BOND COUNTY, ILLINOIS

HAZARD MITIGATION PLAN

April, 2024

PARTICIPATING JURISDICTIONS

Bond County

Greenville, City of

Mulberry Grove, Village of

Old Ripley, Village of

Pierron, Village of

Pocahontas, Village of

Smithboro, Village of

Sorento, Village of

Bond County Health Department

Greenville University

HSHS Holy Family Hospital

ACRONYMS

ACS	American Community Survey
APA	Approval Pending Adoption
ASDSO	Association of State Dam Safety Officials
BRIC	Building Resilient Infrastructure and Communities
CDBG	Community Development Block Grant
CFM	Certified Floodplain Manager
CISA	US Cybersecurity and Infrastructure Security Agency
EOP	Emergency Operations Plan
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HUD	US Department of Housing and Urban Development
IAFSM	Illinois Association of Floodplain and Stormwater Managers
IDNR	Illinois Department of Natural Resources
IDOT	Illinois Department of Transportation
IDPH	Illinois Department of Public Health
IEMA	Illinois Emergency Management Agency
IEPA	Illinois Environmental Protection Agency
ISGS	Illinois State Geological Survey
ISWS	Illinois State Water Survey
MRCC	Midwest Regional Climate Center
NCEI	National Centers for Environmental Information (former NCDC)
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NLD	National Levee Database
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
PDSI	Palmer Drought Severity Index
SBA	Small Business Administration, U.S. Department of Commerce
SHMO	State Hazard Mitigation Officer
UIUC	University of Illinois, Urbana-Champaign
USACE	US Army Corps of Engineers
USDA	US Department of Agriculture
USGS	US Geological Survey

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EXECUTIVE SUMMARY

Hazard Mitigation Goals and Objectives

Communities strive to protect the well-being and safety of their citizens. Hazard mitigation plans begin by identifying natural hazard risks and physical and social vulnerabilities in order to better understand disaster risk within a community. Mitigation plans are then developed by the community to lessen the impacts of hazards to its citizens and infrastructure.

The Bond County Hazard Mitigation Plan identifies risks to Bond County and its jurisdictions from natural hazards and presents hazard mitigation goals and actions that will reduce the risk for loss of life and property damage in the short and long-term future. This is an update to the *2010 Bond County Hazard Mitigation Plan*.

Jurisdictions must approve and adopt a hazard mitigation plan to be eligible to receive mitigation grant funding from the Federal Emergency Management Administration (FEMA). This plan enables all participating communities to be eligible for hazard mitigation grant programs administered by FEMA: Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA) Program, and Building Resilient Infrastructure & Communities (BRIC).

Community Participation

Community involvement is essential for creating a successful mitigation plan. The criteria that would constitute satisfactory jurisdictional participation in the planning process are listed below:

1. Attend a minimum of 1 meeting
2. Submit relevant community documents
3. Confirm hazards that directly affect the community
4. Confirm the list of essential facilities submitted by HAZUS
5. Develop goals for the community
6. Develop and prioritize mitigation actions for the community
7. Provide opportunities for public involvement
8. Review and comment on draft plan

Table 1 shows the jurisdictions participating in the Bond County Hazard Mitigation Plan.

Table 1. Participation by community in Bond County's Hazard Mitigation Plan.

Jurisdiction	Attend 1 meeting	Risk Assessment	Mitigation Projects	Capability Assessment	Review Plan	Adopt Plan
Bond County	x	x	x	x	x	
Greenville, City of	x	x	x	x	x	
Mulberry Grove, Village of	x					
Pierron, Village of	x	x	x	x	x	
Pocahontas, Village of	x	x		x	x	
Smithboro, Village of	x					
Sorento, Village of	x	x	x	x	x	
Greenville University	x	x	x	-	x	
Bond County Health Department	x	x	x	-	x	
HSHS Holy Family Hospital	x	x	x	-	x	

Risk Assessment

Risk assessments help jurisdictions identify hazards that could adversely affect their community. Representatives for Bond County's communities were asked to assess the risk of eighteen hazards – cybersecurity, drought, earthquake, extreme cold, extreme heat, floods: dam/levee failure, floods: flash flooding, floods: riverine flooding, HazMat spill, mine subsidence, pandemic, severe storms: hail, severe storms: lightning, severe storms: wind, tornado, wildfire, winter weather: ice storms, and winter weather: winter storms – affecting their community using hazard profiles (**Hazard Profiles and Risk Analysis**) and their personal experiences.

The overall risk of the hazards was measured by taking into account their probability and severity. Completed risk assessments can be found in **Appendix A: Risk Assessment**.

Risk (R) = Probability (P) x Severity (S)

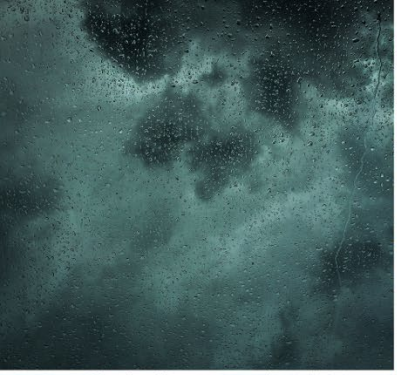
The top five hazards identified by Bond County were Tornados, Flash Flooding, Pandemics, Ice Storms, and Extreme Heat. (Table 2). The details of these hazards and how they affect residents, and the built community will be discussed later in this document.

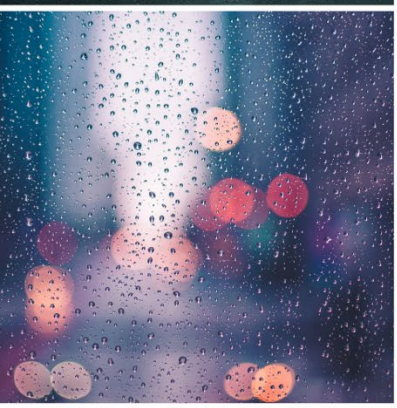
Table 2. Risk of natural hazards identified by jurisdictions in Bond County.

Hazard	Average risk	Risk rank
Tornado	18.50	1
Flash Flooding	11.38	2
Pandemic	11.25	3
Ice Storms	11.13	4
Extreme Heat	9.50	5
Winter Storms	9.50	6
Cybersecurity	9.25	7
Severe Storms: Lightning	9.00	8
HazMat Spill	8.75	9
Severe Storms: Wind	8.75	10
Extreme Cold	8.63	11
Mine Subsidence	8.50	12
Drought	7.63	13
Severe Storms: Hail	7.38	14
Earthquake	5.63	15
Riverine Flooding	4.75	16
Wildfire	4.38	17
Dam/Levee Failure	2.75	18

Mitigation Projects

Mitigation projects help jurisdictions reduce the risk of their community being adversely affected by natural hazards. Representatives from Bond County's communities defined mitigation projects based on their risk assessment and knowledge of their community's needs. More information can be found in **Mitigation Actions**.





SECTION 2

PLANNING PROCESS

INTRODUCTION

The Illinois State Water Survey (ISWS) has collaborated with Bond County and University of Illinois - Extension to create the *Bond County Hazard Mitigation Plan*. Preparing the plan requires the engagement of local governments, stakeholders, and residents in a planning process that meets the requirements in 44 CFR Part 201 Mitigation Planning as described herein.

Mitigation plans are the foundation for effective hazard mitigation and are a required component to secure funding for FEMA mitigation project grants. A mitigation plan is a demonstration of the commitment to reduce risks from natural hazards and serves as a strategic guide for decision-makers as they commit resources.

Developing hazard mitigation plans enables local governments to:

- Identify actions for risk reduction that are agreed upon by stakeholders and the public
- Focus resources on the greatest risks and vulnerabilities
- Build partnerships by involving citizens, organizations, and businesses
- Increase education and awareness around threats and hazards, as well as their risks
- Communicate priorities to State and Federal officials
- Align risk reduction with other state or community objectives

These three guiding principles serve to ensure that the plan is designed to effectively assist Bond County to achieve its resilience goals:

- ***Focus on the mitigation strategy.*** *The mitigation strategy is the plan's main purpose. All other sections contribute to and inform the mitigation strategy and specific hazard mitigation activities.*
- ***Process is as important as the plan itself.*** *The plan is only as good as the process and people involved in its development. The plan also serves as the written record of the planning process.*
- ***This is your community's plan.*** *To have value, the plan must represent the current needs and values of the community and be useful for local officials and stakeholders. The plan shall be developed in a way that best serves your community's purpose and people.*

The primary purpose of the plan is to provide the community with a mitigation strategy and all the other sections of the plan contribute to and inform the mitigation strategy and specific hazard mitigation activities. All procedural details are documented in the plan itself which serves as a written record of the plan-making process. The plan must represent the current needs and values of the community and be useful for local officials and stakeholders. The plan shall be developed in a way that best serves your community's purpose and people.

The planning process involved coordination between ISWS, Bond County EMA, and University of Illinois - Extension. University of Illinois - Extension coordinated with ISWS to undertake the organization of resources and the building of the planning team and created the strategy for community outreach.

This is an update to the hazard mitigation plan developed for Bond County, Illinois in 2010. Once adopted, participating jurisdictions can choose mitigations projects in the plan for which they can apply for federal mitigation funding.

PLAN FINANCING AND PREPARATION

The Bond County Emergency Management Agency, University of Illinois - Extension, and the Illinois State Water Survey (ISWS) partnered together to prepare this mitigation planning update. The ISWS was responsible for managing the planning process, developing the risk assessment, facilitating the mitigation action and strategy development, and preparing the final plan document. University of Illinois - Extension assisted in the process by providing local planning information, outreach to local municipalities, organizing and facilitating meetings, tracking the grant match, and assisting with other grant administration tasks.

Through participation of these agencies as well as participation, input and assistance from Planning Committee members and the citizens of Bond County, the 2024 Hazard Mitigation Planning process for Bond County was successful.

This plan was prepared using funding from FEMA's Pre-Disaster Mitigation Grant program. The funding consisted of a 75% Federal Share with a 25% cost share. The cost share was provided through participation and time of those on the Bond County Mitigation Planning Committee, the Bond County Emergency Management Agency (EMA), as well as in-kind services provided by ISWS.

TIMELINE AND MEETINGS

Timeline

The internal plan-making process started with team building and the organization of resources within the Illinois State Water Survey. This was followed by the conception of a community outreach strategy aimed at identifying community goals, capabilities, and local resources. The risk assessment process takes up five months of the project timeline and is the most time-intensive task. The development of the action plan is followed by the identification of a maintenance strategy to create a feedback loop after the plan has been implemented. The final steps involve reviews by the State and FEMA before it is adopted and submitted to Illinois Emergency Management Agency (IEMA). The plan received final FEMA approval on April 19, 2024. All participating jurisdictions have 1 year to adopt the plan.

Table 3. Timeline of tasks, actions, deliverables, and meetings.

DESCRIPTION OF TASK	START DATE	END DATE	ACTIONS
Organize resources and build planning team	3/25/2023	5/24/2023	Identify planning team member agencies, roles, collect community plans and documents
Create outreach strategy	3/25/2023	5/24/2023	Consult with local champions on best strategy
Assess community capabilities	5/25/2023	7/27/2023	Final call for local plans, review content of local plans
Conduct risk and capability assessments	5/25/2023	7/27/2023	Finalize hazard inventory data collection, historic weather data, hold meeting 2
Identify mitigation goals and actions	7/27/2023	11/16/2023	Create list of potential mitigation strategies, hold meeting 3
Develop action plan for implementation	10/19/2023	11/16/2023	Engage with local champions on how to integrate plan in other planning efforts
Identify plan maintenance strategy	10/19/2023	11/16/2023	Hold discussion with steering committee on plan maintenance
Review final draft	11/16/2023	12/31/2023	Post plan to website, share with Bond County jurisdictions, hold meeting 4
Submit plan to IEMA and FEMA	1/1/2024	2/28/2024	ISWS submits plan and makes revisions as needed
Local adoption of plan	3/1/2024	5/15/2024	Local jurisdictions adopt plan

The final plan identifies community risks and needs specific to each community. For the planning process to accurately represent a community's priorities a local representative would be required to participate throughout the process. For a jurisdiction to be considered a participating community, as per FEMA's requirements, a designated representative would need to participate in at least one of the scheduled committee meetings and complete three forms: a risk assessment, mitigation project grid, and capability assessment. Each jurisdiction must formally adopt the plan once completed.

During the planning process, public meetings were held to encourage public involvement in the creation and review of the plan. The planning committee considered public involvement to be vital to the process.

Meetings

Planning committee members were identified and invited to attend the planning committee meeting held on March 30, 2023. This meeting was designed to prepare for the four steering committee meetings and to tackle administrative tasks. Brief summaries of the steering committee meetings are provided below. Agendas, minutes, and community participation are documented in **Appendix B: Meeting Documents.** These stakeholder meetings provided critical information about the vulnerability and the current resiliency of the jurisdiction. All meetings were open to the public and available via Zoom.

Coordination with local jurisdictions and communities was an important part of the hazard mitigation process. ISWS scheduled multiple meetings for the participating communities of Bond County to attend in order to understand their current disaster preparedness and to document each community's specific needs. All communities within Bond County were contacted via email or telephone and invited to participate in the process by filling out Risk and Capability Assessment worksheets.

A website (https://www.illinoisfloodmaps.org/hazard-mit-plans-bond.aspx) was created for this project which houses all the relevant documents of the Bond County Hazard Mitigation Project for ease of access and a brief explanation of the process.

Meeting 1: Hazard Mitigation Planning Kick-off – May 25, 2023

Meeting Summary: The planning committee went over the purpose of a hazard mitigation plan, what hazard mitigation is, the requirements for communities to participate and the benefits of participating in the plan.

Meeting 2: Hazard Profiles and Risk Assessment – July 27, 2023

Meeting Summary: The planning committee reviewed natural hazards that may impact the communities, identified community vulnerabilities that might affect risk, discussed the history of hazards in the area, introduced the community web map, and participated in a risk assessment activity.

Meeting 3: Mitigation Strategies – October 19, 2023

Meeting Summary: The planning committee reviewed hazard mitigation goals from the 2010 Bond County Multi-Hazard Mitigation Plan. The steering committee presented ideas for hazard mitigation projects and began scheduling one-on-one meetings with individual jurisdictions to develop hazard mitigation projects.

Following the third meeting, ISWS scheduled one-on-one meetings in person with representatives from each participating jurisdiction in Bond County to discuss active mitigation projects and develop new mitigation projects to enhance disaster preparedness. Each jurisdiction was given the opportunity to rank hazards in order of highest perceive risk to their community. Jurisdictions also shared information about their current mitigation capabilities and proposed projects in the Jurisdictional Project Grid that they felt were central to their community's needs (see **Mitigation Actions**).

Meeting 4: Review of Hazard Mitigation Plan – November 16, 2023

Meeting Summary: ISWS invited the committee and the public to review the Draft *2024 Bond County Hazard Mitigation Plan* and provide comments at a public meeting. ISWS emphasized the importance of plan maintenance and developed a strategy with the county 911 Coordinator/EMA to check-in with communities. ISWS agreed to draft the plan adoption documents and send them to communities once the HMP was approved.

PLANNING COMMITTEE INFORMATION

The Bond County Planning Committee consists of representatives from ISWS, University of Illinois - Extension, and the Bond County 911 (Table 4). The planning committee has experts in the domains of urban planning, spatial analysis, hazard mitigation, and floodplain management. Planning Committee members attended every Planning Committee and Steering Committee meeting.

Table 4. Bond County Planning Committee.

Planning Team	Organization	Title
Allan Davis	Bond County 911	Director
Becky Blackburn	Bond County 911	Assistant
Jennifer Russell	University of Illinois Extension	Extension Educator, Community and Economic Development
Carrie McKillip	University of Illinois Extension	Community Development Educator
Brad McVay	Illinois State Water Survey	GIS Specialist
Camden Arnold	Illinois State Water Survey	Hazard Mitigation Planner
Meirah Williamson	Illinois State Water Survey	Scientific Specialist
Zoe Zaloudek	Illinois State Water Survey	Geospatial Application Developer

The plan-making process was designed to be inclusive and tailored to individual communities in Bond County. Local and county officials, fire and police departments, hospital representatives, among others, were invited to be a part of the Steering Committee (Table 5). Members of the Steering Committee were invited to attend every Steering Committee meeting.

Table 5. Bond County Steering Committee.

NAME	COMMUNITY/AGENCY REPRESENTED	TITLE
Allan Davis	Bond County 911	Director
Becky Blackburn	Bond County 911	Assistant
Bernard Myers	Bond County	Bond County Board Chairman
Jimmy Leitshuh	Bond County	Sheriff
Tony Brooks	Bond County Coroner	Coroner
Jeremy Pestle	Bond County Highway Dept	Supervisor
Shawn Kloever	Bond County Housing	Manager
Wes Olson	Bond County Unit 2	Superintendent
Troy Oldham	Carlisle Syntec	Supervisor
Bill Walker	City of Greenville	Economic
Brad Iberg	City of Greenville	Mapping
George Schofield	City of Greenville	Public Work Director
Jim Sutton	City of Greenville	Supervisor Water Plant
JoAnn Hollenkamp	City of Greenville	City Manager
Ryan Johnson	City of Greenville	Assist Public Works
Stefan Neece	City of Greenville	Police Chief
Denny Wise	Greenville Fire	Chief
Robert Neer	Greenville Fire	911 Board/Greenville Fire
Suzanne Davis	Greenville University	President
Shawn Foles	Greenville University	Campus Safety Director
Michael Cureton	Mallinckrodt	Supervisor
Patrick Versteeg	Mallinckrodt	Supervisor
Jessica Sexton	Pocahontas/Old Ripley Fire District	EMS Supervisor
Dave Caulk	Shoal Creek Fire District	Chief
Angie Strohkirch	Smithboro	City Clerk
Bill Archibald	Smithboro	Mayor
Daniel Korte	Village of Keyesport	Mayor
Jim Hess	Village of Pierron	Treasurer/Police Officer
Loni Hensler	Village of Pocahontas	Village Clerk
Jane Krankel	Village of Sorento	City Clerk

PUBLIC COMMENT

Public participation is a welcomed and integral part of the hazard mitigation planning process. Unfortunately, due to the COVID-19 pandemic declared by the World Health Organization in March 2020, and weather challenges in the Fall and Winter 2022, robust engagement in public meetings was a challenge. All meetings were available via Zoom as well as in person and were advertised in local papers.

To further encourage public involvement, an internet survey was open from May 25, 2023, through November 30, 2023, to collect the public's opinions on hazards and their community's vulnerability to them. One resident of Bond County completed this survey. A summary of results can be found in **Appendix D: Public Survey Results**.

A web map was created for the collection of comments from community officials and residents of the county. Users were encouraged to mark the locations of critical facilities, roads or areas that frequently flood, places of community or historical significance, mitigation ideas or successes, or any other place that felt important to the mitigation planning process. Between May 25, 2023, through November 30, 2023, comments were left on the topics of critical facilities, flooded roads/areas, and places that are important to the community.

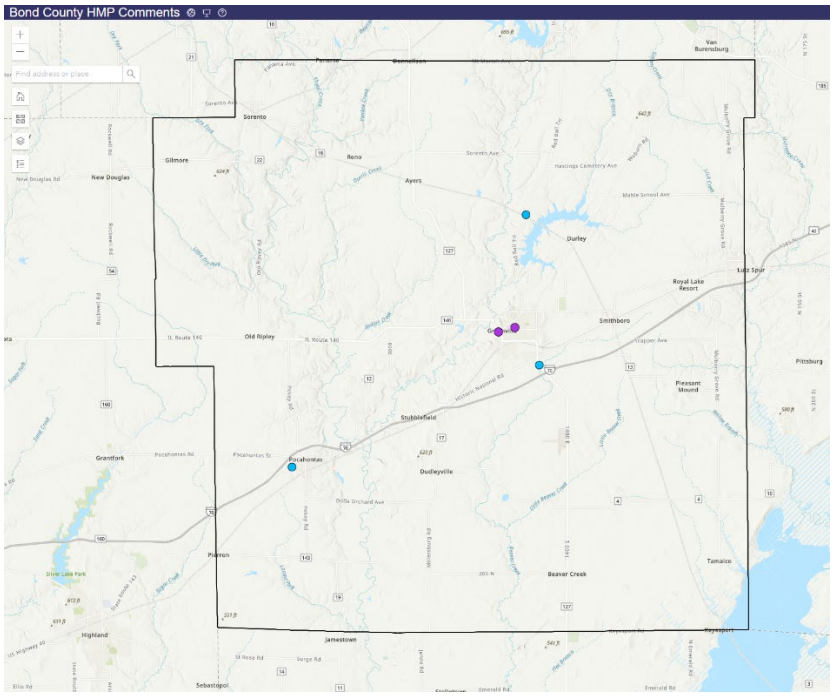


Figure 1. Bond County Comment Web Map.

A public meeting was held on November 16, 2023, to review and allow the public to comment on the Bond County's draft Hazard Mitigation Plan. A comment period for anyone in the communities to provide feedback and input ran from November 17, 2023, until December 31, 2023. Public notifications were distributed by members of the planning committee and local community leaders to share with members of their community that the plan was available for review. Elected officials and representatives from fire and police departments, hospitals, local businesses, and government agencies were invited to represent the communities they serve throughout the process, and act as a voice for their communities when members of the general public were not present. **Appendix B: Meeting Documents** contains the minutes from the public meetings. **Appendix E: Public Notifications** contains articles published by the local newspaper throughout the public input process.

CAPABILITY ASSESSMENT

Each participating jurisdiction has a unique set of capabilities and resources available to accomplish hazard mitigation and reduce long-term vulnerabilities to hazard events. In order to identify these existing capabilities and resources, a Capability Assessment was conducted. The Capability Assessment helps determine the ability of the participating jurisdictions to implement the Mitigation Strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects. It is important to try and establish which goals and actions are feasible based on an understanding of the organizational capacity of those entities tasked with their implementation. This assessment is designed to provide a general overview of the key capabilities in place for each participating jurisdiction along with their potential effect of loss reduction.

To record the existing capabilities of each participant, Capability Assessment Worksheets were distributed to each of the participating jurisdictions following the first Planning Committee meeting on March 30, 2023. The worksheets requested information on four primary types of capabilities described below:

- **Planning & Regulatory Capabilities:** Planning and regulatory capabilities are based on the implementation of existing plans, policies, codes, ordinances, resolutions, local laws, and programs that prevent or reduce the impacts of hazards and guide and manage growth and development.
- **Administrative & Technical Capabilities:** Administrative and technical capabilities are based on the availability of staff, personnel resources, and their related skills and tools that can be used to develop and implement mitigation actions, policies, and programs.
- **Fiscal Capabilities:** Fiscal capabilities include the resources a jurisdiction has access to or is eligible to apply for and use to implement mitigation actions, polices, and programs.
- **Education & Outreach Capabilities:** Education and outreach capabilities include programs and methods already in place that could support the implementation of mitigation actions and communicate hazard-related information.

Many of the participating jurisdictions have limited resources and abilities to expand on and improve the existing policies and programs identified. The lack of legal authority and policies/programs currently in place, especially with regards to building codes and zoning ordinances, which limits the participating jurisdiction's abilities to expand and strengthen existing policies and programs. Often, the participating jurisdiction's fiscal and staffing abilities are also extremely limited; many local community officials are part-time and communities lack the funds to expand or implement new programs and policies.

Overcoming these limitations will require time and a range of actions including, improved general awareness of natural hazards and the potential benefits that may come from the development of new standards in terms of hazard loss prevention and the identification of resources available to expand and improve existing policies and programs should the opportunity arise.

Table 6 summarizes the results of the Capability Assessment for each participating jurisdiction. A capability level of Limited, Moderate or High was assigned by capability type to each participating jurisdiction based on the number of available capabilities and resources as well as the jurisdiction's size/area served.

Table 6. Bond County Capability Assessments.

Capability Type	Bond County	Greenville	Pierron	Pocahontas	Sorento
Comprehensive Plan	X	X	X	X	
Capital Improvements Plan	X		X		
Economic Development Plan				X	
Emergency Operational Plan	X				
Floodplain Management Plan			X		
Storm Water Management Plan			X		
Zoning Ordinance	X	X	X	X	X
Subdivision Regulation/Ordinance		X	X	X	
Floodplain Ordinance		X			
Building Codes		X	X	X	X
Community Rating System					
Level of Capability (Limited, Moderate, High)	**M**	**M**	**M**	**M**	**L**
Planning Commission		X			
Floodplain Administration		X			
GIS Capabilities	X	X			
Chief Building Official		X		X	
Civil Engineering	X	X			
Grant Manager	X	X			
Mutual Aid Agreement	X		X		
Level of Capability (Limited, Moderate, High)	**M**	**H**	**L**	**L**	**L**
Applied for Grants in the Past	X	X	X	X	X
Awarded a Grant in the Past	X	X	X	X	X
Authority to Levy Taxes for Specific Purposes				X	X
Gas/Electric Service Fees				X	
Storm Water Service Fees					X
Water/Sewer Service Fees		X	X	X	X
General Obligation Revenue or Special Tax Bonds	X				
Level of Capability (Limited, Moderate, High)	**M**	**M**	**M**	**M**	**M**
Local groups/non-profit organizations focused on disaster preparedness and response (Ex. CERT Teams, Red Cross, etc.)	X	X			
Ongoing public education or information program (Ex. responsible water use, fire safety, household preparedness, etc.)	X	X			
Disaster or Safety Related School Programs	X	X			
Level of Capability (Limited, Moderate, High)	**H**	**H**	**L**	**L**	**L**
Does the community have the financial resources to implement mitigation projects?	L	L	M	L	L
Does the community have the staff/expertise to implement projects?	L	L	M	L	L
Is there community support to implement projects?	L	L	M	L	M
Does the community staff have time to devote to hazard mitigation?	L	L	M	L	M
Overall Capability (Limited, Moderate, High)	**L**	**L**	**M**	**L**	**M**

Capability assessments for jurisdictions across Bond County can be found in **Appendix C: Capability Assessment.**

NEIGHBORING COMMUNITIES AND SPECIAL DISTRICTS

Bond County is located in southern Illinois and is bordered by four Illinois counties:

- **Madison County:** Situated to the west of Bond County, Madison County is part of the Metro East St. Louis, MO-IL Metropolitan Statistical Area, and has a population of 264,776 and its county seat is Edwardsville.
- **Montgomery County:** Montgomery County is located to the north of Bond County According to the 2020 census, it had a population of 28,288. Its county seat is Hillsboro.
- **Fayette County:** This county located to the east of Bond County is home to 21,482 people and the county seat is Vandalia.
- **Clinton County:** Clinton County is located south of Bond County. The county seat is Carlyle and as of 2020, has a population of 36,899. Clinton County is part of the Metro East St. Louis, MO-IL Metropolitan Statistical Area.

Bond County is served by six school districts:

- Bond County Community Unit School District #2
- Carlyle Community Unit School District #1
- Highland Community Unit School District #5
- Hillsboro Community Unit School District #3
- Mulberry Grove Community Unit School District #1
- Vandalia Community Unit School District #203

Bond County is served by seven fire protection districts, which respond to emergencies across the county. All of the fire departments are operated entirely by volunteers.

ISO fire ratings, also referred to as fire scores, rate fire protection districts on a scale of 1 to 10 to indicate how a fire department is able to protect its community. A score of 1 is the best score a fire protection district can receive while a score of 10 is the worst score. Table 7 shows city and rural ISO fire ratings for districts that serve Bond County. City ISO scores refer to the ability of a fire protection district to serve an area with fire hydrants, while rural ISO scores refer to areas without fire hydrants.

Table 7. Fire protection districts and ISO scores

Fire Protection District	City ISO	Rural ISO	Number of Firefighters
Greenville	4/4		30
Highland-Pierron		4/8	-
Keyesport		7/8	18
Mulberry Grove		5/5	18
Pocahontas-Old Ripley		6/6	25
Shoal Creek		6	25
Smithboro		9/9	23

REVIEW OF TECHNICAL DOCUMENTS

The literature review that was undertaken to prepare this plan document involved a study of several "best practice" plans. These best practice plans have been analyzed to borrow elements that have been drafted with the utmost care and consideration. Reviewing these plans helps to synthesize a comprehensive, all-encompassing hazard mitigation plan that covers every possible detail about natural hazard risk mitigation by providing robust and strategic mitigation mechanisms tailored to specific communities and their capabilities.

Table 8. Review of technical documents.

Document	Element
Bond County 2010 Hazard Mitigation Plan	Review of previous hazards and goals
Bond County Zoning Ordinance	Review of building codes, zoning, and fire prevention and protection
Flood Risk Preparedness - Sid Simpson Levee Breach Analysis (2020)	Flood history and potential impacts in the event of a levee breach
Beardstown Municipal Code	Building regulations, planning and development, floods, fire prevention and protection, and zoning
Greenville, IL Code of Ordinances	Review of building codes, zoning, and fire prevention and protection
Greenville Comprehensive Plan (2005)	Review of community planning efforts and community vision
Bond County GIS Database	
2023 Illinois Natural Hazard Mitigation Plan	Guidance on hazards and mitigation measures and historical disasters in Illinois
IEMA - Repetitive Loss Data	Repetitive loss structures and mitigation status
Local Mitigation Planning Handbook (2023)	Best practices and planning guidance
National Oceanic and Atmospheric Administration (NOAA) / National Water Service Storm Prediction Center	Severe weather data and narratives of historical events
US Census Bureau	2020 census data and 2021 American Community Survey (ACS) 5-year estimates
USGS Earthquake Catalog	Earthquake data

PLAN REVIEW PROCESS

Once the state is satisfied that the plan meets the requirements, the State Hazard Mitigation Officer (SHMO) will forward the plan to the FEMA Regional Office for review and approval. FEMA will conduct its review within 45 days and provide a completed Local Mitigation Plan Review Tool to the state.

Approvable Pending Adoption

To fast-track the approval process, FEMA encourages communities to submit the final draft of the mitigation plan to the State and FEMA for review before formal adoption by the elected officials or other authorized governing bodies. This will allow for revisions to be made to the plan in case FEMA requires it.

Plan Approval

Upon receiving the record of adoption from the State, FEMA will issue an official approval letter deeming communities eligible for FEMA Hazard Mitigation Assistance programs. FEMA also sends a final *Local Mitigation Plan Review Tool* that provides feedback on the strengths of the plan, recommendations for plan improvements during future updates, and suggestions to the plan for implementing mitigation strategies.

PLAN IMPLEMENTATION

Plan Adoption

FEMA outlines adoption mechanisms for both single-jurisdictional plans as well as multi-jurisdictional plans. The plan shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County commissioner, Tribal Council).

Adoption by the local governing body demonstrates the community's commitment to implementing the mitigation strategy and authorizes responsible agencies to execute their actions. For final approval, the community must adopt the plan and send the documentation required for formal adoption to IEMA, which is responsible for forwarding this documentation on to FEMA Region 5. See **Appendix G: Adoption Resolutions**.

The Bond County Hazard Mitigation Plan for 2024-2029 was adopted by the City of Greenville on March 12, 2024. The plan received approval on April 19, 2024 The plan is active for five years following the approval date. **The plan will expire on April 19, 2029.** A full update must be completed within five years to maintain Hazard Mitigation Assistance funding eligibility.

Plan Maintenance

The plan maintenance process is designed to provide:

- A description of the method and schedule for monitoring, evaluating, and updating the mitigation plan within a five-year cycle:
    - **Plan monitoring**: A method and schedule for regular monitoring would ideally include reports or other deliverables and expectations for meeting attendance. Monitoring, therefore, becomes part of the regular administrative function of the offices or positions to which it is assigned.
    - **Plan evaluation**: Evaluation of the plan may not occur as frequently as plan monitoring, but it is a critical step to ensure that the plan continues to serve its purpose effectively. At a minimum, communities are required to convene the planning team annually to evaluate the plan's effectiveness and to prepare a report for their governing bodies that demonstrates progress to date.
- A description of how local jurisdictions can incorporate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate.
- A discussion on how the community will continue public participation in the plan maintenance process.

Monitoring, Evaluating, and Updating the Plan

Throughout the five-year planning cycle, the Bond County 911 Director will reconvene the HMP Planning Committee to monitor, evaluate, and update the plan on an annual basis. An additional meeting will be held in late 2027 to address the five-year update of this plan. Members of the planning committee are readily available to engage in email correspondence between annual meetings. If the need for a special meeting, due to new developments or a declared disaster occurs in the county, the team will meet to update mitigation strategies. Depending on grant opportunities and fiscal resources, mitigation projects may be implemented independently by individual communities or through local partnerships.

The committee will review the county goals and objectives to determine their relevance to changing situations in the county. In addition, state and federal policies will be reviewed to ensure they are addressing current and expected conditions. The committee will also review the risk assessment portion of the plan to determine if this information should be updated or modified. The parties responsible for the various implementation actions will report on the status of their projects, and will include which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies should be revised.

Updates or modifications to the HMP during the five-year planning process will require a public notice and a meeting prior to submitting revisions to the individual jurisdictions for approval. The plan will be updated via written changes, submissions as the committee deems appropriate and necessary, and as approved by the county commissioners.

The GIS data used to prepare the plan was obtained from existing county GIS data as well as data collected as part of the planning process. The updated Hazus GIS data has been returned to the county for use and maintenance in the county's system. As newer data becomes available, this updated data will be used for future risk assessments and vulnerability analyses.

Implementation through Existing Programs

The results of this plan will be incorporated into ongoing planning efforts since many of the mitigation projects identified as part of this planning process are ongoing. Bond County and its incorporated jurisdictions will update the zoning plans and ordinances as necessary and as part of regularly scheduled updates. Each community will be responsible for updating its own plans and ordinances.

Based on conversations with Steering Committee members, none of the jurisdictions who participated in the original Plan have incorporated it into other planning mechanisms within their jurisdictions. This is due in part to the size, fiscal and staffing situations, and technical capacity of the participants. Ongoing planning efforts will have the updated *2024 Bond County Hazard Mitigation Plan* available to better align goals and projects with existing programs throughout the communities.

Adoption of this Plan update will trigger each participating jurisdiction to review and, where appropriate, integrate the Plan into other available planning mechanisms. The HMP planning committee's annual review will help maintain awareness of the Plan among the participating jurisdictions and encourage active integration of the Plan into their day-to-day operations and other planning mechanisms. There is no indication that the County or any of the participating jurisdictions will be adopting, reviewing, or strengthening current policies or programs in the near future.

Most of the participating jurisdictions have limited capabilities, as seen in the **Capability Assessment** section, to integrate the mitigation strategy and other information contained in the Plan update into existing planning mechanisms. These jurisdictions are small in size and do not have the financial resources or trained personnel to develop planning mechanisms such as comprehensive plans or building and zoning ordinances.

Continued Public Involvement

Continued public involvement is critical to the successful implementation of the HMP. Comments from the public on the HMP will be received by the Bond County 911 Director and forwarded to the HMP planning committee for discussion. Educational efforts for hazard mitigation will be ongoing through the Bond County 911 Director. The public will be notified of periodic planning meetings through notices in the local newspaper. Once adopted, a copy of this plan will be maintained in each jurisdiction and in the Bond County 911 Office.

The next Plan update will continue to prioritize public involvement and opportunities will be made available for the community and stakeholders to comment on proposed revisions.

SECTION 3

COUNTY PROFILE

GEOGRAPHIC PROFILE

Bond County is a rural county located in south-central Illinois. Founded in 1817, as part of the Illinois Territory, it was named for Shadrach Bond. Shadrach Bond was a farmer, politician, and colonel during the War of 1812, and became the first governor for Illinois in 1818.[1] At 383 square miles Bond County is one of the smallest counties in Illinois, with ten municipalities and nine townships (Figure 2). Greenville was selected as the county seat in 1821 when Fayette and Montgomery Counties were formed. Established in 1815 by George Davidson, Greenville had its first Federal Post Office in 1819, became a town in 1855 and a city in 1872.[2] The origin of the name Greenville is unknown. Some believe it was named after Greenville, North Carolina; others speculate it was named because early settler Thomas White said it was "so green and nice.". A third possibility is that Greenville got its name from the town's first merchant, Green P. Rice.

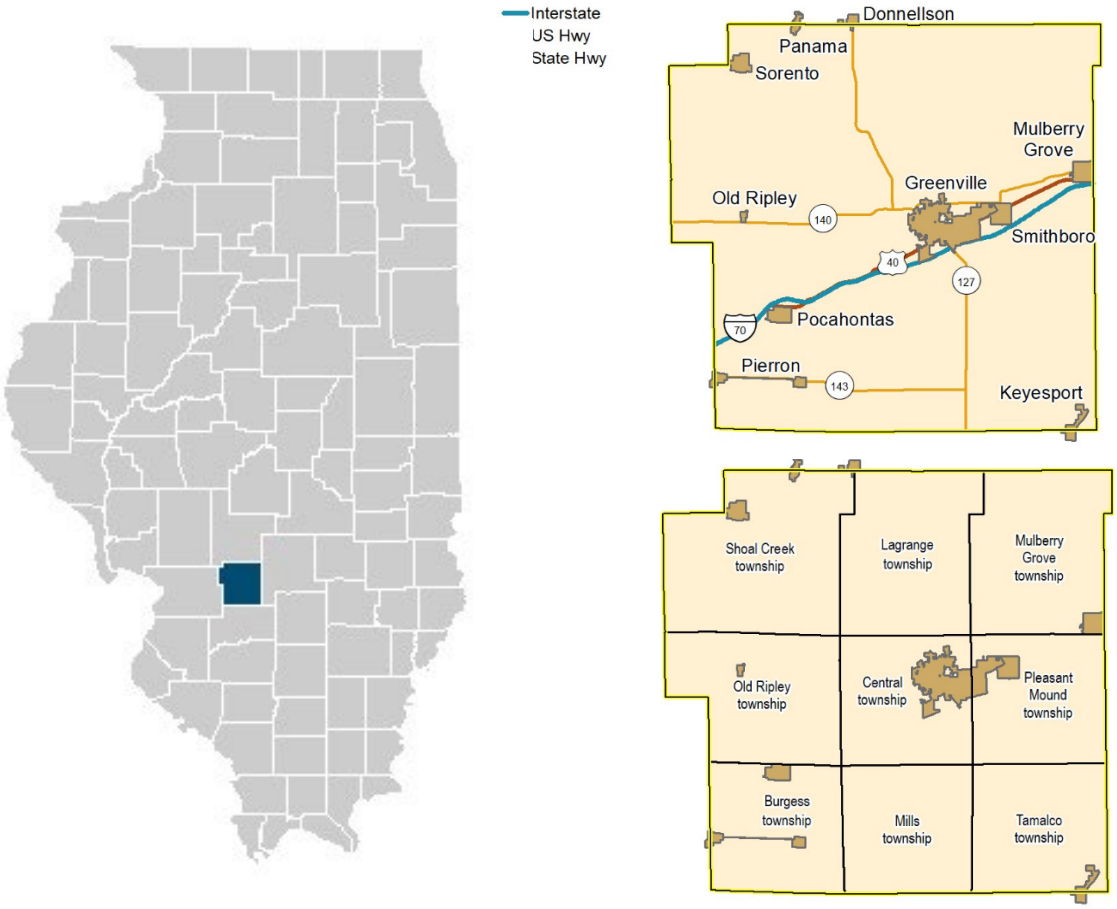


Figure 2. Bond County, jurisdictions, and townships.

[1] Bond County Historical Society. (n.d.). *County History*. Retrieved from https://www.bondcountyhistorical.org/county.html

[2] Greenville - Illinois. (n.d.). *History of Community.* Retrieved from https://www.greenvilleillinois.com/index.asp?SEC=A677E485-E9C6-49CC-8820-B92B883B4AF5&DE=4879FE8B-3A6C-4388-9CD0-740A5B168152

Landscape

Located in the Southern Till Plain biome, which is characterized by high clay content soils, the majority of Bond County is covered by cropland interspersed with deciduous forests and pasture (Figure 3).[3]

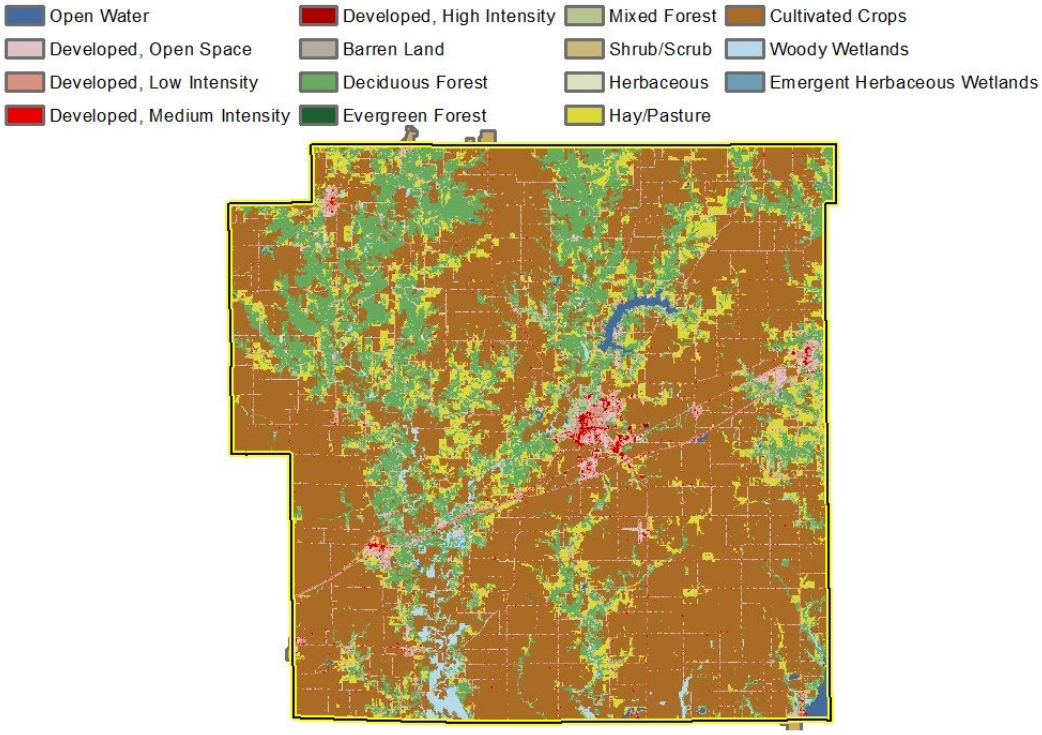


Figure 3. Land cover in Bond County.
Source: Multi-Resolution Land Characteristics (MRLC) Consortium, National Land cover Database (NLCD)

Elevation in the county ranges from more than 589 feet above sea level along the northern border of the county near Sorento, Panama and Donnellson to 473 feet above sea level along the Shoal Creek, East Fork Shoal Creek, and the southeastern part of the county (Figure 4).

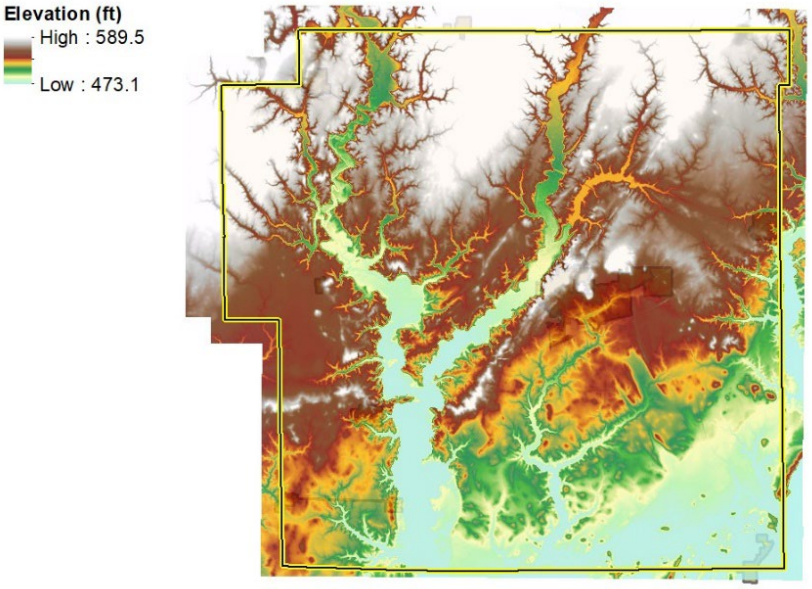


Figure 4. Topography of Bond County. Source: Illinois State Geological Survey (ISGS)

[3] Illinois Natural History Survey. *Natural Divisions*. Retrieved from https://publish.illinois.edu/inhseducation/biodiversity/natural-divisions/

Bond County contains part of 3 watersheds. A watershed, or drainage basin, is the land area that drains directly to a common stream, river, or lake. Bond County falls within the Lower Kaskaskia Watershed, the Shoal Watershed, and the Middle Kaskaskia Watershed (Figure 5). Shoal Creek, East Fork Shoal Creek and Beaver Creek flow through the county. Governor Bond Lake is a crucial water feature in the county, as well as Carlyle Lake.

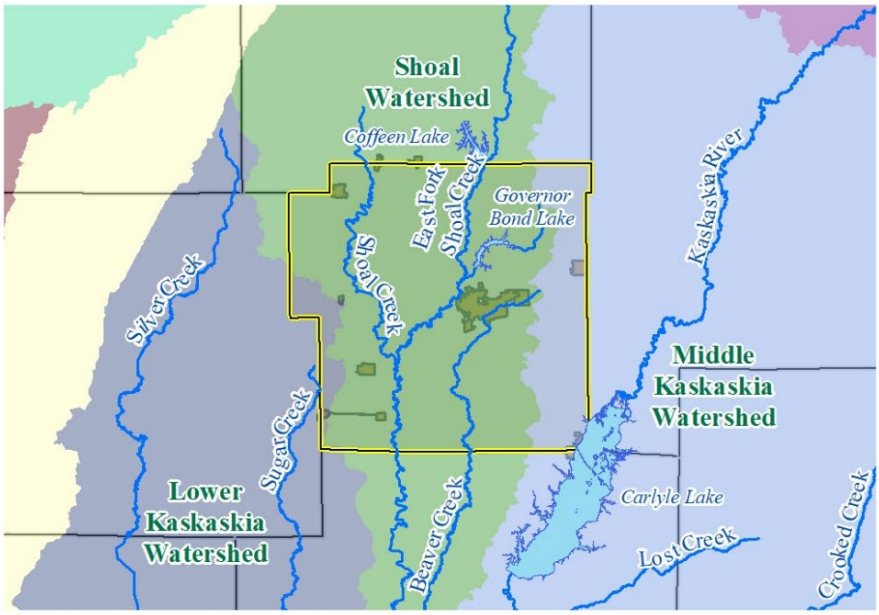


Figure 5. Hydrologic features in Bond County.

Natural Resources

Bond County is home to Governor Bond Lake and a portion of Carlyle Lake lies within the southeastern corner of the county. Governor Bond Lake is a manmade lake built in the 1960s, and provides recreational opportunities such as fishing, boating and camping. Carlyle Lake resides mostly in neighboring Clinton County to the south. Residents of Bond County are frequent visitors to Carlyle Lake and enjoy the many amenities the lake has to offer, including boating, picnicking, water sports, hiking, and camping. The natural areas in Bond County are home to a variety of wildlife. As of April 2023, Bond County is home to 8 threatened or endangered species (Table 9).[4]

Table 9. Threatened and endangered species. Source: IDNR.

Scientific Name	Common Name	State Status
Lanius ludovicianus	Loggerhead Shrike	Endangered
Myotis septentrionalis	Northern Long-eared Myotis	Threatened
Myotis sodalis	Indiana Bat	Endangered
Nycticorax nycticorax	Black-crowned Night-Heron	Endangered
Sabatia campestris	Prairie Rose Gentian	Endangered
Sistrurus catenatus	Eastern Massasauga	Endangered
Spiranthes vernalis	Spring Ladies' Tresses	Endangered
Terrapene ornata	Ornate Box Turtle	Threatened

Bond County's natural areas are an important part of its history and are enjoyed by many of the inhabitants in and around the county. In the event of a natural hazard, natural areas can become inaccessible for days to months. Flood waters may need to fall, trees may need to be removed from roads or trails, and buildings may need repairs to make natural areas accessible after a disaster. This can negatively impact tourism and the quality of life for local residents.

[4] Illinois Department of Natural Resources. (2023, April). Illinois Natural Heritage Database – Illinois Threatened and Endangered Species by County. https://dnr.illinois.gov/content/dam/soi/en/web/dnr/espb/documents/ETCountyList_Apr2023.pdf

Climate

The climate of Illinois is continental with cold winters, warm and humid summers, and moderate spring and fall temperatures. Changes in temperature, humidity, cloudiness, and wind direction occur frequently. Located in the Southern Illinois Climate region, Bond County averages nearly 40 days above 90°F and 80 days below 32°F per year. Measurable precipitation occurs on nearly 100 days of the year, with and 13 days with more than 1 inch of precipitation.[5] Bond County on average experiences its warmest temperatures in July and coldest temperatures in January. The area receives the most rainfall in late spring and early summer (Table 10).

Table 10. Temperature and precipitation 30-year normals for station VANDALIA (USC00118781) and GREENVILLE (USC00113693). Source: NCEI, 1991-2020

Month	**Temperature Normals (Vandalia)**			**Precipitation Normals (Greenville)**	
	Maximum (°F)	*Minimum (°F)*	*Average (°F)*	*Precipitation (in)*	*Snowfall (in)*
Jan	36.9	20.7	28.8	2.77	4.1
Feb	41.9	24.2	33.0	2.40	4.1
Mar	52.7	33.2	42.9	3.11	1.4
Apr	65.1	43.3	54.2	4.60	0.1
May	74.9	54.2	64.6	4.59	0.0
Jun	83.7	63.2	73.5	3.85	0.0
Jul	86.8	66.6	76.7	4.05	0.0
Aug	85.9	64.4	75.2	3.97	0.0
Sep	79.6	55.8	67.7	3.21	0.0
Oct	67.7	44.0	55.8	3.24	0.0
Nov	53.7	34.1	43.9	3.52	0.1
Dec	41.5	25.6	33.6	2.32	2.1
Annual	64.2	44.1	54.2	41.63	11.9

Built Environment

Building Inventory

A structure-based asset inventory, or building inventory, was compiled for Bond County. The building inventory was created using the National Structure Inventory developed by the US Army Corps of Engineers (USACE).

Building Exposure

Exposure consists of an estimation of the total replacement cost of all buildings in Bond County represented in 2022 US dollars. Values were taken from the Hazus General Building Stock (GBS) database which is aggregated to the census block level. The total replacement cost values contain both the structure cost of the building as well as its contents. Table 11 shows the exposure based

Table 11. Building exposure by occupancy.

Occupancy Class	**Total Exposure (2022 USD)**	**Percent of Total**
Residential	$3,125,210,000	44.15
Commercial	$1,742,092,000	24.61
Industrial	$360,032,000	5.09
Agriculture	$1,301,288,000	18.38
Religious	$63,822,000	0.90
Government	$90,452,000	1.28
Education	$395,829,000	5.59
Total	**$7,078,725,000**	**100**

[5] Illinois State Climatologist. "Climate of Illinois". Retrieved from https://stateclimatologist.web.illinois.edu/climate-of-illinois/

on the occupancy class, or use class, of the buildings. Table 12 contains the building exposure for each incorporated community and unincorporated Bond County.

Table 12. Building exposure by community

Community	Total Exposure (2022 USD)	Percent of Total
Village of Donnellson	946,000	0.01
City of Greenville	2,653,026,000	37.48
Village of Keyesport	60,713,000	0.86
Village of Mulberry Grove	201,501,000	2.85
Village of Old Ripley	18,822,000	0.27
Village of Panama	75,800,000	1.07
Village of Pierron	195,015,000	2.75
Village of Pocahontas	203,630,000	2.88
Village of Smithboro	36,155,000	0.51
Village of Sorento	101,244,000	1.43
Unincorporated Bond County	3,531,873,000	49.89
Total	**7,078,725,000**	**100**

Transportation Network

State and national highways 40, 70, 127, 140, and 143 connects the communities of Bond County (Figure 6). Notably, railways run through or near Greenville, Keyesport, Mulberry Grove, Panama, Pierron, Pocahontas, Smithboro and Sorento.

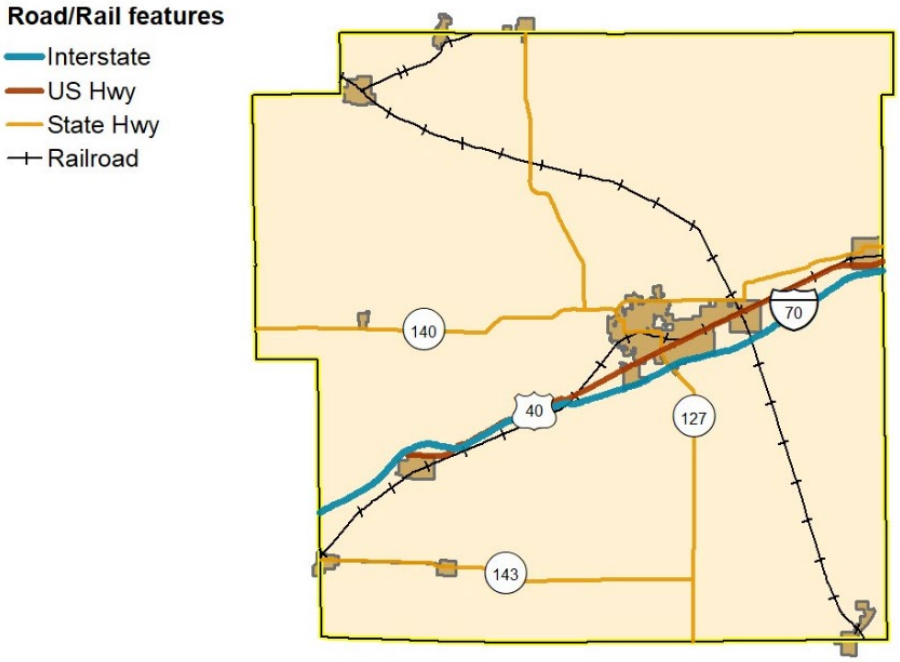


Figure 6. Bond County Roads and Rail Features. Source: IDOT, US Census.

Historic Places

Historic properties and cultural resources contribute to the identity and uniqueness of a community and can cause harm to a community's sense of place if they are damaged or destroyed during a disaster. Damage to historic properties and cultural resources can also cause economic fallout, particularly to the tourism sector. Mitigation actions, such as property improvement and regulatory actions, can be taken to lessen the risk of damage.

Two structures are listed on the National Register of Historic Places: the Greenville Public Library and the Old Main building at Almira College, also known as Hogue Hall. Hogue Hall is no longer standing; in its place is Hogue Tower Memorial recreated in the shape of the iconic tower that was in the center of Hogue Hall.

The Greenville Public Library is a Carnegie Building, opened in 1905 (Figure 7). The library is a member of the Lewis & Clark Library system which provides technical support and inter-library loan services across 8 counties.

Figure 7. Bond County historic sites.

DEMOGRAPHICS

Population

Bond County has a current population of 16,725 according to the 2020 U.S. Census and had a 6.2% decrease in population since the 2010 census (Table 13). Donnellson, Pierron and Old Ripley have experienced the most significant decrease in population. Greenville is the only community who has experienced an increase in population since 2010. Overall, Bond County has seen about 1,000 people move out over the last two decades. The county has a density of 43 inhabitants per square mile.

