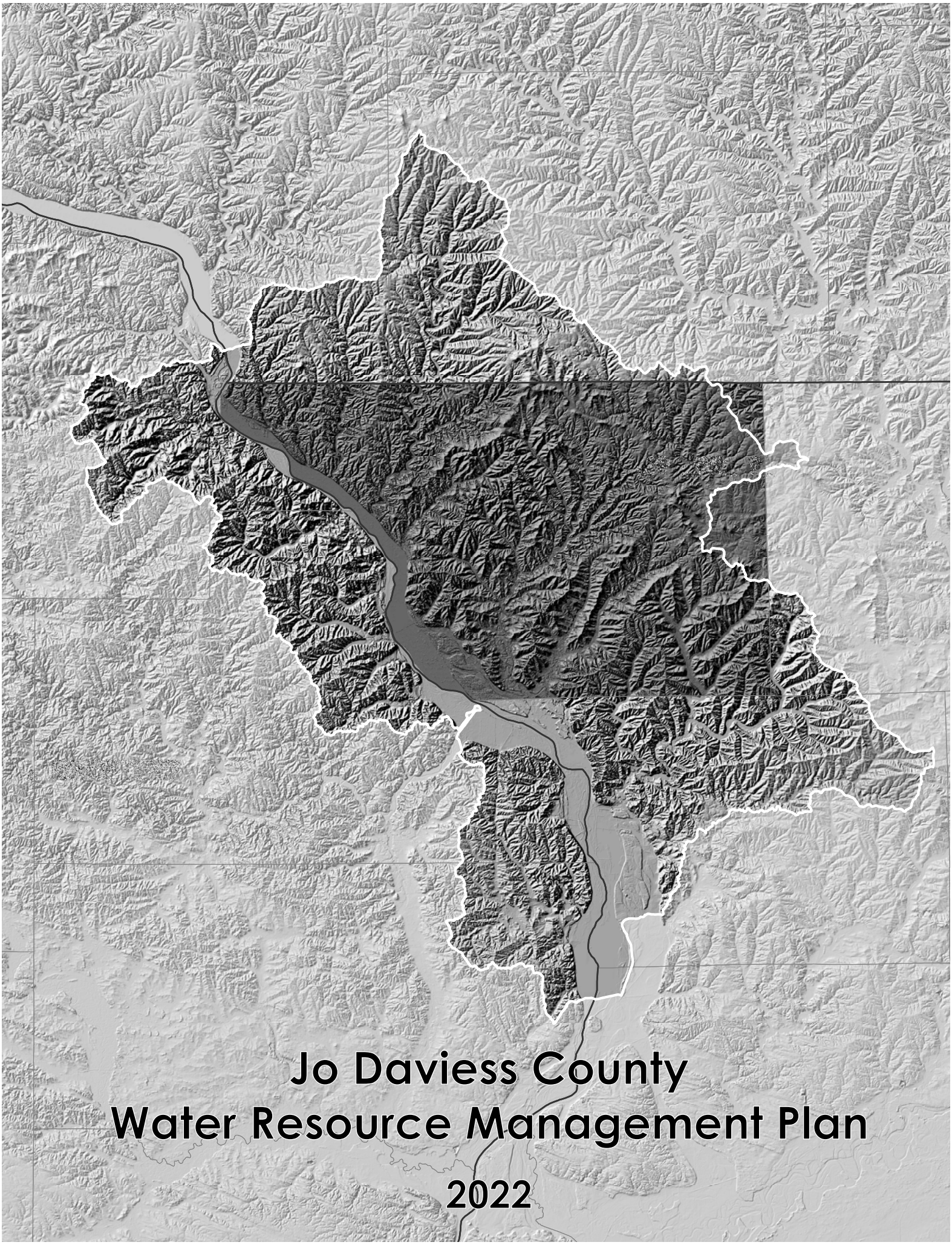

Jo Daviess County
Water Resource Management Plan

2022

Jo Daviess County
Water Resource Management Plan

2022

This planning process was facilitated

by the

University of Illinois Extension

and

The League of Women Voters
of Jo Daviess County

Illinois Extension
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

LWV LEAGUE OF WOMEN VOTERS®
OF JO DAVIESS COUNTY

Cover image of Jo Daviess County and the Apple-Plum HUC 8 Watershed created by Don Luman, Principal Geologist, Illinois State Geological Survey, Prairie Research Institute, University of Illinois Urbana-Champaign

This image of Apple River Canyon State Park, created by Don Luman (Principal Geologist, Illinois State Geological Survey), is a Digital Surface Model (DSM) Light Detection and Ranging (lidar) image.

The following page contains a bare-earth Digital Elevation Model (DEM) of the same area.


Elevation in feet
High : 939
Low : 769
0
125
250
375
500 Feet

Planning Committee
Jo Daviess County Water Resource Management Plan

The following individuals participated on the Planning Committee to create this 2022 plan:

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Jay Solomon - University of Illinois Extension Unit 1 Natural Resource, Environment, & Energy Stewardship Educator

John Schultz - Jo Daviess County Board, Development & Planning Committee Vice-Chair
Jo Daviess County Farm Bureau Board Member
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Jo Daviess County Soil & Water Health Coalition Director

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Galena River Watershed-based Planning Committee,
Jo Daviess County Soil & Water Health Coalition Director

Craig Albaugh - Avid fisherman

The Jo Daviess County Water Resource Management Plan
is dedicated to the memory of
Marge Hospodar,
a founding member of the
League of Women Voters of Jo Daviess County.

It was Marge's suggestion to make
groundwater in Jo Daviess County
the local League's first study subject in 1985.

Special thanks to the scientists
at the University of Illinois Prairie Research Institute for giving us
the evidence for our evidence-based decision making and
the science for our science-based stewardship:

Sam Panno, Principal Scientist, Illinois State Geological Survey

Walt Kelly, Groundwater Geochemist, Illinois State Water Survey

Don Luman, Principal Geologist, Illinois State Geological Survey

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- B. Complex Hydrogeology
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Executive Summary
Jo Daviess County Water Resource Management Plan

Jo Daviess County is located in the far northwest corner of Illinois. Much of Jo Daviess County's topography is rugged, typical of the Driftless Area. Jo Daviess County makes up the largest part of the Apple-Plum Watershed, which drains directly into the Mississippi River (the Mississippi River defines the county's western border). The county relies on groundwater from the Galena-Platteville and the St. Peter Sandstone aquifers for its drinking water supply. Because of the area's fractured carbonate bedrock and shallow soils, there is greater interaction here between surface water and groundwater than in many other settings, and the nature of the relationship between the two is complex, variable, and not entirely understood.

Land use changes affect water resources (see the following page maps showing land cover in the 1830s and in 2012). This plan has been created to identify and assess issues related to surface water and groundwater in the county and to document consensus about the best way to manage water resources going forward. Science-based stewardship and evidence-based decision-making have been the guiding principles of this planning process.

A group of individuals representing a wide range of interests and expertise in the county committed to a two-year planning effort resulting in the 2016 plan. This document is the 2022 update to the original plan.

The local issues identified during the planning process were found to fall into the broad categories of stormwater management, groundwater management, and water quality. The topography, soils and geology of the county create challenges in each of these areas. The plan incorporates information about these interconnected issues and proposes actions designed to meet the challenges.

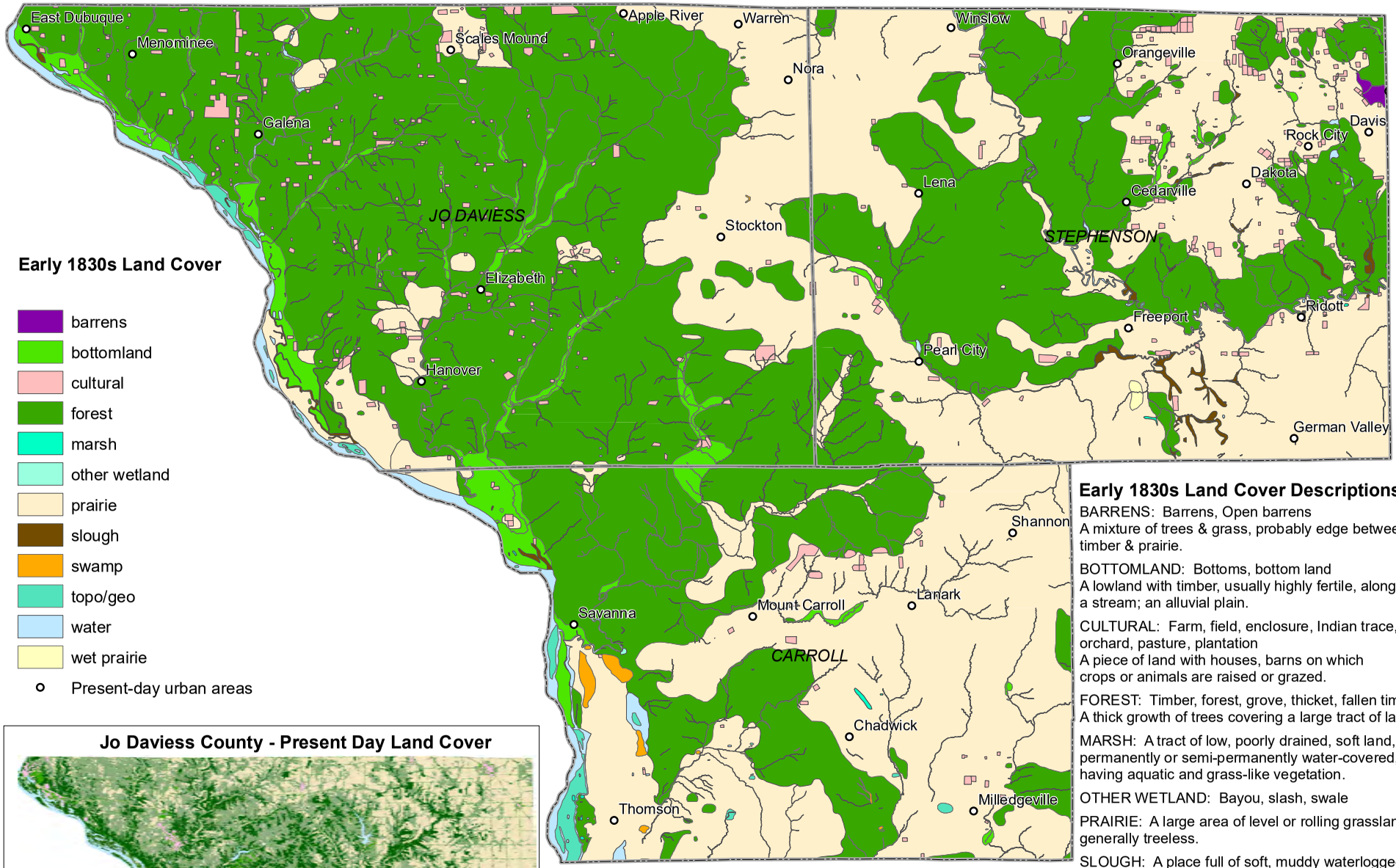
Stormwater resulting from heavy rain or snowfall can cause damage to structures, public infrastructure, and the landscape. Pollutants and sediments are picked up and carried by stormwater flowing over the land or impervious surfaces. More intense and frequent storm events combined with decreased surface permeability result in increased flash flooding, water quality degradation, and damage to stream banks and infrastructure. By managing stormwater runoff, we can reduce erosion, contamination, and infrastructure damage.

Groundwater is water present in that part of the soil, sediment or rock that is saturated with water. Natural and manmade pathways in the bedrock provide conduits that can allow surface water to combine with groundwater. Because of this, contaminants in surface water pose a degree of risk to groundwater quality. The county has an abundant groundwater supply that meets current needs, but withdrawal impacts and sustainable withdrawal maximums are not currently known. Understanding the issues related to groundwater quantity and quality will allow for the responsible use of groundwater resources.

Water quality impacts the general health of ecosystems and the various human uses associated with water resources (drinking water, recreation, etc.). The quality of both surface water and groundwater is impacted by land use and management practices that include elements of conservation, engineering, chemistry and biology. Responsible water resource management calls for an understanding of the factors that affect water quality and the impact that these factors have on the natural and human environment.

This plan documents consensus on three broad goals designed to achieve incremental, sustainable improvements to water resource management within the county:

- Enhance stormwater management
- Enhance surface water management
- Enhance groundwater management



Source: Illinois Natural History Survey
https://clearinghouse.isgs.illinois.edu/data/landcover/illinois-landcover-early-1800s

Early 1830s Land Cover Descriptions

BARRENS: Barrens, Open barrens
A mixture of trees & grass, probably edge between timber & prairie.

BOTTOMLAND: Bottoms, bottom land
A lowland with timber, usually highly fertile, along a stream; an alluvial plain.

CULTURAL: Farm, field, enclosure, Indian trace, orchard, pasture, plantation
A piece of land with houses, barns on which crops or animals are raised or grazed.

FOREST: Timber, forest, grove, thicket, fallen timber
A thick growth of trees covering a large tract of land.

MARSH: A tract of low, poorly drained, soft land, permanently or semi-permanently water-covered, having aquatic and grass-like vegetation.

OTHER WETLAND: Bayou, slash, swale

PRAIRIE: A large area of level or rolling grassland, generally treeless.

SLOUGH: A place full of soft, muddy waterlogged ground; a marsh or shallow undrained depression.

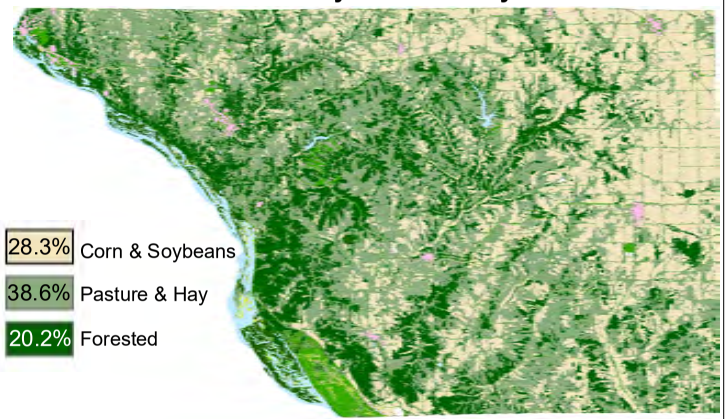
SWAMP: A wet, spongy area, permanently or semi-permanently covered with water, having shrubs & trees

TOPOGRAPHIC, GEOGRAPHIC: Bluff, sand bluff, cliffs, dry ground, glade, hills, sandy hill, mound, high mound, high ridge, sandy ridge, island, sandy island, ledge, licks, rough, rolling land, rocky, ravine, gully, valley, hollow, sandy ground, sinkhole

WATER: Lake, low land, pond, river, wide river, spring

WET PRAIRIE: A large, wet area of level or rolling grassland, generally treeless.

Jo Daviess County - Present Day Land Cover



Source: USDA National Agricultural Statistics Service and Agricultural Research Service
https://www.nass.usda.gov/Research_and_Science/Cropland/SARS1a.php

Incremental, Sustainable Improvement: Water Resource Management Plan Goals & Objectives

	Residential and Commercial Site Owners	Land Owners/Managers of Large Acreages	Local Governments
Goal #1: Enhance Stormwater Management			
Objective #1: Increase stormwater detention/retention	**A.Implement practices that increase stormwater detention/retention such as:**	**A.Implement practices that increase stormwater detention/retention such as:**	**A.Implement practices that increase stormwater detention/retention such as:**
	- Cisterns, tanks and rain barrels	- Detention/retention basins	- Detention/retention basins
	- Rain gardens and bio-swales	- terraces	- rain barrels and cisterns
	- Composting and cover crops	- Bio-swales/filter strips/grass waterways/terraces	- Green infrastructure
	- Green roofs	- No-till/reduced tillage, cover crops, and managed grazing	(e.g. Bio-swales/filter strips/grass waterways/terraces)
	- Permeable surfaces	- perennial plantings	- Cover crops
	- Improved soil absorbency	- wetland protection/restoration/creation	- native perennial plantings
	- Open woodland canopy and establish native grass/forb understory	- erosion control in woodland ravines	- wetland protection/restoration/creation
		- streambank stabilization	- erosion control in woodland ravines
		- Open woodland canopy and established native grass/forb understory	- Open woodland canopy and established native grass/forb understory
			- green roofs
			- streambank stabilization
			- permeable surfaces
	B. Document practice implementation, quantify benefits	**B. Document practice implementation, quantify benefits**	**B. Consider stormwater management ordinances**
	- Voluntary reporting	- Voluntary reporting	- identify model ordinance features
	- SWCD sale of rain barrels	- EQIP funds expended	- update existing ordinances to achieve stormwater management goals
	- SWCD rain garden funding		- adopt ordinances to achieve stormwater management goals
		C. Document maintenance of conservation practices	**C. Integrate goals & objectives from this water resource management**
			local infrfrastructure planning and projects
Objective #2: Measure reductions in stormwater damage	**A. Document actual damage, including expenses, to establish baseline**	**A. Document actual damage, including expenses, to establish baseline**	**A. Document actual damage, including expenses, to establish baseline**
	B. Document projects/repairs/practices implemented following damage	**B. Document projects/repairs/practices implemented following damage**	**B. Document projects/repairs/practices implemented following damage**
	C. Document long-term results of implementation	**C. Document long-term results of implementation**	**C. Document long-term results of implementation**
	D. Complete cost-benefit analysis of real-world local examples	**D. Complete cost-benefit analysis of real-world local examples**	**D. Complete cost-benefit analysis of real-world local examples**

Incremental, Sustainable Improvement: Water Resource Management Plan Goals & Objectives

	Residential and Commercial Site Owners	Land Owners/Managers of Large Acreages	Local Governments
Goal #2: Enhance Surface Water Management			
Objective #1 - Implement projects identified in completed watershed-based plans and TMDL (Total Maximum Daily Load) reports	**A. Implement practices that enhance surface water management such as:**	**A. Implement practices that enhance surface water management such as:**	**A. Implement practices that enhance surface water management such as:**
	- Reduce stormwater flow to waterways (see Goal #1)	- Reduce stormwater flow to waterways (see Goal #1)	- Reduce stormwater flow to waterways (see Goal #1)
	- Reduce salt used for ice melt	- Reduce salt used for ice melt	- Reduce salt used for ice melt
	- Identify, prioritize and stabilize streambanks	- Identify, prioritize and stabilize streambanks	- Identify, prioritize and stabilize streambanks
	- upgrade and maintain septic systems	- upgrade septic systems	- upgrade septic systems
		- Reduce livestock access to waterways and forested areas	
Objective #2 - Monitor surface water quality	**A. Participate in RiverWatch volunteer monitoring program**	**A. Participate in RiverWatch volunteer monitoring program**	**A. Collect regular surface water samples for lab analysis**
	B. Document changes in waterway conditions with photographs	**B. Document changes in waterway conditions with photographs**	**B. Obtain and integrate IEPA surface water monitoring results**
			C. Develop local surface water volunteer monitoring program
			D. Document changes in waterway conditions with photographs

Incremental, Sustainable Improvement: Water Resource Management Plan Goals & Objectives

	Residential and Commercial Site Owners	Land Owners/Managers of Large Acreages	Local Governments
Goal #3: Enhance Groundwater Management			
Objective #1: Promote responsible groundwater use	**A. Implement practices that conserve groundwater such as:**	**A. Implement practices that conserve groundwater such as:**	**A. Implement practices that conserve groundwater such as:**
	- Eliminate leaks	- Eliminate leaks	- Eliminate leaks
	- Install water saving devices and appliances	- Install water saving devices and appliances	- Install water saving devices and appliances
	- Develop water efficient habits	- Develop water efficient habits	- Develop water efficient habits
	- Use drought resistant plants	- Use drought resistant plants	- Use drought resistant plants
	- Water plants efficiently	- Water plants efficiently	- Water plants efficiently
	- Store rainwater for use	- Store rainwater for use	- Store rainwater for use
	- Reuse water when possible (greywater)	- Reuse water when possible (greywater)	- Reuse water when possible (greywater)
	B. Create and maintain local awareness of groundwater resources	**B. Create and maintain local awareness of groundwater resources**	**B. Create and maintain local awareness of groundwater resources**
	- Estimate quantity pumped	- Estimate quantity pumped	- Estimate quantity pumped
	- Share information about natural and current background water chemistry		
Objective #2 - Increase implementation of practices that protect/maintain/improve groundwater quality	**A.Implement practices that protect/maintain/improve water quality**	**A.Implement practices that protect/maintain/improve water quality**	**A.Implement practices that protect/maintain/improve water quality**
	- Annual well testing	- Annual well testing	- Annual well testing
	- Proper well design/construction/maintenance	- Proper well design/construction/maintenance	- Proper well design/construction/maintenance
	- Sealing of abandoned wells	- Sealing of abandoned wells	- Sealing of abandoned wells
Objective #3 - Obtain scientific documentation of groundwater quality	**A. Have well water tested at least annually**	**A. Have well water tested at least annually**	**A. Obtain and integrate groundwater sampling and analysis**
			- Develop ongoing monitoring program for the area
			B. Obtain and integrate IEPA surface water monitoring results
			C. Obtain and integrate County Health Department well data
Objective #4 - Monitor groundwater management	**A. Document volume of use**	**A. Document volume of use**	**A. Document volume of use**
			B. Document treatment costs

Action Plan: 2022-2026
Jo Daviess County Water Resource Management

Completed Actions Since Initial Plan Adoption in 2016

1. The 2016 Plan was presented to local boards and plan was approved by the following: the Jo Daviess County Board, 9 municipalities (Apple River, East Dubuque, Elizabeth, Galena, Hanover, Menominee, Nora, Stockton, and Warren), 5 townships (Apple River, East Galena, Guilford, West Galena, and Warren), and the Apple Canyon Lake Owners Association.
2. The Apple Canyon Lake Owners Association applied for and received an Illinois EPA grant and completed the *Apple Canyon Lake Watershed Based Plan* in 2016.
3. The RiverWatch volunteer stream monitoring program was re-established in the county and the monitoring kit for volunteers is now available through the Jo Daviess Conservation Foundation.
4. In the fall of 2016, the League of Women Voters organized Watershed Game facilitator training at which 25 individuals were trained. River, Stream, and Lake versions of the game were purchased and are stored at the Jo Daviess County Health Department for facilitators to check-out to run the game.
5. In January of 2017, The League of Women Voters partnered with the Galena Rotary Club for the two-day Rotary Roundtable, *Water: We're All in the Same Boat.*
6. The League of Women Voters of Jo Daviess County applied for and received a $38,000 Illinois EPA 319 grant and facilitated the completion of the *Galena River Watershed-based Plan: Phase 1* in 2018. The lower Galena River had been identified as the HUC 12 watershed with the most impairments in the county.
7. In 2018, Steve Keeffer (County Highway Engineer), Jessica Carryer (Jo Daviess Conservation Foundation), and Beth Baranski (League of Women Voters) took a field trip to the Turkey River watershed in Iowa to learn more about the culvert/detention projects being installed there.
8. The League of Women Voters of Jo Daviess County applied for and received grant funding through the U.S. Fish and Wildlife Service to conduct spring sampling, and to establish develop a Jo Daviess County Karst Feature Database.
9. The League of Women Voters of Jo Daviess County worked with scientists from the Illinois State Geological and Water Surveys to sample groundwater in the county to determine the background water chemistry of the shallow aquifer.

