APPENDIX B: TECHNICAL REPORTS

IDNR LAND USE ASSESSMENT

TECHNICAL MEMO - EXISTING BEST MANAGEMENT PRACTICES

REMAINING ACTION ITEMS

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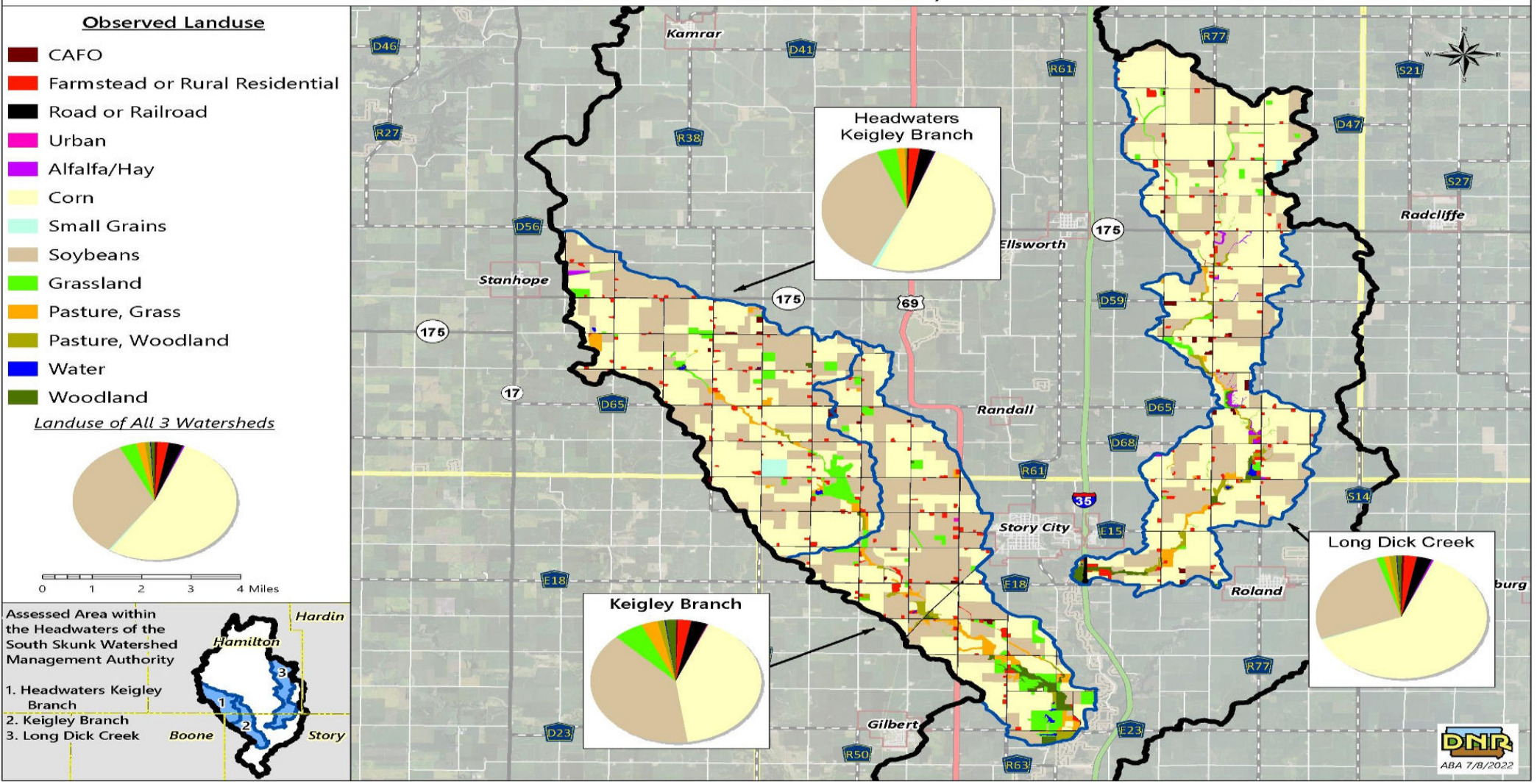
KEIGLEY BRANCH/LDC LAND USE ASSESSMENT

Kyle Ament – Iowa DNR

Megan Volkens - IDALS

Headwaters of the South Skunk WMA
Observed Landuse, 2022



Headwaters of the South Skunk WMA
Estimated Sheet & Rill Erosion

Total Assessed Area: 56,928 acres

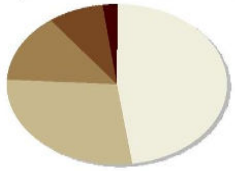
Total Sheet & Rill Erosion
52,220 tons/year

Average Sheet & Rill Erosion
0.9 tons/acre/year

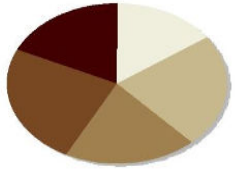
Estimated Sheet & Rill Erosion of Entire Project Area (tons/acre/year)

- Less than 0.5
- 0.51 - 1
- 1.01 - 2
- 2.01 - 5
- 5.01 or Greater
- Terraced Areas

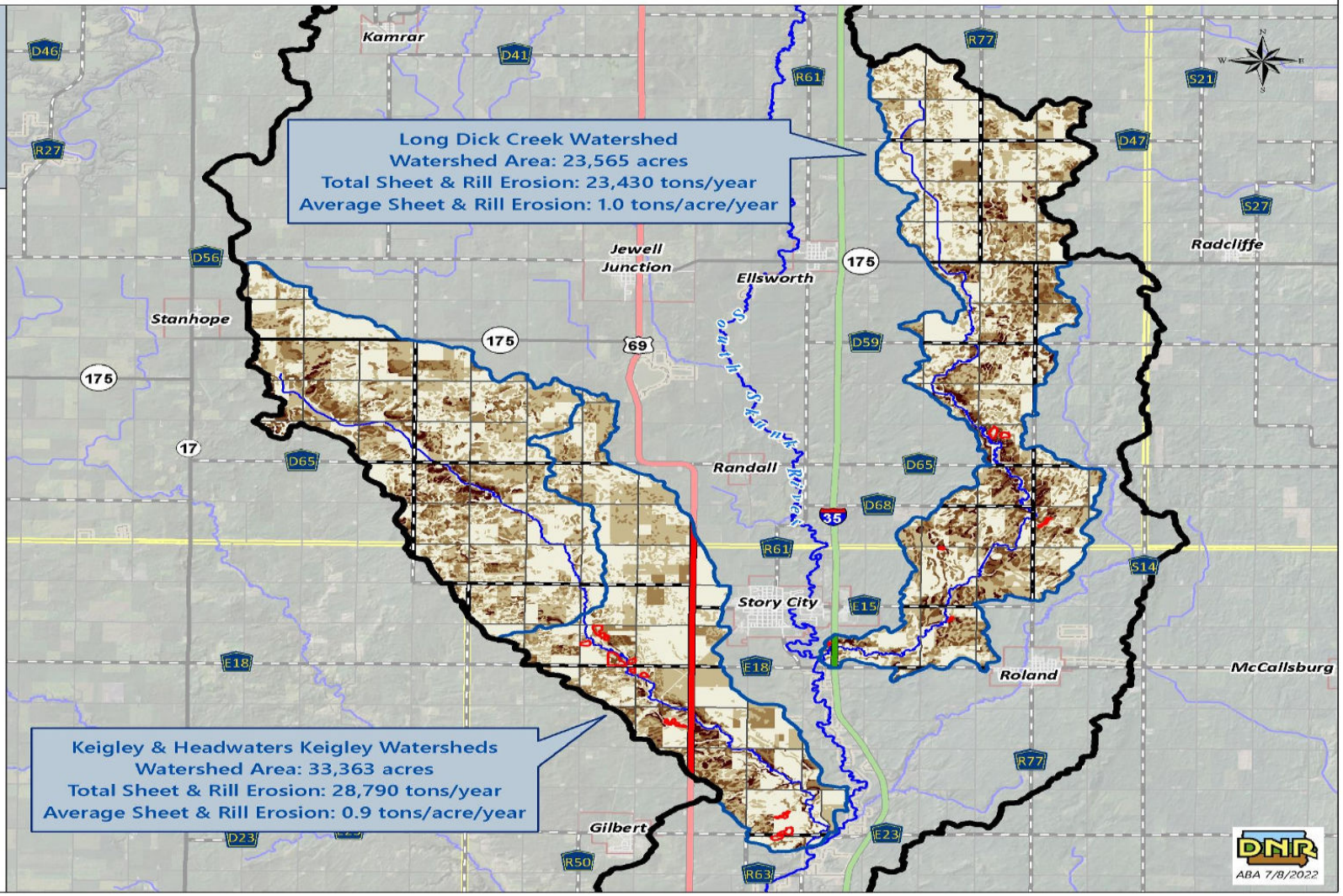
Percent of Total Project Area per Erosion Rate Class