Table 13. Bond County and community population trends. Source: U.S. Census

Community	2000	2010	2020	Population Change 2010-2020 Census (%)
Bond County	17,633	17,768	16,725	-6.2%
Donnellson	224	210	153	-37.3%
Greenville	6,992	7,000	7,083	1.2%
Keyesport	481	421	406	-3.7%
Mulberry Grove	668	634	520	-21.9%
Old Ripley	108	108	82	-31.7%
Panama	330	343	337	-1.8%
Pierron	611	600	459	-30.7%
Pocahontas	741	784	697	-12.5%
Smithboro	195	177	154	-14.9%
Sorento	658	498	429	-16.1%

The historic population estimate shows how population grew exponentially during 1840-1880 with the onset of the Industrial Revolution that brought jobs and consequently people into the county (Figure 8). The county's population reached a high population of 17,075 in 1920 and experienced its peak population of 17,768 in 2010 and has seen a slight decline since then.

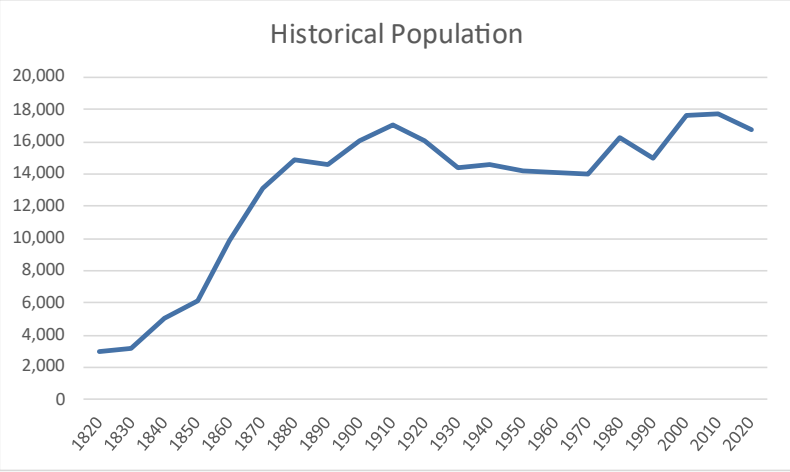


Figure 8. Historic population estimates of Bond County (1840-2020). Source: U.S. Census.

Age & Sex

The age and sex pyramid reveals information about the county's residents (Figure 9). The bulge in the pyramid suggests a large portion of the population is between the ages of 25-39 years and 55-64 years. The average age of the county is 41.5 years. Youth comprise a large portion of the county's populace, with those aged 15 to 19 predominantly being boys. The middle-aged portion of the county's populace tend to be equally distributed across both sexes. However, the county's senior population is largely female.

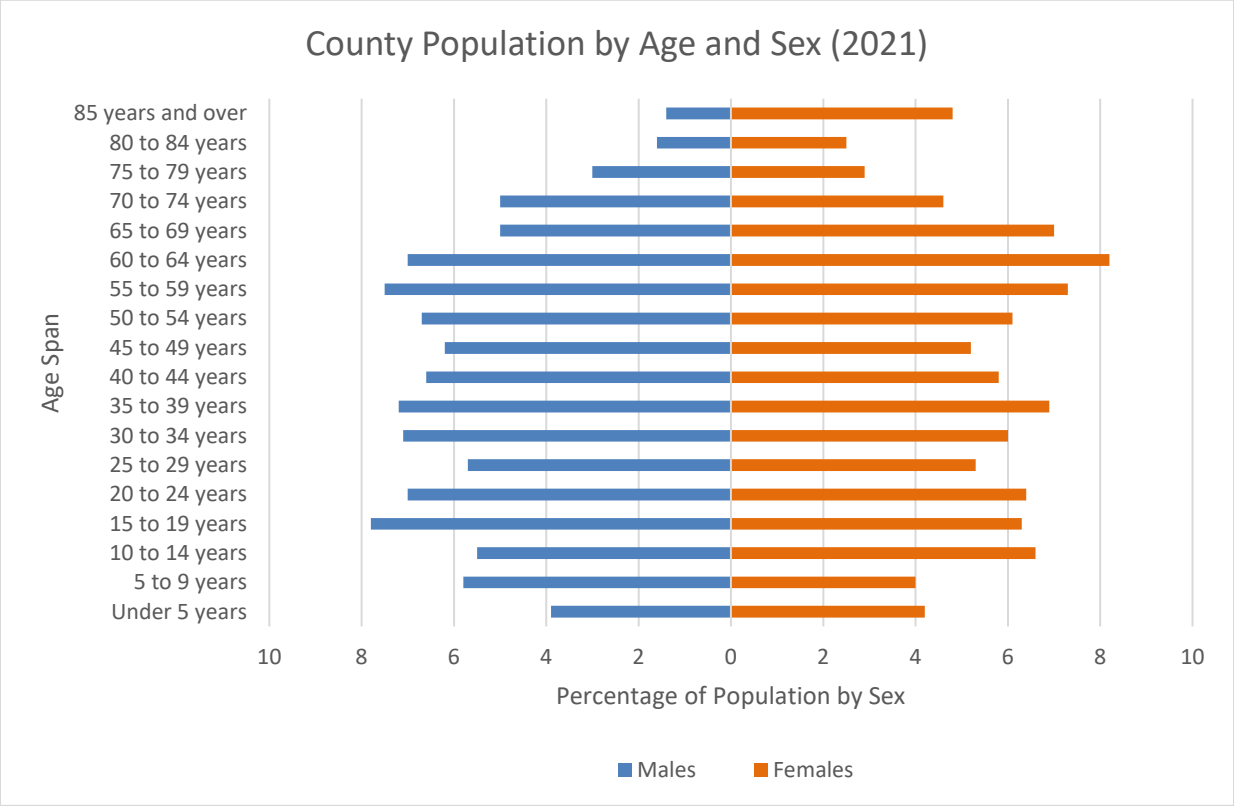


Figure 9. Community population by age and sex (2021). Source: U.S. Census.

Race and Ethnicity

Bond County's racial composition is predominantly white with 6.4% identifying as Black or African American (Table 14).

Table 14. Community population by race & ethnicity (ACS 2021). Source: U.S. Census.

Race	**Bond County (2021)**	
White	14,264	85.3%
Black or African American	1,073	6.4%
American Indian and Alaska Native	52	0.3%
Asian	94	0.6%
Native Hawaiian and Other Pacific Islander	11	0.1%
Some other race	93	0.6%
Two or more races	534	3.2%
Ethnicity		
Hispanic/Latino	604	3.6%

Education Levels

The number of high school graduates is uniformly distributed across all the communities aside from Old Ripley, Mulberry Grove, Panama, and Sorento (Figure 10). The county has a relatively low proportion of people without complete schooling. Greenville and Pocahontas account for a significant portion of the region's population with a bachelor's degree or higher. Overall, 88.8% of the county populace has attained at least a high school graduate level education.

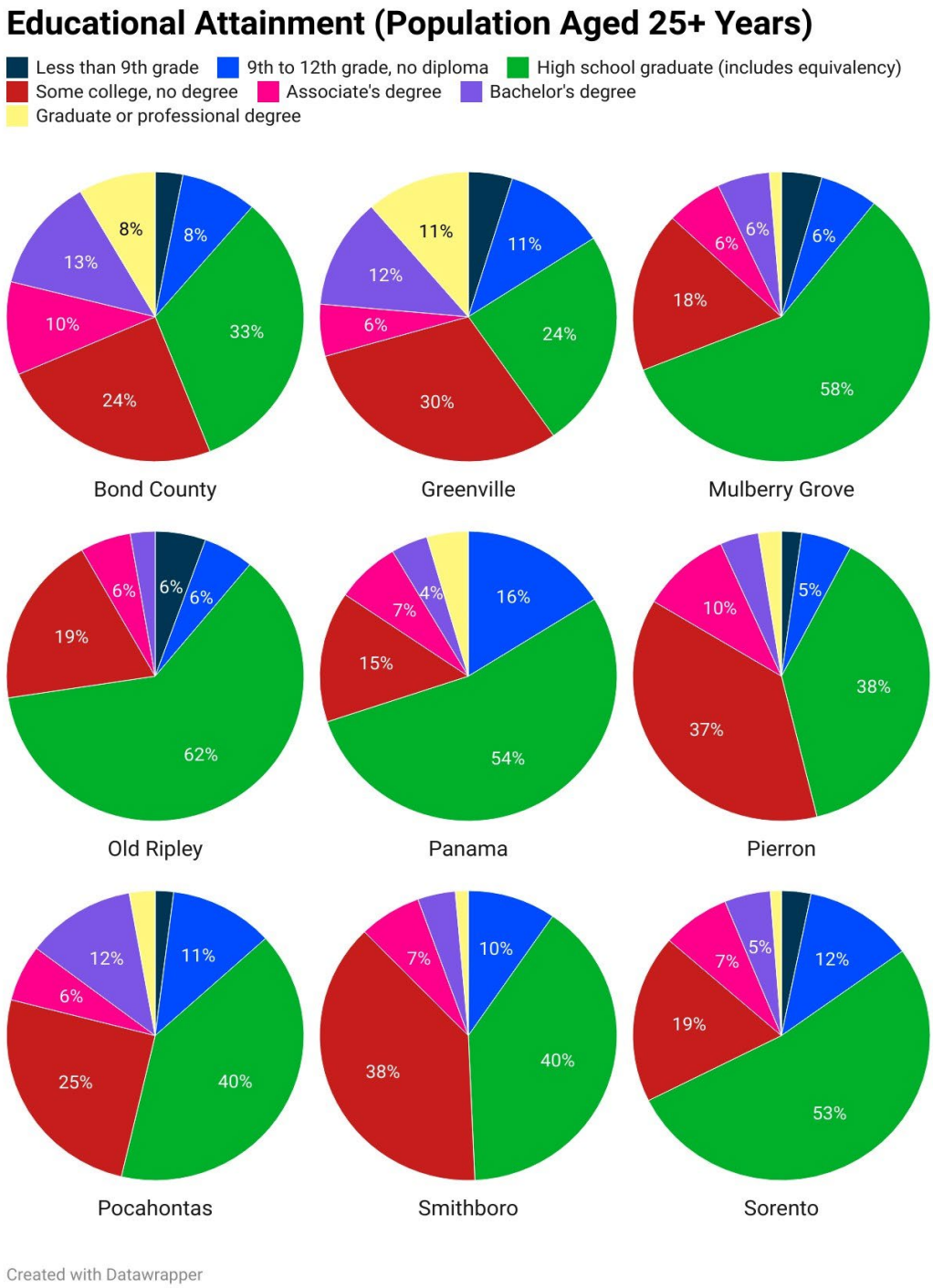


Figure 10. Educational attainment in Bond County (population aged 25+), 2020. Source: U.S. Census

Income

The median household income in Bond is $53,654, with an unemployment rate of 3.8%, as of the 2020 U.S. Census (Table 15).[6] Pierron has the highest median household income and among the lowest unemployment rate, while Keyesport has the lowest median household income and the highest unemployment rate. About 15.1% of the county lives below the poverty line.

Table 15. Community unemployment, income, and poverty (2021). Source: ACS

Community	Unemployment Rate (%)	Median Household Income ($)	Population Below Poverty Line (%)
Bond County	3.8%	53,654	15.1%
Donnellson	18.8%	-	62.5%
Greenville	1.5%	45,961	20.7%
Keyesport	20.1%	34,352	29.3%
Mulberry Grove	3.5%	44,583	26.0%
Old Ripley	8.1%	66,875	0.0%
Panama	5.5%	56,875	9.8%
Pierron	1.5%	70,417	12.5%
Pocahontas	3.5%	46,406	16.5%
Smithboro	19.4%	39,583	20.2%
Sorento	8.1%	35,417	21.4%

Housing

Greenville accounts for the highest proportion of housing units in the county (Table 16). There is relatively low homeowner vacancy rates throughout the county, aside from Old Ripley, while rental vacancy rates are quite high in Keyesport and Greenville. The highest payable median rent is found to be for rental properties in Pierron. The average rent in Bond County is $627, which is below the Illinois median rent of $1,097.

Table 16. Community Housing Occupancy & Rental Market. Source: ACS

Community	Total Housing Units	Homeowner Vacancy Rate (%)	Rental Vacancy Rate (%)	Occupied Units Paying Rent	Median Gross Rent ($)
Bond County	6,902	1.8	9.1	1,316	627
Donnellson	96	6.6	0.0	11	575
Greenville	2,427	3.5	8.9	882	539
Keyesport	298	2.7	17.3	56	533
Mulberry Grove	358	2.4	0.0	49	720
Old Ripley	32	10.0	0.0	2	-
Panama	137	3.8	0.0	11	742
Pierron	225	0.0	0.0	38	857
Pocahontas	335	0.0	6.4	65	842
Smithboro	85	0.0	0.0	0	-
Sorento	252	3.6	0.0	32	488

[6] Economic Census Bureau

ECONOMY AND INDUSTRY

The industry mix in Bond County is dominated by educational services followed by manufacturing, transportation and warehousing, and then by retail trade sectors (Figure 11). The county is also involved in agriculture, mining, forestry, construction and public administration, among other sectors.

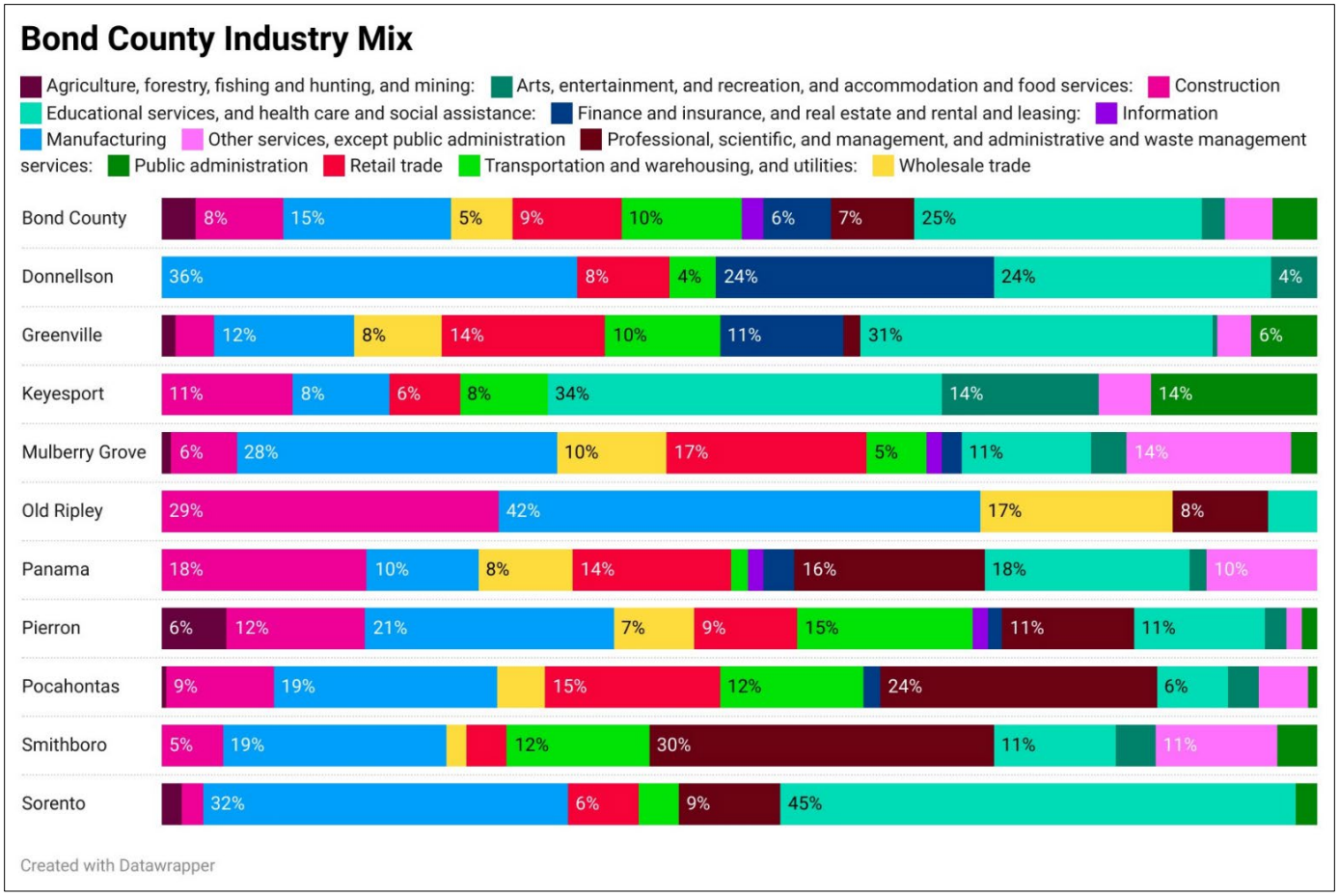


Figure 11. Community Occupational Statistics by Industry (2021). Source: US Census.

Major employers in the county include Greenville University, DeMoulin Brothers, Mallinckrodt Pharmaceuticals, HSHS Holy Family Hospital, Nevco Scoreboard, Bass Mollet Publishing, Carlisle Syntec, and Bond County Community Unit 2 Schools.

Greenville has many advantages as a site for industry, with a business and technology park, an industrial park, rail service and business incentives, Greenville provides many opportunities for prospective businesses.

Agriculture

Bond County lies in the corn belt region and corn and soybeans dominate most of its land area (Figure 12). Roughly 70.5% of the total land in Bond County is used for farmland. Approximately 87% of the farmed lands are used for cropland, 4% for pastureland, 6% for woodland, and 3% for other.[7]

Figure 12. Bond County crop cover.

The average number of farms decreased in this region by 4% since 2012 while the average sizes also decreased by 10% (Table 17). Overall farmed lands have decreased and now make up just over 70% of Bond County's land cover.

Table 17. Farm and crop overview (2012-2017). Source: Census of Agriculture

Commodity	**2017**	**Change since 2012**
Number of Farms	637	-4%
Area of Farmland (acres)	172,840	-13%
Average Size of Farm (acres)	271	-10%
Top crops in Acres	**Crop area (acres)**	
Soybeans	79,234	
Corn	52,929	
Wheat	9,099	

[7] USDA. 2017. National Agricultural Statistics Service. Census of Agriculture. https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Illinois/cp17005.pdf

NATIONAL FLOOD INSURANCE PROGRAM

The National Flood Insurance Program (NFIP) is a federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses. A jurisdiction's eligibility to participate is premised on their adoption and enforcement of state and community floodplain management regulations intended to prevent unsafe development in the floodplain, reducing future flood damages.[8] If a community adopts and enforces a floodplain management ordinance to reduce future flood risk to new construction in floodplains, the federal government will make flood insurance available within the community as a financial protection against flood losses (Table 18). To ensure compliance with the program, communities must continue to enforce their local floodplain management ordinances. In Illinois, most communities have adopted the State of Illinois Model Ordinance that goes above and beyond NFIP minimum standards and are much more restrictive than NFIP minimums.

Table 18. Community participation in the NFIP

Jurisdiction	Participating	Date Joined	Current Effective FIRM Date	SFHA Present
Bond County	Y	1/4/1985	1/4/1985	Y
Donnellson	N			N
Greenville	Y	8/5/1985	8/5/1985	Y
Keyesport	suspended	8/2/2007*	8/2/2007	Y
Mulberry Grove	N			Y
Old Ripley	N			N
Panama	N			Y
Pierron	N			Y
Pocahontas	N			Y
Smithboro	N			Y
Sorento	N			Y

* Village of Keyesport effective FIRM is a Clinton County FIRM; no effective FIRM within Bond County

Flood maps generated by FEMA to support the NFIP are the primary source of information on the location of special flood hazard areas (SFHA) in the state. Flood Insurance Studies (FIS) and Flood Insurance Rate Maps (FIRM) are issued by FEMA following a detailed engineering analysis of flood hazard areas. The FIS and FIRM identify 1%-annual-chance flood elevations and boundaries for selected stream reaches in the community. The FIRM contains flood elevation information for various flood frequencies and may also delineate floodway boundaries. Bond County's FIRMs can be viewed on https://msc.fema.gov/portal/home. Bond County's effective maps are currently in paper format. The Illinois State Water Survey, on behalf of FEMA, is currently in the process of updating effective maps in Bond County.

Repetitive loss properties are defined as any insurable building for which the NFIP paid two or more claims of at least $1,000 over a ten-year period. There are no repetitive loss properties in Bond County.

[8] Federal Emergency Management Agency. "Flood Insurance". https://www.fema.gov/flood-insurance/work-with-nfip/community-status-book

FEMA Guidance specifies that NFIP flood insurance claim information is subject to The Privacy Act of 1974 (As Amended). The Act prohibits public release of policy holder names, or names of financial assistance recipients and the amount of the claim payment or assistance.

After flooding events, local officials are responsible for inspecting flood damaged structures in the special flood hazard area (SFHA) to determine if they are substantially damaged (50% or more damaged). If so, the property owner is required to bring the non-conforming structure into compliance with the local floodplain ordinance. The Illinois Department of Natural Resources (IDNR) created a tool for communities to use with steps to take following a flood.[9] Communities can also contact Illinois Association for Floodplain and Stormwater Management (IAFSM) for additional support following a flood for help with future flood prevention.

In Bond County, local floodplain management is the responsibility of the Bond County Floodplain Administrator. At the time of this publication, Zoning Administrator, Brad Criner, is the Bond County Floodplain Administrator. Bond County will continue to educate these jurisdictions on the benefits of the program.

[9] Illinois Department of Natural Resources, "State of Illinois Flood Damage Packet", 2021. https://www2.illinois.gov/dnr/WaterResources/Documents/IL_Damage_Assess_Packet_March_2020.pdf

SECTION 4

RISK ASSESSMENT

HISTORIC DISASTERS

Disaster declarations in the State of Illinois can be made at the city, county, state, or federal government level. City or county officials may declare a local disaster to activate emergency operation plans within their jurisdiction. If a disaster overwhelms local response capabilities, local officials may request assistance from the Illinois Emergency Management Agency (IEMA). The Governor of Illinois may request a Presidential Disaster Declaration from the federal government if local and state response capabilities are overwhelmed. Disasters can also be declared by the Farm Service Agency (FSA) and the Small Business Administration (SBA).

Presidential Disaster Declarations

Under the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (Stafford Act), a governor of an affected state or territory, or a tribal government, can request that the President of the United States make a disaster declaration. There are two types of presidential disaster declarations: major disaster declarations and emergency declarations.

A major disaster declaration covers any natural hazard, including hurricane, tornado, storm, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought, and any fire, flood, or explosion, regardless of the cause. Federal assistance for recovery and future hazard mitigation can be made available to affected counties. An emergency declaration is more broadly defined – one is declared when federal assistance is needed to protect lives, property, public health, and safety, or to lessen the threat of catastrophe – but provides less federal assistance.

Bond County has received seven presidential disaster declarations since 2002 (Table 20).

Table 19. Presidential and emergency disaster declarations (1973 – 2023). Source: FEMA

Declaration No.	Date Declared	Hazard(s) covered by declaration
3577	12/13/2021	Severe Storms, Straight-Line Winds, Tornadoes
4489	3/26/2020	Covid-19 Pandemic
3435	3/13/2020	Covid-19
1960	3/17/2011	Severe Winter Storm, Snowstorm
1800	10/3/2008	Severe Storms, Flooding
3230	9/7/2005	Hurricane Katrina Evacuation
1416	5/21/2002	Severe Storms, Tornadoes, Flooding

Gubernatorial Disaster Proclamations

Between 2010 and 2022, there were 30 gubernatorial disaster proclamations across the State of Illinois (Table 21). Bond County received eight gubernatorial disaster proclamations.

Table 20. Gubernatorial disaster proclamations (2010-2023).

Date Declared	Hazard(s) covered by declaration
8/1/2022*	Monkeypox
2/1/2022	Winter Storms
2/16/2021	Winter Storms
3/12/2020*	COVID-19
1/29/2019	Winter Storms
1/6/2014	Heavy Snowfall, Cold Temperatures
4/25/2011	High Wind, Tornadoes, Heavy Rain
1/31/2011	Winter Weather

*reissued monthly

Farm Service Agency

The Farm Service Agency (FSA) is an agency in the US Department of Agriculture (USDA) that provides low-interest emergency loans to producers in counties affected by a disaster. Applications for emergency loans must be received within 8 months of the declaration date.

Each county in the State of Illinois has a local FSA office that provides USDA services to producers, including obtaining federal disaster relief. The Bond County FSA office is in the City of Greenville. Bond County has received three FSA-administered disaster declarations since 2012 (Table 22).

Table 21. FSA disaster declarations, (2012-2023).

Declaration No.	Date Declared	Hazard(s) covered by the declaration
S4508	8/7/2019	Excessive Moisture, Flooding, Flash Flooding
S3865	8/12/2015	Excessive Rainfall, Flooding
S3311	8/1/2012	Drought

Small Business Administration

The Small Business Administration (SBA) is a government agency that provides low-interest loans to businesses, private nonprofits, homeowners, and renters after a disaster is declared.

SBA disasters are automatically declared when a presidential disaster or agricultural disaster is declared. SBA disasters can also be declared at the request of the Governor of Illinois.

There was one claim totaling $6,600 following the 2002 tornado and flooding events in Bond County. However, no disaster loans were distributed.

FUTURE CHANGES

Climate Change

Human-induced climate change is expected to increase the intensity and frequency of natural hazards in Illinois, including extreme heat, drought, and flash and riverine flooding. As a result, human health, ecosystems, infrastructure, and agriculture are expected to be negatively impacted. Average temperatures are expected to rise by nearly 4°F and there are projected to be over 15 more days above 95°F per year in western Illinois by 2050 (Figure 13). Increasing temperatures will negatively impact human health by increasing the risk of heat-related illnesses, such as heat stroke or heat exhaustion. Livestock may similarly suffer heat stress. Warming temperatures may make conditions less suitable for native plants and animals across Illinois and invasive, non-native species could move into Illinois, harming native ecosystems. Projected increases in flooding may also affect habitat availability for native species.

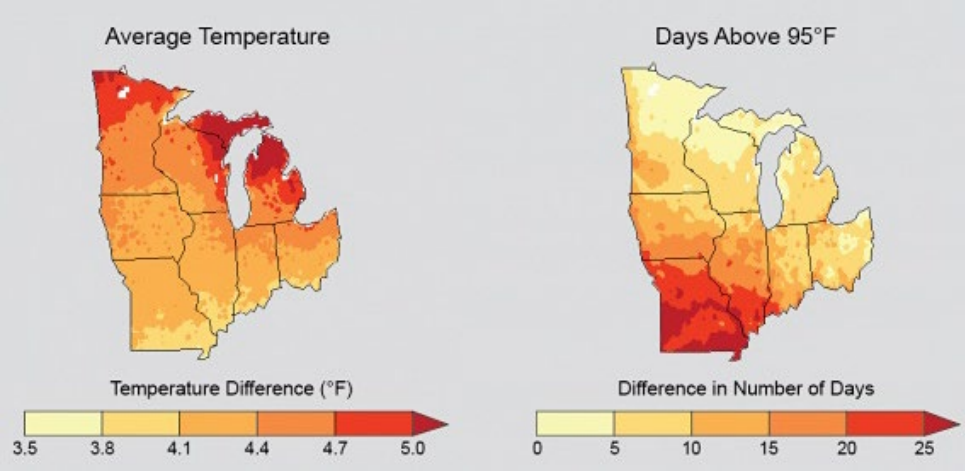


Figure 13. Projected 2050 temperatures changes.
Source: US Global Change Research Program (2014).

While climate change is expected to increase precipitation in Illinois, the distribution is expected to become more extreme. Rainfall events of more than 2" are expected to increase, causing more riverine and flash flooding (Figure 14). Rivers across Illinois are already flooding more frequently, and this trend is expected to continue. Flash flooding in urban areas is expected to increase, as

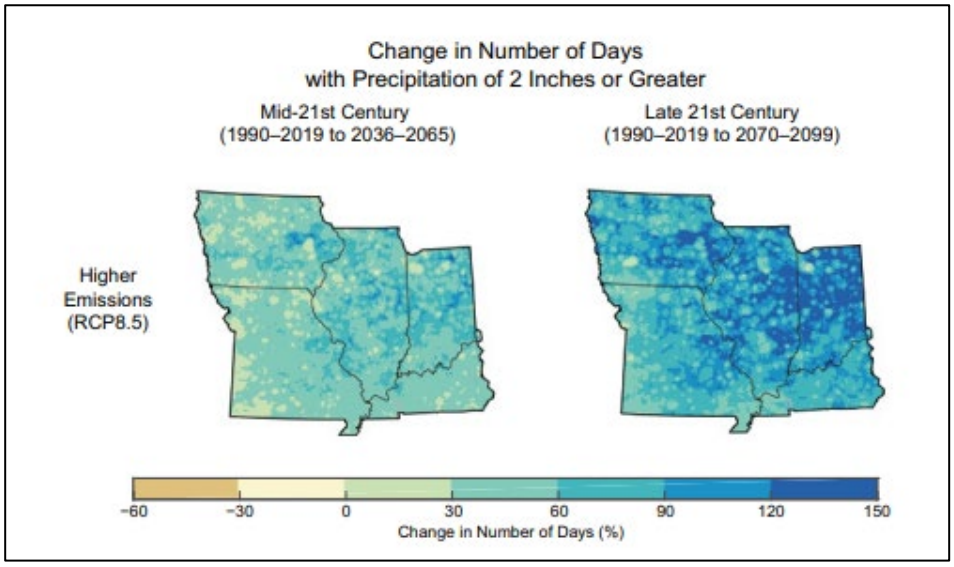


Figure 14. Changes in extreme precipitation by 2100. Source: The Nature Conservancy.

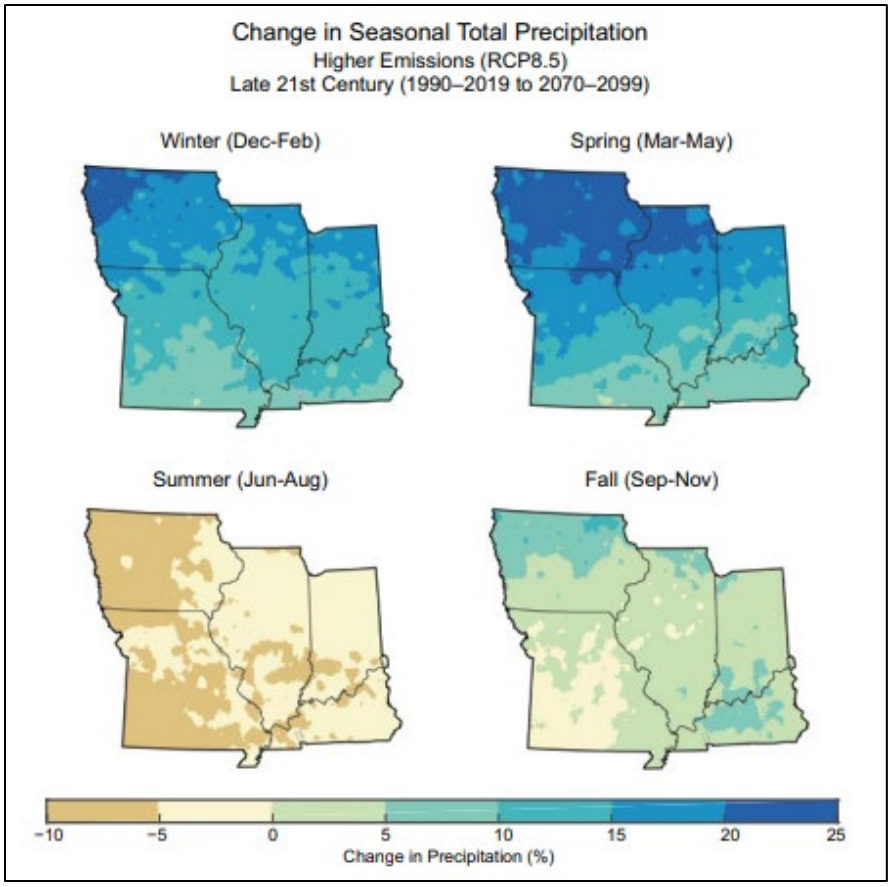


Figure 15. Changes in seasonal total precipitation by 2100.

Source: The Nature Conservancy.

many stormwater systems are not built to handle extreme rainfall events and land-use change from urban sprawl reduces water drainage capabilities. Increased flooding can affect human health by increasing the risk of water-borne diseases and flood-related injuries. In rural Illinois, extreme precipitation has caused runoff from agricultural fertilizer to enter groundwater wells, harming the safety of drinking water.

By the end of the 21st century, dry periods between rainfall events are expected to lengthen, and summer precipitation is expected to decrease, increasing the likelihood of severe summer drought (Figure 15). Soybean and corn yields are expected to decrease due to a combination of rising temperatures, increasing drought, and more water-borne diseases from increased flooding.

Land Use and Development Trends

There has been minimal development and land use change since 2001 (Figure 16). New and expanding factories have increased urban expansion in Greenville. Increased urbanization can be tied to extreme heat events. Urban heat islands occur when natural land cover is replaced with surfaces that absorb and retain heat, such as concrete, asphalt, and buildings. Although large urban areas experience a greater urban heat island effect, small towns and villages can likewise experience warming caused by built-up areas.[10] Increasing development in Greenville could have impacts on future extreme heat events.

[10] Oke, T.R. (1973). City size and the urban heat island. Atmospheric Environment Volume 7, Issue 8, 769-779. https://doi.org/10.1016/0004-6981(73(90140-6

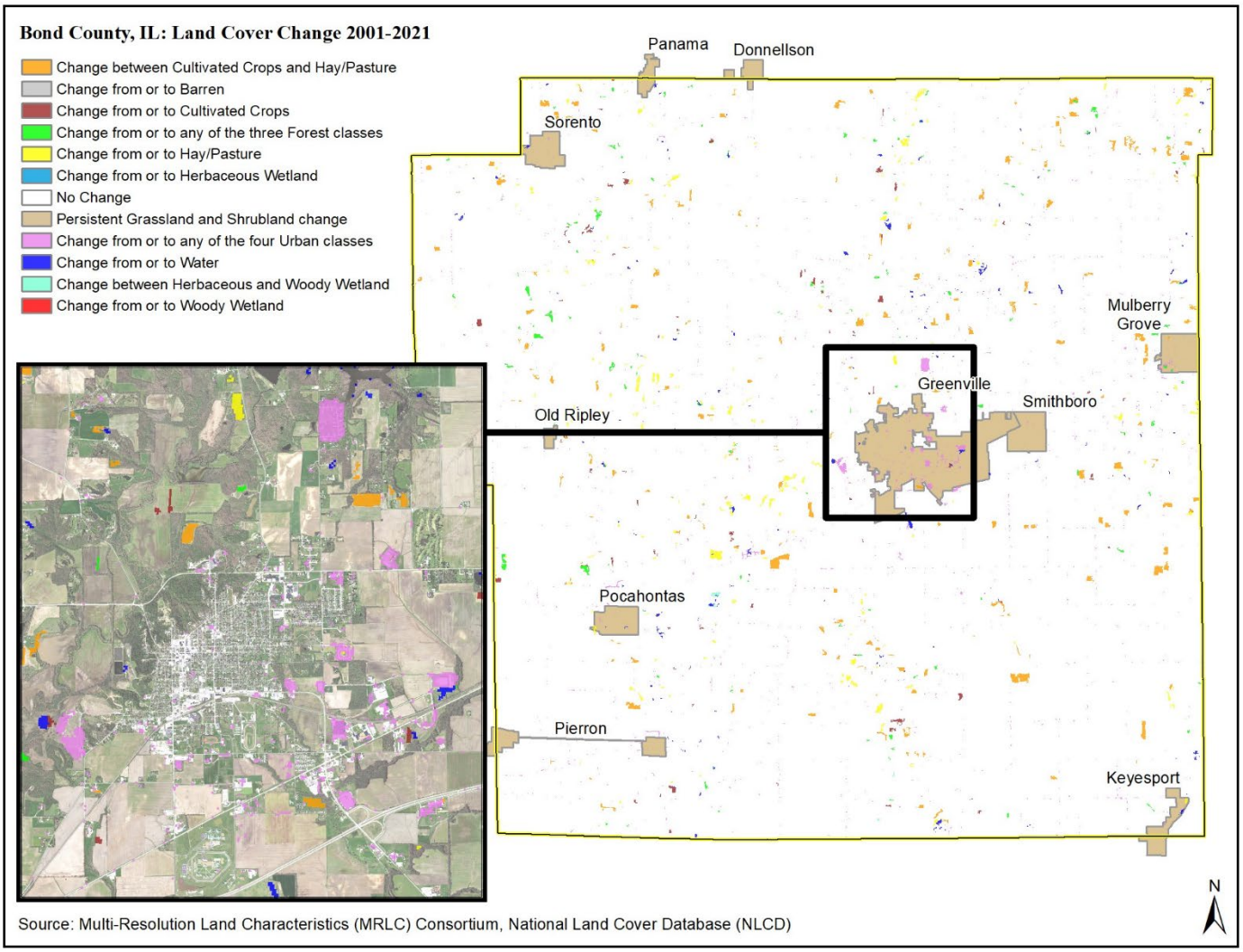


Figure 16. Land cover change in Bond County, 2001-2021.

Bond County may experience growth due to proximity to the St. Louis Metropolitan area. As cities continue to grow, urban sprawl can occur leading to rapid growth in what was once rural areas. Illinois Department of Public Health (IDPH) does not anticipate a population growth for Bond County in 2030, but it may be something for the county to be aware of in future planning efforts.[11]

Since 2012, farmland has decreased by 13% (Table 17). Most of the land was converted from grassland or pasture to cropland. This switch could have an impact on future flooding in the county. Flash and riverine floods can destroy large swaths of agricultural land, temporarily or permanently changing the land cover. Wildfires can burn forests and cropland; recovery may precipitate land use changes.

[11] Illinois Department of Public Health. (April 2021). Population Projections - Illinois. Retrieved from https://dph.illinois.gov/content/dam/soi/en/web/idph/files/publications/population-projections-report-2010-2030.pdf

ESSENTIAL FACILITIES

Essential facilities are buildings and infrastructure that provide necessary services to the public and would cause harm if they were destroyed or damaged. Examples of essential facilities include hospitals, emergency operation centers (such as police and fire departments), schools, nursing homes, cell towers, and utility centers (such as for electricity or water). There are 35 identified essential facilities in Bond County.

Table 22. Essential facilities.

Facility	Number of Facilities
Emergency Operation Centers	1
Fire Stations	8
Medical Care Facilities	1
Police Stations	5
Schools	12
Potable Water Facilities	1
Waste Water Facilities	7

Essential facility data are an example of site-specific information used in Hazus for analysis. This data was first compiled from the Hazus statewide database for Illinois and included schools, medical care facilities, emergency operation centers, police stations, fire stations, and potable/wastewater facilities. This data was used as a starting point with the intent for it to be updated for the *2024 Bond County Hazard Mitigation Plan*.

The planning team was asked to help with updating the essential facilities. Locations of essential facilities were confirmed using community feedback and internet mapping services such as Google Maps and Google Street View. The updated Hazus inventory contributed to the Level 2 analysis, which improved the accuracy of the risk assessment.

Appendix F: Essential Facilities identifies the essential facilities that were used for the analysis.

SOCIAL VULNERABILITY

Social vulnerability is defined as the susceptibility of a community to adverse impacts caused by natural hazards. The Center for Disease Control's (CDC) Social Vulnerability Index (SVI) uses 16 socioeconomic variables grouped under four categories (Figure 17) to identify factors that affect a community's ability to prepare for, respond to, and recover from natural hazards.[12]By including social vulnerability in a risk analysis, hazard mitigation projects can be better tailored to the needs of individual communities.

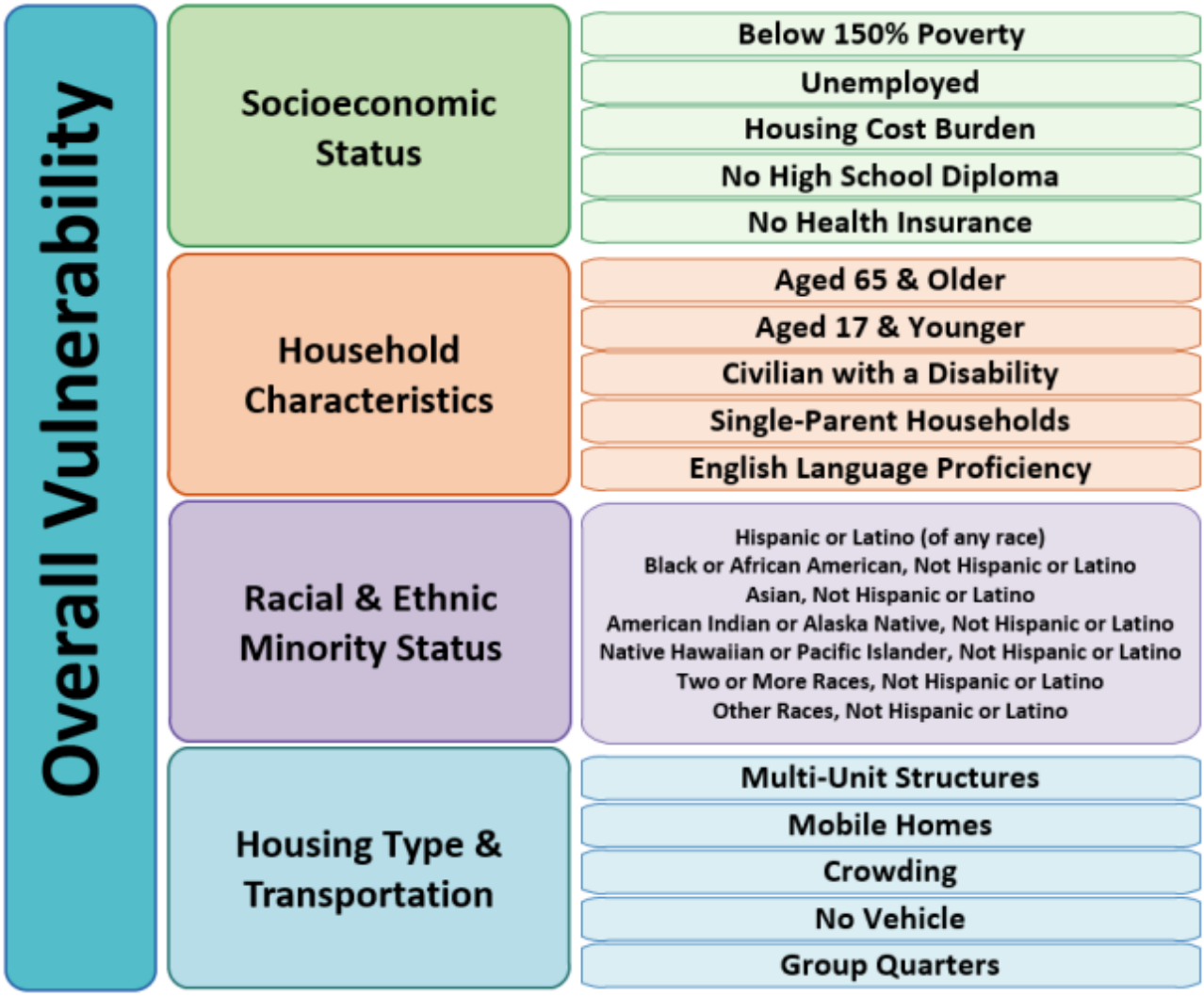


Figure 17. CDC/ASTDR SVI factors. Source: CDC

Socioeconomic status can affect natural hazard risk within communities. Individuals and families may not be able to afford hazard insurance (e.g., flood, earthquake), and may not seek medical assistance if injured during a

[12] CDC. (2022). "CDC/ATSDR SVI 2020 Documentation". https://www.atsdr.cdc.gov/placeandhealth/svi/documentation/pdf/SVI2020Documentation_08.05.22.pdf

disaster due to a lack of health insurance. Stocking up on provisions before a severe weather event or dipping into savings to replace items lost during hazard event may be out of financial reach for communities with lower socioeconomic status.[13] Infrastructure and facilities in low-income communities are frequently of lower quality, exacerbating the impacts of disasters.

Household characteristics may impact the ability to respond to a hazard. Elderly people, young children, and people with disabilities may need extra assistance when a disaster occurs. Children frequently don't have the experience or resources necessary to protect themselves from hazards, and elderly people may require extra medical care or other physical assistance during or after a disaster. People with disabilities may need additional resources or assistance post-disaster. People who are not proficient in English may have difficulty understanding hazard alerts or seeking assistance post-disaster.

Racial and ethnic minority status – namely, communities that are non-white, including Asian-American communities – have wide ranging impacts on hazard risk. Social, political, and economic marginalization makes people of color more vulnerable to natural hazards and can prevent people of color from receiving disaster assistance. Historically redlined neighborhoods, where many people of color reside today, are in areas that are more vulnerable to natural hazards, such as floodplains.

Housing type and transportation likewise impact hazard risk. People who live in mobile homes, because mobile homes are not anchored to the ground, are much more susceptible to natural hazards such as tornadoes, severe wind, floods, and earthquakes. People without a vehicle may be unable to evacuate before a disaster occurs, or get supplies needed to prepare for a disaster. People living in group quarters, such as nursing homes or prisons, do not have autonomy to prepare for a disaster, and must rely on facility operators to have a disaster plan in place.

[13] Fothergill, A., & Peek, L. A. (2004). Poverty and Disasters in the United States: A Review of Recent Sociological Findings. Natural Hazards, 32(1), 89–110. https://doi.org/10.1023/B:NHAZ.0000026792.76181.d9

HAZARD PROFILES AND RISK ANALYSIS

Hazard Identification

The list of hazards (Table 19) that affect Bond County was created through review of the 2010 Bond County Hazard Mitigation Plan, 2023 Illinois Natural Hazard Mitigation Plan, and consultation with the steering committee and members of the public at the first hazard mitigation meeting. Data sources for historic occurrences of hazards include the National Centers for Environmental Information (NCEI) Storm Events Database, the Association of State Dam Safety Officials (ASDSO) Dam Incident Database, the Illinois State Geological Survey (ISGS), the United States Department of Agriculture (USDA), the United States Cybersecurity and Infrastructure Security Agency (CISA), and the Illinois Department of Public Health (IDPH).

Table 23. Summary of hazards in Bond County, IL.

Hazard[1]	Reports	Start Year	End Year	Property Damage	Injuries	Fatalities	Source
Cybersecurity	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Drought	4	1996	2022	$0[3]	n/a	n/a	NCEI, USDA
Earthquake	9	1788	2022	$0	0	0	USGS
Extreme Cold	3	1996	2022	$0	0	0	NCEI
Extreme Heat	43	1996	2022	$0	0	1	NCEI
Flood: Dam/Levee Failure	0	1996	2022	$0	0	0	ASDSO
Flood: Flash Flooding	17	1996	2022	$3,000	0	0	NCEI
Flood: Riverine Flooding	2	1996	2022	$0	0	0	NCEI
HazMat Spill	155	1987	2022	n/a	0	0	IEMA
Mine Subsidence	1	2000	2021	n/a	0	0	ISGS
Pandemic[2]	5,341	2020	2022	n/a	n/a	32	IDPH
Severe Storms: Hail	37	1996	2022	$50,500	0	0	NCEI
Severe Storms: Lightning	176,244	1996	2022	$45,000	0	0	NCEI
Severe Storms: Wind	75	1996	2022	$94,700	0	0	NCEI
Tornado	18	1950	2022	$5,480,000	30	2	NCEI
Wildfire	35	1992	2018	$0	0	0	USDA
Winter Weather: Ice Storms	2	1996	2022	$0	0	0	NCEI
Winter Weather: Winter Storms	44	1996	2022	$0	0	0	NCEI

[1] *Data sources cannot capture every event, so there may be under- or over-reporting for any value*
[2] *Reports (cases) and fatalities from IDPH for the COVID19 pandemic are as of April 2023*
[3] *Crop damage*

Cyberattacks

Description

Hazards and their associated risks are not limited to those that are physical in nature. As technology becomes integrated into everyday life, the risk of cyberattack and the ensuing damage is rising.

Cyberattacks include any attempt to gain illegal access to a computer system with the intent to do harm. Malware, phishing, and ransomware, which have a wide range of injurious motivations, are the most common types of cyberattack (Table 24).

Table 24. Common forms of cyberattacks. Source: CISA

Cyberattack	Description
Malware	Any software used to gain unauthorized access to IT systems in order to steal data, disrupt system services or damage IT networks in any way
Phishing	An online scam enticing users to share private information using deceitful or misleading tactics
Ransomware	A type of malware identified by specified data or systems being held captive by attackers until a form of payment or ransom is provided

Cyberattacks using ransomware pose risks to Information Technology (IT) infrastructure of small and large businesses, government entities, universities, health care systems, and any other service that uses computer information systems to conduct business or store personally identifiable information (PII). Cyberattacks can lead to security breaches, compromising identity, credit cards, bank account information, and other sensitive employee and customer information. [14]

Individuals are vulnerable to phishing. Digital literacy refers to a person's ability to find, assess, communicate, and evaluate the legitimacy of online information.[15] People who are not digitally literate may fall victim to phishing, such as clicking on websites links in emails that appear to be legitimate, but are designed to steal private information. Notably, over 80% of data breaches are caused by human error.[16]

Historical Events

US health care systems have been plagued by ransomware attacks since 2016. Between 2020 and mid-2023, 300 attacks on health care systems were documented. In June 2023, St. Margaret's Health in Spring Valley, Illinois, closed, citing a ransomware attack in 2021 as one of the contributing factors. This was the first hospital to cite cyberattacks as a reason for closure. St. Margaret's Health, which primarily serves a rural population, was unable to bill Medicare or Medicaid for 14 weeks, crippling the institution financially.[17]

Ransomware attacks are the most frequent type of cyberattack on higher education. Lincoln College in Lincoln, Illinois, was hit by a ransomware attack in 2022, severing access to admissions, enrollment, and fundraising

[14] 2024 Illinois Technological Hazard Mitigation Plan [DRAFT]. (2023). State of Illinois.
[15] IEEE. (n.d.). What is Digital Literacy? Retrieved November 3, 2023, from https://ctu.ieee.org/what-is-digital-literacy/
[16] Chamorro-Premuzic, T. (2023, May 3). Human Error Drives Most Cyber Incidents. Could AI Help? Harvard Business Review. https://hbr.org/2023/05/human-error-drives-most-cyber-incidents-could-ai-help
[17] Collier, K. (2023, June 12). An Illinois hospital is the first health care facility to link its closing to a ransomware attack. NBC News. https://www.nbcnews.com/tech/security/illinois-hospital-links-closure-ransomware-attack-rcna85983

information. The college paid a sum of less than $100,000 to ransomware attackers but employees were not able to access the systems for months. Upon regaining access, college officials found that enrollment numbers were too low to keep the college operating, forcing its closure after the semester.[18]

The State of Illinois was a victim of a ransomware attack in June 2023. Cyber criminals infected a file transfer system, stealing data from its database. The full extent and specifics of the attack are still being determined, but state officials believe a large number of people could be impacted.[19]

Extent and Impacts

Cyberattacks can be crippling for regional and local governments because they have weaker security planning, small IT teams, poorer response and recovery, and less familiarity with support services. Often, these weaknesses come from lack of funds and personnel, particularly in rural counties. Neither Bond County nor its jurisdictions have a dedicated IT department.

Education systems, including grade schools and universities, are also vulnerable to cyberattacks. Like governments, education's computer systems contain significant PII making them especially vulnerable to ransomware attacks. Bond County Community Unit School District (CUSD) #2 and Greenville University are the main education systems and large employers of county residents. A ransomware attack could cripple these education systems, putting students' education and employees' jobs in jeopardy.

When a cyberattack occurs, it can take months to recover. Essential services may be down for weeks or months, causing minor inconveniences, such as being unable to pay a water bill online, to major changes, such as first responders needing to keep track of emergency calls using pens and paper.[20]

Cyberattacks can be very costly to recover from. Since 2020, cyberattacks have primarily had a financial motive. Ransom payments in state and local governments averaged $214,000 in 2021. Although 90% of counties in the United States have cyber insurance, insurance rates may go up after a cyberattack, putting more financial strain on a county.[21]

Social Vulnerability

Rural Americans have numerous health disparities compared to their urban counterparts; heart disease, cancer, unintentional injury, chronic lower respiratory disease, and unintentional injuries from vehicle crashes and opioid overdoses occur at higher rates among rural Americans.[22] Hospitals with smaller operating budgets tend to be located in poorer and more rural areas. As ransomware attacks increase on hospitals, rural hospitals may not be able to withstand the financial impacts of attacks, forcing them to close. Lifesaving care might become harder to access or even inaccessible for rural Americans.

Digital literacy is lowest among senior citizens, rural Americans, and impoverished Americans, but it is necessary for assessing phishing scams. Senior citizens are among the most common targets for phishing. Older, rural, and

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[18] Whitford, Emma. (2022, April 19). Cyberattacks Pose 'Existential Risk' To Colleges—And Sealed One Small College's Fate. Forbes. https://www.forbes.com/sites/emmawhitford/2022/04/19/cyberattacks-pose-existential-risk-to-colleges-and-sealed-one-small-colleges-fate/?sh=695fe19c53c2

[19] NBC News Chicago. (2023, June 9). Illinois a victim of CL0P ransomware attacks, state agency says. NBC News. https://www.nbcchicago.com/news/local/illinois-a-victim-of-cl0p-ransomware-attacks-state-agency-says/3158800/

[20] Bailey Jr, Everton. (2023, May 12). Dallas Officials Say Ransomware Recover Could Take Months. The Dallas Morning News. https://www.govtech.com/security/dallas-officials-say-ransomware-recovery-could-take-months

[21] Adams, A. and Miller, B. (2022, Nov/Oct). Threats, Costs and People: Cybersecurity by the Numbers. Government Technology. https://www.govtech.com/biz/data/threats-costs-and-people-cybersecurity-by-the-numbers

[22] CDC. (2023, May 9). About Rural Health. https://www.cdc.gov/ruralhealth/about.html

poorer residents of Bond County who have limited access and exposure to digital media may be more vulnerable to phishing – such as identity theft – than other residents.

Vulnerability of Future Assets

Bond County's entire population and technological infrastructure are vulnerable to cyberattacks. As more services in the county move to an online model, cybersecurity awareness will become increasingly important. Ransom payments in state and local governments averaged $214,000 in 2021. Higher education ransom payments averaged $112,000 in 2022.[23] Bond County and Greenville University could expect to provide similar ransom payments in the future.

[23] Whitford, Emma. (2022, April 19). Cyberattacks Pose 'Existential Risk' To Colleges—And Sealed One Small College's Fate. Forbes. https://www.forbes.com/sites/emmawhitford/2022/04/19/cyberattacks-pose-existential-risk-to-colleges-and-sealed-one-small-colleges-fate/?sh=695fe19c53c2

Drought

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
DROUGHT	COUNTYWIDE	4	< 1	$0	0	0

Description

Drought is a normal, recurrent, and temporary feature of climate. Characteristics of drought vary from one region to another, but drought occurs almost everywhere. All societies are vulnerable to this natural hazard, and drought can affect vast territorial regions and large population numbers. A drought may not have a distinct start, and its termination may be difficult to recognize. Weather conditions, soil moisture, runoff, water table conditions, water quality and stream flow are all natural factors that are important in determining drought. High temperature, high wind and low relative humidity can significantly aggravate its severity.

