

Carroll County

MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN



PARTICIPANTS

Carroll County
Chadwick, Village of
Eastland CUSD #308
Lanark, City of
Milledgeville, Village of
Milledgeville Park District

Mount Carroll, City of
Savanna, City of
Shannon, Village of
Thomson, Village of
Thomson Fire Protection District
West Carroll CUSD #314

JANUARY 2013

The five year update of this Plan must be completed on or before April 18, 2018.

ACKNOWLEDGEMENTS

Preparing a planning document of this size and scope takes a considerable amount of effort and time. Unlike some other kinds of planning efforts, this is the first time that Carroll County and the participating municipalities and townships had prepared a Natural Hazards Mitigation Plan. This Plan should be a useful resource for current and future residents who are interested in the impacts caused by severe weather in Carroll County. Information from various government sources has been supplemented by photographs and weather data from personal collections.

The Carroll County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee included residents who live throughout the County. Their knowledge of the devastation caused by severe weather coupled with their commitment to protecting the lives, property, and welfare of Carroll County residents resulted in this Plan.

Leroy Getz is a crop and weather reporter who lives on his farm located between Mount Carroll and Savanna. He began recording rainfall totals approximately 30 years ago and his interest expanded to include gathering information about other types of weather events for the Carroll County Farm Bureau. Leroy is a fourth generation dairy farmer whose children help him maintain their Centennial Farm. His generous contribution of photographs and weather information, much of which is not available from any other source, greatly enriches the value and readability of this document.

Sally Marken, Carroll County Public Health Department, and Janet Hockman, Carroll County Highway Department, both serve on the Local Emergency Planning Committee in addition to serving on the Committee that prepared this Plan. Through their diligence, photographs showing storm damages to important infrastructure illustrate the destructive power of natural hazards. Larry Stebbins, Mayor of Savanna, was able to provide detailed information and photographs of several historic flood events in Savanna. This information helped provide perspective on the magnitude of the flooding that has occurred repeatedly in and around Savanna.

Larry Acker and his family have kept the only source of continuous weather records in Polo, Illinois since 1883. Larry's great grandfather, William Edwin Acker, started keeping records when the Acker Brothers began farming in Polo. Larry lives on this Centennial farm from where weather information is supplied to the National Weather Service. Before him, Larry's mother, Helen Johnston Acker, assisted in keeping weather records. The Acker site is the oldest continuous weather data site in Illinois that has not been moved to a different location.



FEMA

APR 09 2013

APR 15 2013

Mr. Ron Davis
State Hazard Mitigation Officer
Illinois Emergency Management Agency
1035 Outer Park Drive
Springfield, IL 62704

Dear Mr. Davis:

Thank you for submitting the Carroll County Hazard Mitigation Plan 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. Carroll County met the required criteria for a multi-jurisdictional hazard mitigation plan. Formal approval of this plan is contingent upon the adoption by the participating jurisdictions of this plan. Once FEMA Region V receives documentation of adoption from the participating jurisdictions, we will send a letter of official approval to your office.

We look forward to receiving the adoption documentation and completing the approval process for Carroll County.

If you or the communities have any questions, please contact Kirstin Kuenzi at (312) 408-4460.

Sincerely,

A handwritten signature in cursive script that reads "Christine Stack".

Christine Stack, Director
Mitigation Division

Attachment: Local Mitigation Plan Review

CARROLL COUNTY MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN

CARROLL COUNTY, ILLINOIS

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*Researched and written for the Carroll County Multi-Jurisdictional
Natural Hazards Mitigation Planning Committee
by Greg R. Michaud and Andrea J. Bostwick
Johnson, Depp & Quisenberry*



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1.0 INTRODUCTION

1.0 INTRODUCTION

Each year natural hazards (i.e., severe thunderstorms, tornadoes, severe winter storms, flooding, etc.) cause damage to property and threaten the lives and health of the residents of Carroll County. Since 1965, Carroll County has had nine federally-declared disasters. **Figure 1** identifies each declaration including the year the disaster was declared and the type of natural hazard that triggered the declaration.

Figure 1 Federal Disaster Declarations for Carroll County		
Declaration #	Year	Type of Natural Hazard(s) Event
194	1965	severe storms, flooding and tornadoes
262	1969	flooding
373	1973	severe storms and flooding
438	1974	severe storms and flooding
643	1981	severe storms, flooding and tornadoes
997	1993	flooding
1368	2001	flooding
1935	2010	severe storms (torrential rains)
1960	2011	severe winter storm

In addition, between 2001 and 2011 there have been 67 thunderstorms with damaging winds, 34 severe winter storms (snow and ice), 23 flood and flash flood events, 18 heavy rain events, nine severe hail storms, five extreme cold events, three tornadoes, two lightning strike events, one drought and three earthquakes felt by residents in the County.

While natural hazards cannot be avoided, their impacts can be reduced through effective hazard mitigation planning. This prevention-related concept of emergency management often receives the least amount of attention, yet it is one of the most important steps in creating a hazard-resistant community.

What is hazard mitigation planning?

Hazard mitigation planning is the process of determining how to reduce or eliminate the loss of life and property damage resulting from natural hazards. This process helps the County and participating jurisdictions reduce their risk from natural hazards by identifying vulnerabilities and developing mitigation actions to lessen and sometimes even eliminate the effects of a hazard. The results of this process are documented in a natural hazards mitigation plan.

Why prepare a natural hazards mitigation plan?

By preparing and adopting a natural hazards mitigation plan, participating jurisdictions become eligible to apply for and receive federal hazard mitigation funds to implement mitigation actions identified in the plan. These funds can help provide local government entities with the opportunity to complete mitigation projects that would not otherwise be financially possible.

The federal hazard mitigation funds are made available through the Disaster Mitigation Act of 2000, an amendment to the Robert T. Stafford Disaster Relief and Emergency Assistance Act, which provides federal aid for mitigation projects, but only if the local government entity has a Federal Emergency Management Agency-approved hazard mitigation plan.

How is this plan different from other emergency plans?

A natural hazards mitigation plan is aimed at identifying projects and activities that can be conducted prior to a natural disaster, unlike other emergency plans which provide direction on how to respond to a disaster after it occurs. This is the first time that Carroll County has prepared a plan that describes actions that can be taken to help reduce or eliminate damages caused by specific types of natural hazards.

1.1 PARTICIPATING JURISDICTIONS

Recognizing the benefits that could be gained from preparing a natural hazards mitigation plan, the Carroll County Board passed a resolution on December 17, 2009 authorizing the development of the Carroll County Multi-Jurisdictional Natural Hazards Mitigation Plan (hereto referred to as the Plan). **Appendix A** contains a copy of the resolution. The County then invited all the local government entities within Carroll County to participate. **Figure 2** identifies the participating jurisdictions that are represented in the Plan. The Carroll County Emergency Services and Disaster Agencies administered the Plan.