Contribution to total Sheet & Rill Erosion per Erosion Rate Class



0 1 2 3 4 Miles



Headwaters of the South Skunk WMA
Estimated Sediment Delivery

Total Assessed Area: 56,928 acres

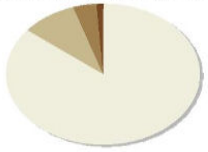
Total Sediment Delivery
1,820 tons/year

Average Sediment Delivery
0.03 tons/acre/year

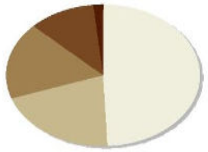
Estimated Sediment Delivery of Entire Project Area (tons/acre/year)

- Less than 0.05
- 0.051 - 0.1
- 0.101 - 0.25
- 0.251 - 0.5
- 0.501 - 1.5
- Pond Catchment (90% Trap)
- Wetland Catchment (75% Trap)
- WASCOB Catchment (75% Trap)

Percent of Total Project Area per Sediment Delivery Rate Class



Contribution to total Sediment Delivery per Sediment Delivery Rate Class



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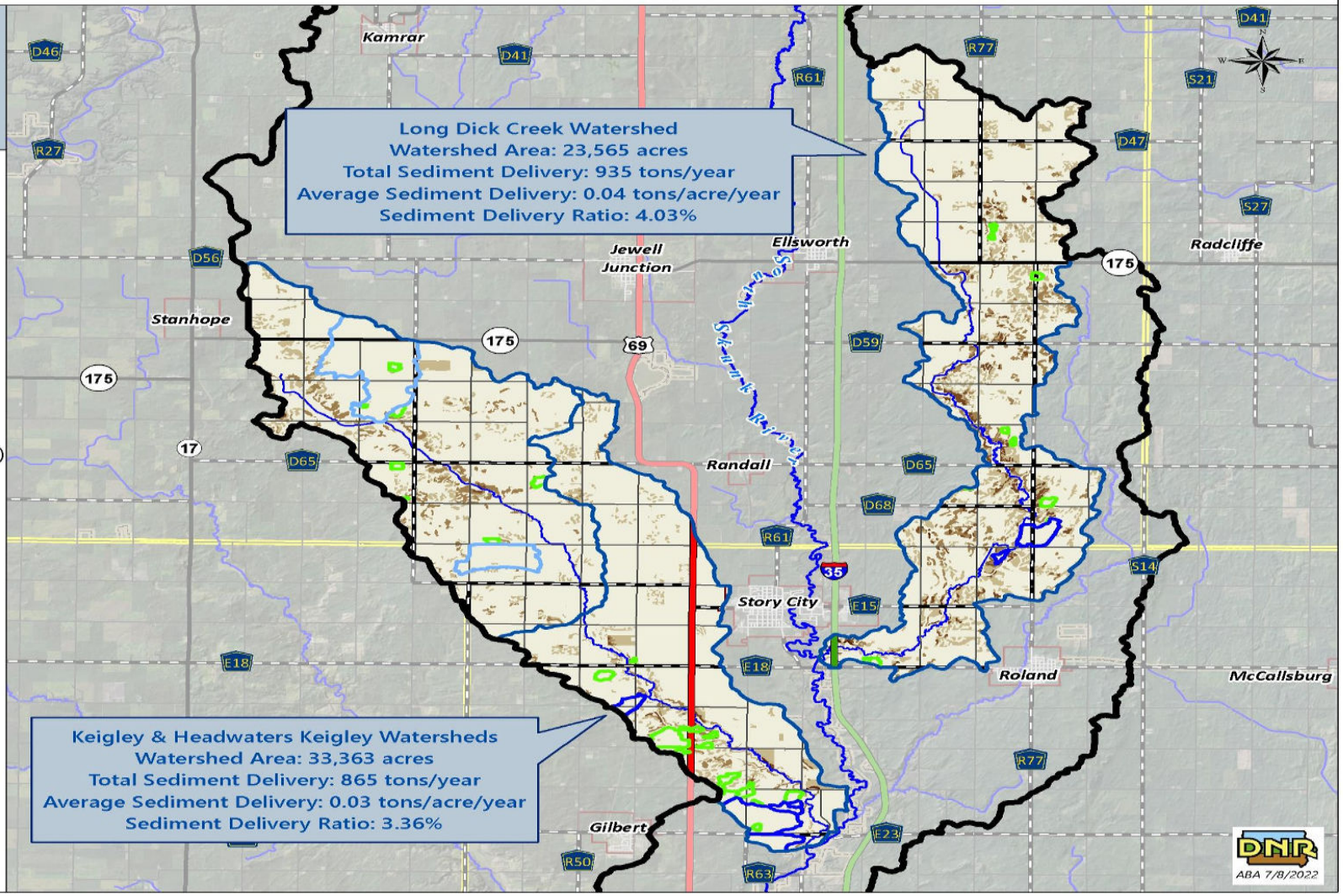


Sheet & Rill Erosion Summary

Sheet & Rill Class (t/a/y)	Acres	% of Project Area	Aggregated Acreage %	Total Sheet & Rill (t/y)	% of Total Sheet & Rill	Aggregated S&R %
5.0 and greater	1,211	2.1%	2.1%	9,384	18.0%	18.0%
2.0 to 5.0	4,659	8.2%	**10.3%**	12,666	24.3%	**42.2%**
1.0 to 2.0	7,810	13.7%	**24.0%**	10,263	19.7%	**61.9%**
0.51 to 1.0	16,048	28.2%	52.2%	12,051	23.1%	85.0%
0.0 to 0.5	27,200	47.8%	100.0%	7,853	15.0%	100.0%
	56,928			52,218		

Possible priority areas considering area and sheet and rill classes

10% of project area accounting for 42% of sheet and rill erosion (areas where TSR>2 t/y), OR

24% of project area accounting for 62% of total sheet and rill erosion (areas where TSR>1t/y)