Droughts originate from a deficiency of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group or environmental sector. Operational definitions help people identify the beginning, end and degree of severity of a drought. The National integrated Drought Information System (NIDIS) operational definitions for droughts:[24]

- **Meteorological Drought:** A period of well-below-average precipitation that spans from a few months to a few years.
- **Agricultural Drought:** A period when soil moisture is inadequate to meet the demands for crops to initiate and sustain plant growth.
- **Hydrological Drought:** A period of below-average stream flow and/or depleted reservoir storage (i.e., stream flow, reservoir and lake levels, ground water).
- **Socioeconomic Drought:** This definition deals with the supply and demand of water. Some years there is an ample supply of water and in other years there is not enough to meet human and environmental needs.
- **Snow Drought:** A period of abnormally little snowpack for the time of year, resulting in either a dry snow drought, below-normal cold-season precipitation, or a warm snow drought, a lack of snow accumulation despite near-normal precipitation. Often caused by warm temperatures and precipitation falling as rain rather than snow or unusually early snowmelt.
- **Flash Drought**: A rapid onset or intensification of drought often set in motion by lower-than-normal rates of precipitation, along with abnormally high temperatures, winds, and radiation.

The Palmer Drought Severity Index (PDSI) is an attempt to compare weekly temperature and precipitation readings over a defined climatic region in order to identify periods of abnormally dry weather. The PDSI shows that Bond County has experienced several extreme droughts (D3) since 2000 (Figure 18).

[24] Drought Basics. (n.d.). Drought.Gov. Retrieved April 16, 2023, from https://www.drought.gov/what-is-drought/drought-basics

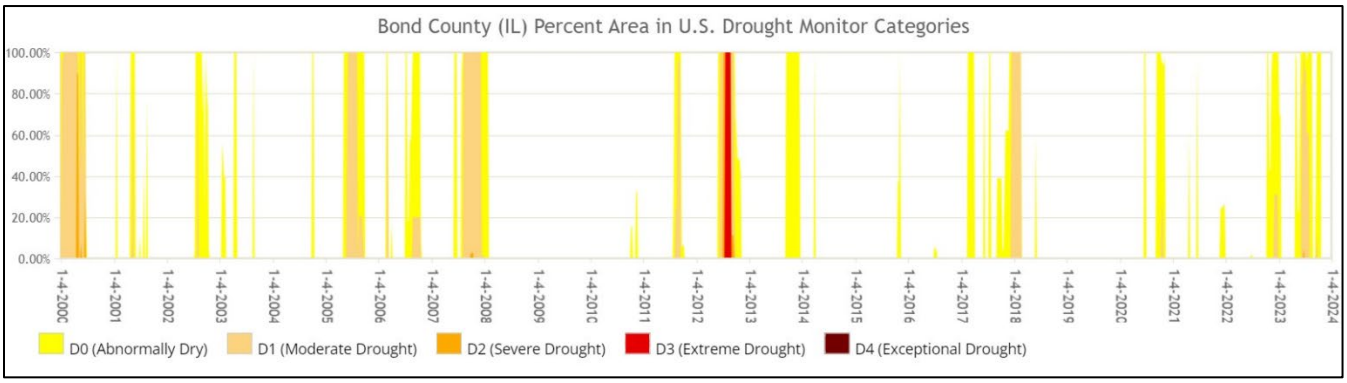

Figure 18. Percentage of Bond County area in PSDI categories over time (2000-2022).

The U.S. Drought Monitor is the standard for determining drought in the U.S. The National Drought Mitigation Center compiled state-specific drought impacts to provide a clearer picture of drought in Illinois (Table 25).[25]

Table 25. Drought monitor categories and associated impacts.

Drought Monitor Categories		**Impacts**
	D0 – Abnormally Dry	Soil moisture declines; lawns turn brown
	D1 – Moderate Drought	Row crops and pasture show drought stress Fireworks are banned Trees show drought stress; wildlife eat more crops
	D2 – Severe Drought	Row crop and vegetable conditions are poor; hay yield is low; corn is baled for feed Outdoor burn bans are implemented Lawns go dormant; weeds grow faster Farmers are stressed; agriculture industry is hurting Power plant intake is compromised Water levels in wells, ponds, rivers, and lakes are low; streamflow is below average; voluntary water conservation is requested
	D3 – Extreme Drought	Disease kills deer; fish are stressed Vegetation is stressed Well and reservoir levels are very low
	D4 – Exceptional Drought	Feed prices are high; crop loss is widespread; livestock are culled Wildlife are severely stressed; fish kills occur in lakes and rivers

Generally, drought is associated with a sustained period (which differs for each drought impact) of significant below average water or moisture supply. The degree of precipitation deficiency, the duration and the size of the affected area determine the severity of the drought. A drought can ruin agriculture-based local economies and increase the risk of fire and flash floods.

[25] Drought Impacts. (n.d.). Drought.Gov. Retrieved April 16, 2023, from https://www.drought.gov/impacts

Historical Events

Illinois was one of several states stricken by the historic US drought of 2012 (Figure 19). After a dry, record warm March and an abnormally dry May, conditions deteriorated rapidly throughout the summer. The average corn yield in Illinois was about 40% below normal, and average soybean yields were about 10% below normal. [26] Bond County's top two crops in terms of acreage are soybeans (79,234 acres) and corn (52,929 acres). Most of the county's farmers practice dryland farming, putting them at greater risk of drought-induced crop losses than farmers who use irrigation. [27] The turning point of the drought occurred in August, due to the rainfall remnants from Hurricane Isaac and other August-September precipitation events. [28]

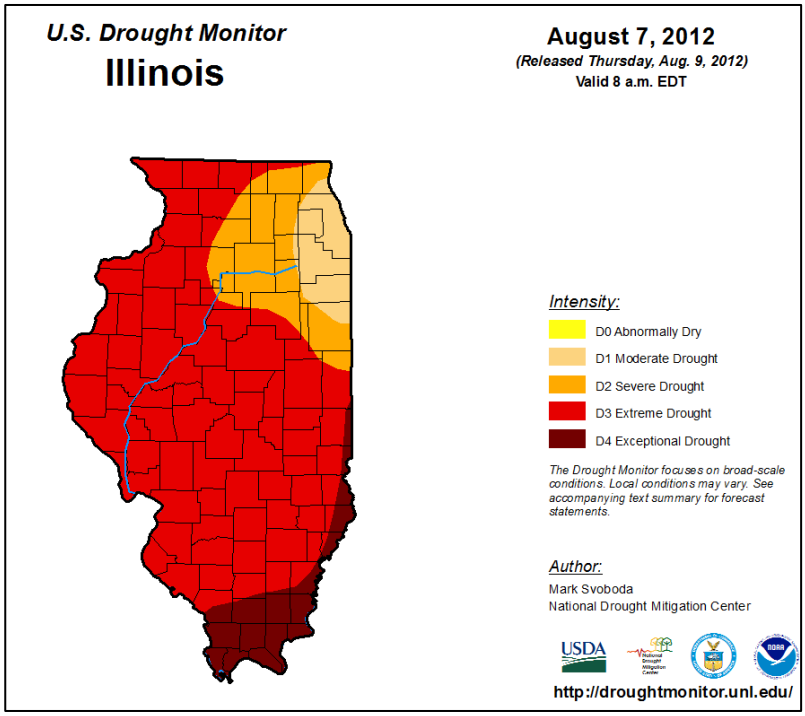

Figure 19. US Drought Monitor map for Illinois on 8/7/2012.

Extent and Impacts

Drought can occur anywhere in the county. The hazard extent of drought depends on the type of drought (e.g., meteorological, agricultural, hydrological, socioeconomic, snow, flash). An agricultural drought will affect farmland the most, while a hydrological drought will affect water reservoirs and supply.

When a drought occurs, the height of under groundwater levels can drop, impacting the water level in an aquifer. Much of Bond County's public water supply comes from aquifers,

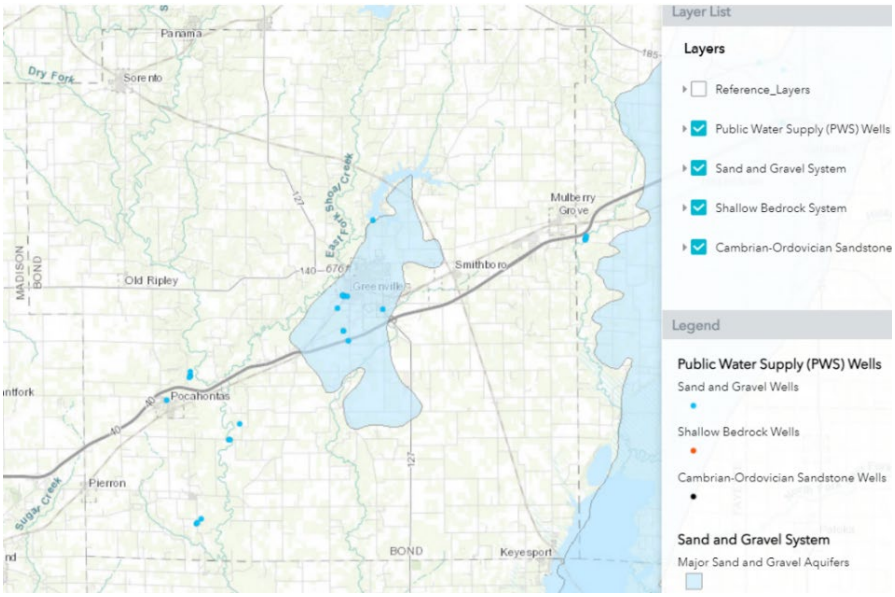

Figure 20. Public Water Supply in Bond County. Source: ISWS

[26] Knapp, H. Vernon; Angel, James R.; Atkins, Jennie R.; Bard, Luke; Getahun, Elias; Hlinka, Kenneth J.; Keefer, Laura L.; Kelly, Walton R.; Roadcap, George S., (2017): The 2012 Drought in Illinois. Illinois State Water Survey. http://hdl.handle.net/2142/96286

[27] 2017 Census of Agriculture. (2019). Bond County Illinois. USDA. https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Illinois/cp17005.pdf

[28] Knapp, H., et al. (2017): The 2012 Drought in Illinois. ISWS. http://hdl.handle.net/2142/96286

making them particularly vulnerable to drought (Figure 20). Water restrictions may be applied, causing residents to receive less water. Even private well owners may be affected if a drought causes groundwater levels to fall below the well's pump intake. Lakes can also be affected by drought in terms of flow, water temperature, and water quality. Governor Bond Lake, located north of Greenville, is a public water supply source for the city and surrounding communities. [29]

Drought can affect infrastructure at different scales. If a building is located on expansive soils, foundation cracking can occur as soil moisture decreases and clay-based soils contract. Damage to underground pipelines and above ground infrastructure can occur due to shrink-and-swell cycles associated with periods of drought when soils dry out and shrink and wet periods when soils expand. Essential facilities buildings that rely on aquifers for water may be impacted by a hydrologic drought.

Drought impacts on the environment can vary significantly based on the geographical extent and severity of the drought. Potential impacts a drought can have on the environment include reduced plant growth over a season, reduction or extinction of local species, changes in vegetation coverage which may result in reduced water retention in soils, and changes in freshwater ecosystems including flow, water temperature and water quality.[30]

Rivers, creeks, and lakes can also be affected by drought in terms of flow, water temperature, and water quality. Governor Bond Lake is home to many water-based recreation activities. Drought could cause a decrease in water levels, affecting water supply and outdoor enjoyment for residents and visitors alike.

Direct economic impacts of drought can affect industries such as agriculture, recreation, energy, tourism, timber, fisheries, and others that rely heavily on water. Local economies can be directly impacted by changes in recreation and tourism caused by drought. Adequate water levels in streams, lakes, and reservoirs are essential for activities such as hunting, fishing, boating and other water and outdoor activities. Other economic impacts of drought can include job losses, business failures, lost investments, economic uncertainty, and changed development and consumption patterns. Farmers and their families would likely be most affected by agricultural drought in Bond County.

Social Vulnerability

Droughts can have significant impacts for populations who rely on agriculture and natural resources for their livelihoods. This can include reduced income, loss of employment opportunities, and increased poverty. Bond County has over 1,000 people employed in agriculture, which is nearly 7% of the county's population.[31] Droughts can lead to water shortages and reduced access to clean potable water, which can have compounding negative impacts on health and wellbeing for populations that are already vulnerable.

Climate Change

Drought is one of the most challenging hazards to define, identify, and manage because of its complex and diverse interactions and impacts and its relatively slow onset and demise. Projections of changes in drought are, therefore, highly dependent on the impact of interest (e.g., agricultural drought vs. hydrologic drought).

Although annual precipitation in Illinois has increased by 3 to 6 inches over the past 100 years in all four seasons, there are several factors that point to future agricultural and hydrological drought risk. First, the expected increases in temperature will drive up evaporation and transpiration rates throughout the year, leading to more rapid soil moisture depletion and potentially drier soils during the growing season. Second, the impact of

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[29] Governor Bond Lake. (n.d.). Greenville, Illinois. Retrieved November 14, 2023, from https://www.greenvilleillinois.com/governorbondlake

[30] Ecological Drought. Drought.Gov. Retrieved March 21, 2023, from https://www.drought.gov/what-is-drought/ecological-drought

[31] 2017 Census of Agriculture. (2019). Bond County Illinois. USDA. https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Illinois/cp17005.pdf

increased evaporation may be exacerbated by projected increasing precipitation variability, which might manifest as fewer but heavy precipitation events interspersed by longer periods of dry weather. Despite projected increases in annual precipitation, increased precipitation variability may result in higher runoff rates and less water return to soil moisture. Lastly, while annual precipitation is projected to increase, models show large seasonal differences in the distribution of those increases. Specifically, model projections are in strong agreement that most of the increased precipitation will occur in winter and spring, with lesser magnitude changes in summer precipitation in Illinois. While summer precipitation projections are far from certain, even a small increase in summer precipitation would be outweighed by larger increases in evaporation and evaporative demand. Drought will continue to be a concern in Illinois in future decades despite an overall wetter climate.

While the frequency of long-duration (i.e., > 1 water year) droughts may continue to decrease in the future, projections suggest a potential higher risk of short-duration (i.e., flash) drought conditions during the growing season by mid- and late-century. Drought will continue to be a concern in Illinois in future decades despite an overall wetter climate.

Vulnerability of Future Assets

Agricultural drought primarily affects agricultural workers and assets. Total farmland has decreased since 2017 in Bond County, so the amount of land that could be affected by agricultural drought may decrease. Bond County's public water supply and infrastructure will be most at risk from hydrological drought.

While Bond County's population decreased from the 2010 to 2020 census, future development is likely in the county, particularly in Greenville where the population is increasing. Future development may decrease farmland, reducing the risk of agricultural drought. However, more development will likely increase the demand for water, meaning Bond County may be more vulnerable to hydrological drought. Drought prediction, early warning, and monitoring systems should be adapted to the potential changing drought characteristics across Illinois, including expanded soil moisture measurements, water infrastructure resilience initiatives, and more frequent updates to local-level drought plans.

Damages in rural counties tend to be underreported or have little data. Therefore, expected annual loss estimates for Bond County were calculated by taking the average damage per year caused by each hazard in rural counties. The expected annual loss of crops caused by agricultural drought is $633,688.

Earthquake

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
EARTHQUAKE	COUNTYWIDE	9	< 1	$0	0	0

Description

Earthquakes are caused by a sudden slip on a fault, which is a fracture in the Earth's crust where movement has occurred in the past. When a slip occurs, energy is released and energy waves travel through Earth's crust, causing the shaking that we feel during an earthquake. Magnitude and intensity are terms used to describe the severity of an earthquake, but they do not mean the same thing.

- **Magnitude:** A measure of the seismic energy released from the earthquake. It is calculated from measurements of the ground vibrations recorded by seismographs.
- **Intensity**: A measurement of the effects brought about by an earthquake; using observations of people in the area affected. Intensities are based on descriptive reports, rather than calculations from instrument readings.

The intensity of an earthquake is measured using the Modified Mercalli (MM) Intensity Scale (Figure 21). Using Roman numerals, the MM ranges from I to X. Lower numbers are generally based on how an earthquake is felt by people, while higher numbers are based on observed structural damage.

Intensity	Shaking	Description/Damage
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest,especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Figure 21. Modified Mercalli Intensity Scale. Source: USGS

Earthquakes can be very dangerous and have the potential to cause widespread damage and loss of life. In Illinois, structures built on thick, loose sediments of river flood plains are more likely to be damaged than structures on glacial till (stiff, pebbly clay) or bedrock. In fact, seismic intensity may increase one or more units on the Modified Mercalli Intensity Scale if loose sediments are present. Earthquakes in Illinois originate within the crystalline basement rocks at depths of 1 to 25 miles, which is below the layers of sedimentary rock where coal, oil, and aggregate (gravel) are mined. They occur in the granitic rocks far below the sedimentary layers of rock where known faults are mapped. The earthquake vibrations move out away from the point of origin (hypocenter or focus) through the bedrock and then up though the overlying soils on top of the bedrock. In the central part of the U.S., the bedrock is flat-lying, old, intact, and strong. Earthquake vibrations travel very far through material such as this in comparison to the young, broken, weak bedrock of the west coast. Because of this difference, Central U. S. earthquakes are felt and cause damage over, an area 15 to 20 times larger than California earthquakes with similar magnitudes. They can also trigger other natural hazards such as landslides and secondary impacts such as hazardous waste spills or leaks, fires, and dam or levee ruptures.

The New Madrid Seismic Zone

The New Madrid Seismic Zone extends southwestward from Cairo, Illinois into Kentucky, Missouri, Tennessee, and Arkansas (Figure 22). There is a 25-40% chance of a M6 or greater earthquake in the next 50 years, and a 7-10% chance of a repeat of the 1811-1812 New Madrid earthquakes in the same time period (see Historical Events). [32] The New Madrid has not experienced a magnitude 6 or stronger earthquake in more than 100 years. [33] Larger earthquakes in the New Madrid region have caused more damage in Illinois than earthquakes originating in Illinois.

The Wabash Valley Seismic Zone

The Wabash Valley Seismic Zone covers parts of southeastern Illinois and southwestern Indiana (Figure 22). Although the New Madrid Seismic Zone is more studied and well-known, it is possible that the Wabash Valley Seismic Zone may cause more damage because of more repeating events. In the past 20 years, there were three magnitude 5 or stronger earthquakes in the region.

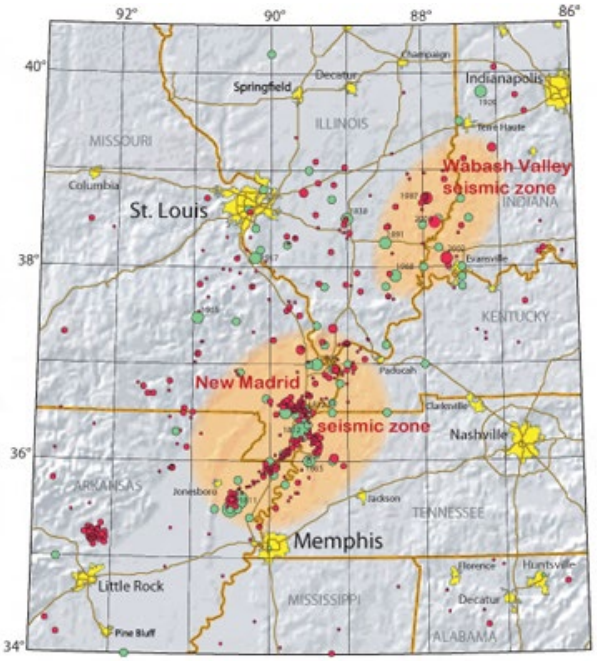

Figure 22. Illinois seismic zones.

Historical Events

The 1811-1812 New Madrid Earthquakes were a series of earthquakes, with the largest estimated magnitude of 7.8 occurred in the New Madrid Seismic Zone, which spans parts of Illinois, Missouri, Arkansas, Kentucky, Tennessee, and Mississippi. The earthquakes were felt as far away as Canada and the East Coast of the United States. While there are no exact records of fatalities or damages in Bond County, it is likely that the earthquakes caused significant damage to buildings and infrastructure and potentially loss of life.

There have been four reports of earthquakes in Bond County, and numerous reports in the surrounding area. On July 1st, 2017, a 3.1 magnitude earthquake struck less than 10 miles southwest of Vandalia. There were no

[32] The New Madrid Seismic Zone | U.S. Geological Survey. (n.d.). Retrieved April 23, 2023, from https://www.usgs.gov/programs/earthquake-hazards/new-madrid-seismic-zone

[33] Webb, J. (2021, April 26). New Madrid Fault: How a major earthquake could devastate the Tri-State. Courier & Press. Retrieved May 18, 2023, from https://www.courierpress.com/in-depth/news/2021/04/26/new-madrid-fault-how-earthquake-could-devastate-evansville-indiana-tri-state/4800331001/

damages or injuries reported in Bond County, although people in Greenville and between Mulberry Grove and Keyesport reported feeling the earthquake.[34]

Extent and Impacts

Earthquakes can occur anywhere in the county. The highest earthquake hazard area in Illinois is in the southernmost counties due to the New Madrid Seismic Zone. Bond County is shown in light yellow, an upper-middle hazard category (Figure 23). [35] The United States Geological Survey (USGS) estimates that a seismic hazard has a 20-30% chance of occurring in Bond County by 2064.

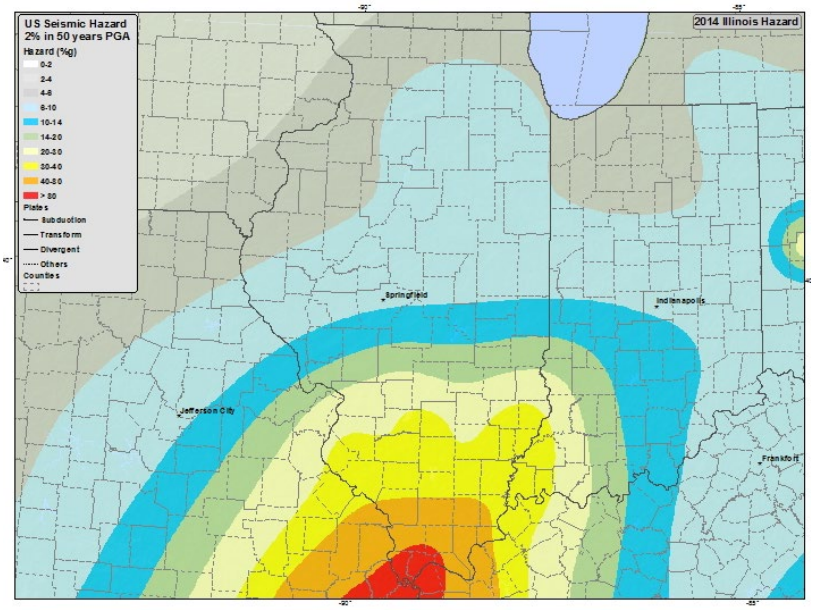

Figure 23. 2014 Illinois Seismic Hazard Map. Source: USGS

Damage to buildings, highways, power lines, pipelines and other structures only partly depends on the amount of energy released during the earthquake. Certain kinds of earth materials resting on the bedrock amplify the earthquake ground motions. In Illinois, structures built on thick, loose sediments of river floodplains are more likely to be damaged than structures on glacial till (stiff, pebbly clay) or bedrock. In fact, seismic intensity may increase one or more units on the MMI Scale if loose sediments are present. Also, loose sandy sediments with high moisture content, such as along river systems, can turn to liquid – a quicksand type state - when shaken enough.

Many of Illinois' bridges are aging and in need of repair, and a major earthquake could cause further damage or collapse. Damaged roadways, bridges, and tunnels would make it difficult for emergency responders and residents to travel. Illinois is a major transportation hub, and a major earthquake could disrupt rail traffic, including both freight and passenger trains. As a major transportation corridor, tremendous volumes of hazardous materials pass through Illinois by rail, highway, and river. Oil and natural gas pipelines also crisscross near or through Bond County, transporting oil and natural gas. As development in Bond County continues, more and more people live and work near industrial and commercial facilities that process or store hazardous materials.

A major earthquake could damage telecommunications infrastructure, such as cell towers and fiber optic cables, leading to disruptions in phone and internet service. Power lines and substations could be damaged, leading to widespread power outages. A major earthquake could damage water supply and treatment facilities, leading to disruptions in water service and potentially contaminating water sources. This could create health risks and make it difficult for emergency responders to access clean water. Waste management facilities, such as landfills and waste treatment plants, could be damaged, which would lead to disruptions in garbage and sewage disposal.

Levees and dams are vulnerable to ground shaking. Given the high number of dams in Bond County and extensive levee network near Keyesport, significant flooding from earthquake induced breaks in dams and levees should be expected at high water periods.

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[34] WGEL. Earthquake SW of Vandalia. Retrieved October 31, 2023, from https://wgel.com/news/2017/07/earthquake-sw-of-vandalia/
https://beardstown.advantage-preservation.com/

[35] United States Geological Survey (USGS), "2014 Seismic Hazard Map for Illinois", accessed Dec 2022. https://www.usgs.gov/media/images/2014-seismic-hazard-map-illinois

The cost of repairs required after a major earthquake would be substantial and have a major economic impact on the area. Aside from structural damage repairs, there could be long lasting disruptions in infrastructure such as roads and railways that would significantly impact businesses and households.

Social Vulnerability

Illinois does not have statewide building codes, although units of local government can adopt building codes of their choice.[36] Bond County and Greenville have building codes and building inspectors.

Limited or outdated building codes may make a community more vulnerable to earthquakes. Additionally, lower income neighborhoods and people of color tend to live in areas with more buildings in disrepair. Buildings that are already structurally unsound are more prone to collapsing during an earthquake, putting people at greater risk.

Climate Change

The impact of climate change on the frequency and intensity of earthquakes is inconclusive.

Vulnerability of Future Assets

Bond County's entire population and infrastructure are vulnerable to earthquakes. While Bond County's population decreased from the 2010 to 2020 census, future development is likely in the county. It is suggested that the county should ensure new structures are built with sturdier construction and harden existing structures to lessen the potential impacts of earthquakes, especially for manufactured homes. The State of Illinois is implementing statewide building codes effective January 1, 2025. Future development may be more earthquake resistant.

Hazus Earthquake Analysis

Hazus[37] is a loss and risk assessment software package built on GIS technology distributed by FEMA. The information generated can be used for planning emergency response actions and prioritizing mitigation efforts to reduce risk. Hazus output provides a baseline for evaluating success in reducing natural hazard risk exposure when conducting future assessments. Hazus assessments depend on several important datasets including essential facilities, building structure information, and general building stock inventories. Bond County's Hazus analyses included the creation of a building inventory using the Bond County assessor's data and an update of the essential facilities database.

Risks and losses due to flood hazards were modeled using Hazus Level 1 methodology on two earthquake scenarios that could impact Bond County. Both scenarios use the Hazus general building stock database to estimate the impact of these events had they occurred in 2022. The magnitude of the earthquakes is measured using the Moment Magnitude (M) scale.

The two scenarios include:

- Scenario #1: New Madrid Historical Event
    - Replication of the 7.4M event that occurred February 7th, 1812
- Scenario #2: Centrailia Historical Event
    - Replication of the 5.1M event that occurred near Centrailia, IL on October 8th, 1857

[36] Building Codes and Regulations. (n.d.). State of Illinois. Retrieved August 23, 2023, from https://cdb.illinois.gov/business/codes/buildingcodesregulations.html
[37] FEMA Hazus 5.0 Software. Released May 24, 2021. https://www.fema.gov/flood-maps/products-tools/hazus

Building Damage

Scenario #1: New Madrid Historical Event

- Hazus estimates that 311 buildings will be at least moderately damaged. This is over 4% of the total number of buildings in the region. An estimated 3 buildings will be damaged beyond repair.

Scenario #2: Centrailia Historical Event

- An estimated 387 buildings will be at least moderately damaged in this scenario. This is over 4% of the total number of buildings in the region. It's estimated that 5 buildings will be damaged beyond repair.

Economic Loss

Scenario #1: New Madrid Historical Event

- The total economic loss estimated for the earthquake is $38.96 million, which includes building and lifeline-related losses based on the region's available inventory.

Scenario #2: Centrailia Historical Event

- The total economic loss estimated for the earthquake is $100.46 million, which includes building and lifeline-related losses based on the region's available inventory.

Building-Related Losses

Building losses are broken into two categories: direct building losses and business interruption losses. Direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. Business interruption losses are those associated with the inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include temporary living expenses for those people displaced from their homes because of the earthquake.

Scenario #1: New Madrid Historical Event

- Total building-related losses were $34.44 million; 25% of the estimated losses were related to the business interruption of the region. The largest loss was sustained by the residential occupancies which made up over 34% of the total loss.

Scenario #2: Centrailia Historical Event

- Total building-related losses were $55.43 million; 19% of the estimated losses were related to the business interruption of the region. The largest loss was sustained by the residential occupancies which made up over 34% of the total loss.

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages.

Scenario #1: New Madrid Historical Event

- Economic losses to transportation infrastructure was estimated to be $1.29 million. This represents loss incurred by physical damage to highways and railways.
- Utility System losses were estimated to be $3.23 million. This includes damages to pipelines, facilities, and distribution lines for utilities including potable water, waste water, natural gas, electrical power, and communication.

Scenario #2: Centrailia Historical Event

- Economic losses to transportation infrastructure was estimated to be $0.91 million. This represents loss incurred by physical damage to highways and railways.

- Utility System losses were estimated to be $44.12 million. This includes damages to pipelines, facilities, and distribution lines for utilities including potable water, waste water, natural gas, electrical power, and communication.

Summary of Scenario Losses

Selected results of the two earthquake scenarios are shown in Table *26* below. Both scenarios would potentially have a significant impact in Bond County in terms of building damage and damage to the infrastructure of the county. Of the two, Hazus estimates that the 5.1M event near Centralia would cause greater damage to the county.

Table 26. Earthquake scenario results (estimated losses in millions of 2022 USD)

	Category	Scenario #1 New Madrid 7.4M	Scenario #2 Centralia 5.1M
Buildings Damaged (Count)	Moderate	286	329
	Extensive	42	53
	Complete	4	5
	Subtotal	**332**	**387**
Building Related Economic Loss Estimate	Income Losses	$8.5825	$10.7774
	Capital Stock Losses	$34.44	$44.6497
	Subtotal	**$43.0225**	**$55.4271**
Transportation System Economic Loss Estimate	Highway	$1.1180	$0.3125
	Airport	$.1058	$0.5878
	Railway	$.0682	$0.0132
	Subtotal	**$1.2920**	**$0.9135**
Utility System Economic Loss Estimate	Potable Water	$0.3522	$0.1931
	Waste Water	$2.8240	$43.8914
	Natural Gas	$0.0482	$0.0134
	Electrical Power	$0.0000	$0.0000
	Communication	$0.0016	$0.0243
	Subtotal	**$3.226**	**$44.1222**
	Loss Totals	**$47.5405**	**$100.4628**

Extreme Cold

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
EXTREME COLD	COUNTYWIDE	3	< 1	$0	0	0

Description

Extreme cold occurs when a cold air mass moves into an area and brings unusually cold temperatures for an extended period of time. A cold wave, a type of extreme cold, is defined as a rapid and significant drop in temperature over a 24-hour period, with the resulting temperatures significantly lower than the average for the time of year. Cold waves can be accompanied by other severe weather conditions, such as blizzards, ice storms, and strong winds, which can lead to dangerous and life-threatening situations. Very cold temperatures, usually in the single digits or below zero, which combined with the wind can cause frostbite or a potentially deadly condition known as hypothermia. The National Weather Service (NWS) uses the following terms to define extreme cold (Table 27).

Table 27. Extreme cold terms. Source: NWS

	Definition
Cold Wave	A rapid fall in temperature within 24 hours and extreme low temperatures for an extended period.
Wind Chill Warning	Dangerously cold wind chill values are expected or occurring.
Wind Chill Watch	Dangerously cold wind chill values are possible.
Wind Chill Advisory	Seasonably cold wind chill values but not extremely cold values are expected or occurring.

The wind chill temperature, which combines temperature and wind speed, describes how cold air feels on your skin is commonly used to provide a value taking wind speeds into account (Figure 24).[38] Very cold wind chill temperatures can cause frostbite or hypothermia.

The National Weather Service (NWS) office in St. Louis, MO (LSX) is Bond County's weather forecasting office. LSX issues a wind chill advisory when the wind chill is expected to be between -15°F and -24°F. The NWS advises caution when going outside and to cover exposed skin. A wind chill warning is issued when the

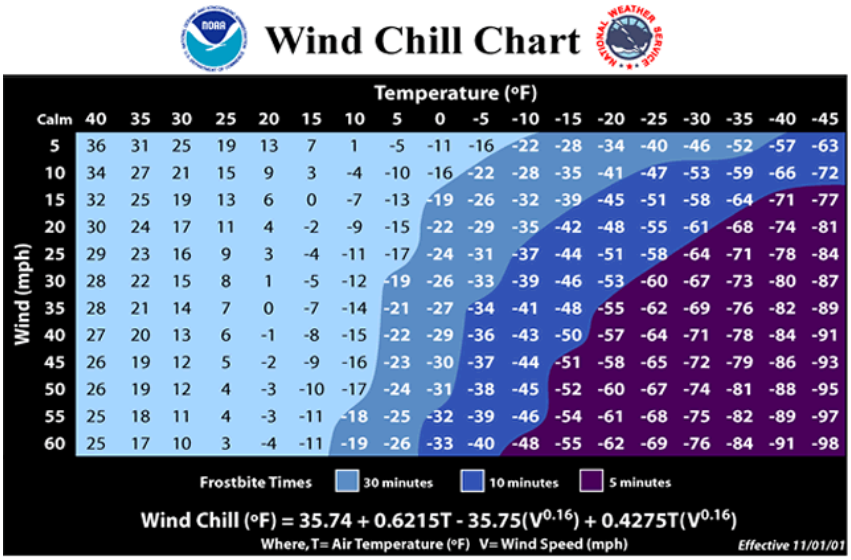

Figure 24. Wind chill temperatures. Source: NWS

[38] NWS. "Wind Chill Chart". Retrieved August 24, 2023, from https://www.weather.gov/safety/cold-wind-chill-chart

wind chill is expected to be -25°F or below. The NWS advises people to stay inside, as frostbite or hypothermia could occur in minutes.

Historical Events

The Midwestern Regional Climate Center (MRCC) has calculated wind chill climatologies for select stations across the US. Belleville, IL is the station nearest to Bond County. The area can expect an average of 1.3 days per year with at least one hour of a wind chill below -15°F (Figure 25). [39] In January 2014, a winter storm was followed by the coldest temperatures southwestern Illinois had experienced in years. Wind chill temperatures reached -39°F. wind chill readings reached -30°F in Bond County. Two hypothermia-induced deaths were reported south of Bond County in Perry and Jackson counties.[40]

Wind Chill Climatology: Average Number of Days with ≥ 1 hr

BELLEVILLE SCOTT AFB

Wind Chill ≤	30°F	25°F	20°F	15°F	10°F	5°F	0°F	-5°F	-10°F	-15	-20°F	-25°F	-30°F	-35°F	-40°F
Snow Year	106.6	80.7	54.8	37.7	26.1	17.2	10.7	6.1	3.2	1.3	0.7	0.4	0.1	0	0
July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
October	1.4	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0
November	12	7.8	3.8	1.7	0.7	0.2	0.1	0	0	0	0	0	0	0	0
December	25.1	19.7	13.6	9.4	6.1	4.1	2.5	1.5	0.8	0.3	0.2	0.1	0	0	0
January	27.8	23.7	18.5	14.7	11.3	7.9	5.1	3.1	1.9	0.8	0.4	0.2	0.1	0	0
February	23.2	18.8	13.6	9.5	6.8	4.4	2.7	1.3	0.5	0.2	0.1	0.1	0	0	0
March	13.8	9	4.8	2.3	1.2	0.6	0.3	0.2	0	0	0	0	0	0	0
April	3.3	1.4	0.5	0.1	0	0	0	0	0	0	0	0	0	0	0
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: Annual averages may not match the sum of monthly averages due to rounding.
Data Time Period: Snow Years 1973/74 to 2018/19

Figure 25. Average number of days with at least 1 hour of selected wind chill temperatures in Belleville, IL (1973/74 - 2018/19). Source: MRCC

Extent and Impact

Extreme cold can occur anywhere in the county, severely impacting day to day life. Aging essential infrastructure and systems, such as electrical and water/wastewater systems, can fracture and fail. Cold weather can cause water pipes to freeze and burst, leading to disruptions in water supply for homes and businesses. Damage to roofs, windows, and other structural components can occur in buildings that are not designed to withstand extreme cold temperatures. Extreme cold can cause power outages as a result of increased demand for electricity to heat homes and businesses.

Extreme cold can have negative impacts on plants and wildlife, particularly if the cold temperatures persist for an extended period of time. Cold waves can cause changes in water availability, particularly if they are accompanied by snow and ice buildup. This can include changes in stream flow, as well as impacts on groundwater resources. This could impact Bond County's public water supply.

Extreme cold can also significantly impact the economy. Loss of business function and consequently, revenue can occur due to transportation disruptions or power outages. Depending on the time of the year, cold waves can significantly impact the agricultural sector and lead to crop loss if the cold wave happens during growing seasons. Nearly 7% of Bond County's employment is in the agricultural sector.[41]

[39] MRCC, "Wind Chill Climatology", accessed Dec 2022. https://mrcc.illinois.edu/clim/windChill/index.jsp
[40] NCEI, Storm Events Database, accessed Dec 2022. https://www.ncdc.noaa.gov/stormevents
[41] USDA. 2017. National Agricultural Statistics Service. Census of Agriculture. https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Illinois/cp17005.pdf

Social Vulnerability

The entire county is at risk of extreme cold. However, the severity of extreme cold may be mitigated by the urban heat island effect. Urban heat islands are densely built-up areas that have the ability to trap heat, warming the surrounding air. Greenville is the most densely built-up region in Bond County, meaning it may be less susceptible to cold waves. However, Greenville University has a large international community with many students coming from China and Vietnam. These countries are typically warm throughout the year, meaning students may be less prepared. Greenville's international population may be more susceptible to cold waves than the rest of the city.

Other vulnerable populations include elderly adults and young children as the body's ability to thermoregulate is least effective at young and old ages. Over 25% of Old Ripley's and Pierron's populations are over 65.

Climate Change

Climate models project significant decreases in extremely low temperatures, both daytime and nighttime, across Illinois by mid- and late-century. The annual coldest five-day minimum temperature in southern Illinois is projected to increase from 5°F currently to between 8 and 15°F by mid-century and between 10 and 17°F by late-century under the moderate emissions scenario. Similarly, the annual number of nights with a minimum temperature below freezing in northern Illinois is projected to decrease from 135 days currently to between 110 and 127 days by mid-century and between 100 and 120 days by late-century. The combination of projected decreased frequency of extreme cold and the frequency of nights with below freezing temperatures across Illinois suggests a significantly decreased risk of extreme cold hazard exposure across Illinois in the next three to six decades

Vulnerability of Future Assets

Bond County's entire population and infrastructure are vulnerable to extreme cold. While Bond County's population decreased from the 2010 to 2020 census, future development is likely in the county, particularly in Greenville where the population is increasing. The county can mitigate vulnerability by adding warming centers to new or existing development. Information on how to prevent frozen pipes can be distributed to new residents.

Damages in rural counties tend to be underreported or have little data. Therefore, expected annual loss estimates for Bond County were calculated by taking the average damage per year caused by each hazard in rural counties. The expected annual loss of property and infrastructure caused by extreme cold is less than $100.

Extreme Heat

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
EXTREME HEAT	COUNTYWIDE	43	1.7	$0	0	1

Description

Extreme heat events occur as a result of above normal temperatures, which often coincide with high relative humidity. Extreme heat increases the likelihood of heat disorders among people and animals with prolonged exposure or strenuous activity. The NWS differentiates between heat related terms[42]:

- **Excessive Heat**: Excessive heat occurs from a combination of high temperatures (significantly above normal) and high humidities. At certain levels, the human body cannot maintain proper internal temperatures and may experience heat stroke.
- **Heat Wave:** A period of abnormally and uncomfortably hot and unusually humid weather. Typically, a heat wave lasts two or more days.
- **Heat Index**: The Heat Index (HI) or the "Apparent Temperature" is an accurate measure of how hot it really feels when the Relative Humidity (RH) is added to the actual air temperature.

The heat index combines relative humidity and temperature to measure how hot it feels. As relative humidity increases, a given temperature can feel even hotter (Figure 26).

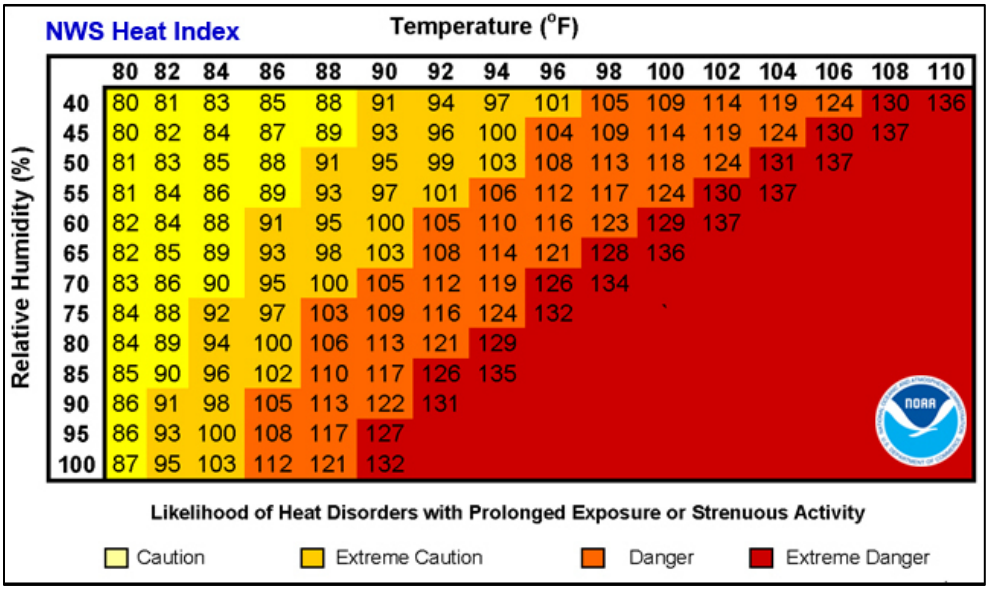

Figure 26. Heat Index Chart. Source: National Weather Service

[42] Service, N. N. W. Glossary—NOAA's National Weather Service. Retrieved February 4, 2023, from https://w1.weather.gov/glossary/

The NWS issues heat warnings when the heat index exceeds given local thresholds (Table 28). The NWS office in St. Louis, MO (LSX) is Bond County's weather forecasting office. LSX issues a heat advisory when heat index temperatures are forecast for 105°F or higher or when head index temperatures are between 100-104°F for four consecutive days. A heat warning is issued when heat index temperatures are forecast to be at least 110°F for two days or at least 105°F for four days. The Bond County Senior Center in Greenville acts as a cooling center when a heat advisory or warning is issued.[43]

Table 28. Heat Index effects on the body.

Classification	Heat Index	Effect on the body
Extreme Danger	125°F or higher	Heat stroke highly likely.
Danger	103°F - 124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity.
Extreme Caution	90 °F -103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity.
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity.

Heat kills by pushing the human body beyond its limits. Normally the body's internal thermostat produces perspiration that evaporates to cool and regulate the body's temperature to 98.6 degrees. Sweating does nothing to cool the body unless the water is removed by evaporation. High humidity slows this process. Because the body has been robbed of its ability to cool itself, the body must work much harder to maintain a normal temperature in excessive heat and high humidity. A sunburn also slows down the skin's ability to release excess heat.

The MRCC has calculated heat index climatologies for select stations across the US. Belleville, IL is the station nearest to Bond County. The area can expect an average of 5 days per year with at least one hour of a heat index above 105°F (Figure 27).

Heat Index Climatology: Average Number of Days with ≥ 1 hr for

BELLEVILLE SCOTT AFB

Heat Index ≥	80°F	85°F	90°F	95°F	100°F	105°F	110°F	115°F
Calendar Year	120.2	87.2	59.9	38.2	21.2	9.5	3	0.7
January	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0
March	0.7	0	0	0	0	0	0	0
April	3.7	1	0.2	0	0	0	0	0
May	11.9	7	2.8	0.8	0.2	0	0	0
June	24.2	18.3	12.6	7.4	3.2	1.1	0.1	0
July	29.3	25.4	20.3	14.9	9.7	4.9	1.7	0.4
August	28.9	23.6	17.5	12	7	3.3	1.1	0.2
September	16.6	10.3	5.9	3.1	1	0.2	0.1	0
October	4.7	1.6	0.5	0	0	0	0	0
November	0.3	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0

Note: Annual averages may not match the sum of monthly averages due to rounding.

Data Time Period: 1973 to 2018

Figure 27. Average number of days with at least 1 hour of selected Heat Index temperatures for Belleville, IL (1973-2018). Source: MRCC

Historical Events

In 2012, during the historic drought, a heat wave occurred across the Midwest during the last four days of June and continued into July. A large area of high pressure over this part of the US suppressed rainfall and kept skies cloud-free, allowing abundant solar energy to heat the surface.[44] In nearby St. Louis, MO, an air temperature of 107°F and a heat index of 108°F was recorded on July

[43] Cooling Center. (n.d.). Bond County Senior Center of Greenville, Illinois. Retrieved October 31, 2023, from https://www.bondseniors.org/

[44] NWS St. Louis office, "Historic Heat Wave 2012", accessed Dec 2022. https://www.weather.gov/media/lsx/Events/07_07_2012.pdf

7th. Although there were no deaths in Bond County, three heat-related deaths were reported in nearby Madison and St. Clair counties. Thirty-two people perished during this heat event across Illinois.[45]

Extent and Impact

Extreme heat and its impacts can occur anywhere in the county. Transportation infrastructure can be impacted when roads deform, caused by pavement expansion in the heat. The pavement pushes up off the ground at its weak spots when there is no place for it to expand, or where cracks have weakened the pavement, particularly in areas of poor drainage. The risk for roads buckling is greatest when the temperature is over 90 degrees for extended periods. Extreme heat can also cause rail lines to buckle (called "sun kinks"), causing derailments leading to hazardous material spills.

When water supplies are depleted in drought, subsidence (the sinking of the ground) can occur as more groundwater is removed. This affects infrastructure, including roads, buildings, and water pipes, and can lead to the formation of sinkholes. Heat waves can increase demand for electricity, which can lead to power outages and blackouts, particularly in areas with aging or stressed energy infrastructure.[46] Heat waves can impact communication systems, including cell phone towers, internet infrastructure, and other communication networks, due to equipment failures due to extreme heat, as well as disruptions to power and transportation systems.

The increased demand for water due to extreme heat can have impacts on water sources, which can lead to reduced water quality and availability. This could impact Bond County's public water supply. Excessive heat exposure can stress plants, stunt development, and potentially cause plant mortality, which can result in reduced quality and lower yield in agricultural crops.[47] Extreme heat can also cause mass die-offs for plants and wildlife due to unfavorable living conditions.

Extreme heat can have significant impacts on the economy. For areas that rely on outdoor recreation and tourism, they can experience reduced activity and visitors due to the heat. Extreme heat can increase demand for electricity and other forms of energy, particularly for cooling purposes. This can lead to increased energy costs for homes and businesses.[48] They can also impact labor productivity, particularly in outdoor occupations such as agriculture and construction. Other impacts on agriculture can include crop loss if excessive heat temperatures are sustained for long periods of time and may lead to drought. Nearly 7% of Bond County's residents are employed in the agricultural sector.[49]

Social Vulnerability

The entire county is at risk of extreme heat. However, the severity of a heat wave may be worsened by the urban heat island effect. Urban heat islands are densely built-up areas that have the ability to trap heat, warming the surrounding air. Greenville is the most densely built-up region in Bond County, meaning it may be more susceptible to heat waves.

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[45] NCEI, Storm Events Database, accessed Dec 2022. https://www.ncdc.noaa.gov/stormevents

[46] United States. Environmental Protection Agency. Office of Atmospheric Programs. (2006). Excessive heat events guidebook. US Environmental Protection Agency, Office of Atmospheric Programs. https://www.epa.gov/sites/default/files/2016-03/documents/eheguide_final.pdf

[47] Parker, L. E., McElrone, A. J., Ostoja, S. M., & Forrestel, E. J. (2020). Extreme heat effects on perennial crops and strategies for sustaining future production. https://www.climatehubs.usda.gov/sites/default/files/ParkerEtal2020_PlantScience.pdf

[48] [48] National Climate Assessment. (2018). Impacts of Climate Change on the United States: The Fourth National Climate Assessment. Retrieved from https://nca2018.globalchange.gov/

[49] USDA. 2017. National Agricultural Statistics Service. Census of Agriculture. https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Illinois/cp17005.pdf

Elderly adults are the most vulnerable demographic to extreme heat as the body's ability to thermoregulate deteriorates with age. Since 1999, people over 65 years old have been several times more likely to die from heat-related cardiovascular disease than the rest of the US population. [50] Over 25% of Old Ripley's and Pierron's populations are over 65 years old, making these villages especially susceptible.

Air conditioning and cooling centers are important tools for fighting heat-related illness. Lower-income households may not be able to afford air-conditioning, making them more susceptible to extreme heat. Smaller towns may not have a cooling center or the capacity to keep one staffed during the hottest parts of the day.

Climate Change

The average daily temperature in Illinois has increased by 1-2°F over the past 100 years. While all four seasons have experienced warming, overnight minimum temperatures have increased more than daytime maximum temperatures. This pattern of disproportionate warming at night is largest in the summer, such that summer nighttime temperatures have increased at three to four times the rate of summer daytime high temperatures. Researchers have consistently documented a strong response of excess mortality and morbidity to very high nighttime temperatures because extreme nighttime temperatures reduce the ability of humans to recover from hot days. The frequency of extreme heat has increased earlier in the warm season, especially in mid- to late-May. These kinds of early season heat waves are especially associated with elevated risk of heat-related health impacts because of the lack of human acclimatization to heat that is built up during the warm season. Therefore, a continued expansion of extreme heat occurrence in spring can increase risk of heat-related poor health outcomes even without a noticeable change in overall frequency.

Vulnerability of Future Assets

Bond County's entire population and infrastructure are vulnerable to extreme heat. While population has decreased from the 2010 to 2020 census, future development is likely in the county, particularly in Greenville where the population is increasing. The county can mitigate vulnerability by adding cooling centers to new or existing development. Information on how to prevent heat stroke can be distributed to new residents.

Damages in rural counties tend to be underreported or have little data. Therefore, expected annual loss estimates for Bond County were calculated by taking the average damage per year caused by each hazard in rural counties. The expected annual loss of property and infrastructure caused by extreme heat is less than $100.

[50] Climate Change Indicators: Heat-Related Deaths. (2021). EPA. https://www.epa.gov/climate-indicators/climate-change-indicators-heat-related-deaths#ref18

Floods: Dam and Levee Failure

HAZARD	GEOGRAPHIC EXTENT	HIGH HAZARD POTENTIAL	SIGNIFICANT HAZARD POTENTIAL	LOW HAZARD POTENTIAL	NUMBER OF LEVEES	MILES OF LEVEES
DAM/LEVEE FAILURE	COUNTYWIDE	1	3	9	1	1.4

Description

A dam is a barrier constructed across a watercourse in order to store, control, or divert water. Dams are usually constructed of earth, rock, concrete, or mine tailings. A dam failure is the collapse, breach, or other failure of the structure that causes downstream flooding. Dam failures may result from natural events, human-caused events, or a combination.

A system was created that categorizes dams according to the degree of adverse incremental consequences of a failure or mis-operation of a dam. The hazard potential classification does not reflect the current condition of the dam (e.g., safety, structural integrity, flood routing capacity). Dams are categorized into High, Significant, and Low Hazard Potential based on the probable loss of human life and the impacts on economic, environmental, and essential (Table 29).

Table 29. Dam hazard potential classification.

Hazard Potential Classification	
High Hazard Potential	Dams assigned the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life.
Significant Hazard Potential	Dams assigned the significant hazard potential classification are those dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.
Low Hazard Potential	Dams where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

A levee is a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to reduce risk from temporary flooding. A levee can be breached (break or gap in the levee), overtopped (water levels exceed the levee and flow into protected areas), or a combination of the two. Levees are designed to reduce flood risk from flood events, but do not eliminate the hazard entirely. When levees fail, they may result in greater loss of life and damage than if the levee had not been built.[51]

Levee systems can be accredited by FEMA provided they meet specified design, data, and documentation requirements. An accredited levee is expected to provide 1-percent annual chance (base) flood risk reduction.

[51] FEMA. (2021). Meeting the Criteria for Accrediting Levee Systems on Flood Insurance Rate Maps. https://www.fema.gov/sites/default/files/documents/fema_meeting-criteria-accrediting.pdf

Accredited levees may reduce the risk of flooding, but it is still not completely removed. It is important for all people living behind levees to understand their flood risk and take precautionary measures.[52]

There are 13 dams located in Bond County. The Potthast Dam, located in the southwestern part of the county, has a high downstream hazard potential. Three others, Alexander Pond Dam, Bond Christian Camp Lake Dam, and Greenville New City Dam, have a significant downstream hazard potential. The remaining nine dams have low downstream hazard potential (Figure 28). There have been no reported dam failures in Bond County.

There is one levee, Lake Carlyle-Keyesport Levee, in Bond and Clinton counties which protects 478 people and 294 buildings valued at $138 million in Keyesport (Figure 28).[53] The levee is in the process of becoming accredited by FEMA.

