservation practice incentives program.

A clear path and plan needs to be developed for dissemination of proposed strategies to potential adopters under existing funding mechanisms. There are many existing programs that can help to fund establishment or maintenance of a strategy, but there is a lack of clear understanding regarding how to navigate some of the funding mechanisms. If this information is shared with potential adopters, the rate of strategy implementation would increase.

Additional incentive programs need to be developed at a watershed and regional level to ensure the viability of practices being adopted and ultimately implemented on a wide scale. This will involve communication between jurisdictions within the watersheds and the region to target and develop the types of incentive programs needed. This will also create a great opportunity for jurisdictions to provide pooled resources to maximize adoption of practices throughout the watersheds and region.

6.2.4.6 Tasks 2A, 2B, and 2C: Cover Crops, Grassed Waterways, Stream Buffers

Vegetative cover provides multiple benefits in the watersheds and to the streams themselves. First, rainfall is intercepted by the vegetation, which reduces kinetic energy of the water before it contacts the soil. This increases the potential for infiltration and reduces the chance that soil particles are dislodged and suspended in stormwater runoff that exits a field. Second, the vegetative cover slows and filters any runoff as it leaves the field and before it reaches a waterway. This serves to enhance infiltration, attenuate peak flow rates, and reduce pollutant content in runoff entering nearby streams. Finally,

vegetative cover uses excess nutrients that may be in the soil profile for its growth, further reducing the potential for those nutrients to reach a nearby stream or other water body.

Vegetative cover practices include cover crops, stream buffers, grassed waterways, prairie strips and perennial crops. Some of these practices are illustrated in Figures 6-2 and 6-3 below.

Figure 6-2: Cover Crops

Figure 6-3: Grassed Waterway

6.2.4.7 Tasks 2D and 2E: Strip Tillage and No Tillage

Minimizing soil disturbance reduces the opportunity for erosion and sediment loading to waterways. This keeps soil and organic matter upstream in the watershed, available for further valuable agricultural production. It also keeps nutrients and other pollutants attached to sediments from reaching waterways within the watersheds.

These practices include reduced tillage, strip tillage, and no till. The agricultural leaders of the stakeholder group emphasized the value of reduced tillage and strip tillage. Strip tillage is illustrated in Figure 6-4 below.

Figure 6-4: Soybean Field Following Strip Tillage

6.2.4.8 Task 2F: Edge of Field/Tile Treatments

Edge of field treatments can be installed at the end of a field drainage way or at the end of a drain tile outlet. Each treatment has unique applications. At the end of a tile line, runoff treatment practices tend to reduce nitrogen. A bioreactor or saturated buffer at a tile outlet can accomplish high nitrogen reductions, according to the Iowa Nutrient Reduction Strategy (NRS). However, it will have little impact on sediment load, since water exiting tile lines does not usually have high turbidity. A wetland at the end of a field can allow sediment in the surface runoff to settle out, increase infiltration, and use excess nutrients contained within the runoff for vegetative growth. An end of tile bioreactor installation is illustrated in Figure 6-5 below.

Figure 6-5: Bioreactor Being Installed in a Field

6.2.5 Objective 5: Recognize and showcase the efforts of landowners, farm operators, developers, individuals, businesses, and other who demonstrate leadership and make a commitment to land and water conservation stewardship in the watershed.

Another way to increase community support and awareness is to acknowledge those individuals or companies who have implemented conservation practices or shown other forms of leadership to natural resources within the watershed. This will help reward those who are already participating and educate those that might be interested in it and need more information. Several different ideas the stakeholder group presented are discussed below.

6.2.5.1 Task 1: Develop and implement an award/recognition program.

The stakeholders envisioned an award or recognition program put on by the MCSCWMA where residents in the watersheds would be selected for a panel and select and showcase other residents in the watersheds who demonstrate the highest commitment to protecting and improving the watershed. Both urban and rural practices would be recognized, with help from Polk SWCD on the agricultural side. This program would encourage and inform other residents in the watersheds of their options for implementing conservation practices.

6.2.5.2 Task 2: Develop an incentives program for conservation practices.

As discussed in a previous section, incentive programs have shown to be successful and can provide benefits to watersheds and waterways, as funding is available. With the help of a Watershed Coordinator, the incentives program benefits will be maximized by utilizing partnerships formed with organizations within the watersheds. Polk SWCD has agricultural partner connections and the jurisdictions have urban partner connections.

6.2.5.3 Task 3: Develop BMP Database/Documentation.

Documentation of the best management practices being implemented within the watersheds is a critical element in the implementation strategy. The jurisdictions are already executing many practices and the documentation of all of these practices in the watersheds will provide opportunities for additional advocacy, as well as assist with future funding opportunities. If homeowners, land owners, or business entities see that a practice is being adopted on a wide scale by their peers, this would provide an environment of increased interest in a particular practice and may provide increased implementation. Also, oftentimes this information is critical in the application for grant funding for additional practices.

6.3 Goal 3: Maintain, preserve, and enhance natural resources character and function for habitat, recreation, and quality of life.

One goal that the stakeholder group identified is focused on maintaining, preserving, and enhancing natural resources and function. This is a priority because sometimes it is not taken into consideration during the planning process and is an afterthought. This is one of the main goals in most WMAs that are formed. This will be an ongoing effort because there are always going to be improvements that could be made in the watershed. With the appropriate staff and partnerships, the efforts will be successful.

6.3.1 Objective 1: Provide incentives and options to landowners to retain contiguous natural areas, open spaces, and agricultural areas.

Additional incentive programs need to be developed at a watershed and regional level to ensure the viability of practices being adopted and ultimately implemented on a wide scale. This will involve communication between jurisdictions within the watersheds and the region to target and develop the types of incentive programs needed. This will also create a great opportunity for jurisdictions to provide pooled resources to maximize adoption of practices throughout the watersheds and region.

6.3.1.1 Task 1: Convene with agricultural partners to assess current incentives and determine future enhancements.

Developing partnerships is a great way to pool resources and not repeat work that has already been done. This will save time and resources. Some groups focused on agricultural conservation practices have experience with successes and current incentive programs

that work. This will help in the planning process of determining future enhancements. Polk SWCD should be utilized as the convener because they already have the relationships with agricultural residents. Partners will also include Polk County, Iowa Natural Heritage Foundation, and the communities within the watersheds, among others.

6.3.1.2 Task 2: Develop partnership board with organizations to conduct assessments and gain support from the communities.