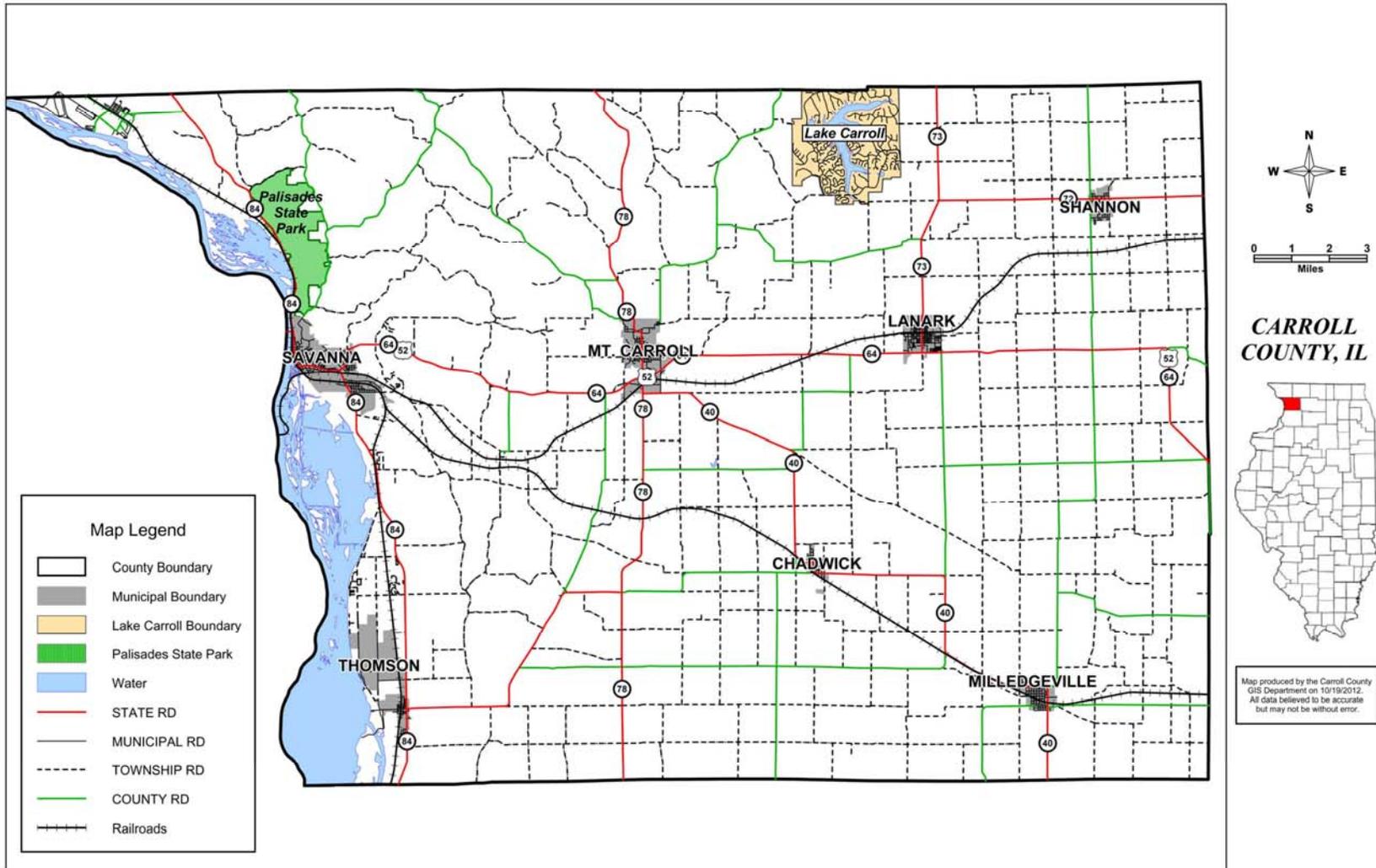
Figure 2 Jurisdictions Represented in the Plan	
<ul style="list-style-type: none">• Chadwick, Village of• Eastland CUSD #308• Lanark, City of• Milledgeville, Village of• Milledgeville Park District• Mount Carroll, City of	<ul style="list-style-type: none">• Savanna, City of• Shannon, Village of• Thomson, Village of• Thomson Fire Protection District• West Carroll CUSD #314

1.2 DEMOGRAPHICS

Carroll County is located in northwestern Illinois and covers approximately 466 square miles. **Figure 3** provides a location map of Carroll County and the participating jurisdictions. The topography of the County is varied with gently sloping farmland in the eastern and central portions and hills, bluffs and palisades in the western portion. The western boundary of the County is formed by the Mississippi River. The county seat is located in Mount Carroll. Agriculture is a major industry in the County. The County has a high percentage of productive soils, good transportation facilities, nearby markets and a favorable climate.

According to the 2007 Census of Agriculture, there were 676 farms in Carroll County occupying approximately 89% (265,153 acres) of the total acreage. The major crops include corn, soybeans and hay while the major livestock includes hogs, beef and dairy cattle. Most of the County is well adapted to a combination of grain and livestock farming because of its topography and a high percentage of farm income is derived from livestock and livestock products. Carroll

**Figure 3
Location Map**



County ranks in the top five Illinois Counties for livestock cash receipts and in the top 45 for crop cash receipts.

Manufacturing in the County is primarily located in Savanna, Lanark, Milledgeville, Thomson and Shannon where such items as fasteners, water fountains and coolers, kitchen and bath cabinetry, light assembly/packaging, injection molds, specialty sweeteners sewer cleaning equipment and microwave popcorn products are produced. The County also has an active mineral operation, including approximately eleven limestone and dolomite quarries distributed throughout the County. Other important industries located in the County include education and retail trade.

Figure 4 provides demographic data on the County and each of the participating municipalities along with information on housing units and assessed values. The assessed values are for all residential structures and associated buildings (including farm homes and buildings associated with the main residence.) The assessed value of a residence in Carroll County is approximately one-third of the market value.

Figure 4 Demographic Data by Participating Jurisdiction						
Participating Jurisdiction	Population (2000)	Population (2010)	Land Area (Sq. Miles) (2000)	Number of Housing Units (2000)	Housing Unit Density (Units per Sq. Mile)	Total Assessed Value of Housing Units (2011)
Carroll County (unincorporated)	6,782	6221	434.94	3,275	8	\$147,605,495
Chadwick	505	551	0.32	227	---	\$6,007,131
Lanark	1,584	1,457	1.04	694	668	\$16,126,584
Milledgeville	1,016	1,032	0.71	499	---	\$13,460,077
Mount Carroll	1,832	1,717	1.90	854	450	\$16,982,569
Savanna	3,542	3,062	2.61	1,796	689	\$26,639,043
Shannon	854	757	0.48	361	---	\$11,081,880
Thomson	559	590	2.21	239	109	\$5,868,781

Sources: Eberle, Leah, Carroll County Chief County Assessment Office, "Assessment Data", Fax to Greg Michaud, April 4, 2012.

Illinois Department of Commerce and Economic Opportunity, Census 2000 Data for Illinois.

Illinois Department of Commerce and Economic Opportunity, Census 2010 Data.

U. S. Census Bureau, Geography, Census 2000 U.S. Gazetteer Files.

1.3 LAND USE AND DEVELOPMENT TRENDS

Population growth and economic development are two major factors that trigger changes in land use. Carroll County is largely rural with a population that has been declining since 1960. Between 1960 and 2010, the population of Carroll County decreased by approximately 21% from 19,507 to 15,387. Lanark, Mount Carroll, Savanna and Shannon have all experienced declines in their population since 2000, while Chadwick, Milledgeville and Thomson have seen modest increases.

Land use in Carroll County is primarily agricultural. As discussed in the previous section, approximately 89% of the land within the County is used as farmland. Agriculture is and will continue to be the leading employment sector within the County for residents and a vital part of the County's economy.

There are no large-scale economic development initiatives underway in the County. Substantial changes in land use (from forested and agricultural land to residential, commercial and industrial) are not anticipated within the County in the immediate future. No sizeable increases in residential or commercial/industrial developments are expected within the next five years.

2.0 PLANNING PROCESS

2.0 PLANNING PROCESS

The Carroll County Multi-Jurisdictional Natural Hazards Mitigation Plan (the Plan) was developed through the Carroll County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee (Planning Committee). The Plan was prepared to comply with the Disaster Mitigation Act of 2000 and incorporates the Federal Emergency Management Agency’s (FEMA) 10 step planning process approach. **Figure 5** provides a brief description of the process utilized to prepare this Plan.