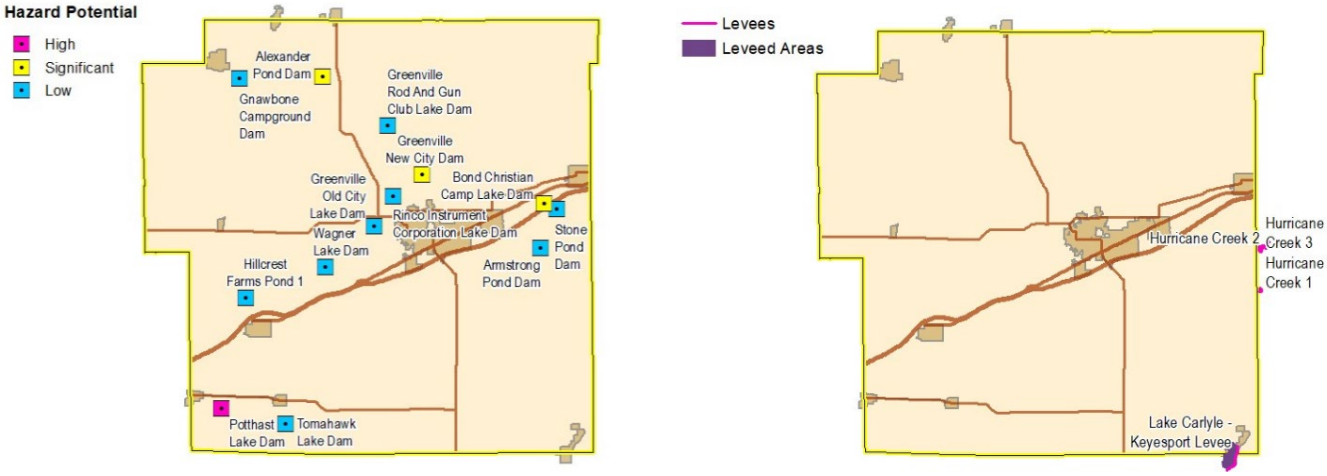

Figure 28. Dams (L) and levees (R) in Bond County. Source: USACE NID, NLD

Historical Events

There have been no dam or levee failures in Bond County. However, that does not mean that dams and levees in the area cannot fail. Recently, in nearby Washington County, a secondary dam on the Nashville Reservoir was breached. Roads in the surrounding area flooded, and several residents evacuated voluntarily in case the primary dam were to fail.[54]

Extent and Impacts

The geographic extent of dam failure is mostly confined to northwestern Bond County, north of I-70. There is the possibility of dam failure in the southwestern area and levee failure in the southeastern area. The hazard extent is similar but may extend further downstream in the case of dam failure. Hazard extent is also greater at dams with High and Significant Hazard Potential.

Extreme rain events can cause severe damage to infrastructure. The most immediate impact of dam or levee failure is flooding. Floodwater can cause significant property damage and infrastructure disruptions. Essential facilities and buildings in Bond County that are near or downstream of dams are particularly vulnerable. Keyesport, Greenville, and areas around Significant and High Hazard Potential Dams likely have buildings and infrastructure more at risk than other areas.

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[52] Martindale, B and Osman, P. (n.d.). Why the Concerns with Levees? They're Safe, Right? IAFSM. Retrieved June 7, 2023, from https://www.illinoisfloods.org/news-file/download/6

[53] NLD. Levees of Bond County. Retrieved November 1, 2023, from https://levees.sec.usace.army.mil/

[54] KFVS. (2022, July 26). KFVS12. https://www.kfvs12.com/2022/07/26/it-did-what-it-was-supposed-secondary-dam-breaches-nashville-ill-reservoir/

Flooding can damage or wash away roads or bridges making them unsafe for travel. Floodwater can obstruct travel networks causing delays in the movement of goods or people. Floodwater can also carry debris and other hazards, making it difficult for emergency responders to access affected areas. Floodwater can damage or disrupt utilities such as power, water, and sewer systems, leading to outages, contaminated water supplies, and other health hazards.

When a dam or levee fails, it can cause rapid changes in water levels, which can result in the loss of aquatic and riparian habitats. It can also impact wetland ecosystems by altering water levels and hydrologic patterns. A dam or levee failure can release large amounts of sediment, debris, and other pollutants into nearby waterways impacting water quality and animal habitats. Dam or levee failures can impact nearby agricultural lands by causing soil erosion from floodwaters. They can also pose a risk to water quality and human or wildlife health if hazardous materials such as chemicals, pesticides, or other pollutants contaminate nearby waterways. This could pose an especially big risk at Lake Carlyle

Dam or levee failure can result in significant property damage to homes, businesses, and other structures. This can be particularly devastating for property owners who may not have flood insurance. Floods caused by dam or levee failure can result in the closure of businesses, particularly those located in flood-prone areas. This can lead to lost income for business owners and their employees. Dam or levee failure can result in significant costs for repairs and rebuilding, both for individuals and for local, state, and federal governments. In addition, floods caused by dam or levee failure will result in increased costs for emergency response and cleanup efforts.

Social Vulnerability

Certain characteristics of dams and levees may put people more at risk. High-hazard potential dams and dams without emergency action plans (EAP) may leave downstream areas more at risk of catastrophic flooding. Only the Greenville New City Dam, which is owned by the City of Greenville, has an EAP. The Greenville New City Dam is north of Greenville and classified as a significant hazard, making residents and infrastructure susceptible to the dam's failure.

Communities with levees may also be at greater risk of flooding due to the perception that flood risk has been eliminated once a levee is constructed. Residents may decrease their flood preparedness activities, and communities may build structures in these high-risk areas. Once accredited, the Lake Carlyle-Keyesport Levee will provide protection to Keyesport on their Flood Insurance Rate Maps (FIRM). In Illinois, fewer than 3% of people living behind levees carry flood insurance.[55] Keyesport is currently suspended from the National Flood Insurance Program (NFIP), meaning residents cannot buy federally backed flood insurance. Levees can and do fail and without flood insurance, Keyesport's residents and their property may be especially at risk of financial loss.

Climate Change

As climate changes, heavy rainfall is predicted to increase in Illinois which could result in more stress being placed on dams and levees. Dams in Bond County are on average 59 years old. Many of these structures were likely built using less rigorous engineering standards that may not stand up to extreme precipitation and faster streamflow.[56]

Illinois does not currently have a funding program to assist dam owners with dam rehabilitation, although the state is removing aging low head dams.[57] Levees also need frequent maintenance and strengthening, which falls to the owner of the levee. If dams and levees do not improve to catch up with changing precipitation and

[55] Martindale, B and Osman, P. (n.d.). Why the Concerns with Levees? They're Safe, Right?. IAFSM. Retrieved June 7, 2023, from https://www.illinoisfloods.org/news-file/download/6

[56] Masters, J. (2021, March 3). New report: U.S. dams, levees get D grades, need $115 billion in upgrades. Yale Climate Connections. https://yaleclimateconnections.org/2021/03/new-report-u-s-dams-levees-get-d-grades-need-115-billion-in-upgrades/

[57] Illinois Section of the American Society of Civil Engineers. (2022). 2022 Report Card for Illinois Infrastructure. ASCE. https://infrastructurereportcard.org/wp-content/uploads/2016/10/Illinois_Report_Card_Report_2022.pdf

streamflow conditions, high-hazard dam failure has the potential to be catastrophic for areas downstream such as Greenville. A levee failure on Lake Carlyle could inundate Keyesport.

Vulnerability of Future Assets

Dam and levee failure will likely primarily affect areas around Significant and High Hazard Potential dams, and the area behind the levee in Keyesport. Infrastructure, new assets, and new residents in northern Greenville and downstream of the Alexander Pond Dam, Bond Christian Camp Lake Dam, and Potthast Lake Dam could be severely impacted by dam failure.

While Bond County's population decreased from the 2010 to 2020 census, future development is likely in the county, particularly in Greenville where the population is increasing. It is suggested that Greenville and other areas downstream of High and Significant Hazard Potential dams are cognizant of inundation areas when creating new development.

Damages in rural counties tend to be underreported or have little data. Therefore, expected annual loss estimates for Bond County were calculated by taking the average damage per year caused by each hazard in rural counties. The expected annual loss of property and infrastructure caused by dam and levee failure is $1,319.

Floods: Flash Flooding

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
FLASH FLOODING	COUNTYWIDE	18	< 1	$3,000	0	0

Description

A flash flood is the rapid and extreme flow of high water into a normally dry area. Generally, flash flood events begin within six hours of the causative event, which includes heavy rainfall, dam/levee failure, and ice jams. It is most often caused by heavy rainfall. The intensity of the rainfall, the location and distribution of the rainfall, the land use and topography, and soil type all determine where and how quickly a flash flooding event may occur.

Urbanized areas and rural roads are especially prone to flash floods because concrete and asphalt surfaces prevent water from draining into the soil. Water runs down the streets and can overwhelm stormwater and sewer systems, causing water to pool and rise. Basements are frequently flooded during flash flood events.

The NWS advises people not to drive through floodwaters. Roads may be washed out under floodwaters Six inches of rushing water can wash cars away and cause stalling; one foot of water can float most vehicles, including pick-up trucks and SUVs.[58] Nearly half of flash flood fatalities in the US are vehicle related.[59] Flash floods can occur anywhere in Bond County, making vigilance on all roadways important (Figure 29).

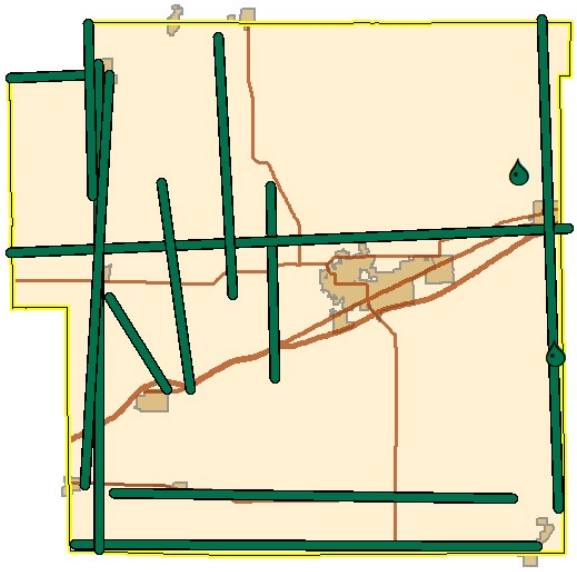

Figure 29. Flash flood reports (1996-2022). Source: NCEI

[58] NWS. (n.d.) Turn Around Don't Drown. Retrieved November 1, 2023, from https://www.weather.gov/tsa/hydro_tadd

[59] NWS. (n.d.). Severe Weather Awareness Week—Flash Flood Safety. Retrieved November 1, 2023, from https://www.weather.gov/shv/awarenessweek_severe_flashflood

Historical Events

In the last 20 years, law enforcement and emergency responders in Bond County have reported almost yearly rural road and major highway closures and rescues from flooded cars due to flash floods. On August 12, 2019, much of Bond County received 4 to 8 inches of rainfall. In Greenville, over 9 inches fell. The intensity of the rainfall overwhelmed storm sewers and drainage ditches, causing road, parking lot, and yard flooding (Figure 30). Basement flooding was extensive too, flooding homeowners and Greenville Elementary School. There were no fatalities, but there was one water rescue from a vehicle caught in floodwaters.

Figure 30. Flooded roadway at Route 140 and Idler Lane. Source: WGEL

On July 26, 2022, up to 6 inches of rain fell over a 6-to-10-hour period in northern Bond County. Roads in the area flooded and a vehicle was washed off the roadway. The driver was rescued without any injuries. The same storm system caused two fatalities in Missouri; both people were in their cars.

Extent and Impacts

Flash floods and their impacts can occur anywhere in the county, causing major destruction to infrastructure and property. Low-lying rural roads can be particularly vulnerable in part because roads and bridges can be washed away, making recovery efforts more difficult. Utility infrastructure is also vulnerable: flash floods can down utility poles and expose underground water and sewer lines by eroding the ground above. Downed power lines are especially dangerous because of their potential to cause electric shocks or electrical fires.

Flash floods can cause major damage to homes and buildings. Flood waters can cause structural damage, making them dangerous to enter and, in severe cases, uninhabitable. Gas leaks, electrical system damage, and sewage and water line damage in a home can leave residents without basic utilities.[60] Basements are particularly vulnerable to flash flooding because basement foundations are particularly vulnerable due to a rapid increase in subsurface water pressure or a rapid rise in surface water can move, crack or break foundation walls. People can lose appliances or other expensive property stored in basements, in addition to incurring costs from mitigation measures, like water pumps, to prevent flooding from occurring again.

Health impacts are among the biggest environmental concerns during and after a flash flood. Floodwaters can contain sewage and toxic chemicals, exposing people to chemical hazards and diseases such as E. coli and Salmonella.[61] Downed power lines and sharp objects in floodwaters can cause injury or even death. Although NOAA's "Turn Around Don't Drown" campaign is designed to warn people about the dangers of driving through floodwaters, vehicles are frequently involved in flood-related deaths in the US. Cars are easily swept away by 12 inches of water; SUVs and trucks by 24 inches of water.[62]

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[60] FEMA. (n.d.). Floods and Flash Floods. FEMA. Retrieved May 22, 2023, from https://www.fema.gov/pdf/library/floodpi.pdf

[61] CDC. (n.d.). Floodwater After a Disaster or Emergency. CDC. Retrieved May 22, 2023, from https://www.cdc.gov/disasters/floods/floodsafety.html

[62] NWS. (n.d.). Turn Around Don't Drown. NOAA. Retrieved May 22, 2023, from https://www.weather.gov/safety/flood-turn-around-dont-drown

Flash floods can also destroy wildlife habitat and cause soil erosion or landslides along streams. Squirrels, birds, and other tree dwellers can lose their habitat due to trees being uprooted, and animals that are not able to get to higher ground before a flash flood might drown.

Waterlogged basements, structural damage to homes, and the potential temporary housing costs if a home is deemed unsafe for living can be a financial burden to homeowners with and without flood insurance. Infrastructure such as roads and bridges may require extensive and expensive repairs.

Flash floods can cause devastating crop loss on farms. If plant roots are underwater for several days, water and soil pathogens may cause plant disease or even death. Agricultural chemicals, manure, and human waste from rural septic systems can also be found in floodwaters, making crops unsellable.[63] Other industries and individual jobs may be impacted, too. While flood damage is being cleaned up, businesses may be closed for days or weeks. People's ability to go to work may be hampered by inoperable personal vehicles.

Social Vulnerability

Flooding has been well documented as having a disproportionate impact on socially vulnerable populations. Low-income populations and people of color are more likely to live in floodplains. However, floodplains are not the only places where flooding occurs. In fact, nearly 40% of NFIP claims come from outside SFHAs. Homeowners living outside SFHAs are not required to purchase flood insurance, meaning that they are at risk of incurring high out-of-pocket expenses if their home is flooded. Renters may not be aware that flood insurance is available.

Compared to the rest of Illinois, Bond County has low vulnerability to flash floods, although social vulnerability is high in Greenville (Figure 31). Low-income households across the county may also not be able to afford insurance or extra expenses incurred from flash flood damage. Greenville, Keyesport, Mulberry Grove, Smithboro, and Sorento all have more than 20% of their population below

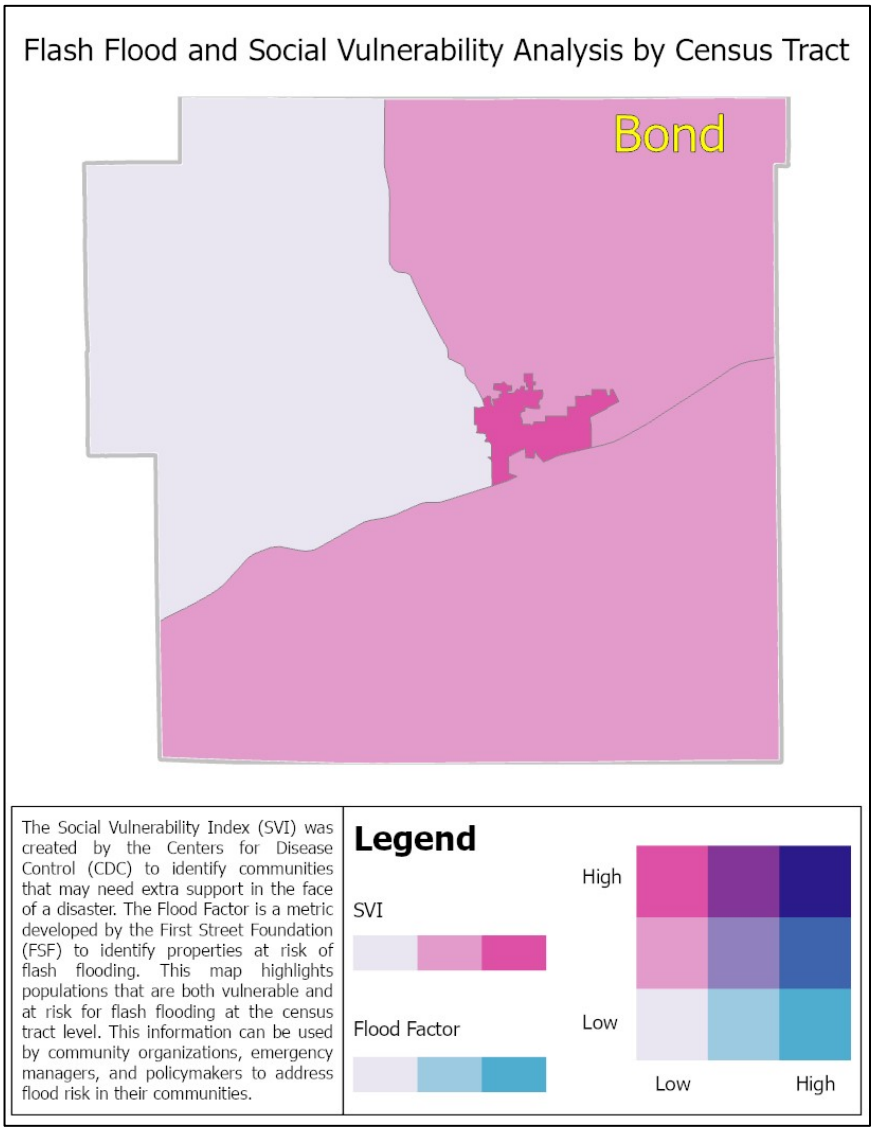

Figure 31. Flash flood and social vulnerability.

[63] UMass Extension. (n.d.). Flooded Crops: Food Safety and Crop Loss Issues. UMassAmherst. Retrieved May 22, 2023, from https://ag.umass.edu/vegetable/fact-sheets/flooded-crops-food-safety-crop-loss-issues

the poverty line. Greenville also has a high number of residents who rent who may not be aware of the availability of flood insurance.

Climate Change

As climate changes, flash floods are expected to get "flashier", meaning that they will be shorter in duration but higher in severity. This is in part because precipitation is expected to increase across the state under multiple climate scenarios (Figure 13, Figure 14). In southern Illinois, both total and extreme precipitation are expected to increase.[64] The combination of increased total and extreme precipitation may lead to more severe flash floods. More precipitation may also lead to wetter soils, preventing drainage.

Surface water drainage is also a major issue in areas with storm sewers from over 50 years ago that were designed to handle less or slower rainfall. There is no state-wide stormwater ordinance in Illinois. Typically, storm sewer design standards in the state are based on a 10-year storm return, meaning that storm sewers are designed to handle a storm that has a 10% chance of occurring every year. In central and southern Illinois, sewer systems may be designed to only handle a two or five-year storm (50% or 20% yearly chance occurrence, respectively).[65] As climate changes, 100 and 500-year storms (1% and 0.2% yearly chance occurrence, respectively) are expected to become more common due to heavier rainfall. Storm sewers across the state will likely not be able to handle these increasingly heavy precipitation storms, causing more severe flash floods. [66]

Vulnerability of Future Assets

Bond County's entire population and infrastructure are vulnerable to flash floods. While Bond County's population decreased from the 2010 to 2020 census, future development is likely in the county, particularly in Greenville where the population is increasing. Current and future residents should be educated about floodplains and the availability and importance of flood insurance. Developers should avoid developing in areas that have frequently flooded in the past.

Damages in rural counties tend to be underreported or have little data. Therefore, expected annual loss estimates for Bond County were calculated by taking the average damage per year caused by each hazard in rural counties. The expected annual loss of property and infrastructure caused by flash floods is $177,839.

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[64] Wuebbles, D; Angel, J; Petersen, K; Lemke, A.M. (2021). An Assessment of the Impacts of Climate Change in Illinois. University of Illinois at Urbana-Champaign. https://doi.org/10.13012/B2IDB-1260194_V1

[65] Illinois Section of the American Society of Civil Engineers. (2022). 2022 Report Card for Illinois Infrastructure. ASCE. https://infrastructurereportcard.org/wp-content/uploads/2016/10/Illinois_Report_Card_Report_2022.pdf

[66] IDNR. (2015). Report for the Urban Flooding Awareness Act. State of Illinois. https://dnr.illinois.gov/content/dam/soi/en/web/dnr/waterresources/documents/final-ufaa-report.pdf

Floods: Riverine Flooding

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
RIVERINE FLOODING	COUNTYWIDE	2	< 1	$0	0	0

Description

A riverine flood is defined as when rivers or streams exceed the capacity of their channels to accommodate water flow, overflowing into normally dry land. Riverine floods are generally caused by heavy rainfall, dam/levee failure, rapid snowmelt, or ice jams, and occur over longer periods than flash floods.[67] Standing water can linger for days or weeks, disrupting daily life. Riverine flooding is more likely closer to a river, lake, or other surface water feature.

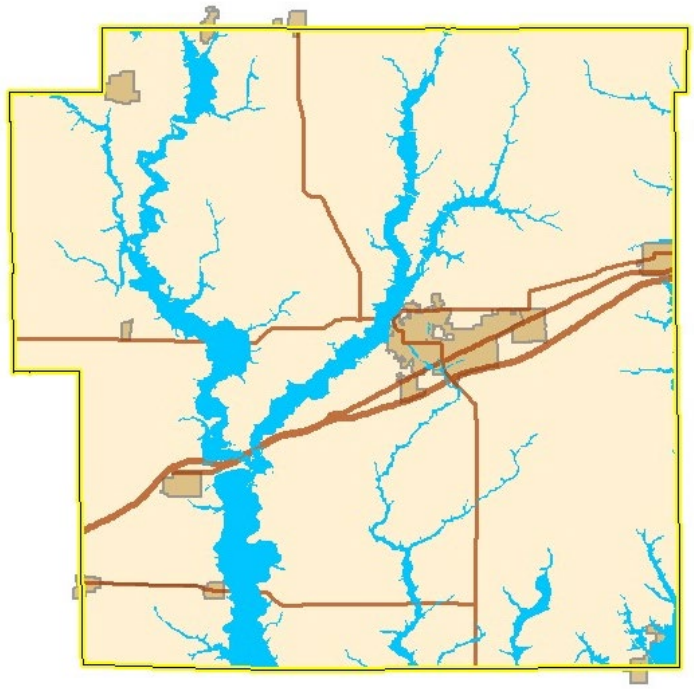

Figure 32. SFHAs on FEMA FIRMs for Bond County. Sources: FEMA

Many cities and towns in Illinois are located along streams or rivers and have had development in floodplains. Vegetation and soil removal and new storm sewers increase runoff into streams, which increases streamflow and stream volume. More and faster moving water increases the chance of flooding in the surrounding area and downstream.[68] Even with protection from dams and levees, which can fail, infrastructure and buildings on rivers are at risk of riverine flooding.

Special Flood Hazard Areas (SFHA), or floodplains, are areas on land that are at high risk for flooding. SFHAs have a 1% chance of flooding in a given year. In addition to the unincorporated areas of Bond County, Greenville, Keyesport, Mulberry Grove, Panama, Pierron, Pocahontas, Smithboro, and Sorento have FEMA Flood Insurance Rate Maps (FIRM) showing SFHAs (Figure 32).[69] Only unincorporated Bond County and Greenville are enrolled in the National Flood Insurance Program (NFIP).

[67] NWS. (n.d.). Flood Related Hazards. NOAA. Retrieved June 6, 2023, from https://www.weather.gov/safety/flood-hazards

[68] IAFSM. (n.d.). Floodplains. IAFSM. Retrieved June 7, 2023, from https://prepare.illinoisfloods.org/learn/flood-risk/floodplains

[69] Federal Emergency Management Agency, Flood Map Service Center, accessed Dec 2022. https://msc.fema.gov

The major rivers running through Bond County are Shoal Creek, East Shoal Creek, and Beaver Creek. The Kaskaskia River fills and empties Lake Carlyle, located in the southeastern corner of the county.

Historical Events

During the August 21, 2019, flood event, Beaver Creek and its tributaries flooded, inundating farmland, roads, and parking lots off of IL-127 and E City Road 40 in southeastern Greenville.

Between December 26 and December 28, 2015, prolonged rainfall between southwest Missouri and central Illinois caused widespread flooding. Nearly every small creek and tributary in the area went into flood stage. Interstate 70 between Pocahontas and Greenville, Illinois, was closed for several days due to flooding on Shoal Creek and East Fork Shoal Creek.

Extent and Impacts

Riverine floods and their impacts primarily affect high hazard areas (SFHAs), or areas with a 1% chance of flooding in a given year (see Figure 32). However, riverine floods can also affect areas with moderate or minimal flood hazard, or areas with a 0.2% chance of flooding. These floodplains can be found on FIRMs for Bond County and its jurisdictions at the online FEMA Flood Map Service Center (https://msc.fema.gov/portal/advanceSearch).

Riverine flooding can cause major destruction to infrastructure and property. Roadway infrastructure can be particularly vulnerable in part because roads and bridges can be washed away. For structures near rivers, riverine flooding can cause extensive damage. The flood waters can cause structural damage, making them dangerous to enter and, in severe cases, uninhabitable. Gas leaks, electrical system damage, and sewage and water line damage in a home can leave residents without basic utilities.[70]

Essential facilities and buildings in Bond County in SFHAs (Figure 32) and other floodplains are at risk of riverine flooding. Floodplains for Bond County and its jurisdictions can be found on the FEMA Flood Map Service Center's website (https://msc.fema.gov/portal/advanceSearch).

Riverine floods can cause soil erosion, landslides, and damage wildlife habitats. High water levels and strong currents can cause soil erosion, which can lead to nutrient loss and decreased soil fertility. This can reduce the ability of soil to absorb and retain water, increasing the risk of future flooding. Riverine floods can lead to contamination of water sources, as floodwaters can pick up pollutants such as agricultural runoff, sewage, and chemicals from industrial sites. This can harm aquatic life and make the water unsafe for human consumption.

The economic impact of riverine flooding could be extensive. Basement damage, structural damage to homes, and the potential temporary housing costs if a home is deemed unsafe for living can be a financial burden to homeowners with and without flood insurance. Infrastructure such as roads and bridges may require extensive and expensive repairs.

[70] FEMA. (n.d.). Floods and Flash Floods. FEMA. Retrieved May 22, 2023, from https://www.fema.gov/pdf/library/floodpi.pdf

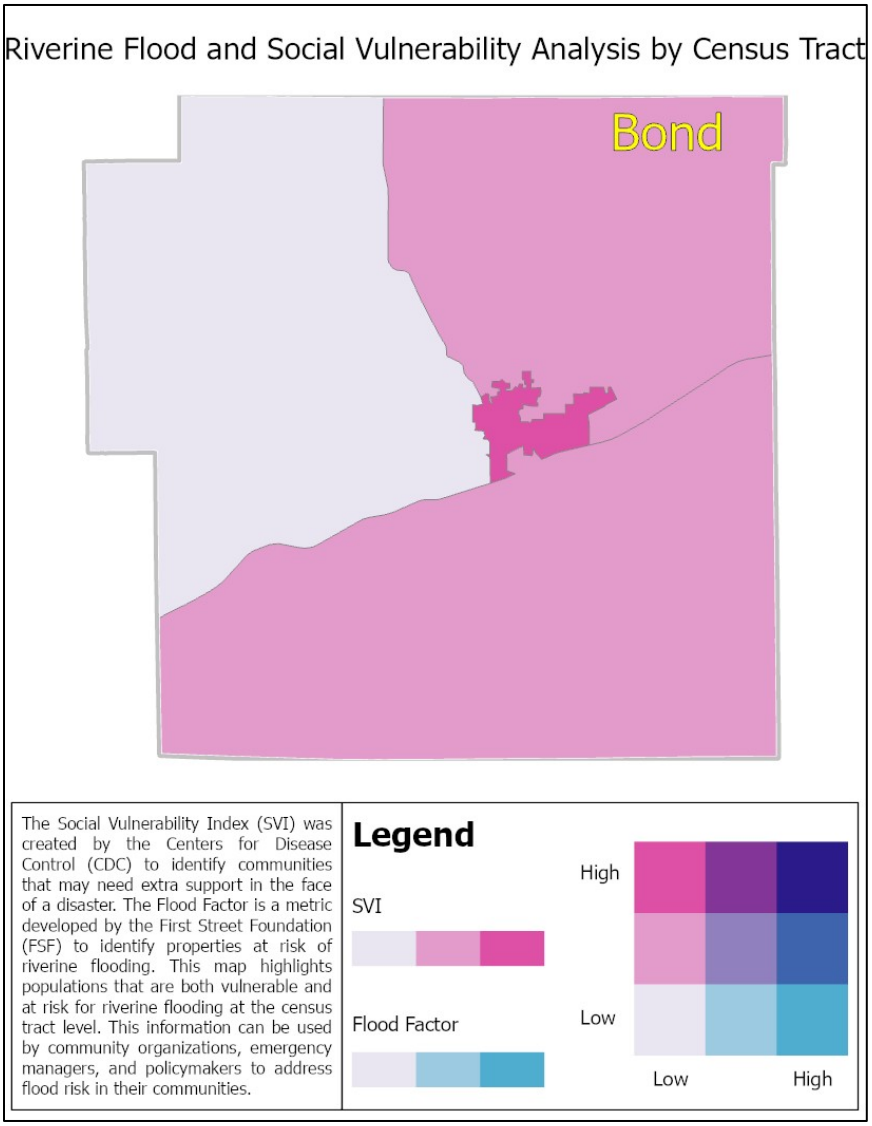

Figure 33. Riverine flooding and social vulnerability.

Social Vulnerability

Flooding has been well documented as having a disproportionate impact on socially vulnerable populations. Low-income populations and people of color are more likely to live in floodplains. However, floodplains are not the only places where flooding occurs. In fact, nearly 40% of NFIP claims come from outside SFHAs. Homeowners living outside SFHAs are not required to purchase flood insurance, meaning that they are at risk of incurring high out-of-pocket expenses if their home is flooded. Renters may not be aware that flood insurance is available.

Compared to the rest of Illinois, western Bond County has low vulnerability to riverine floods (Figure 33). Flood insurance and flood recovery may be unaffordable for residents in Greenville, Keyesport, Mulberry Grove, Smithboro, and Sorento, where more than 20% of the population is below the poverty line. Greenville also has a high number of residents who rent who may not be aware of the availability of flood insurance.

Climate Change

Climate change has a less clear impact on riverine floods compared to flash floods. Unlike flash floods, runoff and streamflow heavily impact riverine floods. Snowmelt runoff may decrease due to less snowpack as the climate warms, decreasing streamflow. However, heavy precipitation is increasing, which increases stream volume. In Illinois, riverine floods have broadly increased between 1965 and 2015.[71] If riverine floods continue this trend, Bond County's river-adjacent communities –Greenville, Mulberry Grove, and Panama – will become more at risk.

Dams and levees are an integral part of assessing climate change's impact on riverine flooding. Designed to prevent buildings, infrastructure, and farmland from riverine flooding, dams and levees may not be able to withstand increasing streamflow and flood volume, leading to more deadly and damaging riverine floods. The impact of climate change on dams and levees is further discussed in the **Floods: Dam and Levee Failure** section.

[71] Mallakpour, I. and Villarini, G. (2015). The changing nature of flooding across the central United States. Nature Clim Change 5, 250–254 (2015). https://doi.org/10.1038/nclimate2516

Vulnerability of Future Assets

While Bond County's population decreased from the 2010 to 2020 census, future development is likely in the county, particularly in Greenville where the population is increasing. Developers should consult the FIRMs in Bond County to prevent development in SFHAs. Any development in the floodplain could lead to catastrophic damage in the future. Floodplains for Bond County and its jurisdictions can be found online at the FEMA Flood Map Service Center's website (https://msc.fema.gov/portal/advanceSearch).

Damages in rural counties tend to be underreported or have little data. Therefore, expected annual loss estimates for Bond County were calculated by taking the average damage per year caused by each hazard in rural counties. The expected annual loss of property and infrastructure caused by riverine flooding is $46,191, which could rise if floodplains are developed.

Hazus Riverine Flooding Analysis

Hazus is a loss and risk assessment software package built on GIS technology distributed by FEMA. The information generated can be used for planning emergency response actions and prioritizing mitigation efforts to reduce risk. Hazus output provides a baseline for evaluating success in reducing natural hazard risk exposure when conducting future assessments. Hazus assessments depend on several important datasets including essential facilities, building structure information, and general building stock inventories. Bond County's Hazus analyses included the creation of a building inventory using the Bond County assessor's data and an update of the essential facilities database.

Risks and losses due to flood hazards were modeled using the Hazus methodology of a Level 2, or advanced, analysis. The impact of five separate flood events was analyzed including the 10%, 4%, 2%, 1%, and 0.2% annual chance floods. An average annualized loss (AAL) value is then calculated using the values from the five flood events listed above. AAL represents the estimated long-term value of losses averaged on an annual basis. This value can be useful for estimating the potential flood losses over a defined period of time.

Depth Grids

To represent the flood hazard, flood depth grids were created for selected flood events in Bond County; 10%, 4%, 2%, 1%, and 0.2% annual chance floods. Each depth grid consists of a grid of equal-sized cells that cover the spatial extent of a given flood event. Each cell in a grid has a flood depth value associated with it for the annual chance event being represented. Depth grids are calculated by subtracting ground elevations from flood elevations. Ground elevations take the form of a GIS raster Digital Elevation Model (DEM) or Digital Terrain Model (DTM). Flood elevations at modeled cross-sections along each studied stream are interpolated to create Water Surface Elevation (WSE) grids. Depth grids for this analysis were created based on a DTM derived from 2015 LiDAR for Bond County. The Lake Carlyle - Keyesport Levee was shown as protecting up to and including the 1% annual chance flood event in this analysis.

While the extents of the flood depth grids may closely resemble FEMA regulatory Flood Insurance Rate Maps (FIRMs), they are not regulatory products and cannot be used to determine requirements for flood insurance.

Building Exposure

74 structures were identified to be at a high risk of flooding in Bond County. For this risk assessment, "high risk" structures are those that are located within the 0.2% annual chance (500-year) floodplain. Estimates of the structure counts and fair market value of the structures are detailed in Table 30 below.

Table 30. High-risk building exposure (building and content cost) (2022 USD)

	1% Annual Chance Flood (100yr)		*0.2% Annual Chance Flood (500yr)*	
Community Name	**Count**	**Total Exposure**	**Count**	**Total Exposure**
City of Greenville	11	$11,581,820	30	$19,365,855
Village of Keyesport	0	$0	12	$8,055,122
Village of Pocahontas	1	$74,576	1	$74,576
Village of Sorento	1	$203,248	1	$203,248
Bond County Unincorporated Areas	22	$28,120,699	30	$35,888,286
Total	**35**	**$39,980,343**	**74**	**$63,587,087**

Economic Loss Due to Flooding

A Hazus flood loss analysis was performed using the structure-based asset inventory to investigate the impact of the five analyzed flood events. The results are listed by community (Table 31) and by occupancy class (Table 32).

Flooding events can be extreme and devastating, leading to millions of dollars of losses during a flood event. Looking at the flood risk faced on an annual basis by using the average annualized losses shows on average how much it costs per year to keep properties unprotected from floods or in the floodplain.

Structure counts only include buildings that returned flood losses in the analysis. Some structures were not shown to be damaged despite being located within the floodplain such as structures that are elevated above the water of the flood event being analyzed.

Table 31. Total flood losses by community (2022 USD).

		City of Greenville	Village of Keyesport	Village of Pocahontas	Village of Sorento	Bond County Unincorporated Areas	**Total**
10% Annual Chance Flood (10yr)	Count	0	0	0	1	8	9
	Total Losses	$0	$0	$0	$62,600	$497,300	$559,900
4% Annual Chance Flood (25yr)	Count	2	0	0	1	12	15
	Total Losses	$739,000	$0	$0	$69,800	$2,399,200	$3,208,000
2% Annual Chance Flood (50yr)	Count	7	0	0	1	16	24
	Total Losses	$1,241,500	$0	$0	$73,800	$3,950,700	$5,266,000
1% Annual Chance Flood (100yr)	Count	11	0	1	1	22	35
	Total Losses	$1,875,200	$0	$0	$78,100	$5,425,300	$7,378,600
0.2% Annual Chance Flood (500yr)	Count	30	12	1	1	30	74
	Total Losses	$3,872,000	$1,344,000	$0	$92,000	$9,612,800	$14,920,800
Average Annualized Loss	Count	30	12	1	1	30	74
	Total Losses	$88,320	$8,080	$0	$7,030	$276,680	$380,110

Table 32. Total Flood Losses by Occupancy (2022 USD).

		Agricultural	Commercial	Industrial	Religious	Residential	**Total**
10% Annual Chance Flood (10yr)	Count	1	0	0	0	8	9
	Total Losses	$120,700	$0	$0	$0	$439,200	$559,900
4% Annual Chance Flood (25yr)	Count	2	1	1	0	11	15
	Total Losses	$654,400	$706,300	$1,212,100	$0	$635,200	$3,208,000
2% Annual Chance Flood (50yr)	Count	5	4	1	0	14	24
	Total Losses	$1,066,500	$1,173,000	$2,240,700	$0	$785,800	$5,266,000
1% Annual Chance Flood (100yr)	Count	8	4	1	0	22	35
	Total Losses	$1,675,100	$1,563,100	$2,816,700	$0	$1,323,700	$7,378,600
0.2% Annual Chance Flood (500yr)	Count	12	7	2	1	52	74
	Total Losses	$3,643,900	$3,063,800	$4,428,000	$277,200	$3,507,900	$14,920,800
Average Annualized Loss	Count	12	7	2	1	52	74
	Total Losses	$82,750	$78,320	$134,010	$1,660	$83,370	$380,110

HazMat Spill

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
HAZMAT SPILL	COUNTYWIDE	155	4.3	N/A	0	0

Description

Hazardous materials (HazMat) are events involving large-scale accidental or intentional releases of chemical, biological, or radiological (nuclear) materials. Hazardous materials events generally involve incidents at fixed-site facilities that manufacture, store, process, or otherwise handle hazardous materials or along transportation routes like major highways, railways, navigable waterways, and pipelines. Although HazMat incidents are typically human induced, natural hazards such as floods and tornadoes can cause HazMat spills. HazMat incidents have the potential to cause harm to humans, animals, and the natural and built environment.[72]

The severity of a hazardous materials release depends on the type of material released, the amount of the release proximity to populations or sensitive areas like wetlands or waterways, and environmental factors such as wind velocity and direction and sunlight. The release of materials can lead to injuries or the evacuation of thousands of nearby residents. HazMat incidents should be reported to the Illinois Environmental Protection Agency (IEPA), Local Emergency Planning Committee, and the National response Center (NRC) immediately if the meet any one of the following conditions:[73]

- A member of the general public is killed;
- A member of the general public receives injuries requiring hospitalization;
- An authorized official of an emergency agency recommends an evacuation of an area by the general public;
- A motor vehicle has overturned on a public highway;
- Fire, breakage, release or suspected contamination occurs involving an etiologic agent (i.e., an agent that causes the development of a disease or condition);
- Any release of petroleum (or oil) that produces a sheen on nearby surface water and/or threatens navigable waters;
- Any spill or overfill of petroleum that results in a release to the environment that exceeds 25 gallons.

HazMat spills frequently occur along transportation routes. Interstates, US Highways, State Highways, and railroads run through Bond County's incorporated and unincorporated areas (Figure 34).

[72] FEMA (n.d.). Hazardous Materials Incidents. Retrieved August 11, 2019, from https://www.fema.gov/sites/default/files/2020-07/hazardous-materials-incidents.pdf
[73] IEMA. (2020, December). Emergency Release Notification Fact Sheet. https://epa.illinois.gov/content/dam/soi/en/web/epa/topics/emergency-response/documents/emernotfactsheet2-04.pdf

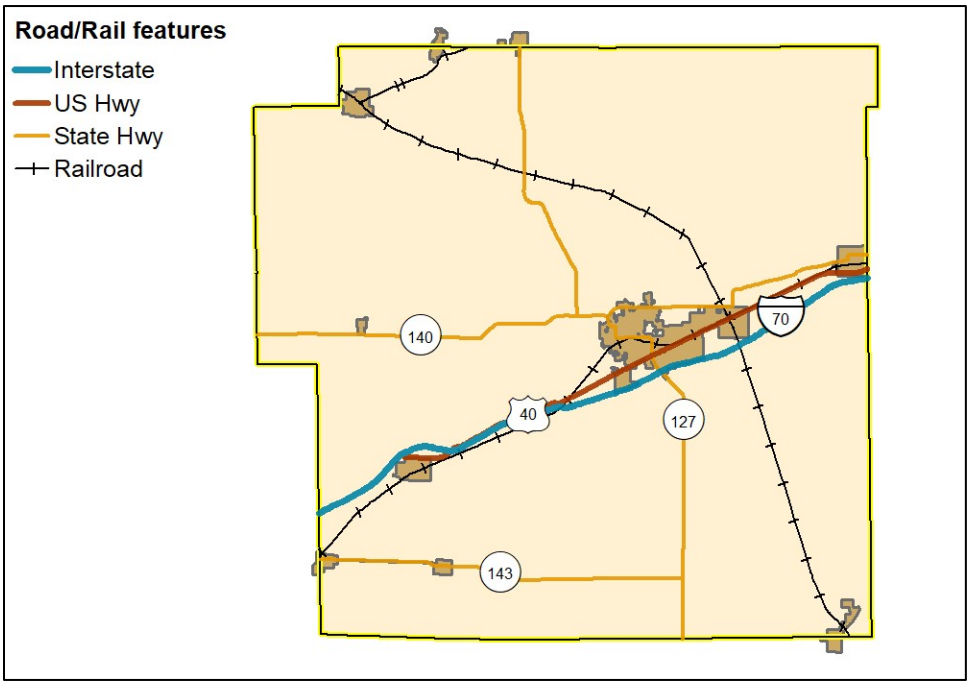

Figure 34. Major transportation features. Source: IDOT

Gas transmission and hazardous liquid pipelines cut across Bond County. Several pipelines intersect Pocahontas, and one pipeline each goes through Donnellson and Pierron. Other pipelines run near incorporated areas such as Greenville and Mulberry Grove, but the majority of pipeline length runs through the unincorporated county (Figure 35). Every gas transmission pipeline is operated by Ameren Illinois, while hazardous liquid pipelines are operated by different private oil companies. The southernmost gas transmission pipeline is abandoned; all other pipelines are still active.

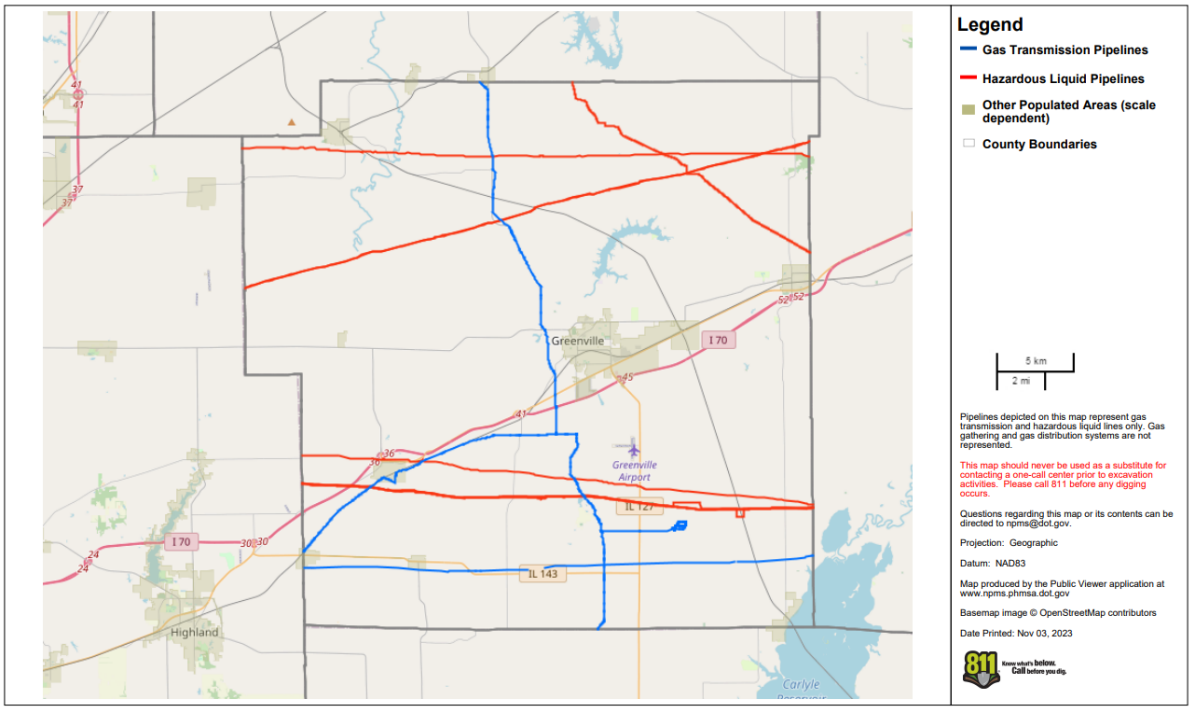

Figure 35. Gas transmission and hazardous liquid pipelines. Source: US Department of Transportation

Historical Events

IEPA has received 155 HazMat reports in and near Bond County since 1987 (Table 33). The plurality of HazMat incidents occurred on I-70. Most HazMat incidents in Bond County are a result of diesel and gasoline spills or leaks.[74]

Table 33. HazMat incidents by jurisdiction. Source: IEPA

Community	Number of Reported HazMat Incidents
Donnellson	2
Greenville	82
Keyesport	2
Mulberry Grove	23
Old Ripley	2
Panama	0
Pierron	5
Pocahontas	22
Smithboro	3
Sorento	10

While none of these incidents resulted in evacuations, injuries, or deaths, HazMat incidents in Ohio and Illinois in 2023 have caused serious harm. On February 3, 2023, a Norfolk Southern train derailed, causing hundreds of thousands of toxic chemicals to leach into the soil and water, and spread miles through the air around East Palestine, Ohio. Hazardous materials released by the derailment included substances that are linked to liver damage, cancers, skin irritations, and headaches. As of today, the cleanup process is still in progress.[75]

On September 29, 2023, five people were killed and seven people were hospitalized after tanker carrying anhydrous ammonia crashed on US Route 40 near Teutopolis, Illinois. The Effingham County Coroner confirmed that all five deaths were caused by respiratory failure due to inhalation and exposure to anhydrous ammonia. The hospitalized individuals suffered from chemical burns to the eyes, lungs, and respiratory system.[76]

Extent and Impacts

The geographic extent of a HazMat spill occurring is primarily tied to its proximity to either a transportation route or a potential fixed-point source. The hazard extent can be wide ranging, particularly if the hazardous substance is a gas that can be spread miles from the point of the incident by high winds.

Anhydrous ammonia is a danger across Bond County, particularly in rural, farming areas. Anhydrous ammonia is a gas (or liquid under high pressure) widely used in nitrogen fertilizers. Inhalation of the substance can lead to lung and eye irritation, blindness, severe respiratory problems, or even death.[77] Although there have been no

[74] IEPA. (n.d.). Search for Hazardous Materials Incident Report. IEMA. Retrieved November 2, 2023, from https://public.iema.state.il.us/FOIAHazmatSearch/

[75] Sullivan, B. (2023, March 3). Here's why it's hard to clean up toxic waste from the East Palestine train derailment. NPR. https://www.npr.org/2023/03/03/1160481769/east-palestine-derailment-toxic-waste-cleanup

[76] Long, J. (2023, October 23). Autopsies confirm Teutopolis deaths due to respiratory failure from inhalation of anhydrous ammonia; 2 survivors remain in critical condition. Effingham Daily News. https://www.effinghamdailynews.com/news/local_news/autopsies-confirm-teutopolis-deaths-due-to-respiratory-failure-from-inhalation-of-anhydrous-ammonia-2-survivors/article_85c3e18e-71ad-11ee-a05a-87778ce75a1f.html

[77] CDC. (n.d.). Ammonia Solution, Ammonia, Anhydrous: Lung Damaging Agent. Retrieved August 25, 2023, from https://www.cdc.gov/niosh/ershdb/emergencyresponsecard_29750013.html

deadly incidents, anhydrous ammonia tank vent issues have been reported to the Greenville Fire Protection District.

Hazardous materials are frequently transported on infrastructure including interstates, state highways, and railroads. A HazMat spill could shut down an important transportation corridor, such as I-70 which cuts across Bond County.

HazMat incidents can cause widespread environmental damage. Leaks and spills can pollute groundwater and surface water. This can be harmful to waterways and plants and animals that depend on them. Groundwater and surface water pollution can also impact people's health if it contaminates food or drinking water. Aquifers, an underground water source, are the primary source of drinking water in Bond County, making drinking water especially vulnerable.

HazMat incidents can also be very costly. Remediation and cleanup can be expensive in terms of personnel, equipment, and materials needed.

Social Vulnerability

People with existing health conditions are more vulnerable to HazMat incidents. Anhydrous ammonia leaks may affect people with preexisting conditions, such as asthma. Lack of health insurance is also a vulnerability, as people exposed to hazardous materials may be less likely to seek treatment. Uninsured numbers are especially high in Smithboro (over 30% of the population).

Climate Change

Climate change may increase exposure to chemicals in Bond County. More frequent and intense storms may increase the likelihood of flooding, causing chemicals held in underground storage tanks, landfills, and storm debris to leak or spread to previously unsoiled areas.

Vulnerability of Future Assets

HazMat incidents, particularly airborne ones, can affect the entire county; therefore, the entire county population is vulnerable to HazMat incidents.

While Bond County’s population decreased from the 2010 to 2020 census, future development is likely in the county, particularly in Greenville where the population is increasing. Evacuation and shelter in place plans should remain up to date. Future development should be conscious of any existing brownfield sites across Bond County.

Mine Subsidence

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
MINE SUBSIDENCE	LIMITED	1	< 1	N/A	N/A	N/A

Description

Mine subsidence occurs when the ground surface sinks downward due to the failure of support in an underground mine. It can take place gradually or suddenly. Minor to severe damage may occur to structures in the vicinity of a subsidence event. While it is difficult to predict when subsidence will occur, a location's proximity to a mine is a good indicator of whether it will occur.

There are two types of mine subsidence in Illinois: sag and pit. Sag subsidence (Figure 36), the most common type of mine subsidence, and appears as a gentle depression in the ground which can spread over a large area, up to several acres. Pit subsidence (Figure 36), which is less common, forms a bell-shaped hole 6-8 feet deep, from 2-40 feet across, and occurs when a shallow mine roof collapses.[78] Pit subsidence tends to occur more rapidly than sag subsidence, which can take weeks or months.

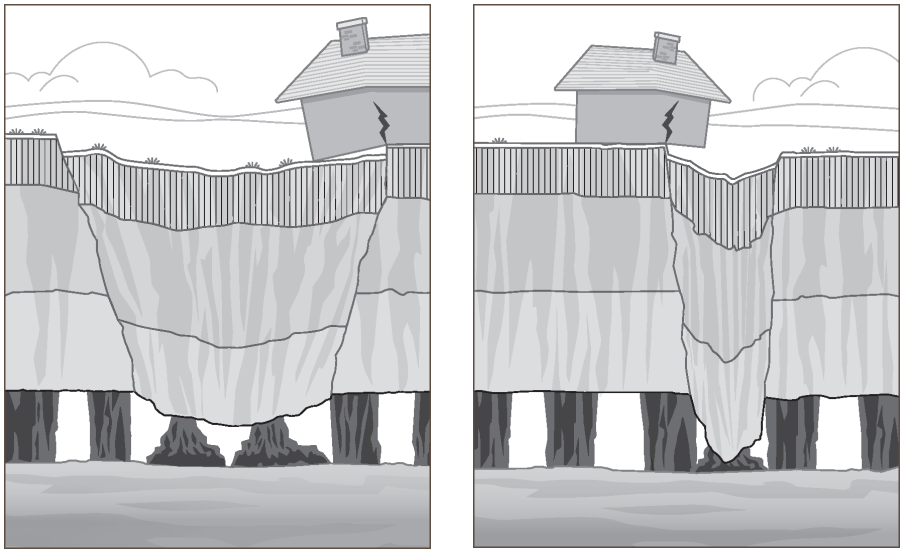

Figure 36. Diagram of sag subsidence (L) and pit subsidence (R). Source: IMISF

Historical Events

There is no known publicly available database which entirely captures mine subsidence events in Bond County or Illinois. However, some larger events have been documented.

In 1968, homeowners in neighboring Clinton County reported damage to their homes from mine subsidence. A local dairy whose property was also affected attempted to stop the subsidence by filling the mine with concrete

[78] Moran, K. A. (2017) Illinois Mine Subsidence Insurance Fund Historical Record

and whey. This backfired, causing subsidence to spread and affect more homes in the area. The homeowners formed an association and successfully sued the dairy.[79] As recently as July 2022, a high school in Springfield was closed to students and its summer camp had to relocate due to suspected mine subsidence.[80]

The Illinois Mine Subsidence Insurance Fund (IMSIF) collects data on insurance claims. There has been one reinsured confirmed claim of an unknown amount in Bond County between 2000-2021.

Extent and Impacts

Mine subsidence is highly localized to where underground mines exist. Panama, Pocahontas, Smithboro, Sorento, and areas surrounding these villages are within the geographic and hazard extent of mine subsidence (Figure 37). Essential facilities and buildings in these villages are especially at risk.

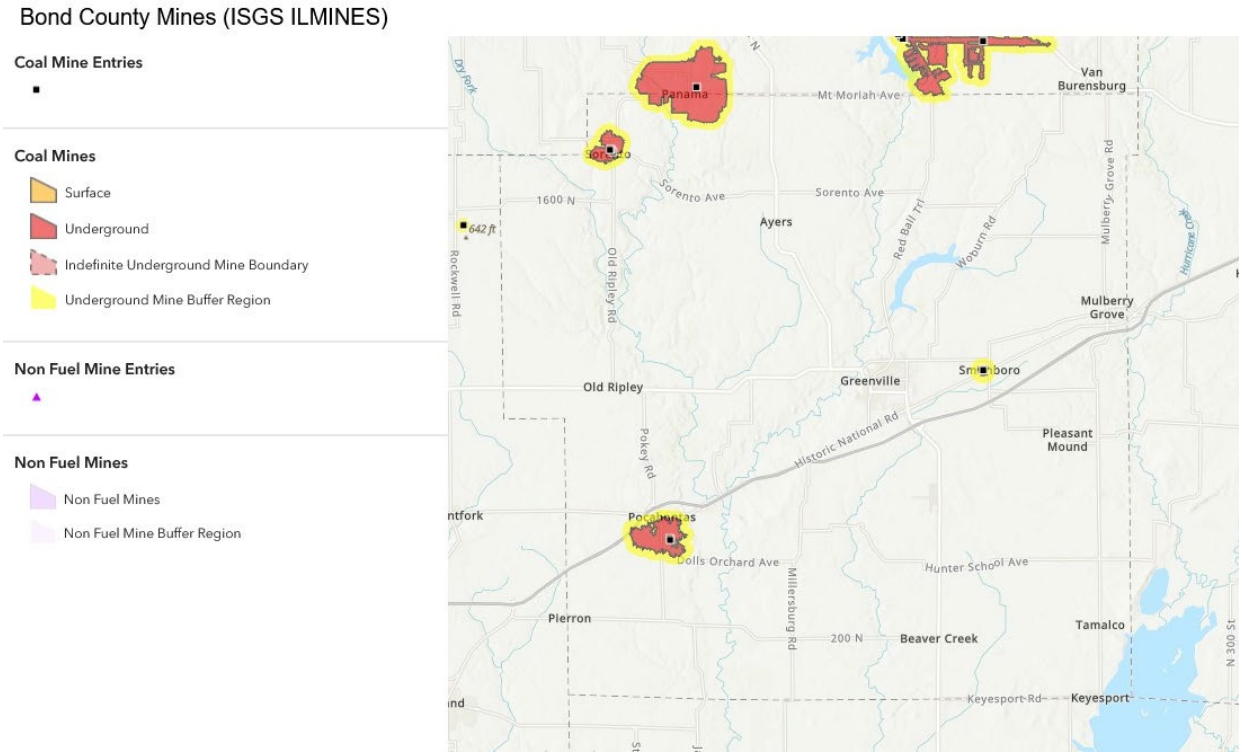

Figure 37. Underground mines. Source: ISGS

Movement of the ground due to mine subsidence is not selective, and any structure on the surface can be damaged. Infrastructure at risk of being damaged during an event can include buildings and other structures, roads, sidewalks, sewer/water pipes and other utilities.[81] Since the pits created from pit subsidence are relatively small, a pit may form underneath a structure without being noticed. Anything within the area of sag subsidence will be affected and move towards the center of the event. Roads can also be affected by mine subsidence. Compression lines can form, buckling the road because of the ground movement.