As a result of partnerships being made from the implementation of this plan, additional information could be gathered or produced from these sources. This information could also serve as a resource to gain support from the communities within the watersheds. This will help ensure maximized planning for programs and best management practices. For example, Polk SWCD has supplied their services to conduct several assessments in the watershed, Snyder & Associates, Inc. completed a study on Mud Creek in 2014, and water monitoring data has been made available through IOWATER and their staff of volunteers. More information should be gathered utilizing the partnerships and resources and made aware to the public. Residents in the watersheds should know what is going on and what the future of the watersheds looks like.

6.3.2 Objective 2: Promote conservation of open space lands not only for their economic importance, but also to retain a key measure of the area's scenic views and cultural areas.

Open space lands are being developed at a rapid rate, and sometimes in the floodplain, which can cause problems. In some watersheds, money is being spent to buy and conserve these open space lands to keep a natural presence. The open spaces also serve an economic and cultural purpose. In some cases, the State Historic Preservation Office could be helpful in administering historic or cultural preservation programs based on their review and outreach from the MCSCWMA.

6.3.2.1 Task 1: Assign a responsible party or parties to identify areas in the watersheds that are likely for easement/buy-out.

As part of conserving open space areas, some areas in the floodplain need to be preserved for the health and safety of residents, decrease in natural disaster clean up, and other things. A responsible party or parties should be assigned to identify the areas that are the most probable to be eligible or provide the most benefit for a buy-out. The properties that are identified will also have to be assessed based on funding available or obtained.

6.3.2.2 Task 2: Review the watershed assessment work that has already been completed for identifying possible conservation open space areas.

Identifying land prone to flooding is the first step in preserving these open spaces and enhancing the safety of the residents. Watershed assessment work has been completed in a few watersheds in Central Iowa. A study was completed in 2014 by Snyder & Associates on Mud Creek. Polk SWCD has completed RASCAL assessments on all three of the creeks in

2013 and 2015, as well as land cover assessments in 2014. Based on assessments done in the watersheds, this information should be reviewed and compiled for identifying high priority areas that are flood-prone.

6.3.3 Objective 3: Promote thoughtful consideration of land use planning to preserve rural character and encourage green infrastructure.

When communities are developing comprehensive plans and land use plans, the planning process should take into consideration the future of the watershed and plan on preserving green spaces. Also, green infrastructure should be encouraged, through educational programs or incentive programs, if resources are available. Partnerships between jurisdictions within the watersheds should be utilized to pool resources and ensure these programs are going to be maximized. The planning staff of each city and county in the watersheds should be involved throughout the planning and policy review.

6.3.3.1 Task 1: Determine policy modifications or additions for potential broad-based adoption.

When policies are developed, they will be developed on a small scale for the watersheds, but it should be taken into consideration that the policies could be adopted on a larger scale. Policies should be implemented on a regional level to ensure the viability of practices being adopted before ultimately being implemented on a wide scale. The policies could be implemented in other watersheds or communities to which these policies are applicable. Policies that have already been implemented in other watersheds should also be reviewed for guidance.

6.3.3.2 Task 2: Address developer ownership and the impact on future soil and water health.

In parts of the watersheds, large parcels of land are owned by commercial developers or residential developers that will develop in the future. The MCSCWMA and stakeholders want to make sure the development is smart development and carefully planned out to give the most benefit to the watershed, instead of having it turn into a large impervious area with increased runoff and pollutants. Green infrastructure or other stormwater conservation methods could be implemented. A key step will be to meet with the developers before development and make sure every party is in agreement with the next steps.

6.3.3.3 Task 3: Establish a Natural Resources Overlay District.

A natural resources overlay district would assist in the planning of transportation and development projects throughout the watersheds. The Tomorrow Plan, as prepared by the Des Moines Area Metropolitan Planning Organization, provides outlines and examples of information that would be included in a proposed overlay district. The MCSCWMA needs to discuss any and all information that they and other stakeholders would like to see in this very important planning tool. Examples include: floodplains, prairies, wetland sites,

archeological assets, etc. Once this overlay district is established, it can be updated frequently as new information is acquired. It can then be used during long term planning exercises within the watersheds to avoid issues and concerns before they even arise. Additionally, a potential developer could consult the overlay district information to plan what mitigation strategies they may use or need to use during their project.

6.3.4 Objective 4: Develop and preserve open space areas to serve as buffers and habitat protection.

Open space areas should be identified and acquired to function as buffers between different land uses. The buffers will serve to conserve open space and can be used for recreational purposes. Conservations easements should also be identified if possible. A Watershed Coordinator and any supporting partnership personnel will be responsible for working with developers and determining the need for conservation easements.

6.3.4.1 Task 1: Identify sites and determine minimum buffer and/or setback limits unique to each site.

The sites where buffers or setback limits should be implemented need to be identified early in the process. Each site will have specific requirements and limitations that will need to be determined. As the watersheds develop, the potential sites should have already been assigned to ensure the most benefit for the watersheds and consistent implementation.

6.3.4.2 Task 2: Assign a responsible party or parties to determine if conservation easements are needed for future protection.

A responsible party or parties should be assigned to determine where buffers should be implemented in the watersheds and if conservation easements would be necessary. A conservation easement can be used to maintain and improve water quality, maintain and improve wildlife habitat, and ensure that lands are properly managed. Once land becomes considered a conservation easement, it has restrictions placed on it and preserves the land for future generations. Based on the available data, the responsible party or parties should be responsible for determining whether or not a conservation easement will provide benefit to the watersheds.

6.3.5 Objective 5: Utilize recreational opportunities as a means to promote conservation and greenway preservation/adoption throughout the watersheds.

Recreational opportunities, such as lakes, parks, trails, and wildlife areas can be used to promote conservation throughout the watersheds. Informational sessions or attending meetings will reach a wide variety of watershed residents, both urban and rural. Also, partnerships could be utilized to promote conservation, such as the PCCB conducting assessments or integrating this information within the Water Trails Plan by the Des Moines

MPO. These partnerships could also be used to gain support from cities in the watersheds and Audubon, whose mission is to conserve and restore natural ecosystems.

A greenway system allows for multiple benefits along the stream and in the watershed as a whole. It is being targeted by the MCSCWMA to reserve the 500 year (0.2% annual chance) floodplain as a greenway. This could be by acquisition, donation, or by overlay district. This will ensure that future property and life loss due to flooding will be lessened significantly. A greenway system also allows for the implementation of many practices presented in relation to other goals in this plan such as native vegetation, stream buffers, wetlands, etc. Additionally, greenways offer greater opportunity for recreation and aesthetic enhancement near a stream or river.

6.3.5.1 Task 1: Improve the understanding of current and potential recreation opportunities in the watersheds.

The watersheds are full of recreational amenities, some more well-known and popular than others. For example, trails and parks are common but others need to be considered, such as birding or other natural wildlife areas. Some residents currently utilize these amenities and other amenities have either not yet been identified or are not utilized as much as the better known amenities. The amenities that are currently available should be promoted and made aware to those who do not utilize them. In addition, the potential for implementing new recreational amenities should also be considered and supported.