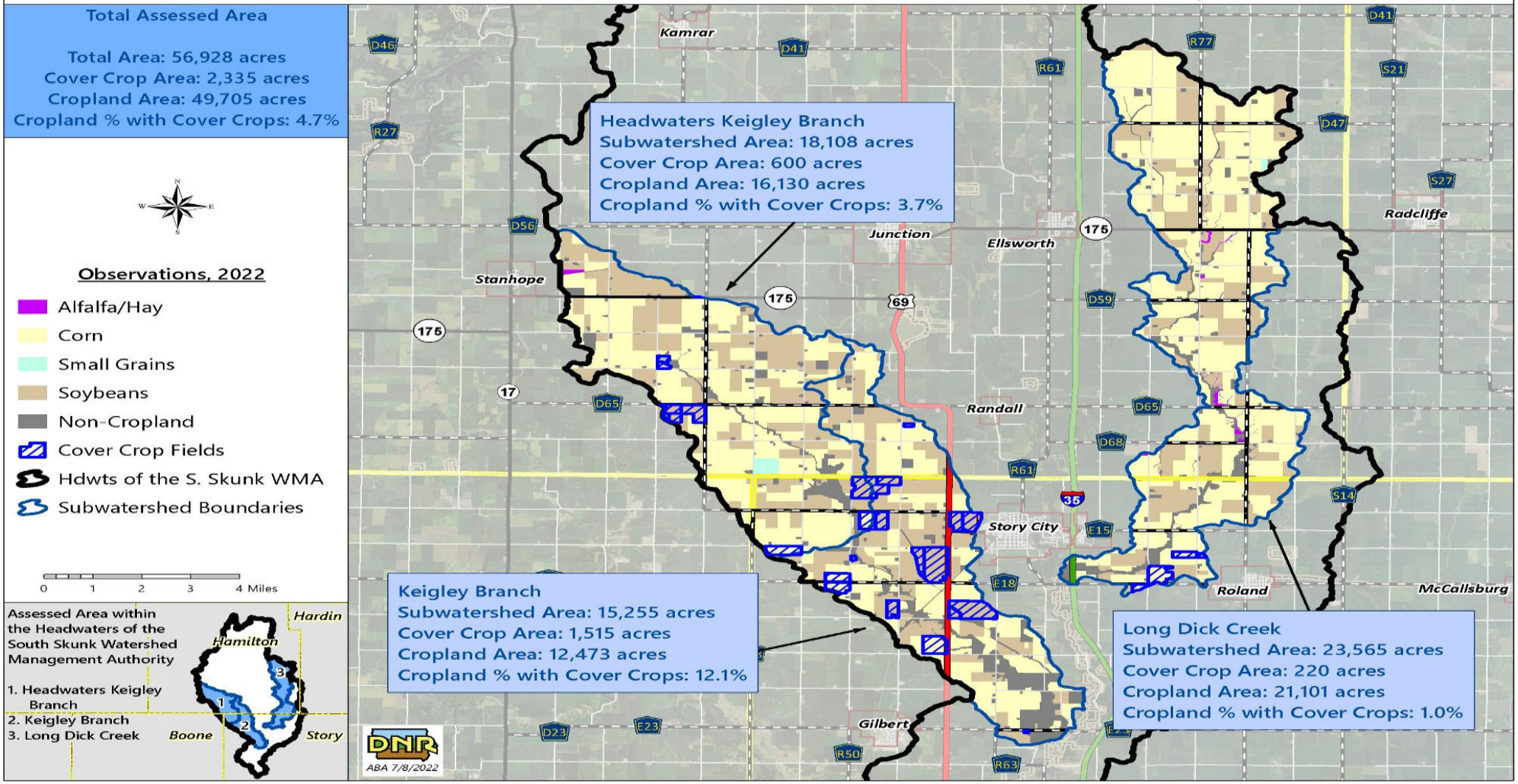
Sediment Delivery Summary

Sediment Delivery Class (t/a/y)	Acres	% of Project Area	Aggregated Acreage %	Total Sediment Delivery (t/y)	% of Total Sediment Delivery	Aggregated Sed. Del. %
0.5 to 1.5	44	0.1%	0.1%	30	1.6%	1.6%
0.25 to 0.5	640	1.1%	**1.2%**	202	11.1%	**12.8%**
0.1 to 0.25	2,190	3.8%	**5.0%**	318	17.5%	**30.2%**
0.05 to 0.1	5,220	9.2%	14.2%	372	20.4%	50.7%
0.00 to 0.05	48,834	85.8%	100.0%	897	49.3%	100.0%
	56,928			1,819		

Possible priority areas considering area and sediment delivery classes

14% of project area accounting for 51% of sediment delivery (areas where TSD>0.01 t/y), OR

Headwaters of the South Skunk WMA
Observed Cover Crops with No Tillage, 2022



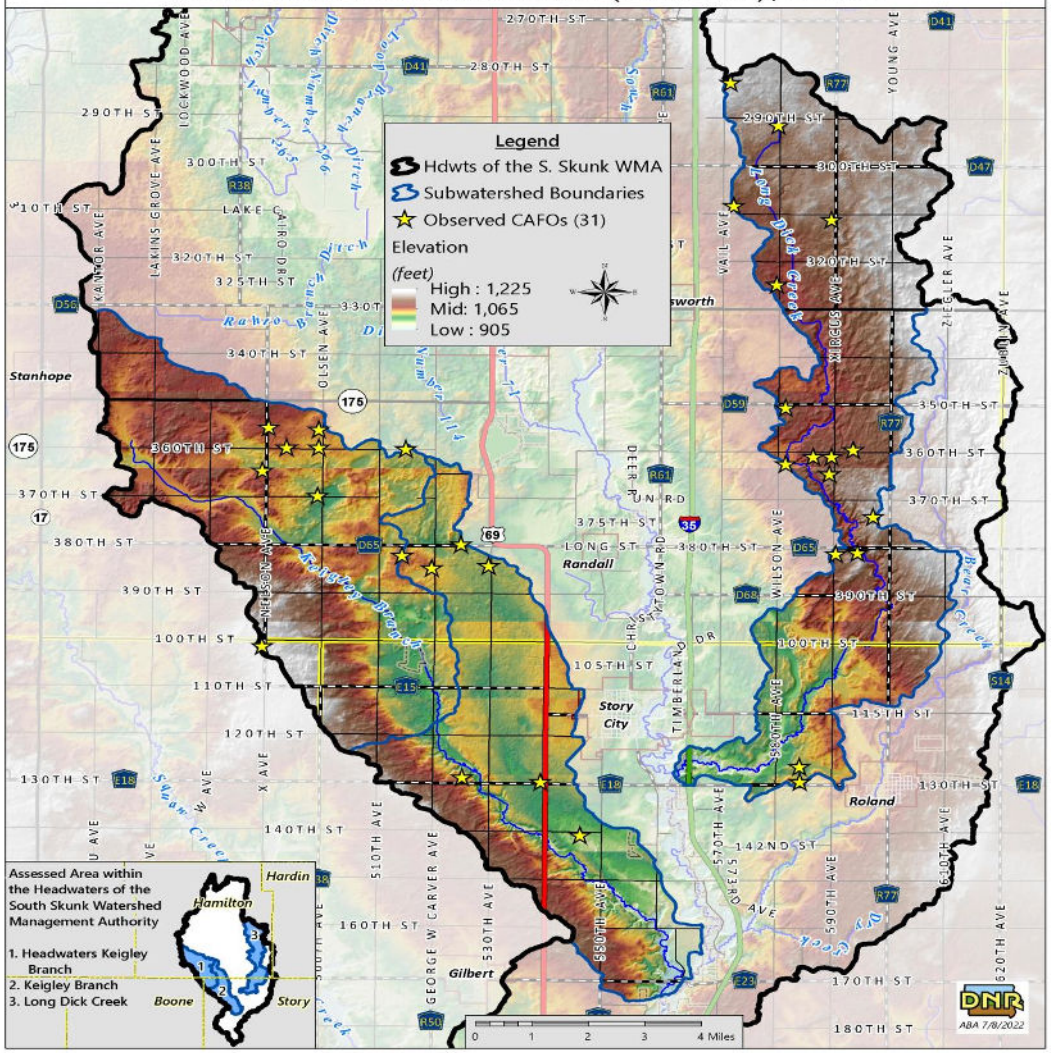
Headwaters Keigley Branch (070801050404)