Figure 5 Description of Planning Process	
Tasks	Description
Task One: Organize	The Planning Committee was formed with broad representation and specific expertise to assist the County and the Consultant in preparing the Plan.
Task Two: Public Involvement	Early and ongoing public involvement activities were conducted throughout the Plan’s development to ensure the public was given every opportunity to participate and provide input.
Task Three: Coordination	Agencies and organizations were contacted to identify plans and activities currently being implemented that impact or might potentially impact hazard mitigation activities.
Task Four: Risk Assessment	The Consultant identified and profiled the natural hazards that have impacted the County and conducted a vulnerability assessment to evaluate the risk to each participating jurisdiction. (This task incorporated two of FEMA’s steps: assessing the hazard and assessing the problem.)
Task Five: Goal Setting	After reviewing existing plans and completing the risk assessment, the Consultant assisted the Planning Committee in establishing goals and objectives for the Plan.
Task Six: Mitigation Activities	The participating jurisdictions were asked to identify mitigation actions based on the results of the risk assessment. These actions were then analyzed, categorized and prioritized.
Task Seven: Draft Plan	The draft Plan summarized the results of Tasks One through Six. In addition, a section was added that describes the responsibilities to monitor, evaluate and update the Plan. The draft Plan was reviewed by the participants and a public forum was held to give the public an additional opportunity to provide input. Any comments received were incorporated into the draft Plan submitted to the Illinois Emergency Management Agency (IEMA) and FEMA for review and approval.
Task Eight: Final Plan	Comments received from IEMA and FEMA were incorporated in to the final Plan. The final Plan was then submitted to the County and participating jurisdictions for adoption. The Plan will be reviewed periodically and updated every five years. (This task incorporated two of FEMA’s steps: adopt the plan and implement, evaluate and revise the plan.)

Plan development was led at the staff level by Greg Miller, the Carroll County ESDA Coordinator. Johnson, Depp & Quisenberry, an environmental and engineering consulting firm, with experience in hazard mitigation, risk assessment and public involvement, was employed to guide the County and participating jurisdictions through the planning process.

Participation in the planning process, especially by the County and local government representatives was crucial to the development of the Plan. To ensure that all participating

jurisdictions took part in the planning process, participation requirements were established. Each participating jurisdiction agreed to satisfy the following requirements in order to be included in the Plan. All of the participating jurisdictions met the participation requirements.

- Attend at least two Planning Committee meetings.
- Submit a list of existing planning documents (i.e., plans, studies, reports, maps, etc.) relevant to the natural hazard mitigation planning process.
- Identify and submit a list of critical infrastructure and facilities.
- Review the risk assessment and provide information on additional events and damages.
- Participate in the development of mitigation goals.
- Submit a list of mitigation actions.
- Review and comment on the draft Plan.
- Formally adopt the Plan.
- Where applicable, incorporate the Plan into existing planning efforts.
- Participate in the Plan maintenance.

2.1 PLANNING COMMITTEE

As previously mentioned, at the start of the planning process, the Carroll County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee was formed. The Planning Committee included representatives from each participating jurisdiction, as well as agriculture, education, emergency services (Red Cross, ambulance, fire and law enforcement), healthcare, GIS and insurance.

Figure 6 details the entities represented on the Planning Committee and the individuals who attended on their behalf. The Planning Committee was chaired by the Carroll County ESDA.



Additional technical expertise was provided by the staff at the Illinois Emergency Management Agency Hazard Mitigation Unit, the Illinois Department of Natural Resources Office of Water Resources, the Illinois Environmental Protection Agency, Carroll County Soil and Water Conservation District, the Illinois State Water Survey, the Illinois State Geological Survey, and the University of Illinois.

Mission Statement

Over the course of the first two meetings, the Planning Committee developed a mission statement they felt best described their objectives for the Plan.

“The mission of the Carroll County Multi-Jurisdictional Natural Hazards Mitigation Plan Committee is to develop a mitigation plan that can reduce the negative impacts of natural hazards on citizens, infrastructure, private property and critical facilities.”

**Figure 6
Carroll County Multi-Jurisdictional Natural Hazards Mitigation
Planning Committee Member Attendance Record**

Representing	Name	2/2/2012	3/29/2012	5/24/2012	9/27/2012	12/13/2012
American Red Cross - Northwest IL Chapter	Allshouse, Scott	X		X	X	
Carroll Co. - Administrator	Doty, Mike	X		X	X	
Carroll Co. - Assessor	Eberle, Leah	X	X	X	X	X
Carroll Co. - Clerk's Office	Buss, Amy		X			
	Woessner, Brian	X				
Carroll Co. - ESDA	Miller, Greg	X	X	X	X	X
	Mobley, Kim	X	X	X	X	X
Carroll Co. - Farm Bureau	Welch, Chas	X	X	X		X
Carroll Co. - GIS	Hughes, Jeremy	X	X	X		
Carroll Co. - Health Dept.	Marken, Sally	X	X	X	X	
Carroll Co. - Highway Dept.	Hockman, Janet	X	X	X		X
	Vandendooren, Kevin		X		X	
Carroll Co. - Sheriff's Office	Sandy, Ken	X				X
Carroll Co. - Zoning	Yuswak, Julie	X	X	X		X
Carroll County Review	Gengenbach, Bill	X		X	X	
Chadwick, Village of	McNeal, Zelma	X	X	X	X	X
Cherry Grove - Shannon Township	Koch, Brian	X	X	X		X
Country Financial Insurance Company	Johnston, Randy	X	X	X	X	
Eastland CUSD #308	Hansen, Mark	X	X	X	X	
IEMA	Purchis, Bryan		X			
IEMA - Region 2	Coers, Sue			X		
Johnson, Depp & Quisenberry	Bostwick, Andrea	X	X	X	X	X
	Michaud, Greg	X	X	X	X	X
Lake Carroll Association	Fossett, Luke		X			
Lanark, City of	Guenzler, Les	X			X	
	Stern, Ed	X	X	X	X	X
	Viglietta, Ken	X	X	X	X	X
Milledgeville, Village of	Ottens, Christine	X	X	X	X	X
Mount Carroll, City of	Cuckler, Julie	X		X	X	X
	Fuller, Pat			X	X	
Prairie Advocate	Forth, Lynnette		X			
Savanna, City of	Stebbins, Larry	X	X	X	X	X
Shannon, Village of	DeMichele, Jason	X	X	X	X	
Shannon Fire Protection District	Klinefelter, Jim	X				
Stephenson Co. - EMA	Groves, Terry			X		
Thomson, Village of	Balk, Beth	X	X	X	X	X
	Hebeler, Jerry			X		
Thomson Fire Protection District	Iben, Gary				X	X
West Carroll CUSD #314	Mathers, Craig	X	X	X		
Weather Reporter	Acker, Larry			X	X	X
	Getz, Leroy					X
Whiteside Co. - ESDA	Buhler, Doug			X		

Planning Committee Meetings

The Planning Committee met five times between February, 2012 and December, 2012. **Figure 6** identifies the representatives present at each meeting. **Appendices B** and **C** contain copies of the sign-in sheets and meeting minutes for each meeting. The purpose of each meeting, including the topics discussed, is provided below.

First Planning Committee Meeting – February 2, 2012

The purpose of this meeting was to explain the planning process to the Planning Committee members and give them a brief overview on what a natural hazards mitigation plan is and why one should be prepared. Drafts of the mission statement and mitigation goals were presented. Representatives for the County and the participating jurisdictions were asked to complete the forms entitled “List of Existing Planning Documents” and “Critical Facilities” and return them at the next meeting. Copies of a hazard events questionnaire and citizen questionnaire were also distributed.