6.3.5.2 Task 2: Establish Main Channel Greenway Network.

Establishment of the 500 year floodplain along the main channels as a greenway system will be easier and should be implemented before a similar strategy for the tributaries is developed. Flooding along the main channel of Mud Creek has been analyzed with detailed hydraulic methods as a part of the Mud Creek Watershed Study performed by Snyder & Associates, Inc. This study will also be used for the update of the Polk County FEMA Flood Insurance Rate Maps (FIRMs). Within this study, new hydrologic models and peak discharges were developed. These peak discharges were then used in a detailed hydraulic model to develop flood profiles along Mud Creek. These updated flood profiles were used to map inundation extents in the 100 year and 500 year floodplains along the entire studied reach.

6.3.5.3 Task 3: Establish Tributary Greenway Network.

After the establishment of a greenway system along the main channel, a greenway system adoption plan for the tributaries should be created. Most, if not all, of the tributaries have not been modeled with detailed hydrologic and/or hydraulic methods that accurately map the 100 year and 500 year floodplain extents.

The 100 year and/or the 500 year floodplain boundaries should be established over time for each major tributary to ensure consistent connectivity of the greenway system throughout the watershed. However, in instances where only the 100 year floodplain is

mapped for a tributary or there is not an official floodplain that has been mapped, a Minimum Protection Elevation should be established. In instances where there has not been a floodplain that has been mapped, the 500 year floodplain should be established to ensure proper buffer width through proposed developments.

6.3.5.4 Task 4: Promote stream corridors.

Based on work done in the Mud Creek Watershed Study completed in 2014 by Snyder & Associates, Inc., stream corridors were identified as a crucial component of stormwater management and flood hazard mitigation. Stream corridors have multiple functions, including reducing flood risk, improving water quality and other conditions, maintaining and improving aquatic and terrestrial habitats, filtering and treating runoff contaminants, and possible recreational and educational facilities.

6.4 Goal 4: Identify and address soil and water issues to improve flood management and water quality.

One critical goal of the MCSCWMA is to address soil and water quality issues in the watershed. Each watershed poses different challenges and MCSC is unique because it is largely agricultural and not as developed as some of the other watersheds in the Central Iowa area. This gives the MCSCWMA flexibility to plan for future improvements and determine the best placement for Best Management Practices (BMPs). Some information is currently available but the extent of the water quality concerns and high risk areas need to be identified before any actions can be made.

6.4.1 Objective 1: Establish water quality monitoring programs to identify water quality issues.

An understanding of the current conditions is critical to assess the impact of future improvements. There is water quality monitoring data available in the watershed, but it is intermittent. This monitoring information is crucial to determine the extent of the concerns of the water quality within the watershed and the problem areas, as well as to make recommendations for the best placement for BMPs and other conservation practices. Protocols have been developed by IOWATER, which are also being used in other watersheds as a guide. A monitoring plan is needed to meet the needs of the watershed and help the implementation of this plan to move forward in the right direction.

A subcommittee of the MCSCWMA was formed to establish the ideal locations for monitoring and develop monitoring strategies. This includes developing a monitoring plan and properly submitting the data. The MCSCWMA will work with the IDNR and designate Polk County Conservation Board as the record keeper for all data. Appendix H includes examples of the IOWATER chemical, physical, and biological assessment documents.

Monitoring sites were designated so as to divide the watershed to more likely demonstrate a measureable change in water quality as Watershed Management Plan elements are implemented. Site locations were chosen to meet access requirements and monitoring

personnel safety. Fixed monitoring locations will be used to represent the condition of the waterway and to provide the ability to reassess the waterway for future reports. Some locations were given priority due to past monitoring data collection. There are 8 site locations that will be monitored on a regular basis. Table 6-1 shows the locations of the monitoring sites with coordinates.

Table 6-1: Monitoring Locations

IOWATER Site #	Creek	Brief Location Description	Latitude	Longitude
977066	Camp Creek	Bridge crossing leaving Thomas Mitchell (TM)	N41.63709	W093.37826
977067	Camp Creek	SE 6th Ave.- SE Polk Environmental Learning Center	N41.57992	W093.35652
977152	Camp Creek	Bridge crossing into TM (low water crossing)	N41.64281	W093.37997
977302	Mud Creek	Gravel road SW of Runnells	N41.50741	W093.36693
977303	Mud Creek	NE 62nd Ave just north of Altoona	N41.67304	W093.45518
977304	Mud Creek	NE 12th just off Hwy 163/University	N41.60078	W093.41424
977108	Spring Creek	Vandalia Ave.	N41.53627	W093.43663
977242	Spring Creek	Near SE Polk High School	N41.59865	W093.45079

Monitoring will be conducted twice a month to allow for a consistent sampling interval and allow the data from all sites to be directly compared. Monitoring locations are shown in Figure 6-6. Monitoring frequency will be assessed and modified, as needed, as the testing program progresses.