Observed Landuse	Acres	Pct of Watershed	Total_Sheet & Rill (tons/year)	Pct of Total Sheet & Rill	Total Sediment Delivery (tons/year)	Pct of Total Sediment Delivery	Cover Crop Area	Cropland Area	Cover Crops, % of Cropland
Artificial, CAFO	70	0.4%	15	0.1%	0	0.1%	600	16,130	3.7%
Artificial, Farmstead or Rural Residential	364	2.0%	125	0.6%	4	0.6%			
Artificial, Road or Railroad	506	2.8%	124	0.6%	4	0.6%			
Cropland, Alfalfa/Hay	33	0.2%	2	0.0%	0	0.0%			
Cropland, Corn	9,153	50.5%	12,762	63.9%	398	65.2%			
Cropland, Small Grains	162	0.9%	24	0.1%	1	0.1%			
Cropland, Soybeans	6,783	37.5%	6,838	34.2%	201	32.9%			
Grassland	683	3.8%	30	0.2%	1	0.1%			
Pasture, Grass	271	1.5%	36	0.2%	1	0.2%			
Pasture, Grass/Woodland	39	0.2%	6	0.0%	0	0.0%			
Water	23	0.1%	0	0.0%	0	0.0%			
Woodland	21	0.1%	4	0.0%	0	0.0%			
Totals	**18,108**		**19,965**		**610**				

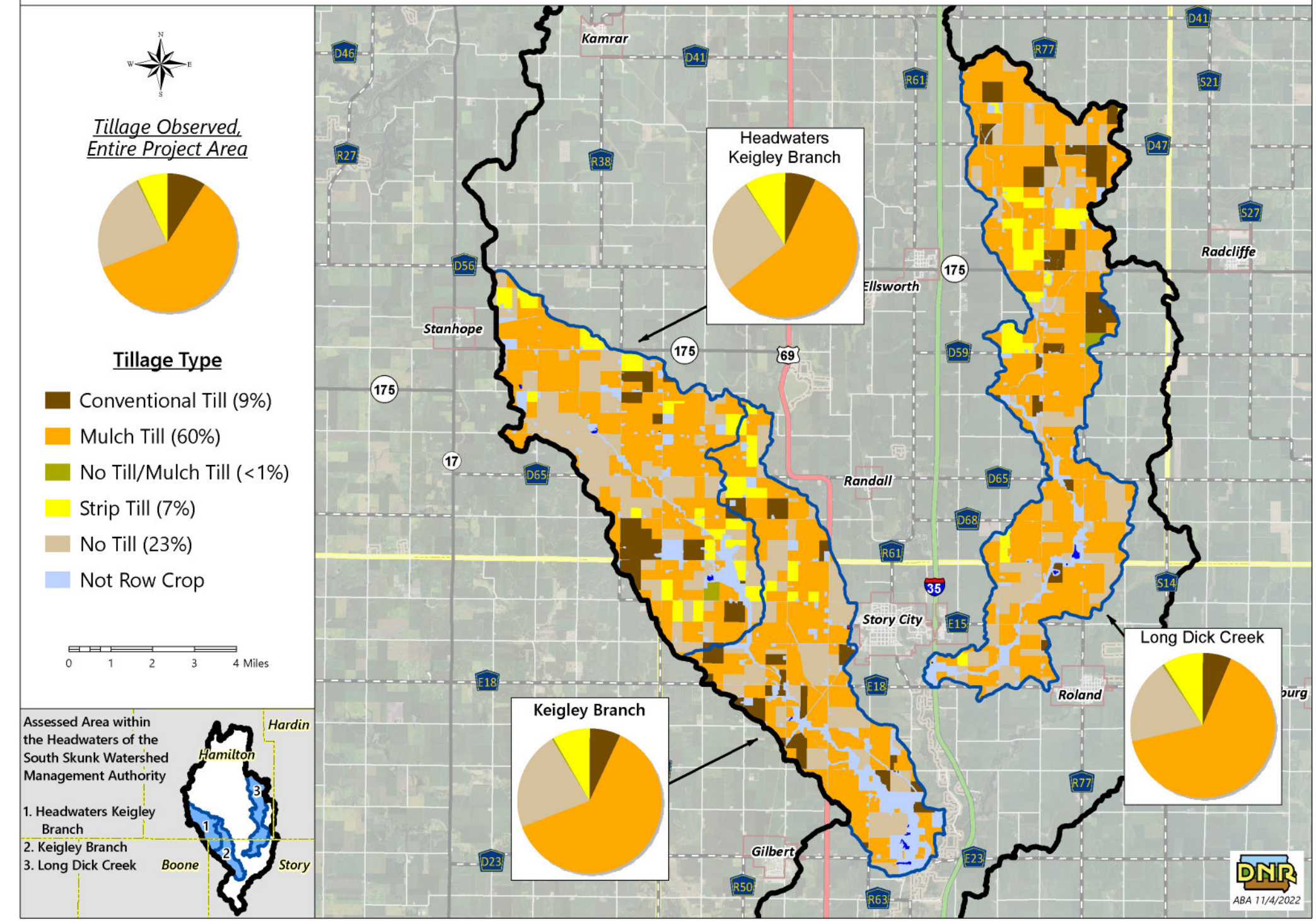
Keigley Branch (070801050405)

Observed Landuse	Acres	Pct of Watershed	Total_Sheet & Rill (tons/year)	Pct of Total Sheet & Rill	Total Sediment Delivery (tons/year)	Pct of Total Sediment Delivery	Cover Crop Area	Cropland Area	Cover Crops, % of Cropland
Artificial, CAFO	47	0.3%	11	0.1%	0.4	0.1%	1,515	12,473	12.1%
Artificial, Farmstead or Rural Residential	383	2.5%	145	0.8%	4.5	0.8%			
Artificial, Road or Railroad	485	3.2%	147	0.8%	4.8	0.9%			
Artificial, Urban	7	0.0%	1	0.0%	0.0	0.0%			
Cropland, Corn	6,367	41.7%	10,290	58.2%	310.2	56.6%			
Cropland, Soybeans	6,106	40.0%	6,321	35.7%	203.7	37.1%			
Grassland	845	5.5%	84	0.5%	2.2	0.4%			
Pasture, Grass	486	3.2%	219	1.2%	7.3	1.3%			
Pasture, Grass/Woodland	195	1.3%	80	0.5%	2.6	0.5%			
Pasture, Woodland	9	0.1%	8	0.0%	0.3	0.0%			
Water	32	0.2%	1	0.0%	0.0	0.0%			
Woodland	294	1.9%	376	2.1%	12.5	2.3%			
Totals	**15,255**		**17,684**		**548**				

Headwaters of the South Skunk WMA
Observed Confined Animal Feeding Operations (CAFOs), 2022



Headwaters of the South Skunk WMA
Observed Tillage, 2022



Headwaters Keigley Branch			
Observed Tillage	**Acres**	**Pct of Row Crop Acres**	**Pct Deviation from Total Project Area**
Conventional Till	1,332	8.4%	-0.6%
Mulch Till	8,553	53.7%	-6.7%
No Till/Mulch Till	92	0.6%	0.2%
Strip Till	1,436	9.0%	2.1%
No Till	4,522	28.4%	5.0%
TOTAL	**15,935**	**100.0%**	

Keigley Branch			
Observed Tillage	**Acres**	**Pct of Row Crop Acres**	**Pct Deviation from Total Project Area**
Conventional Till	1,321	10.6%	1.7%
Mulch Till	7,315	58.6%	-1.8%
No Till/Mulch Till	-	0.0%	-0.4%
Strip Till	632	5.1%	-1.9%
No Till	3,205	25.7%	2.3%
TOTAL	**12,473**	**100.0%**	

Long Dick Creek			
Observed Tillage	**Acres**	**Pct of Row Crop Acres**	**Pct Deviation from Total Project Area**
Conventional Till	1,747	8.3%	-0.6%
Mulch Till	13,950	66.6%	6.2%
No Till/Mulch Till	90	0.4%	0.1%
Strip Till	1,365	6.5%	-0.4%
No Till	3,798	18.1%	-5.2%
TOTAL	**20,951**	**100.0%**	

Overall Project Area		
Observed Tillage	**Acres**	**Pct of Row Crop Acres**
Conventional Till	4,401	8.9%
Mulch Till	29,818	60.4%
No Till/Mulch Till	182	0.4%
Strip Till	3,434	7.0%
No Till	11,525	23.3%
TOTAL	**49,360**	**100.0%**

Technical Memo – Existing Best Management Practices

Prepared By: Adam Rupe, CERP
Date: January 21, 2022
JEO Project # 210289.00

Purpose

The purpose of this memo is to summarize the existing best management practices (BMPs) within the Headwaters of the South Skunk River Watershed. Located in central Iowa, the watershed covers over 210,711 acres, much of which is used for agriculture. This area includes portions of Boone, Hamilton, Hardin, and Story County. Additional discussion, clarification, and definition about each BMP will be provided in the South Skunk River Watershed Management Plan. BMPs identified in this memo are focused on those that provide benefits to water quality and/or flood risk reduction. It should be noted that this memo does not identify or address the needs for additional BMP treatment within the watershed - this additional assessment will be documented separately from this memo. No new assessment or data collection were taken, only existing data sources were used to prepare this summary.