Immediate Actions (2022-2023)

1. Present Water Resource Management Plan to local boards for possible adoption (*LWV)*
2. Create an annual public water resource management event (*LWV*)

II A Driftless Area

1. Make accessible short 2013 video Mysteries of the Driftless - The Documentary and the 2018 movie, *Decoding the Driftless*.
    a. Share with schools
    b. YouTube link in document

II B Complex Hydrogeology

1. Develop effective land use practices given the complex hydrogeology of the county in local public and private planning efforts (e.g. the pending update of the County Comprehensive Plan). (*County*)

II C Issues and Opportunities

1. Identify a potential road culvert project in a stormwater problem area and bring landowners in the subwatershed area together to discuss possible cooperative solutions including culvert detention project(s). (*County*)
2. Invite engineer from Iowa to present on culvert detention projects. (*Extension and LWV*)
3. Promote and incentivize wastewater operator certifications and employment at local plants. (*John McCool, JDCF, and LWV*)
4. Improve understanding of regulations on pond construction. (*Extension and LWV*)

III A What is a Watershed?

1. Re-establish opportunities to play the Watershed Game. (*LWV*)
2. Explore local representatives becoming Certified Floodplain Managers (CFM) through the Illinois Association for Floodplain and Stormwater Management (IAFSM). (*County, LWV*)

III B Stormwater Management

1. Gather and evaluate ordinances from other parts of the Driftless Area that have similar stormwater management issues and opportunities and make recommendations to Jo Daviess County. (*LWV*)
2. Create a table summarizing stormwater ordinances currently adopted by local jurisdictions (county, municipal) in Jo Daviess County. (*LWV*)

3. Invite someone from Dubuque to present on the implementation of their stormwater utility program. http://www.cityofdubuque.org/877/Stormwater-Utility. (*Extension and LWV*)
4. Evaluate and create a baseline for the amount of impervious areas in watersheds. One resource for this might be the "Impervious Surface Analysis Tool": https://www.arcgis.com/home/item.html?id=530e2fd7338c4ffb8f88416a074c7dca. (*Beth Baranski*)
5. Revisit and re-analyze model predictions for reduced sedimentation through the implementation of forestry management plans cited in the Galena River Watershed-based plan. (*NRCS, Beth Baranski, Brad Petersburg*)
6. Promote discussion of coordination and collaboration with and between federal, state and local governmental entities. (*LWV - https://drive.google.com/file/d/1tCfSNse-d79pNTYB1yKJvr6SFBpOXUyV/view?usp=sharing)*

III C Impaired Waterbodies

1. Integrate TMDL Stage 3 Report recommendations into the water resource management plan. (*Beth Baranski*)

III D Watershed Planning

1. Look for opportunities for a new HUC 12 watershed in the county for planning purposes. (*LWV*)

IV Groundwater

1. Create updated promotional pieces on well-sealing. (*County Health Department, Extension, and NWILED*)
2. Organize program for bankers and realtors regarding well and septic inspections when land transfers take place. (*Extension, LWV, and NWILED*)

VI A BMPs Stormwater Management

1. Develop and distribute model lease contract language that incorporates best management practices to support/encourage implementation of these practices on leased land. (*LWV, Soil and Water Health Coalition, and Extension*)
    a. Look at what is out there
    b. Formulate conservation clauses that can be put into a lease
    c. How do we get it out there?
2. Compile model ordinances and other measures that should be considered to better manage groundwater resources and make recommendations to local governments. (*LWV*)
3. Establish a prairie strip demonstration project. (*Greg Thoren*)

4. Identify best management practices to control woodland ravine erosion in Jo Daviess County. (*NRCS, NIFA, Woodland Wildlife Cooperative*)

VI B BMPs Groundwater Management

1. Compile model ordinances and other measures that should be considered to better manage groundwater resources and make recommendations to local governments. (*LWV*)

Intermediate Actions (2024-2025)

III B Stormwater Management

1. Identify and evaluate remaining CCC conservation structures in the county. (*Bonnie Cox*)

VI A BMPs Stormwater Management

1. Examine the effectiveness of riparian buffers in a karst area, referencing the Minnesota model where buffers are required. Note: The "Illinois Nutrient Loss Reduction Strategy" states "Buffers along agricultural ditches and streams can reduce nitrate-nitrogen losses by increasing plant uptake and denitrification in the water that seeps through them. In tile-drained landscapes, much of the water bypasses buffers, and estimating the water that does flow through them is difficult. (*LWV*)

VI B BMPs Groundwater Management

1. Establish a method to track the quantity of groundwater being pumped in our area. (*LWV*)
2. Determine the current status of Illinois regulations for allowable uses of grey water and associated plumbing? (*LWV*)
3. Create a table summarizing local government practices including whether or not municipalities are doing "leak audit surveys" to compare pumpage and use volumes to determine volume of loss, and if they are metering water usage using smart meters and data logging. (*LWV*)
4. Organize program for bankers and realtors regarding well and septic inspections when property transfers take place *(Extension and LWV)*

Long Term Actions (2026)

II A Driftless Area

1. Support the multi-state effort to establish the Driftless Area as a National Heritage Area and participate in the effort. (*Jessica Carryer*)

II B Complex Hydrogeology

1. Monitor the findings of Illinois Geological Survey related to the depth and character of bedrock in our area. (*LWV, Geological Survey*)
2. Determine the frequency and nature of the material in crevices, and the impact of this material on recharge and groundwater flow. (*LWV, Geological Survey*)
3. Evaluate the accuracy of the ISGS aquifer sensitivity map for Jo Daviess County relative to the karst areas with shallow coverage. https://isgs.illinois.edu/sites/isgs/files/maps/county-maps/jodaviess-as.pdf. (*LWV, Geological Survey*)

III C Impaired Waterbodies

1. Explore options to construct wetlands to filter wastewater plant discharges to low-flow streams to reduce phosphorus levels and eliminate impairments and develop recommendations.

IV Groundwater

1. Hire an intern to assist with well sealing in the county. (*County Health Department*)

V Available Water Quality Data

1. Obtain and analyze historical data that has already been collected.
2. Expand on the scientific analysis of existing data.
3. Determine the extent that septic effluent is contributing to nutrient pollution and how it might be affecting well and surface water quality in the county.

III B Stormwater Management

1. Review and evaluate other communities that have instituted stormwater utilities. Develop the pros and cons of implementing stormwater utilities to generate revenue to support stormwater management in Jo Daviess County. For a quick overview see: https://www.illinoisfloods.org/content/documents/1d_stormwater_utilities_101_a_031009.pdf
2. Review local government requirements for stormwater management relative to new development within the county and within municipalities. (*LWV*)
3. Explore Permaculture benefits to stormwater management.

VI A BMPs Stormwater Management

1. Conduct a survey of large landowners about the BMPs they have found to be most effective.

Ongoing Actions

II A Driftless Area

1. Monitor progress of the Driftless Area Institute to be established at the University of Wisconsin-Platteville (contact is Evan Larson: larsonev@uwplatt.edu, 608/342-6193) (*LWV*)

II C Issues and Opportunities

1. Promote construction of ponds with more detention capacity. (*Extension*)

III B Stormwater Management

1. Participate in Jo Daviess County All Hazards Mitigation Plan updates (The plan was first created in 2013, and was updated in 2020). (*County*)

III C Impaired Waterbodies

1. Identify ways for Jo Daviess County to collaborate with others at the state and regional level to achieve the nutrient loss reduction goals set in the state strategy. (*LWV*)

IV Groundwater

1. Promote and incentivize well-sealing. (*SWCD, LWV, Extension*)

V Available Water Quality Data

1. Establish a consistent and sustainable water quality monitoring effort in Jo Daviess County. (*JDCF, LWV*)
2. Research natural remedies such as the possible use of mussels and clams to improve water quality in streams. https://www.seeker.com/mussels-and-clams-can-clean-up-polluted-water-1768972732.html (*LWV, Craig Albaugh*)

VI A BMPs Stormwater Management

1. Define the BMPs most suitable for cropland, pastureland, and woodland areas in Jo Daviess County. (*Soil and Water Health Coalition, NIFA, Woodland Wildlife Cooperative*)

VI B BMPs Groundwater Management

1. Gather references about the impacts of quarries on groundwater. (*Illinois State Geological and Water Surveys*)

Jo Daviess County
Water Resource Management Plan
Workbook

I. Introduction

The *Jo Daviess County Water Resource Management Workbook* (updated in 2022) has been created to provide a repository for critical information gathered throughout the Jo Daviess County water resource management planning process. In particular, materials and information directly pertinent to Jo Daviess County have been included for easy reference when working on the Goals, Objectives, and Action Plan items identified in the *Jo Daviess County Water Resource Management Plan*.

The committee has approached the planning process through a reliance on evidenced-based decision-making to achieve science-based stewardship. Efforts have been made to review scientific findings, ask questions and understand the evidence in the context of pertinent land use issues and water management opportunities specific to our area.

When referencing various writings, it's important to consider their nature (*e.g*. scientific or nonscientific) and relative quality. Different types of writings typically represent differing levels of professional content, as well as differing levels of review. As an illustration, examples provided below from the Illinois State Geological Survey are ordered qualitatively from non-reviewed to a high level of review: a) personal field notes; b) field trip guides; c) conference abstracts; d) published conference proceedings; grant/contract-funded reports to sponsors/clients; e) internally reviewed Geologic Maps, Circulars, Bulletins; and f) externally reviewed, published journal articles and books. It's also important to remember that scientific inquiry is an ongoing process, and that as new sources of information become available, conclusions often change or are refined.

This planning process was initiated in 2014 by the League of Women Voters of Jo Daviess County, and the planning approach is largely based on the League's methodology of studying an issue and coming to formal consensus before taking action. As we move forward, we plan to continue to draw from many sources of information, and to design our actions on the basis of a shared understanding of the best information available to us. This will necessarily be an ongoing process, and in recognition of that idea, the committee has framed our work with an overall goal of "Incremental, Sustainable Improvement".

As work on the Action Plan proceeds, it is anticipated that information will be regularly added to the workbook, and that both will be reviewed and formally updated when the Water Resource Management Plan is updated. The Action Plan was reviewed in January of 2023 and the next update is scheduled to occur early in 2024.

II. Jo Daviess County Water Resources
A. The Driftless Area

Introduction

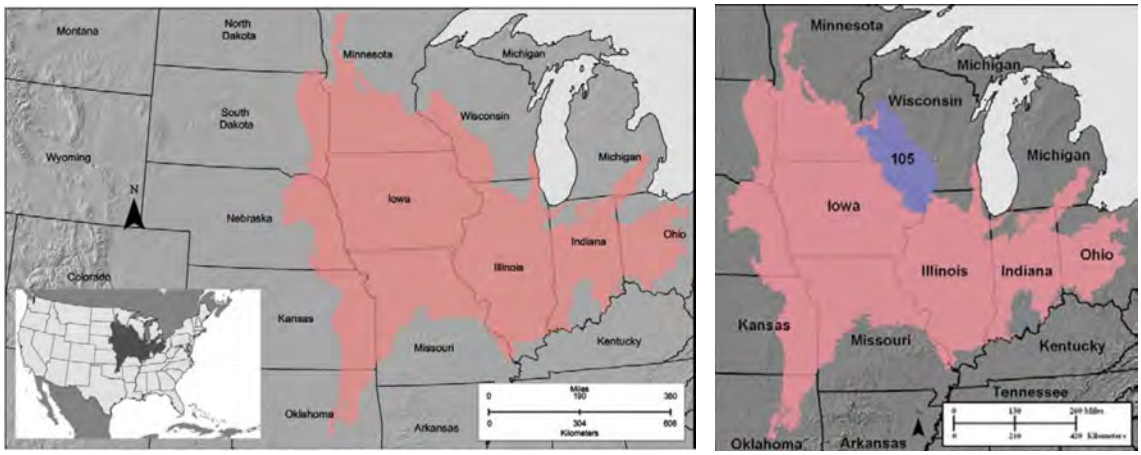
Because of the unique nature of The Driftless Area, it is likely that the water resource issues and opportunities in Jo Daviess County have more in common with the driftless areas in neighboring states than with the rest of Illinois. *The Jo Daviess County, Illinois Comprehensive Plan 2012 Update* (in early 2022, the county initiated a process to update its comprehensive plan) states:

> The natural resources in Jo Daviess County are unique relative to the rest of the state and much of the midwest because the county is part of the Wisconsin Driftless Region bypassed by continental glaciers of the Ice Age. This region covers parts of southern Minnesota and Wisconsin, Northwestern Illinois and Northeastern Iowa. Glaciated areas were leveled, strewn with glacial debris or "drift" and dotted with lakes and ponds. The driftless areas, on the other hand, have bedrock close to the surface into which deep valleys have been carved by millions of years of weathering and erosional processes. In Jo Daviess County, streams are numerous and the only two lakes are man made. The relief from the higher ridges to the valley floors is typically 300 feet or more creating a rugged and scenic landscape. Ecosystems can be found in this landscape that are older than those found in glaciated areas.

Map of the Driftless Area from 1919 Illinois State Geological Survey Bulletin
(color added to differentiate state areas in the Driftless, with Illinois shown in purple)

Major Land Resource Area 105

Recognizing the value of defining areas with similar geographical features such as elevation, topography, climate, water, soils and vegetation for resource planning and management, the United States Department of Agriculture Natural Resource Conservation Service (NRCS) identified "Land Resource Regions" and divided these into "Major Land Resource Areas" (see NRCS *Handbook 296:* Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin). Jo Daviess County is located within Region M, the "Central Feed Grains and Livestock Region," and within Major Land Resource Area 105 (MLRA 105), the "Northern Mississippi Valley Loess Hills" (which is the same area as the Upper Mississippi River Region watershed).



Figures showing the location of Land Resource Region M (left) and location of MLRA 105 (right) from the "Land Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin"

Handbook 296 notes that in Region M, "The major soil resource concerns are water erosion, wetness, and maintenance of the content of organic matter and productivity of the soils. Wind erosion is a hazard in some of the northern parts of the region where lighter textured soils occur. Protecting wildlife habitat and preserving the quality of surface water and groundwater are additional concerns in many parts of the region."

Handbook 296 describes the water resources in MLRA 105, noting that of the approximately 2,650 million gallons of daily freshwater withdrawals in the area, about…

> …9 percent is from groundwater sources, and 91 percent is from surface water sources. In most years the moderate precipitation is adequate for crops and forage, but in years of little or no precipitation, yields are reduced on soils that are shallow over bedrock. The many springs, streams, and farm ponds are additional sources of surface water in the area. The surface water is abundant and generally is of good quality. Poor water quality in stream reaches is primarily the result of nonpoint sources of sediment, nutrients, and pesticides from agricultural land or wastewater discharges downstream from the larger cities.
>
> Ground water is abundant in glacial outwash deposits in most of the river valleys in this area. This water is moderately hard or hard but is generally of very good quality. The level of total dissolved solids is typically less than 250 parts per million. The supply of groundwater varies in the uplands. The sandstone and dolomite layers in the Jordan and Prairie du Chien aquifers *(also known as the St. Peter - Prairie du Chien - Jordan Aquifer, and referred to locally as the St. Peter Sandstone)* usually provide adequate yields to wells. The water from these aquifers is suitable for all uses, although the level of total dissolved solids approaches 1,000 parts per million in some areas.

Handbook 296 notes that in MLRA 105, "The major resource concerns are water erosion, depletion of organic matter in the soils, and poor water quality."

Soil survey offices are organized to serve groups of the major resource land areas. The current contact information for MLRA 105 is: Kevin Traastad, MLRA Project Leader, Onalaska MLRA Soil Survey Office, 1107 Riders Club Road, Onalaska WI 54650-2079, Ph: (608) 782-0180.

Dr. Stanley W. Trimble has done extensive work studying erosion in the Driftless Area, as documented in his book, *Historical Agriculture and Soil Erosion in the Upper Mississippi Valley Hill Country*.

Action Plan Items

1. Support the multi-state effort to establish the Driftless Area as a National Heritage Area and participate in the effort.

2. Support progress of the Driftless Area Institute to be established at the University of Wisconsin-Platteville (contact is Evan Larson: larsonev@uwplatt.edu, 608/342-6193)

3. Make accessible short 2013 video Mysteries of the Driftless - The Documentary and the 2018 movie, *Decoding the Driftless*.