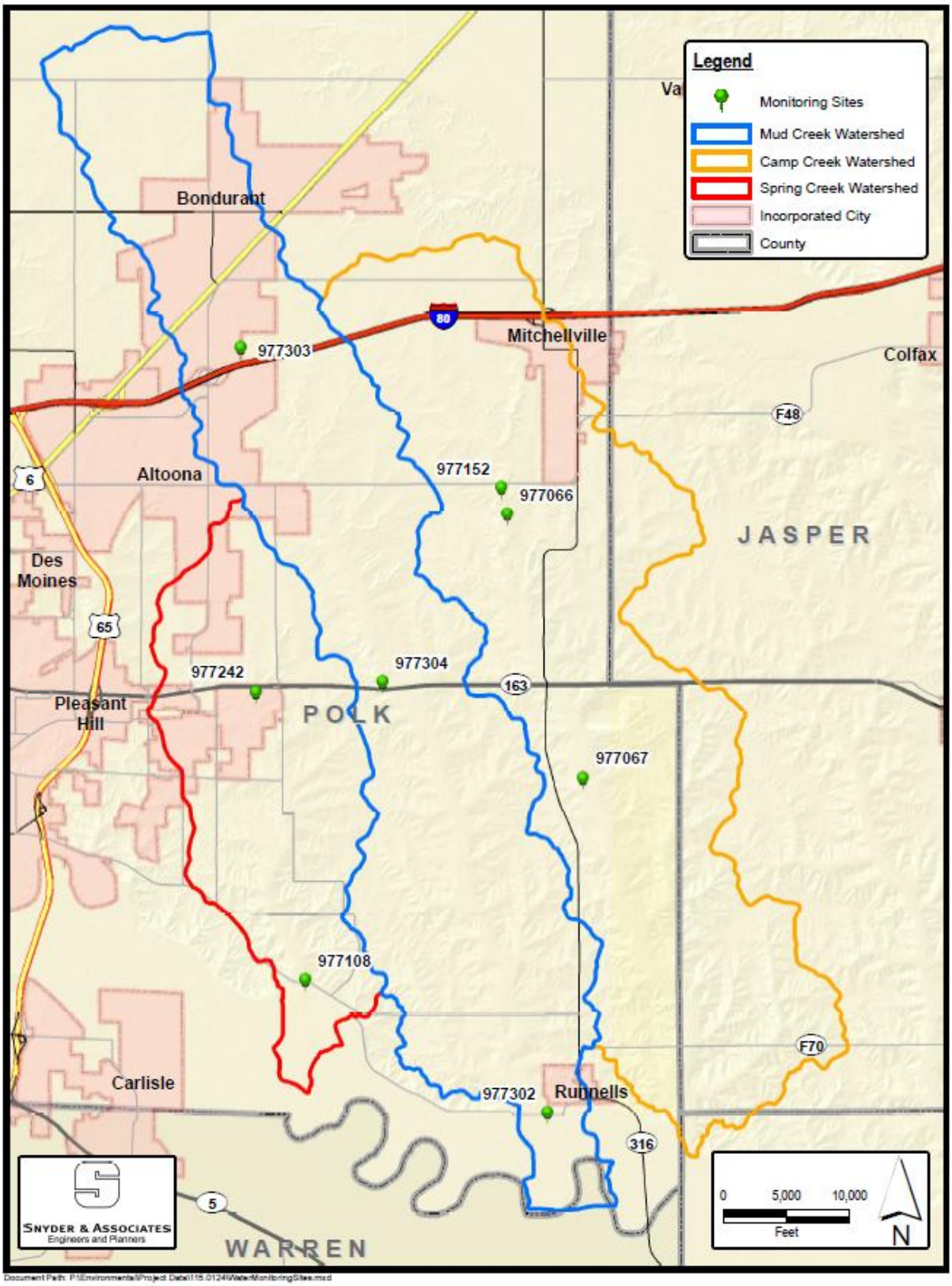


Figure 6-6: Mud, Camp, and Spring Creek Water Quality Monitoring Sites

The chemical and physical assessments will comprise of monitoring various characteristics of each site, including weather, water color, water odor, air temperature, precipitation, transparency, pH, nitrite as nitrogen, nitrate as nitrogen, dissolved oxygen, phosphate, chloride, water temperature, and stream flow. The MCSCWMA determined these constituents based on priority areas in the watersheds.

The constituents described above will be monitored by staff within the designated responsible jurisdictions using field kits and practices developed by IOWATER. The monitoring results will be used to analyze trends within the watersheds. A red flag network will also be used to alert monitoring personnel of any abnormal results requiring additional testing. The constituents to be monitored are specified in Table 6-2 below, as well as the Iowa Water Quality Standard, Designated Use Classifications, and Parameter Quantity limits.

Table 6-2: Water Quality Criteria for Monitored Constituents

Parameter	Iowa Water Quality Standard	Mud, Camp, and Spring Creek Designated Use Classification(s)	Parameter Quantity Limit
Total Suspended Solids	None	None	1 mg/L
Nitrate as N	10 mg/L	None	0.05 mg/L
Nitrite as N	1 mg/L	None	0.05 mg/L
Total Phosphate as P	None	None	0.02 mg/L
Chloride	389 mg/l(chronic) 629 mg/l (acute)	B(WW-2)	
Dissolved Oxygen	5.0 mg/L[1] 4.0 mg/L[2]	B(WW-2)	0.1 mg/L
pH	Minimum 6.5; Maximum 9.0	A, B	0.1 unit
Temperature	Maximum increase = 3°C not to exceed 32°C	B(WW-2)	0.5°C

Source: Iowa Administrative Code [567], Chapter 61

[1] Minimum value for at least 16 hours of every 24-hour period

[2] Minimum value at any time during every 24-hour period

A monitoring committee will be formed to review the monitoring results. This may include members of the MCSCWMA and outside agencies or stakeholders. They will review the results on a quarterly basis and provide an annual report with a summary of the monitoring data. As the monitoring goals and objectives change with increased data collection, the monitoring process will be assessed and modified, as needed, by the monitoring committee and be presented for approval to the members of the MCSCWMA.

6.4.1.1 Task 1: Review Polk County Conservation Board's monitoring plan.

The Polk County Conservation Board (PCCB) has completed a monitoring plan for the Fourmile Creek Watershed. It has been implemented and successful and should be reviewed for adoption and implementation in the Mud, Camp, and Spring Creek Watersheds. The plan should be adapted to the needs of the watersheds. Locations will need to be determined to best identify constituents and priority areas. The monitored constituents will also need to be established to provide the most benefit to the MCSCWMA's goals.

6.4.1.2 Task 2: Partner with PCCB, DNR, and Polk SWCD to identify sites and protocols.

Partnerships with the PCCB, DNR, and Polk SWCD should be formed and utilized to identify the best potential sites that will maximize benefits to the watersheds. Protocols should also be identified that are best suited for the practices in the watersheds. Based on the information that is compiled, sites and protocols will be established, as well as the constituents that need to be monitored, to guide the development of the management plan.

6.4.1.3 Task 3: Conduct Habitat Assessment Methodology.

An appropriate and consistent habitat assessment methodology needs to be identified and adopted throughout the watersheds and the region. This will ensure that consistent habitat quality and quantity measurements are being implemented throughout the region in support of shared goals. If different levels of habitat quality are desired in each individual watershed, wildlife and other biological elements may thrive in an individual watershed, but will not thrive as readily throughout the region. High communication levels will need to be sustained during the creation and adoption of this methodology.

6.4.1.4 Task 3A: Conduct Annual Biological Assessments.

A biological assessment will be completed at each of the sites monitored by Polk County Conservation annually. The goal of this task is to assess trends in biological activity and stream health status, potentially resulting from land management and stormwater control practices implemented. The biological assessment uses key indicators to measure the health of a given stream, including indicators from the chemical and physical assessments. The key indicators of the biological assessment include benthic macroinvertebrates, microhabitats, aquatic plant cover, and invasive species.

6.4.1.5 Task 4: Compile past information from Camp Creek projects, Metro Waste Authority, and monitoring data.

Previous work has been done in the watershed and can be useful in the planning and implementation of this plan. This information will help save time and effort by using data that is already available. Metro Waste Authority has completed work in the watershed on Camp Creek. Monitoring data is available through IOWATER.