Second Planning Committee Meeting – March 29, 2012

At the second Planning Committee meeting the natural hazard risk assessment section was presented for review. Committee members were asked to think about whether any critical facilities have been damaged by a natural hazard event within their jurisdiction. The Planning Committee continued their discussions on the mission statement and mitigation goals and finalized both. Ideas for potential mitigation projects were presented. Representatives for the County and the participating jurisdictions were asked to complete the forms entitled “Critical Facilities Damaged by Natural Hazard Events” and “Hazard Mitigation Projects” and return them at the next meeting.



Third Planning Committee Meeting – May 24, 2012

The purpose of the third Planning Committee meeting was to review the mitigation actions identified by the participating jurisdictions and discuss the mitigation strategy. The mitigation strategy discussion focused on the project prioritization methodology and categories of mitigation actions. Sections of the Plan focusing on the vulnerability assessment were presented for review.

Fourth Planning Committee Meeting –September 27, 2012

At the fourth meeting the sections of the Plan focusing on the mitigation strategy and plan maintenance were presented for review. In addition, the mitigation action tables were completed for each participating jurisdiction and distributed for review. The tables listed all of the mitigations actions identified and prioritized them using the approved project prioritization methodology.

Fifth Planning Committee Meeting – December 13, 2012

The purpose of the fifth Planning Committee meeting was to provide the public an opportunity to provide comments on the draft Plan.

2.2 PUBLIC INVOLVEMENT

To engage the public in the planning process, a comprehensive public involvement strategy was developed. The strategy was structured to engage the public in a two-way dialogue, encouraging the exchange of information throughout the planning process. A mix of public involvement techniques and practices were utilized to:

- disseminate information;
- identify additional useful information about natural hazard occurrences and impacts;
- assure that interested residents would be involved throughout the Plan's development; and
- nurture ownership of the Plan, thus increasing the likelihood of adoption by the participating jurisdictions.

The dialogue with the public followed proven risk communication principles to help assure clarity and avoid overstating or understating the impacts posed by the natural hazards identified in the Plan. The following public involvement techniques and practices were applied to give the public an opportunity to access information and participate in the dialogue at their level of interest and availability.

Citizen Questionnaire

A citizen questionnaire was created to gather facts and gauge public perceptions about natural hazards. The questionnaire was made available at the government offices of participating jurisdictions. A copy of the questionnaire is contained in **Appendix D**.

A total of 25 questionnaires were completed and returned to the Planning Committee. The questionnaires were filled out by residents of unincorporated Carroll County as well as all of the participating municipalities. While fewer questionnaires were returned than has been experienced using similar techniques with virtually the same survey in other counties, the responses should provide useful information to decision makers as they deliberate how best to disseminate information about natural hazards and how residents can protect themselves and their property.

Additionally, these results provide an indication of countywide sentiment as to the types of projects that are more likely to receive public support. A review of the questionnaires indicated the following:

- Severe storms (thunderstorms, hail, lightning and heavy rain) and severe winter storms have been the most frequently encountered natural hazards in Carroll County. This response is consistent with weather records compile for Carroll County and described in this Plan.
- Electronic media (television, internet and radio) and print media were identified as the most effective ways to disseminate information about natural hazards. Of the electronic

media choices, television was recognized as the most favored means of dissemination followed closely by the internet. Fact sheets distributed via mail through municipalities, the county and fire and law enforcement departments also received strong support among respondents.

- Five categories of mitigation projects and activities were felt to be most needed. The following identifies each category and provides the percentage of support received:
 - ❖ provide flood or drainage protection (76%) – the respondents who selected this category felt that culverts and drainage ditch maintenance and dam or levee construction/maintenance were the most needed activities, followed closely by hydraulic studies to determine the cause of drainage problems;
 - ❖ maintain power during storms by burying power lines, trimming trees, and/or purchase backup generators (68%);
 - ❖ retrofit critical infrastructure (64%);
 - ❖ install sirens or other alert systems (52%); and
 - ❖ disseminate public information materials (52%).

The next closest category was maintain roadway passage during winter storms and heavy rain which received 44% of the respondents support.

FAQ Fact Sheet

A “Frequently Asked Questions” fact sheet was created to explain what a natural hazard mitigation plan is and briefly explain the planning process. The fact sheet was made available at the government offices of participating jurisdictions. A copy of the fact sheet is contained in **Appendix E**.

News Releases

News releases were prepared and submitted to local print media prior to each Planning Committee meeting. The releases announced the purpose of the meetings and how the public could become involved in the Plan’s development. **Appendix F** contains a list of the newspapers that received the new releases and copies of the news articles that were printed.

Planning Committee Meetings

All of the meetings conducted by the Planning Committee were open to the public and publicized in advance to encourage public participation. At the end of each meeting, time was set aside for public comment. In addition, Committee members were available throughout the planning process to talk with residents and local government officials and were responsible for relaying any concerns and questions voiced by the public to the Planning Committee.

Public Forum

The final meeting of the Planning Committee, held on December 13, 2012, was conducted as an open-house public forum. The open-house format was chosen for this forum instead of a hearing to provide greater convenience for residents who wished to participate. Residents were able to come and go at any time during the forum, reducing conflicts with business, family, and social activities.

At the forum, residents could review the draft Plan; meet with representatives from the County, participating municipalities and the Consultant to discuss the Plan; ask any questions; and provide comments on the Plan. Individuals attending the public forum were provided with a two-page handout summarizing the planning process and a comment sheet that could be used to provide feedback on the draft Plan. **Appendices G and H** contain copies of these materials.

Public Comment Period

After the public forum, the draft Plan was made available for public review and comment through December 28, 2012 at the Carroll County Courthouse. Residents were encouraged to submit their comments electronically, by mail or through representatives of the Planning Committee.

Results of Public Involvement

The public involvement strategy implemented during the planning process created a dialogue among participants and interested residents which resulted in many benefits, a few of which are highlighted below.

- *Discovered previously unidentified documentation about natural hazards.* Verifiable hazard event and damage information was obtained from participants that presents a clearer assessment of the extent and magnitude of natural hazards that have impacted the County. This information included damage estimates for thunderstorms with damaging winds, hail and severe winter storms. Photographs of storm damage were provided by Leroy Getz, the Carroll County Highway Department, the Carroll County Health Department and the Mayor of Savanna.
- *Obtained critical facilities damage information.* Data collection surveys soliciting information about critical facilities damaged by severe storms and other natural hazards were used to supplement information obtained from government databases. This information was used in the preparation of the vulnerability assessment.
- *Increased awareness of the impacts associated with natural hazard events within the County.* Understanding how mitigation actions can reduce risk to life and property helped generate potential projects at the local level that had not been previously considered.

2.3 PARTICIPATION OPPORTUNITIES FOR INTERESTED PARTIES

Businesses, schools, not-for-profit organizations, neighboring counties, and other interested parties were provided multiple opportunities to participate in the planning process. Wide-reaching applications were combined with direct, person-to-person contacts to reach anyone who might have an interest or possess information which could be helpful in developing the Plan.

Business Community

Assertive outreach to the business community began early in the planning process. Contact with local chambers of commerce was initiated through telephone calls and direct mail. These contacts clearly described the value of mitigation planning to various kinds of business based on this message: “maintaining business operations after a natural hazard event strikes begins before the hazard hits with mitigation planning.” How customers and employees are impacted can make the difference between staying in business and closing. Information packets were sent to

the Mount Carroll Chamber of Commerce and the Savanna Chamber of Commerce and included a letter from Greg Miller, Carroll County ESDA Coordinator, a fact sheet describing the ease and various opportunities for businesses to have input, and an American Red Cross brochure designed specifically for businesses describing how employees, customers, and the business facility can be protected from natural hazard events. **Appendix I** contains copies of these materials.