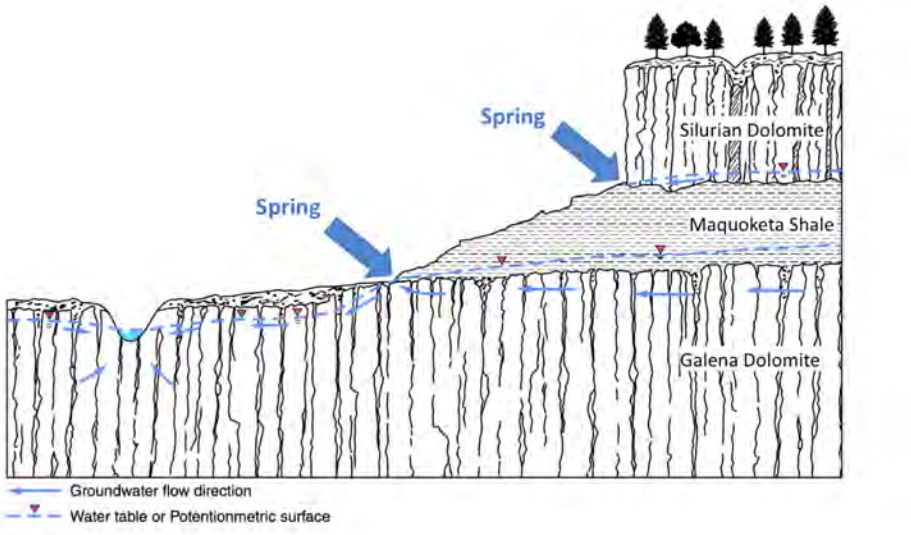
II. Jo Daviess County Water Resources
B. Complex Hydrogeology

Introduction

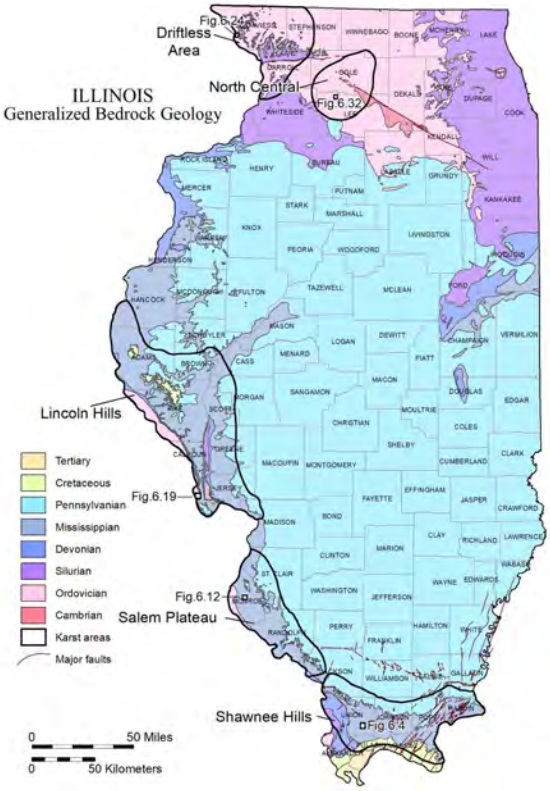
Jo Daviess County is a karst area, defined as "a geologically and hydrologically integrated and self-organizing network of landforms and subsurface large-scale porosity created by a combination of fractured soluble bedrock, the movement of water into and through the rock body as part of the hydrologic cycle, and physical and chemical weathering" (from Illinois State Geological Survey Circular 586). In 2021, a Jo Daviess County Karst Feature Database was completed. The database, a web map, and links to 6 explanatory videos (including an Introduction, summaries on Crevices & Caves, Sinkholes, Springs, and Mining, and a database Tutorial) being hosted by the U.S. Fish and Wildlife Service are now available to the public (https://bit.ly/JDC_KarstFeatures).

A selection of images included in the videos associated with the Jo Daviess County Karst Feature Database

Bedrock in Jo Daviess County is primarily dolomite (a sedimentary rock composed of calcium magnesium carbonate). Worldwide tectonic activity has fractured the crustal rocks including the bedrock of our county. Because rainfall and snowmelt are acidic in nature, they can dissolve carbonate rock (such as limestone and dolomite). Over time (thousand to millions of years), the bedrock fractures have been enlarged, forming a network of open spaces and creating the groundwater storage area referred to as the Galena-Platteville aquifer. The Galena-Platteville aquifer is, for the most part, an unconfined aquifer - confined only in the mound areas where it lies beneath the Maquoketa shale and Silurian dolomite ("perched" aquifers occur above the Maquoketa shale in the Silurian dolomite). The dissolving action has also resulted in solution-enlarged fractures (crevices), crevice caves, springs, and cover-collapse sinkholes. Because of the openness of the aquifer and the relatively thin soils in the Driftless Area, surface-borne contaminants can enter the aquifer without the benefit of filtration and microbial degradation by thicker soils. Consequently, there is cause for concern that groundwater will be contaminated by constituents carried in surface water runoff. Extensive research efforts have been undertaken to help us better understand the particular nature of our area's hydrogeology.



Cross-section of Jo Daviess County geology showing the rock formations of our surface bedrock and relationships to groundwater flow. Private wells draw from the Galena Aquifer. Image created by Samuel V. Panno, Principal Scientist at the Illinois State Geological Survey.



Bedrock Geology and karst areas in Illinois. Image created by Samuel V. Panno, Principal Scientist at the Illinois State Geological Survey.

Illinois State Geological Survey Findings

Scientists from the Illinois State Geological Survey (ISGS) and the Illinois State Water Survey (ISWS) have been studying the hydrogeology of Jo Daviess County and publishing their findings for many years. Recent abstracts, proceedings, guidebooks, circulars and maps with information specific to our area's hydrogeology (like those listed in the reference section below) can be accessed online.

ISGS Circular 586 entitled "The karst of northwestern Illinois' Driftless Area, Jo Daviess County," contains the results of an investigation of the geology, hydrogeology and groundwater chemistry of the area. https://isgs.illinois.edu/maps/county-maps/karst-terrain/jo-daviess-0

ISGS Circular 589: *Characterization of Karst Terrain and Regional Tectonics Using Remotely Sensed Data in Jo Daviess County, Illinois* was initiated by the observance of vibrant alfalfa crop lines apparent during extreme drought conditions in 2012, and provides evidence that these crop lines are a reflection of the fractures and crevices exposed at the bedrock surface.
https://www.isgs.illinois.edu/maps/county-maps/karst-terrain/jo-daviess

Samuel V. Panno and Don Luman presented the findings documented in Circular 589 in Jo Daviess County on October 16th and 17th, 2015. The October 16th presentations are available on YouTube:

Part 1, Donald E. Luman - https://www.youtube.com/watch?v=X7tn99VRFac
Part 2, Samuel V. Panno – https://www.youtube.com/watch?v=XXw2ZlhO8-Y
Part 3, Question & Answer session – https://www.youtube.com/watch?v=ZgavUsAGS9U

Low-altitude oblique photograph of an alfalfa field exhibiting complex networks of vegetated crop lines taken on July 19, 2012, in eastern Jo Daviess County (photograph by S. Panno).

A field trip guidebook created for Jo Daviess County provides a good overview of the Geology, Hydrogeology, History, Archaeology, and Biotic Ecology of the area.
https://www.isgs.illinois.edu/publications/gb042

Natural Resource Conservation Service (NRCS) Findings

Responding to a preliminary Illinois State Geological Survey (ISGS) report on the crop lines, Roger Windhorn, geologist and retired soil scientist from the NRCS State office, produced field notes ("JoDavies [sic] County Crop Lines, RDW – Geologist/Soil

Scientist"summarizing findings from his August 23, 2012 investigative visit (conducted with others) to Jo Daviess County. Borings were made in two locations between the crop lines, and one boring was made directly in a crop line. In the first boring outside the crop line area, they were able to take a push core to a depth of about 34 inches, reaching 6 inches further using a continuous 2-inch auger. In the boring in the second non-crop line area, they were able to take a push core to a depth of about 30 inches, reaching to 42 inches using an auger. For the boring within one of the crop lines, they were able to take a push core to a depth of about 39 inches drilled to 11 feet 10 inches using a continuous 2-inch auger - the deepest two feet of this sample were found to be very moist. Higher conductivity values were found at the crop lines (12.5 to 13.2 ms/m versus 2.8 to 3.7 ms/m) directly correlating with higher "moisture, clay content, and any salts or "charged" ions in the soil solution." The field notes end concluding "This very brief look at the situation could lead to more structured sampling and electromagnetic approach to verify these initial results. Conclusive decisions could have an impact on our soil maps and their interpretations within the counties having these features."

In correspondence to USDA NRCS Illinois State Conservationist Ivan Dozier, Jonathan Hempel, Director of the National Soil Survey Center, includes a report on the investigations conducted in Jo Daviess County by James Doolittle on May 1, 2014. Hempel notes that "…the presence and distribution of joints in bedrock were studied in an area of Frankville soils with ground-penetrating radar (GPR) in Jo Daviess County. These cracks are common and have an impact on water and gas movement through the bedrock, and influence plant rooting depths and available soil moisture… Results from a GPR detailed survey of joint patterns in an area of Franklinville soil were disappointing. However, results from this study provided a greater understanding of how different soil properties influence GPR results and the clarity of the interpretations."

2021-22 Jo Daviess County Bedrock Mapping Project

The Illinois State Geological Survey is in the process of remapping the bedrock geology in Jo Daviess County.

Action Plan Items

1. Determine the depth and character of bedrock crevices in our area.

2. Determine the frequency and nature of the material in crevices, and the impact of this material on recharge and groundwater flow?

3. Evaluate the accuracy of the ISGS aquifer sensitivity map for Jo Daviess County relative to the karst areas with shallow soil coverage? http://isgs.illinois.edu/sites/isgs/files/maps/county-maps/jodaviess-as.pdf

4. Evaluate and develop higher construction standards for certain land uses (e.g. underground storage tanks) for consideration.

5. Develop land use practices given the complex hydrogeology of the county in local public and private planning efforts (e.g. the pending update of the County Comprehensive Plan).

II. Jo Daviess County Water Resources
C. Issues and Opportunities

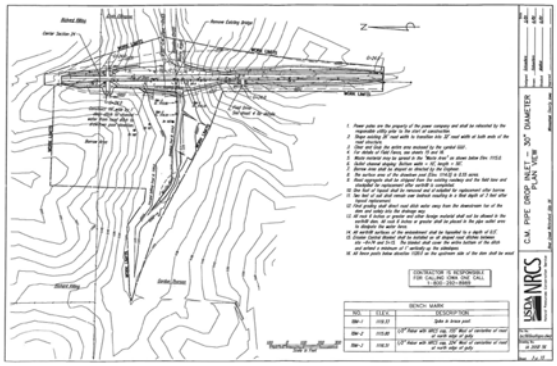
Introduction

Through the planning process, the committee was able to identify issues that mesh with existing opportunities. Information about two of these circumstances are provided here.

County Infrastructure Requirements

The county and townships regularly budget for road and bridge infrastructure improvements. These funded projects are opportunities to address stormwater management issues along with the infrastructure. Landowner participation in project solutions that might go beyond the roadway is both challenging and critical.

The culvert work being done in Fayette County, Iowa, is a possible model. Culvert replacement projects are being designed as detention basins using adjacent properties to slow surface water runoff and allow for settling and infiltration to improve water quality. The Water Resource Management Action Plan calls for inviting the engineer working on the Iowa projects to make a presentation.

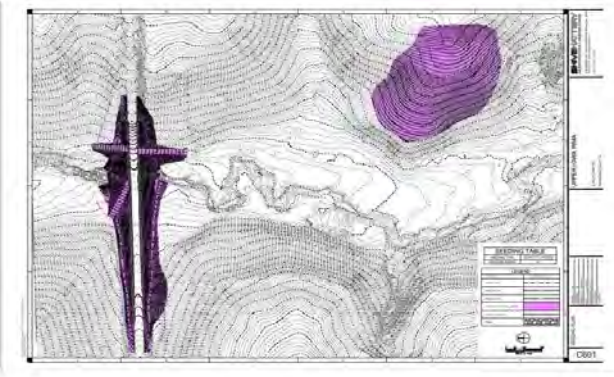


The contact information for this project is:

Joel D. Fantz, P.E.
Fayette County Engineer
engineer@co.fayette.ia.us
114 N. Vine St., P.O. Box 269
West Union IA 52175
Phone: 712/922-9626

April 9, 2019 Fayette County, IA detention project field trip
Photo by Beth Baranski used with permission

Matt Frana (Upper Iowa Watershed Project Coordinator, Winneshiek County Soil & Water Conservation District, Decorah, Iowa, matt.frana@ia.nacdnet.net, 563/382-4352 x3) is working on road dam projects in Winnishiek County, IA and has sample Road Dam Easements for reference. He is also looking at using innovative culvert designs to increase detention at roadways.



Winneshiek County, Iowa road/culvert detention project

The City of Galena has used an innovative culvert plate design that provides detention.

Photo by Beth Baranski used with permission

Need for Trained Wastewater Management Professionals

Waste Water Operators are responsible for insuring that the plants in the county operate correctly and maintain required water quality standards for the discharge flowing into local waterways. The Planning Committee discussed the fact that many of the municipal wastewater operators in our area are approaching retirement age, with no replacements in sight. John McCool (retired Warren Wastewater Operator) noted in 2016 that Highland Community College (HCC) had discontinued their operator training program, requiring individuals to go down to Carbondale for training. HCC had considered an online program, but because Wastewater Operators were not required to have continued education once certified, there wasn't enough interest to justify the effort.

Revisiting the issue in 2022, John discovered that much has changed. Wastewater Operator training is now available at the Environmental Resources Training Center (ERTC) in Rockford. Illinois now requires wastewater operators to obtain continuing education units which supports programs being offered to keep operators current.

There is still a need to draw people into the profession. The municipal jobs generally include health insurance and retirement benefits. Individuals must take an exam and obtain on-the-job experience to become certified (generally this requires about four years, but additional coursework can be used to reduce the time). The job has changed significantly over the years and is more technical. The job would suit those with an interest in science who like to work independently.

In early 2019 conversations with Chris Davis, Illinois EPA Bureau of Water, noted that the Bureau Chief is promoting the idea of working on this problem which is viewed as a statewide issue. They are deciding how to approach the situation and have begun by starting an evaluation of existing materials that promote a career as a WWTP Operator. If needed, they will begin developing promotional materials.

The Illinois Manufacturing Excellence Center IIMEC) http://www.imec.org (IMEC) might be another good resource as they are involved with training and succession planning.

Action Plan Items

1. Identify a potential road culvert project in a stormwater problem area and bring landowners in the subwatershed area together to discuss possible cooperative solutions including culvert detention project(s).

2. Invite engineer from Iowa to present on culvert detention projects.

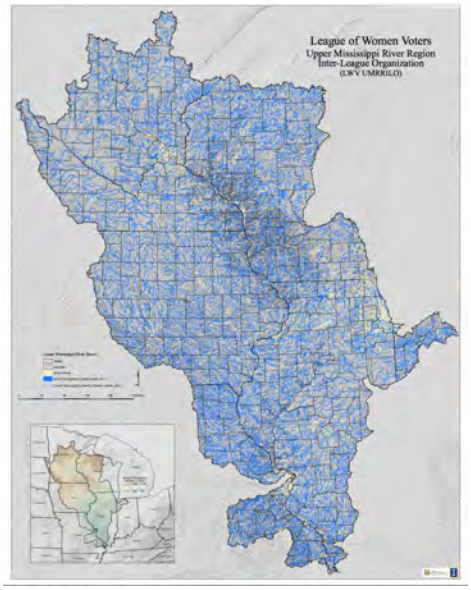
3. Promote and incentivize wastewater operator certifications and employment at local plants.

4. Encourage contractors to build detention ponds rather than fish ponds.

III. Surface Water
A. What is a Watershed?

Introduction

The study of surface water is organized by hydrological units, commonly referred to as watersheds. Watersheds are like bowls of land draining to a certain point in a water body. Hydrological units are areas of land upstream from a specific point on a waterway that contributes surface water runoff to this point. HUC is an acronym for Hydrological Unit Code, and hydrological units have been classified and given a HUC of 2 to 12 digits based on the size of the watershed. The hydrological unit classifications are nested within each other, and numbers are added to the HUC as the units get smaller from a HUC-2 down to a HUC-12 in even numbers. For example, Jo Daviess County is located within the "HUC 2" Upper Mississippi River Region (HUC 07), the "HUC 4" Upper Mississippi-Maquoketa-Plum Subregion (HUC 0706), the "HUC 8" Apple-Plum (07060005) and the Pecatonica (0709003) Basins. Watershed basins are further broken down into subbasins, watersheds, and subwatersheds. The U.S. Geological Survey "Science in Your Watershed" provides mapping down to the basin level at https://water.usgs.gov/wsc/reg/07.html.



The Upper Mississippi River Region (HUC 2)

Jo Daviess County within the Apple-Plum and Pecatonica Basins (HUC 8s)

The Apple-Plum Watershed

The majority of Jo Daviess County is located in the Apple-Plum Watershed Basin. In June, 2008, U.S. Department of Agriculture, Natural Resource Conservation Service (Wisconsin) completed a "Rapid Watershed Assessment: Apple Plum River Watershed." The Assessment reports the Apple Plum Basin to encompass over 950,000 acres (in SW Wisconsin, NW Illinois, and East Central Iowa), with 66.6% of the land in agriculture, 22.8% in forest, and the remaining 10.6% consisting of wetlands, urban areas and open water. The Assessment, available at:
www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_020058.pdf notes that:

> The major resource concerns from production lands in the watershed include sheet, rill, ephemeral gully and streambank erosion as well as excessive nutrients and organics in surface water and groundwater. Some best management practices (BMPs) well-suited to address these concerns include mulch-till and no-till planting, nutrient management, grassed waterways, streambank stabilization and cover crops. Aquatic and terrestrial invasive species are also a concern.

The Wisconsin Natural Resource Conservation Service (NRCS) office also completed a "Rapid Watershed Assessment Pecatonica River Watershed" in June of 2008 (which can be viewed online at http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_020420.pdf. The resource concerns identified in this HUC 8 are similar to those in the Apple-Plum Watershed:

> The major resource concerns from production lands in the watershed include sheet, rill, and ephemeral gully erosion, excessive nutrients and organics in surface water, and inadequate wildlife cover and shelter. Some best

management practices (BMPs) well-suited to address these concerns include mulch-till and no-till planting, nutrient management, grassed waterways, cover crops and conservation cover. Aquatic and terrestrial invasive species are also a concern.

The Watershed Game

The University of Minnesota Extension in conjunction with Minnesota Sea Grant has created a watershed game. The Watershed Game (WSG) is an interactive, educational tool that helps individuals understand the connection between land use and water quality. The WSG is available in two versions: The Watershed Game for Local Leaders and The Watershed Game for Classrooms. The local-leader version comes in four tabletop versions: Stream, River, Lake, and Coastal. Participants learn how a variety of land uses impact water and natural resources, increase their knowledge of best management practices (BMPs), and learn how their choices can prevent adverse impacts. Participants apply the tools of plans, practices, and policies that help them achieve clean water goals for protection and restoration while providing for community growth.

- The stream version addresses the watershed for an entire headwater (source of a stream) and the land uses found in that watershed.
- The river version addresses the land uses associated with large river systems and urban areas.
- The lake version concentrates on land uses surrounding a typical lake.
- The coastal version focuses on improving community resilience to flooding and water quality by addressing nitrogen, phosphorus, and sediment.
- The classroom version is designed for middle-school grades 6-8, but can be used for grades 9-12. This version emphasizes collaboration and cooperative decision-making, developing persuasive arguments, teamwork, and leadership skills in addition to science and math.

The League of Women Voters of Jo Daviess County has purchased stream and lake versions of the games that are stored at the Jo Daviess County Environmental Health Department (9483 US Hwy. 20 West, Galena, 815/777-0283) along with a list of 28 individuals in Jo Daviess County who have been trained to facilitate the game. Anyone who is interested in having the game facilitated for a group can simply schedule a time with one of the trained facilitators who is authorized to check out the game for the event. Plans were in place at the beginning of 2020 to make the Watershed Game available at least once a month at Prairie Ridge in Galena. Covid necessitated halting these monthly games. The LWV-JDC hopes to resume the practice when Covid guidelines allow. The creator of the game and the individual to contact in order to become a trained facilitator is John Bilotta, Extension Educator, 612/624-7708, jbilotta@umn.edu. More general information about The Watershed Game is available at: https://seagrant.umn.edu/programs/community-resilience-program/watershed-game

The Watershed Game board s for the Stream Model and the Lake Model

Another watershed game, available online and created by Iowa State University is People in Ecosystems Watershed Integration (PEWI), can be found at https://www.nrem.iastate.edu/pewi/

A "Resource Management Mapping Tool" for Illinois containing watershed boundaries and other informational resource layers is available at: http://www.rmms.illinois.edu/

The Illinois Association for Floodplain and Stormwater Management (IAFSM) has five Watershed Tabletop Models available for all members to check out (free of charge) and bring to Public Works Open Houses, Scout meetings, 4-H meetings, school classrooms, etc. This offers a great opportunity to educate about the dangers and impact of unplanned development and human activity in the floodplain. IAFSM currently keeps tables in Springfield, Champaign, Bartlett, Woodridge, and Fairview Heights. Contact Sarah at IAFSM@illinoisfloods.org to make arrangements.

Action Plan Items

1. Re-establish opportunities to play the Watershed Game.

2. Promote local representatives becoming Certified Floodplain Managers (CFM) through the Illinois Association for Floodplain and Stormwater Management (IAFSM)

III. Surface Water
B. Stormwater Management

Introduction

Stormwater management involves reducing and/or controlling precipitation runoff (keeping the raindrop where it falls). When stormwater is absorbed into soil, it is filtered and ultimately replenishes aquifers or flows into streams and rivers. As development increases the amount of impervious surfaces, runoff increases. Soil compaction increases runoff. Run off tends to be greater on sloped areas. Creating conduits (storm sewers, trenches, tiling) designed to convey water accelerates runoff. Stormwater runoff has impacted Jo Daviess County through erosion, surface water contamination, costly infrastructure damage and loss of life. Addressing our stormwater issues is critical for effective water resource management.