Technical information on many of these BMPS can be found from the following sources:

- **Iowa Nutrient Reduction (NRS)**
  - The NRS has identified multiple BMPs to reduce nutrients.
  - Summary sheet SP435A provides information on reduction rates for select BMPs and can be accessed at: http://www.nutrientstrategy.iastate.edu/
- **Clean Water Iowa**
  - Clean Water Iowa provides information on BMPs applicable to rural (agricultural), urban, and industrial areas.
  - This information is available at: https://www.cleanwateriowa.org/
- **ACPF Toolbox Manual**
  - Available at: https://acpf4watersheds.org/
- **Iowa Stormwater Education Partnership (ISWEP)**
  - ISWEP has developed multiple information sheets for stormwater BMPs. These are available at: https://iowastormwater.org/
- **Iowa Watershed Approach**
  - Multiple BMP informational sheets were developed by Iowa State University Extension. These are available at: https://iowawatershedapproach.org/

- **Small Open Beef Feedlots in Iowa – A Producer Guide**
  - Information on BMPs specific to livestock management can be found in this guide.
  - Available at: https://store.extension.iastate.edu/product/Small-Open-Beef-Feedlots-in-Iowa-a-producer-guide
- **Iowa DNR River Restoration Toolbox**
  - a series of best management practices developed to assist designers in stream stabilization and restoration projects in Iowa with proven techniques with emphasis on incorporating natural materials, such as logs, stone, and live plantings.
  - Available at: https://www.iowadnr.gov/Environmental-Protection/Water-Quality/River-Restoration/River-Restoration-Toolbox
- **Low-Tech Process Based Restoration of Riverscapes Design Manual**
  - This design manual provides restoration practitioners with guidelines for implementing a subset of low-tech tools—namely post-assisted log structures (PALS) and beaver dam analogues (BDAs)—for initiating process-based restoration in streams.
  - Available at: http://lowtechpbr.restoration.usu.edu/manual/

Data Sources and BMP Types

No central listing or full inventory exists for estimating existing BMPs and treated areas. Many government agencies, especially the Natural Resources Conservation Service (NRCS), work with producers to install BMPs, however, that information is typically subject to privacy laws. Additionally, many landowners implement BMPs on their own without government assistance. To estimate existing BMP levels, multiple types of data sources were utilized, as discussed below. Note that each source has varying levels of detail and coverage dates, additionally, the data is limited by the types of BMPs included in each source.

While existing data on structural BMPs is more readily available, estimated existing non-structural BMPs (which includes soil health, livestock, and nutrient management BMPs) are more difficult to identify. Generally, input from local natural resource managers, landowners, or producers is needed to properly estimate adoption levels of non-structural BMPs.

- Iowa BMP Mapping Project
  - https://www.gis.iastate.edu/gisf/projects/conservation-practices
  - Sponsored by Iowa State University
  - Focused on providing a baseline of structural BMPs dating from 2007-2010
  - Utilizes aerial photography
  - BMPs included: Terraces, Water and Sediment Control Basins (WASCOB), Grassed Waterways, Pond Dams, Contour Strip Cropping, and Contour Buffer Strips
- Conservation Technology Information Center (CTIC) - Operational Tillage Information System (OpTIS)

    - https://www.ctic.org/OpTIS
    - Sponsored by the Conservation Technology Information Center
    - Utilizes remote sensing data to map results at regional and watershed scales
    - Includes estimates for tillage practices and cover crop utilization
    - Data Period: 2005 - 2018
- Water Quality Initiative (WQI) (Administered through IDALS)
    - The South Skunk River Watershed was part of a WQI project from 2018 – 2021; however, no BMPs were implemented (Source: Personal Correspondence with Jaimie Benning, ISU Extension, 11/17/2021)
    - Project websites:
        - https://naturalresources.extension.iastate.edu/waterquality/southskunkwqi
        - https://www.cleanwateriowa.org/south-skunk-river-watershed-project
    - BMPs Included: cover crops, strip/no-till, nitrogen inhibitor, bioreactor, drainage water management, CREP wetlands, and oxbow restoration
- Edge-of-Field Blitz
    - "The Blitz" is a new approach underway in several central Iowa counties that is working install saturated buffers and bioreactors through a public-private partnership. Currently, no practices have been installed within the Headwaters of the South Skunk River Watershed, but there are several that have been sited and are being evaluated.
    - This approach may serve as a model for future implementation efforts within the watershed plan.
- CREP Wetlands
    - IDALS administers the Iowa Conservation Reserve Enhancement Program (CREP) which is available in select Iowa counties in north central Iowa.
    - Specific locations of CREP wetlands is not available
    - Correspondence with IDALS has confirmed there are three CREP wetlands within the watershed (personal correspondence with Jerry Neppel, IDALS, 1/27/2022)
    - IDALS CREP websites:
        - https://iowaagriculture.gov/water-resources-bureau/iowa-conservation-reserve-enhancement-program-crep
        - https://www.iowacrep.org/)
    - Data period: 2004 - Present
- Existing Watershed Plans
    - Hallett's Quarry Lake Watershed Project (2003).
    - No other watershed projects found
        - https://naturalresources.extension.iastate.edu/waterquality/iowa-watershed-project-database

- Natural Resources Conservation Service (NRCS)
    - 2008 Rapid Assessment of the South Skunk River Watershed (BRW)
        - https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_007355.pdf
        - This document summarizes watershed conditions across the entire South Skunk River Watershed, therefore BMP counts are not applicable to the Headwaters South Skunk WMA

List of BMPs Considered

The following list of practices was used to guide the search for existing information. Some BMPs have been grouped into a "practice suite". Additional information on practice suites is provided below. Note: an asterisk (*) indicates that BMP summary sheets are available from the sources previously identified in this memo.

- Soil Health Practices
    - Nutrient Management BMPs (Practice Suite)
    - Cover Crops
    - Reduced Tillage
    - Land Use Change BMPs (Practice Suite)
- In-Field Practices
    - Contour Buffer Strips / Praire STRIPS*
    - Grassed Waterways
    - Drainage Water Management
    - Terraces*
- Below Field (Edge of Field) Practices
    - Riparian Buffers*
    - Saturated Buffers*
    - Bioreactors*
    - Wetlands*
    - Farm Ponds*
    - Water and Sediment Control Basins (WASCOBS)*
- Riparian Management Practices
    - Grade/Stream Stabilization*
    - Floodplain Restoration*
    - Oxbow Restoration*
    - Channel Stabilization*
    - Two-Stage Drainage Ditch

- Livestock Practices
    - Grazing Lands Management BMPs (Practice Suite)
    - Small Open Feedlot BMPs (Practice Suite)
- Urban Practices
    - Pet Waste Pickup
    - Ordinances, zoning, or regulations pertaining to: stormwater, pet waste, and flood plain management
    - Onsite Wastewater Treatment System (OWTS) Upgrade
    - Urban Stormwater BMPs (Practice Suite)*

Practice Suites

In the context of watershed planning, there are instances where numerous BMPs all have the potential to address a certain pollutant source. For the purpose of this planning effort, some BMP practices have been grouped together into "suites" (which allows for better stakeholder communication, estimating load reductions, costs, etc.). BMPs that are included within each of these practice suites are identified below.