Representatives from those segments of the business community who had the most interest in natural hazard mitigation were invited to serve on the Planning Committee. Agriculture is the dominant business in Carroll County. Virtually every aspect of life in Carroll County is affected by agriculture. Consequently, input was sought from the agricultural community which responded positively to being involved. The Carroll County Farm Bureau hosted all planning meetings and served on the Planning Committee.

Input from the insurance industry was also needed to provide balance and context for discussions on property damages, not only to agriculture, but also to residences. Input from the insurance industry was useful when having discussions with the Mayor of Savanna and IEMA about mitigation projects that could prevent damages to downtown businesses, especially from flooding. An experienced and well respected local insurance agent represented the insurance industry and his perspectives on storm damages were invaluable to the development of the Plan.

Schools

Three school districts serve Carroll County: Chadwick-Milledgeville CUSD #399, Eastland CUSD #308 and West Carroll CUSD #314. Outreach to these school districts resulted in Eastland and West Carroll actively participating on the Planning Committee. A separate small group meeting was held in August, 2012 with the school district superintendents to discuss mitigation measures.

Not-For-Profit Organizations

The American Red Cross served on the planning committee. The representative, Scott Allshouse, also works with the Salvation Army. He has exceptional experience in mitigation and emergency management in Carroll County and throughout northwestern Illinois. With his background, he was able to provide a considerable amount of input.

The Blackhawk Hills Regional Council, located in adjacent Whiteside County, is a not-for-profit organization that provides community planning, natural resource protection, and grant writing services to northwestern Illinois. Their planning documents provided information useful in the development of this Plan.

Neighboring Counties

The EMA/ESDA offices in neighboring counties have worked cooperatively on various emergency management activities. An announcement was sent to EMA/ESDA offices in all of the neighboring counties inviting participation in the mitigation planning process. **Appendix J** contains a copy of the invitation memo. Doug Buhler, Whiteside County ESDA Coordinator and Terry Groves, Stephenson County EMA Director attended the May 24, 2012 Planning Committee meeting. The Jo Daviess and Lee County ESDA Coordinators have worked

cooperatively with the Carroll County ESDA and reviewed draft copies of the Plan. In addition, at least two and perhaps all these counties intend to participate in Carroll County emergency planning activities that will be conducted in 2013.

2.4 INCORPORATING EXISTING PLANNING DOCUMENTS

As part of the planning process, each participating jurisdiction was asked to identify and provide existing documents (plans, studies, reports and technical information) relevant to the Plan. **Figure 7** summarizes the availability of existing planning documents by participating jurisdiction. These documents were reviewed and incorporated into the Plan whenever applicable.

Figure 7 Existing Planning Documents by Participating Jurisdiction								
Existing Planning Documents	Participating Jurisdiction							
	Carroll County	Chadwick	Lanark	Milledgeville	Mount Carroll	Savanna	Shannon	Thomson
Plans								
Comprehensive Plan	X	X		X	X	X		X
Emergency Management Plan	X	X	X	X		X		X
Land Use Plan	X				X	X		
Codes & Ordinances								
Building Codes						X		
Drainage Ordinances		X						X
Historic Preservation Ordinance					X			
Subdivision Ordinance(s)	X	X	X		X	X		X
Zoning Ordinances	X		X	X	X	X	X	X
Maps								
Existing Land Use Map	X	X				X		
Infrastructure Map		X	X			X	X	X
Zoning Map	X		X	X	X	X	X	X
Flood-Related								
Flood Ordinance(s)	X		X	X	X	X		
Flood Insurance Rate Maps	X		X	X	X	X		
Repetitive Flood Loss List	X					X		
Elevation Certificates for Buildings	X							

3.0 RISK ASSESSMENT

3.0 RISK ASSESSMENT

Risk assessment is the process of evaluating the vulnerability of people, buildings and infrastructure to natural hazards in order to estimate the potential loss of life, personal injury, economic injury and property damage resulting from natural hazards. This section summarizes the results of the risk assessment conducted on the natural hazards that pose a threat to Carroll County. The information contained in this section was gathered by evaluating local, state and federal records from the last 60 years.

This risk assessment identifies the natural hazards that pose a threat to the County and includes a profile of each which identifies past occurrences, the severity or extent of the hazard, and the likelihood of future occurrences. It also provides a vulnerability assessment which identifies the impacts to public health and property, evaluates the assets of the participating jurisdictions (i.e., residential buildings, critical facilities and infrastructure) and estimates the potential impacts each natural hazard would have on the health and safety of the residents as well as the buildings, critical facilities and infrastructure located within the County. Where applicable, the differences in vulnerability between participating jurisdictions are described.

One of the responsibilities of the Planning Committee was to decide which natural hazards to include in the Plan. Over the course of the first two Planning Committee meetings, the Planning Committee members discussed their experiences with natural hazard events and reviewed information about various natural hazards. After much discussion, they chose to include the following natural hazards in this Plan:

- ❖ severe storms (thunderstorms, hail, lightning & heavy rain)
- ❖ severe winter storms (snow, ice & extreme cold)
- ❖ floods
- ❖ tornadoes
- ❖ drought
- ❖ extreme heat
- ❖ earthquakes
- ❖ dams

The subsequent sections provide detailed information on each of the selected natural hazards. The sections are color-coded and ordered by the frequency with which the natural hazard has previously occurred within the County, starting with severe storms. Each natural hazard section contains three subsections: identifying the hazard, profiling the hazard and assessing vulnerability.

3.1 SEVERE STORMS (THUNDERSTORMS, HAIL, LIGHTNING & HEAVY RAIN)

IDENTIFYING THE HAZARD

What is the definition of a severe storm?

The National Oceanic and Atmospheric Administration's National Weather Service (NWS) defines a "severe storm" as any thunderstorm that produces one or more of the following:

- winds with gust of 50 knots (58 mph) or greater;
- hail that is at least one inch in diameter (quarter size) or larger; and/or
- a tornado.

While severe storms are capable of producing deadly lightning and excessive rainfall that may lead to flash flooding, the NWS does not use either to define a severe storm. However, a discussion of both lightning and heavy rain is included in this section because they both capable of causing extensive damage. For the purposes of this report, tornadoes and flooding are categorized as separate hazards and are not discussed under severe storms.

What is a thunderstorm?

A thunderstorm is a rain shower accompanied by lightning and thunder. An average thunderstorm is approximately 15 miles in diameter, affecting a relatively small area when compared to winter storms or hurricanes, and lasts an average of 30 minutes. Thunderstorms can bring heavy rain, damaging winds, hail, lightning and tornadoes.

There are four different types of thunderstorms: single cell storm, multicell cluster storm, multicell line storm (squall line) and supercell storm. The following provides a brief description of each.

Single Cell Storms

Single cell storms last 20-30 minutes and are not usually considered severe. A true single cell storm is actually quite rare because the leading edge of rain-cooled air (gust front) of one cell triggers the growth of another. Occasionally a single cell storm will become severe, but only briefly. When this happens, it is called a pulse severe storm. Pulse severe storms have the potential to produce small hail, brief damaging winds, heavy rainfall and weak tornadoes.

Multicell Cluster Storms

Multicell cluster storms are the most common type of thunderstorm. A multicell cluster storm consists of a group of cells, moving along as on unit. Each cell usually lasts about 20 minutes while the cluster itself may persist for several hours. This type of storm is usually more intense than a single cell storm, but is much weaker than a supercell storm. Multicell cluster storms can produce moderate size hail, flash floods and weak tornadoes.