Jo Daviess Comprehensive Plan

The Jo Daviess County Comprehensive Plan 2012 Update (a new update is being initiated in 2022) https://jodaviesscountyil.gov/vertical/sites/%7B7C77C92D-D4A3-4866-8D3D-FE560FE5CFC8%7D/uploads/JDC_Comp_Plan_2012_Update_Adopted_11-13-2012.pdf contains useful reference information on both surface and ground water resources in the county as well as a high priority objective to "Continue efforts of stormwater control and streambank stabilization."

Hazards Mitigation Plan

The county hazard mitigation plan was updated in May of 2020: https://www.jodaviess.org/vertical/sites/%7B7C77C92D-D4A3-4866-8D3D-FE560FE5CFC8%7D/uploads/Jo_Daviess_Co._AHMP_Update_-_05252020.pdf . The Hazards Mitigation Plan assesses hazard risks, offers mitigation strategies and recommendations regarding hazards in the county as a requirement for emergency funding. The plan is intended to help the county and participating jurisdictions within the county "by identifying vulnerabilities and developing mitigation actions to lessen and sometimes even eliminate the effects of a hazard."

The plan notes that Jo Daviess County has been included in 11 federally-declared disasters since 1965, the majority of these being related to severe storms and flooding. From 2010 through 2019 there have been 81 heavy rain events, 60 thunderstorms with damaging winds, 39 severe winter storms, 18 flash flood events, 16 severe storms with hail one inch in diameter or greater, four tornadoes, three riverine flood events, two extreme cold events, two excessive heat events, one drought and one lightning strike verified in the county.

The overall hazard mitigation goals in the 2020 update remained the same as the goals in the original 2013 plan:

Figure MIT-1
Mitigation Goals

Goal 1	Educate people about the hazards (natural and man-made) they face and the ways they can protect themselves, their homes, and their businesses from those hazards.
Goal 2	Protect the lives, health, and safety of the people and animals in the County from the dangers of natural and man-made hazards.
Goal 3	Protect existing infrastructure and design new infrastructure (roads, bridges, utilities, water supplies, sanitary sewer systems, etc.) to be resilient to the impacts of natural and man-made hazards.
Goal 4	Incorporate natural and man-made hazard mitigation into community plans and regulations.
Goal 5	Place a priority on protecting public services, including critical facilities, utilities, roads and schools.
Goal 6	Preserve and protect the rivers and floodplains in our County.
Goal 7	Ensure that new developments do not create new exposures to damage from natural and man-made hazards.
Goal 8	Protect historic, cultural, and natural resources from the effects of natural and man-made hazards.

The 2020 Plan contains updated tables documenting Hazard Mitigation Actions proposed throughout the county. Many of the proposed actions relate to stormwater management. The Hazard Mitigation Plan incorporates a methodology for prioritizing mitigation actions that may be a useful reference:

Figure MIT-14 Mitigation Action Prioritization Methodology			
		Hazard	
		Most Significant Hazard **(M)** (i.e., severe storms, severe winter storms/extreme cold, floods, tornadoes)	Less Significant Hazard **(L)** (i.e., excessive heat, drought, earthquakes, landslides, dam failures)
Mitigation Action	Mitigation Action with the Potential to Virtually Eliminate or Significantly Reduce Impacts **(H)**	**HM** mitigation action will virtually eliminate damages and/or significantly reduce the probability of fatalities and injuries from the most significant hazards	**HL** mitigation action will virtually eliminate damages and/or significantly reduce the probability of fatalities and injuries from less significant hazards
	Mitigation Action with the Potential to Reduce Impacts **(L)**	**LM** mitigation action has the potential to reduce damages, fatalities and/or injuries from the most significant hazards	**LL** mitigation action has the potential to reduce damages, fatalities and/or injuries from less significant hazards

Measuring Reductions in Stormwater Damage

We need to adopt an approach for evaluating the benefits of practices implemented to manage stormwater. There are computer modeling programs that estimate the impact that various practices will have on stormwater runoff. If modeling is used, it will be important to check the predictive modeling against actual results as projects are implemented. The costs associated with stormwater damage over time will be another indicator of the impact that stormwater management efforts are having.

Evaluation of the Volume of Rainfall Infiltration/Runoff Relative to Agricultural Practices

The Jo Daviess County Soil and Water Health Coalition was formed to invite individuals into a farmer-led conversation about soil health and water quality. The Coalition uses the information gained through experimentation and shared experience to implement practices that reduce soil erosion and nutrient loss while increasing resiliency and profitability on Jo Daviess County farms. Producers in the group are experimenting with in-field practices (e.g. no-till/reduced tillage, cover crops, and managed grazing) and sharing the results in field days, presentations, and on their website: https://www.jdcsoilandwaterhealth.com/

The Coalition has been working with researchers at UW-Platteville (Dennis Busch and Andrew Cartmill) to measure relative infiltration and runoff using in-field rain simulation experiments. The experiment is a multi-year investigation and results will be made available on the Coalition website as they become available.

JO DAVIESS COUNTY
Soil & Water
HEALTH COALITION
A farmer led conversation

Forestry Management and Stormwater

The *Lower Galena River Watershed-based Plan* highlights the importance of forestry management relative to stormwater. Areas too steep for development or row-cropping have developed as mixed closed-canopy forest. Sunlight can't reach the understory to support deep-rooted native grasses and forbs, and shallow-rooted invasive species have taken over. Given the lack of protection and the steep slopes, stormwater causes significant erosion. Modeling work in the Lower Galena River watershed suggests that the implementation of forestry management plans that could reduce sediment loading to the Lower Galena River watershed by 46.1 tons/acre/year.

The Northwest Illinois Forestry Association (NIFA)

The Northwest Illinois Forestry Association (NIFA) is committed to the economic and environmental benefits of maintaining sustainable forest management practices. This group of about 125 woodland landowners is dedicated to providing educational

activities to sustain a healthy woodland through the use of preferred practices. Annual tours and presentations highlight forestry management practices available to owners. Many of the educational programs demonstrate efforts to control invasives, explain benefits of opening the forest canopy (allowing light on to the forest floor), and enhancing natural tree regeneration. These activities all support the objectives of improving watershed management of the forested areas. For more information about NIFA, contact President Ken Beach at 815-238-0708.

Jo Daviess Conservation Foundation (JDCF)

Forestry management practices implemented by the Jo Daviess Conservation Foundation (JDCF) are based on goals specific to each unique property. To improve the overall water quality in a watershed, it is important to orient forest management goals towards water retention, filtration, and transpiration. This can be achieved by promoting conditions that allow a robust understory and ground cover. To promote such conditions in a closed-canopy forest, land managers should increase the amount of sunlight on the forest floor. This can be achieved by mimicking natural processes with prescribed fire, seeding native plants, mowing, or selectively cutting trees to thin the canopy. If the land currently has no native vegetation, such as row-crop fields, a land manager would benefit from planting species of trees, shrubs, grasses, and forbes to retain vital nutrients and top soil on the fields.

JDCF creates unique management plans for each JDCF property that align with the specific conditions of soil, existing plant and animal communities, and topography. Currently JDCF is managing 2,134 acres in Jo Daviess County. Within the Galena River Watershed, JDCF is currently promoting water resources by restoring an oak savanna ecosystem at Horseshoe Mound Preserve. Oak savanna ecosystems are dependent on fire and consist of fire-tolerant trees spaced at a low density that allows vegetation and forbs to grow in the understory. This restoration project totals 21 acres in the Galena River Watershed.

Private landowners holding Conservation Easements make up a larger majority of JDCF's land management impact, totaling 5,162 acres in Jo Daviess county. JDCF invites landowners to two Landowner Education Programs per year to feature specific land management practices. To learn more about JDCF's land management practices, contact Jim Johannsen at jjohanssen@jdcf.org or 815-858-9100.

Woodland Wildlife Cooperative

Most of the forested land in this region is privately owned so altering forest management practices and/or adding erosion control structures will require landowner involvement and support. Inspiring landowners to implement such practices is a perpetual challenge for several reasons… (i) parcelization of forested land results in more owners of smaller parcels, (ii) many of the new landowners in this region are absentee and many have no experience with forest management, (iii) ownership of each parcel changes over time, and (iv) erosion control practices and structures may require a significant investment with no economic return on investment.

An interesting project initiated near Chestnut Mountain involves an informal cooperative formed by neighboring woodland owners… the “Woodland Wildlife Cooperative”. Its mission is… “To improve the health of our woodlands and wildlife.” In 18 months, the Cooperative has grown to 35 members representing about 3,500 acres. Woodland owners within the Driftless Area of Illinois are welcome to join (contact Brad Petersburg at 641-420-5851).

Among other benefits, working collaboratively allows members to… (i) capture efficiencies of contiguity and scale, (ii) attract outside resources, (iii) share ideas and inspire each other, and (iv) think and plan at a landscape scale. In pursuit of its mission, the Cooperative is promoting forest management strategies that benefit wildlife. Practices such as the restoration of native oak ecosystems not only improve the health of our woodlands and wildlife, they also improve the health of our water resources by reducing erosion.

With the support of the Illinois DNR and various forestry and woodland restoration experts, the Cooperative has developed a wildlife-friendly version of an FMP labeled an FWMP (Forest & Wildlife Management Plan), which members are encouraged to adopt. The FWMP lists five Cooperative Objectives, most of which relate to oak ecosystem restoration for the benefit of wildlife. However, Objective #5 specifically relates to water quality…

Preserve topsoil and water quality by controlling erosion. Restoration of native oak ecosystems will result in more deep-rooted grasses and forbs, and fewer invasive species, which will help prevent erosion at no additional cost. Trails will be managed to minimize erosion. Tactics include adding water bars, seeding grasses where the canopy allows adequate sunlight, rerouting trails that are not laid out properly to shed surface runoff, and Forestry Best Management Practices (BMP's): http://www2.illinois.gov/dnr/publications/Documents/00000168.pdf

Urban and Residential Stormwater Management Education

The University of Illinois Extension can now offer the Rainscaping Education Program developed by Purdue University across the state. Rainscaping refers to a combination of suitable landscape design and management practices that direct stormwater to be absorbed by plants and soils. The program focuses on helping communities and residents reduce stormwater run-off and associated water pollution impacts. Through a two-day workshop (or shorter, multiple day workshops), participants learn about the importance of rainwater management along with how to design, install, and maintain raingardens on residential and public spaces. In addition to classroom instruction, participants receive hands-on experience by helping to build a raingarden in a public space.

Local Natural Resource, Environment, and Energy Educator Jay Solomon has been trained as part of the statewide Illinois Rainscaping Education team. In addition to other programs on stormwater impacts and management, the Extension plans to offer the Rainscaping Educational program in Jo Daviess County at least once within the next three years.

University of Wisconsin, Platteville Environmental Engineering students worked with Bonnie Cox to do analyses and design rain gardens for her property. They may be interested in continuing to work with property owners of future projects.

Stormwater Management Ordinances

At a minimum, existing county and municipal ordinances should be reviewed to identify any unintended negative consequences affecting stormwater management. Adoption of stormwater ordinances should be seriously considered, either as stand-alone ordinances, or incorporated into existing ordinances (e.g. zoning).

Dubuque County has adopted a storm water ordinance: (https://www.dubuquecountyiowa.gov/DocumentCenter/View/128/Chapter-4---Storm-Water-Management-PDF) that requires new construction to implement stormwater best management practices. Landowners are given a number of best management practices to choose from and the cost of these practices is negligible at the time of construction when earthmoving equipment is already on site. The Dubuque County Erosion Control and Stormwater Management Manual can be referenced at: Urban Stormwater Permits & Projects | Dubuque Watersheds. Dubuque offers additional stormwater information at https://www.cityofdubuque.org/782/Stormwater-Management

In Illinois, Peoria has a stormwater Utility: https://peoriastormwater.com/stormwater-utility/
Other models and references that may be helpful include:
A model ordinance released by the Illinois State Water Survey and Illinois Department of Natural Resources in November of 2015: https://www2.illinois.gov/dnr/WaterResources/Documents/IL_Model_Stormwater_Ordinance.pdf

The IEPA "Water Quality Scorecard: Incorporating Green Infrastructure Practices at the Municipal, Neighborhood, and Site Scale," https://www.epa.gov/smartgrowth/water-quality-scorecard, is a booklet containing a checklist and scoring system that allows municipalities to assess current practices and identify opportunities for advancing water resource management. There are many questions posed about existing codes and ordinances.

Ogle County's "Comprehensive Stormwater Management Ordinance" was adopted in February of 1999: https://files4.revize.com/oglecountyil/document_center/highway/doing%20business/Stormwater_Ordinance%20(1).pdf

Action Plan Items

1. Gather and evaluate ordinances from other parts of the Driftless Area that have similar stormwater management issues and opportunities and make recommendations to Jo Daviess County.

2. Create a table summarizing stormwater ordinances currently adopted by local jurisdictions (county, municipal) in Jo Daviess County.

3. Review and evaluate other communities that have instituted stormwater utilities. Develop the pros and cons of implementing stormwater utilities to generate revenue to support stormwater management in Jo Daviess County. For a quick overview, see: https://www.illinoisfloods.org/content/documents/1d_stormwater_utilities_101_a_031009.pdf

4. Invite someone from Dubuque to present on the implementation of their stormwater utility program. http://www.cityofdubuque.org/877/Stormwater-Utility

5. Participate in Jo Daviess County All Hazards Mitigation Plan updates (The plan was first created in 2013, and was updated in 2020).

6. Identify and evaluate remaining WPA conservation structures in the county.

7. Evaluate and create a baseline for the amount of impervious areas in watersheds. One resource for this might be the "Impervious Surface Analysis Tool": https://www.arcgis.com/home/item.html?id=530e2fd7338c4ffb8f88416a074c7dca

8. Review local government requirements for stormwater management relative to new development within the county and within municipalities.

9. Revisit and re-analyze model predictions for reduced sedimentation through the implementation of forestry management plans cited in the Galena River Watershed-based plan.

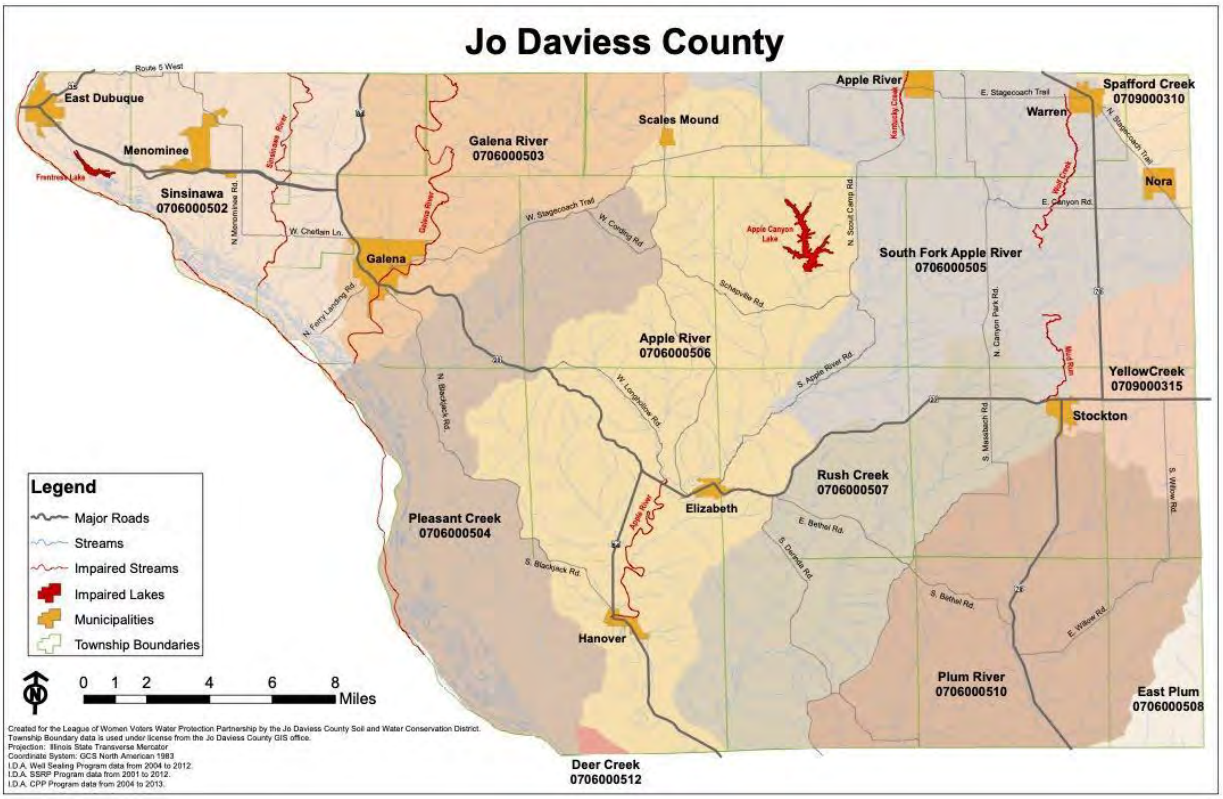
10. Explore Permaculture/Agriforestry/Eco-Agriculture/Agroecology/Restoration Agriculture benefits to stormwater management.

11. Promote discussion of coordination and collaboration with and between federal, state and local governmental entities.

III. Surface Water
C. Impaired Waters

Introduction

Under the Federal Clean Water Act (CWA), impaired waters are rivers, lakes or streams that do not meet one or more water-quality standards and are considered too polluted for their intended uses. The Illinois Environmental Protection Agency (IEPA) is required (under sections 303d and 305b of the CWA) to assess the waters of the state and evaluate compliance with applicable water quality standards and designated uses. The IEPA recently received U.S. EPA approval of its "Long-term Vision for Assessment, Restoration, and Protection under the CWA Section 303(d) Program (The Vision)" https://www.epa.gov/sites/default/files/2015-07/documents/vision_303d_program_dec_2013.pdf The Vision allows States to prioritize watersheds and develop alternative approaches to address impairments. The 2020-2022 303(d) list impaired water bodies in Jo Daviess County are shown in red on the map below.



Illinois EPA designated Jo Daviess County impaired waterbodies shown in red.

The Illinois Pollution Control Board (IPCB) sets water quality standards. The water quality standards are used to assess whether waters in the state meet standards for various uses. Water quality data from individual monitoring stations is extrapolated to represent a lake or stream segment (called "assessment units"). Stream segments are assessed for applicable uses and found to be "Fully Supporting," or "Not Supporting" that use, and those found to be "Not Supporting" are designated as impaired. Illinois waters are designated for various uses including aquatic life, wildlife, agricultural use, primary contact (e.g. swimming, water skiing), secondary contact (e.g. boating, fishing), industrial use, public and food-processing water supply, and aesthetic quality.

Potential causes of impairment (pollutant and nonpollutant) sources are identified. In general, pollution point sources are regulated and non-point sources rely on voluntary measures.

303d List

Waters not found to meet standards are included on what is known as the "303(d) List" in the "Integrated Water Quality Report". Each integrated report incorporates a two-year set of new data available since the prior report. The 2020-2022 draft report is awaiting USEPA approval.

Impaired Waterbodies in Jo Daviess County per February 2022 DRAFT 303(d) List				
Name of Waterbody (I.D.)	**Area or Length**	**Hydrologic Unit Code (HUC 12)**	**Impaired Use(s)**	**Cause(s)**
Apple Canyon Lake (RM1)	450 acres	7060050601	Aesthetic Quality	Phosphorous (Total)
Apple River (MN-03)*	9.01 miles	7060050605	Primary Contact	Fecal Coliform
East Fork Galena River (MQB)	11.74 miles	7060050305		
Frentress Lake (RMA)	92 acres	7060050202	Aesthetic Quality	Total Suspended Solids (TSS)
			Aquatic Life	Total Suspended Solids (TSS)
Galena River (MQ-01)*	8.64 miles	7060050307	Aquatic Life	Sedimentation/Siltation, Total Suspended Solids (TSS)
			Fish Consumption	Polychlorinated Biphenyls, Mercury
Galena River (MQ-02)*	8.62 miles	7060050306	Fish Consumption	Polychlorinated Biphenyls, Mercury
			Primary Contact	Fecal Coliform
Kentucky Creek (MNJ-01	2.45 miles	7060050503	Aquatic Life	Cause Unknown
Mud Run (MNID-C4)	4.93 miles	7060050501	Aquatic Life	Ammonia (Total), Dissolved Oxygen, Phosphorous (Total)
Sinsinawa River (MS-01)*	3.48. miles	7060050203	Aquatic Life	Sedimentation/Siltation
Wolf Creek (MNIC)		7060050		
* Flow Gage Data Available				

Information on Jo Daviess County Impaired Water Bodies from the DRAFT 2020-2022 Water Quality Report

Water bodies can be removed from the 303(d) list entirely, or for certain causes. For example, in the "2020-2022 Integrated Water Quality Report," Frentress Lake is on the list of "Segment/Causes removed from Illinois' 2018 Section 303(d) List" for the impairment causes of "Phosphorous, Total" and the Galena River is on the removal list for "Fecal Coliform" and "Zinc" as a result of the completed 2018 TMDL report. Small Pox Creek was added to the 2018 303(d) list for "Dissolved Oxygen" but removed from the 2020-2022 list as it was found to be fully supporting Aquatic Life in the 2020 cycle.