- Nutrient Management BMPs (Practice Suite)
    - Modified timing, rates, or placement of application of nutrients
    - Education for manure application
    - Nitrogen inhibitors
    - Changing nutrient sources
    - Soil and plan tissue sampling
    - Practicing the 4Rs of Nutrient Stewardship
    - Living mulches
- Land Use Change BMPs (Practice Suite)
    - Land use change through conversion of corn-soybean systems to perennial vegetation or extended rotations
        - Perennial crops (energy or biomass crops)
        - Diversified or extended crop rotations
            - Includes at least 2 yrs alfalfa in a 4- or 5-year rotation
        - Land retirement (Prairie or CRP)
        - Conversation to pasture
- Grazing Lands Management BMPs (Practice Suite)
    - Exclusion or cross fencing
    - Alternative water sources
    - Grazing management plans
    - Stream crossings

- Small Open Feedlot BMPs (Practice Suite)
    - Animal waste/manure storage systems
    - Clean water diversion systems
    - Vegetative treatment systems
    - Terraces
    - Manure containment structures and management
    - Open lot runoff management
    - Heavy use area protection
    - Feed management practices
    - Education for manure application
- Urban Stormwater BMPs (Practice Suite)
    - Detention Basins and Ponds*
    - Bioswales*
    - Rain Gardens
    - Bioretention Cells
    - Constructed Wetlands*
    - Green Roofs and Living Walls*
    - Permeable Pavers*
    - River Restoration
    - Tree Boxes and Trenches*

Existing Agricultural BMP Counts

Structural BMPs

A summary of existing levels of BMPs within the watershed was compiled, based on a review from multiple sources, as previously identified in this memo. Due to the varying differences in data (age, coverage period, spatial coverage area, programs included, method of collection, etc.) the most representative data sources were selected for reporting in this memo.

A summary count of known structural BMPs is included in Table 1. Existing locations of BMPs from the Iowa BMP Mapping Project are shown in Figure 1.

Table 1: Summary of Existing Structural BMPs

BMP	Count	Source
Contour Buffer Strips	7 structures	Iowa BMP Mapping Project
Grassed Waterways	2,853,948 feet	Iowa BMP Mapping Project
Ponds	32 structures	Iowa BMP Mapping Project
Terraces	32,823 feet	Iowa BMP Mapping Project
WASCOBs	221 structures	Iowa BMP Mapping Project
CREP Wetland*	3 sites	CREP program - Correspondence with Jerry Neppel, IDALS

**No map location provided from data source, due to landowner privacy policies*

Bear Creek Riparian Buffer Project

This project involves research and demonstration of a large scale, "real world" application of riparian buffer BMPs. It is located within the watershed on Bear Creek, just north of Roland. Iowa State University, through the Leopold Center, operated it from 1990 to 2002, and research still continues. The project re-established various types of riparian buffers on row cropped land, including trees, shrubs, and native grasses.