Multicell Line Storms (Squall Line)

Multicell line storms, or squall lines, consist of a long line of storms with a continuous well-developed gust front. The line of storms can be solid or there can be gaps and breaks in the line. Multicell line storms are best known for producing strong damaging winds in the form of

downdrafts, but can also produce hail up to 1 ¾ inch in diameter, heavy rainfall, and weak tornadoes.

Supercell Storm

Supercell storms are highly organized thunderstorms that have one main current of rising air (updraft) which is extremely strong, reaching estimated speeds of 150 to 175 miles per hour. The main characteristic that sets a supercell storm apart from other thunderstorm types is the presence of rotation in the updraft. The rotating updraft of a supercell (called a mesocyclone when visible on radar) helps a supercell storm produce extreme weather events, such as giant hail (more than 2 inches in diameter) strong damaging winds in the form of downbursts (with speeds of 80 miles an hour or more) and strong to violent tornadoes. While supercell storms are rare, they pose a high threat to life and property.

Despite their size, all thunderstorms are dangerous and capable of threatening life and property. Of the estimated 100,000 thunderstorms that occur each year in the United States, roughly 10% are classified as severe.

What kinds of damaging winds are produced by a thunderstorm?

Aside from tornadoes, thunderstorms can produce straight-line winds. A straight-line wind is defined as any wind produced by a thunderstorm that is not associated with rotation. There are several types of straight-line winds including downdrafts, downbursts, microbursts, gust fronts, derechos and bow echoes.

Damage from straight-line winds is more common than damage from tornadoes and accounts for most thunderstorm wind damage. Straight-line wind speeds can exceed 87 knots (100 mph), produce a damage pathway extending for hundreds of miles and can cause damage equivalent to a strong tornado. These winds can also be extremely dangerous for aircrafts.

The NWS measures a storm’s wind speed in knots or nautical miles. A wind speed of one knot is equal to approximately 1.15 miles per hour. **Figure 8** shows conversions from knots to miles per hour for various wind speeds.

Figure 8 Wind Speed Conversions			
Knots (kts)	Miles Per Hour (mph)	Knots (kts)	Miles Per Hour (mph)
50 kts	58 mph	60 kts	69 mph
52 kts	60 mph	65 kts	75 mph
55 kts	63 mph	70 kts	81 mph
58 kts	67 mph	80 kts	92 mph

What is hail?

Hail is precipitation in the form of spherical or irregular-shaped pellets of ice that occur within a thunderstorm when strong rising currents of air (updrafts) carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice. There are two ideas about how hail is formed. In the past, the prevailing thought was that hailstones grew by colliding with supercooled water drops. The supercooled water drops would freeze on contact with ice crystals,

frozen rain drops, dust, etc. Thunderstorms with strong updrafts would continue lifting the hailstones to the top of the cloud where it would encounter more supercooled water and continue to grow. Eventually the hail would become too heavy to be supported by the updraft and would fall to the ground.

Recent studies, however, suggest that supercooled water may accumulate on frozen particles near the back side of the storm as the particles are pushed forward, across and above the updrafts by the prevailing winds near the top of the storm. Eventually the hailstones encounter rapidly sinking columns of air (downdrafts) and fall to the ground.

In the United States, hail annually causes more than \$1 billion in damages. Much of the damage done by hail is to crops, although it can damage buildings and homes as well as automobiles and landscaping. Hail has been known to cause injuries to individuals, but is very rarely fatal.

How is the severity of a hail event measured?

The severity or magnitude of a hail event is measured in terms of the size (diameter) of the hailstones. The hail size is estimated by comparing it to known objects. **Figure 9** provides descriptions for various hail sizes.

Figure 9 Hail Size Descriptions			
Hail Diameter (inches)	Description	Hail Diameter (inches)	Description
0.25 in.	pea	1.75 in.	golf ball
0.50 in.	marble/mothball	2.50 in.	tennis ball
0.75 in.	penny	2.75 in.	baseball
0.88 in.	nickel	3.00 in.	tea cup
1.00 in.	quarter	4.00 in.	grapefruit
1.50 in.	ping pong ball	4.50 in.	softball

Source: NOAA, National Severe Storm Laboratory.

Hail size can vary widely. Hailstones may be as small as 0.25 inches in diameter (pea-sized) or, under extreme circumstances, as large as 4.50 inches in diameter (softball-sized). Typically hail that is 1 inch in diameter (quarter-sized) or larger is considered severe.

The severity of a hail event can also be measured or rated using the TORRO Hailstorm Intensity Scale. This scale was developed in 1986 by the Tornado and Storm Research Organisation of the United Kingdom. It measures the intensity or damage potential of a hail event based on several factors including: maximum hailstone size, distribution, shape and texture, numbers, fall speed and strength of the accompanying winds.

The Hailstorm Intensity Scale identifies ten different categories of hail intensity, H0 through H10. **Figure 10** gives a brief description of each category. This scale is unique because it recognizes that, while the maximum hailstone size is the most important parameter relating to structural damage, size alone is insufficient to accurately categorize the intensity and damage potential of a hail event.

Figure 10 TORRO Hailstorm Intensity Scale					
Intensity Category		Typical Hail Diameter		Description	Typical Damage Impacts
		millimeters (approx.)*	inches (approx.)*		
H0	Hard Hail	5 mm	0.2"	pea	no damage
H1	Potentially Damaging	5-15 mm	0.2" – 0.6"	pea / mothball	slight general damage to plants, crops
H2	Significant	10-20 mm	0.4" – 0.8"	dime / penny	significant damage to fruit, crops, vegetation
H3	Severe	20-30 mm	0.8" – 1.2"	nickel / quarter	severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25-40 mm	1.0" – 1.6"	half dollar / ping pong ball	widespread glass damage, vehicle bodywork damage
H5	Destructive	30-50 mm	1.2" – 2.0"	golf ball	wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	40-60 mm	1.6" – 2.4"	golf ball / egg	bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	50-75 mm	2.0" – 3.0"	egg / tennis ball	severe roof damage, risk of serious injuries
H8	Destructive	60-90 mm	2.4" – 3.5"	tennis ball / tea cup	severe damage to aircraft bodywork
H9	Super Hailstorms	75-100 mm	3.0" – 4.0"	tea cup / grapefruit	extensive structural damage, risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	> 100 mm	> 4.0"	softball	extensive structural damage, risk of severe or even fatal injuries to persons caught in the open

* Approximate range since other factors (i.e., number and density of hailstones, hail fall speed and surface wind speed) affect severity.

Source: Tornado and Storm Research Organisation, TORRO Hailstorm Intensity Scale Table.

It should be noted that the typical damage impacts associated with each intensity category reflect the building materials predominately used in the United Kingdom. These descriptions may need to be modified for use in other countries to take into account the differences in building materials typically used (i.e., whether roofing materials are predominately shingle, slate or concrete, etc.).

What is lightning?

Lightning, a component of all thunderstorms, is a visible electrical discharge that results from the buildup of charged particles within storm clouds. It can occur from cloud-to-ground, cloud-to-cloud, within a cloud or cloud-to-air. The air near a lightning strike is heated to approximately 50,000°F (hotter than the surface of the sun). The rapid heating and cooling of the air near the lightning strike causes a shock wave that produces thunder.

Lightning on average causes 60 fatalities and 300 injuries annually in the United States. Most fatalities and injuries occur when people are caught outdoors in the summer months. In addition, lightning can cause structure and forest fires. Many of the wildfires in the western United States and Alaska are started by lightning. While it is difficult to quantify lightning-related losses,

NOAA's National Severe Storms Laboratory estimates that lightning causes \$4 to \$5 billion in damages each year.

Are alerts issued for severe storms?

Yes. The National Weather Service Weather Forecast Office of the Quad Cities, Iowa/Illinois is responsible for issuing *severe thunderstorm watches* and *warnings* for Carroll County depending on the weather conditions. The following provides a brief description of each type of alert.