Total Maximum Daily Load

A Total Maximum Daily Load (TMDL) is the sum of the allowable amount of a pollutant that a water body can receive from all contributing sources and still meet quality standards and designated uses. The IEPA is required to establish TMDLs for impaired water bodies. They have a prioritized list and are systematically doing so. The contact person at the Illinois EPA for TMDLs is Abel Haile (abel.haile@illinois.gov, 217/782-3362). In June of 2018 the final report for the Galena/Sinsinawa Rivers Watershed TMDL Report was released. This report also included Frentress Lake. The report is available online at: Galena/Sinsinawa Rivers Watershed TMDL Report . No proposed TMDL efforts are shown for Jo Daviess County in the 20202022 list showing the status of TMDL development.

Selection of Priority Watershed

Stream gaging is a technique used to measure the discharge, or the volume of water moving through a channel per unit time, of a stream. The height of the stream channel, known as a stage or gage height, can be used to determine the discharge in a stream. If you know the discharge rate, you can calculate the total mass load of constituents sampled in terms of concentration (e.g. 6.0 milligrams/Litre NO_3-N x 3,000 Liters/second = 18,000 mg/second. 18,000 mg/sec x 1 pound/453,592 milligrams x 86,400 seconds/day = 3,429 lbs Nitrate-N/day)

There is a USGS Apple River Gage (05419000), located at Hanover, IL, which records real-time data from the Apple River watershed.The discharge data is available from 1967-present

There is a gage measuring flow on the Galena River located off Beebe Rd. in Buncombe, Wisconsin (05415000). This stream-flow gage was operated by the U.S. Geological Survey from 1939 to 1992. The gage is currently active and maintained by the National Weather Service in conjunction with the U.S. Army Corps of Engineers hydrology section. The Buncombe gage measures a drainage area of 125 square miles.

There is a Sinsinawa River gage near Menominee, IL (USGS 05414820)

In 2016, the Planning committee looked at the impaired water bodies in Jo Daviess County (2014 approved list) that had associated flow gage data (shown in yellow below) in order to select the highest priority HUC 12 subwatershed for a detailed watershed plan. Flow gage data allows for some quantification of the constituents in the water body, and the possibility of documenting changes over time.

HUC 12s in Jo Daviess County with Impaired Waterbodies with Flow Gage Data			
Hydrological Unit Code (HUC)	Name of Waterbody (I.D.)	Impaired Use(s)	Cause(s)
70600050202	Frentress Lake (RMA)	Aesthetic Quality	Phosphorous (Total), Total Suspended Solids (TSS), Turbidity
		Aquatic Life	Dissolved Oxygen, Phosphorous (Total), Total Suspended Solids (TSS)
70600050203	Sinsinawa River (MS)	Aquatic Life	Sedimentation/Siltation
70600050307	Galena River (MQ-01)	Aesthetic Quality	Bottom Deposits
		Aquatic Life	Sedimentation/Siltation, Total Suspended Solids (TSS), Zinc
		Fish Consumption	PCBs
		Primary Contact, Recreation	Fecal Coliform
70600050306	Galena River (MQ-02)	Fish Consumption	PCBs
70600050503	Kentucky Creek (MNJ-01)	Aquatic Life	Cause Unknown
70600050502	Wolf Creek (MNIC)	Aquatic Life	Cause Unknown, Phosphorous (Total)
70600050501	Mud Run (MNID-C4)	Aquatic Life	Ammonia (Total), Dissolved Oxygen, Phosphorous (Total)
70600050605	Apple River (MN-03)	Primary Contact, Recreation	Fecal Coliform

Because of the large number of impaired uses, the nature of the causes of impairment, and the then- pending TMDL implementation plan, the Galena River MQ-01 sub-watershed (70600050307) was selected as the first priority for planning. An application for Clean Water Act Section 319 Nonpoint Source Management Program grant funds was obtained and the plan was completed in 2018.

The Water Resource Management Action Plan includes the further prioritization of HUC 12s in the county, so that an ongoing watershed planning effort is developed in the county.

Illinois Nutrient Loss Reduction Strategy

In July of 2015, the state released its USEPA-mandated nutrient reduction strategy noting "The Strategy does not call for new regulations for either point or non-point sources; however, it does rely on the latest science and best available technologies to guide statewide efforts to reduce phosphorus and nitrogen losses that impact Illinois waterways and ultimately the Gulf of Mexico." Since the development of the initial strategy, biennial reports have been issued to assess progress and adjust the strategy, the most recent being the Biennial Report 2021 The 2021 report noted that increases in precipitation and river flow over 2015-2019 have resulted in a 13% increase in in Nitrate-N load and a 35% increase in Total Phosphorus load over the 1980-1996 baseline levels in spite of widespread management efforts in all sectors. Attempts to increase participation and investment in nutrient management practices continue in an effort to reach state nutrient reduction goals.

In 2018, the Illinois Nutrient Science Advisory Committee put forth recommendations for numeric nutrient criteria for waterways in Illinois: https://www2.illinois.gov/epa/topics/water-quality/standards/Documents/NSAC%20Report%20-%20Final.pdf

Phosphorus Reductions and Wastewater Treatment Plants

Identified in the *Illinois Nutrient Loss Reduction Strategy* as contributing significantly to phosphorus surface water levels, wastewater treatment plants are anticipating increased regulations requiring reduced phosphorus discharge levels. It is anticipated that plants will eventually be required to limit phosphorus discharge levels to less than 1 mg/L. Currently, plants in Jo Daviess County discharge as high as 8-10 mg/L. Depending on the status of their permits, plants in Jo Daviess County are either not monitoring phosphorus levels (East Dubuque, as they discharge to the high volume of the Mississippi River), or monitoring phosphorus levels (Warren, Scales Mound, Hanover, Galena, and Elizabeth). Warren and Galena are currently having phosphorus studies done to evaluate phosphorus reduction options.

Wisconsin allows for "credit trading" whereby a treatment plant could fund alternative and less costly phosphorus reduction activities - most notably, working with farmers in the watershed to implement practices that reduce phosphorus loading - to meet permit requirements. Credit trading is not currently accepted in Illinois.

Treated wastewater effluent can be directed into a constructed wetland for additional phosphorus removal. A county resident is working on a wastewater treatment wetland project with Craig Annen of Integrated Restorations, LLC, 228 S. Park St., Belleville WI 53508, Office: 608/424-6997, Cell: 608/547-1713, www.ir-wi.com.

Action Plan Items

1. Explore options to construct wetlands to filter wastewater plant discharges to low-flow streams to reduce phosphorus levels and eliminate impairments and develop recommendations.

2. Integrate TMDL Stage 3 Report recommendations into the water resource plan.

3. Identify ways for Jo Daviess County to collaborate with others at the state and regional level to achieve the nutrient loss reduction goals set in the state strategy.

III. Surface Water
D. Watershed Planning

Introduction

A watershed plan is a work plan for achieving water resource goals. Watershed plans can include a variety of components, but the U.S. EPA has identified nine elements critical to improving water quality. These elements have become fairly broadly accepted, and are required in order to receive Section 319 Nonpoint Source grant funding for planning or project implementation. The nine elements are:

1) Identification of causes of impairment and pollutant sources,

2) Estimation of load reductions expected from management measures,

3) Description of the nonpoint source management measures that will need to be implemented to achieve the expected load reductions, and identification of the critical areas in which those measures will be needed,

4) Estimation of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied on to implement the plan,

5) An information/education component to enhance public understanding and encourage participation,

6) A schedule for implementing the plan,

7) A description of measurable milestones towards plan implementation,

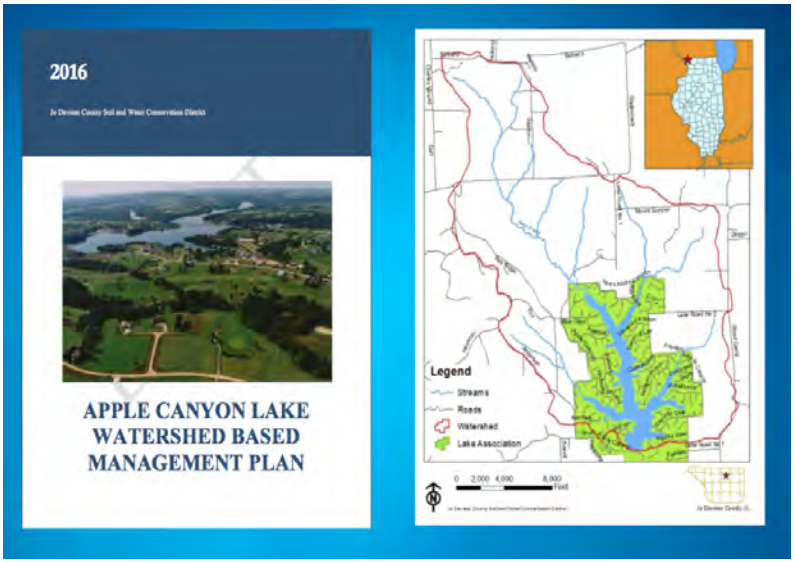
8) Criteria used to determine whether load reductions are being achieved over time, and

9) A monitoring component.

The EPA highly recommends taking an adaptive management approach to watershed planning, where problems are assessed, solutions to the problems designed and implemented, then these designs are monitored, evaluated and adjusted before addressing new problems. Though there may be exceptions, the Illinois EPA recommends that most watershed planning be conducted at the HUC 12 scale.

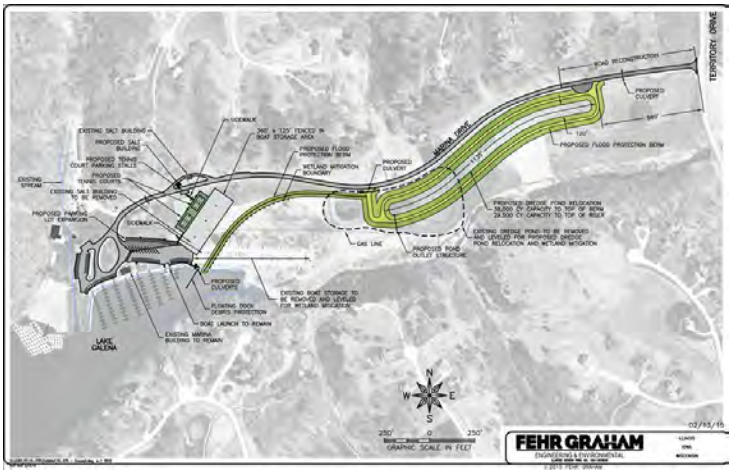
Apple Canyon Lake

Apple Canyon Lake Resort received an IEPA Section 319 grant and completed the Apple Canyon Lake Watershed Based Management Plan in 2016. The plan is available at:
Apple Canyon Lake Watershed Based Management Plan



Lake Galena Marina Flood Mitigation Plan

The Galena Territory has done flood mitigation planning also completed an in-house watershed plan for Lake Galena.



Flood Mitigation Plan for Lake Galena

Galena River Watershed Plan

The League of Women Voters of Jo Daviess County applied for Illinois EPA Clean Water Act Section 319 grant funding and received a $38,000 319 grant to support the development of a watershed-based plan for the Lower Galena River. This HUC 12 area was selected by the Jo Daviess County Water Resource Management planning committee because of the nature and extent of its impairments. On the 2016 303d List, the Illinois EPA 2016 designated the segment of the river in this subwatershed as being impaired for bottom deposits, sedimentation and siltation, Total Suspended Solids, zinc, PCBs, and Fecal Coliform. Mercury was added to the 2018 303d list. These impairments affect the use of the river for aquatic life, fish consumption, primary contact and recreation.

A watershed-based planning committee was formed late in 2016 and the plan was completed and approved by the Illinois EPA by the end of 2018. A Galena-area farmer-led group was formed and provided input into the plan on agricultural matters (the group then expanded to a countywide group and is called the Soil & Water Health Coalition). The planning process led to the conclusion that reducing overland flow reduces both overland pollutant contributions to the waterways and flow within the waterways that can increase stream bank erosion and the associated pollutants (it's believed that 60-80% of sedimentation in the river comes from historical landscape erosion as legacy sediment eroding from the stream banks). Sediment loads can be used to trace stormwater flow. Practices that reduce sedimentation generally also reduce stormwater flow and vice versa. Estimated load reductions for Best Management Practices (BMPs) that reduce sedimentation suggest that the greatest benefits will be derived from implementing Forest Management Plans (forested areas comprise 40% of the watershed), implementing no-till and cover crops in row crop areas (13% of the watershed), increasing detention in developed areas (8% of the watershed), and strategically stabilizing streambanks. The watershed plan is available at: Galena River Watershed-based Plan: Phase 1

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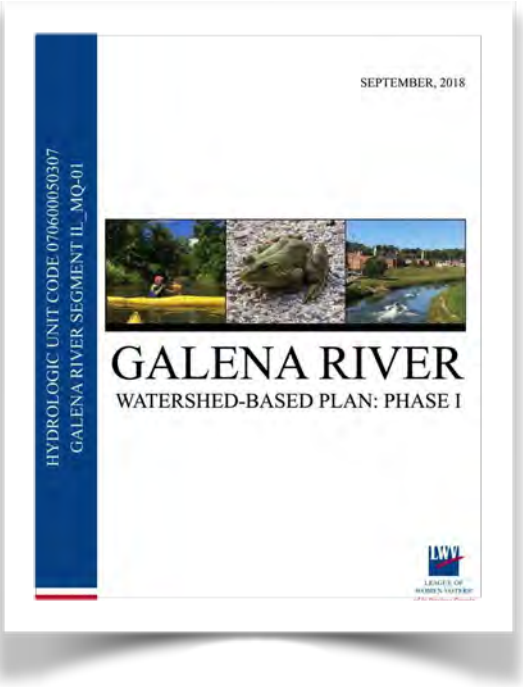


GALENA RIVER WATERSHED GOALS

Designed to achieve our vision for the watershed

VISION STATEMENT

As residents and property owners in the Galena River watershed, we recognize the value of our groundwater and surface-water resources.

We appreciate the important role these resources play in the ecosystem, our area's history, our economy, our future productivity, and our personal health and well-being.

We accept responsibility for the balanced management of these resources, including self-imposed limitations to enhance stormwater management, enhance groundwater management, and protect / maintain / improve water quality.

We monitor water resources to document our successful management.

GOAL 1: ***Improve Water Quality***

This goal reflects an understanding of the Galena River's inclusion on the list of impaired waters created by the Illinois EPA, the need to reduce nitrogen and phosphorous entering the Mississippi River, and growing concern about the cumulative effects of road salt and other contaminants such as pharmaceuticals, personal care products, and microplastics.

GOAL 2: ***Increase Infiltration and Stormwater Storage to Reduce Runoff and Flooding***

This goal is intended to address not only current flooding, erosion, and water quality issues, but also to deal with the impact that the predicted increases in precipitation and storm intensity will bring.

GOAL 3: ***Protect and Preserve Groundwater***

This goal recognizes that everyone in the watershed relies on high-quality groundwater for drinking water, and that this water is a limited resource particularly vulnerable to contamination from surface-borne pollutants because of our complex geology (fractured and creviced karst aquifers).

GOAL 4: ***Enhance Water-based Recreation***

This goal underscores the role the Galena and Mississippi Rivers play in providing recreational opportunities for residents and tourists as well as emphasizing the social and economic importance of these activities.

GOAL 5: ***Update and Integrate Government Plans, Policies, and Regulations at All Levels***

This goal recognizes the responsibility that all governing bodies have for water resource management and the need for thoughtful coordination in order to achieve long-term success.

GOAL 6: ***Develop and Maintain Ongoing Activities for Shared Watershed Learning***

This goal supports the thinking that broad-based understanding of watershed issues, opportunities, and responsibilities is essential for effective water resource management.

GOAL 7: ***Monitor Water Resource Management Outcomes and Adapt Practices as Needed***

This goal is required to measure the effectiveness of the efforts undertaken, to remain aware of issues that may arise, and to take new actions as needed to achieve goals.

GOAL 8: ***Ensure Functional and Financial Sustainability of Galena River Watershed-based Planning***

This goal recognizes the need to dedicate human resources and funding resources to achieve successful long-term water resource management in the Galena River watershed.

GALENA RIVER watershed

Photo by S.V. Panno of Mellwood Farm Spring used with permission
Illinois State Geological Survey, Prairie Research Institute
University of Illinois, Urbana-Champaign

Cover of the Galena River Watershed-based Plan and part of the brochure summarizing the plan

Galena/Sinsinawa Rivers Watershed TMDL Report
Simultaneously, and somewhat in conjunction with the completion of the Galena River Watershed-based Plan, the Illinois EPA and their consultant completed the *Galena/Sinsinawa Rivers Watershed TMDL Report* which covered Frentress Lake in East Dubuque in addition to the two rivers. A "TMDL Report" sets the "Total Maximum Daily Load" levels for pollutants that the waterbody can have to be taken off the list of impaired waterbodies. The US EPA is now requiring that TMDL reports include the nine elements of a watershed plan, so the Galena River Watershed-Based Planning Committee worked hard to coordinate with the Illinois EPA and their consultant to minimize discrepancies between the TMDL report and the watershed plan.

Northwest Illinois Healthy Land & Water
Jo Daviess Conservation Foundation and the Natural Land Institute partnered for this planning project that used GIS mapping to identify priority watersheds in northwest Illinois with the greatest potential to improve water quality, soil health, and habitat connectivity. The lower Galena River watershed was identified as a priority watershed. Learn more at https://storymaps.arcgis.com/stories/bc161e261cbd4bcfb3aee785277ad5bd

Catfish Creek
Though located across the Mississippi River in Iowa, Catfish Creek is within the Apple-Plum Watershed as the boaundary for this HUC 8 is defined by the land area draining to a point on the Mississippi River. A watershed authority http://www.catfishcreekwatershed.org/AboutUs/Administration.aspx was formed for Catfish Creek. The administrators are:

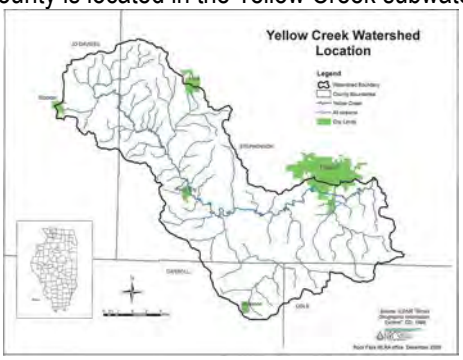
Eric Schmechel, Watershed Program Director, Dubuque Soil & Water Conservation District
eschmechel@dubuquecounty.us, Ph: (920) 327-0908

John Wiley, Urban Watershed Coordinator
john.wiley@dubuquecounty.us , Ph: (503) 957-0961

The December 2014 “Catfish Creek Watershed Management Plan” is available online at:
http://www.watershediowa.org/wp-content/uploads/2018/02/Catfish-Creek-Watershed-Management-Plan-Full-Small-File-Size.pdf

Spafford Creek
The far northeast corner of Jo Daviess County is located in the Spafford Creek subwatershed of the Pecatonica Watershed.

Yellow Creek
The far central east portion of Jo Daviess County is located in the Yellow Creek subwatershed of the Pecatonica Watershed.



Yellow Creek Watershed Partnership, Inc. was incorporated in 2005 (www.ycwp.org).
Joe Ginger is the President of the corporation.