[79] Moran, K. A. (2017) Illinois Mine Subsidence Insurance Fund Historical Record

[80] Spearie, S. (July 5, 2022) Mine subsidence problems hit Lutheran High School in Springfield, IL, State Journal-Register. Retrieved Apr 2023. https://www.sj-r.com/story/news/local/2022/07/05/mine-subsidence-problems-hit-lutheran-high-school-springfield-il/7813197001/

[81] Bauer, R. A. (2013) Mine Subsidence in Illinois: Facts for Homeowners

Mine subsidence can cause severe disruptions to the surface. This can lead to changes in surface water flow which can impact the water quality and quantity supplied to streams and lakes. The impacts of subsidence are potentially severe in terms of damage to surface utility lines and structures, changes in surface-water and ground-water conditions, and effects on vegetation and animals. A large area of subsidence can cause ponding in locations that did not typically have standing water before.[82] This can also lead to soil erosion and have an overall impact on the soil quality in the area.

When a structure is compromised by mine subsidence, it may become unsafe for occupancy. Depending on the location of the subsidence, a single-family residence may be affected, or even a commercial, industrial, or government building. Events scheduled to take place within a structure may need to be cancelled. Repair costs may be substantial, and property values can be impacted by mine subsidence.

Social Vulnerability

The areas affected by mine subsidence are Panama, Pocahontas, Smithboro, and Sorento. Approximately 10% of Bond County's total population lives above or near an underground mine (Figure 37). Among the most socially vulnerable to mine subsidence may be residents of areas with high poverty rates. High poverty rates in Panama and Sorento may impact residents' ability to afford mine subsidence insurance, leaving them financially vulnerable to a disaster.

Climate Change

The majority of mines in Illinois are deep enough underground that warmer temperatures at the surface are not expected to make a difference. While warmer air can hold more moisture and seasonal variations in humidity can play a role in weakening the roof of a mine over time, this would only affect actively ventilated mines, and the risk of subsidence still depends on the geologic makeup of the layers above an individual mine. Increased rainfall due to climate change may have an effect. Pit subsidence has been noted to occur after heavy rainfalls or snow melts[83], so increased precipitation may play a role in future pit subsidence events. However, most underground coal mines in Illinois are dry due to impermeable shales above the coal, unless sandstone channels happen to down cut through the shale layers to intersect the coal seam.

Vulnerability of Future Assets

Mine subsidence will only affect assets and infrastructure above underground mines. Assets and infrastructure in Panama, Pocahontas, Smithboro, and Sorento could be affected (Figure 37).

While Bond County's population decreased from the 2010 to 2020 census, future development is likely in the county. Development in Panama, Pocahontas, Smithboro, and Sorento will need to take into account mine subsidence, particularly because mine subsidence will be added to a homeowner's coverage policy.

The IMSIF provides reinsurance to insurance companies for damage to property caused by mine subsidence. These values only include statistics based on reinsured claims filed and do not reflect uninsured properties, nor properties where reinsurance was waived by the insured. Consequently, there may be unaccounted properties with mine subsidence damage. Additionally, the maximum limits for both residential and commercial structures were increased to $750,000 in 2008 and 2011 respectively.

Rural counties in Illinois average $91,565 per mine subsidence reinsurance claim. Only one reinsured claim has been submitted in Bond County between 2000 and 2021. Therefore, Bond County can expect to incur $4,162 in reinsurance claims due to mine subsidence per year.

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[82] Lee, F. T., & Abel, J. F. (1983). Subsidence from underground mining; environmental analysis and planning considerations (Report No. 876; Circular). USGS Publications Warehouse. https://doi.org/10.3133/cir876
[83] Ibid

Pandemic

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
PANDEMIC	COUNTYWIDE	5	< 1	N/A	5,341	32

Description

According to the World Health Organization (WHO), a pandemic involves the worldwide spread of a new infectious disease. Pandemics occur when new diseases or viruses develop the ability to spread rapidly. Humans may have little or no immunity against a new virus. Usually, a new virus cannot spread between animals and people, but it can easily spread if it mutates, and a pandemic may result. Seasonal flu epidemics generally occur because of a viral subtype that is already circulating among people.

Pandemics are typically caused by new viruses that are easily transmitted from person to person.[84] Viruses causing pandemics can potentially affect people in all age groups. In addition to illness and death caused by pandemics, societal impacts may include economic disruption.[85]

Historical Events

According to the Centers for Disease Control and Prevention (CDC), there have been five pandemics in the US since 1918. The first four pandemics were caused by influenza viruses, each starting in 1918, 1957, 1968, and 2009 (Table 34). The most recent pandemic, declared by the World Health Organization in 2020[86], was caused by a coronavirus, SARS-CoV-2.[87]

Table 34. Pandemics since 1918. Sources: CDC, WHO

Pandemic Declared	Cause	US Deaths (est.)	Global Deaths (est.)
1918	Influenza A (H1N1) virus	675,000	50,000,000
1957	Influenza A (H2N2) virus	116,000	1,100,000
1968	Influenza A (H3N2) virus	100,000	1,000,000
2009	Novel influenza A (H1N1) pdm09 virus	8,868 – 18,306	151,700 – 575,400
2020	Coronavirus SARS-CoV-2	1,074,367*	6,634,816*
*As of April 2023			

[84] Ready.gov, "Pandemics", accessed Jul 2021. https://www.ready.gov/pandemic
[85] State of California, "2018 California State Hazard Mitigation Plan", accessed from https://www.caloes.ca.gov/cal-oes-divisions/hazard-mitigation/hazard-mitigation-planning/state-hazard-mitigation-plan
[86] World Health Organization, "WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020", accessed from https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020
[87] World Health Organization, "Coronavirus disease 2019 Q&As", accessed from https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-covid-19

Extent and Impacts

Pandemics and their impacts can occur anywhere in the county. The type and duration of a pandemic can cause unique impacts. In a short duration incident, there may be a medical surge at the beginning which tapers off as the incident goes on and may not result in significant disruption to everyday life. However, longer duration incidents may have significant impacts not only for the public health response, but also for business/industry and the economy.

Infrastructure is not exposed to or vulnerable to communicable diseases, thus having a minimal impact on infrastructure. The type of communicable disease can significantly impact infrastructure development due to changes in productivity or supply chain issues, and thus result in long-term impacts on the county's infrastructure.

Essential facilities and buildings are not exposed or vulnerable to communicable diseases. Essential facility operations may be impacted. Staffing shortages due caused by illness educational facilities, first responder facilities, and other essential facilities may negatively impact residents of the county.

A pandemic has been shown to have a significant impact on the economy. With epidemics and pandemics, high levels of illness and, in some cases death, can lead to economic losses, social disruptions and interruption of supply chains as demand for certain goods and services increases or decreases.

Social Vulnerability

Race, income, education and employment status can impact exposure to infectious diseases. People living in poverty often must work through illness to afford necessities such as food and housing, making recovery take longer and exposing others to illness. Lack of health insurance is also a vulnerability, as people exposed to illness materials may be less likely to seek treatment. Uninsured numbers are especially high in Smithboro, where up to 30% of the population is uninsured.

Climate Change

As the climate warms, average winter temperatures decrease and bring about shorter winters. Shorter and milder winters bring on earlier spring seasons which can result in an increasingly hospitable environment for carriers of vector-borne diseases and increase the likelihood of new pests and transmission of diseases. Climatic factors such as temperature, humidity and precipitation strongly influence the survival of ticks and the bacterium that causes Lyme disease. Pathogens like Zika, Dengue and West Nile virus, which are commonly found in tropical or temperate climates, may become more prevalent in Illinois.[88]

Vulnerability of Future Assets

Bond County's entire population is vulnerable to pandemics. Health care infrastructure and essential facility operations are vulnerable too.

While Bond County's population decreased from the 2010 to 2020 census, future development is likely in the county, particularly in Greenville where the population is increasing. Pandemic awareness, preparedness, and adequate staffing at the HSHS Holy Family Hospital and the Bond County Health Department will be crucial for dealing with future pandemics.

[88] CDC. (2021, February 25). Regional Health Effects – Midwest. https://www.cdc.gov/climateandhealth/effects/midwest.htm

Severe Storms: Hail

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
HAIL	COUNTYWIDE	37	1.7	$50,500	0	0

Description

Hail is precipitation in the form of balls of irregular lumps of ice, typically from a thunderstorm.[89] Most thunderstorms have hail, but not all thunderstorms produce hail at the ground. Hail occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice. When the weight of the hailstones becomes too heavy to be supported by the updrafts, they fall out of the clouds.

Hail can be the size of a pea or smaller, however larger hailstones can cause severe damage to buildings, vehicles, and plants.[90] Hailstones less than 1.0 inch in diameter are not considered severe, however, once a hailstone is 1.0 inch in diameter it has the potential to cause significant damage.[91] Most hailstorms are made up of a mix of different sizes, and only the very largest hail stones pose serious risk to people caught in the open. The National Severe Storms Laboratory (NSSL) uses common objects to distinguish hail size (Table 35).[92]

Table 35. Hail sizes.

Reference Object	Size
Pea	¼-inch diameter
Mothball	½-inch diameter
Penny	¾-inch diameter
Nickel	⅞- inch diameter
Quarter	1 inch diameter — hail quarter size or larger is considered severe
Ping-Pong Ball	1 ½- inch diameter
Golf Ball	1 ¾- inch diameter
Tennis Ball	2 ½- inch diameter
Baseball	2 ¾- inch diameter
Teacup	3- inch diameter
Softball	4- inch diameter
Grapefruit	4 ½-inch diameter

Historical Events

Since 1996, the NCEI Storm Events Database has recorded 37 hail events across Bond County (Figure 38). The largest hail recorded in Bond County Illinois was 3 inches in diameter, or teacup sized, in Pocahontas, IL on April 2, 2006.[93]

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[89] American Meteorological Society Glossary. (n.d.). *Hail.* Retrieved April 2021, https://glossary.ametsoc.org/wiki/Hail

[90] National Weather Service. (n.d.). *Severe Thunderstorm Safety,* Retrieved from https://www.weather.gov/safety/thunderstorm

[91] National Weather Service. *National Implementation of the Use of 1-inch Diameter Hail Criterion for Severe Thunderstorm Warnings in the NWS.* Retrieved from https://nws.weather.gov/products/PDD/OneInchHail_Oper_PDD.pdf

[92] NOAA National Severe Storms Laboratory. (n.d.). Retrieved *Hail Basics*. Retrieved from https://www.nssl.noaa.gov/education/svrwx101/hail/

[93] National Centers for Environmental Information. (n.d.). *Storm Events Database—Event Details.* Retrieved from https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=5501803

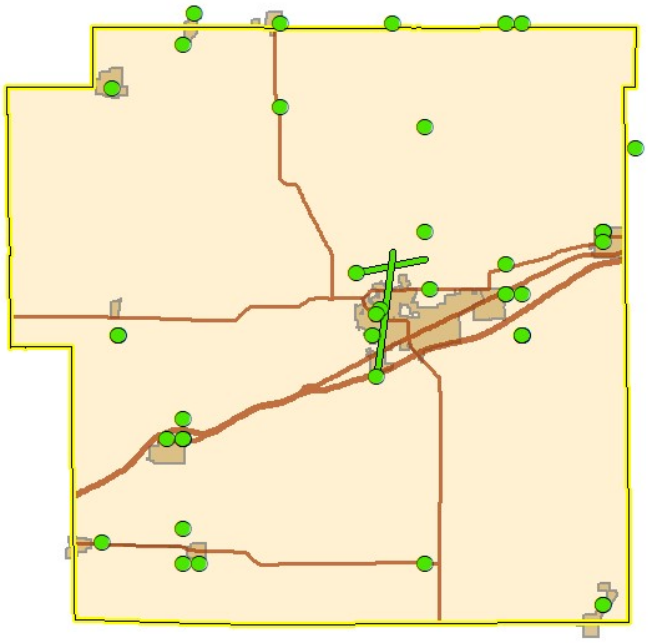

Figure 38. Hail Reports in Bond County (1996-2023). Source: NWS Storm Prediction Center

On August 18, 1974, a severe thunderstorm produced hail measuring up to 2 inches in diameter in Bond County.[94]

On February 27, 1999, golf ball sized hail was recorded in Pocahontas, resulting in $50,000 in damages.[95]

On March 28, 2021, a storm system stretched from southern Missouri up to Central Illinois brought severe thunderstorms to the area. In addition to reports of trees and power lines being down. Hail was recorded throughout the county (Figure 39).

Figure 39. Hail from March 28, 2021 event. Source: WGEL

Extent and Impacts

Hailstorm damage is widespread, impacting homes, businesses, agriculture and infrastructure. Annual mean property losses have begun to exceed 10 billion U.S. dollars and severe hail events that impact large cities routinely reach 1 billion U.S. dollars in losses.[96] Hail can cause severe damage to homes and cars in the form of dents, broken windows, and roof damage.

Agricultural crop losses are typically related inversely to increasing hailstone size, experiencing greater impact with increased density of hailfall. Hail can damage crops by breaking stems, bruising and tearing leaves, and

[94] NWS. (n.d.). *August Weather Facts*. NOAA's National Weather Service. Retrieved from https://www.weather.gov/lsx/aug_trivia?n=wxtrivia

[95] National Centers for Environmental Information. (n.d.). *Storm Events Database—Event Details.* Retrieved from https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=5683670

[96] Gunturi, P., & Tippett,M. K. (2017). *Managing severe thunderstorm risk: Impact of ENSO on U.S. tornado and hail frequencies* (Tech. Rep.). Minneapolis, MN, USA: Willis Re.

damaging fruit. This can lead to a reduction in crop yield and quality, and in severe cases, the loss of an entire crop.[97] Hail can also disrupt wildlife by causing damage to habitats.

The economic impacts from hail can be quite extensive. The cost of repairs to damaged property can be significant. Crop damage can lead to loss of income for households. In Bond County, 7% of people are employed in agriculture. Severe storms are some of the costliest disasters and can have long lasting impacts on the economy when repairs to damaged infrastructure, households, and property is needed.

Social Vulnerability

Among the most vulnerable to hail are people who have outdoor occupations, such as construction workers, agricultural workers, utility repair workers, and landscapers.

In Bond County, 11.3% of the population is employed in agriculture, natural resources, and construction. These workers are particularly vulnerable to injury from hail while working. Injuries that are severe enough could lead to lost income, impacting workers and their families. Farmers are physically and financially vulnerable as hail can cause crop damage and loss.

Climate Change

The impact of climate change on severe weather in the Midwest is less well known than for other hazards such as heatwaves. Overall, the frequency of storm environments conducive to producing severe weather has increased in frequency across much of the Midwest and mid-south over the past 40-50 years. Studies have documented an increase in the frequency of large hail environments, with significant impacts from extensive hail damage. There remains uncertainty of the extent to which climate change has caused these recent trends; however, it is thought the warmer and more humid climate in Illinois has had at least some effect on the increasing frequency in severe storm environments. More frequent severe weather environments have already played an important role in the larger number of billion-dollar disasters, recorded by the National Oceanic and Atmospheric Administration (NOAA). Illinois has experienced 81 billion-dollar disasters since 2003, 64 of which (80%) have been caused by severe storms.

Climate model projections show a potential shift in the seasonality of supercells, one of the most powerful types of severe storms experienced in Illinois. Supercells generate virtually all hail. Model projections show a potential shift toward higher frequency of supercell storms in the late winter and early spring, with fewer in the fall. Projections of changes in hail in Illinois are more uncertain than those for severe storms and supercells; however, models project the potential for decreased frequency of hail events but increased severity, meaning more intense and extensive impacts when hailstorms occur in the future.

Vulnerability to Future Assets

Bond County's entire population and infrastructure are vulnerable to hail. While Bond County's population decreased from the 2010 to 2020 census, future development is likely in the county. It is suggested that the county should ensure new structures are built with sturdier construction and harden existing structures to lessen the potential impacts of severe weather, especially for mobile/manufactured homes. Additional warning sirens can warn the community of approaching storms to ensure the safety of Bond County residents and minimize property damage.

Damages in rural counties tend to be underreported or have little data. Therefore, expected annual loss estimates for Bond County were calculated by taking the average damage per year caused by each hazard in rural counties. The expected annual loss of property and infrastructure caused by hail is $83,333.

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[97] Battaglia, M., Lee, C., Thomason, W., Fike, J., & Sadeghpour, A. (2019). Hail damage impacts on corn productivity: A review. *Crop Science*, *59*(1), 1-14.

Severe Storms: Lightning

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
LIGHTNING	COUNTYWIDE	176,244	7,663	$45,000	0	0

Description

Lightning is a transient, high-current electric discharge most commonly produced by thunderstorms. Lightning discharges can happen within and between thunderstorm clouds. The National Weather Service uses the following definitions for lightning:[98]

- **Intra-cloud lightning**: An electrical discharge between oppositely charged areas within the thunderstorm cloud.
- **Cloud-to-ground lightning**: A discharge between opposite charges in the cloud and on the ground.

Lightning appears as a "bolt" when the buildup of electric charge becomes strong, with the flash of light (bolt) occurring between the clouds and the ground. In a split second the bolt of lightning reaches a temperature approaching 50,000 degrees Fahrenheit. Thunder is the rapid heating and cooling of air near lightning. Cloud-to-ground lightning strikes are the most studied. This type of lightning can severely injure or kill people, in addition to doing damage to structures, disrupting power/communications infrastructure, and starting fires. [99] Lightning occurs most frequently during the summer, although thunderstorms can happen at any time of year.[100]

Historical Events

Bond County has experienced 176,244 lightning strikes since 1992. Average yearly lightning strikes in Bond County range from 462-527 strikes a year (Figure 40).

On May 2, 2004, lightning struck a large tree between two houses in Greenville, IL causing the tree to explode. Branches from the tree went through the roof of a garage damaging a truck inside. Fencing between the homes and

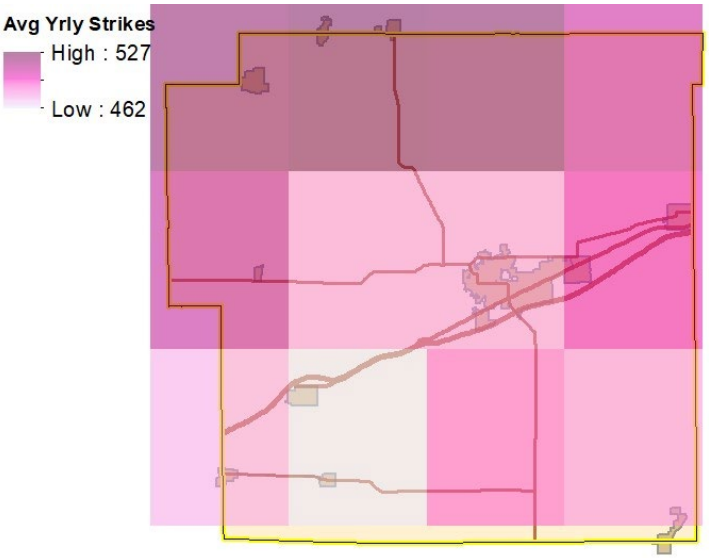

Figure 40. Average yearly lightning strikes in Bond County (1992-2023). Source: NCEI

[98] US Department of Commerce, N. (n.d.). *Understanding Lightning: Types of Flashes*. NOAA's National Weather Service. Retrieved from https://www.weather.gov/safety/lightning-science-types-flashes
[99] American Meteorological Society Glossary. (n.d.). *Lightning.* Retrieved from https://glossary.ametsoc.org/wiki/Lightning
[100] National Weather Service. (n.d.). *Lightning Safety Tips and Resources.* Retrieved from https://www.weather.gov/safety/lightning

a swing set were also damaged. The damage amounted to nearly $25,000.[101]

On June 22, 2007, a lightning strike took out virtually all communications at the Police and Sheriff Department in Greenville, IL. 911 service was out for several hours. This event resulted in $20,000 in damages.[102]

Extent and Impacts

Lightning strikes can occur anywhere in the county, damaging infrastructure such as buildings, power lines, or cell phone towers. This can lead to disruption in power services, or damage that can be costly.

Lightning is a major cause for damage to trees and forests, either by directly killing trees on strike or by igniting fires and burning large numbers of trees when conditions are conducive to the spread of wildfires.[103] Studies also show that lightning contributes to air pollution, though there is debate as to how much. The rapid heating and cooling of the gases within a lightning bolt produces nitric oxide (NO), which combines with oxygen to create nitrogen dioxide (NO_2). The combination of these is known as nitrogen oxides. When nitrogen oxides are created in the atmosphere during a storm, the result causes changes in one of the primary air pollutants, ground-level ozone (O_3). This gas is harmful to the environment and people.[104]

Lightning can cause damage to infrastructure which can require repairs leading to significant replacement costs. Lightning has been known to cause housefires, resulting in property damage, which can be a financial burden for some. Lightning can also cause wildfires that not only damage our natural environment, but it can also lead to crop loss and therefore loss of income for households. In Bond County, 7% of people are employed in the agricultural industry. Power outages caused by lightning strikes can lead to disruptions in services and result in loss of income for businesses that cannot operate.

Social Vulnerability

Among the most vulnerable to lighting are people who have outdoor occupations, such as construction workers, agricultural workers, utility repair workers, and landscapers. Lightning is an especially dangerous hazard for workers who use metal, due to metal's conductivity properties.

In Bond County, 11.3% of the population is employed in agriculture, natural resources, and construction.[105] These workers are particularly vulnerable to injury from hail while working. Injuries that are severe enough could lead to lost income, impacting workers and their families. Farmers are physically and financially vulnerable as hail can cause crop damage and loss.

Climate Change

The impact of climate change on lightning is less well known. Researchers have begun to address the complexity and uncertainty around climate change impacts to severe weather in Illinois. It is thought the warmer and more humid climate in Illinois has had at least some effect on the increasing frequency in severe storm environments. Studies have shown that lightning activity will increase in a warmer climate.[106]

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[101] NWS. (n.d.). *May Weather Facts*. NOAA's National Weather Service. Retrieved from https://www.weather.gov/lsx/may_trivia?n=wxtrivia

[102] National Centers for Environmental Information. (n.d.). *Storm Events Database—Event Details.* Retrieved from https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=45625

[103] Latham, D., & Williams, E. (2001). Lightning and forest fires. In *Forest Fires* (pp. 375-418). Academic press. https://doi.org/10.1016/B978-012386660-8/50013-1

[104] US EPA, O. (2015, May 29). *Ground-level Ozone Basics* [Overviews and Factsheets]. https://www.epa.gov/ground-level-ozone-pollution/ground-level-ozone-basics

[105] ACS. (2021). DP03 | Selected Economic Characteristics. US Census Bureau. https://data.census.gov

[106] Price, C. (2009). Will a drier climate result in more lightning?. *Atmospheric Research*, *91*(2-4), 479-484. https://doi.org/10.1016/j.atmosres.2008.05.016

Some studies suggest that a warmer troposphere and higher surface temperature will result in increased heat and moisture, driving stronger convection and increasing the potential for cloud development, charge separation, and lightning. An expanded troposphere allows clouds to have a larger vertically dimension, which has been strongly correlated with higher flash rates.[107]

Climate model projections show a potential shift in the seasonality of supercells, one of the most powerful types of severe storms we experience in Illinois. Supercells generate many, if not most, tornadoes in the Midwest and virtually all hail. Model projections show a potential shift toward higher frequency of supercell storms in the late winter and early spring, with fewer in the fall. Most severe storms in Illinois occur between 3 pm and 8 pm, and therefore a potentially increasing number of storms in late winter and early spring mean more nighttime storms, which increases the risk of life-threatening impacts.

Vulnerability to Future Assets

Bond County's entire population and infrastructure are vulnerable to lightning. While Bond County's population decreased from the 2010 to 2020 census, future development is likely in the county. It is suggested that the county should ensure new and existing structures are built with lightning rods to lessen the potential impacts of lightning strikes. All buildings can also include electrical surge protection devices for incoming power, data, and communication lines; and surge protection devices for vulnerable appliances to reduce the risk of a fire caused by a lightning strike.[108]

Damages in rural counties tend to be underreported or have little data. Therefore, expected annual loss estimates for Bond County were calculated by taking the average damage per year caused by each hazard in rural counties. The expected annual loss of property and infrastructure caused by lightning is $2,723.

[107] Yair, Y. (2018). Lightning hazards to human societies in a changing climate. *Environmental research letters*, *13*(12), 123002. https://iopscience.iop.org/article/10.1088/1748-9326/aaea86
[108] NWS. (n.d.). *Lightning Rods*. Retrieved from https://www.weather.gov/safety/lightning-rods

Severe Storms: Wind

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
WIND	COUNTYWIDE	75	2.8	$94,700	0	0

Description

Thunderstorms can cause several types of damaging wind. A downward rush of cool descending air from a thunderstorm is a downburst. The air rushing to the ground may look like a cloud or shaft of heavy rain. Once the air strikes the ground at a high speed, the air usually spreads out in all directions. The wind may be 100-150 miles per hour which is as strong as an EF1 or EF2 tornado. Downburst winds can damage roofs, overturn, or push mobile homes off foundations, push vehicles off the road, and destroy structures. A linear group of thunderstorms, typically ahead of a cold front, can produce what is known as "straight-line" winds. High winds from straight-line gusts can reach speeds of 40-50 mph, and up to 110 mph. The damage path can extend from tens to hundreds of miles. Thunderstorm downbursts and straight-line winds are the leading cause of wind related damage.

The National Weather Service uses the following definitions to differentiate different wind related terms:[109]

- **Wind**: The horizontal motion of the air past a given point. Winds begin with differences in air pressures. Pressure that's higher at one place than another sets up a force pushing from the high toward the low pressure. The greater the difference in pressures, the stronger the force.
- **Wind Advisory**: Sustained winds 25 to 39 mph and/or gusts to 57 mph. Issuance is normally site specific.
- **Wind Gust**: Rapid fluctuations in the wind speed with a variation of 10 knots or more between peaks and lulls. The speed of the gust will be the maximum instantaneous wind speed.
- **Windy**: 20 to 30 mph winds.
- **Downburst**: A strong downdraft current of air from a cumulonimbus cloud, often associated with intense thunderstorms. Downdrafts may produce damaging winds at the surface.

The National Weather Service uses the following terms for assessing wind gust levels of severity:[110]

Table 36. Wind gust severity.

Severity	Description
Strong Wind Gusts	Thunderstorm wind gusts between 39 mph and 57 mph (between 34 knots and 49 knots).
Damaging Wind Gusts	Severe thunderstorm wind gusts between 58 mph and 74 mph (between 50 knots and 64 knots) causing minor damage.
Very Damaging Wind Gusts	Severe thunderstorm wind gusts between 75 mph and 91 mph (between 65 knots and 79 knots) causing moderate damage.
Violent Wind Gusts	Severe thunderstorm wind gusts greater than 92 mph (80 knots or greater) causing major damage.

[109] Service, N. N. W. (n.d.). *Glossary—NOAA's National Weather Service*. Retrieved from https://w1.weather.gov/glossary/

[110] US Department of Commerce, N. (n.d.). *Wind Threat Defined*. NOAA's National Weather Service. Retrieved from https://www.weather.gov/mlb/wind_threat

According to the NWS, some weather patterns can produce what is called a derecho. A derecho is a widespread, long-lived windstorm. Derechos are associated with bands of rapidly moving showers or thunderstorms variously known as bow echoes, squall lines, or quasi-linear convective systems. These lines or storms can move very quickly and produce widespread straight-line winds over long periods of time. Derechos can move anywhere from 35-70 mph, and last 8 hours or more. Most derechos that produce severe weather move at speeds greater than 50 mph. For a wind event to be classified as a derecho, wind damage must extend at least 400 miles, be at least 60 miles wide, include wind gusts of at least 58 mph along most of its length, and also include several, well-separated 75 mph or greater gusts.

Historical Events

Since 1996, the NCEI Storm Events Database has recorded 18 severe wind events in Bond County (Figure 41).

On April 27, 1983, severe thunderstorms produced winds greater than 57mph (50kts) in St. Clair, Madison and Bond counties in Illinois.[111]

On June 23, 2007, thunderstorm wind gusts of nearly 60 mph caused scattered damage across Greenville. Some large tree limbs and power lines were down, a couple of storage sheds were blown over, and a couple of backyard playgrounds were damaged.[112]

On Saturday March 27, 2021, a storm system from Missouri to central Illinois brought severe thunderstorms to the area. The Bond County Sheriff's Department and Greenville Police each reported several cases of trees and power lines being down.

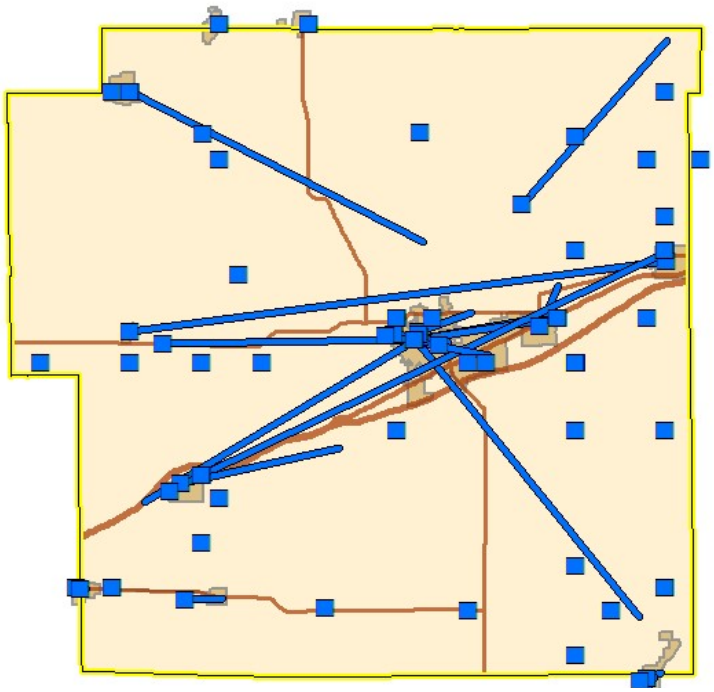

Figure 41. Severe wind reports in Bond County (1996-2023). Source: NCEI

On May 19, 2022, thunderstorm winds of 61 knots (70 mph) blew down several trees, numerous tree limbs and several power lines in Pocahontas, IL.[113]

Extent and Impacts

High winds can occur anywhere in Bond County, causing power lines to sway, break or fall, which can lead to power outages and disrupt daily life. They can also cause damage to buildings, including roof damage, broken windows, and collapsed walls. Strong winds can uproot trees, break branches, and cause debris to fly around,

[111] US Department of Commerce, N. (n.d.). *April Weather Facts*. NOAA's National Weather Service. Retrieved July 21, 2023, from https://www.weather.gov/lsx/apr_trivia

[112] National Centers for Environmental Information. (n.d.). *Storm Events Database—Event Details.* Retrieved from https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=45626

[113] National Centers for Environmental Information. (n.d.). *Storm Events Database—Event Details.* Retrieved from https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=1028157

which can damage homes and buildings, and block roads.[114] Blocked roads can severely disrupt transportation systems either by damage to the infrastructure itself or by limiting the capacity of roadways.[115]

High winds can lead to soil erosion. The erosion of surface soil or bare land by wind renders the soil less productive by removing the most fertile part of the soil, namely, the clays and organic matter. The removal of organic matter reduces native productivity of the soil and damages soil structure and biological activity. Eroded soil can also be deposited into waterways where it impacts water quality and/or emitted into the air where it degrades the air resources. This could impact the public water supply from aquifers and Governor Bond Lake in Bond County. In addition to soil loss, high winds can damage habitats, such as forests, plants, and wetlands, causing lasting impacts on wildlife.[116]

Severe storms can be extremely costly. As stated previously, windstorms can disrupt transportation systems which can cause delays in normal business operations leading to lost revenue, downtime, and increased costs. Property damage from windstorms can be very costly, and widespread damage can result in high repair and building costs.

Social Vulnerability

Those living in manufactured or mobile homes are at risk due to many not being built to withstand strong winds. In addition to the physical vulnerability of living in a mobile home, these residents tend to be lower-income, compounding risk to wind damages. Mobile and manufactured homes in Pierron, Pocahontas, and Smithboro constitute over 15% of the housing stock, the highest in the county. Because Illinois has not adopted statewide building codes, counties or cities with less strict building codes may be more vulnerable to tornadoes than those with stringent building codes. Bond County and Greenville have building codes and a building inspector.

Climate Change

Overall, the frequency of storm environments conducive to producing severe weather, such as strong winds or tornadoes, has increased across much of the Midwest and mid-south over the past 40-50 years. Climate models project continued increases in severe convective environments that can result in the formation of tornadoes. Additionally, projections show a potential shift in the seasonality of supercells, one of the most powerful types of severe storms experienced in Illinois.

Vulnerability to Future Assets

Bond Countyŕs entire population and infrastructure are vulnerable to severe windч While Bond Countyŕs population decreased from the ҬȜҚȜ to ҬȜҬȜ censusш future development is likely in the countyч It is suggested that the county should ensure new structures are built with sturdier construction and harden existing structures to lessen the potential impacts of severe weatherш especially for mobileħmanufactured homesч Additional warning sirens can warn the community of approaching storms to ensure the safety of Bond County residents and minimize property damageч

Damages in rural counties tend to be underreported or have little data. Therefore, expected annual loss estimates for Bond County were calculated by taking the average damage per year caused by each hazard in rural counties. The expected annual loss of property and infrastructure caused by severe wind is яҺҮшҚҺҲч

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[114] Illinois Emergency Management Agency. (2021). Wind hazards. Retrieved from https://www2.illinois.gov/iema/Preparedness/hazards/Pages/Wind.aspx

[115] Illinois Department of Transportation. (2019). Transportation asset management plan. Retrieved from https://www2.illinois.gov/idot/Documents/2019%20TAMP%20Final%20Report.pdf

[116] Natural Resources Conservation Service (n.d.). *Wind Erosion Prediction System*. Retrieved from http://www.nrcs.usda.gov/resources/tech-tools/wind-erosion-prediction-system

Tornado

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
TORNADO	COUNTYWIDE	18	< 1	$5,480,000	30	2

Description

A tornado is a violently rotating column of air extending from the base of a thunderstorm to the ground. Typically spawned by thunderstorms or other warm, humid, and windy weather, tornadoes generally move southwest to northeast but can quickly change direction at any time.[117] Although tornadoes can occur at any time of day, half of all tornadoes in Illinois form between the hours of 3 p.m. and 7 p.m. The peak tornado season in Illinois runs from March through June, but tornadoes can occur during any month.[118]

The Enhanced Fujita (EF) scale replaced the Fujita (F) Scale on February 1, 2007. EF ratings are assigned to tornadoes based on their estimated windspeeds and infrastructure damage (Table 37).

Table 37. Enhanced Fujita (EF) Scale. Source: NWS

F/EF Rating	Wind Speeds	Expected Damage
F/EF-0	65-85 mph	**'Minor' damage**: Shingles blown off or parts of a roof peeled off, damage to gutters/ siding, branches broken off trees, shallow rooted trees toppled.
F/EF-1	86-110 mph	**'Moderate' damage**: More significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.
F/EF-2	111-135 mph	**'Considerable' damage**: Roofs torn off well-constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.
F/EF-3	136-165 mph	**'Severe' damage**: Entire stories of well-constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.
F/EF-4	166-200 mph	**'Extreme' damage**: Well-constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.
F/EF-5	> 200 mph	**'Massive/incredible' damage**: Well-constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.

[117] NOAA. (n.d.). A Preparedness Guide. Retrieved from https://www.weather.gov/media/owlie/ttl6-10.pdf
[118] Illinois State Climatologist. (n.d.). Tornadoes in Illinois. Retrieved from https://stateclimatologist.web.illinois.edu/climate-of-illinois/tornadoes-in-illinois/

Historical Events

Since 1950, the NCEI Storm Events Database has recorded 18 tornadoes with a rating of F/EF-0 or above in Bond County. One tornado had a rating of F/EF-3, killing two people and causing 25 injuries. Two tornadoes had a rating of F/EF-2, 14 tornadoes had a rating of F/EF-1, and five tornadoes had a rating of F/EF-0. No deaths were caused by any of these tornadoes.

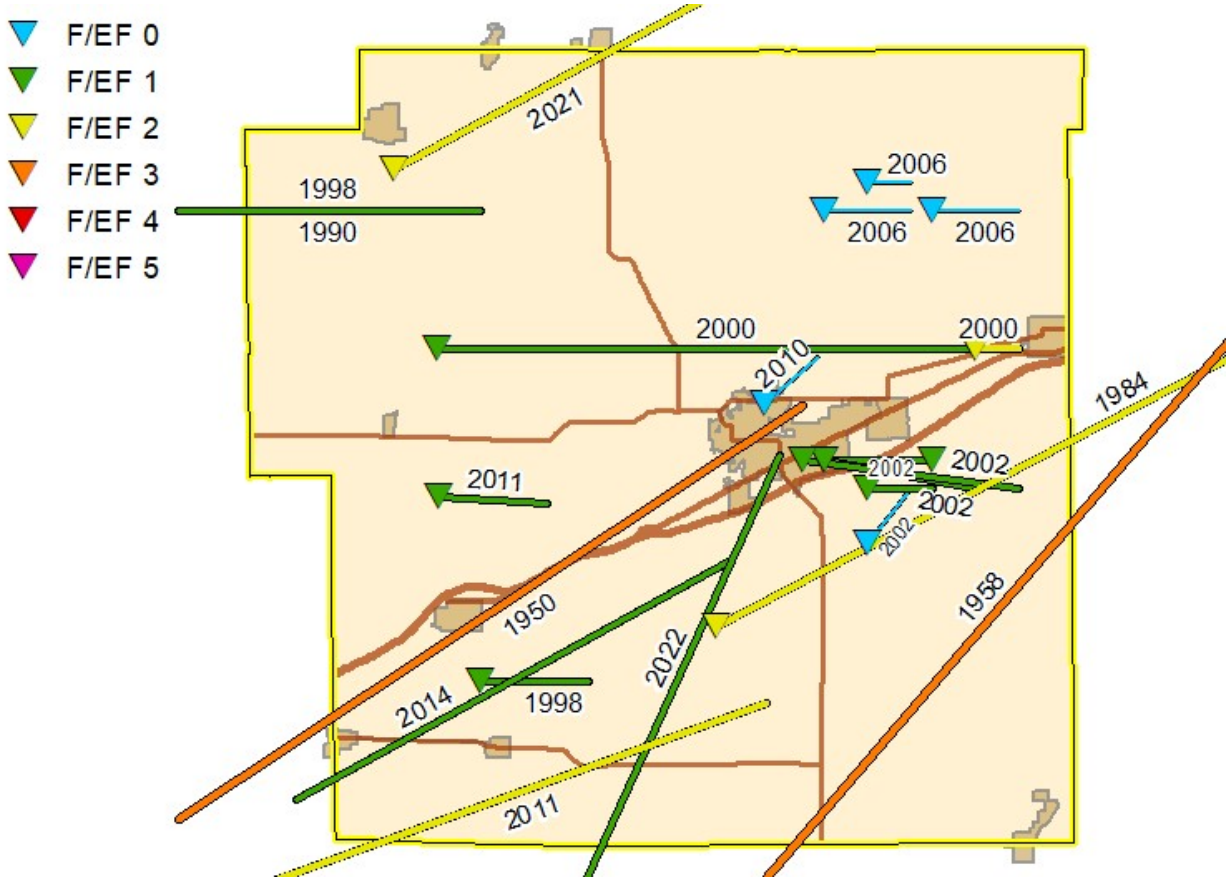

Figure 42. Tornado Reports/Tracks in Bond County (1950-2023). Source: NWS Storm Prediction Center

On March 1, 2002, five separate tornadoes struck at virtually the same time in Bond County. Luckily, no one was killed and there was only one resulting injury.[119]

On April 22, 2011, two tornadic supercells ripped through the St. Louis area producing a total of 5 tornadoes. An EF4 moved through St. Louis County into Madison County, IL. Lambert St. Louis Airport had significant damage along with neighborhoods and municipalities. Luckily there were no fatalities. The same cell also spawned an EF1 tornado in New Melle and an EF2 tornado that moved through Madison, Clinton, and Bond Counties. The fourth tornado was produced by another cell and was rated EF2 in Monroe County, and the fifth and final tornado was rated EF1 in St. Clair County.[120]

[119] NWS. (n.d.). *March Weather Facts*. NOAA's National Weather Service. Retrieved from https://www.weather.gov/lsx/mar_trivia?n=wxtrivia

[120] NWS. (n.d.). *April Weather Facts*. NOAA's National Weather Service. Retrieved from https://www.weather.gov/lsx/apr_trivia

On February 20, 2014, a tornado touched down about 3.4 miles northeast of Highland, in Madison County, on Trestle Road causing window, roof and tree damage to a home. The tornado then crossed into Bond County and continued to produce intermittent tree damage as it headed northeast and crossed Illinois Route 143 causing damages to trees, farm outbuildings, roofs and sidings (Figure 43).[121]

Figure 43. Damaged outbuilding from February 20, 2014 tornado. Source: NWS

On December 10, 2021, severe thunderstorms and tornadoes formed ahead of a cold front in Missouri and southeastern Illinois, the EF-2 Shelby County tornado reported by the Lincoln NWS office touched down earlier in Bond County and moved through parts of Montgomery and Fayette Counties, causing damage to multiple farm buildings and trees. [122] In Bond County, the tornado first touched down south of Sorento on New Douglas Road, west of Sorento Reservoir, where it snapped several trees.

On May 19, 2022, An EF-1 tornado with wind speeds of 110 mph impacted northern Clinton and southern Bond counties in Illinois. The tornado touched down north of Breese, Illinois and moved southeast of Greenville, Illinois. The tornado damaged trees, farm outbuildings and machine sheds, as well as roofs and garages of homes, resulting in $20,000 in damages.[123] The tornado in Bond County had a path length of 10.9 miles and a max path width of 250 yards.[124]

Extent and Impacts

The entire county has the same risk of tornado occurrence. Tornadoes can occur at any location within the county.

Tornadoes can cause massive destruction to property and infrastructure. The magnitude of tornado damage is the main indicator of tornado intensity, which is translated to a ranking on the EF Scale (Table 38).

Residential structures – manufactured or mobile homes in particular – are especially susceptible to tornado damage as they tend to be less structurally sturdy than larger buildings and other large-scale infrastructure. Manufactured or mobile homes can sustain damage from tornadoes with an intensity as low as EF-1, while well-constructed residential structures will start to see structural damage with EF-2 or EF-3 tornados. EF-4 and stronger tornadoes will level even sturdy residential structures. Large residential buildings, such as apartments or condominiums, will begin to sustain damage with EF-3 or EF-4 tornadoes and severe structural damage with an EF-5 tornado.

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[121] NWS. (n.d.). *February 20th 2014 Tornadoes and Strong Gradient Winds*. NOAA's National Weather Service. Retrieved from https://www.weather.gov/lsx/02_20_2014

[122] NWS. (n.d.). December 10th, 2021 Tornado Outbreak. St. Louis, MO Weather Forecast Office. Retrieved from https://www.weather.gov/lsx/12_10_2021

[123] NWS. (n.d.). *May 19, 2022 Tornadoes*. Retrieved from https://www.weather.gov/lsx/May192022Tornadoes

[124] National Centers for Environmental Information. (n.d.). *Storm Events Database—Event Details.* Retrieved from https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=1024276

Tornadoes can devastate utility infrastructure, making recovery more difficult:

- **Power**: Aboveground power poles and lines are easily taken down by tornadoes, leaving residential homes and essential infrastructure, such as hospitals, without power. Underground power sources, such as gas and electric lines, can be exposed or even torn up by tornadoes.
- **Water and wastewater**: storage tanks, water distribution systems, and wastewater treatment plants can be damaged by tornadoes, leaving residents without safe drinking water. Fire hydrants may be uprooted or have inadequate water pressure due to ruptured service lines in damaged buildings.[125]
- **Telecommunication**: Cell towers and aboveground internet cables can be damaged or even downed by tornadoes. Underground internet cables, like underground power sources, can also sustain damage.

In addition to utility infrastructure, essential infrastructure such as hospitals, schools, emergency services, government buildings, transportation (e.g., roads, bridges), among others, are at risk of tornado damage. Large buildings, such as hospitals, are typically built using steel or concrete, making them better able to withstand tornado damage. Buildings made from stone, brick, or wood may be more susceptible to damage.

Like infrastructure, tornadoes can have a negative impact on the environment. Tornadoes can rip up trees and other vegetation, causing wildlife habitat loss and increases in invasive plant species that thrive under full sunlight.[126] Debris from homes and other buildings can contain hazardous or even toxic substances, which can contaminate the surrounding air, water, land, and food if not disposed of correctly.[127]

Tornadoes can cause significant economic loss in their aftermath. Tornadoes can cause minor damage (e.g., ripping siding off a wall) to catastrophic damage (e.g., levelling residential homes and making essential infrastructure unusable). Essential infrastructure must be repaired immediately, which can be costly.

Social Vulnerability

Among the most socially vulnerable people to tornadoes are those who live in manufactured or mobile homes. Manufactured homes are not built to withstand the force of a tornado and are thus not safe structures in which to shelter.[128] Mobile home fatalities account for a large fraction of even the less powerful tornadoes (F/EF-1 to F/EF-3) across the US.[129] Although Illinois requires tie-downs (systems of heavy-duty straps and anchors designed to stabilize manufactured homes during high winds[130]) through the Illinois Mobile Home Tiedown Act, mobile homes can be thrown from the ground by an F/EF-0 tornado. Mobile home fatalities account for a large fraction of less powerful tornadoes (F/EF-1 to F/EF-3) across the US. In addition to the physical vulnerability of living in a mobile home, these residents tend to be lower-income, compounding tornado risk. Mobile and manufactured homes in Pierron, Pocahontas, and Smithboro constitute over 15% of the housing stock, the highest in the county.

Because Illinois has not adopted statewide building codes, counties or cities with less strict building codes may be more vulnerable to tornadoes than those with stringent building codes.

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[125] EPA. (n.d.). Incident Action Checklist – Tornado. EPA. Retrieved April 13, 2023, from https://www.epa.gov/system/files/documents/2021-10/incident-action-checklist-tornado_508c-final.pdf
[126] Quinn, L. (2019, July 18). Tornadoes, windstorms pave way for lasting plant invasions. https://aces.illinois.edu/news/tornadoes-windstorms-pave-way-lasting-plant-invasions
[127] EPA. (n.d.). Tornadoes. Retrieved April 13, 2023, from https://www.epa.gov/natural-disasters/tornadoes
[128] NWS. (n.d.). Severe Weather Preparedness Week. Jackson, MS Weather Forecast Office. https://www.weather.gov/jan/swpw_mhsafety
[129] Sutter, D., & Simmons, K. M. (2010). Tornado fatalities and mobile homes in the United States. Natural Hazards, 53(1), 125–137. https://doi.org/10.1007/s11069-009-9416-x
[130] Gromicko, N. and Shephard, K. (n.d.). Tie-Downs for Manufactured Homes. Retrieved April 14, 2023, from https://www.nachi.org/manufactured-home-tie-downs.htm

Climate Change

The impact of climate change on tornadoes in the Midwest is less well known than for hazards such as heatwaves. Overall, the frequency of storm environments conducive to producing severe weather, such as strong winds or tornadoes, have increased in frequency across much of the Midwest and mid-south over the past 40-50 years. The number of high frequency tornado days, those with at least 10 tornadoes occurring in a single day, have also increased in the Midwest over the past several decades. There remains uncertainty of the extent to which climate change has caused these recent trends; however, it is thought the warmer and more humid climate in Illinois has had at least some effect on the increasing frequency in severe storm environments. More frequent severe weather environments have already played an important role in the larger number of billion-dollar disasters, recorded by the NOAA. Illinois has experienced 81 billion-dollar disasters since 2003, 64 of which (80%) have been caused by severe storms.

Climate models project continued increases in severe convective environments that can result in tornadoes. Additionally, projections show a potential shift in the seasonality of supercells, one of the most powerful types of severe storms we experience in Illinois. Supercells generate many, if not most, tornadoes in the Midwest. Model projections show a potential shift toward higher frequency of supercell storms in the late winter and early spring, with fewer in the fall. Most severe storms in Illinois occur between 3 pm and 8 pm, and therefore a potentially increasing number of storms in late winter and early spring mean more nighttime storms, which increases risk of life-threatening impacts. Recent research has found that while fatalities from daytime tornado events have decreased by 20% over the past century, fatalities from nighttime tornadoes have increased by 20% over the same time.

Vulnerability to Future Assets

Bond County's entire population and infrastructure are vulnerable to tornadoes. While Bond County's population decreased from the 2010 to 2020 census, future development is likely in the county. It is suggested that the county should ensure new structures are built with sturdier construction and harden existing structures to lessen the potential impacts of severe weather, especially for mobile/manufactured homes. Additional warning sirens can warn the community of approaching storms to ensure the safety of Bond County residents and minimize property damage.

GIS Tornado Analysis

GIS-overlay modeling was used to estimate the risk and losses of an F3 tornado moving through Bond County. A hypothetical tornado track was created that begins in the southwestern quarter of the City of Greenville and travels approximately 2.5 miles crossing through the city and terminates at the approximate street centerline of Illinois State Route 140. GIS was used to create four different damage zones around the tornado track (Figure 44).[131] Estimates of dollar losses for structures located in the tornado's path were determined through this analysis; injuries/loss of life, shelter needs, and damage to infrastructure were not included.

[131] Hubbard, S.A. and MacLaughlin, K. A Study of the GIS Tools Available During Tornado Events and Their Effectiveness for Meteorologists, First Responders and Emergency Managers. Conference publication, American Meteorological Society Cloud Physics Conference. 2006.

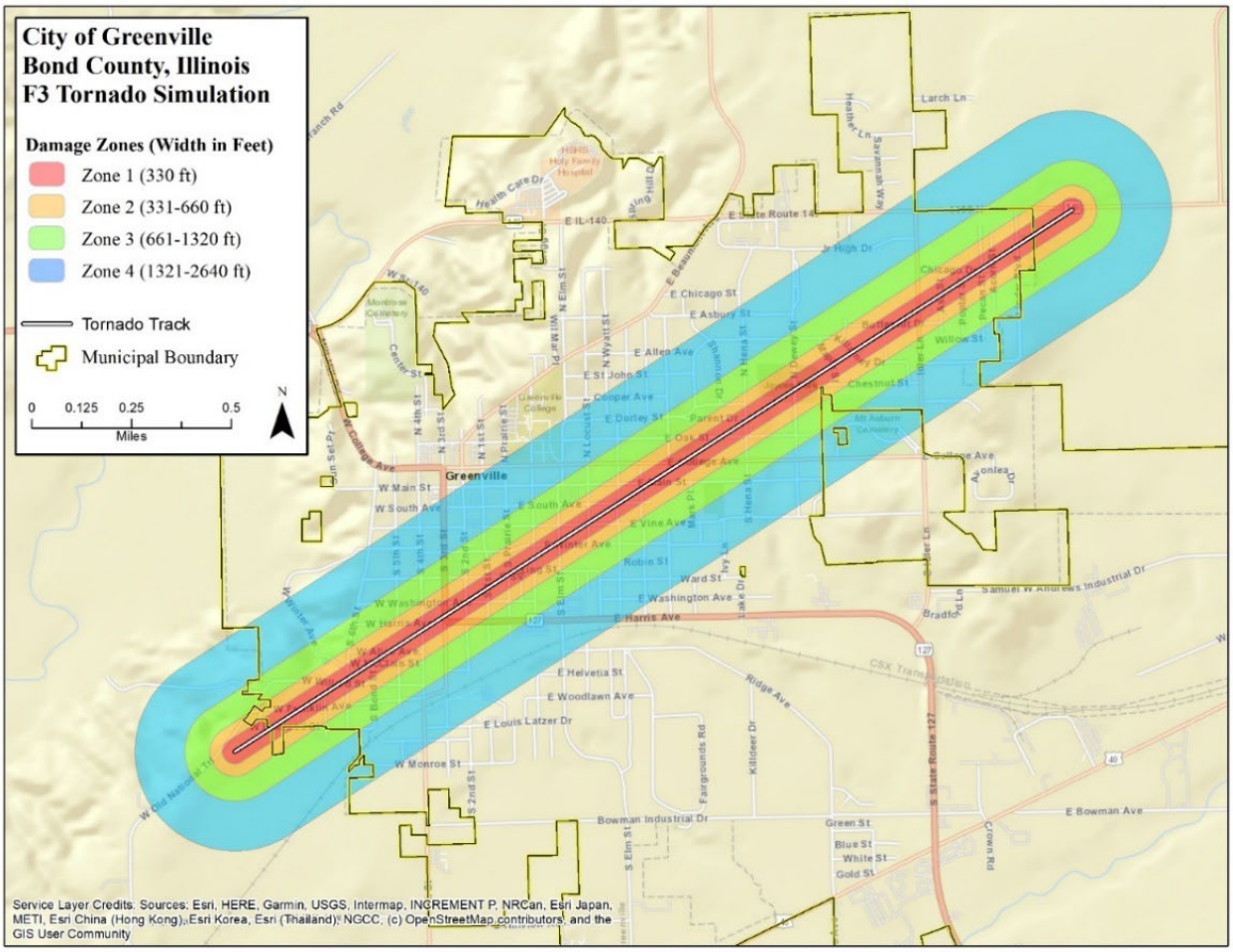

Figure 44. Tornado Damage Zones.

Each zone represents a different Fujita Scale wind intensity from F3 to F0 based on its proximity to the center of the track. A damage percentage is assigned to each zone, with the most intense damage occurring within the center of the tornado path and decreasing amounts of damage away from the center (Table 38).

Table 38. Tornado Damage Zones.