- **Watch.** A severe thunderstorm watch is issued when conditions are favorable for a severe thunderstorm to develop. The watch will tell individuals when and where a severe thunderstorm is likely to occur.
- **Warning.** A severe thunderstorm warning is issued when severe weather (i.e., hail 1 inch in diameter or greater and/or damaging winds of 58 miles or greater) has been reported by spotters or indicated on radar. Warnings indicate imminent danger to life and property for those who are in the path of the storm.

PROFILING THE HAZARD

When have severe storms occurred previously? What is the extent of these previous severe storms?

Figures 11, 12, 13, and 14, located at end of this section, summarize the previous occurrences as well as the extent or magnitude of severe storm events recorded in Carroll County. The severe storm events are separated into four categories: thunderstorms with damaging winds, hail, lightning and heavy rain. Severe storms are the most frequently occurring natural hazard in Carroll County.

Thunderstorms with Damaging Winds

The National Oceanic and Atmospheric Administration's Storm Events Database has documented 130 reported occurrences of thunderstorms with damaging winds in Carroll County between 1960 and 2011. Of the 130 occurrences, 101 had reported wind speeds of 50 knots or greater. There were 29 occurrences, however, where the wind speed was not recorded.

The highest wind speed recorded in Carroll County occurred at Chadwick on June 23, 1996 when winds reached 90 knots (104 mph) during a thunderstorm event. This same thunderstorm system also produced the second highest recorded wind speed at 80 knots (92 mph) at the Timber Lake campground southeast of Mount Carroll. Thunderstorms with damaging winds have impacted every municipality within the County on multiple occasions.

Severe Storms Fast Facts – Carroll County

Number of Thunderstorms with Damaging Winds (1960 – 2011): **130**

Number of Severe Hail Events (1960 – 2011): **24**

Highest Recorded Wind Speed: **90 knots (104 mph)**

Largest Hail Recorded: **3.00 inches in diameter**

Most Likely Month for Thunderstorms with Damaging Winds to Occur: **June**

Most Likely Month for Severe Hail to Occur: **April**

Most Likely Time for Thunderstorms with Damaging Winds to Occur: **Afternoon**

Most Likely Time for Severe Hail to Occur: **Afternoon**

Figure 15 charts the reported occurrences of thunderstorms with damaging winds in Carroll County by month. Eighty-four of the 130 events (65%) took place between June and August, making this the peak period for thunderstorms with damaging winds in Carroll County.

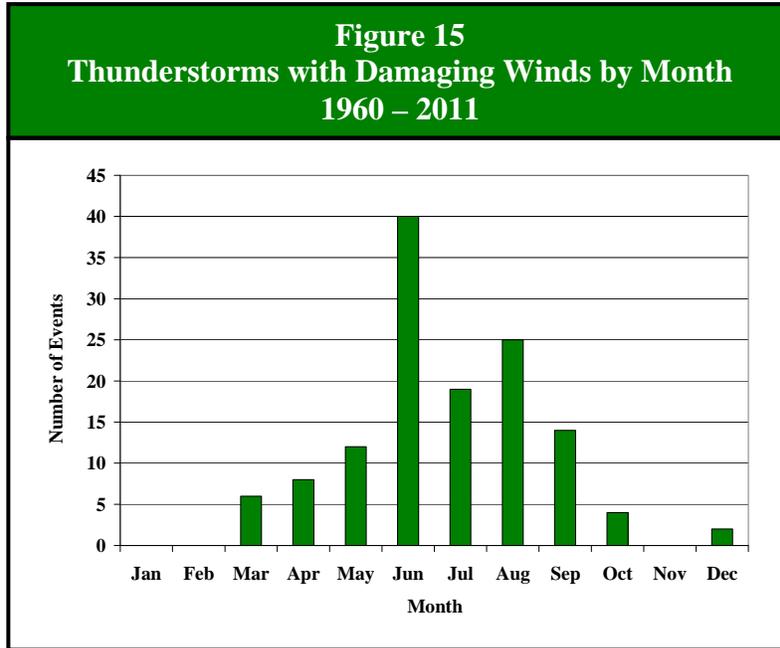
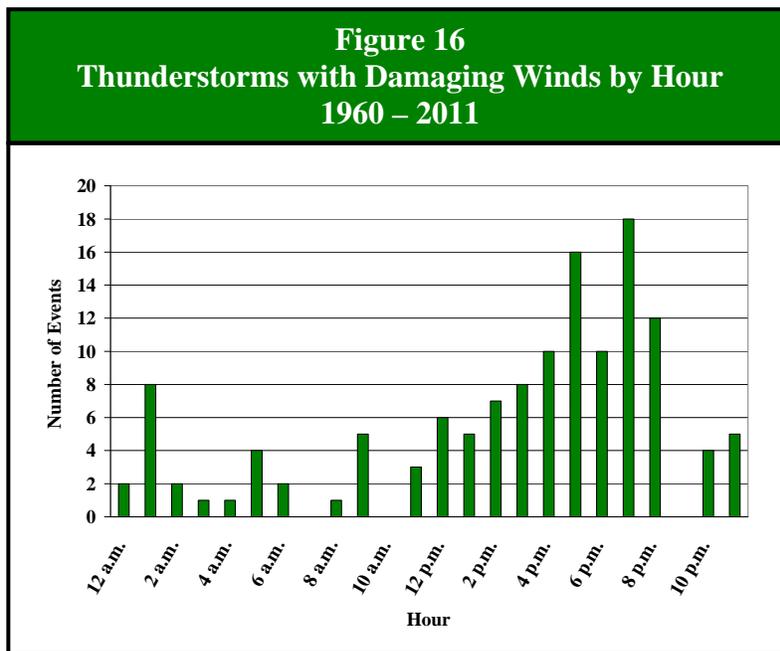


Figure 16 charts the reported occurrences of thunderstorms with damaging winds in Carroll County by hour. Approximately 78% of all thunderstorms with damaging winds occurred during the p.m. hours, with 66 of the events (51%) taking place between 4 p.m. and 8 p.m.



Hail

The Storm Events Database has documented 24 reported occurrences of severe storms with hail that caused significant damage and/or was one inch in diameter or greater in Carroll County between 1960 and 2011. Of the 24 occurrences, eight produced hailstones 1.50 inches or larger in diameter. The largest hail documented in Carroll County measured 3.00 inches in diameter (tea cup-sized) and fell on July 26, 1978 in Lanark. Hail one inch in diameter or greater has occurred at least once in every municipality within the County.

Figure 17 charts the reported occurrences of hail in Carroll County by month. Sixteen of the 24 events (67%) took place between April and June. Of the 16 hail events, seven occurred during April.

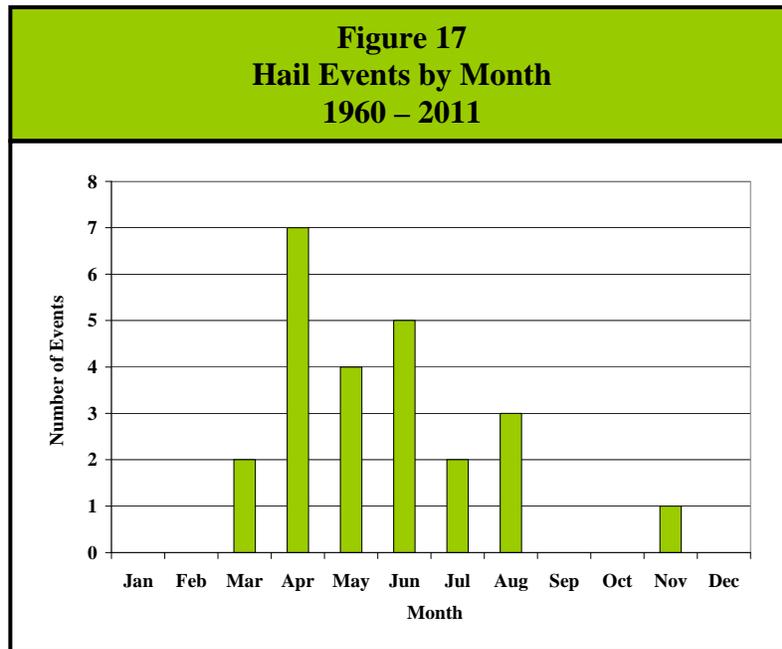


Figure 18 charts the reported occurrences of hail in Carroll County by hour. Approximately 75% of all hail events occurred during the p.m. hours, with 11 of the events (46%) taking place between 5 p.m. and 8 p.m.