6.4.1.6 Task 5: Identify funding alternatives to conduct additional water quality monitoring.

One aspect of successful water quality monitoring is funding. The jurisdictions are limited in how much funding and resources they have available. Therefore, alternative funding sources must be investigated and identified. Many of the costs associated with the goal implementation have watershed wide benefits. Therefore, pooling resources on a project by project basis or as an annual amount will allow costs to be more evenly distributed among the jurisdictions. This funding could also be used for grant matching funds, where applicable. This shows that jurisdictions are invested in plan's goals and objectives and increases opportunities for future funding. In addition, state level funding is also available, especially if the state sales tax is increased and 3/8 of one cent will be allocated to the Natural Resources and Outdoor Recreation Trust Fund. This funding would improve the chances of funding available to watershed management authorities.

6.4.2 Objective 2: Develop strategies to improve water quality.

Water quality improvement is an important priority to focus on to improve the watersheds. The strategies developed will play an integral role in the success of the implementation of this plan and for future planning efforts. Current water quality monitoring information will be critical in determining which pollutants are priorities and strategies should be focused on.

6.4.2.1 Task 1: Modify approaches based on monitoring data.

While some monitoring data exists, adequate levels of monitoring data are lacking in the Mud, Camp, and Spring Creek Watersheds to target long-term management approaches for some pollutants. Once a monitoring program is established and the results are analyzed, this data should be used to guide and modify watershed management priorities. During this process, some strategies may be found to be more effective than others within this watershed. This overall plan and implementation strategy should be revisited as monitoring data warrant doing so.

6.4.2.2 Task 2: Emphasize constituent reduction.

The two primary water quality constituents of concern mentioned in the monitoring goal section are bacteria and sediment. Practice implementation will prioritize reductions for these constituents first, and monitoring for other constituents will be assessed as funding is available.

6.4.2.3 Task 3: Emphasize secondary constituent reduction.

Some of the strategies being targeted can yield multiple benefits throughout the watersheds. However, practices will not be implemented according to the priorities presented in this plan if the sole purpose is to reduce constituents other than bacteria and sediment, depending on funding options and practice impact. For example, funding may be

available for practice implementation to reduce the secondary constituents of nitrogen or phosphorus. If these practices would also reduce bacteria or sediment, funding would be assessed at that time.

Until a monitoring program compiles enough watershed specific data, initial pollutant reduction goals will be consistent with those described in the Iowa Nutrient Reduction Strategy (NRS). The NRS is a science and technology-based framework that was developed to assess and reduce nutrients in Iowa's surface water. The NRS has established specific goals of 45% reduction for both total nitrogen and total phosphorous exiting Iowa's lakes and rivers. NRS strategies for N and P will provide auxiliary water quality benefits to reduce bacteria and sediment loading. The NRS strategies address both point source (i.e. waste water treatment plant discharge) and non-point source (i.e. agricultural runoff) loading. As monitoring data becomes available, the goals for the Mud, Camp, and Spring Creek Watersheds can be reassessed based on actual field conditions. Based on NRS assessments and initial assessments of the watershed, the pollutant reduction goals are shown in Table 6-3.

Table 6-3: Desired Loading Reduction in Mud, Camp, and Spring Creek Watersheds

Monitoring	Total Reduction Goal (per NRS)	Maximum Point Source Reduction Anticipated	Non-Point Source Reduction Requirement
Nitrogen	45%	4%	41%
Phosphorous	45%	16%	29%

As discussed throughout this Implementation Plan section, both rural and urban land strategies need to be implemented to achieve this reduction. Some of the tasks described require high levels of communication and collaboration between representatives associated with the different land use categories to ensure maximum effectiveness during and after final implementation. Many of the strategies described within the NRS are focused on rural (i.e. agriculture) practices, however, urban practices will also help meet the reduction goals. Urban practices also have a critical role for water quality and quantity improvements. If implemented in combination, these tasks will collectively benefit overall watershed health and can also work as community educational pieces.

The urban strategies emphasize reduction of impervious (hard) surfaces, increasing stormwater infiltration (water soaking through the soil), and slowing water through extended detention practices or other means. The rural strategies are specifically targeted for rural land uses and emphasize practices that are identified within the NRS. Specifically, priority is given to practices that are most likely to achieve higher reductions (as a percentage) of nutrients and sediment in rural area runoff. A regional coordinator may be needed to ensure urban and rural strategies are consistent throughout.

6.4.2.4 Task 4A: Identify bacteria sources related to septic systems.

The major sources of preventable bacteria in Mud, Camp, and Spring Creeks are from on-site wastewater system (septic system) discharges and from livestock grazing. The

Environmental Health Division of Polk County Public Works provides a number of services to the public and business community relating to those affecting the health and safety of the environment. One of these services is permit issuing, inspection, and maintaining maintenance records of private on-site wastewater systems. The Environmental Health Division will be utilized to investigate on-site wastewater discharges within Polk County. The investigation areas will be prioritized based on data collected from stream monitoring, septic system permitting, and time of transfer septic system inspections. Polk County anticipates the development of a GIS database of on-site wastewater sites in Polk County to track their location, permitting, and maintenance. Over time, an understanding of on-site wastewater system locations can assist in assessing and correcting deficiencies which contribute to bacteria in Mud, Camp, and Spring Creeks.

6.4.2.5 Task 4B: Mitigate bacteria sources related to agricultural and rural lands.

Another possible source of bacteria in Mud, Camp, and Spring Creeks is the presence of livestock grazing adjacent to streams. Eliminating the direct access of livestock to Mud, Camp, and Spring Creeks and their tributaries can minimize or eliminate a source of bacteria. Livestock should be held at a buffered distance by fencing or other means to stop direct contact with water bodies. A watershed coordinator could work closely with affected property owners and producers to review options for separating livestock from the water bodies and look for cost sharing opportunities to implement these options.

Wildlife is another source of bacteria yet is more difficult to prevent. While the initial bacteria focus will be on-site wastewater systems and livestock, field reviews will note locations of high populations of wildlife, such as geese, to address in later years of the management plan.

6.4.2.6 Task 5: Develop a wetland mitigation bank.

As discussed in previous sections, wetlands can be a very effective treatment tool for a variety of runoff pollutants, as well as provide peak discharge attenuation and promote infiltration. However, a common practice during development of a parcel of land is to buy wetland "credits" at a wetland banking site to mitigate any losses of wetlands that may occur during and after development. These wetland credits are not required to stay within the Mud, Camp, and Spring Creek Watersheds, nor is there an approved wetland banking site located within the watershed. When these credits are purchased outside of the Mud, Camp, and Spring Creek watersheds, the benefits of the wetland are completely removed and another watershed reaps the rewards.