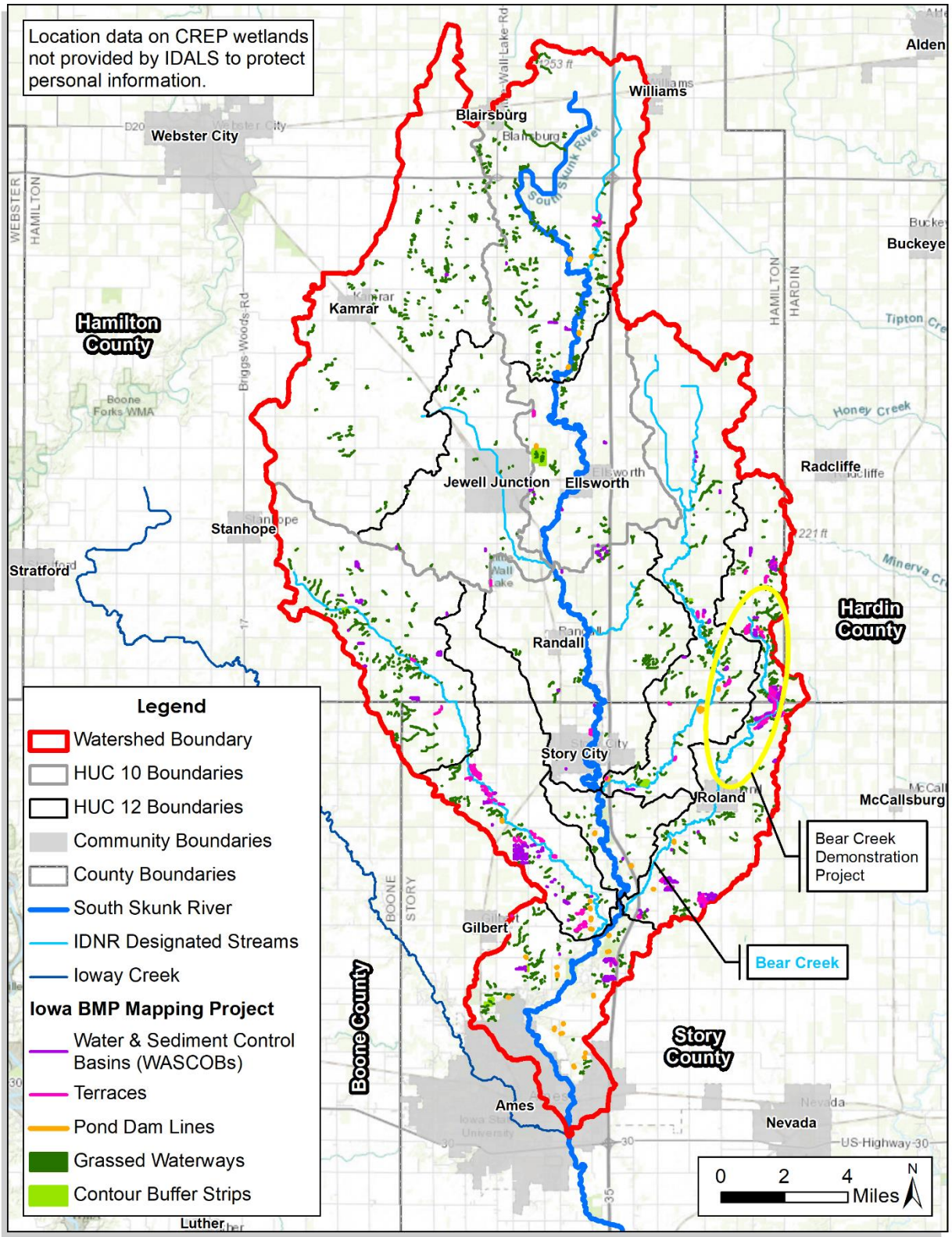


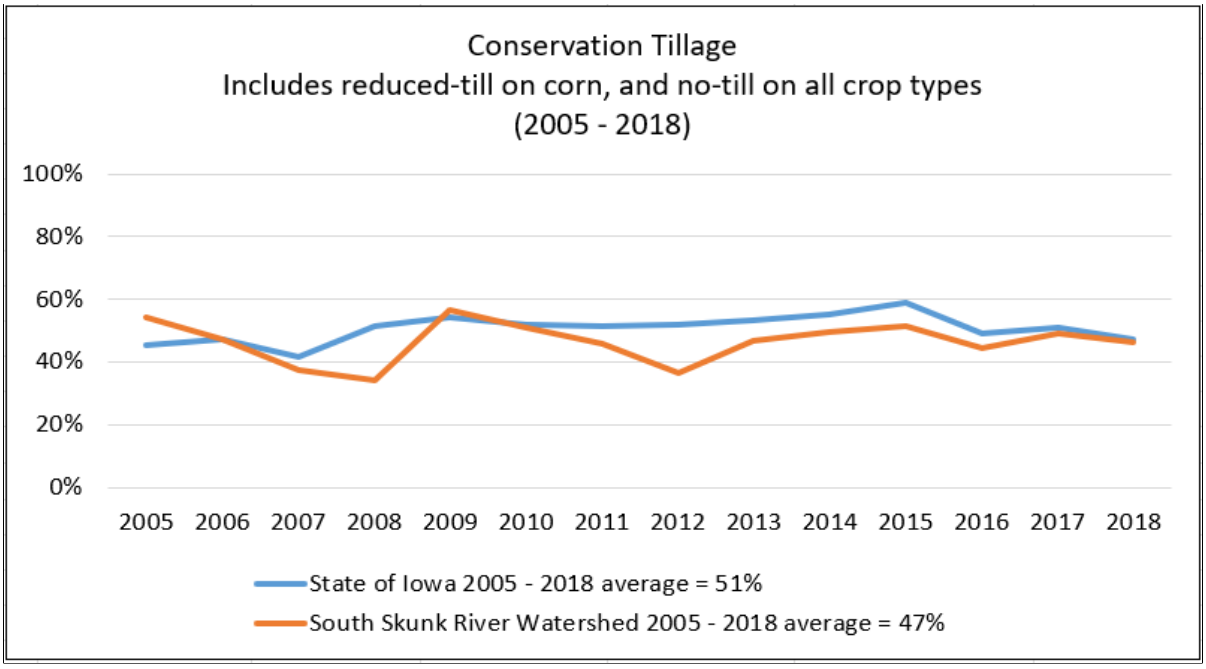
Figure 1: Map of Structural BMPs in the Headwaters South Skunk River Watershed

Non-Structural BMPs

While structural BMPs are relatively permanent BMPs, non-structural BMPs are not. Adoption or implementation levels can vary year-by-year based on landowner or producer management practices.

To gain an understanding of adoption levels of non-structural BMPs across the entire watershed, OpTIS data, provided by CTIC, was reviewed (Figure 2 and Figure 3). OpTIS data includes estimates of tillage practices and use of cover crops. This data represents an aggregated count across the entire watershed from 2005 through 2018 and shows practices being utilized, whether they are adopted through a cost-share program or where a producer has implemented them on their own.

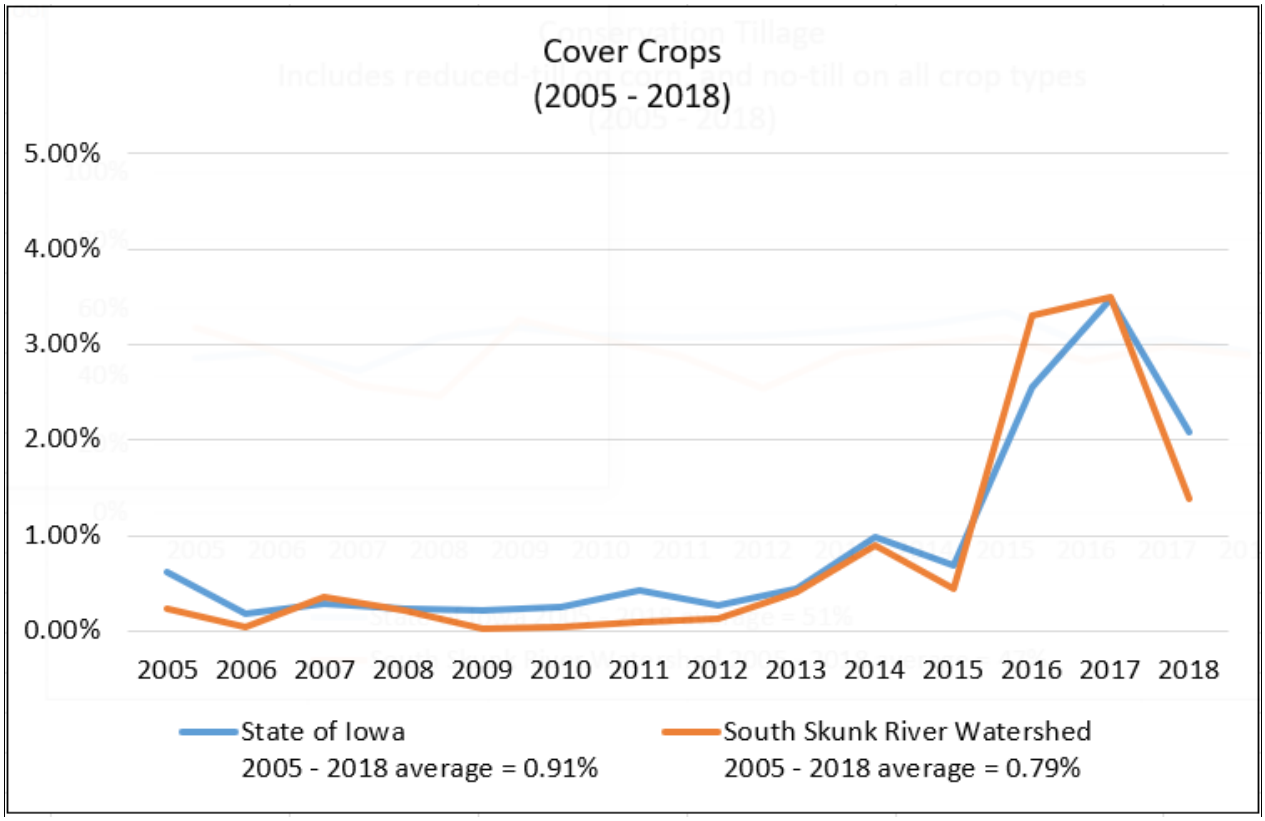
Conservation tillage is a broadly defined practice that includes strip-till, ridge-till, and mulch till systems. Vertical tillage is sometimes included as well. These techniques maintain plant residues on at least 30% of the soil surface after tillage activities. No-till is also considered a form of conservation tillage, however, strip-till, ridge-till, and mulch-till, and vertical tillage all involve some level of tillage and are not considered true no-till. Figure 2 rates of both conservation tillage and no-till are summed together over time for the watershed – levels across Iowa are also shown for context. Over the period of 2005-2018 an average of 47% (391,626 acres) of the watershed used some form of conservation tillage, while the rest of Iowa average 51%. Please note that due to data format limitations, the data presented represent the entire South Skunk River Watershed and is not limited to the Headwaters.



Source: Conservation Technology Information Center (CTIC) Operation Tillage Information System (OpTIS)

Figure 2: Adoption Rates of Conservation Tillage

OpTIS data shows the adoption of cover crops across Iowa and the watershed has shown increasing rates of adoption in recent years. Figure 3 shows cover crop adoption rates over time for the watershed, and levels for all of Iowa are also shown for context. Over the period of 2005-2018 an average of 0.79% (6,628 acres) of the watershed used cover crops, while the rest of Iowa averaged 0.91%. There has been a marked increase since 2015; however, the total area treated by this BMP is still very small. Please note that due to data format limitations, the data presented represent the entire South Skunk River Watershed and is not limited to the Headwaters.



Source: Conservation Technology Information Center (CTIC) Operation Tillage Information System (OpTIS)

Figure 3: Adoption Rates of Cover Crops

Existing Urban BMP Counts

Identifying and summarizing existing urban BMPs was limited to input from watershed partners. The City of Ames has implemented many urban stormwater BMPs in the past. These BMPs include reconstructing the City Hall parking lot with permeable pavers, implementing a stormwater erosion control project along South Skunk River from Carr Park to Homewood Golf Course, developing bioretention cells on 24th Street with the Street Rehabilitation Project, and construction of riffle pools and streambank stabilization with Ioway Creek Water Main Stabilization at Lincoln Way. Other stormwater BMPs that Ames regularly implements include the use of phosphorus-free fertilizer in parks and water quality treatment of stormwater runoff through the city's current post-construction ordinance. The City of Roland has implemented a bioswale project in Britson Park.

Ordinances pertaining to stormwater, pet waste pick up, and flood plain management are shown by community and county below.