Damage Zone	Distance from Tornado Centerline (Feet)	Damage Percentage
1 (F3)	0-165	0.8
2 (F2)	166-330	0.5
3 (F1)	331-660	0.1
4 (F0)	661-1320	0

Once these zones were created, they were overlaid on top of points taken from the building inventory derived from the National Structure Inventory developed by the US Army Corps of Engineers. Each point represents an existing structure and is attributed with an estimate of the replacement cost of the structure as calculated from RSMeans square footage values. The number of structures that fell in each tornado damage zone is listed in Table 39.

Table 39. Structure Count in Each Tornado Damage Zone.

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	244	197	328	413
Commercial	10	10	33	83
Industrial	2	0	4	9
Agriculture	1	0	1	3
Government	2	0	2	6
Religion	2	2	3	5
Education	1	0	0	3
Total	**262**	**209**	**371**	**522**

A total of 842 structures located in Zones 1-3 were damaged in this scenario. Seven of these structures were essential facilities. Three essential facilities fell within Zone 3. These facilities are listed in Table 40.

Table 40. Essential facilities located in tornado path.

Essential Facilities	Damage Zone	City
Bond County Civil Defense Control Center	Zone 3	Greenville
Bond County Sheriff	Zone 3	Greenville
Greenville Police Department	Zone 3	Greenville
Bond County CUSD 2 Early Childhood Center	Zone 4	Greenville
Greenville Elementary School	Zone 4	Greenville
Greenville Jr. High School	Zone 4	Greenville
Greenville Free Methodist Church (School)	Zone 4	Greenville

Damage to, or loss of, these essential facilities can result in a large negative impact on the community during a disaster, such as the capability of first responders to help those in need. Though there are no damages to schools reported in this simulation, potential damage can have impacts such as reduced options for temporary shelter and can increase the amount of time it takes to restore a level of normalcy to the community.

Economic Losses

The total loss estimate for this event is $147,640,600. Using the structure count in Table 39, the fair market value of the structure was multiplied by the percentage listed in Table 38 to give an estimate of the dollar losses that may result in such an event (Table 41). Residential losses are the largest contributor to loss estimates, due to the fact that residential structures make up 91% of the total structure located in Zones 1-3.

Table 41. Total loss estimates by occupancy.

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	$57,957,600	$32,093,000	$10,412,700	$0
Commercial	$9,377,300	$6,549,300	$7,182,500	$0
Industrial	$1,083,900	$0	$1,809,300	$0
Agriculture	$416,600	$0	$727,200	$0
Governmental	$756,400	$0	$544,600	$0
Religion	$4,300,500	$1,150,200	$1,284,000	$0
Education	$11,995,500	$0	$0	$0
Total	**$85,887,800**	**$39,792,500**	**$21,960,300**	**$0**

Wildfire

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
WILDIFRE	COUNTYWIDE	35	1.3	$0	0	0

Description

A wildfire is an unplanned wildland fire, including unauthorized human-caused fires, escaped wildland fire use events, and escaped prescribed fire projects.[132] Wildfires can occur in Illinois under certain conditions, such as during periods of drought or when dry, windy weather patterns occur. Wildfires can start naturally or be caused by human activities such as campfires, fireworks, or power lines. Wildfires vary in size and severity.

The Wildland-Urban Interface (WUI) is the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetation fuels.[133] This interface can be found in rural, suburban, and urban areas where homes and businesses are located near or within natural areas such as forests, grasslands, or wetlands. The WUI is often characterized by an abundance of highly flammable vegetation, which can act as fuel for the fire. When a wildfire enters the WUI, it can ignite homes and other structures, putting people's lives at risk and causing significant damage to property.

Historical Events

There have been 35 reported fires in Bond County, all of which were human induced (Figure 45). Six fires were classified as Class C (between 10 and 100 acres of burning), 22 as Class B (between 1-fourth and 10 acres), and seven as Class A (one-fourth acre or less). Debris and open burning contributed to a 30-acre fire on March 11, 2014, near Old Ripley. Debris and open burning have contributed to 16, or nearly half, of wildfires in Bond County.

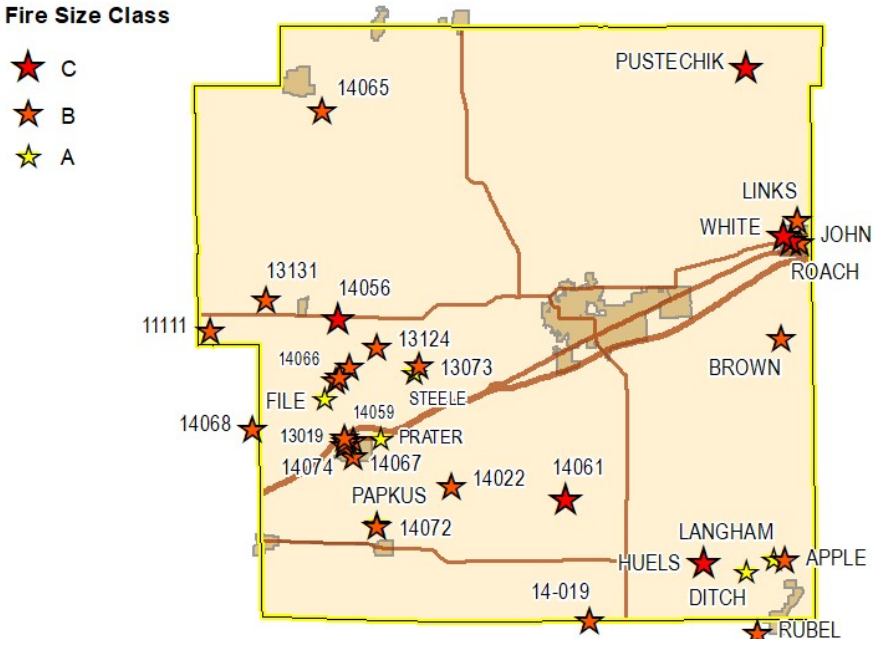

Figure 45. Wildfire reports within 1 km of Bond County (1992-2018).

Source: USDA Forest Service

[132] FEMA. (n.d.) *Wildfire | What*. Retrieved from https://community.fema.gov/ProtectiveActions/s/article/Wildfire-What

[133] NWCG. (n.d.). Glossary of Wildland Fire, *PMS 205 | NWCG*. Retrieved from https://www.nwcg.gov/publications/pms205

Impact and Extent

Nearly 85% of wildfires are caused by humans. Any place there are humans, there is a chance of wildfires. Lightning is also a prominent source of wildfires. A wildfire that strikes farmland or wooded areas in Bond County may spread to homes and other structures. Farmland, wooded areas, and surrounding infrastructure may be more susceptible to wildfires in Bond County.

Wildfires that start near communities frequently move into populated areas and burn buildings and infrastructure. Transportation infrastructure is critical in the event of a wildfire; it is necessary for person mobility, goods movement, the rescue of people, and access to critical services. Depending on the severity, wildfires can result in road closures, which may have larger consequences in rural areas, where alternative routes are unrealistic or do not exist.

Following a wildfire, the area is at higher risk of flooding due to loss of vegetation, which in turn may lead to soil erosion. Locations that are downhill and downstream from burned areas are highly susceptible to flash flooding or debris flows. These flood events can also lead to further damage due to the higher demand placed on infrastructure elements like culverts, bridges, and drainage systems.

Wildfires are naturally occurring and play an important role in the life of a wildland area. As such, many of the environmental impacts are naturally recovered as the wildland area returns to its pre-fire state. Completely preventing forest fires can have a negative effect, resulting in underbrush growing in overabundance and acting as fuel resulting in more damaging fires. Prescribed fires are a mitigation effort to actively reduce the impact of wildfires. Following a fire, many parks will actively reseed almost immediately after a fire. The vegetation loss can result in soil erosion which can have an impact on watersheds and water quality.[134]

Wildfires can have long-lasting impacts on the economy. Wildfires can cause devastating damage for farmers, resulting in loss of income. Seven percent of people are employed in the agriculture industry in Bond County. Damage to homes and structures can be costly to repair. A wildfire can result in long-lasting economic impacts by experiencing a decrease in economic activity due to disruption in business activity for the area or a decrease in population due to displaced households.[135]

Social Vulnerability

Among the most socially vulnerable to wildfires are the elderly, children, and people with underlying respiratory health conditions.[136] Air pollution and other particulates associated with wildfires are more harmful to these socially vulnerable groups, making wildfire-smoke inhalation dangerous and deadly. Existing respiratory diseases, such as asthma, can be exacerbated by wildfire-smoke. Cardiorespiratory-related excess deaths have been reported in the days following wildfires, particularly among the elderly.[137] People with outdoor occupations may also be more at risk, particularly if they do not have the proper equipment to protect their respiratory systems from smoke.

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[134] Thomas, D. , Butry, D. , Gilbert, S. , Webb, D. and Fung, J. (2017), The Costs and Losses of Wildfires, Special Publication (NIST SP), National Institute of Standards and Technology, Gaithersburg, MD, [online], https://doi.org/10.6028/NIST.SP.1215

[135] Ibid

[136] D'Evelyn, S. M., Jung, J., Alvarado, E., Baumgartner, J., Caligiuri, P., Hagmann, R. K., Henderson, S. B., Hessburg, P. F., Hopkins, S., Kasner, E. J., Krawchuk, M. A., Krenz, J. E., Lydersen, J. M., Marlier, M. E., Masuda, Y. J., Metlen, K., Mittelstaedt, G., Prichard, S. J., Schollaert, C. L., … Spector, J. T. (2022). Wildfire, Smoke Exposure, Human Health, and Environmental Justice Need to be Integrated into Forest Restoration and Management. Current Environmental Health Reports, 9(3), 366–385. https://doi.org/10.1007/s40572-022-00355-7

[137] Kochi, I., Champ, P. A., Loomis, J. B., & Donovan, G. H. (2012). Valuing mortality impacts of smoke exposure from major southern California wildfires. Journal of Forest Economics, 18(1), 61–75. https://doi.org/10.1016/j.jfe.2011.10.002

Rural and low-income communities may also be more susceptible to wildfires. All of Bond County's fire departments are volunteer staffed and may not have the resources, personnel, or training required to extinguish big wildfires. People without access to transportation, which frequently intersects rural and low-income populations, may not have the ability to evacuate in case of a wildfire. Greenville, Mulberry Grove, and Sorento have the highest percentage of residents without vehicles.

Climate Change

While Bond County has a relatively low risk for wildfires, there has been an increase in wildfire season length, wildfire frequency, and burned area due to climate change.[138] Climate change threatens to increase the frequency, extent, and severity of fires through rising temperatures and prolonged drought. Crop and orchard fires are the most common type of agricultural fire in the US. Bond County's extensive farmland and farmers may be at risk of crop loss as climate changes.

Vulnerability of Future Assets

Bond County's entire population and infrastructure are vulnerable to wildfires. While Bond County's population decreased from the 2010 to 2020 census, future development is likely in the county. All buildings should include electrical surge protection devices for incoming power, data, and communication lines; and surge protection devices for vulnerable appliances to reduce the risk of a fire caused by a lightning strike.[139] New residents of Bond County may not have knowledge of wildfire safety. Programs to educate current and new residents on wildfire safety could be beneficial. Laws regarding fireworks should be updated and enforced.

Damages in rural counties tend to be underreported or have little data. Therefore, expected annual loss estimates for Bond County were calculated by taking the average damage per year caused by each hazard in rural counties. The expected annual loss of property and infrastructure caused by wildfires is less than <$100. However, this value is likely to increase as wildfire occurrences and resulting damages increase nationwide.

[138] U.S. Global Change Research Program. (2018). Impacts, risks, and adaptation in the United States: Fourth National Climate Assessment, volume II. Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.). https://nca2018.globalchange.gov/downloads. doi:10.7930/NCA4.2018.
[139] NWS. (n.d.). *Lightning Rods*. Retrieved from https://www.weather.gov/safety/lightning-rods

Winter Weather: Ice Storms

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
ICE STORMS	COUNTYWIDE	2	< 1	$0	0	0

Description

An ice storm is a storm which results in the accumulation of at least ¼ inches of ice on exposed surfaces. An ice storm can be caused by sleet or freezing rain. NWS uses the following definitions to define sleet and freezing rain: [140]

- **Sleet** occurs when snowflakes only partially melt when they fall through a shallow layer of warm air. These slushy drops refreeze as they next fall through a deep layer of freezing air above the surface, and eventually reach the ground as frozen rain drops that bounce on impact.
- **Freezing rain** occurs when snowflakes descend into a warmer layer of air and melt completely. They instantly refreeze upon contact with anything that that is at or below 32°F, creating a glaze of ice on the ground, trees, power lines, or other objects.

Sleet and freezing rain can create slick spots on roadways and sidewalks, making all types of travel dangerous. Motorists can lose control of their automobiles and people on foot can slip and get seriously injured. Heavy accumulations can bring down trees, power lines, and other built structures.[141] Bond County can expect an average of 3 days of freezing rain per year (Figure 46).

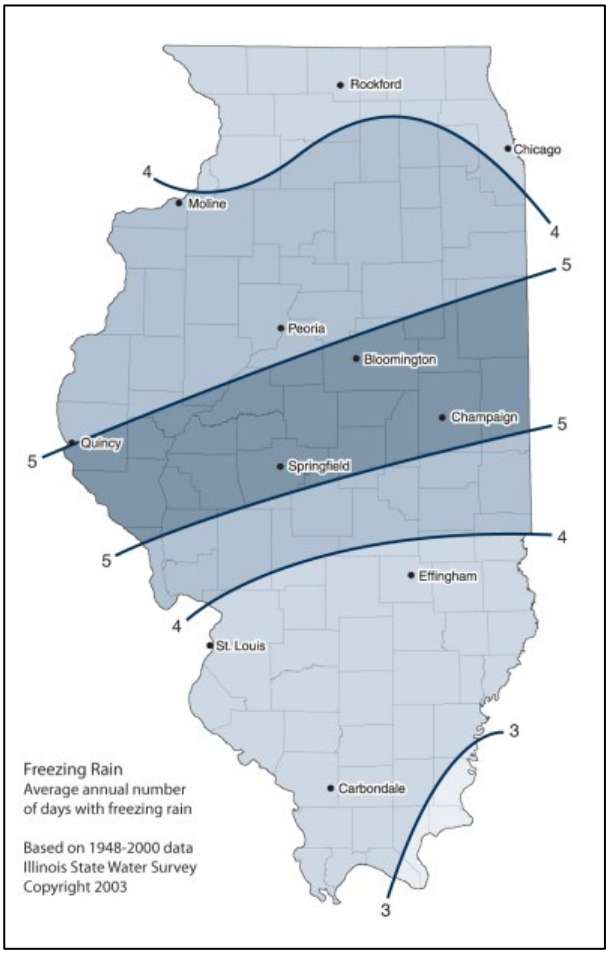

Figure 46. Average Annual number of days with freezing rain (1948-2000). Source: ISWS

[140] US Department of Commerce, N. (n.d.). *What is the Difference between Sleet, Freezing Rain, and Snow?* NOAA's National Weather Service. Retrieved from https://www.weather.gov/iwx/sleetvsfreezingrain

[141] NWS. (n.d.). "Ice Storm Safety". Retrieved November 2, 2023, from https://www.weather.gov/safety/winter-ice-frost

Historical Events

On January 12, 2018, an ice storm, consisting of rain which turned into freezing rain which turned into sleet, hit Bond County. Bond County Schools, Transit, and Senior Center all closed for the day. One semi-truck slid off I-70 but no injuries were reported.[142]

In late February 2022, up to an inch of sleet was reported in Bond County.

Extent and Impacts

Ice storms and their impacts can occur anywhere in the county. Ice storms that cause power outages may affect an area larger than the geographic extent of an ice storm.

Freezing rain and ice storms can occur during winter storms when rain freezes upon contact with cold surfaces. This ice accumulation can be particularly damaging to trees, power lines, and infrastructure. The weight of ice can cause branches and power lines to break, leading to power outages and hazardous conditions. The weight of ice can cause building roofs to collapse. Freezing temperatures accompanied by ice storms can lead to pipes bursting, causing damage to water supply and wastewater systems. Ice storms can also cause widespread transportation disruptions, including road closures and reduced or delayed public transportation. Interstate 70 is a major thoroughfare in Bond County.

Freezing rain and ice storms can occur during winter storms when rain freezes upon contact with cold surfaces. This ice accumulation can be particularly damaging to trees, due to the weight of the ice. Ice can make it difficult for animals to find food and access their regular habitats. Burrowing animals may face challenges in digging through frozen ground or ice. Ice storms also contribute to ice jams which can obstruct waterways and cause damage to bridges or dams, leading to localized flooding.[143]

Ice storms can be very costly. Repairing and restoring infrastructure can be expensive and result in significant economic costs for governments, businesses, and households. Downed power lines and trees are not only a hazard but can be extremely costly to remove or repair. Ice storms can lead to increased demand for heating and other energy sources, which can drive up energy prices and result in economic impacts for consumers and businesses. Ice storms can lead to the closure of businesses, particularly in sectors heavily dependent on physical presence, resulting in loss of income for some. Disruptions in transportation networks can also result in economic losses due to delayed delivery of goods and services.

Social Vulnerability

Ice storms bring the possibility of power outages and loss of heat in homes. This can lead people to resort to unsafe practices such as running a generator, gas stove, or using a barbecue or fire inside their house for warmth, resulting in house fires or carbon monoxide poisoning. Greenville's international population, primarily from warmer regions, may be unprepared for the severity of ice storms and not know the best practices for staying warm during a power outage.

The elderly population in Bond County could be disproportionately affected by ice storms, too. Power outages caused by ice storms could prevent life-saving oxygen and dialysis machines from operating at home. Ice storms create slick, hazardous driving conditions and road closures, meaning emergency vehicles may take longer to reach people in crisis, resulting in preventable deaths. Old Ripley and Pierron are some of the more vulnerable communities in the county, as nearly 25% of their population is over 65.

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[142] WGEL. (2018, January 12). "Rain-Freezing Rain-Sleet All Fall Thursday Night". https://wgel.com/news/2018/01/rain-freezing-rain-sleet-all-fall-thursday-night/

[143] US Department of Commerce, N. (n.d.). *National Flood Safety Awareness Week, Day 3: Ice Jams and Snowmelt*. NOAA's National Weather Service. Retrieved from https://www.weather.gov/fgf/FloodAwarenessWeekDay3

Climate Change

The historical record of snowfall, winter storms, and ice storms do not show any significant trends despite a strong trend toward warmer overall winter temperatures in Illinois. The lack of trend in winter weather events is partly attributable to large year-to-year variability, incomplete observation records (especially for ice), and the complex relationship between air temperature, water vapor content, and snowfall. The impact of climate change on ice storms in Bond County is unknown.

Vulnerability of Future Assets

Bond County's entire population and infrastructure are vulnerable to ice storms. While Bond County's population decreased from the 2010 to 2020 census, future development is likely in the county, particularly in Greenville where the population is increasing. It will be important for the county to periodically trim and check trees for damage and ensure that backup generators will provide enough power for essential services to operate should ice weigh down and topple power lines. As the southeast Asian population at Greenville University grows,[144] educational programs teaching students how to safely stay warm during a power outage could be beneficial.

Damages in rural counties tend to be underreported or have little data. Therefore, expected annual loss estimates for Bond County were calculated by taking the average damage per year caused by each hazard in rural counties. The expected annual loss of property and infrastructure caused by ice storms is $2,817.

[144] Greenville University. (2021, April 31). From China to Greenville. https://www.greenville.edu/news-media/news/2021/04/13/from-china-to-greenville-english-language-program-draws-growing-number-of-chinese-students

Winter Weather: Winter Storms

HAZARD	GEOGRAPHIC EXTENT	UNIQUE EVENTS	EVENTS/YEAR	PROPERTY DAMAGE	INJURIES	FATALITIES
WINTER STORMS	COUNTYWIDE	44	1.6	$0	0	0

Description

A winter storm is a combination of heavy snow, blowing snow and/or dangerous wind chills. Precipitation falls as snow when the air temperature remains below freezing throughout the atmosphere. The NWS uses the following terms when talking about snow*:*

- **Snow Flurries:** Light snow falling for short durations. No accumulation or light dusting is all that is expected.
- **Snow Showers:** Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
- **Snow Squalls:** Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant. Snow squalls are best known in the Great Lakes Region.
- **Blowing Snow:** Wind-driven snow that reduces visibility and causes significant drifting. Blowing snow may be snow that is falling and/or loose snow on the ground picked up by the wind.
- **Blizzards:** Winds over 35mph with snow and blowing snow, reducing visibility to 1/4 mile or less for at least three hours.

According to IEMA's 2021 Winter Weather Preparedness Guide, there has not been a winter without at least one winter storm in the past century in Illinois.

Historical Events

Beginning December 15, 2019, a slow-moving winter storm system brought snow to the central and southwestern part of the state. Between 4 to 6 inches of snow fell across Bond County, the majority of which fell in a two-hour period. February 14-15, 2021, brought heavy snowfall to southcentral Illinois. The northern third of Bond County received between 8-12 inches of snow; the rest of the county received 4-8 inches. continued to fall through the morning of January 13th, bringing up to 15" of snow across Bond County.[145] Travel was impacted the following morning, and a snow emergency was declared in Greenville, which received 7 inches.

The MRCC has calculated snow climatology for select stations across the US. Nashville, IL is the station nearest to Bond County, where an average of 1.6 events per year with at least 6 inches of snow over 3 days can be expected (Figure 47).

[145] WGEL. (2021, February 6). Sunday-Monday Snow Totals From National Weather Service https://wgel.com/news/2021/02/sunday-monday-snow-totals-from-national-weather-service/

Snow Climatology: Average number of 3-Day Snow Totals for

NASHVILLE 1 E

	≥ 0.1"	≥ 1.0"	≥ 2.0"	≥ 3.0"	≥ 4.0"	≥ 6.0"	≥ 8.0"	≥ 12.0"	≥ 18.0"	≥ 24.0"
All Months	21.7	13.3	7.6	5.1	3.3	1.6	0.6	0.1	0	0
January	7	4.1	2.3	1.6	0.9	0.3	0.2	0	0	0
February	6.7	3.8	2.2	1.4	0.9	0.4	0.2	0	0	0
March	2.9	1.8	0.9	0.7	0.5	0.2	0.1	0	0	0
April	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0	0
May	0	0	0	0	0	0	0	0	0	0
June	0	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0	0	0	0
November	0.7	0.6	0.4	0.2	0.2	0.1	0.1	0	0	0
December	4.2	2.7	1.7	1.1	0.8	0.4	0.1	0	0	0

Period of Record used: Snow Years 1960-61 to 2017-18

Figure 47. Average number of 3-day snow totals for Nashville, IL (1960/61 - 2017/8). Source: MRCC

Extent and Impacts

Winter storms and their impacts can occur anywhere in the county.

Winter storms, particularly those accompanied by heavy snow or strong winds, can cause damage to infrastructure such as power lines, roadways, bridges, and buildings. Roofs can collapse under the weight of snow or ice, and high winds can cause structural damage or topple trees onto buildings. Power outages can disrupt daily activities, including heating systems, telecommunication networks, and other essential services. If a winter storm is accompanied by extreme cold temperatures, water supply and wastewater systems can be vulnerable to freezing and bursting pipes. Winter storms can cause widespread transportation disruptions, including road closures and reduced or delayed public transportation. Interstate 70 is a major throughfare in Bond County.

Winter storms often bring heavy snowfall. While snow can provide insulation for plants and small animals, excessive snow accumulation can lead to damage, especially if it is wet and heavy. Heavy snow can break tree branches, damage shrubs, and put stress on structures. Heavy snow can make it difficult for animals to find food and access their regular habitats. Burrowing animals may face challenges in digging through frozen ground or snow. Winter storms can impact natural water systems in several ways. Heavy snowmelt resulting from warmer temperatures or rain can cause rapid runoff, leading to flooding and erosion. Winter storms contribute to ice jams which can obstruct waterways, damage bridges and dams, and potentially lead to localized flooding and changes in water flow patterns.[146]

Winter storms can be costly. Preparation for winter storms is a cost that many local governments incur. Repairing and restoring infrastructure can be expensive and result in significant economic costs for governments, businesses, and households. Winter storms can lead to increased demand for heating and other energy, which can drive up energy prices and result in economic impacts for consumers and businesses. Severe winter storms can lead to the closure of businesses, particularly in sectors heavily dependent on physical presence, resulting in

[146] US Department of Commerce, N. (n.d.). *National Flood Safety Awareness Week, Day 3: Ice Jams and Snowmelt*. NOAA's National Weather Service. Retrieved November 3, 2023, from https://www.weather.gov/fgf/FloodAwarenessWeekDay3

loss of income. Disruptions in transportation networks can result in economic losses due to delayed delivery of goods and services.

Social Vulnerability

Like ice storms, winter storms bring the possibility of power outages and loss of heat in homes. This can lead people to resort to unsafe practices such as running a generator, gas stove, or using a barbecue or fire inside their house for warmth, resulting in house fires or carbon monoxide poisoning. Greenville's international population, primarily from warmer regions, may be unprepared for the severity of winter storms and not know the best practices for staying warm during a power outage.

The elderly population in Bond County could be disproportionately affected by snowstorms. Power outages caused by ice storms could prevent life-saving oxygen and dialysis machines from operating at home. Snowstorms create low visibility leading to hazardous driving conditions. Emergency vehicles may take longer to reach people in crisis, resulting in preventable deaths. Snow shoveling is a strenuous activity and can be especially dangerous for those with heart conditions. Old Ripley and Pierron may be especially vulnerable communities in the county, as more than 25% of their population is over 65.

Climate Change

It is predicted that Illinois will likely see fewer snow days leading to decreases in total seasonal snowfall as climate changes, although large year-to-year variability makes predicting snowfall changes difficult. The snow season is also predicted to decrease, reducing the risk of early- or late-season snowfall events. Overall, winter climate in central Illinois is expected to become milder with decreasing snowfall and winter storm frequency, severity, and extent.[147]

Vulnerability of Future Assets

Bond County's entire population and infrastructure are vulnerable to winter weather. While Bond County's population decreased from the 2010 to 2020 census, future development is likely in the county, particularly in Greenville where the population is increasing. It will be important for the county to periodically trim and check trees for damage and ensure that backup generators will provide enough power for essential services to operate should ice weigh down and topple power lines. As the southeast Asian population at Greenville University grows,[148] educational programs teaching students how to safely stay warm during a power outage could be beneficial.

Damages in rural counties tend to be underreported or have little data. Therefore, expected annual loss estimates for Bond County were calculated by taking the average damage per year caused by each hazard in rural counties. The expected annual loss of property and infrastructure caused by winter weather is $31,027.

[147] Wuebbles, D; Angel, J; Petersen, K; Lemke, A.M. (2021): An Assessment of the Impacts of Climate Change in Illinois. University of Illinois at Urbana-Champaign. https://doi.org/10.13012/B2IDB-1260194_V1

[148] Greenville University. (2021, April 31). From China to Greenville. https://www.greenville.edu/news-media/news/2021/04/13/from-china-to-greenville-english-language-program-draws-growing-number-of-chinese-students

SECTION 5

MITIGATION STRATEGIES

MITIGATION GOALS

Hazard mitigation planning reduces loss of life and property during disasters and builds stronger communities. In Bond County, the process began with local community representatives identifying natural hazards and vulnerabilities within their communities that could cause disasters using a natural hazard risk assessment. Community representatives then developed short-term and long-term mitigation strategies for protecting people and property from disasters.

To create goals for the *2024 Bond County Hazard Mitigation Plan*, the previous goals from the *2010 Bond County Multi Hazard Mitigation Plan* goals and objectives were discussed. As follows, 2010 goals and objectives were:

Goal 1: Lessen the impacts of hazards to people and new and existing structures and infrastructure

(a) Objective: Retrofit critical facilities and structures with structural design practices and equipment that will withstand natural disasters and offer weatherproofing.
(b) Objective: Equip public facilities and communities to guard against damage caused by secondary effects of hazards.
(c) Objective: Minimize the amount of infrastructure exposed to hazards.
(d) Objective: Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county.
(e) Objective: Improve emergency sheltering in Bond County.

Goal 2: Create new or revise existing plans/maps for Bond County

(a) Objective: Support compliance with the NFIP for each jurisdiction in Bond County.
(b) Objective: Review and update existing, or create new, community plans and ordinances to support hazard mitigation.
(c) Objective: Conduct new studies/research to profile hazards and follow up with mitigation strategies.

Goal 3: Develop long-term strategies to educate Bond County residents on the hazards affecting their county

(a) Objective: Raise public awareness on hazard mitigation.
(b) Objective: Improve education and training of emergency personnel and public officials.

These goals and objectives were kept for the *2024 Bond County Hazard Mitigation Plan*. A fourth goal was added by to include the protection of life:

Goal 4: Protect life and livelihoods in Bond County

SUMMARY OF CHANGES

A status update of mitigation actions identified in the *2010 Bond County Multi-Hazard Mitigation Plan* can be found in Table 43.

Table 42. Status of 2010 Mitigation Actions.

Mitigation Strategy	Jurisdiction	Hazard	Priority	Status	Comments
Establish amutual aid response agreement	Bond County	Hazmat	High	Keep	Dependent on available resources
Procure generators, transfer switches,and portable heaters for warming centers	Bond County,Sorento	Winter Storm	High	Keep	Dependent on funding
Submit application to join the NFIP	Donnellson, Mulberry Grove, Old Ripley, Panama, Pierron, Pocahontas, Smithboro, Sorento	Flood	High	Ongoing	Dependent on available resources
Purchase signage for roads that flood frequently: Shoal Creek Road (Sorento), Old Ripson Road (Sorento), Trestle Road (Panama)	Sorento, Panama	Flood	High	Keep	Dependent on funding
Construct safe houses in key locations within the county	Sorento, Smithboro, Mulberry Grove	Tornado, Thunderstorm	High	Ongoing	Dependent on funding
Conduct an engineering study to investigate redundancy in public water supply	Bond County	Flood	Medium	Keep	Dependent on funding
Improve drainage in key communities in the county	Bond County, Sorento, Smithboro, Mulberry Grove	Flood	Medium	Ongoing	Dependent on funding
Establish an LEPC and write a CEMP for all hazards	Bond County	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Subsidence	Medium	Ongoing	Dependent on available resources

Mitigation Strategy	Jurisdiction	Hazard	Priority	Status	Comments
Implement Nixle for mass media release via e-mail and text messages	Bond County, Greenville, Donnellson, Mulberry Grove, Old Ripley, Panama, Pierron, Pocahontas, Smithboro, Sorento	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Subsidence	Medium	Remove	No longer applicable
Develop a public education program to present at public events, e.g. county fair, and in schools	Bond County, Greenville, Donnellson, Mulberry Grove, Old Ripley, Panama, Pierron, Pocahontas, Smithboro, Sorento	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Subsidence	Medium	Ongoing	Dependent on available resources
Create maps of undermined areas in the county	Bond County	Subsidence	Medium	Keep	Dependent on available resources
Trim trees to minimize the amount/duration of power outages	Bond County	Winter Storm	Low	Ongoing	Dependent on available resources
Compile a database of 4x4 vehicles for transportation of people and supplies	Bond County, Greenville, Donnellson, Mulberry Grove, Old Ripley, Panama, Pierron, Pocahontas, Smithboro, Sorento	Winter Storm	Low	Keep	Dependent on available resources
Procure back-up generators for critical facilities	Bond County, Greenville, Donnellson, Mulberry Grove, Old Ripley, Panama, Pierron, Pocahontas, Smithboro, Sorento	Flood, Tornado, Earthquake, Thunderstorm, Winter Storm	Low	Ongoing	Dependent on funding
Establish backup power for warning sirens	Mulberry Grove, Smithboro, Sorento	Tornado, Flood, Thunderstorm, Winter Storm	Low	Keep	Currently manual, update to automatic
Develop a program to distribute weather radios to all critical facilities	Bond County, Greenville, Donnellson, Mulberry Grove, Old Ripley, Panama, Pierron, Pocahontas, Smithboro, Sorento	Flood, Tornado, Thunderstorm, Winter Storm	Low	Ongoing	Dependent on funding
Begin storm sewer construction	Sorento	Flood	Low	Unknown	Specific activity referenced unknown, ongoing updates will continue

MITIGATION ACTIONS

Hazard mitigation project ideas came from members of the community who spent time considering the hazards affecting their area and residents. Members of the community ranked priorities and the cost and benefit of each project, discussed funding sources, and developed a proposed schedule with the assistance of the planning committee. Potential projects included construction, education, policy, communication, preparedness, and response. These projects were prioritized using a high-medium-low scale, where high priority projects could have a permanent or further-reaching impact than medium priority projects, although both address the hazards of greatest concern in a community. Low priority projects may address hazards of lesser concern. The implementation of all actions is desirable regardless of prioritized order. Potential funding sources came from local operating budgets, in-kind donations, donations from local businesses, regional funding opportunities, state and federal grants and low-interest loan programs.

The committee assigned preliminary cost/benefit assessments to each project, using general a high-medium-low scale. A high-cost project indicated that the jurisdiction may not be able to accomplish the project without outside funding. A medium-cost project indicated that the cost may be within or slightly exceed normal maintenance or operating budgets. A low-cost rating indicated that the jurisdiction could accomplish the project with little financial burden. A high-benefit project was expected to have significant hazard mitigating impacts to people and property. A medium-benefit project protected people or property, but the scope was generally limited to non-infrastructure projects. A low-benefit project may be limited in reach or applicable to only one hazard.

Jurisdictional Project Grid Instructions

Under the **Goal** column, a goal for the project is listed that aligns with goals previously stated in this section.

Under the **Jurisdiction** column, wherever *'All'* is listed, the project applies to all incorporated municipalities in the county, otherwise it applies to the specific jurisdiction listed.

Under the **Action** column, the following codes can be used to categorize projects: *C = Construction Project; E = Education Project; P = Policy Project; COM = Communication; PR = Preparedness; R = Response;* and *BO = Buyout*.

Under the **Hazard** column, the following codes can be used to identify the hazard being addressed: *A = All hazards; W = Wind; H = Hail; L = Lightning; T = Tornado; RF = Riverine Flooding; FF = Flash Flooding; DF = Dam/Levee Failure; WS = Winter Storms; IS = Ice Storms; D = Drought; EH = Extreme Heat; EC = Extreme Cold; E = Earthquake; WF = Wildfire; HM = HazMat Spill; MS = Mine Subsidence; CS = Cybersecurity;* and *P = Pandemic*.

Under the **Funding** column, the potential source of funding should be listed. Examples of potential sources include, but are not limited to, public agencies such as *FEMA, HUD, USDA,* or *local funding*; private agencies can be included too if relevant. **REQUIRED:** each jurisdiction must have at least one project funded by *FEMA*.

Under the **Description** column, a short description of the project should be provided.

Under the **Priority** column, the following codes are used: *H = High; M = Medium;* and *L = Low.*

Under the **Contact** column, wherever *EMA* is listed, this refers to the County Emergency Manager, the implication is that the *EMA* will be assisted by municipal employees and others who meet regularly with the *EMA*.

Under the **Timeline** column, a timeframe for the project should be provided. Examples of timelines could include a start year and end year (e.g., 2024-2026) or the expected duration of a project (e.g., 5-7 years)

Under the **Benefit, Cost** column, the following codes are used: *H = High; M = Medium;* and *L = Low.* There should be one code each for benefit and cost.

Bond County Mitigation Strategies

Goals	Jurisdiction	Action	Hazard	Funding	Description	Priority	Contact	Timeline	Benefit, Cost
Goal 1, 4	All	PR	All, T	USDA Rural Development	Install sirens or other emergency notification system	H	EMA	1-3 years	H, M
Goal 1, 4	All	C	EC, EH	Local, FEMA	Identify a location for a heating and cooling center with back-up generators	M	EMA	1-5 years	H, H
Goal 1, 2, 3	All	PR, R	HM	Local	Develop emergency action plan to combat and respond to hazmat spills	H	EMA	1-3 years	H, L
Goal 2, 3, 4	Bond County, Greenville, Donnellson, Keyesport, Mulberry Grove, Old Ripley, Panama, Pierron, Pocahontas, Smithboro, Sorento	P, PR	All	Local	Formalizing mutual aid-agreements within county for support during an emergency response to possible disasters. This will ensure communities with limited resources have the support they need during the response efforts.	H	EMA	1-3 years	H, L

City of Greenville Mitigation Strategies

Goals	Jurisdiction	Action	Hazard	Funding	Description	Priority	Contact	Timeline	Benefit, Cost
Goal 2, 3	Greenville	P	T, W	Local	Conduct tree surveys and put tree survey plans into writing	M	City Manager, Public Works	1-5 years	M, L
Goal 1, 3, 4	Greenville	E	T	Local	Conduct tornado awareness and outreach programs	M	EMA, City Administration	1-3 years	H, L
Goal 1, 3, 4	Greenville	E, PR	CS	Local	Create a training and awareness campaign for cyber-attacks	L	City Administration	1 year	L, L
Goal 1, 2	Greenville	P	All	Local	Keep aerial photography current, especially in rapidly developing areas	L	EMA, County Board	1-3 years	M, M
Goal 1, 2	Greenville	P, C	FF	Local, FEMA	Perform engineering review of stormwater management. Identify problem areas and solution options	M	City Council, City Administration, Public Works	5-10 years	M, H

Village of Pierron Mitigation Strategies

Goals	Jurisdiction	Action	Hazard	Funding	Description	Priority	Contact	Timeline	Benefit, Cost
Goal 1, 4	Pierron	R	ALL	USDA Rural Development	Install sirens or other emergency notification system to alert residents during severe weather events	H	Village Treasurer	1-5 years	H, M

Village of Sorento Mitigation Strategies

Goals	Jurisdiction	Action	Hazard	Funding	Description	Priority	Contact	Timeline	Benefit, Cost
Goal 1, 4	Sorento	C	T, W, EC, EH	Local, FEMA	Develop a wind resistant shelter for severe wind/tornado sheltering use, heating and cooling center for extreme heat/cold events	H	EMA	1-5 years	H, H
Goal 1, 4	Sorento	R	ALL	USDA Rural Development	Install sirens or other emergency notification system to alert residents during severe weather events	H	EMA	1 year	H, M
Goal 1, 3, 4	Sorento	PR, COM	HM	Local, private	Organize a giveaway or sale event to provide air purifiers for households that live near the tracks to reduce impact of poor air quality from uncovered rail cars nearby	M	EMA	1-5 years	M, H
Goal 2, 3	Sorento	R	HM	Local	Develop (or update) an Emergency Action Plan (EAP) for hazmat spills along the railroad that runs near the community	M	EMA	1-5 years	M, L
Goal 1, 2	Sorento	C	FF	Local, FEMA	Continue to identify locations in the community that get affected during flash floods and construct culverts to direct the flow of storm water in those areas. Monitor current culverts for any damage/repair needs	H	EMA	1 year	H, H

Bond County Health Department Mitigation Strategies

Goals	Jurisdiction	Action	Hazard	Funding	Description	Priority	Contact	Timeline	Benefit, Cost
Goal 1, 2	All	P	All	Local, n/a	Form a COAD (Community Organizations Active in Disasters) with other local agencies and philanthropies	H	Health Department	1-3 years	H, L
Goal 1, 3, 4	All	PR	WF, Fire	Local, Red Cross	Partner with the Red Cross to obtain free smoke detectors; partner with local fire department to distribute smoke detectors door-to-door	M	Health Department, Fire Protection Districts, Red Cross	1 year	H, M
Goal 1, 3, 4	All	PR, COM	All	Local, NOAA	Organize a giveaway or sale event to provide weather radios to the community	M	EMA, Health Department	1 year	H, M
Goal 1, 4	All	PR	All, T	USDA Rural Development	Install sirens or other emergency notification system	H	EMA	1-3 years	H, M
Goal 1, 4	All	R	All	Local, Private	Create emergency supply kits for vulnerable populations to quickly distribute necessary supplies	H	Health Department	1-3 years	H, M
Goal 1, 4	All	C	EC, EH	Local, FEMA	Identify a location for a heating and cooling center with back-up generators	H	EMA, Health Department	1-5 years	H, H

Greenville University Mitigation Strategies

Goals	Jurisdiction	Action	Hazard	Funding	Description	Priority	Contact	Timeline	Benefit, Cost
Goal 1, 3, 4	Greenville, University	PR, COM	CS	University Funding	Perform Cybersecurity training for faculty, staff, and students	H	IT Department	Yearly	M, L
Goal 1, 2	Greenville, University	P, PR	EC	University Funding	Develop mitigation plans for power failures	H	Facilities, Campus Safety	1-3 years	H, L
Goal 1, 4	Greenville, University	C	EC	University Funding	Develop community warming stations utilizing campus resources	H	Facilities, Athletics, Campus Safety, GPD	1-3 years	H, M
Goal 1, 4	Greenville, University	C	EH	University Funding	Develop community cooling stations	H	Facilities, Campus Safety, GPD	1-2 years	H, M
Goal 1, 2, 3	Greenville, University	P, PR	HM	University Funding	Work with Chemistry Department to revise hazmat plan	L	Campus Safety	1 year	L, L
Goal 1, 2, 3	Greenville, University	PR, COM	HM	University Funding	Work with GPD to provide Hazmat Spill training scenarios	H	Campus Safety, GPD	1 year	H, M

HSHS Holy Family Hospital Mitigation Strategies

Goals	Jurisdiction	Action	Hazard	Funding	Description	Priority	Contact	Timeline	Benefit, Cost
Goal 1, 4	All	C	EC, EH	Local, FEMA	Identify a location for a heating and cooling center with back-up generators	H	EMA, Mayors, City Councils	2-3 years	M, H
Goal 1, 3, 4	All	PR	HM	Local	Develop evacuation and cleaning drills to respond to accidental spills	M	Fire chief, police chief	1-2 years	H, L
Goal 1, 4	All	PR	HM	Local, FEMA	Acquire portable decontamination units to respond to accidental spills	H	County, EMA, Fire Departments	1-2 years	H, H
Goal 1, 3, 4	All	PR, E	HM	Local, Private	Educate first responders and healthcare workers with disaster preparedness information for hazardous materials spills	H	County, EMA, Fire Departments	1-2 years	H, L

SECTION 6

APPENDIX

APPENDIX A: RISK ASSESSMENT

Bond County Risk Assessment

Bond County Multi-Jurisdictional Hazard Mitigation Plan

Risk Assessment

Name: ALLAN DAVIS

Title and Employer: BOND CO 9-1-1 JEMA

Hazard	Probability (1-4)	Severity (1,2,4,8)	Risk (Probability x Severity)	Ranking
Cybersecurity	3	2	6	
Drought	3	1	3	
Earthquake	2	2	4	
Heat Wave	3	2	6	
Cold Wave	3	2	6	
Mine Subsidence	2	1	2	
HazMat Spill	4	2	8	
Tornado	4	3	12	
Lightning	4	2	8	
Hail	4	1	4	
Wind	4	2	8	
Winter Weather	3	1	3	
Ice Storm	3	3	~~8~~ 9	
Wildfire	1	1	1	
Pandemic	4	2	8	
Flash Flooding	3	1	3	
Riverine Flooding	2	1	2	
Dam/Levee Failure	1	1	1	

Bond County Multi-Jurisdictional Hazard Mitigation Plan

Risk Assessment

Name: Becky Blackburn

Title and Employer: Secretary Bond Co 911

Hazard	Probability (1-4)	Severity (1,2,4,8)	Risk (Probability x Severity)	Ranking
Cybersecurity	3	2		
Drought	3	2		
Earthquake	~~4~~ 2	1		
Heat Wave	2	1		
Cold Wave	2	1		
Mine Subsidence	1	1		
HazMat Spill	4	4		
Tornado	4	2		
Lightning	4	1		
Hail	4	1		
Wind	4	2		
Winter Weather	3	2		
Ice Storm	3	2		
Wildfire	1	1		
Pandemic	3	2		
Flash Flooding	4	4		
Riverine Flooding	3	2		
Dam/Levee Failure	2	2		

City of Greenville Risk Assessment

Bond County Multi-Jurisdictional Hazard Mitigation Plan

Risk Assessment

Name: BRAD IDERS

Title and Employer: GIS ANALYST - CITY OF GREENVILLE

Hazard	Probability (1-4)	Severity (1,2,4,8)	Risk (Probability x Severity)	Ranking
Cybersecurity	2	2	4	5
Drought	2	2	4	5
Earthquake	1	~~1~~ 2	~~1~~ 2	7
Heat Wave	3	1	3	6
Cold Wave	3	2	6	4
Mine Subsidence	1	2	2	7
HazMat Spill	2	~~1~~ 2	~~2~~ 4	5
Tornado	4	8	32	1
Lightning	4	1	4	5
Hail	4	1	4	5
Wind	3	1	3	6
Winter Weather	4	1	4	5
Ice Storm	4	1	4	5
Wildfire	3	2	6	4
Pandemic	3	4	12	2
Flash Flooding	2	4	8	3
Riverine Flooding	3	2	6	4
Dam/Levee Failure	2	2	4	5

Village of Pierron Risk Assessment

Bond County Multi-Jurisdictional Hazard Mitigation Plan

Risk Assessment

Name: JAMES HESS

Title and Employer: Treasurer Village of Pierron

Date: 12/18/23

Contact email: Villageofpierron@wispershome.com

Hazard	Probability (1-4)	Severity (1,2,4,8)	Risk (Probability x Severity)	Ranking
Cybersecurity	3	2	6	5
Drought	2	4	8	3
Earthquake	2	8	16	1
Heat Wave	1	1	1	13
Cold Wave	1	1	1	14
Mine Subsidence	1	1	1	15
HazMat Spill	2	4	8	4
Tornado	3	4	12	2
Lightning	3	2	6	6
Hail	3	1	3	10
Wind	3	1	3	11
Winter Weather	3	1	3	12
Ice Storm	3	2	6	7
Wildfire	1	1	1	16
Pandemic	2	2	4	8
Flash Flooding	2	2	4	9
Riverine Flooding	1	1	1	17
Dam/Levee Failure	1	1	1	18

Village of Pocahontas Risk Assessment

Bond County Multi-Jurisdictional Hazard Mitigation Plan

Risk Assessment

Name: Loni Hensler

Title and Employer: Village Clerk - Village of Pocahontas

Hazard	Probability (1-4)	Severity (1,2,4,8)	Risk (Probability x Severity)	Ranking
Cybersecurity	2	4	8	
Drought	4	4	16	
Earthquake	2	4	8	
Heat Wave	4	4	16	
Cold Wave	3	2	6	
Mine Subsidence	~~4~~ 3	8	~~24~~ ~~32~~	
HazMat Spill	4	4	16	
Tornado	4	4	16	
Lightning	3	2	6	
Hail	4	1	4	
Wind	4	2	8	
Winter Weather	4	4	16	
Ice Storm	4	4	16	
Wildfire	4	4	16	
Pandemic	3	4	12	
Flash Flooding	4	2	8	
Riverine Flooding	2	1	2	
Dam/Levee Failure	~~0~~ 1	1	1	

Village of Sorento Risk Assessment

Bond County Multi-Jurisdictional Hazard Mitigation Plan

Risk Assessment

Name: Jane Krankel

Title and Employer: Treasurer Village of Sorento

Hazard	Probability (1-4)	Severity (1,2,4,8)	Risk (Probability x Severity)	Ranking
Cybersecurity	4	8	32	
Drought	2	4	6	
Earthquake	1	1	1	
Heat Wave	4	8	32	
Cold Wave	4	8	32	
Mine Subsidence	4	8		
HazMat Spill	2	2	4	
Tornado	4	8	32	
Lightning	4	8	32	
Hail	4	8	32	
Wind	4	8	32	
Winter Weather	4	8	32	
Ice Storm	4	8	32	
Wildfire	2	2	4	
Pandemic	4	8	32	
Flash Flooding	4	8	32	
Riverine Flooding	1	1	1	
Dam/Levee Failure	1	1	1	

Bond County Health Department Risk Assessment

Bond County Multi-Jurisdictional Hazard Mitigation Plan

Risk Assessment

Name: Wendy White

Title and Employer: Emer. Prep. Coord. / Bond County Health Dept.

Hazard	Probability (1-4)	Severity (1,2,4,8)	Risk (Probability x Severity)	Ranking
Cybersecurity	3	2	6	
Drought	3	2	6	
Earthquake	1	4	4	
Heat Wave	4	2	8	
Cold Wave	4	2	8	
Mine Subsidence	2	2	4	
HazMat Spill	3	2	6	
Tornado	3	4	12	
Lightning	4	1	4	
Hail	4	1	4	
Wind	4	1	4	
Winter Weather	4	2	8	
Ice Storm	3	4	12	#2
Wildfire	1	2	2	
Pandemic	2	4	8	
Flash Flooding	4	1	4	
Riverine Flooding	4	1	4	
Dam/Levee Failure	1	2	2	

Greenville University Risk Assessment

Bond County Multi-Jurisdictional Hazard Mitigation Plan

Risk Assessment

Name: Shawn Foles

Title and Employer: Director of Campus Safety Greenville U

Hazard	Probability (1-4)	Severity (1,2,4,8)	Risk (Probability x Severity)	Ranking
Cybersecurity	3	2	6	12
Drought	4	3	12	4
Earthquake	2	4	8	10
Heat Wave	4	2	8	5
Cold Wave	4	2	8	7
Mine Subsidence	1	2	2	18
HazMat Spill	2	4	8	6
Tornado	4	8	24	1
Lightning	4	2	8	8
Hail	4	1	4	13
Wind	4	1	4	14
Winter Weather	4	1	4	15
Ice Storm	4	1	4	16
Wildfire	2	2	4	17
Pandemic	1	8	8	11
Flash Flooding	4	4	16	2
Riverine Flooding	4	4	16	3
Dam/Levee Failure	2	4	8	9

APPENDIX B: MEETING DOCUMENTS

B.1 Meeting 1 Documents

Meeting 1 Agenda

BOND COUNTY HAZARD MITIGATION PLAN UPDATE – KICK OFF MEETING

Meeting Location:	In-Person, Virtual Available
Date & Time:	Thursday May 25, 2023 6:30PM – 7:30PM
Location:	County Courthouse – Boardroom 200 W College Ave, Greenville, IL 62246
Virtual Meeting Link:	https://illinois.zoom.us/j/86006507188?pwd=dnF6UUtHRG9NcExybEZrMmtXTnVBdz09 Meeting ID: 860 0650 7188 Password: 556977

AGENDA DETAILS

I. INTRODUCTIONS
II. HAZARD MITIGATION OVERVIEW
III. PLANNING SCHEDULE
IV. MEETING & PLAN DOCUMENTATION
- Meeting agendas, minutes, and materials will be stored on the Bond County Box folder

V. PUBLIC INVOLVEMENT
VI. PLAN UPDATES
VII. ADJOURN

Meeting 1 Notes

BOND COUNTY HAZARD MITIGATION PLAN UPDATE – KICK OFF MEETING

Meeting Location:	In-Person, Virtual Available
Date & Time:	Thursday May 25, 2023 6:30PM – 7:30PM
Location:	County Courthouse – Boardroom 200 W College Ave, Greenville, IL 62246
Virtual Meeting Link:	https://illinois.zoom.us/j/86006507188?pwd=dnF6UUtHRG9NcExybEZrMmtXTnVBdz09 Meeting ID: 860 0650 7188 Password: 556977

AGENDA DETAILS

I. INTRODUCTIONS

Those present shared who they were, where they were from and their favorite thing about their community. Some responses included; smallmcommunity, everyone knows everyone, people step up and help each other, laid back atmosphere, outdoor recreation at Carlyle Lake, trees, and the people.

II. HAZARD MITIGATION OVERVIEW

A Natural Hazard Mitigation Plan (HMP) lets you be eligible for hazard mitigation funds and help build stronger and more prepared communities. We want to act before a disaster strikes to reduce or eliminate the long-term risk to life and property. Strategies include policy changes, education and outreach, and capital projects. Mitigation is important to protect people, property, and natural resources. Hazard risk is the intersection of hazards and community assets. Mitigation can reduce risk.

III. PLANNING SCHEDULE

There will be three more meetings: Risk Assessment (7/27/2023), Hazard Mitigation Strategies (10/19/2023), Plan Review and Maintenance (11/29/2023).

IV. MEETING & PLAN DOCUMENTATION

Meeting agendas, minutes, and materials will be stored on the Bond County Box folder

V. PUBLIC INVOLVEMENT

Webpage hosts all the meeting agendas, notes, slides, paperwork. Community web map lets people add information about flooding, businesses that help out in a disaster, etc.

Please encourage your community to participate. You don't need to be representing a jurisdiction to participate – everyone is welcome. It's important to get all 11 communities to participate in order to be eligible for mitigation dollars and increase the success of the plan. Also important because your time counts as a match for the grant.

Very important to be involved in regional plans. Participation makes you eligible for grants.

VI. PLAN UPDATES

Goals and objectives should be specific to Bond County and its communities. Are these objectives realistic in terms of resources/finances/etc.? Goals and objectives can be added, removed, reworded.

- Goal 1: Lessen the impacts of hazards to new and existing infrastructure
    - From these goals, people are missing! Reword to "*Lessen the impacts of hazards to **people** and new and existing **structures and** infrastructure***"**
    - Can add objectives that are more specific in order to tie them to projects
    - Objective C: add verbiage to include "protect vulnerable populations" to push forward preparedness and education strategies
- Goal 2: Create new or revise existing plans/maps related to hazards affecting Bond County
    - Objective A: NFIP communities are in compliance
    - Objective B: Increased capacity of water treatment facilities, fire hydrants
        - Important to have strategies in planning documents in order to receive funding
    - Objective C: can change to initiative in progress (having doctor's name, medication on magnet on fridge so EMS has more information)
- Goal 3: Develop long-term strategies in educate the public on the hazards affecting Bond County
    - Increase specificity – don't just tell people that they're at risk, tell them how to prepare.

Health department has pandemic, bio-terrorism plan that could be integrated into Bond County's HMP. Cyber-security can be added to the list of hazards. Can involve big companies, hospitals, schools, in mitigation planning process.