Restoration of wetlands would allow end of field treatments to be identified, capitalize on the ability of wetlands to improve runoff quality and quantity, and potentially create a site(s) for an approved wetland bank to be established within the Mud, Camp, and Spring Creek watersheds. Once banking sites have been established, wetland credits, and the benefits that come with them, could then be required to stay within the watershed.

A wetland site assessment would need to take place to determine potential sites for banking. A Corps of Engineers permit will need to be submitted to ensure site construction eligibility. Once the site has been constructed, a mitigation cost per acre will be established.

The Conservation Reserve Enhancement Program (CREP) is a state and federal initiative that develops wetlands in areas that are targeted to remove nitrate from tile-drainage water in cropland areas. No CREP wetland sites are currently located in the watershed at this time. If funding becomes available, sites will be identified that meet the CREP criteria, including a 500 acre minimum drainage area with a wetland of at least 0.5% of the drainage area, viability, and landowner interest.

6.4.2.7 Task 6: Promote native prairie plantings.

Native vegetation typically has deeper roots and taller stands than non-native vegetation. The deeper roots enhance the soil profile and provide greater potential for runoff infiltration and nutrient absorption than turf grasses and other non-native landscaping. The deeper roots, coupled with the taller stand, also provide increased protection from erosion within waterways and on streambanks.

Native vegetation is currently being used in both rural and urban environments in the watershed, usually for different purposes, but yielding similar benefits. Although this practice is being used, there is the potential to realize greater benefits if planting and maintenance of native vegetation is more commonplace.

In the rural environment, native vegetation is being used within stream buffers, grassed waterways, and as a streambank stabilization measure. However, there are many areas within the watersheds where turf grass is being grown where native vegetation could be established instead. In the urban environment, native vegetation is being used within infiltration ditches and basins, edge treatment and stabilization in detention basin designs, and for streambank stability. However, stormwater infiltration practices are not common and native vegetation is not typically used extensively at development sites in the watersheds.

6.4.2.8 Task 7A: Implement a streambank restoration program for Mud, Camp, and Spring Creeks.

Streambank erosion is one of the leading causes of sediment transport and loading within Mud, Camp, and Spring Creeks. To combat this issue, the stakeholder group targeted a need to develop a streambank restoration program. This program will use data already collected and collect additional data, if needed, to assess the condition of the streambanks throughout the watershed. As discussed in Section 4, a stream assessment was completed by the PSWCD to determine the existing conditions of bank stability and erosion on Mud, Camp, and Spring Creeks. This information was used to prioritize areas of concern along the stream for restoration. The areas were ranked based on various characteristics, including severity of erosion, condition of stream habitat, development of bank vegetation,

bank height, and riparian width. The implementation of each project will be based on cost to reduce or eliminate erosion, funding availability, and stakeholder participation. The stream assessment and prioritization was completed on the main stems of Mud, Camp, and Spring Creeks. This does not include known issues on other tributaries. Figure 6-7 shows the top ten areas of restoration along the assessed reaches of Mud, Camp, and Spring Creeks, based on the results of the RASCAL assessment. Detailed figures of each area are in Appendix G.

6.4.2.9 Task 7B: Implement a streambank restoration program for the tributaries.

The tributaries of the creeks were not assessed, but could be done at a later date if concern is expressed.

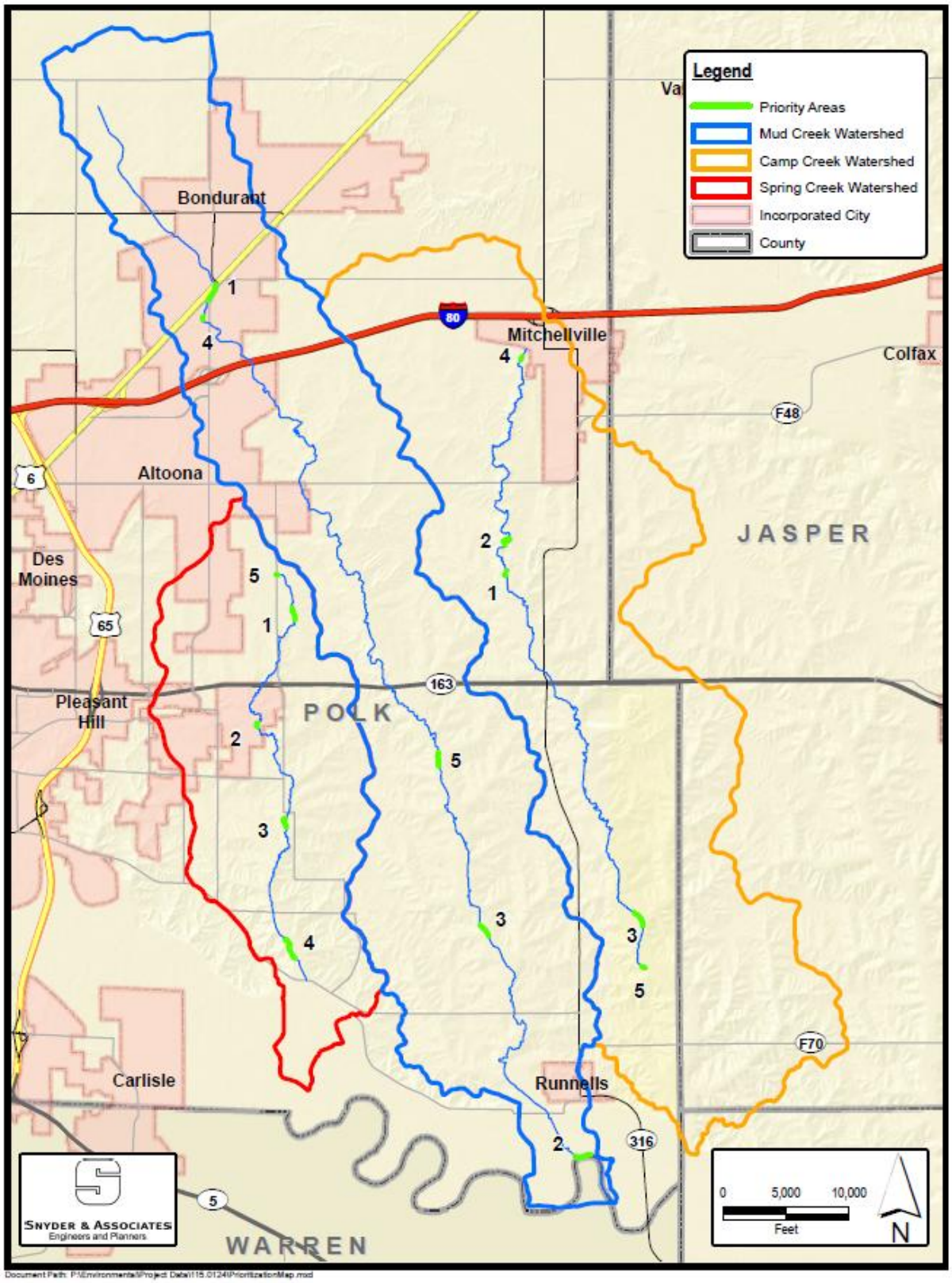


Figure 6-7: Top Restoration Priorities Based on RASCAL Assessment

6.4.2.10 Promote consistent implementation of water quality improvement strategies.

As standards and procedures are developed, every community and organization should be involved to ensure consistent development. Promotion should also be made through public meetings and other methods. This promotion should also be conducted on a regional level. Each watershed management plan will have different strategies, which means different water quality improvement practices will be implemented at various times and to different extents in the watersheds. If consistent implementation is encouraged, the same high quality data could be gathered in each watershed and each WMA could share their experiences with specific practices and strategies.