Northwest Illinois Waters Resource Plan
In March 2002 representatives of the Blackhawk Hills RC&D, Illinois Department of Natural Resources, Natural Resource Conservation Service and Carroll County Soil & Water Conservation District, working with a planning committee created the “Northern Illinois Waters Resource Plan” covering Carroll, Jo Daviess, Lee, Ogle, Stephenson and Whiteside counties. The mission of the plan was “to coordinate and present a clear course of action that will solve problems, avoid undesirable consequences, and provide benefits to as many natural resource concerns as possible.” The plan identifies water quality problems

and opportunities related to livestock waste, streambank stabilization, nutrient management, pesticide holding facilities, and groundwater contamination.

Wisconsin

The Wisconsin portion of the Apple-Plum Watershed falls in the Southwestern Wisconsin Regional Planning Commission's planning area (https://www.swwrpc.org/). The Executive Director of the Commission is Troy Maggied (608/342-1636, t.maggied@swwrpc.org).

Illinois Watershed Planning

General information on our and other watershed-based planning efforts in the state is available on these sites:
The Illinois EPA provides information about watersheds and watershed-based planning:
Watershed Based Planning,

and the Illinois Water Environment Association (IWEA) has created a story map and GIS map that provides information about current watershed-based planning in the state (including the Lower Galena River Watershed-based Plan):
https://gza.maps.arcgis.com/apps/MapJournal/index.html?appid=6ec65bcc2bed484fa5490069bc761baa

Action Plan Items

1. Select a new HUC 12 watershed in the county for planning purposes.

IV. Groundwater

Introduction

In Jo Daviess County, we rely on wells drawing groundwater from the Galena-Platteville and the St. Peter Sandstone aquifers for our potable water supply. The U.S. Geological Survey's Definitions of Selected Ground-Water Terms includes the following definition of an aquifer: "A body of rock that contains sufficient saturated permeable material to conduct groundwater and to yield significant quantities of water to wells and springs."

"Groundwater: Where Does It Come From and Where Does it Go?" by Samuel V. Panno, Illinois State Geological Survey (ISGS), includes information about groundwater specific to northern Illinois:

> The availability of groundwater and the types of aquifers vary across the state. The northern third of Illinois relies on groundwater from three sources: (1) glacial sand and gravel aquifers; (2) shallow dolomite aquifers; and (3) deep sandstone aquifers. The dolomite is fractured and has solution features. Where there are glacial deposits, groundwater that moves downward through them recharges the shallow dolomite aquifers. In the western and northwestern parts of the state where these rocks are exposed at the surface (e.g., Jo Daviess and Calhoun Counties) there is recharge directly into the shallow dolomite aquifer. Relatively large quantities of groundwater of predictable quality are produced from the deep bedrock aquifers.

The Jo Daviess County Environmental Health Division staff manages our potable water supply program, "reviews plans, issues permits, inspects the construction of new private water wells, and performs well evaluations for real estate transactions. Staff also collects water samples from your home for new wells, real estate transactions, and newborn & suspect waterborne illness and provides consultation associated with the laboratory analysis; assists in sealing abandoned wells; performs comprehensive well inspections annually for every licensed well driller that drills in the county; investigates complaints of potential water pollution; performs sanitary surveys for non-community water supplies; permits and inspects geothermal closed loop systems." Sandra Schleicher, 815/777-0283, with offices at 9483 U.S. Hwy 20 West, Galena IL 61036 is the Director of Environmental Health.

The state has a Groundwater Advisory Council (GAC), comprised of 9 public members, who review, evaluate and make recommendations on groundwater matters. Jo Daviess County resident, John Liberg (Apple River Well & Pump) serves on the council. https://www2.illinois.gov/epa/topics/water-quality/groundwater/Pages/gw-advisory-council.aspx

The Illinois Association of Groundwater Professionals (IAGP - http://www.iagp.org/) mission states they "are dedicated to the protection and efficient utilization of groundwater, providing programs that support industry professionalism and providing consumer information about water wells and groundwater." Dave Schulenberg is IAGP Executive Director and can be reached at (877) 267-0350 or at info@iagp.org.

The Illinois Environmental Protection Agency (IEPA) established a regional groundwater protection planning program. There are currently 4 planning regions: Northern, Northeastern, Central, and Southern. The formation of a Northwest Region was explored, but 2012-13 conversations suggested that the IEPA is unable to provide the staff and funding support for a new region. The IEPA contact for regional planning is Anthony Dulka (217/782-1020), and Joe Konczyk has been particularly helpful (same number).

Water Quality

The County Environmental Health Division started issuing well permits in 1990. The paperwork for each well drilled includes a water sample analysis for coliform bacteria, E. coli., nitrates and nitrites.

Locally, water samples can be analyzed at the City of Dubuque Laboratory (795 Julien Dubuque Dr., Dubuque IA 52003, 563/589-4178) and at Lyons Lab (9795 U.S. Rte. 20 East, Stockton IL 61085, 815/947-3360). The County

Health Department will sample a well, free of charge, for those who are pregnant or have a child up to three years old in their home or have a doctor's notice to have their water sampled because of gastrointestinal illness.

Sampling and analyses of groundwater in the county has added significantly to our understanding of our hydrogeology and groundwater quality. For more information, see Section V. Available Water Quality Data.

Wells

Wells in the county are generally drilled between 100 and 350 feet and cased down as far as 40 to 100 feet.

The Illinois Geological Survey maintains Illinois well records (as far back as the late 1800s!), and these can be accessed through an online interactive map at Illinois Water Well (ILWATER) Interactive Map. Paper records are being scanned for access as well.

The ISWS maintains a shallow monitoring well (just 25 feet) in Galena as part of their Water and Atmospheric Monitoring (WARM) network to monitor the water table (for data and more information, see Water and Atmospheric Resources Monitoring Program - Illinois Provisional Monthly Flows).

The ISWS offers a free 10-part online class on wells for homeowners at The Private Well Class.

Rock River/NWIL Groundwater Assessment

The assessment process was started in 2018, and was funded and managed through Illinois Department of Natural Resource (IDNR) grants received by the Blackhawk Hills Regional Council (Executive Director Dan Payette, daniel.payette@blackhawkhills.com, 815/625-3854). Blackhawk Hills RC&D facilitated the groundwater assessment process for the eleven-county Rock River area (Jo Daviess, Stephenson, Winnebago, Boone, Carroll, Ogle, Whiteside, Lee, Rock Island, Henry, and Bureau counties). The project was to involve an assessment of current groundwater conditions and future scenario planning. The Illinois State Water Survey (ISWS) created a story map summary of the assessment findings, which is available at:
https://www.isws.illinois.edu/illinois-water-supply-planning/rock-river-region-webmap

Because of the planning area's sprawling geography, the decision was made to proceed with scenario planning at the sub-region level, organized roughly by regional council planning area. The sub-regions, which do not include Jo Daviess County, are as follows:

- Sub-region 1: Bi-State Regional Commission will conduct a scenario planning process for stakeholders of the Quad Cities region. Contact/facilitator: Gena McCullough (gmccullough@bistateonline.org)
- Sub-region 2: Blackhawk Hills Regional Council will conduct a scenario planning process for Green River Lowlands stakeholders. Contact/facilitators: Abby Ebelherr (abigail.ebelherr@blackhawkhills.com), Daniel Payette (daniel.payette@blackhawkhills.com), and Kevin Lindeman (klindeman@ncicg.org)
- Sub-region 3: Region 1 Planning Council will conduct a scenario planning process for Boone and Winnebago stakeholders. Contact/facilitators: Caitlin Eastman (ceastman@r1planning.org) and Shelby Best (sbest@r1planning.org)

Each sub-region will outline its own process to create scenario plans, concluding with the publication of sub-region goals and reports. In late 2022/early 2023, an aggregate report will be compiled and delivered to state officials. After that, they hope to focus on implementation - including project, program, and policy development or delivery.

Abandoned Well-Sealing Program

The Illinois Water Well Construction Code requires the owner of a water well, boring or monitoring well to properly seal the well within 30 days after it is abandoned and no longer used to supply water. The Health department estimates that there are about 1,000 abandoned wells in Jo Daviess County that have not been sealed. The Jo Daviess County Soil & Water Conservation District (SWCD) has funds available to provide for 75% of the cost of sealing a well for those that apply. The sealing can be contracted to a licensed well driller or done by the landowner. The Health Department must oversee and certify the sealing. For information about the local well sealing program, contact Mindy Pratt, SWCD Administrator, at 815/858-3418, and Sandra Schleicher, Jo Daviess County Director of Environmental Health, 815/777-0283.

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
# Wells Sealed										
SWCD $ Used										

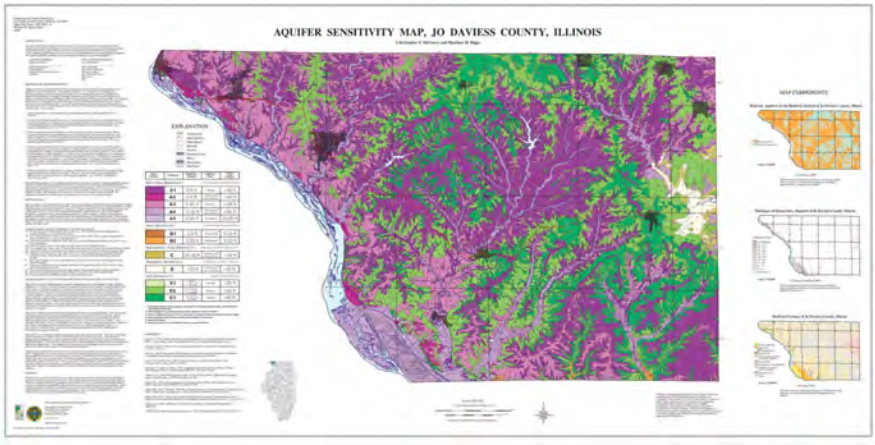
Proposed table format to show County Health Department totals for number of wells sealed and number of wells sealed with funding support from the Soil and Water Conservation District - Data to be collected

Other Information

The Illinois Water Inventory Program (IWIP), a comprehensive program to inventory water use throughout the state, began in 1978. It is designed to collect data in three major categories: water withdrawal, water use, and water returns. For each water-using facility inventoried, the database includes locations and amounts of water withdrawn from surface water and groundwater sources, as well as significant amounts of water purchased from other facilities. Public water supplies, self-supplied industries, irrigation, fish and wildlife, and conservation uses are inventoried. Data can be summarized geographically by county, township, and drainage basin, as well as by various water use and water source categories for inclusion in publications of the USGS National Water Use Program.

Aquifer Sensitivity Map

The “Aquifer Sensitivity Map, Jo Daviess County, Illinois” is available through the ISGS at http://isgs.illinois.edu/sites/isgs/files/maps/county-maps/jodaviess-as.pdf



Aquifer Sensitivity Map for Jo Daviess County

One of the “Highest Priority Objectives” in the Jo Daviess County Comprehensive Plan is to “Develop land use groundwater protection policies following completion of Illinois Geological Survey’s county aquifer sensitivity mapping.”

Sale of Groundwater Pumped at the Savanna Depot Park

In 2015, the Local Redevelopment Authority (LRA) at the Savanna Depot Park entered into an agreement with Jeanblanc International, Inc. (JBI) allowing for the sale of 43 million (and possibly up to 100 million gallons pending further negotiation) of pumped well water per month. Because the proposal relies on existing wells, the Water Act of 1983 requirement to have the Soil & Water Conservation District review (with the assistance of the state water and geological surveys) the impacts to others of proposed high capacity withdrawals does not apply. However, the LRA denied extension of a prior contract that expired December 1, 2015 and included in a new agreement the requirement that a hydrologic study be performed prior to permission for extraction "by an LRA approved contractor (Illinois State Water Survey) and paid for by JBI establishing that water extraction volume contemplated in the agreement will not significantly impact water quality or supply at the depot and its environs." The contract further stipulates: "In the event the aquifer/water source of extraction is in anyway compromised by water being extracted in accordance with the agreement, then in such an event this agreement shall terminate and all water extraction shall immediately terminate." Ultimately, this project did not move forward, but it focused attention on the value and use of groundwater in the area.

There is a question about the legality of transporting groundwater out of the state. Gary R. Clark, P.E.'s 1985 report to the Illinois Groundwater Association, "Illinois Groundwater Law: The Rule of Reasonable Use," has become a primary reference in case law on Illinois groundwater matters (the report is available through the Illinois State Water Survey at https://www.isws.illinois.edu/iswsdocs/wsp/illinoisgroundwaterlaw.pdf). Gary Clark now works at the Illinois State Water Survey, and is willing to make presentations (gclark@illinois.edu, 217/891-5412).

Potential Action Plan Items

1. Might it be worthwhile to pursue the formation of a Northwest Region Groundwater Planning Region in the future?

2. Promote and incentivize well-sealing.

3. Create updated promotional pieces on well-sealing.

4. Hire an intern to assist with well sealing in the county.

5. Organize program for bankers and realtors regarding well and septic inspections when land transfers take place.

V. Available Water Quality Data

Introduction

The karst terrain of Jo Daviess County indicates a generally heightened level of interaction between groundwater and surface water, so both water sources and their close relationship must be considered in an evaluation of our area's water quality. Water quality data have been collected historically for the area and additional sampling and analyses are being conducted strategically as funding allows.

During dry periods with little precipitation and low flow, the surface waters are dominated by groundwater discharge from springs and seeps along stream courses. During those times, stream water quality will be very similar to the groundwater quality. Because of the open nature of the karst aquifers in the county, much of the landscape serves as an aquifer recharge area. Precipitation and stormwater runoff can enter the aquifer almost directly, passing through cracks in thin soils before entering fractures, enlarged crevices and bedding planes within the rock formations that make up the aquifers. Groundwater composition and contamination levels tend to vary with depth. In general, the shallower the source of the groundwater, the younger it is (in terms of how recently it fell as precipitation), the more likely it is to contain surface-borne pollutants that have washed in as dissolved and particulate contaminants with runoff, and the less time the recharging water has had to chemically interact with the rock of the aquifer. Groundwater emanating from springs and seeps serves as the source of our surface waters and is a blend of groundwater from various depths and of various ages. Understanding the close interaction between surface water and groundwater in our karst terrain is important when interpreting available water quality data.

Groundwater and surface-water monitoring involves a consistently executed evaluation of water quality. Monitoring can be done through discrete or grab-sample collection followed by laboratory analyses that provide a detailed description of the types and levels of inorganic constituents in the water at the time the sample was taken. Equipment is available to collect continuous samples, as well as remotely monitor levels of specified parameters over time. Laboratory analysis is expensive, but a fairly significant amount of sampling and analyses is already being conducted in the county and is described below. Biological monitoring can also be conducted to assess the overall health of a water body. We in Jo Daviess County need to determine our capacity to sufficiently monitor the water quality of our groundwater and surface water in order to better focus efforts on water quality issues that need to be addressed, and to evaluate qualitative changes once best management practices have been implemented.

Illinois Environmental Protection Agency (IEPA) Monitoring

The Illinois EPA regularly collects water samples and records water-quality data on streams and lakes in Jo Daviess County to comply with the Federal Clean Water Act. There are three fixed monitoring stations on tributaries in the county. Data collected by the Illinois EPA is referenced when determining whether or not a water body is impaired. A large number of parameters (55) are studied and it is likely that these data could be mined for further analysis and be used to develop a better understanding of changes in the area's water quality over time. The data are maintained in the IEPA's STOrage and RETrieval and Water Quality Exchange databases, STORET and WQX (Water Quality Data | US EPA).

The IEPA offers participation in a volunteer lake monitoring program. Citizen scientists are trained to conduct monitoring according to IEPA standards. Volunteer lake monitoring programs are in place at both Lake Galena and Apple Canyon Lake.

Spring and Well Sampling

Water flowing from springs is a blend of shallow and deep groundwater that periodically can be diluted by recharge of rainfall and snowmelt. Recent work by the Illinois Geological and Water Surveys (ISGS and ISWS) and the League of Women Voters of Jo Daviess County have resulted in a greater understanding of the aquifers and groundwater quality of northwestern Illinois' Driftless Area. The examination of bedrock in quarries, road cuts, and croplines, and the results of sampling of groundwater from over thirty springs and private wells in the area, has yielded information on the area aquifers. The data indicate that the Galena Dolomite is an open karst system where rainwater and snowmelt enter and flow through fractures and crevices with widths ranging from hairline cracks to crevices over one foot wide. The thin soils allow surface-borne contaminants like road salt and septic effluent to flow into the aquifer unimpeded. Contaminants have been found at depths of up to 200 feet within this aquifer. Background concentrations of dissolved components of groundwater (e.g. chloride and nitrate) were calculated using a reliable statistical technique and provide a measure against which water quality samples can be compared. For example, chloride concentrations ranging from 4 to 13 mg/L, and nitrate (as nitrogen) concentrations ranging from 0.5 to 2.0 mg/L represent the background levels. Concentrations above those ranges indicate the presence of contaminants. Deep and shallow aquifer background levels were

calculated from all available water-quality data. The shallow aquifer levels have been further separated into ranges characteristic of pristine groundwater before European settlement and in the present. The present-day background ranges are greater than those of

pre-settlement times due to sustained activities from human habitation over time. These ranges provide an important reference to evaluate localized contamination when parameter levels are found to be above the upper bound of the range (referred to as the threshold). These background ranges will also be a useful reference for evaluating changes in the overall background water quality over time.

Background concentration thresholds of selected ions (in mg/L)

Ion or Parameter	Deep aquifer	Pre-settlement	Present-day
Na^+ (Sodium)	≤ 2.7	≤ 6.1	≤ 22
Cl^- (Chloride)	≤ 1.3	≤ 4.0	≤ 13
NO_3-N (Nitrate-nitrogen)	≤ 0.04	≤ 0.5	≤ 2.0
o-PO_4-P (Orthophosphate Phosphorous)	≤ 0.01	≤ 0.01	≤ 0.4
SO_4^{2-} (Sulfate)	≤ 26	≤ 15	≤ 46
F^- (Fluoride)	≤ 0.3	≤ 0.2	≤ 0.2

Background concentrations for selected constituents in the deep aquifer (greater than 150 feet) and the shallow aquifer (less than 150 feet). The shallow aquifer is further examined in terms of estimated pre-settlement levels (based on pristine area samples) and general present-day background levels.

Spring and well samples have also been analyzed for plastic microfibers, resulting in the first known documentation of plastic microfibers (particulates) found in groundwater. In addition, analyses for Pharmaceuticals and Personal Care Products (PPCPs) have shown that a variety of these products can be found in our area groundwater. Both the microplastic fibers and the PPCPs originate from the discharge of septic effluent entering the karst aquifer.

RiverWatch

Incorporating use of the RiverWatch Program in Jo Daviess County is based on the understanding that regular stream water sampling and lab analysis for water quality monitoring purposes is expensive and - while helpful and desirable for an improved understanding of the water quality in Jo Daviess County streams - only represents the water quality at a point in time and would be difficult to maintain financially. A biological monitoring program run by volunteers can provide a cost-effective, long-term reference point for the health of our streams based on the quantity and type of macro-invertebrates found over time, and can also provide an opportunity to raise our level of awareness and improve our understanding of stream health.

The Illinois RiverWatch Network is a statewide, non-profit, volunteer stream monitoring program. Volunteers are trained and certified as “Citizen Scientists” to monitor and protect a local stream. Upon completing training and becoming certified, volunteers adopt a stream site and examine indicators of water quality, including stream habitat and the diversity of species such as dragonfly nymphs, beetle larva, midges, and snails. Citizen Scientists play an important role in helping identify potentially degraded waters and areas that may need better protection.

The RiverWatch program was initiated by the Illinois Department of Natural Resources (IDNR) in 1995, and there was an active RiverWatch group in Jo Daviess County from 1996 to 2009. Nancy Winter was the RiverWatch Monitoring Kit Host during this period, and the data from that time period still exists documenting the work done then. In 2006, the responsibility for the program was transferred to the National Great Rivers Research and Education Center, located in Alton, Illinois where it resides as of 2019.

Each year, a schedule of RiverWatch training workshops is made available. The daylong workshops consist of a morning lab session, a lunch period (participants are responsible for their lunch - many bring a sack lunch), and an afternoon field training. For

example, a training session is being offered on Saturday, April 16th, 2022 at the Severson Nature Area in Rockford. Those completing the training are encouraged to select a stream location to monitor on one day every year in the spring, and this information is collected and recorded by the RiverWatch Coordinator at NGRREC. Citizen Scientists are required to pass an annual online recertification test to allow the data they submit to be considered "tier-one" data. Online registration for training is available through the RiverWatch Website: http://www.ngrrec.org/riverwatch/. For more information about the program, contact the RiverWatch Technician and Volunteer Coordinator, Hannah Griffis. She can be reached at hgriffis@lc.edu and 618/468-2781. The Jo Daviess Conservation Foundation (JDCF) is serving as the host for the RiverWatch monitoring kit which can be used by volunteers (Contact Jessica Carryer at educator@jdsf.org, 815/858-9100).