Entity	Ordinance Type		
	Floodplain	Stormwater	Pet Waste
Ames	Yes	Yes	Yes
Blairsburg*	-	-	-
Ellsworth*	-	-	-
Jewell	No	Yes	Yes
Kamrar	No	Yes	Yes
Randall	No	No	Yes
Roland	Yes	Yes	Yes
Story City	No	Yes	Yes
Williams	No	No	No
Story County	Yes	Yes	No
Hamilton County	No	No	Yes

** Denotes a community did not respond.*

Future Data Needs for BMP Estimates

This memo provides a summary using readily available data and information reported by partners. It is highly likely that additional BMPs are existing within the watershed. The following is a list of key BMPs that very limited or no information was found to be available for. Collecting this data in future efforts is recommended. This data could be collected from a variety of methods, including but not limited to: in-field/visual assessments, review of aerial photography, producer/community surveys, and obtaining access to existing BMP cost-share program records from NRCS, IDALS, or others.

- Soil Health Practices
    - Nutrient Management BMPs (Practice Suite)

    - Land Use Change (Perennial crops, extended rotations, diversified crops, CRP, and Prairie STRIPS)
- In-Field Practices
    - Drainage Water Management
- Below Field (Edge of Field) Practices
    - Riparian Buffers
    - Saturated Buffers
    - Bioreactors
- Riparian Management Practices
    - Grade/Stream Stabilization
    - Floodplain Restoration
    - Channel Stabilization
    - Two-Stage Drainage Ditch
- Livestock Practices
    - Grazing Lands Management BMPs (Practice Suite)
    - Small Open Feedlot BMPs (Practice Suite)
- Urban Practices
    - Onsite Wastewater Treatment System (OWTS) Upgrade
    - Urban Stormwater BMPs (Practice Suite)

REMAINING ACTION ITEMS

Background

The following is a summary of remaining action items identified throughout the planning process. These activities were identified through evaluation of watershed data and input from WMA members and stakeholders. Additional consideration was given to ensure that action items were identified for each of the draft goals. Only the action items that were of highest priority and thought to be realistically achievable within five years were included in the action plan. These can be found in the Action Plan within Chapter 7.

The following is the list of all remaining action items that were identified during this process, but not selected for the Action Plan.

Potential 'Education' Action Items Not Included in Action Plan

- Compile "success stories" from across the watershed that focus on various topics (stream restoration, farmer success with BMPs, etc.) and develop materials around these.
- Provided targeted education and outreach to animal feeding operations (AFOs) facilities and to manure spreading companies, regarding manure management practices and BMPs that are above and beyond any regulatory requirements.
- Work with multiple partners to hold two BMP workshops per year in the watershed.
- Develop or make available online webinars, YouTube videos, and guidance materials to absentee landowners regarding watershed issues and how to encourage BMP adoption by renters.
- Work with educators from partner organizations (County Conservation Board, Schools, Extension, etc.) to develop or promote a watershed focused curriculum.
- Provide targeted education to unsewered communities and homes that use septic systems and to companies that provide septic system services regarding maintenance and waste handling (especially if utilizing land application).
- Utilize or incorporate the work the City of Ames is doing regarding nutrient trading as an opportunity for educational efforts.
- Install watershed boundary signs to raise awareness at 12 key locations.
- Develop or make available educational materials on groundwater protection, rural water, and private well costs, water quality concerns/risks, treatment costs, and reliability.
- Work with Iowa Stormwater Education Partnership (ISWEP), IDALS urban conservationists, and other partners to educate community leaders on stormwater management practices and the Iowa Storm Water Management Manual.
- Develop educational materials directed at new developments regarding fertilizer, stormwater runoff, and septic system management recommendations.
- Provide regular communications and updates to the general public on the WMA's, goals, projects, events, and accomplishments.
- Develop education materials that explain the benefits, effectiveness, farming profitably/productivity, and cost-share opportunities for BMPs.

- Work with DNR, CCBs, cities, Natural Heritage Foundation to increase river access points and/or make improvements to existing river access points to enhance usability.
- Form an educational committee within the HWSSRWMA to help lead these efforts and provide direction between formal WMA board meetings.
- Provide targeted educational programs to entities using land application of community wastewater.
- Create an onboarding document that would help get new members up to speed on WMA activities, goals, and other updates.
- Develop a database of projects or demonstration sites that can be utilized in outreach materials and events.
- Publish examples of producers and the BMPs they are utilizing on an on-going basis, such as newsletters, social media, or other outlets.
- Develop educational materials that address common questions and concerns of landowners and producers, which are specific to the watershed.
- Provide at least one citizen science event per year within the watershed.
- Publish regular (minimum 6 per year) press releases and materials to local newspapers or other existing organizations within the watershed.
- Enhance signage at river access points to provide information on watershed issues.
- Developed uniform messaging about the WMA and the plan for use by all partners.
- Provide all farm owners and operators a copy of the "Whole Farm Conservation Best Practices Manual" from ISU Extension.

Potential 'Projects & Studies' Action Items Not Included in Action Plan

- Complete land use assessments in select subwatersheds to gauge the existing levels of BMP adoption (no-till, cover crops, terraces, etc.) and to evaluate opportunities for additional BMPs.
- Apply for funding through grants, partner contributions, or other means to fund operations, implement education activities, cost-share BMPs, and complete projects or studies.
- Complete a flood risk assessment for each community to identify flood risks and potential solutions that address flood risk and each community's ability to recover economically and socially.
- Develop a load duration curve for E. coli bacteria loadings to better identify pollutant sources and loads.
- Complete a hydrologic risk assessment of the watershed to understand the historical and current hydrology, historic floods, future hydrologic trends, and evaluate structural and nature-based flood mitigation strategies at the watershed level.
- Develop a unified water quality model that addresses nutrients, sediment, and bacteria.
- Gauge BMP retention levels with randomized yearly follow-ups with operators who implement practices. This information can be used for monitoring progress and improving education efforts or BMP designs.
- Complete a flood damage loss avoidance study, which will identify a baseline level of flood resiliency and quantify the losses or damages avoided due to the implementation of flood mitigation measures.
- Develop stormwater management plans for ## communities.

- Develop a watershed recreation plan, that would help to enhance new or existing recreation opportunities, bring additional economic development, and provide opportunities for education.
- Complete a study to fully identify the locations and extents of unsewered communities and aging septic systems across the watershed.
- Identify ageing septic systems or unsewered communities throughout the watershed.
- Implement urban stormwater BMP projects within ## communities.
- Complete a study to identify fish passage obstructions or barriers across the watershed.

Potential 'Partnerships & Policy' Action Items Not Included in Action Plan

- Assist cities and counties in developing examples or models for regulations or ordinances related to stormwater management, floodplain management, pet waste, etc.
- Organize and conduct a bioblitz across the watershed. A bioblitz is a citizen-science effort to capture water quality data at many locations throughout the watershed on the same day to capture an "snapshot" of the watershed conditions.
- Present and share the final plan at the meetings of potential partners to build awareness and partnerships for future projects.
- Create and distribute an annual report of WMA activities and finances to partners and the public.
- Current WMA members and partners attend board meeting of potential members on a regular basis to educate and provide updates on the WMA, with the goal of recruiting them to joining the WMA.
- For each WMA meeting, arrange for 1-2 guest speakers from major funding or technical programs to present and educate.
- Keep a standing invite for WMA meetings to all potential members or partners.
- Attend and participate in state and regional conferences, meetings, organizations, and other events focused on watershed management.

Potential 'Monitoring & Plan Evaluation' Action Items Not Included in Action Plan

- Continue to operate the existing water quality monitoring and sampling efforts.
- Work with ISU Extension to complete a baseline survey of existing knowledge, understanding, and attitudes of target audiences in 2022.
- Create a database to track flood resiliency indicators, such as: public assistance claims, flood insurance enrollment and claims, properties in the regulatory floodplain, properties removed from the floodplain, and projects completed.

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