6.4.3 Objective 3: Develop water quality and quantity models in order to establish areas of potential flooding concern and develop strategies to improve flood management in the region.

Computer models should be utilized to gather more information about flooding and water quality issues in the watersheds. This information will helpful to determine areas of flooding and the potential areas for BMPs. This will also increase the safety of the residents in the watersheds by decreasing future flood loss and damages. The ultimate goal is to develop the best ways to improve the current and future flooding issues in the watersheds.

6.4.3.1 Task 1: Assign a responsible party or parties to develop and store base water quantity and quality models.

The development of water models will have to be completed by a party or parties that are familiar with the watersheds and the MCSCWMA's goals and objectives. Each WMA has utilized different modeling software and the best models suitable for the watersheds will need to be agreed upon. The models will be used as one of the many tools to help future planning and implementation be successful.

6.4.3.2 Task 2: Analyze the results of the models for strategy development.

The party or parties discussed above will also need to provide the results and work with the MCSCWMA to analyze them. The results will help gather more information on specific areas of the watersheds on water quality and flooding. Updated flood profiles could be provided to map inundation extents in the 100 year or 500 year floodplains along the creeks. The results should be further analyzed to help develop strategies to improve flood management in the watersheds.

6.4.4 Objective 4: Identify high priority areas for flood management and future flood loss mitigation.

Using the information gathered through the planning process, high priority areas for flood management should be identified. Based on the results of modeling, the 100 year and 500 year floodplains along each creek should be targeted as high priority areas to prevent future flood loss. After priority areas are identified, each area will need to be prioritized

and determine if the areas are feasible for moving forward with implementation. Discussions among the MCSCWMA and partners will be used to determine the best course of action for each priority area, considering funding and resources available.

6.4.4.1 Task 1: Compile previously completed models and information available to identify any high priority areas.

Prior studies and any other pertinent work done in the watersheds should be compiled to maximize the amount of information available to the WMA. This will help make informed decisions on determining areas of high priority areas of flood management and mitigation. This information could also assist in obtaining funding related to flood risk management and mitigation.

6.4.4.2 Task 2: Hold a meeting with city and county planning staff to discuss future flood loss mitigation.

A meeting should be held with city and county staff, in conjunction with land use planning meetings, to discuss future improvements regarding flood loss. This will help assure the equal representation and agreement of each city and county in the discussions and development of any policies regarding future flood loss mitigation that will benefit the watersheds. All of the information gathered, including information presented from modeling results, will be compiled and used to help provide a successful planning process. Because the watersheds are largely agriculture and not heavily developed, future planning of flood prone areas is critical to the safety of the residents of the watersheds.

6.4.5 Objective 5: Use data in the land use planning and decision-making process to evaluate the impact of development, visualize alternative development patterns, and combine the desired planning outcomes with relevant ordinances and building codes.

After all of the information from all of the city and county is compiled, it should be used to make decisions regarding development, future planning, and planning outcomes. Ordinances and building codes should also be factored into the decision-making process. A GIS database is a powerful tool to track land use information, development patterns, assessment information and can be used to make future decisions.

6.4.5.1 Task 1: Develop partnerships with cities, counties, USACE, Iowa Flood Center, among others to define and compile relevant data.

As discussed in earlier sections, developing partnerships will be crucial to the success of the plan's implementation. The compilation of resources available between different organizations is important for consistency purposes and to ensure the equal representation of all cities and communities within the watersheds. As discussed in previous sections, relevant data is available from previous work done in the watersheds. It will be a task to compile all of the information into one easily accessible place and format. It will also be a task to decide on what additional information is needed and to gather new information.

6.4.5.2 Task 2: Develop an education plan to present to the citizens in the watershed regarding development impacts, policies, and the future of the watershed if no changes are made.

An education plan should be developed for the residents in the watersheds. Some residents are new to the idea of a watershed management authority and what purposes it serves. A few key messages should be emphasized in the education plan to focus on policies, partnerships, the impacts of different land uses, what will happen to the watershed if nothing is done, and a range of solutions to the problems. This could be a powerful tool to use at public meetings or other professional organization's meetings and benefit the implementation of this plan by gaining the support of the residents in the watersheds.

6.5 Tasks That Fall Under Multiple Goals and Objectives

The following action items do not fit under one specific goals or objective because they apply to all of them in some way. Each of these tasks are fundamental to foster a successful implementation plan.

Task 1: Hire a Watershed Coordinator

A full time Watershed Coordinator should be hired to oversee the implementation plan. This will ensure that goals and tasks are achieved and that proper communication is given for certain goals and tasks. A 28E agreement should be developed to split the costs associated with this position. The Watershed Coordinator will have several roles and tasks, but should particularly be involved and engaged in the development of educational programs, incentives programs, and model ordinances, as well as engaging the appropriate groups for the proper tasks.

Task 2: Assign Strategy Champions

To ensure that practices are implemented throughout the watersheds, there is a need to target individuals and groups as early adopters and advocates for each strategy. These individuals and groups will be effective stewards for targeted practices to thrive within the watershed. Not only can they provide one-on-one guidance and education for their peers, but they also can provide education and demonstration sites for the general public and other potential adopters within the same demographic. It will be the work of the Watershed Coordinator to facilitate identifying these champions.

Task 3: Regional Collaboration Mechanism

Due to the nature of the jurisdictional boundaries in Central Iowa, coordination on a regional basis is critical to the overall success of the adoption of consistent policies. The establishment of other WMAs in the region provides a great opportunity for communication on a regional level. The Mud, Camp, and Spring Creek Watershed Management Authority can use the work completed by other WMAs to create model ordinances and approaches that can assist in the planning process for others.