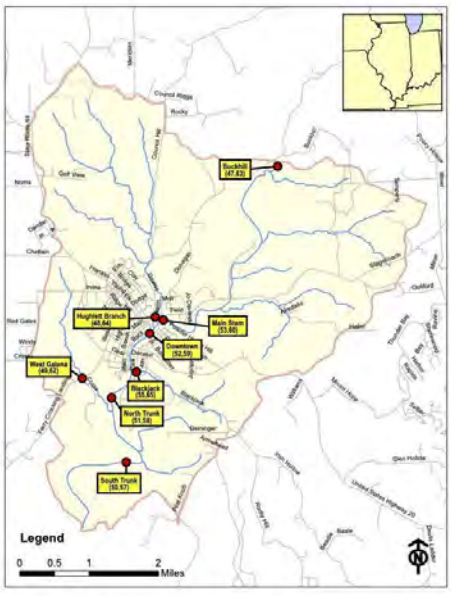


Training by 2019 RiverWatch Coordinator, Charlie Blake

The Jo Daviess Conservation Foundation (JDCF) is now the RiverWatch Monitoring Kit Host for Jo Daviess County, and the materials for monitoring by those certified are available for loan at the JDCF office (Contact is Education Director Jessica Carryer at 815/858-9100, educator@jdcf.org; 126 North Main Street, Elizabeth IL).

Galena River Monitoring

In conjunction with the Galena River watershed-based planning effort, the Lower Galena River and its tributaries were sampled for their chemical compositions and nitrate to determine whether the source of nitrates in the samples was predominantly chemical fertilizer or animal waste, and then analyzed for caffeine to establish whether or not the animal waste had a human component (assuming that livestock don't drink coffee!). Eight surface water sites were selected, including 5 in the main trunk of the Galena River and 3 in tributaries of the Galena River - all within the lower Galena Watershed (070605000307). These eight sites were sampled in August of 2017 at low-flow conditions, and again in May of 2018 at high-flow conditions.



August 2017 & May 2018 sampling locations (sample nos.) on the lower Galena River and its tributaries

2017-2018 Galena River Water Sampling																				
Information Collected	Symbol/ Abbreviation	Units	Buckhill Road		Hughlett Branch		West Galena		South Trunk		North Trunk		Downtown		Main Stem		Blackjack	
Sampling Date	N/A	N/A	8/14/17	5/15/18	8/14/17	5/15/18	8/14/17	5/14/18	8/15/17	5/14/18	8/15/17	5/14/18	8/14/17	5/14/18	8/14/17	5/14/18	8/14/17	5/15/18
Sample Number	N/A	N/A	47	63	48	64	49	62	50	57	51	58	52	59	53	60	55	65
Time	N/A	N/A	12:47 PM	9:00 AM	2:08 PM	9:30 AM	2:45 PM	4:30 PM	9:00 AM	11:00 AM	10:00 AM	11:20 AM	1:00 PM	11:40 AM	2:00 PM	Noon	3:00 PM	9:55 AM
Temperature	C	C	18.6	17.2	18.8	17.5	19	19.9	18.7	16.1	18.7	14.4	18.8	13.8	19.1	14.4	17.5	15.2
Potential Hydrogen (in field)	pH	1-14 scale	8.08	7.83	7.86	7.43	8.12	7.7	7.86	7.59	7.88	7.66	8.06	7.68	8.1	7.87	7.97	7.66
Specific Conductance	SpC	uS/cm	914	739	908	596	956	429	934	701	939	684	932	717	930	737	994	824
Saturated Dissolved Oxygen	DO (sat)	%	136	400	127	387	116	369	88	429	92	371	115	384	126	401	89	370
Dissolved Oxygen	DO	mg/L	10.5	6.9	9.8	5.6	8.9	6.9	6.74	8.3	7.1	8.1	8.8	8.5	9.6	9.0	7.06	8.3
Aluminum	Al	mg/L	<0.037	<0.037	<0.037	<0.037	<0.037	0.15265	<0.037	<0.037	<0.037	<0.037	<0.037	0.03713	<0.037	<0.037	<0.037	<0.037
Arsenic	As	mg/L	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11
Boron	B	mg/L	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	0.027	<0.023
Barium	Ba	mg/L	0.0832	0.082932	0.0837	0.095481	0.104	0.06884	0.0866	0.07867	0.0865	0.06908	0.0899	0.08737	0.0866	0.07173	0.108	0.10586
Beryllium	Be	mg/L	<0.00055	<0.00055	<0.00055	<0.00055	<0.00055	<0.00055	<0.00055	<0.00055	<0.00055	<0.00055	<0.00055	<0.00055	<0.00055	<0.00055	<0.00055	<0.00055
Calcium	Ca	mg/L	89.4	96	85.4	57	86.1	34	88.5	86	90.2	85	94.7	74	90.6	93	92.1	91
Cadmium	Cd	mg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Cobalt	Co	mg/L	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Chromium	Cr	mg/L	<0.0058	<0.0058	<0.0058	<0.0058	<0.0058	<0.0058	<0.0058	<0.0058	<0.0058	<0.0058	<0.0058	<0.0058	<0.0058	<0.0058	<0.0058	<0.0058
Copper	Cu	mg/L	<0.0016	<0.0016	<0.0016	0.002524	<0.0016	0.00356	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016
Iron	Fe	mg/L	<0.024	<0.024	<0.024	0.034886	<0.024	0.17415	0.043	<0.024	<0.024	<0.024	<0.024	0.0287	<0.024	<0.024	<0.024	<0.024
Potassium	K	mg/L	2.18	3.11	1.73	9.3	1.99	14.35	2.24	3.63	2.19	3.72	3.37	4.88	2.22	2.62	3.06	3.48
Lithium	Li	mg/L	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11
Magnesium	Mg	mg/L	50.5	50	50.9	29.1	50.3	17.1	50.7	49.7	50.5	46	52.4	39.5	50.1	49.8	50.3	48.3
Manganese	Mn	mg/L	0.0227	0.058	0.0555	0.061	0.0421	0.053	0.0645	0.139	0.0533	0.106	0.0444	0.078	0.0419	0.08	0.0568	0.174
Molybdenum	Mo	mg/L	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022
Sodium	Na	mg/L	10.6	10.9	13.4	30.8	22.7	30.6	10.3	12.3	9.88	13.4	9.84	27	9.39	10.1	23.9	33.6
Nickel	Ni	mg/L	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043	<0.043
Phosphorous	P	mg/L	<0.073	<0.073	<0.073	0.166258	<0.073	0.45425	0.086	<0.073	<0.073	<0.073	<0.073	0.12606	<0.073	<0.073	0.095	0.72603
Lead	Pb	mg/L	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041
Sulfur	S	mg/L	30.9	39.1575	20.1	13.9574	13.9	6.957	30.4	37.8191	30.8	34.4507	32.4	27.453	31.1	38.832	20.3	23.1664
Antimony	Sb	mg/L	<0.059	<0.059	<0.059	<0.059	<0.059	<0.059	<0.059	<0.059	<0.059	<0.059	<0.059	<0.059	<0.059	<0.059	<0.059	<0.059
Selenium	Se	mg/L	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
Silicon	Si	mg/L	1.69	4.35	4.71	4.17	7.07	3.73	1.75	2.56	1.59	2.96	1.78	3.26	1.78	3.35	5.87	5.09
Tin	Sn	mg/L	<0.086	<0.086	<0.086	<0.086	<0.086	<0.086	<0.086	<0.086	<0.086	<0.086	<0.086	<0.086	<0.086	<0.086	<0.086	<0.086
Strontium	Sr	mg/L	0.101	0.091574	0.0875	0.078004	0.108	0.0529	0.0951	0.09122	0.096	0.0825	0.0998	0.08539	0.0963	0.08754	0.107	0.10924
Titanium	Ti	mg/L	<0.00056	<0.00056	<0.00056	0.00142	<0.00056	0.0064	0.00192	<0.00056	<0.00056	<0.00056	<0.00056	0.00122	<0.00056	<0.00056	<0.00056	<0.00056
Thallium	Tl	mg/L	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047
Vanadium	V	mg/L	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047	<0.047
Zinc	Zn	mg/L	0.0352	0.036145	0.0113	<0.0097	<0.0097	<0.0097	0.0353	0.03881	0.0376	0.03918	0.0355	0.02144	0.0432	0.05433	<0.0097	0.01538
Potential Hydrogen (in Lab)	pH	1-14 scale	8.41	8.195	8.20	7.902	8.40	8.128	8.19	8.192	8.19	8.147	8.29	8.099	8.31	8.238	8.20	8.104
	Alkalinity	mg/L	298	290	341	201	349	128	302	278	304	269	304	243	304	297	365	330
Fluorine	F	mg/L	0.12	0.171	0.12	0.197	0.10	0.109	0.12	0.182	0.12	0.173	0.11	0.221	0.12	0.187	0.13	0.201
Chlorine	Cl	mg/L	22.8	24.7	29.3	57.3	48.4	53.1	24.5	26.7	24.0	28.0	23.3	47.5	22.8	23.8	41.7	64.2
Bromine	Br	mg/L	0.11	<0.08	0.10	<0.08	0.10	<0.08	0.10	<0.08	<0.08	<0.08	0.10	<0.08	0.10	<0.08	<0.08	<0.08
Nitrate Nitrogen	NO3-N	mg/L	7.38	4.21	0.85	2.23	1.58	0.90	6.85	1.54	6.95	1.98	6.99	4.01	7.21	2.64	0.84	0.60
Sulfate	SO4	mg/L	91.3	111	59.8	40	41.2	19	91.1	106	91.9	98	91.8	83	93.0	113	61.0	66
Phosphorous	o-PO4-P	mg/L	0.008	0.047	0.033	0.182	0.087	0.431	0.018	0.019	0.011	0.027	0.010	0.127	0.009	0.021	0.079	0.068
Microbial Volatile Organic Compounds	NVOC	mg/L	N.D.	2.502	N.D.	8.109	N.D.	12.94	N.D.	3.073	N.D.	2.35	N.D.	4.138	N.D.	1.896	N.D.	2.689
Total Kjeldahl Nitrogen	TKN	mg/L	0.29	0.663	0.21	2.55	0.34	2.792	0.46	0.78	0.39	0.491	0.26	2.420	0.43	0.312	0.19	0.345
Ammonia Nitrogen	NH3-N	mg/L	<0.03	0.107	<0.03	0.602	<0.03	0.169	<0.03	0.046	<0.03	0.103	<0.03	1.320	<0.03	0.057	<0.03	0.064
Total Coliform	Total Coliform	cfu	127180	9900	21430	198630	129970	241960	13330	6130	18600	691	15000	15970	12500	1600	77010	5730
E. Choli	E. Coli	cfu	137.6	5380	579.4	111990	1986.3	98040	259.2	127.4	266.8	396.8	412.8	3270	310.6	141.4	651	1986
acetaminophen	ACE	mg/L		N.D.		N.D.		N.D.		N.D.		N.D.		N.D.		N.D.		N.D.
caffeine	CAF	ng/L	N.D.	N.D.	10.3	10.5	9.7	23.4	12.6	24.2	6.7	14.6	5.5	N.D.	N.D.	N.D.	5.4	N.D.
carbamazepine	CBZ	mg/L		0.63		0.27		N.D.		2.04		0.57		0.75		0.8		0.36
diphenhydramine	DPH	mg/L		N.D.		N.D.		N.D.		N.D.		N.D		N.D.		N.D.		N.D.
erythromycin	ERY	mg/L		N.D.		N.D.		N.D.		N.D.		N.D		N.D.		N.D.		N.D.
fluoxetine	FLU	mg/L		N.D.		N.D.		N.D.		N.D.		N.D		2.1**		N.D.		N.D.
gemfibrozil	GEM	mg/L		1.4		N.D.		N.D.		4.3		2		1.1**		2.1		1.0**
ibuprofen	IBU	mg/L		N.D.		N.D.		N.D.		3.3**		N.D.		N.D.		N.D.		N.D.
naproxen	NAP	mg/L		N.D.		N.D.		3.6**		3.4**		N.D.		1.8**		N.D.		N.D.
sulfamethazine	SMI	mg/L		N.D.		N.D.		N.D.		N.D.		N.D.		N.D.		N.D.		N.D.
sulfamethoxazole	SMO	mg/L		N.D.		N.D.		N.D.		N.D.		1.9**		N.D.		N.D.		N.D.
triclocarban	TCC	mg/L		0.34		0.61		0.3		N.D.		0.38		N.D.		0.26		0.31
triclosan	TCS	mg/L		N.D.		N.D.		N.D.		N.D.		N.D.		N.D.		N.D.		N.D.
trimethoprim	TMP	mg/L		N.D.		N.D.		N.D.		N.D.		N.D.		N.D.		N.D.		N.D.

*Not Detected **Compound was detected between LOD and LOQ

Lab results for constituents found in samples collected in August 2017/May 2018 on the lower Galena River and its tributaries

An add-on to the project included analysis for Pharmaceuticals and Personal Care Products (PPCPs). The sampling project was conceived of, designed, and conducted by scientists from the Illinois State Geological and Water Surveys. The first round of sampling was completed in August of 2017 when the river was at low flow, with a second round in May of 2018 to capture the impacts of run-off during high flow. The presence of PPCPs at all sampling sites indicates the ubiquitous nature of human waste within the Galena River and its tributaries.

An award from the Illinois EPA from funds distributed according to Section 604b of the Clean Water Act provided grant funding to sample for nutrients in the Galena River beginning in May of 2019. The project involved the collection of nutrient data for the Galena River as a reference for defining actions that will support the Illinois Nutrient Loss Reduction Strategy. The US Geological Survey (USGS) was contracted to take discrete samples from the Galena River 19 times in each of two locations - just below the Wisconsin border and at the bottom of the Galena River watershed where it flows into the Mississippi River. The samples are being

analyzed for a complete suite of nutrients (Nitrate + Nitrite, Ammonia, Organic Nitrogen, Total Nitrogen, Dissolved Phosphorus, Total Phosphorus, and Ortho Phosphorus) and suspended-sediment concentrations.

Edge of Field Monitoring

A continuous monitoring pilot project was conducted in 2018 to specifically address nitrogen loss from farm fields by installing a low cost monitoring station with edge-of-field sensors providing real-time online data to the farmer, with the goal of providing data to affect farm management decision-making. This project is being evaluated to consider expanding it to other farms in the county.

Other Monitoring Programs

Weather Underground collects real-time weather data from local weather stations (https://www.wunderground.com/about/background.asp)

National Atmospheric Data Program (NADP) – maintains nationwide long term measurement of precipitation chemistry. The program office and central lab is located at the Illinois State Water Survey in Champaign, IL.

Sierra Club Water Sentinels conduct volunteer water quality monitoring (phosphorous, nitrate, ammonia, chloride, pH, temperature, etc.). The Illinois Chapter of the Sierra club has several active Water Sentinel teams (https://www.sierraclub.org/water-sentinels). Training and support is available:

Katrina Phillips at katrina.phillips@sierraclub.org 312-251-1680 x116
Cindy Skrukrud at cindy.skrukrud@sierraclub.org 312-251-1680 x110
Volunteer Leader: Fran Caffee at fran.caffee@illinois.sierraclub.org

Action Plan Items

1. Establish a consistent and sustainable water quality monitoring effort in Jo Daviess County.

2. Obtain and analyze historical data that has already been collected.

3. Expand on the scientific analysis of existing data.

4. Determine the extent that septic effluent is contributing to nutrient pollution and how it might be affecting well water quality in the county.

5. Experiment with natural remedies such as the possible use of mussels and clams to improve water quality in streams. https://www.seeker.com/mussels-and-clams-can-clean-up-polluted-water-1768972732.html

VI. Best Management Practices
A. Stormwater Management

Introduction

Best Management Practices (BMPs) are methods or techniques found to be the most effective and practical way to achieve a goal. For this plan, the goals are to enhance stormwater and groundwater management, and to protect/maintain/improve water quality.

Every setting and set of circumstances is unique. Each situation must be studied and the appropriate best management practices implemented accordingly. This plan recommends that situations be evaluated, a practice implemented, and then results of that practice evaluated, with the idea that - over time - we will be able to strategically place practices best suited to our area and achieve the best results with an efficient use of our resources.

There are many references available for identifying and evaluating practices. Here, brief definitions and associated notes have been provided for some common practices utilized to manage stormwater resources. This list is not complete, and efforts to identify and evaluate additional practices should be ongoing. It should also be noted that some stormwater management problems may require multiple practices to create an effective solution.

The definitions and notes provided below have been created primarily by referencing the following:

- Natural Resource Conservation Service (NRCS) Field Office Technical Guide (FOTG) as applicable in Illinois https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/fotg/
- Association of Illinois Soil Water Conservation Districts' "Illinois Urban Manual" (www.aiswcd.org/illinois-urban-manual/),
- The "Illinois Nutrient Loss Reduction Strategy" (https://www2.illinois.gov/epa/topics/water-quality/watershed-management/excess-nutrients/Pages/nutrient-loss-reduction-strategy.aspx) ,
- The Illinois Council on Best Management Practices (http://illinoiscbmp.com/),
- The U.S. Green Building Council's Leadershp in Energy and Environmental Design certification program(LEED) (www.usgbc.org/leed)
- University Extension (Illinois: http://extension.illinois.edu/lcr/stormwater.cfm, Wisconsin: https://green.extension.wisc.edu/groundwater-quality-trend-data-program-2/)

Glossary of Practices

The following are an abridged list of conservation practices that address stormwater management. There are both urban and rural practices listed in alphabetical order.

Bioswales

Grassed Waterway - A shaped or graded channel that is established with suitable vegetation to convey surface water at a non-erosive velocity using a broad and shallow cross section to a stable outlet." (NRCS Conservation Standard 412)

Grass-Lined Channels - Natural or constructed channel vegetated to convey water (AISWCD Code 840)

Infiltration Trench - Pits or trenches designed to hold water to increase infiltration (AISWCD Code 847)

Vegetated Treatment Area - An area of permanent vegetation used for agricultural wastewater treatment." (NRCS Conservation Standard 635)

Cisterns/tanks/rain barrels

A rain barrel is a system that collects and stores rainwater from your roof that would otherwise be lost to runoff and diverted to storm drains and streams (Jo Daviess County SWCD).

Larger tanks and underground cisterns can also be used to store greater quantities of rainwater.

Composting

A mixture of decayed or decaying organic matter used to fertilize soil. Compost enhanced and amended soils reduce runoff, soil erosion, and unwanted transport of chemicals and residues. University of Wisconsin offers a master composter resource guide: https://fyi.extension.wisc.edu/danecountycommunitydevelopment/files/2021/10/MasterComposterWEbsitePost.pdf

Conservation Tillage

Residue and Tillage Management, No-Till - Limiting soil disturbance to manage the amount, orientation and distribution of crop and plant residue on the soil surface year around." (NRCS Conservation Standard 329)

Cover crops

Cover Crop - Grasses, legumes, and forbs planted for seasonal vegetative cover" (NRCS Conservation Standard 340).

Detention/retention basins

Sediment Basin - A basin constructed with an engineered outlet, formed by an embankment or excavation or a combination of the two." (NRCS Conservation Standard 350)

Shallow Water Development and Management - The inundation of lands to provide habitat for fish and/or wildlife." (NRCS Conservation Standard 646)

Structure for Water Control - A structure in a water management system that conveys water, controls the direction or rate of flow, maintains a desired water surface elevation or measures water." (NRCS Conservation Standard 587)

Water and Sediment Control Basin - An earth embankment or a combination ridge and channel constructed across the slope of minor watercourses to form a sediment trap and water detention basin with a stable outlet.

The University of Wisconsin, Platteville, Environmental Engineering students designed detention basins for the City of Galena.

Filter/Buffer strips

"Filter Strips": A strip or area of permanent herbaceous vegetation situated between cropland, grazing land, or disturbed land and environmentally sensitive areas." (NRCS Conservation Standard 393)

"Filter Strips": Vegetated filter zone to remove pollutants (AISWCD Code 835)

"Contour Buffer Strips": Narrow strips of permanent, herbaceous vegetative cover established around the hill slope, and alternated down the slope with wider cropped strips that are farmed on the contour (NRCS Conservation Standard 332).