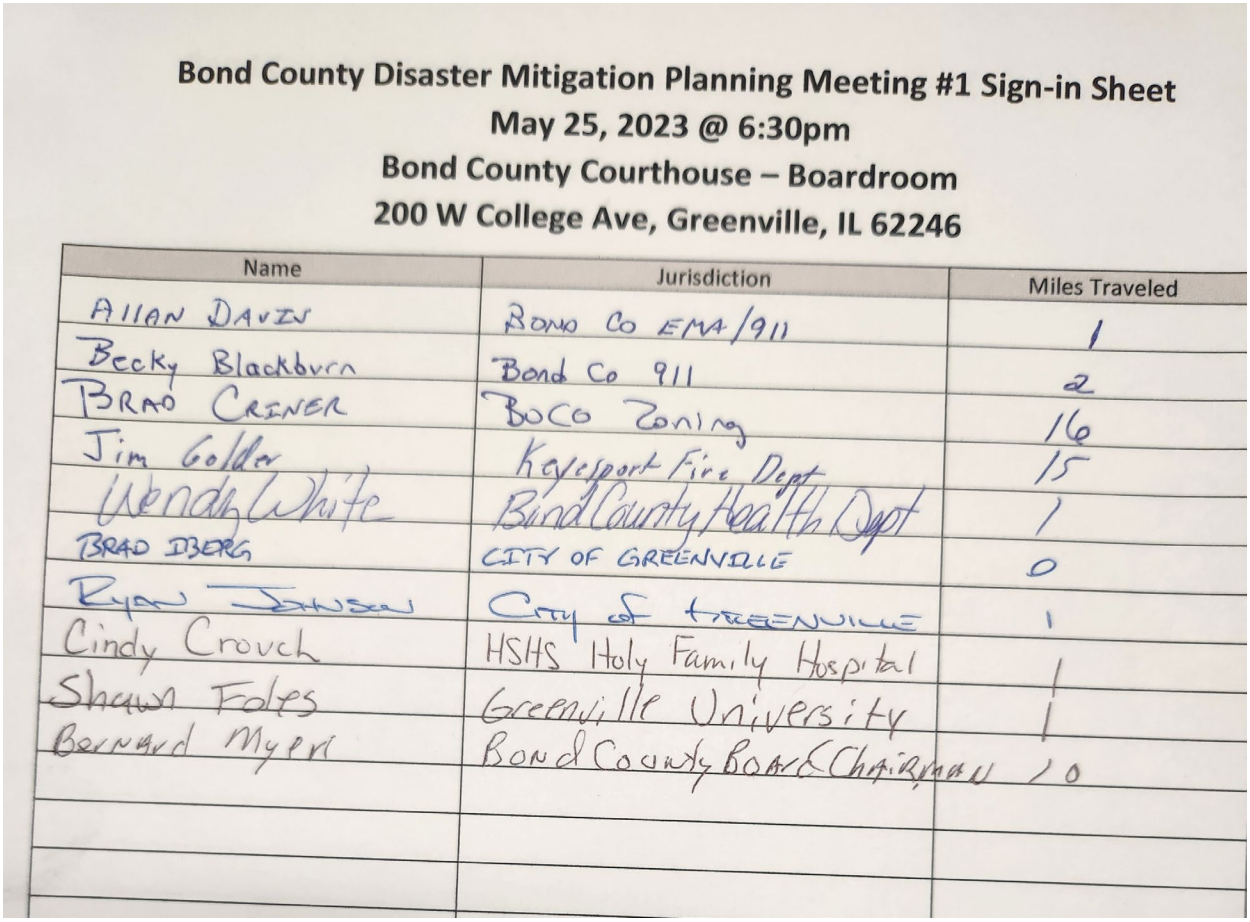
Potential goal/objective: Education based on zones – put more emphasis on educating people who are in closer proximity to a hazard. Good idea to add low/no monetary cost goals such as education so they can be checked off.

Add cyber-security in addition to new, proposed hazards. Including wildfires (wildfires in fields count too) can make communities eligible for funds without a disaster declaration.

VII. ADJOURN

Meeting adjourned at 7:32 PM.

Meeting 1 Sign-In Sheet



Bond County Disaster Mitigation Planning Meeting #1 Sign-in Sheet
May 25, 2023 @ 6:30pm
Bond County Courthouse – Boardroom
200 W College Ave, Greenville, IL 62246

Name	Jurisdiction	Miles Traveled
Allan Davin	Bond Co EMA/911	1
Becky Blackburn	Bond Co 911	2
Brad Criner	BoCo Zoning	16
Jim Golden	Keyesport Fire Dept	15
Wendy White	Bond County Health Dept	1
Brad Iberg	City of Greenville	0
Ryan Johnson	City of Greenville	1
Cindy Crouch	HSHS Holy Family Hospital	1
Shawn Foltes	Greenville University	1
Bernard Myers	Bond County Board Chairman	10

B.2 Meeting 2 Documents

Meeting 2 Agenda

BOND COUNTY HMP UPDATE – MEETING 2 – HAZARD PROFILES AND RISK ASSESSMENT

Meeting Location:	In-Person, Virtual Available
Date & Time:	Thursday July 27, 2023 6:30PM – 7:30PM
Location:	County Courthouse – Boardroom 200 W College Ave, Greenville, IL 62246
Virtual Meeting Link:	https://illinois.zoom.us/j/89895802053?pwd=eDI5UXMxNzBEMTdpejRvakpVbGx4QT09 **Meeting ID:** 898 9580 2053 **Password:** 714831

AGENDA DETAILS

I. WELCOME AND OVERVIEW
II. COMMUNITY WEB MAP AND SURVEY
III. COMMUNITY VULNERABILITIES
IV. HAZARD PROFILES AND MITIGATION IDEAS
V. RISK ASSESSMENT AND ACTIVITY
VI. WRAP UP

Meeting agendas, minutes, and materials will be stored on the Bond County Box folder

VII. ADJOURN

Meeting 2 Notes

BOND COUNTY HMP UPDATE – MEETING 2 – HAZARD PROFILES AND RISK ASSESSMENT

Meeting Location:	In-Person, Virtual Available
Date & Time:	Thursday July 27, 2023 6:30PM – 7:30PM
Location:	County Courthouse – Boardroom 200 W College Ave, Greenville, IL 62246
Virtual Meeting Link:	https://illinois.zoom.us/j/89895802053?pwd=eDI5UXMxNzBEMTdpejRvakpVbGx4QT09 **Meeting ID:** 898 9580 2053 **Password:** 714831

AGENDA DETAILS

I. WELCOME AND OVERVIEW

II. COMMUNITY WEB MAP AND SURVEY

Webpage hosts all the meeting agendas, notes, slides, paperwork. Community web map lets people add information about flooding, businesses that help out in a disaster, etc. The survey allows us to gather input from anyone in the community, it is only 11 questions long. Please encourage your community to participate. You don't need to be representing a jurisdiction to participate – everyone is welcome. It's important to get all 11 communities to participate in order to be eligible for mitigation dollars and increase the success of the plan. It's also important because your time counts as a match for the grant.

Community Webmap: https://www.illinoisfloodmaps.org/hmp/bond.htm

Community Survey: https://go.isws.illinois.edu/BondHMPSurvey

III. COMMUNITY VULNERABILITIES

Carrie McKillip provided a brief discussion on community vulnerabilities using data collected from Headwaters Economics. Vulnerabilities to be aware of include, age, race, ethnicity, persons with disabilities, housing type, poverty, educational attainment language proficiency, labor participation, housing affordability and single parent households.

Complete Information at https://headwaterseconomics.org/equity/the-american-community-survey-in-our-data-tools/

IV. HAZARD PROFILES AND MITIGATION IDEAS

Meirah Williamson and Camden Arnold provided information on hazards that impact Bond County. A brief summary and potential mitigation strategies was discussed for the

following hazards; cybersecurity, hazmat spill, flash flooding, tornadoes, heat wave, lightning and winter weather.

V. RISK ASSESSMENT AND ACTIVITY

Participants completed a brief risk assessment on their perceptions of the hazards included in the hazard mitigation plan update.

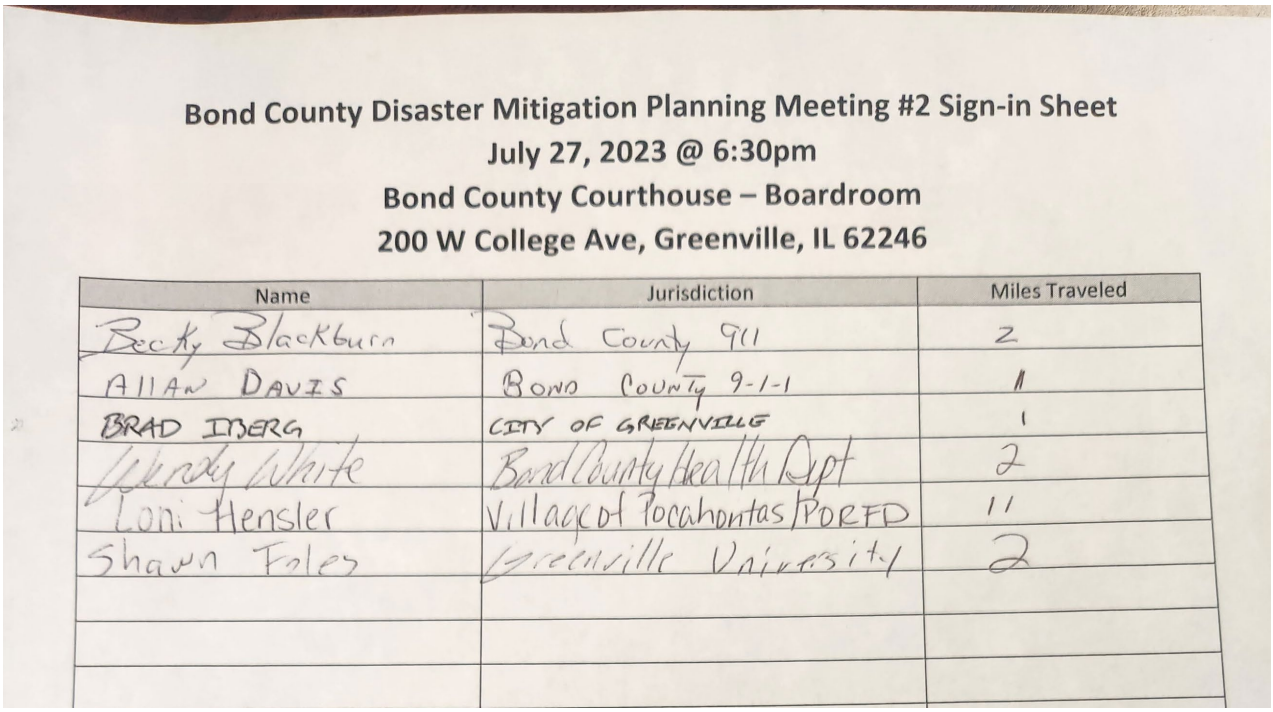
VI. WRAP UP

Meeting agendas, minutes, and materials will be stored on the Bond County Box folder

VII. ADJOURN

Meeting adjourned at 7:29 PM.

Meeting 2 Sign-In Sheet



Bond County Disaster Mitigation Planning Meeting #2 Sign-in Sheet
July 27, 2023 @ 6:30pm
Bond County Courthouse – Boardroom
200 W College Ave, Greenville, IL 62246

Name	Jurisdiction	Miles Traveled
Becky Blackburn	Bond County 911	2
ALLAN DAVIS	BOND COUNTY 9-1-1	1
BRAD ISBERG	CITY OF GREENVILLE	1
Wendy White	Bond County Health Dept	2
Loni Hensler	Village of Pocahontas/PORFD	11
Shawn Foles	Greenville University	2

B.3 Meeting 3 Documents

Meeting 3 Agenda

BOND COUNTY HMP UPDATE – MEETING 3 – HAZARD MITIGATION PROJECTS

Meeting Location:	In-Person, Virtual Available
Date & Time:	Thursday October 19, 2023 6:30PM – 7:30PM
Location:	County Courthouse – Boardroom 200 W College Ave, Greenville, IL 62246
Virtual Meeting Link:	https://illinois.zoom.us/j/83930937910?pwd=cktWRTYzMElFZkQxRlRnY0dWWjMrQT09 **Meeting ID:** 839 3093 7910 **Password:** 405087

AGENDA DETAILS

I. WELCOME AND OVERVIEW
II. COMMUNITY WEB MAP AND SURVEY
III. HAZARDS REVIEW
IV. MITIGATION PROJECTS ACTIVITY
V. WRAP UP

Meeting agendas, minutes, and materials will be stored on the Bond County Box folder

VI. ADJOURN

Meeting 3 Notes

BOND COUNTY HMP UPDATE – MEETING 3 – HAZARD MITIGATION PROJECTS

Meeting Location:	In-Person, Virtual Available
Date & Time:	Thursday October 19, 2023 6:30PM – 7:30PM
Location:	County Courthouse – Boardroom 200 W College Ave, Greenville, IL 62246
Virtual Meeting Link:	https://illinois.zoom.us/j/83930937910?pwd=cktWRTYzMElFZkQxRlRnY0dWWjMrQT09 **Meeting ID:** 839 3093 7910 **Password:** 405087

AGENDA DETAILS

I. WELCOME AND OVERVIEW

II. COMMUNITY WEB MAP AND SURVEY

Webpage hosts all the meeting agendas, notes, slides, paperwork. Community web map lets people add information about flooding, businesses that help out in a disaster, etc. The survey allows us to gather input from anyone in the community, it is only 11 questions long. Please encourage your community to participate. You don't need to be representing a jurisdiction to participate – everyone is welcome. It's important to get all 11 communities to participate in order to be eligible for mitigation dollars and increase the success of the plan. It's also important because your time counts as a match for the grant.

Community Webmap: https://www.illinoisfloodmaps.org/hmp/bond.htm

Community Survey: https://go.isws.illinois.edu/BondHMPSurvey

III. HAZARDS REVIEW

Camden Arnold provided a brief summary on hazards that impact Bond County. It was discussed that mine subsidence is not a big concern in the county. Participants expressed an increased concern for wildfire, and the want for more controlled burning. All firefighters in the county are volunteers. There was discussion on communication concerns in parts of the county and how to call for help when phone lines and cell towers are down. Additional discussion was held about Hazmat Spills and increased exposure to hazardous materials due to rail cars nearby. Participants also discussed an interest in establishing a COAD (Community Organizations Active in Disaster) group that could work the already established MRC at the Bond County Health Department.

IV. MITIGATION PROJECTS ACTIVITY

Carrie McKillip provided a brief summary and potential mitigation strategies were discussed before participating in a hazard mitigation projects activity. The activity involved jurisdictional representatives completing a list of projects they would like to add as goals for the updated Bond Count Hazard Mitigation Plan. Blank project grids can be found on the Bond County HMP Update Webpage. Please send all grids to mitigation@illinois.edu.

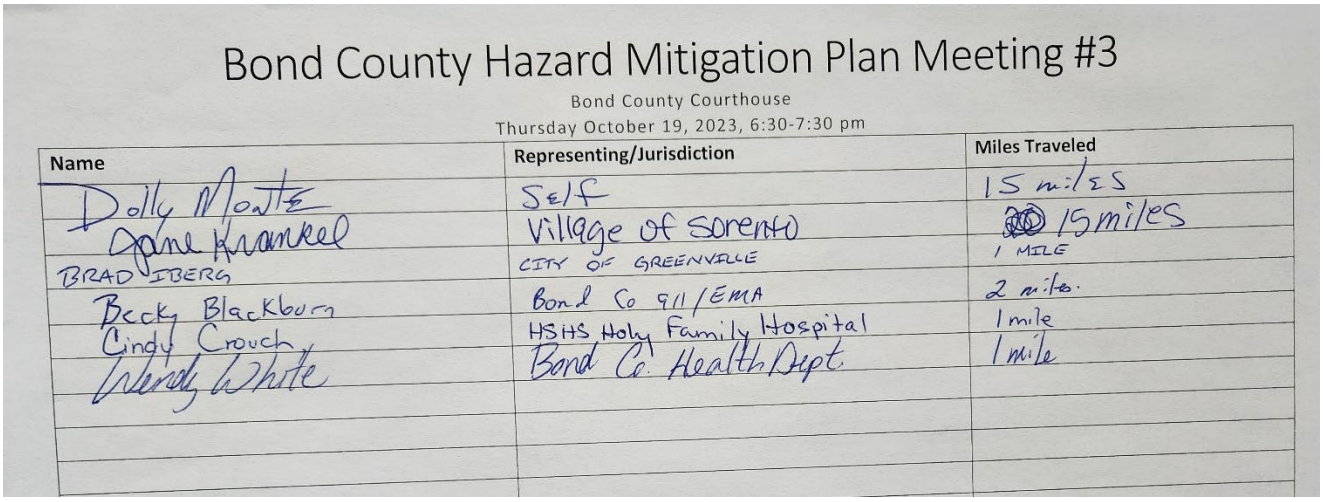
V. WRAP UP

Meeting agendas, minutes, and materials will be stored on the Bond County Box folder

VI. ADJOURN

Meeting was adjourned at 7:47PM.

Meeting 3 Sign-In Sheet



Bond County Hazard Mitigation Plan Meeting #3

Bond County Courthouse

Thursday October 19, 2023, 6:30-7:30 pm

Name	Representing/Jurisdiction	Miles Traveled
Dolly Monte	Self	15 miles
Jane Krankel	Village of Sorento	15miles
BRAD IBERG	CITY OF GREENVILLE	1 MILE
Becky Blackburn	Bond Co 911/EMA	2 miles
Cindy Crouch	HSHS Holy Family Hospital	1 mile
Wendy White	Bond Co. Health Dept	1 mile

B.4 Meeting 4 Documents

Meeting 4 Agenda

BOND COUNTY HMP UPDATE – MEETING 4 – PROJECTS AND PLAN REVIEW

Meeting Location:	In-Person, Virtual Available
Date & Time:	Thursday November 16, 2023, 6:30PM – 7:30PM
Location:	County Courthouse – Boardroom 200 W College Ave, Greenville, IL 62246
Virtual Meeting Link:	https://illinois.zoom.us/j/81329959917?pwd=U0psRVB2bWszRlJqcGxxNm5lZHFnQT09 **Meeting ID:** 813 2995 9917 **Password:** 245633

KEY INFORMATION

1) **Every jurisdiction must provide comments on the hazard mitigation plan**. You can view the plan at https://www.illinoisfloodmaps.org/hazard-mit-plans-bond.aspx and send comments to mitigation@isws.illinois.edu.
2) **Every jurisdiction must complete a capability assessment, risk assessment, and mitigation project grid.** All documents can be found on the plan update webpage (https://www.illinoisfloodmaps.org/hazard-mit-plans-bond.aspx). Please see the table in PENDING DOCUMENTS NEEDING COMPLETION of these notes.
3) **Every jurisdiction must adopt the plan.** This can be done by formal resolution, council minutes, or other adoptions allowed under local law.
4) Every participating jurisdiction will be eligible for federal mitigation funds.

AGENDA DETAILS

I. WELCOME AND OVERVIEW
II. PROJECT RECAP
III. MITIGATION PROJECTS
IV. PLAN REVIEW
V. PLAN MAINTENANCE/UPDATES
VI. PENDING DOCUMENTS NEEDING COMPLETION
VII. NEXT STEPS
VIII. WRAP UP
IX. ADJOURN

Meeting 4 Notes

BOND COUNTY HMP UPDATE – MEETING 4 – PROJECTS AND PLAN REVIEW

Meeting Location:	In-Person, Virtual Available
Date & Time:	Thursday November 16, 2023, 6:30PM – 7:30PM
Location:	County Courthouse – Boardroom 200 W College Ave, Greenville, IL 62246
Virtual Meeting Link:	https://illinois.zoom.us/j/81329959917?pwd=U0psRVB2bWszRlJqcGxxNm5lZHFnQT09 **Meeting ID:** 813 2995 9917 **Password:** 245633

KEY INFORMATION

5) **Every jurisdiction must provide comments on the hazard mitigation plan**. You can view the plan at https://www.illinoisfloodmaps.org/hazard-mit-plans-bond.aspx and send comments to mitigation@isws.illinois.edu.
6) **Every jurisdiction must complete a capability assessment, risk assessment, and mitigation project grid.** All documents can be found on the plan update webpage (https://www.illinoisfloodmaps.org/hazard-mit-plans-bond.aspx). Please see the table in PENDING DOCUMENTS NEEDING COMPLETION of these notes.
7) **Every jurisdiction must adopt the plan.** This can be done by formal resolution, council minutes, or other adoptions allowed under local law.
8) Every participating jurisdiction will be eligible for federal mitigation funds.

AGENDA DETAILS

I. WELCOME AND OVERVIEW

The goal of this meeting is to review the natural hazard mitigation plan draft along with projects created by each community.

II. PROJECT RECAP

Reviewed the four mitigation goals for Bond County and which communities are currently participating. Greenville University submitted their documentation today.

Participants were happy to see that cybersecurity was included in the hazard mitigation plan.

Tornado was rated as the highest concern for the community; dam/levee failure was the lowest.

III. MITIGATION PROJECTS

Example mitigation projects were provided, including education and construction projects. Many HazMat projects were listed.

IV. PLAN REVIEW

The draft plan was presented to those in attendance. It is available online on the Bond County HMP Update Webpage. All are welcome to review and provide comments on the plan.

Comments will be accepted through December 31st. The draft will then be sent to IEMA and FEMA for approval.

V. PLAN MAINTENANCE/UPDATES

Sample text below

Bond County's Hazard Mitigation Plan must be updated every five years (next update will be in 2028/2029). Plan maintenance includes:

- Monitoring: develop a process to track progress and status of mitigation projects
- Evaluating: develop criteria to determine if the plan is effective
- Updating: decide where, when, and who will participate in monitoring, evaluating, and the 2028 update process; check-ins should happen yearly
    - For example, the mayor, county clerk, or EMA could check in on mitigation project status every year
    - Or, jurisdictions can send one representative to a yearly group meeting called by the EMA to discuss mitigation projects and progress

Attendees suggested that 911 Coordinator, Allan Davis, will initiate check ins with each community during their yearly reports. At this time, information about upcoming grant opportunities can also be shared with the communities. Other organizations or committees may also initiate this process.

VI. PENDING DOCUMENTS NEEDING COMPLETION

Jurisdiction	Risk Assessment	Mitigation Projects	Capability Assessment
Bond County	x	x	
Greenville, City of	x	x	
Mulberry Grove, Village of			
Old Ripley, Village of			
Pocahontas, Village of	x		
Pierron, Village of			
Smithboro, Village of			
Sorento, Village of	x	x	x
Greenville University	x	x	-
Bond County Health Department	x	x	-
HSHS Holy Family Hospital	x	x	-

VII. NEXT STEPS

The community survey is available for any community member to fill out and can be found here: https://go.isws.illinois.edu/BondHMPSurvey.

The draft plan can be found on the Bond County HMP Webpage, all are welcome to comment on the plan, each jurisdiction must provide comments or acknowledge they have read the plan: https://uofi.box.com/s/t4ejj8g13dgwcnihjalsbul3avtu9781.

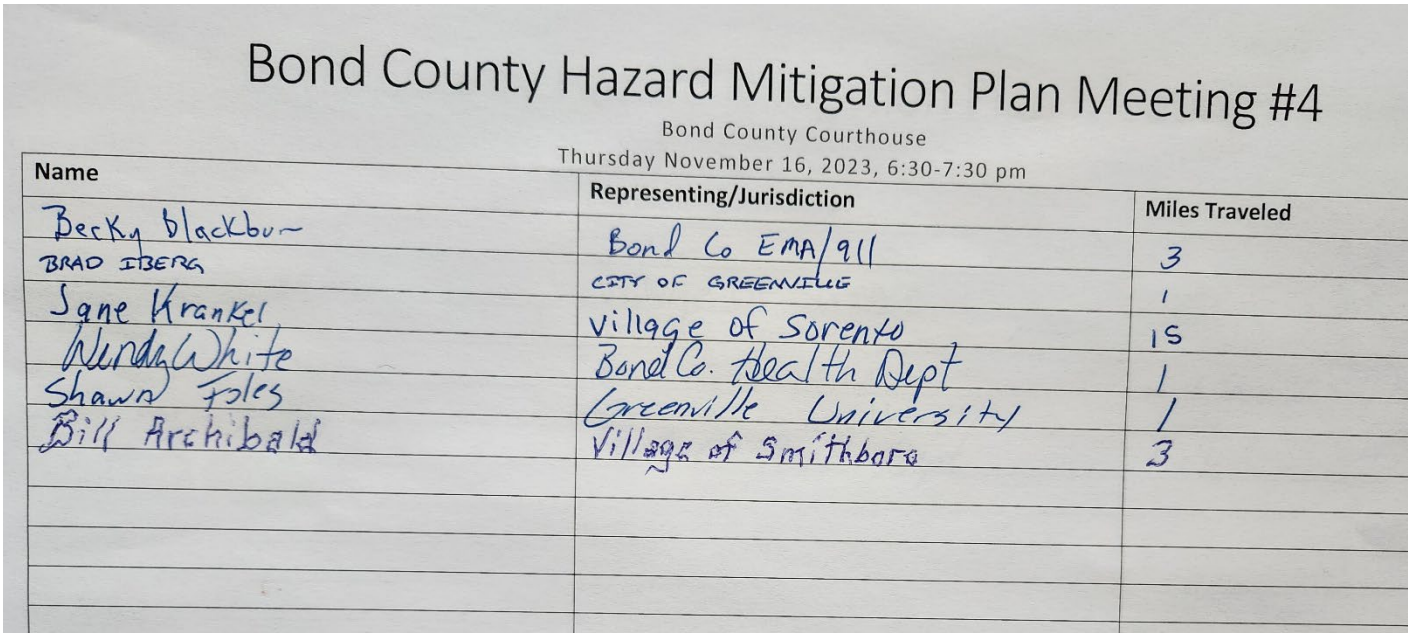
VIII. WRAP UP

Meeting agendas, minutes, and materials will be stored on the Bond County Box folder

IX. ADJOURN

Meeting was adjourned at 7:47PM.

Meeting 4 Sign-In Sheet



Bond County Hazard Mitigation Plan Meeting #4

Bond County Courthouse

Thursday November 16, 2023, 6:30-7:30 pm

Name	Representing/Jurisdiction	Miles Traveled
Becky Blackburn	Bond Co EMA/911	3
BRAD IBERG	CITY OF GREENVILLE	1
Jane Krankel	Village of Sorento	15
Wendy White	Bond Co. Health Dept	1
Shawn Foles	Greenville University	1
Bill Archibald	Village of Smithboro	3

APPENDIX C: CAPABILITY ASSESSMENT

Bond County Capability Assessment

Capability Assessment

Submitted By: Anonymous user
Submitted Time: November 27, 2023 11:54 AM

Name
Becky Blackburn
Email
becky.blackburn@bondcountyil.gov
Jurisdiction
Bond County 911

Planning and Regulatory Capability
Comprehensive Plan
Yes
Economic Development Plan
Unsure/Do not know
Emergency Operations Plan
Yes
Floodplain Management Plan
Unsure/Do not know
Stormwater Management Plan
Unsure/Do not know
Building Code Ordinance
No
Subdivision Ordinance
No
Zoning Ordinance
No
Floodplain Ordinance
Unsure/Do not know
National Flood Insurance Program (NFIP)
Unsure/Do not know

Fiscal Capability
Capital Improvements Plan
Yes
Applied for grants in the past
Yes
Awarded grants in the past
Yes
Authority to levy taxes for specific purposes (e.g., mitigation projects)
No
Gas/Electric Service Fees

No

Stormwater Service Fees

No

Water/Sewer Service Fees

No

Special Tax Bonds

Yes

Administrative Capability

Code Enforcement Department/ Chief Building Inspector

Unsure/Do not know

Engineering Department/ Civil Engineer

Unsure/Do not know

Planning Commission

Unsure/Do not know

Floodplain Administration/Administrator

Unsure/Do not know

GIS Capabilities

Yes

Grant Manager

Yes

Mutual Aid Agreements

Yes

Education and Outreach Capability

Local citizen groups/non-profits focused on disaster preparedness and response (e.g., Citizen Emergency Response Team (CERT), Red Cross)

Yes

Ongoing public education/information program (e.g., household preparedness)

Yes

Ongoing disaster or safety related school programs

Yes

Community Capability

Does your community have the financial resources to implement mitigation projects?

Limited

Does your community have the staff and expertise to implement mitigation projects?

Limited

Capability Assessment

Submitted By: Anonymous user
Submitted Time: November 22, 2023 7:56 AM

Name
Brad Iberg
Email
biberg@greenvilleillinois.com
Jurisdiction
City of Greenville

Planning and Regulatory Capability
Comprehensive Plan
Yes
Economic Development Plan
No
Emergency Operations Plan
No
Floodplain Management Plan
No
Stormwater Management Plan
No
Building Code Ordinance
Yes
Subdivision Ordinance
Yes
Zoning Ordinance
Yes
Floodplain Ordinance
Yes
National Flood Insurance Program (NFIP)
Yes

Fiscal Capability
Capital Improvements Plan
No
Applied for grants in the past
Yes
Awarded grants in the past
Yes
Authority to levy taxes for specific purposes (e.g., mitigation projects)
No
Gas/Electric Service Fees
No
Stormwater Service Fees
No
Water/Sewer Service Fees
Yes
Special Tax Bonds
Unsure/Do not know

Administrative Capability

Code Enforcement Department/ Chief Building Inspector

Yes

Engineering Department/ Civil Engineer

No

Planning Commission

Yes

Floodplain Administration/Administrator

Yes

GIS Capabilities

Yes

Grant Manager

Yes

Mutual Aid Agreements

No

Education and Outreach Capability

Local citizen groups/non-profits focused on disaster preparedness and response (e.g., Citizen Emergency Response Team (CERT), Red Cross)

Yes

Ongoing public education/information program (e.g., household preparedness)

Yes

Ongoing disaster or safety related school programs

Yes

Community Capability

Does your community have the financial resources to implement mitigation projects?

No

Does your community have the staff and expertise to implement mitigation projects?

No

Village of Pierron Capability Assessment

CAPABILITY ASSESSMENT CHECKLIST

Does the plan document each jurisdiction's existing authorities, policies, programs and resources, and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))

Name: JAMES HESS Jurisdiction Represented: Village of Pierron

Title and employer: Treasurer Village of Pierron

Date: 12/18/23 Contact email: villageofpierron@wispertome.com Time Spent: 30 minutes

Please return your filled worksheet to mitigation@isws.illinois.edu

Survey Components/ Subcomponents		Yes/ No
Planning and regulatory Capability	Comprehensive Plan	yes
	Capital Improvements Plan	yes
	Economic Development Plan	NO
	Emergency Operational Plan	NO
	Floodplain Management Plan	Yes
	Storm Water Management Plan	yes
	Zoning Ordinance	yes
	Subdivision Regulation/Ordinance	yes
	Floodplain Ordinance	NO
	Building Codes	yes
	National Flood Insurance Program	NO
	Community Rating System	NO
	Other (if any)	
Administrative & Technical Capability	Planning Commission	NO
	Floodplain Administration	NO
	GIS Capabilities	NO
	Chief Building Official	NO
	Civil Engineering	NO

	Local Staff Who Can Assess Community's Vulnerability to Hazards	NO
	Grant Manager	NO
	Mutual Aid Agreement Other (if any) BOND COUNTY 911	yes
	Other (if any)	
Fiscal Capability	Capital Improvement Plan/ 1- & 5-Year plan	NO
	Applied for grants in the past	yes
	Awarded a grant in the past	yes
	Authority to Levy Taxes for Specific Purposes such as Mitigation Projects	NO
	Gas/Electric Service Fees	NO
	Storm Water Service Fees	NO
	Water/Sewer Service Fees	yes
	Development Impact Fees	NO
	General Obligation Revenue or Special Tax Bonds	NO
	Other (if any)	
Education and Outreach Capability	Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc. Ex. CERT Teams, Red Cross, etc.	NO
	Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	NO
	Natural Disaster or Safety related school programs	NO
	Storm Ready Certification	NO
	Fire wise Communities Certification	NO
	Tree City USA	NO
	Other (if any)	

Overall Capability	Limited/Moderate/High
Does the community have the financial resources needed to implement mitigation projects?	yes
Does the community have the staff/expertise to implement projects?	yes
Is there community support to implement projects?	yes
Does the community staff have time to devote to hazard mitigation?	yes

In case of any queries, please email us at mitigation@isws.illinois.edu

Capability Assessment

Submitted By: Anonymous user
Submitted Time: January 2, 2024 9:36 AM

Name
Loni Hensler
Email
pokeyvillage@gmail.com
Jurisdiction
Pocahontas

Planning and Regulatory Capability
Comprehensive Plan
Yes
Economic Development Plan
Yes
Emergency Operations Plan
Unsure/Do not know
Floodplain Management Plan
Unsure/Do not know
Stormwater Management Plan
Unsure/Do not know
Building Code Ordinance
Yes
Subdivision Ordinance
Yes
Zoning Ordinance
Yes
Floodplain Ordinance
Unsure/Do not know
National Flood Insurance Program (NFIP)
Unsure/Do not know

Fiscal Capability
Capital Improvements Plan
Unsure/Do not know
Applied for grants in the past
Yes
Awarded grants in the past
Yes
Authority to levy taxes for specific purposes (e.g., mitigation projects)
Yes
Gas/Electric Service Fees
Yes
Stormwater Service Fees
Unsure/Do not know
Water/Sewer Service Fees
Yes
Special Tax Bonds
Unsure/Do not know

Administrative Capability

Code Enforcement Department/ Chief Building Inspector

Yes

Engineering Department/ Civil Engineer

No

Planning Commission

No

Floodplain Administration/Administrator

No

GIS Capabilities

Unsure/Do not know

Grant Manager

No

Mutual Aid Agreements

Unsure/Do not know

Education and Outreach Capability

Local citizen groups/non-profits focused on disaster preparedness and response (e.g., Citizen Emergency Response Team (CERT), Red Cross)

No

Ongoing public education/information program (e.g., household preparedness)

No

Ongoing disaster or safety related school programs

No

Community Capability

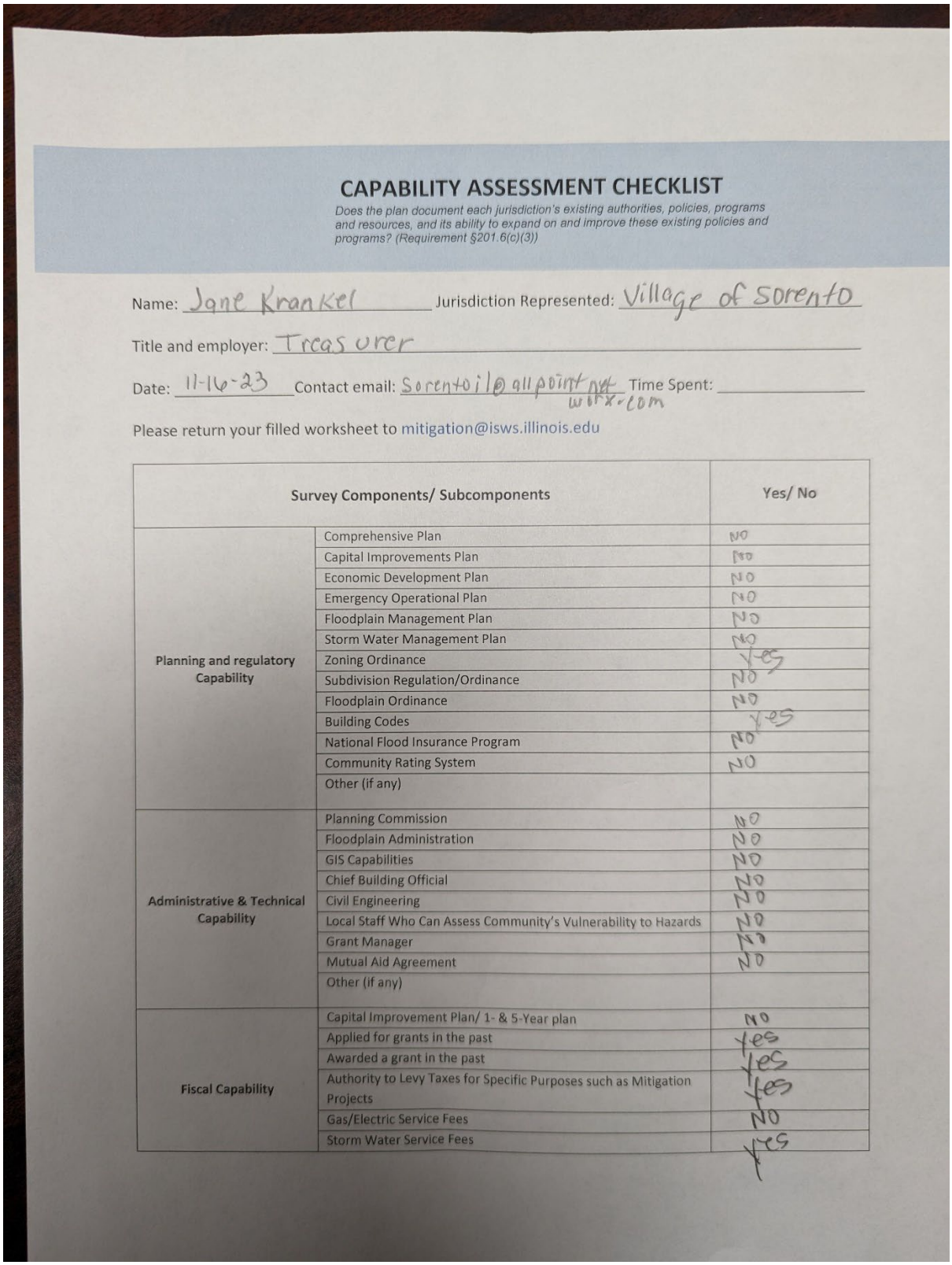
Does your community have the financial resources to implement mitigation projects?

Limited

Does your community have the staff and expertise to implement mitigation projects?

Limited

Village of Sorento Capability Assessment



CAPABILITY ASSESSMENT CHECKLIST

Does the plan document each jurisdiction's existing authorities, policies, programs and resources, and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))

Name: Jane Krankel Jurisdiction Represented: Village of Sorento

Title and employer: Treasurer

Date: 11-16-23 Contact email: Sorentoil@allpointnetwork.com Time Spent: _____

Please return your filled worksheet to mitigation@isws.illinois.edu

Survey Components/ Subcomponents		Yes/ No
Planning and regulatory Capability	Comprehensive Plan	NO
	Capital Improvements Plan	NO
	Economic Development Plan	NO
	Emergency Operational Plan	NO
	Floodplain Management Plan	NO
	Storm Water Management Plan	NO
	Zoning Ordinance	Yes
	Subdivision Regulation/Ordinance	NO
	Floodplain Ordinance	NO
	Building Codes	Yes
	National Flood Insurance Program	NO
	Community Rating System	NO
	Other (if any)	
Administrative & Technical Capability	Planning Commission	NO
	Floodplain Administration	NO
	GIS Capabilities	NO
	Chief Building Official	NO
	Civil Engineering	NO
	Local Staff Who Can Assess Community's Vulnerability to Hazards	NO
	Grant Manager	NO
	Mutual Aid Agreement	NO
	Other (if any)	
Fiscal Capability	Capital Improvement Plan/ 1- & 5-Year plan	NO
	Applied for grants in the past	Yes
	Awarded a grant in the past	Yes
	Authority to Levy Taxes for Specific Purposes such as Mitigation Projects	Yes
	Gas/Electric Service Fees	NO
	Storm Water Service Fees	Yes

	Water/Sewer Service Fees	YES
	Development Impact Fees	NO
	General Obligation Revenue or Special Tax Bonds	NO
	Other (if any)	
Education and Outreach Capability	Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc. Ex. CERT Teams, Red Cross, etc.	NO
	Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	NO
	Natural Disaster or Safety related school programs	NO
	Storm Ready Certification	NO
	Fire wise Communities Certification	NO
	Tree City USA	NO
	Other (if any)	
Overall Capability		**Limited/Moderate/High**
Does the community have the financial resources needed to implement mitigation projects?		Limited
Does the community have the staff/expertise to implement projects?		Limited
Is there community support to implement projects?		Moderate
Does the community staff have time to devote to hazard mitigation?		moderate

In case of any queries, please email us at mitigation@isws.illinois.edu

Capability Assessment

Submitted By: Anonymous user
Submitted Time: November 16, 2023 3:29 PM

Name
Shawn M. Foles
Email
shawn.foles@greenville.edu
Jurisdiction
Greenville University-Bond County

Planning and Regulatory Capability

Comprehensive Plan
Yes
Economic Development Plan
No
Emergency Operations Plan
Yes
Floodplain Management Plan
No
Stormwater Management Plan
No
Building Code Ordinance
Yes
Subdivision Ordinance
No
Zoning Ordinance
No
Floodplain Ordinance
No
National Flood Insurance Program (NFIP)
No

Fiscal Capability

Capital Improvements Plan
Unsure/Do not know
Applied for grants in the past
Yes
Awarded grants in the past
Yes
Authority to levy taxes for specific purposes (e.g., mitigation projects)
No
Gas/Electric Service Fees
No
Stormwater Service Fees
No
Water/Sewer Service Fees
No
Special Tax Bonds
No

Administrative Capability

Code Enforcement Department/ Chief Building Inspector

No

Engineering Department/ Civil Engineer

No

Planning Commission

No

Floodplain Administration/Administrator

No

GIS Capabilities

No

Grant Manager

Yes

Mutual Aid Agreements

Yes

Education and Outreach Capability

Local citizen groups/non-profits focused on disaster preparedness and response (e.g., Citizen Emergency Response Team (CERT), Red Cross)

Yes

Ongoing public education/information program (e.g., household preparedness)

Yes

Ongoing disaster or safety related school programs

Yes

Community Capability

Does your community have the financial resources to implement mitigation projects?

Yes

Does your community have the staff and expertise to implement mitigation projects?

Limited

Other Resources or Capabilities

Partnership with restaurant in the smart center. On Campus dining facility. Variety of meeting space, shelters

APPENDIX D: PUBLIC SURVEY RESULTS

Bond County Hazard Mitigation Plan

Submitted by: Anonymous user

1. Where in Bond County do you live?
   City of Greenville

2. How long have you lived in Bond County?
   More than 20 years

3. Do you own or rent your home?
   Own

4. How concerned are you about the following hazards impacting your community?

   Cybersecurity
   Very concerned

   Drought
   A little concerned

   Earthquake
   A little concerned

   Extreme Cold
   A little concerned

   Extreme Heat/Heat Wave
   A little concerned

   Flood - Dam/Levee Failure
   Not concerned

   Flood - Flash Flood
   Very concerned

   Flood - Riverine Flood
   Very concerned

   HazMat Spill
   Extremely concerned

   Mine Subsidence
   Not concerned

   Pandemic
   Very concerned

   Severe Storms (including Hail, Lightning, Wind)
   A little concerned

   Severe Winter Storms - Ice Storm
   A little concerned

   Severe Winter Storms - Blizzard/Heavy Snow
   A little concerned

   Tornado
   Very concerned

   Wildfire
   Not concerned

   Other
   Not concerned

5. Which of the following hazards have you been affected by?
HazMat Spill

6. Do you feel prepared for a natural hazard event?
Depends on the hazard

If other or 'Depends on the hazard', please explain:
Have enought food stored at house to last a month if needed

7. Do you have flood insurance through the National Flood Insurance Program (NFIP)?
No

8. Are you interested in obtaining more information about the NFIP?

No

9. What are the most effective ways for you to receive information about how to make your household safer fromdisaster?

Social media

10. What do you think the most important thing you community should do to reduce future damages from naturalhazards?

Make plans on how to handle situations ahead of time

APPENDIX E: PUBLIC NOTIFICATIONS

Meeting 1 Public Notification

For Immediate Press Release

First Public Meeting to Discuss Bond County Local Hazard Mitigation Plan Set for May 25, 2023

Bond County will be having their first public meeting May 25, 2023 from 6:30-7:30 pm at the Bond County Courthouse (200 W College Ave, Greenville, IL 62246). The purpose of this meeting is to discuss the risks to natural hazards the communities in Bond County face. While natural hazards cannot be entirely prevented, Hazard Mitigation Plans form the foundation for a community's long-term strategy to reduce disaster-related losses. One representative from each jurisdiction is invited to serve on the committee. The Planning Committee invites the public to learn more about the 2023 Local Hazard Mitigation Plan Update.

An important part of the planning process is public input. The public is invited to actively participate in the development of the 2023 Update. To start the process, please join us on May 25th to learn more about how you can be involved in the planning process. If you'd like to attend virtually, send an email to mitigation@isws.illinois.edu requesting the Zoom Link information.

All of the participating jurisdictions will work with Bond County 911, University of Illinois Extension, and the Illinois State Water Survey, in order to develop a plan to offer practical approaches and examples for how the communities can engage in effective planning to reduce long-term risk from natural hazards and disasters.

Under the Disaster Mitigation Act of 2000, the Federal Emergency Management Agency (FEMA) requires communities to develop a mitigation plan to minimize or eliminate the long-term risk to human life and property from known hazards. Mitigation is defined by FEMA as sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects. Hazards that may pose risk and potentially result in disaster include but not limited to flood, drought, severe storms, tornado, and earthquake. Communities with a FEMA-approved plan are eligible for certain grant funding under the Hazard Mitigation Assistance (HMA) program to fund critical projects such as buyouts and structural elevation of repetitive flood loss structures, drainage projects, and hardening critical facilities, to minimize future damage from disasters that affect Bond County, as well as additional funds available post-disaster.

Future planning meetings will be tentatively held on July 27, 2023, October 19, 2023, and November 29, 2023.

Meeting 2 Public Notification

For Immediate Press Release

Second Public Meeting to Discuss Bond County Local Hazard Mitigation Plan

Set for July 27, 2023

Bond County will be having their second public meeting on July 27, 2023 from 6:30-7:30 pm at the Bond County Courthouse (200 W College Ave, Greenville, IL 62246). The purpose of this meeting is to discuss the different hazards that may impact communities in Bond County, the risks the communities in Bond County face, and introduce potential mitigation projects. While natural hazards cannot be entirely prevented, Hazard Mitigation Plans form the foundation for a community's long-term strategy to reduce disaster-related losses. One representative from each jurisdiction is invited to serve on the committee.

An important part of the planning process is public input. The public is invited to actively participate in the development of the 2023 Update. Please join us on July 27th to learn more about how you can be involved in the planning process. If you'd like to attend virtually, send an email to mitigation@isws.illinois.edu requesting the Zoom Link information.

All of the participating jurisdictions will work with Bond County 911, University of Illinois Extension, and the Illinois State Water Survey, in order to develop a plan to offer practical approaches and examples for how the communities can engage in effective planning to reduce long-term risk from natural hazards and disasters.

Information about the plan and previous meetings can be found at https://www.illinoisfloodmaps.org/bondHMP.aspx

Under the Disaster Mitigation Act of 2000, the Federal Emergency Management Agency (FEMA) requires communities to develop a mitigation plan to minimize or eliminate the long-term risk to human life and property from known hazards. Mitigation is defined by FEMA as sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects. Hazards that may pose risk and potentially result in disaster include but not limited to flood, drought, severe storms, tornado, and earthquake. Communities with a FEMA-approved plan are eligible for certain grant funding under the Hazard Mitigation Assistance (HMA) program to fund critical projects such as buyouts and structural elevation of repetitive flood loss structures, drainage projects, and hardening critical facilities, to minimize future damage from disasters that affect Bond County, as well as additional funds available post-disaster.

Future planning meetings will be tentatively held on October 19, 2023, and November 29, 2023.

Meeting 3 Public Notification

For Immediate Press Release

Third Public Meeting to Discuss Bond County Local Hazard Mitigation Plan Set for October 19, 2023

Bond County will be having their third public meeting on October 19, 2023 from 6:30-7:30 pm at the Bond County Courthouse (200 W College Ave, Greenville, IL 62246). The purpose of this meeting is to discuss the different hazards that may impact communities in Bond County, create and discuss potential mitigation projects. While natural hazards cannot be entirely prevented, Hazard Mitigation Plans form the foundation for a community's long-term strategy to reduce disaster-related losses. One representative from each jurisdiction is invited to serve on the committee.

An important part of the planning process is public input. The public is invited to actively participate in the development of the 2023 Update. Please join us on October 19th to learn more about how you can be involved in the planning process. If you'd like to attend virtually, send an email to mitigation@isws.illinois.edu requesting the Zoom Link information, or visit the Bond County HMP Update Website: https://www.illinoisfloodmaps.org/bondHMP.aspx. Information about the plan and previous meetings can also be found on the webpage.

All of the participating jurisdictions will work with Bond County 911, University of Illinois Extension, and the Illinois State Water Survey, in order to develop a plan to offer practical approaches and examples for how the communities can engage in effective planning to reduce long-term risk from natural hazards and disasters.

Under the Disaster Mitigation Act of 2000, the Federal Emergency Management Agency (FEMA) requires communities to develop a mitigation plan to minimize or eliminate the long-term risk to human life and property from known hazards. Mitigation is defined by FEMA as sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects. Hazards that may pose risk and potentially result in disaster include but not limited to flood, drought, severe storms, tornado, and earthquake. Communities with a FEMA-approved plan are eligible for certain grant funding under the Hazard Mitigation Assistance (HMA) program to fund critical projects such as buyouts and structural elevation of repetitive flood loss structures, drainage projects, and hardening critical facilities, to minimize future damage from disasters that affect Bond County, as well as additional funds available post-disaster.

Future planning meetings will be tentatively held on November 30, 2023.

Meeting 4 Public Notification

Immediate Press Release

Final Public Meeting To Discuss Bond County Local Hazard Mitigation Plan Set For November 16

Bond County will be having their fourth and final public meeting on November 16, 2023 from 6:30-7:30 pm at the Bond County Courthouse (200 W College Ave, Greenville, IL 62246). The purpose of this meeting is to review the draft of the plan and provide opportunities for public input. The draft plan will be made available online following the meeting. Open comment period will run for a minimum of 30 days. While natural hazards cannot be entirely prevented, Hazard Mitigation Plans form the foundation for a community's long-term strategy to reduce disaster-related losses. One representative from each jurisdiction is invited to serve on the committee.

An important part of the planning process is public input. The public is invited to actively participate in the development of the 2023 Update. Please join us on November 16th to provide input on the draft plan. If you'd like to attend virtually, send an email to mitigation@isws.illinois.edu requesting the Zoom Link information, or visit the Bond County HMP Update Website: https://www.illinoisfloodmaps.org/hazard-mit-plans-bond.aspx. Information about the plan and previous meetings can also be found on the webpage.

All of the participating jurisdictions have been working with Bond County 911, University of Illinois Extension, and the Illinois State Water Survey, in order to develop a plan to offer practical approaches and examples for how the communities can engage in effective planning to reduce long-term risk from natural hazards and disasters.

Under the Disaster Mitigation Act of 2000, the Federal Emergency Management Agency (FEMA) requires communities to develop a mitigation plan to minimize or eliminate the long-term risk to human life and property from known hazards. Mitigation is defined by FEMA as sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects. Hazards that may pose risk and potentially result in disaster include but are not limited to flood, drought, severe storms, tornado, and earthquake. Communities with a FEMA-approved plan are eligible for certain grant funding under the Hazard Mitigation Assistance (HMA) program to fund critical projects such as buyouts and structural elevation of repetitive flood loss structures, drainage projects, and hardening critical facilities, to minimize future damage from disasters that affect Bond County, as well as additional funds available post-disaster. Planning meetings were held May 25, 2023, July 27, 2023, and October 19, 2023 in order to assist the Local Planning Team in identifying and analyzing potential hazards affecting residents. Possible actions were recommended to reduce hazard impact throughout Bond County and its communities. Once public comments are obtained, the plan will be submitted to FEMA for approval. It normally takes from 3-6 months for FEMA review. Upon FEMA approval, the plan will come back to each jurisdiction for final adoption to become the official Bond County Hazard Mitigation Plan. The plan is required by FEMA to be reviewed and updated every five years.