Task 4: Develop Model Ordinance

Successful stormwater management ordinances and other policies and standards throughout the watersheds and the region should be reviewed by a WMA subcommittee for possible inconsistencies and synergies. Many of the model ordinances that should be reviewed can be found on the Iowa Storm Water Education Program's website (www.iowastormwater.org). The City of Coralville's Post-Construction Stormwater Ordinance is one example on the website that aligns well with the MCSCWMA's approach to a model ordinance. A few items that would be applicable to the Mud, Camp, and Spring Creek watersheds include the stormwater standards, approval of stormwater management concept plan and final plan, and maintenance and repair of stormwater BMPs. Once this review is complete, a model ordinance tailored for the Mud, Camp, and Spring Creek watersheds should be presented to the full MCSCWMA for comment. Once a final ordinance has been drafted, it should be shared with member jurisdictions for adoption.

6.6 Schedule

Milestones and outcomes were applied to each task discussed above to develop the Implementation Schedule. See Appendix A for the complete schedule.

7. Implementation Plan Prioritization

Over the course of several meetings, the MCSCWMA and stakeholder group determined the goals and objectives of the Implementation Plan. Priorities were also set among the groups to determine which actions take priority when funding and resources allow. The results are presented below.

Top Priorities List

1. Hire Watershed Coordinator
2. Water Quality Monitoring
3. Streambank Restoration
4. Create Model Ordinance
5. Establish Greenway

8. Funding Sources

The following list includes resources made available to implement a successful Watershed Management Plan. Due to being in the early stages of implementation, the sources of funding could vary.

- **Iowa Department of Agriculture and Land Stewardship (IDALS)**

  IDALS offers several grants for projects related to water quality and watershed improvements. They offer Development and Planning Assistance grants and support the Watershed Improvement Review Board, which awards grants to eligible applicants.

- **Iowa Department of Natural Resources (IDNR)**

  The IDNR provides technical and financial assistance to eligible applicants. They offer grants for developing and implementing Watershed Management Plans, such as Section 319 grants, Land and Water Conservation Fund, and Resource Enhancement and Protection (REAP) funding. The IDNR is also one of the supervisors of the Clean Water State Revolving Fund, along with other state loan programs, including the Storm Water Loan Program and the Water Resource Restoration Sponsored Projects Program. The IDNR also facilitates IOWATER volunteer services to provide monitoring data on Mud, Camp, and Spring Creeks.

- **Iowa Economic Development Authority**

  The Iowa Economic Development Authority offers financial assistance through Vision Iowa and Community Development Block Grants, which can be used for water and sewer facilities.

- **Metro Waste Authority**

  The Metro Waste Authority offers grants through the Growing Green Communities program and a reimbursable grant program to eligible applicants for cleanups, waste reduction and diversion, environmental education, pollution prevention, energy efficiency, and water quality protection or improvement.

- **Non-Governmental Organizations (NGOs)**

  NGOs are organizations that are neither a part of a for-profit business nor a government entity. They may be funded in a variety of ways and can offer their services and/or funding to organizations. Some examples include Ducks Unlimited, Keep Iowa Beautiful, Pheasants Forever, and Trees Forever.

- **Private Donors**

  Private donations will provide financial assistance to any projects related to the Mud, Camp, and Spring Creek Watersheds.

- **United States Army Corps of Engineers (USACE)**

  The USACE provides technical and financial assistance on wetland, stream bank stabilization, and certain watershed projects.

- **United States Environmental Protection Agency (USEPA)**

  The USEPA leads Clean Water Act related initiatives and offers grants and support for projects related to solving environmental problems. Examples of these grants include Environmental Education Sub-Grants, Environmental Justice Grants, and Urban Waters.

- **United States Department of Agriculture (USDA)**

  The USDA offers technical and financial assistance to both the rural and urban land uses for implementing conservation practices related to water, soil, and wildlife.

- **WMA/Jurisdictions**

  Each jurisdiction that is a member of the MCSCWMA will provide funding, as needed for each project, and the funding will be allocated appropriately. This funding can be sourced from stormwater utilities, public works funds, etc.

9. References

Iowa Department of Agriculture and Land Stewardship, Water Resources Bureau. *Iowa Conservation Reserve Enhancement Program (CREP)*. <http://www.iowaagriculture.gov/waterResources/CREP.asp>.

Iowa Department of Natural Resources. October 28, 2009. *Iowa Stormwater Management Manual.* Version 3.

Iowa Drainage District Association. *Facts about drainage and drainage districts.* <http://www.iowadrainage.org/>.

Iowa Environmental Mesonet. 2015. *COOP Quality Controlled and Estimated Data Download*. <http://mesonet.agron.iastate.edu/request/coop/fe.phtml>.

Iowa Flood Information System (IFIS). <http://ifis.iowafloodcenter.org/ifis/main/>.

Iowa Legislature – Iowa Administrative Code. Environmental Protection Commission [567], Chapter 61 – Water Quality Standards. 2015.

Iowa Nutrient Reduction Strategy (NRS). <http://www.nutrientstrategy.iastate.edu/>.

Iowa Statewide Urban Design and Specifications Program. 2014. *SUDAS Design Manual*.

Iowa Storm Water Education Program (ISWEP). 2015. *Model Ordinances*. <http://www.iowastormwater.org/en/clean_water_depend_on_all_of_us/communities/model_ordinances/>.

Iowa Storm Water Education Program (ISWEP). 2015. *Watershed Funding/Financial Resources*. <http://www.iowastormwater.org/en/what_is_a_watershed/watershed_resources/watershed_funding__financial_resources/?option=com_content&view=article&id=182%253Afunding-financial-resources&catid=40%253Ams4-cat&Itemid=275>.

National Climatic Data Center (NCDC) – National Oceanic and Atmospheric Administration (NOAA). <http://www.ncdc.noaa.gov/cag/>.

Snyder & Associates, Inc. January 2014. *Mud Creek Watershed Management Study: City of Altoona, Iowa, Project #113.0116*.

Tomer, M.D., S.A. Porter, D.E. James, K.M.B. Boomer, J.A. Kostel, and E. McLellan. 2013. *Combining precision conservation technologies into a flexible framework to facilitate agricultural watershed planning*. J. Soil Water Conserv. 68(5):113A-120A.

United States Department of Agriculture – Natural Resources Conservation Service. *Part 630 Hydrology National Engineering Handbook. Chapter 7 Hydrologic Soil Groups*. <http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>.

URS. February 2005. *Polk County Comprehensive Plan: Analysis of Conditions*. <http://www.polkcountyiowa.gov/media/30975/1-naturalresources.pdf>.

Welch, J. 2014, 2015. RASCAL Assessment, Land Use, RUSLE, Sediment Delivery. Polk Soil and Water Conservation District.