"Conservation Buffers": Conservation buffers are strips of permanent vegetation that are meant to capture nutrients and sediment carried by surface water. They do that by slowing down surface water and allowing plants to take up and use the water and nutrients (C-BMP).

"Riparian Buffers": Riparian buffers are vegetated areas next to water resources that protect water resources from nonpoint pollution and provide bank stabilization and aquatic and wildlife habitat. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_043594.pdf

Forest Stand Improvement: "The manipulation of species composition, stand structure, or stand density by cutting or killing selected trees or understory vegetation to achieve desired forest conditions or obtain ecosystem services." (NRCS Conservation Standard 747). Practices used to achieve forest stand improvement might include the implementation of practices like fire management, invasive treatments, and the creation of stream side management zones.

Green Roofs

A green roof, or "living roof" is a roof of a building that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane. It may also include additional layers such as a root barrier and drainage and irrigation systems.

Native perennial plantings

Perennial crops are crops that live for years and can be harvested many times before they die. Plants such as apples and alfalfa are perennials that are commercially grown and harvested, as are biofuel crops such as miscanthus and switchgrass. Perennial crops have been shown to reduce nutrient losses (C-BMP).

"Conservation Cover" - Establishing and maintaining permanent vegetative cover (NRCS Conservation Standard 327).

"Critical Area Planting" - The establishment of permanent vegetation on sites with high erosion rates, and on sites that have physical, chemical or biological conditions that prevent the establishment of vegetation with normal practices." (NRCS Conservation Standard 342)

Nutrient Management

Nutrient Management - Managing the amount (rate), source, placement (Method of application), and timing of plant nutrients and soil amendments." (NRCS Conservation Standard 590)

Drainage Water Management - Drainage water management is the practice of using a water control structure in a main, submain, or lateral drain to vary the depth of the drainage outlet. *https://extension.umn.edu/crop-production/agricultural-drainage*

Denitrifying Bioreactor - "A structure containing a carbon source, installed to reduce the concentration of nitrate nitrogen in subsurface agricultural drainage via enhanced denitrification." (NRCS Conservation Standard 747)

Saturated Buffer - A saturated buffer is a riparian buffer in which the water table is artificially raised by diverting subsurface drainage along the buffer, accomplished by installing a water control structure in the main drainage outlet.
https://www.ars.usda.gov/midwest-area/ames/nlae/news/what-are-saturated-buffers/#:~:text=Saturated%20buffers%20are%20a%20conservation,(4)%20a%20vegetated%20buffer.

Permeable surfaces

Permeable Pavement - Pavement having interspersed sod, gravel or sand areas (AISWCD Code 890). These are designed and installed to allow significant rainwater transfer through them into soil beneath the paved area.

The City of Dubuque has been implementing a permeable paver program:
http://cityofdubuque.org/1818/Green-Alley-Reconstruction

Prairie Strips

Prairie strips are a conservation practice that uses strategically placed native prairie plantings in crop fields. John Tyndall, Iowa State University has been studying the benefits prairie strip plantings can provide to reduce stormwater run-off and nutrient loss and obtaining impressive results: https://www.nrem.iastate.edu/research/STRIPs/

Rain Gardens/Rainscaping

Rain Garden - Small, shallow, depressions constructed to temporarily hold and infiltrate stormwater close to where the stormwater is generated. (Under NRCS Stormwater Runoff Control, Code 570)

Rainscaping - Rainscaping refers to a combination of sustainable landscape design and management practices that direct stormwater to be absorbed by plants and soils.

Streambank Stabilization

Streambank and Shoreline Protection - "Treatment(s) used to stabilize and protect banks of streams or constructed channels, and shorelines of lakes, reservoirs, or estuaries." (NRCS Conservation Standard 580)

Vegetative Streambank Stabilization - Vegetation to control streambank erosion (AISWCD Code 995).

Structural Streambank Stabilization - Structure to control streambank erosion (AISWCD Code 940).

Terraces

Terrace - An earth embankment, or a combination ridge and channel, constructed across the field slope." (NRCS Conservation Standard 600)

Wetland protection/restoration/creation

Wetland - A marsh-type area with saturated soils and water-loving plants. Wetlands can be constructed for the purpose of removing nutrients because they filter nutrients, chemicals, and sediment from runoff or tile water before water moves… into streams and rivers. Because wetlands slow overland flow and store runoff water, they reduce both soil erosion and flooding downstream. Many wetlands release water slowly into the ground which recharges groundwater supplies (C-BMP).

Constructed Wetland - An artificial ecosystem with hydrophytic vegetation for water treatment (NRCS Conservation Standard 656).

Wetland Creation - The creation of a wetland on a site location that was historically non-wetland." (NRCS Conservation Standard 658)

Wetland Enhancement - The augmentation of wetland functions beyond the original natural conditions on a former, degraded, or naturally functioning wetland site: sometimes at the expense of other functions." (NRCS Conservation Standard 659)

Wetland Restoration - The return of a wetland and its functions to a close approximation of its original condition as it existed prior to disturbance on a former or degraded wetland site." (NRCS Conservation Standard 657)

Bioretention - Constructed wetland to improve stormwater quality (AISWCD Code 800).

Action Plan Items

1. Develop and distribute model lease contract language that incorporates best management practices to support/encourage implementation of these practices on leased land.

2. Examine the effectiveness of riparian buffers in a karst area, referencing the Minnesota model where buffers are required. Note: The "Illinois Nutrient Loss Reduction Strategy" states "Buffers along agricultural ditches and streams can reduce nitrate-nitrogen losses by increasing plant uptake and denitrification in the water that seeps through them. In tile-drained landscapes, much of the water bypasses buffers, and estimating the water that does flow through them is difficult." (p. 3-34)

3. Compile model ordinances and other measures that should be considered to better manage groundwater resources and make recommendations to local governments.

4. Establish a prairie strip demonstration project.

5. Conduct a survey of large landowners about the BMPs they have found to be most effective.

6. Define the BMPs most suitable for cropland, pastureland, and woodland areas in Jo Daviess County.

7. Identify best management practices to control woodland ravine erosion in Jo Daviess County.

Groundwater Conservation

Conserving groundwater involves, in large part, common sense measures, including the following:

- Eliminate leaks
- Install water saving devices and appliances
- Develop water-efficient habits (e.g. don't let the faucet run when brushing your teeth, take shorter showers, etc.)
- Use drought resistant plants
- Water plants efficiently
- Store rainwater for use (in rain barrels, tanks and cisterns)
- Reuse greywater when possible

Abandoned Well Sealing

Abandoned wells provide direct conduits from the surface to groundwater, creating opportunity for direct contamination.

Well Decommissioning: The sealing and permanent closure of an inactive, abandoned, or unusable water or monitoring well." (NRCS Conservation Standard 351)

"Well Decommissioning": Permanent sealing of a water well, boring, or monitoring well (AISWCD Code 996)

Sealing Mining Artifacts

The long mining history of the area has left its mark in the form of shafts and exploratory boreholes in the county. Over 2,500 mining borehole locations are included in the *Jo Daviess County Karst Feature Database* as well as the locations of mining areas (bit.ly/JDC_KarstFeatures)

Mine Shaft and Adit Closing: Closure of underground mine openings by filling, plugging, capping, installing barriers, gating or fencing." (NRCS Conservation Standard 457)

Quantifying Groundwater Use

Our Plan asks us to estimate the quantity of water being pumped in our area. This is so that we can better "budget" our groundwater use to ensure sustainability. The U.S. Geological offers information about hydrological budgets: http://pubs.usgs.gov/ha/ha747/pdf/hydrologic-budgets.pdf

The Rock River Regional Water Supply Planning effort included an assessment of water supply and demand. The Illinois State Water Survey (ISWS) has provided an online summary of the findings: https://www.isws.illinois.edu/illinois-water-supply-planning/rock-river-region-webmap

Action Plan Items

1. Establish a method to track the quantity of groundwater being pumped in our area.

2. Determine the current status of Illinois regulations for allowable uses of greywater and associated plumbing.

3. Determine how the management of groundwater resources relates to future development.

4. Compile model ordinances and other measures that should be considered to better manage groundwater resources and make recommendations to local governments.

5. Create a table summarizing local government practices including whether or not municipalities are doing “leak audit surveys” to compare pumpage and use volumes to determine volume of loss, and if they are metering water usage using smart meters and datalogging.

6. Gather references about the impacts of quarries on groundwater.

VII. Funding Opportunities

The list below includes currently active grant programs as well as entities that have offered funding in the past and may be worth contacting to determine if funding may be available for specific projects. The potential funding sources are grouped by category: "Government Funding", "Organization Funding", and "Private Funding".

Government Funding

1. U.S. Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS)

   Conservation Partners Program (CPP) – 60% cost-share on conservation farming practices, well decommissioning, rain gardens and grade stabilization structures

   Streambank Stabilization and Restoration Program (SSRP) – 75% cost-share program.

   Conservation Reserve Program (CRP) – Provides rental payments to farmland placed into conservation retirement for periods of 10 years or more.

   Environmental Quality Incentives Program (EQIP) – Provides fixed payment scenarios for landowners to achieve conservation practices including stream restoration, nutrient management planning, forestry planning, and nutrient control structures.

2. U.S. Department of Agriculture (USDA)

   Sustainable Agriculture Research and Education (SARE) grants - https://www.sare.org/

   Farm Bill Conservation Grants

3. U.S. Environmental Protection Agency (US EPA)

   EPA Clean Water Act Section 319 Grants – 60% funding for watershed planning, and projects included in an approved watershed plan.

   EPA Clean Water Act Section 604(b) Grants – No match required.

   EPA "Healthy Watersheds" Watershed Consortium Grant - https://www.epa.gov/hwp/healthy-watersheds-consortium-grants-hwcg

   EPA Environmental Education Grant - https://www.epa.gov/education/grants

4. U.S. Fish & Wildlife Service (USFWS)

   Fishers and Farmers Partnership for the Upper Mississippi River Basin (Through U.S. Fish & Wildlife Service) http://fishersandfarmers.org/action-resources/

   U.S. Fish & Wildlife Service - www.fws.gov/grants/ http://www.fws.gov/birds/grants/north-american-wetland-conservation-act/how-to-apply-for-a-nawca-grant.php

5. Illinois Emergency Management Agency (IEMA)

   FEMA Hazard Mitigation Assistance (HMA) Grant Program https://www.fema.gov/grants/mitigation/floods/previous-fiscal-year-subapplication-statuses/fy2020-subapplication-status

   Building Resilient Infrastructure and Communities (BRIC) grants

https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities#:~:text=BRIC%20is%20a%20competitive%20FEMA,from%20disasters%20and%20natural%20hazards

Organization Funding

5. Farm Bureau – Jo Daviess County: http://jodaviesscfb.com/,
   Illinois: https://www.ilfb.org/media/illinois-farm-bureau-announces-2022-environmental-stewardship-grant-recipients/

6. Friends of Reservoirs – http://www.waterhabitatlife.org/

7. Hungry Canyons Alliance – https://www.legis.iowa.gov/docs/publications/SD/524.pdf

8. Trout Unlimited – Driftless Area Restoration Effort
   http://www.tu.org/conservation/watershed-restoration-home-rivers-initiative/embrace-a-stream
   http://www.darestoration.com/

9. Pheasants Forever –
   www.pheasantsforever.org/Newsroom/2015-June/NAWCA-Grants-Deliver-$4-Million-to-Habitat-Conserv.aspx

10. Ducks Unlimited – http://www.ducks.org/related/grants

11. Small Bass Alliance – http://www.illinoissmallmouthalliance.com/html/proposals.html

12. Local Non-profits – Lions Club, Rotary, Country Fair, League of Women Voters

Private Funding (Foundations, Corporations, Individuals)

13. American Waters - https://www.amwater.com/corp/customers-and-communities/environmental-grant-program

14. Private Donations

The League of Women Voters is setting up an endowment at the Community Foundation of Jo Daviess County to support the Jo Daviess County Water Resource Management Planning process into the future. Proceeds from the endowment support the University of Illinois Extension's maintenance of annual plan updates. Donations made to the endowment will be tax deductible.

VIII. Appendix
A. Bibliography

Panno, S.V., Donald E. Luman, and Dennis R. Kolata. Characterization of karst terrain and regional tectonics using remotely sensed data in Jo Daviess County, Illinois. Circular 589, Illinois State Geological Survey, Prairie Research Institute, University of Illinois Urbana-Champaign, 2015. https://www.isgs.illinois.edu/maps/county-maps/karst-terrain/jo-daviess

Samuel V. Panno and Don Luman presented the findings documented in Circular 589 in Jo Daviess County on October 16th and 17th, 2015. The October 16th presentations are available on YouTube:

Part 1, Donald E. Luman - https://www.youtube.com/watch?v=X7tn99VRFac

Part 2, Samuel V. Panno – https://www.youtube.com/watch?v=XXw2ZlhO8-Y

Part 3, Question & Answer session – https://www.youtube.com/watch?v=ZgavUsAGS9U

Panno, S.V., Philip G. Millhouse, Randy W. Nyboer, Daryl Watson, Walton R. Kelly, Lisa M. Anderson, Curtis C. Albert, and Donald E. Luman. Guide to the Geology, Hydrogeology, History, Archaeology, and Biotic Ecology of the Driftless area of Northwestern Illinois, Jo Daviess County.Illinois State Geological Survey Guidebook 42, 2016. https://www.isgs.illinois.edu/publications/gb042

Panno, S.V., Donald E. Luman, Walton R. Kelly, Timothy H. Larson, and Stephen J. Taylor. Karst of the Driftless Area of Jo Daviess County, Illinois. Circular 586, Illinois State Geological Survey, Prairie Research Institute, University of Illinois Urbana-Champaign, 2017. https://isgs.illinois.edu/maps/county-maps/karst-terrain/jo-daviess-0

Panno, S.V., W.R. Kelly, and E.L. Baranski. Hydrogeochemical controls on aquifers of northwestern Illinois' Driftless Area, USA. *Environmental Earth Sciences* 78:276, 2019. https://doi.org/10.1007/s12665-019-8271-7

Panno, S.V., W.R. Kelly, and E.L. Baranski. Hydrogeochemical controls on aquifers of northwestern Illinois' Driftless Area, USA. *Environmental Earth Sciences* 78:276, 2019. https://doi.org/10.1007/s12665-019-8271-7

Panno, S.V., Walton R. Kelly, John Scott, Wei Zheng, Rachel E. McNeish, Nancy Holm, Timothy J. Hoellein, and Elizabeth L. Baranski. Microplastic Contamination in Karst Groundwater Systems. *Groundwater.*57(2):189-196. doi:10.1111/gwat.12862,2019. Microplastic Contamination in Karst Groundwater Systems - Panno

VIII. Appendix
B. Survey Results

Introduction

A survey was conducted to assess perceptions about water resources in Jo Daviess County in 2013 prior to the start of the water resource management planning process. The same survey was conducted in late 2016 and early 2017 after the end of the planning process. The purpose of the survey was to see if there had been any changes in perception resulting from educational efforts conducted during plan development. The results will be a reference for water resource education planning going forward.

Bonnie Cox, then President of the League of Women Voters of Jo Daviess County completed an Illinois Environmental Protection Agency (IEPA) Quality Assurance Project Plan (QAPP) to ensure and to document that the survey met accepted standards. Surveys were given to individuals representing key interests and centers of authority/influence, including the county board, municipal boards, township boards, resort community boards, and special interest organizations. Students at the University of Wisconsin, Platteville, tabulated the survey responses and used the U.S. EPA Region 5 Social Indicator Data Management and Analysis Tool (SIDMA) to record, manage and analyze the data.

The following is a summary of the survey results:.

Part 1 Survey Results

233 individuals completed surveys. The respondents were fairly evenly divided between those responsible for the land and water management practices for over 100 acres, 5-100 acres, up to 5 acres, and none. Over 60% of those responding were on well and septic. Over 87% reported being somewhat or very interested in learning more about the quality of ground and surface water in their area.

Some survey highlights are provided below:

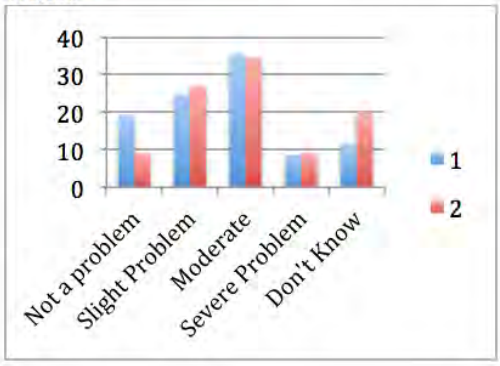
- Over 74% of those responding rated the overall quality of drinking water in their area as “Good”.
- Of those responding, over 40% didn’t know how much of a problem the following impairments were in their area: Nitrogen, Phosphorous, Bacteria and viruses in the water (such as E. Coli/coliform), High water temperature, Fractured carbonate bedrock making ground water more susceptible to surface water contaminants, and Toxic substances in the water.
- Over 35% of those responding felt the following sources of water quality pollution are not a problem: Discharges from sewage treatment plants, Waste material from pets, Mine tailings, Turf management (golf courses, sports fields).
- Over 35% of those responding felt the following sources of water quality are a moderate to severe problem: Soil erosion from farm fields, Soil erosion from shorelines and/or streambanks, Excessive use of lawn fertilizers and/or pesticides, Excessive use of fertilizers for crop production, and Stormwater runoff.
- Between 47 and 77% of those responding felt that in regards to poor water quality issues leading to consequences for communities there was no problem or a slight problem.
- Of those responding, the order (from most to least) of issues that limit their ability to change management practices a little, some, or a lot was 1) Personal out-of-pocket expense, 2) Not being able to see a demonstration of the practice before I decide, 3) Lack of available information about a practice, 4) The need to learn new skills or techniques, and 5) Don’t want to participate in government programs.
- When asked to what extent various sources of information about soil and water were trusted, the top 5 most trusted sources were: 1) Soil and Water Conservation District, 2) Natural Resource Conservation Service, 3) University Extension, 4) Farm Bureau, and 5) County Health Department.

Part 2 Survey Results

In the follow-up survey data largely remained the same. The following are highlights of significant changes and conclusions from the two surveys:

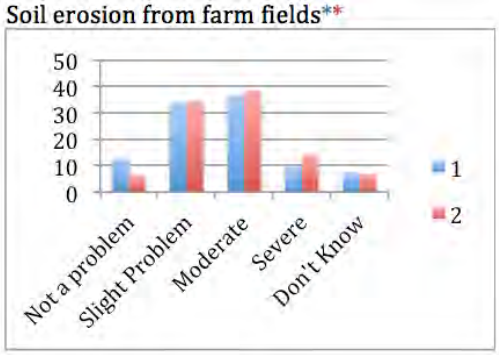
There was no change in the highest mean between the two surveys for each question.
In your opinion, how much of a problem are the following water impairments in your area?

1. Sedimentation (dirt and soil) in the water**



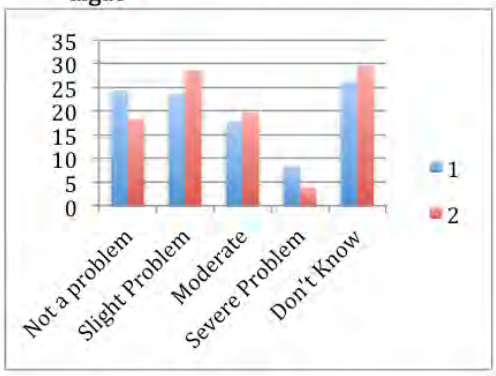
In your opinion, how much of a problem are the following sources in your area?

2. Soil erosion from farm fields**

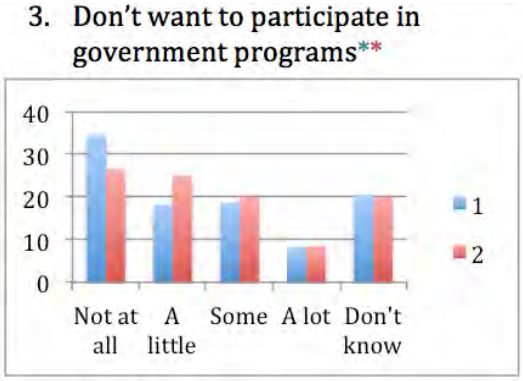


In your opinion, how much of a problem are the following issues in your area?

7. Excessive aquatic plants or algae**



In general, how much does each issue limit your ability to change your management practices?



The League of Woman Voters went up in trust, from being ranked number 14 to number 10 in the second survey.

The US Environmental Protection Agency increased as well, from rank 10 to 8.