APPENDIX F: ESSENTIAL FACILITIES

Emergency Operations Center

Name of Facility	Location
Bond County Civil Defense Control Center	Greenville

Police Stations

Name of Facility	Location
Pocahontas Police Department	Pocahontas
Bond County Sheriff	Greenville
Mulberry Grove Police Department	Mulberry Grove
Pierron Police Department	Pierron
Greenville Police Department	Greenville

Fire Facilities

Name of Facility	Location
Greenville Fire Protection District	Greenville
Smithboro Fire Protection District	Smithboro
Keyesport Fire Protection District	Keyesport
Mulberry Grove Fire Protection District	Mulberry Grove
Shoal Creek Fire Protection District	Sorento
Pocahontas - Old Ripley Fire Protection District	Old Ripley
Pocahontas - Old Ripley Fire Protection District	Pocahontas
Highland-Pierron Fire Protection District	Pierron

Medical Facilities

Name of Facility	Location
HSHS Holy Family Hospital	Greenville

School Facilities

Name of Facility	Location
Greenville Jr High School	Greenville
Greenville Elementary School	Greenville
Bond County Community Unit 2 High School	Greenville
Mulberry Grove Elementary School	Mulberry Grove
Mulberry Grove Jr High School	Mulberry Grove
Mulberry Grove Sr High School	Mulberry Grove
Pocahontas Center	Pocahontas
Bond County CUSD 2 Early Childhood Center	Greenville
Greenville University	Greenville
Greenville Free Methodist Church	Greenville
Greenville University Early Childhood Center	Greenville

Waste Water Facilities

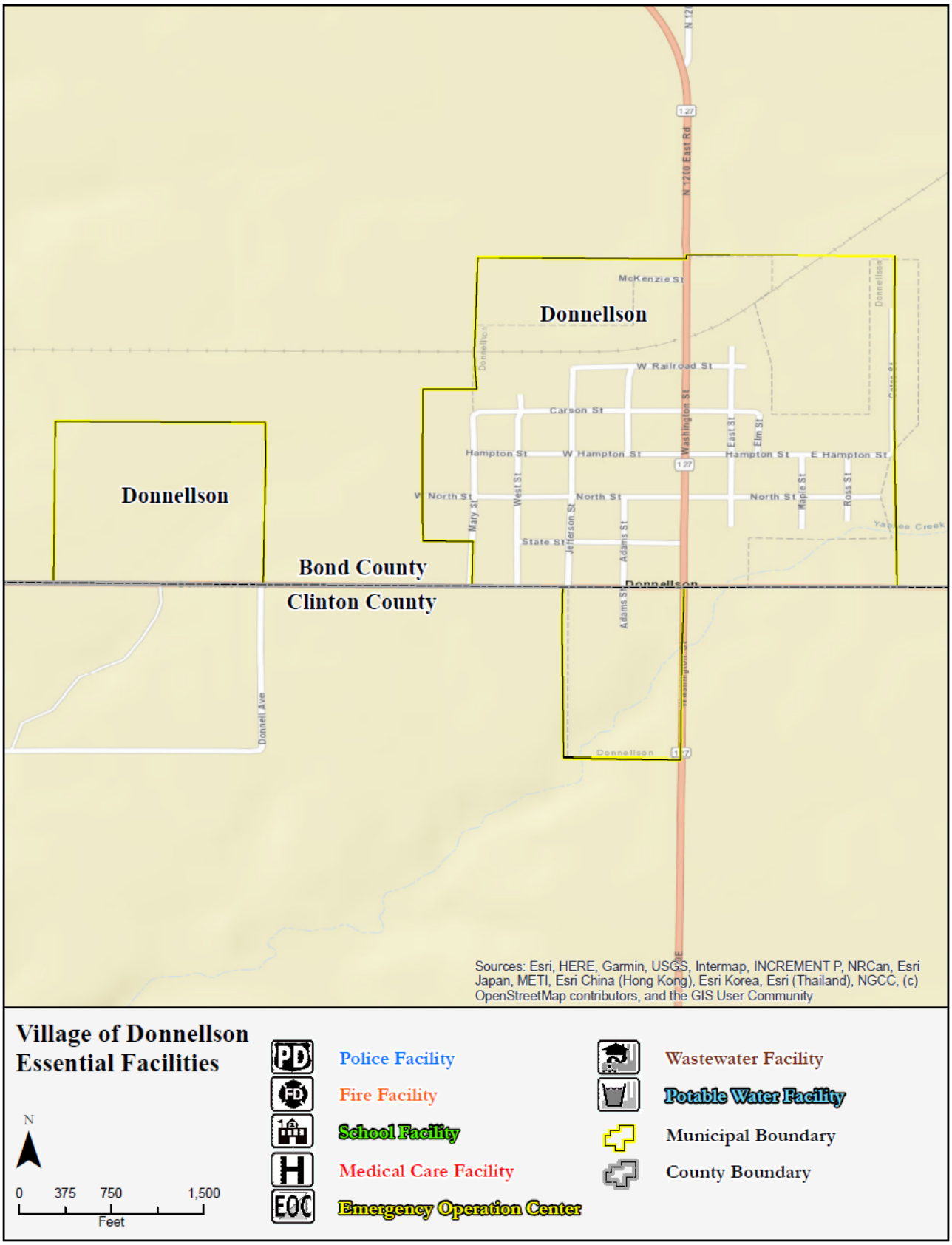
Name of Facility	Location
Sorento STP, Village of	Sorento
Mulberry Grove SD, Village of	Mulberry Grove
Pierron West STP, Village of	Pierron
Pierron East STP, City of	Pierron
Keyesport STP, Village of	Keyesport
Greenville STP, City of	Greenville
Pocahontas STP, Village of	Pocahontas

Potable Water Facilities

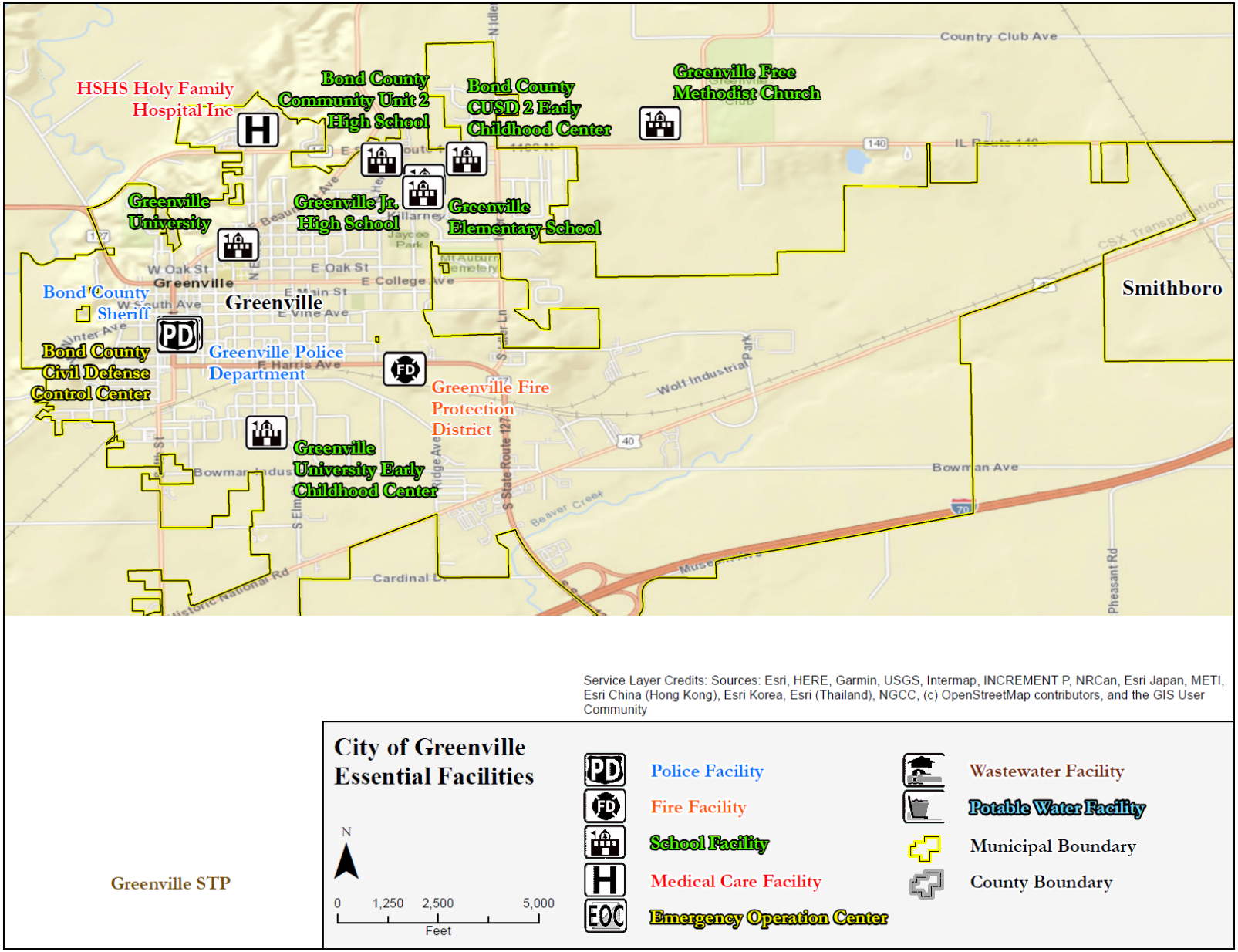
Name of Facility	Location
Sorento WTP, Village of	Sorento

Bond County Essential Facilities Map

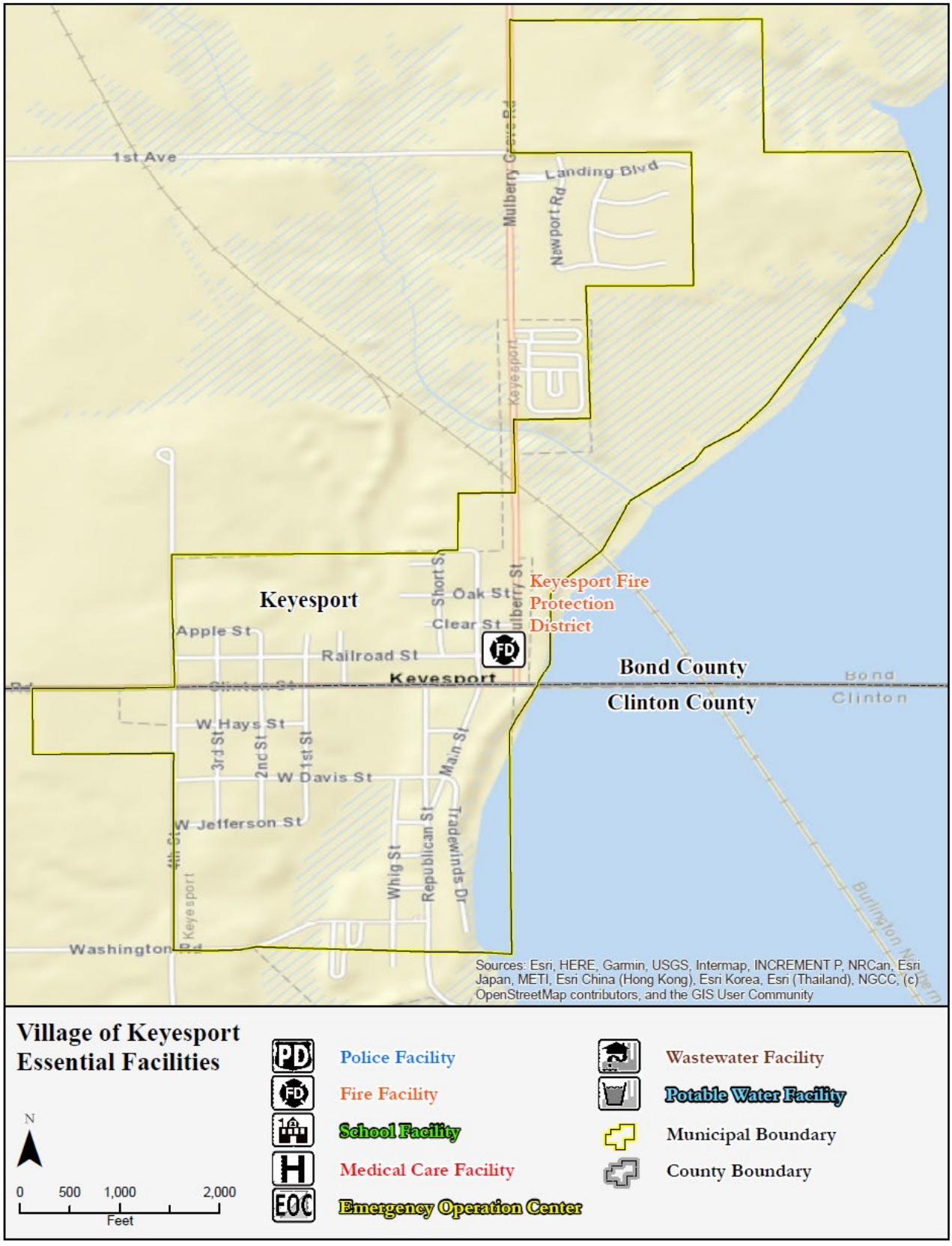
Village of Donnellson Essential Facilities Map



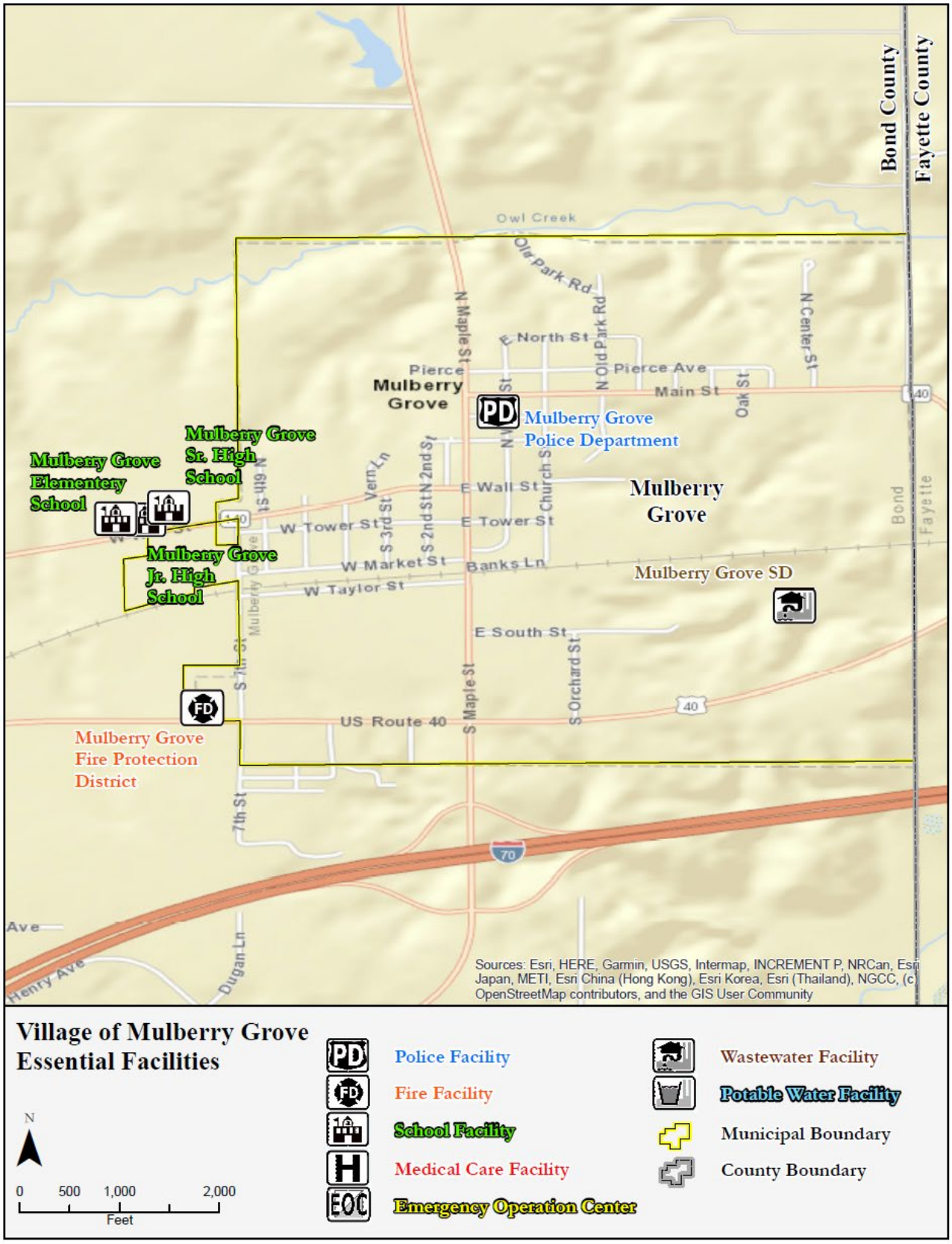
City of Greenville Essential Facilities Map



Village of Keyesport Essential Facilities Map

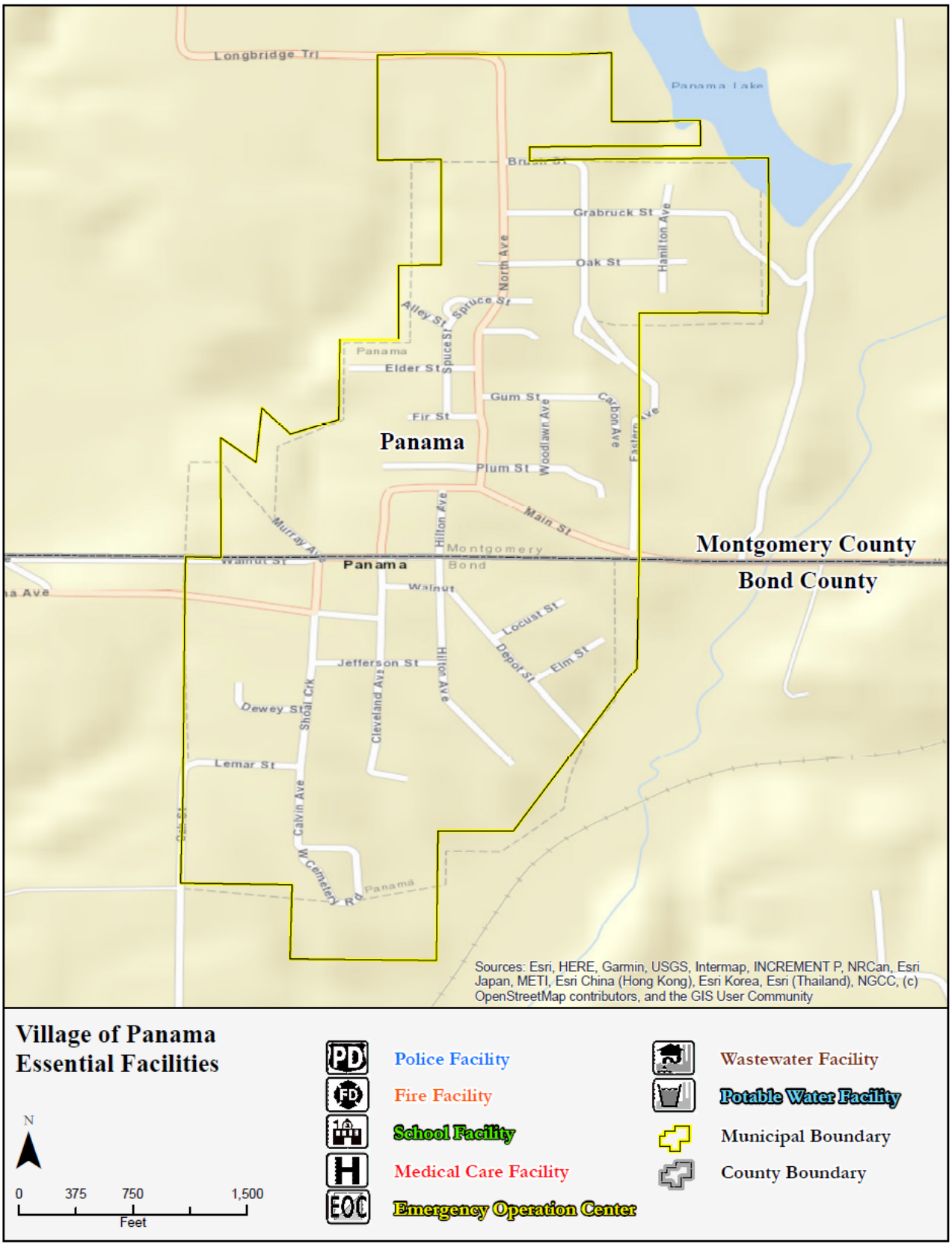


Village of Mulberry Grove Essential Facilities Map

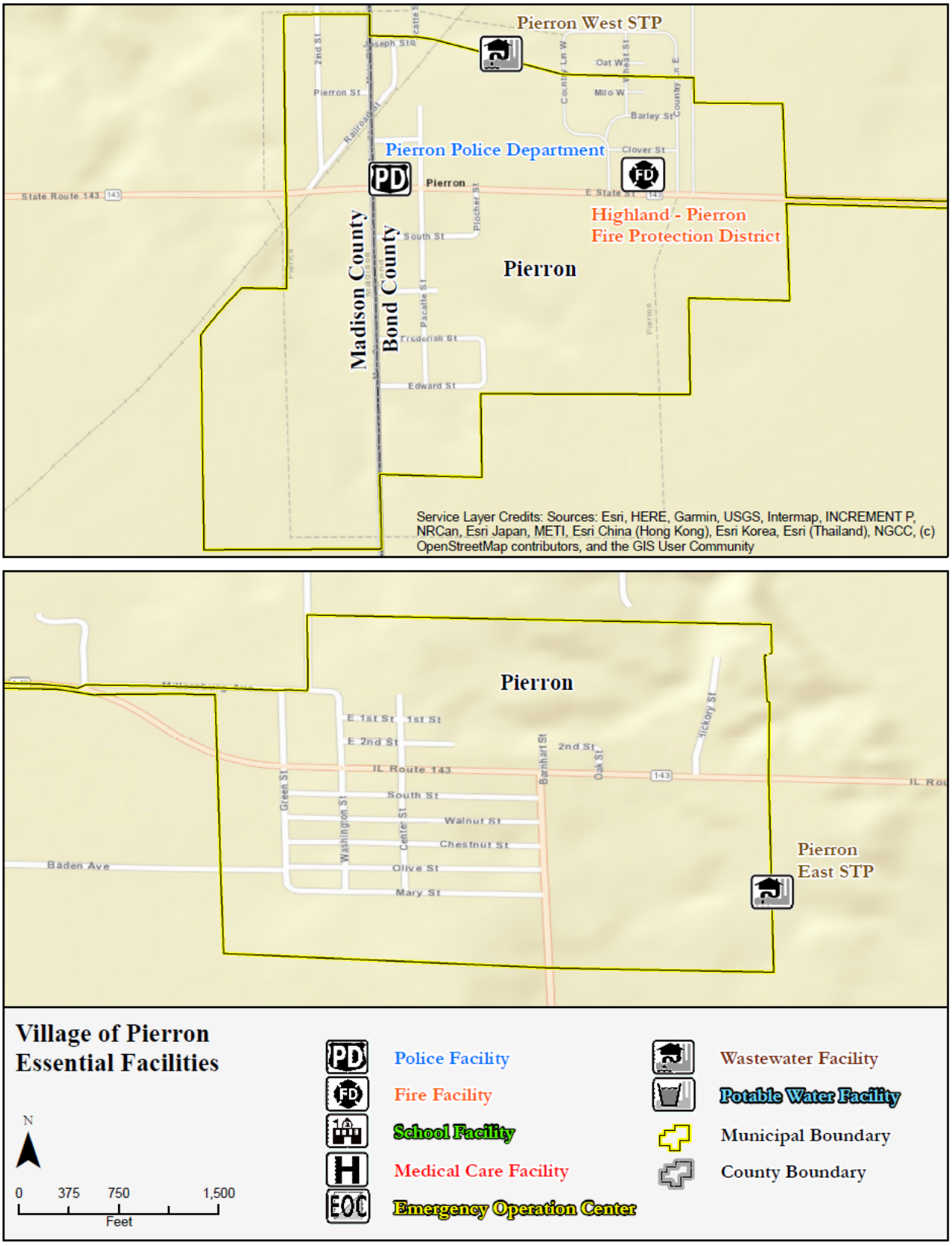


City of Old Ripley Essential Facilities Map

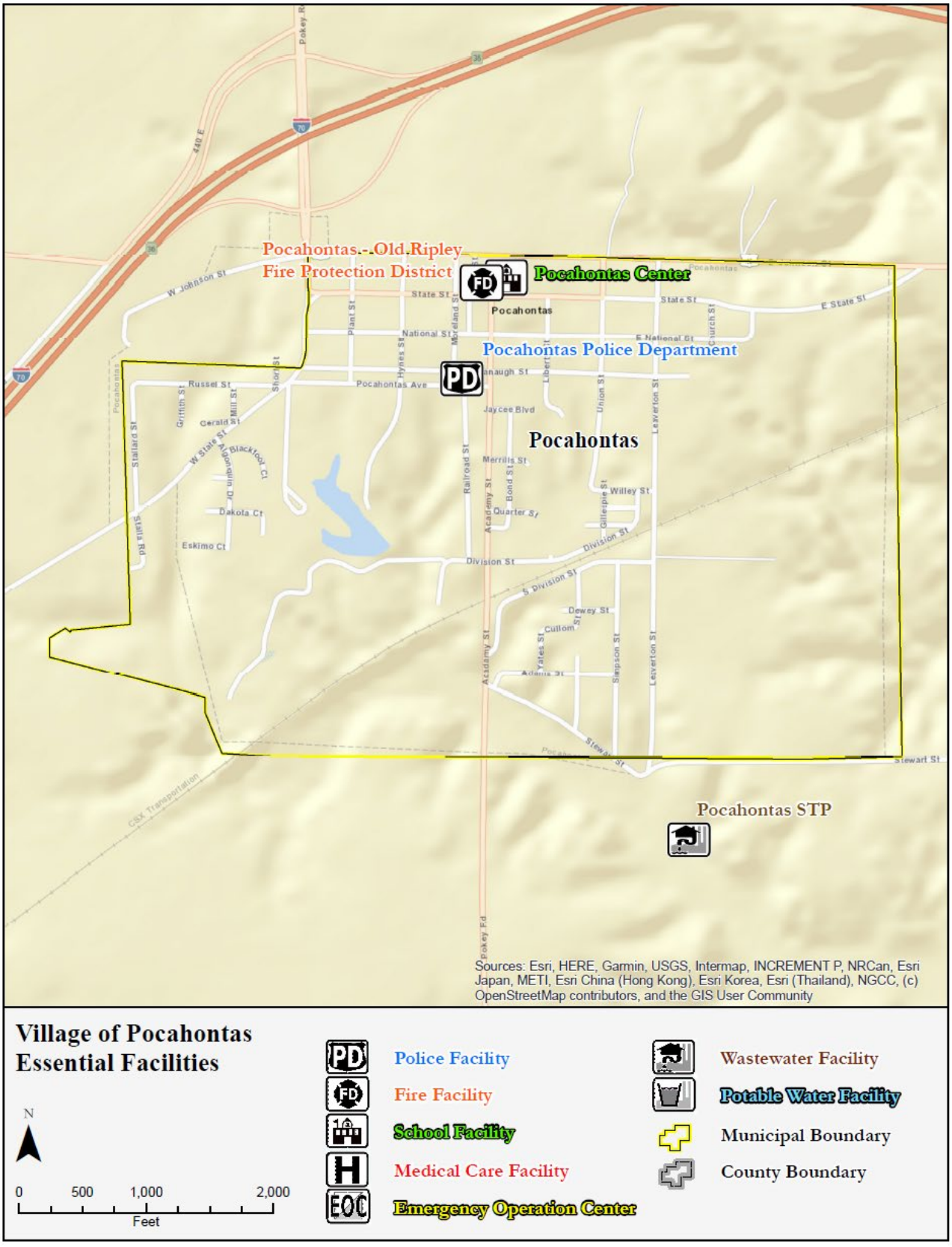
Village of Panama Essential Facilities Map



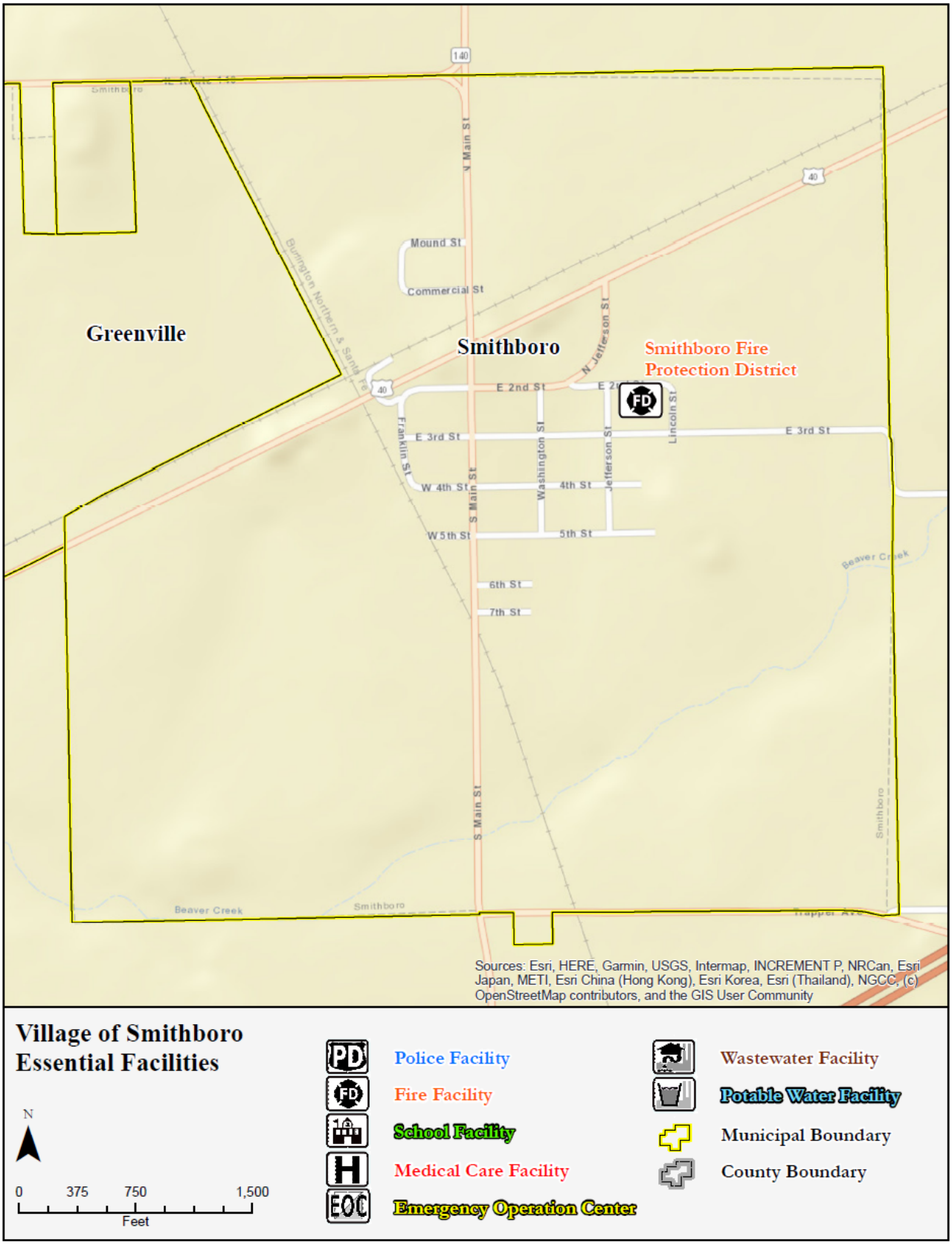
Village of Pierron Essential Facilities Map



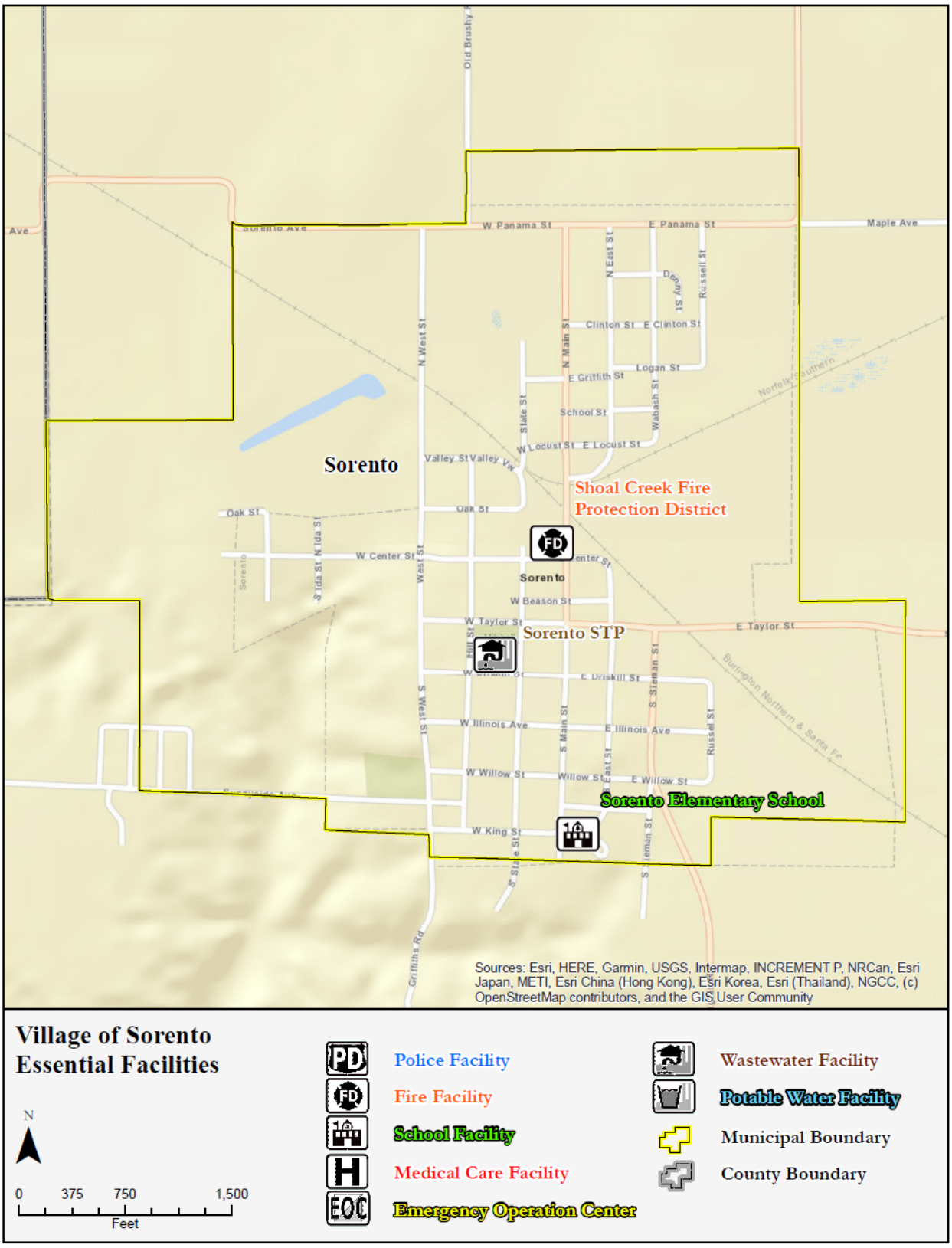
Village of Pocahontas Essential Facilities Map



Village of Smithboro Essential Facilities Map



Village of Sorento Essential Facilities Map



APPENDIX G: ADOPTION RESOLUTIONS

FEMA Approval Pending Adoption Letter

U.S. Department of Homeland Security
FEMA Region 5
536 S. Clark St. 6th Floor
Chicago, IL 60605

FEMA

February 28, 2024

Zachary Krug
Hazard Mitigation Section Manager
Illinois Emergency Management Agency
1035 Outer Park Drive
Springfield, IL 62704

Dear Mr. Krug,

Thank you for submitting the Bond County Hazard Mitigation Plan 2024 update for our review. The plan was reviewed based on the local plan criteria contained in 44 CFR Part 201, as authorized by the Disaster Mitigation Act of 2000. The Bond County Hazard Mitigation Plan 2024 update met the required criteria for a multi-jurisdiction hazard mitigation plan. Formal approval of this plan is contingent upon the adoption by the participating jurisdictions of this plan. Once FEMA Region 5 receives documentation of adoption from the participating jurisdictions, we will send a letter of official approval to your office.

An approved local mitigation plan, including adoption by the local government, is one of the conditions for applying for and/or receiving FEMA mitigation grants from the following programs:

- Hazard Mitigation Grant Program (HMGP)
- HMGP Post-Fire
- Building Resilient Infrastructure and Communities
- Flood Mitigation Assistance

Please note that participating jurisdictions that adopt the plan more than one year after APA status has been issued must either:

- Validate that their information in the plan remains current with respect to both the risk assessment (no recent hazard events, no changes in development) and their mitigation strategy (no changes necessary); or
- Make the necessary updates before submitting the adoption resolution to FEMA.

We look forward to receiving the adoption resolution(s) and discussing options for implementing this mitigation plan. If there are any questions from either you or the communities, please contact Maria Freeman at (202) 793-0810 or email at maria.freeman@fema.dhs.gov.

Sincerely,

JOHN A WETHINGTON
Digitally signed by JOHN A WETHINGTON
Date: 2024.02.28 16:38:16 -06'00'

John Wethington
Chief, Risk Analysis Branch
Mitigation Division

www.fema.gov

FEMA Approval Letter 1

U.S. Department of Homeland Security
FEMA Region 5
536 S. Clark St. 6th Floor
Chicago, IL 60605

FEMA

April 19, 2024

Zachary Krug
Hazard Mitigation Section Manager
Illinois Emergency Management Agency
1035 Outer Park Drive
Springfield, IL 62704

Dear Mr. Krug,

The Bond County Hazard Mitigation Plan 2024 was reviewed based on the local plan criteria contained in 44 CFR Part 201, as authorized by the Disaster Mitigation Act of 2000. The Bond County Hazard Mitigation Plan 2024 met the required criteria for a multi-jurisdictional hazard mitigation plan and the plan is now approved for the Bond County Health Department, Greenville City, and Pierron Village. Please submit adoption resolutions for any remaining jurisdictions who participated in the planning process.

The expiration date of the Bond County Hazard Mitigation Plan 2024 is five years from the date of this letter.

An approved local mitigation plan, including adoption by the local government, is one of the conditions for applying for and/or receiving FEMA mitigation grants from the following programs:

- Hazard Mitigation Grant Program (HMGP)
- HMGP Post-Fire
- Building Resilient Infrastructure and Communities
- Flood Mitigation Assistance

Having an approved mitigation plan does not mean that mitigation grant funding will be awarded. Specific application and eligibility requirements for the programs listed above can be found in each FEMA grant program's respective policies and annual Notice of Funding Opportunities, as applicable.

To avoid a lapsed plan, the next plan update must be approved before the end of the approval period, including adoption by the participating jurisdictions. Before the end of the approval period, please allow sufficient time to secure funding for the update, including the review and approval process. Please include time for any revisions, if needed, and for your jurisdiction to formally adopt the plan after the review, if not adopted prior to submission. This will enable you to remain eligible to apply for and receive funding from FEMA's mitigation grant programs with a mitigation plan requirement. Local governments, including special districts, with a plan status of "Approvable Pending Adoption" are not eligible for FEMA's mitigation grant programs with a mitigation plan requirement.

We look forward to discussing options for implementing this mitigation plan. If there are any questions from either you or the communities, please contact Maria Freeman at (202) 793-0810 or email at maria.freeman@fema.dhs.gov.

Sincerely,

JOHN A WETHINGTON
Digitally signed by JOHN A WETHINGTON
Date: 2024.04.19 10:39:45 -05'00'

John Wethington
Chief, Risk Analysis Branch
Mitigation Division

FEMA Approval Letter 2

U.S. Department of Homeland Security
FEMA Region 5
536 S. Clark St. 6th Floor
Chicago, IL 60605

FEMA

May 21, 2024

Zachary Krug
Hazard Mitigation Section Manager
Illinois Emergency Management Agency
1035 Outer Park Drive
Springfield, IL 62704

Dear Mr. Krug,

The Bond County Hazard Mitigation Plan 2024 was reviewed based on the local plan criteria contained in 44 CFR Part 201, as authorized by the Disaster Mitigation Act of 2000. The Bond County Hazard Mitigation Plan 2024 met the required criteria for a multi-jurisdictional hazard mitigation plan and the plan is now approved for Bond County, Sorento Village, and Greenville University. Please submit adoption resolutions for any remaining jurisdictions who participated in the planning process.

The expiration date of the Bond County Hazard Mitigation Plan 2024 is April 18, 2029.

An approved local mitigation plan, including adoption by the local government, is one of the conditions for applying for and/or receiving FEMA mitigation grants from the following programs:

- Hazard Mitigation Grant Program (HMGP)
- HMGP Post-Fire
- Building Resilient Infrastructure and Communities
- Flood Mitigation Assistance

Having an approved mitigation plan does not mean that mitigation grant funding will be awarded. Specific application and eligibility requirements for the programs listed above can be found in each FEMA grant program's respective policies and annual Notice of Funding Opportunities, as applicable.

To avoid a lapsed plan, the next plan update must be approved before the end of the approval period, including adoption by the participating jurisdictions. Before the end of the approval period, please allow sufficient time to secure funding for the update, including the review and approval process. Please include time for any revisions, if needed, and for your jurisdiction to formally adopt the plan after the review, if not adopted prior to submission. This will enable you to remain eligible to apply for and receive funding from FEMA's mitigation grant programs with a mitigation plan requirement. Local governments, including special districts, with a plan status of "Approvable Pending Adoption" are not eligible for FEMA's mitigation grant programs with a mitigation plan requirement.

We look forward to discussing options for implementing this mitigation plan. If there are any questions from either you or the communities, please contact Maria Freeman at (202) 793-0810 or email at maria.freeman@fema.dhs.gov.

Sincerely,

John Wethington

John Wethington
Chief, Risk Analysis Branch
Mitigation Division

FEMA Approval Letter 3

U.S. Department of Homeland Security
FEMA Region 5
536 S. Clark St. 6th Floor
Chicago, IL 60605

FEMA

July 31, 2024

Zachary Krug
Hazard Mitigation Section Manager
Illinois Emergency Management Agency
1035 Outer Park Drive
Springfield, IL 62704

Dear Mr. Krug,

The Bond County Hazard Mitigation Plan 2024 was reviewed based on the local plan criteria contained in 44 CFR Part 201, as authorized by the Disaster Mitigation Act of 2000. The Bond County Hazard Mitigation Plan 2024 met the required criteria for a multi-jurisdictional hazard mitigation plan and the plan is now approved for Pocahontas Village, Smithboro Village, and HSHS Holy Family Hospital.

To ensure that all participating jurisdictions are eligible to apply for future funding opportunities, please submit adoption resolutions for the remaining jurisdictions who participated in the planning process:

- Mulberry Grove Village
- Old Ripley Village

The expiration date of the Bond County Hazard Mitigation Plan 2024 is April 18, 2029.

An approved local mitigation plan, including adoption by the local government, is one of the conditions for applying for and/or receiving FEMA mitigation grants from the following programs:

- Hazard Mitigation Grant Program (HMGP)
- HMGP Post-Fire
- Building Resilient Infrastructure and Communities
- Flood Mitigation Assistance

Having an approved mitigation plan does not mean that mitigation grant funding will be awarded. Specific application and eligibility requirements for the programs listed above can be found in each FEMA grant program's respective policies and annual Notice of Funding Opportunities, as applicable.

To avoid a lapsed plan, the next plan update must be approved before the end of the approval period, including adoption by the participating jurisdictions. Before the end of the approval period, please allow sufficient time to secure funding for the update, including the review and approval process. Please include time for any revisions, if needed, and for your jurisdiction to formally adopt the plan after the review, if not adopted prior to submission. This will enable you to remain eligible to apply for and receive funding from FEMA's mitigation grant programs with a mitigation plan requirement. Local governments, including special districts, with a plan status of "Approvable Pending Adoption" are not eligible for FEMA's mitigation grant programs with a mitigation plan requirement.

We look forward to discussing options for implementing this mitigation plan. If there are any questions from either you or the communities, please contact Meg Burrows at 312-408-5320 or email at meghan.burrows@fema.dhs.gov.

Sincerely,

John Wethington
Chief, Risk Analysis Branch
Mitigation Division

Bond County Adoption Resolution

Adoption Resolution

BOND COUNTY 911

ILLINOIS

RESOLUTION NO. __2024_____

A RESOLUTION OF THE BOND COUNTY 911 ADOPTING THE

BOND COUNTY HAZARD MITIGATION PLAN – MARCH 2024

WHEREAS the BOND COUNTY 911 recognizes the threat that natural hazards pose to people and property within BOND COUNTY .

WHEREAS the BOND COUNTY has prepared a multi-hazard mitigation plan, hereby known as Bond County Hazard Mitigation Plan – March 2024 in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS Bond County Hazard Mitigation Plan – March 2024 identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in BOND COUNTY from the impacts of future hazards and disasters; and

WHEREAS adoption by the BOND COUNTY 911 demonstrates their commitment to the hazard mitigation and achieving the goals outlined in the Bond County Hazard Mitigation Plan – March 2024.

NOW THEREFORE, BE IT RESOLVED BY THE BOND COUNTY EMA, ILLINOIS, THAT:

Section 1. In accordance with local rule for adopting resolutions, the BOND COUNTY 911 Board adopts the Bond County Hazard Mitigation Plan – March 2024.

ADOPTED by a vote of __5__ in favor and __0__ against, and __2__ abstaining, this __11th__ day of __April__, __2024__.

By:_____
(print name)

ATTEST:

By:_____
(print name)

Bond County Health Department Adoption Resolution

Adoption Resolution

Bond County Health Department
ILLINOIS

RESOLUTION NO. __2024_____

A RESOLUTION OF THE Bond County Health Department ADOPTING THE

BOND COUNTY HAZARD MITIGATION PLAN – MARCH 2024

WHEREAS the Bond County Board recognizes the threat that natural hazards pose to people and property within Bond County and the Bond County Health Department; and

WHEREAS Bond County has prepared a multi-hazard mitigation plan, hereby known as Bond County Hazard Mitigation Plan – March 2024 in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS Bond County Hazard Mitigation Plan – March 2024 identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Bond County from the impacts of future hazards and disasters; and

WHEREAS adoption by the Bond County Health Department demonstrates their commitment to the hazard mitigation and achieving the goals outlined in the Bond County Hazard Mitigation Plan – March 2024.

NOW THEREFORE, BE IT RESOLVED BY THE Bond County, ILLINOIS, THAT:

Section 1. In accordance with local rule for adopting resolutions, the Bond County Health Department adopts the Bond County Hazard Mitigation Plan – March 2024.

ADOPTED, this __13___ day of March _____, __2024___.

By: ___Sean Eifert, Administrator Bond County Health Department_____
(print name)

ATTEST:

By: ___Sean Eifert_____
(print name)

APPROVED AS TO FORM:

By: _____Sean Eifert_____
(print name

City of Greenville Adoption Resolution

Resolution

FILED
MAR 2 1 2024
BOND COUNTY CLERK & RECORDER

CITY OF GREENVILLE

ILLINOIS

RESOLUTION NO. 24-02

A RESOLUTION OF THE CITY OF GREENVILLE ADOPTING THE

BOND COUNTY HAZARD MITIGATION PLAN – MARCH 2024

WHEREAS the City of Greenville recognizes the threat that natural hazards pose to people and property within Greenville; and

WHEREAS the City of Greenville has prepared a multi-hazard mitigation plan, hereby known as Bond County Hazard Mitigation Plan – March 2024 in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS Bond County Hazard Mitigation Plan – March 2024 identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Greenville from the impacts of future hazards and disasters; and

WHEREAS adoption by the Greenville City Council demonstrates their commitment to the hazard mitigation and achieving the goals outlined in the Bond County Hazard Mitigation Plan – March 2024.

NOW THEREFORE, BE IT RESOLVED BY THE CITY OF GREENVILLE, ILLINOIS, THAT:

Section 1. In accordance with, the Greenville City Council adopts the Bond County Hazard Mitigation Plan – March 2024.

ADOPTED by a vote of 4 in favor and 0 against, and 0 abstaining, this 12th day of March, 2024.

By: George Barber
Mayor George Barber

ATTEST:

By: Jody D Weiss
City Clerk Jody Weiss

APPROVED AS TO FORM:

By:
City Manager Jo Hollenkamp

Greenville University Adoption Resolution

Greenville University

ILLINOIS

RESOLUTION NO.1

A RESOLUTION OF Greenville University ADOPTING THE

BOND COUNTY HAZARD MITIGATION PLAN – MARCH 2024

WHEREAS Greenville University recognizes the threat that natural hazards pose to people and property within Greenville University; and

WHEREAS Greenville University has prepared a multi-hazard mitigation plan, hereby known as Bond County Hazard Mitigation Plan – March 2024 in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS Bond County Hazard Mitigation Plan – March 2024 identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Greenville University from the impacts of future hazards and disasters; and

WHEREAS adoption by Greenville University demonstrates their commitment to the hazard mitigation and achieving the goals outlined in the Bond County Hazard Mitigation Plan – March 2024.

NOW THEREFORE, BE IT RESOLVED BY Greenville University THAT:

Section 1. In accordance with Greenville University Regulations, Greenville University adopts the Bond County Hazard Mitigation Plan – March 2024.

ADOPTED by a vote of ____ in favor and ____ against, and ____ abstaining, this _____ day of _____, _____.

By: _____
(print name) Suzanne Davis

ATTEST:

By: _____
(print name)

APPROVED AS TO FORM:

By: _____
(print name

Village of Pierron Adoption Resolution

ADOPTION RESOLUTION

VILLAGE OF PIERRON

ILLINOIS

RESOLUTION NO. 3-20-24

FILED
MAR 2_ 2024
BOND COUNTY CLERK & RECORDER

A RESOLUTION OF THE VILLAGE OF PIERRON ADOPTING THE

BOND COUNTY HAZARD MITIGATION PLAN – MARCH 2024

WHEREAS the VILLAGE OF PIERRON recognizes the threat that natural hazards pose to people and property within THE VILLAGE OF PIERRON.

WHEREAS the VILLAGE OF PIERRON/BOND COUNTY has prepared a multi-hazard mitigation plan, hereby known as Bond County

Hazard Mitigation Plan – March 2024 in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS Bond County Hazard Mitigation Plan – March 2024 identifies mitigation goals and actions to

reduce or eliminate long-term risk to people and property in VILLAGE OF PIERRON/BOND COUNTY from the impacts of future

hazards and disasters; and

WHEREAS adoption by the VILLAGE OF PIERRON demonstrates their commitment to the hazard mitigation and

achieving the goals outlined in the Bond County Hazard Mitigation Plan – March 2024.

NOW THEREFORE, BE IT RESOLVED BY THE VILLAGE OF PIERRON, ILLINOIS, THAT:

Section 1. In accordance with local rule for adopting resolutions, the VILLAGE OF PIERRON Board adopts the

Bond County Hazard Mitigation Plan – March 2024.

ADOPTED by a vote of 4 in favor and 0 against, and 0 abstaining, this 20 day of March, 2024

By: TONI KLITZING

(print name)

ATTEST:

By: JAMES HESS

(print name)

APPROVED AS TO FORM:

By: ______________________

(print name

SEAL OF THE VILLAGE OF PIERRON BOND & MADISON COUNTIES, IL
INCORPORATED
MARCH 25TH
1893

Village of Smithboro Adoption Resolution

STATE OF ILLINOIS - COUNTY OF BOND,
VILLAGE OF SMITHBORO

RESOLUTION NO: 446

A RESOLUTION OF THE VILLAGE OF SMITHBORO ADOPTING THE BOND COUNTY HAZARD MITIGATION PLAN - APRIL 2024

ADOPTED BY THE VILLAGE BOARD OF TRUSTEES
OF
THE VILLAGE OF SMITHBORO
THIS 1ST DAY OF JULY, 2024

WHEREAS the VILLAGE OF SMITHBORO recognizes the threat that natural hazards pose to people and property within BOND COUNTY.

WHEREAS BOND COUNTY has prepared a multi-hazard mitigation plan, hereby known as Bond County Hazard Mitigation Plan - April 2024 in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS Bond County Hazard Mitigation Plan - March 2024 identifies mitigation goals and actions to reduce or eliminate long-term to people and property in BOND COUNTY from the impacts of future hazards and disasters; and

WHEREAS adoption by the VILLAGE OF SMITHBORO demonstrates their commitment to hazard mitigation and achieving the goals outlined in Bond County Hazard Mitigation Plan - April 2024.

NOW THEREFORE, BE IT RESOLVED BY THE VILLAGE OF SMITHBORO, ILLINOIS, THAT:

Section 1. In accordance with local rule for adopting resolutions, the VILLAGE OF SMITHBORO adopts the Bond County Hazard Mitigation Plan - April 2024.

ADOPTED by vote of 5 in favor and 0 against, and 0 abstaining, this 1st day of July, 2024.

APPROVAL: _____
VILLAGE PRESIDENT, WILLIAM ARCHIBALD

ATTEST: Angela Strohkirch
ANGELA STROHKIRCH, CLERK

Village of Sorento Adoption Resolution

VILLAGE OF SORENTO, ILLINOIS

RESOLUTION NO. 2024- 003

A RESOLUTION OF THE VILLAGE OF SORENTO, ILLINOIS ADOPTING THE MARCH 2024 BOND COUNTY HAZARD MITIGATION PLAN

ADOPTED BY THE BOARD OF TRUSTEES
OF THE VILLAGE OF SORENTO, ILLINOIS

THIS 6TH DAY OF MAY 2024

Prepared by:

Jeffrey A. Mollet
silver lake group, ltd.
560 Suppiger Way
Post Office Box 188
Highland, Illinois 62249
Telephone 618.654.8341
Facsimile 618.654.8391

VILLAGE OF SORENTO, ILLINOIS

RESOLUTION NO. 2024-003

A RESOLUTION OF THE VILLAGE OF SORENTO, ILLINOIS ADOPTING THE MARCH 2024 BOND COUNTY HAZARD MITIGATION PLAN

WHEREAS, the Village of Sorento ("Village") recognizes the threat that natural hazards pose to people and property within the Village; and

WHEREAS, the Village is wholly located within Bond County, Illinois; and

WHEREAS, Bond County, Illinois, has prepared a multi-hazard mitigation plan, formally known as Bond County Hazard Mitigation Plan-March 2024 in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS, after full review and consideration, the Village desires to mitigate the threat that natural hazards pose to people and property within the Village by adopting the Bond County Hazard Mitigation Plan-March 2024.

NOW THEREFORE, be it resolved by the President and Board of Trustees of the Village of Sorento, Illinois, as follows:

1. RESOLVED, that the recitals set forth above shall constitute findings of fact and are incorporated as part of this Resolution.

2. FURTHER RESOLVED, that the Village hereby adopts the Bond County Hazard Mitigation Plan-March 2024, as the same may be amended from time to time, and such amendments, unless otherwise stated by formal action of the Village, shall be effective and applicable in accordance with this Resolution.

3. FURTHER RESOLVED, that this Resolution shall take effect and be in full force and effect upon adoption and as provided by law.

Passed this 6th day of May 2024, by the by the following vote:

	Aye	*Nay*	*Absent*
Lowell Halford	Y	___	___
Fred Houchlei	X	___	___
Blair Kunkel	X	___	___
Janie Sugg	X	___	___

Jimmy Thomas	X	___	___
Joel Turner	X	___	___

Anthony Rapien, Village President
Village of Sorento, Illinois

ATTEST:

Donna Suzanne Braman, Village Clerk
Village of Sorento, Illinois

STATE OF ILLINOIS)
) SS
COUNTY OF BOND)

CERTIFICATION

The undersigned does hereby certify that I am the duly qualified and acting Village Clerk of the Village of Sorento, Bond County, Illinois, and that as such officer, I am the keeper of the records and files of the Village of Sorento, Illinois.

I do further certify that the foregoing document is a true, correct, and complete copy of Resolution No. 2024-003 as passed by the Board of Trustees of the Village of Sorento, Illinois at the regularly scheduled Village Board Meeting held on May 6th, 2024, said Resolution being entitled:

A RESOLUTION OF THE VILLAGE OF SORENTO, ILLINOIS ADOPTING THE MARCH 2024 BOND COUNTY HAZARD MITIGATION PLAN

In witness whereof, I have hereunto affixed my official signature and the seal of the Village of Sorento, Bond County, Illinois, this 6th day of May 2024.

Donna Suzanne Braman, Village Clerk
Village of Sorento, Illinois

(SEAL)

HSHS Holy Family Hospital Adoption Resolution

Adoption Resolution

HSHS Holy Family Hospital

ILLINOIS

RESOLUTION NO. _____

A RESOLUTION OF THE Holy Family Hospital ADOPTING THE

BOND COUNTY HAZARD MITIGATION PLAN – MARCH 2024

WHEREAS Holy Family Hospital recognizes the threat that natural hazards pose to people and property within Bond County ; and

WHEREAS Holy Family Hospital has prepared a multi-hazard mitigation plan, hereby known as Bond County Hazard Mitigation Plan – March 2024 in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS Bond County Hazard Mitigation Plan – March 2024 identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Holy Family Hospital from the impacts of future hazards and disasters; and

WHEREAS adoption by Holy Family Hospital demonstrates their commitment to the hazard mitigation and achieving the goals outlined in the Bond County Hazard Mitigation Plan – March 2024.

NOW THEREFORE, BE IT RESOLVED BY Holy Family Hospital, Greenville , ILLINOIS, THAT:

Section 1. In accordance with local rules and regulations, Holy Family Hospital adopts the Bond County Hazard Mitigation Plan – March 2024.

ADOPTED by a vote of __x__ in favor and ____ against, and ____ abstaining, this 14 day of May, 2024

By: Kelly Sager
(print name)

ATTEST:

By: Kelly Sager
(print name)

APPROVED AS TO FORM:

By: Kelly Sager
(print name

Village of Pocahontas Adoption Resolution

VILLAGE OF POCAHONTAS

ILLINOIS

RESOLUTION NO. 2024-03

A RESOLUTION OF THE VILLAGE OF POCAHONTAS ADOPTING THE

BOND COUNTY HAZARD MITIGATION PLAN – MARCH 2024

WHEREAS the Village of Pocahontas recognizes the threat that natural hazards pose to people and property within Village of Pocahontas; and

WHEREAS the Village of Pocahontas has prepared a multi-hazard mitigation plan, hereby known as Bond County Hazard Mitigation Plan – March 2024 in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS Bond County Hazard Mitigation Plan – March 2024 identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Pocahontas from the impacts of future hazards and disasters; and

WHEREAS adoption by the Village of Pocahontas demonstrates their commitment to the hazard mitigation and achieving the goals outlined in the Bond County Hazard Mitigation Plan – March 2024.

NOW THEREFORE, BE IT RESOLVED BY THE VILLAGE OF POCAHONTAS, ILLINOIS, THAT:

Section 1. In accordance with Article XIV, the Village of Pocahontas adopts the Bond County Hazard Mitigation Plan – March 2024.

ADOPTED by a vote of 4 in favor and 0 against, and 2 absent, this 11th day of March, 2024.

By: Karen Heilig
Karen Heilig, Village President

ATTEST:

By: Loni Hensler
Loni Hensler, Village Clerk