Lightning

The Storm Events Database has documented four reported occurrences of lightning strikes in Carroll County between 1996 and 2011. Property damage was sustained during three of the four strikes.

Heavy Rain

The Storm Events Database has documented 20 reported occurrences of heavy rain in Carroll County between 1993 and 2011. Of the 20 occurrences, magnitudes were unavailable for nine events. Of the remaining 11 heavy rain events with recorded rainfall totals, 10 events (91%) produced at least three inches of rain. Flash flooding and nuisance street flooding resulted from 15 of the 20 heavy rain events, with one of the events leading to historic flash flooding.

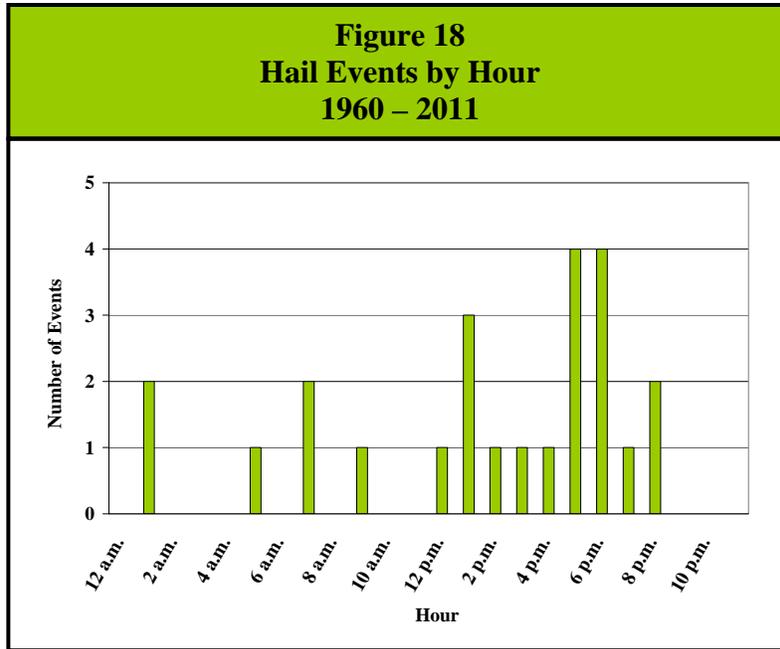


Figure 19 charts the reported occurrences of heavy rain in Carroll County by month. Of the 20 events, 18 (90%) took place between May and July. Of the 18 heavy rain events, nine occurred during July, making this the peak month for heavy rain in Carroll County.

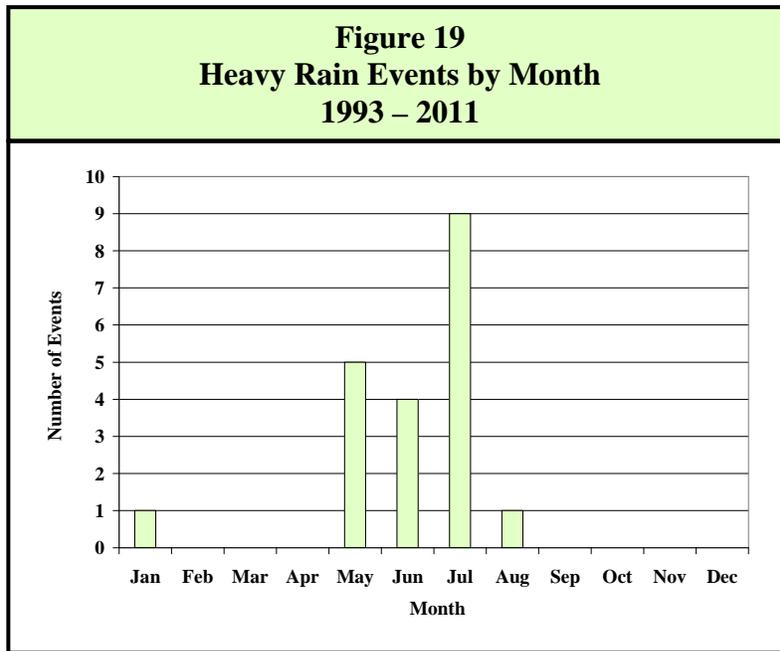
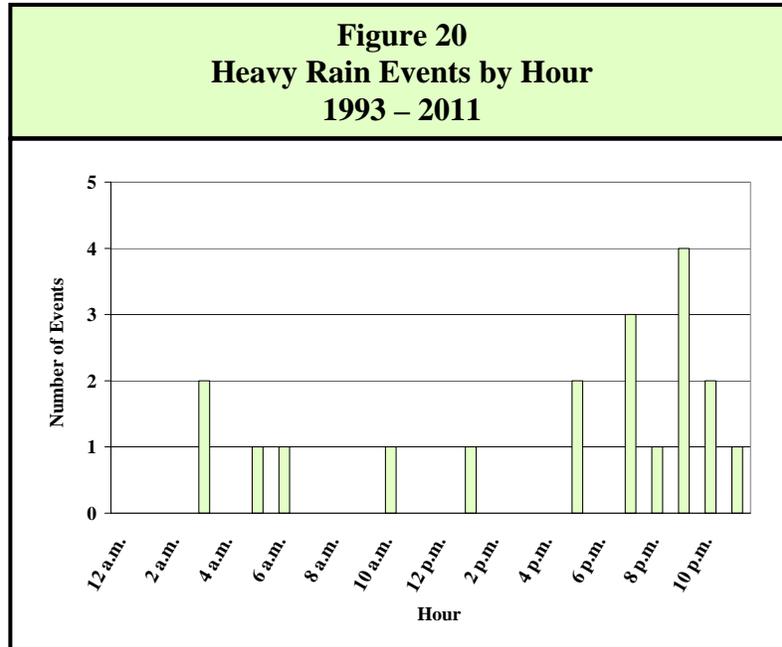


Figure 20 charts the reported occurrences of heavy rain in Carroll County by hour. Of the 20 occurrences, start times were unavailable for one event. Of the remaining 19 events with recorded times, approximately 74% occurred during the p.m. hours. Eleven of the events (58%) took place between 7 p.m. and 12 a.m. (midnight).



What locations are affected by severe storms?

Severe storms affect the entire County. A single severe storm event will generally extend across the entire County and affect multiple locations. The 2010 Illinois Natural Hazard Mitigation Plan prepared by the Illinois Emergency Management Agency (IEMA) classifies Carroll County’s hazard rating for severe storms as “severe.” (IEMA’s hazard rating system has five levels: low, guarded, elevated, high and severe.)

What is the probability of future severe storm events occurring?

Carroll County has had 130 verified occurrences of thunderstorms with damaging winds between 1960 and 2011. With 130 occurrences over the past 52 years, Carroll County should expect to experience at least two thunderstorms with damaging winds each year. There were 18 years over the last 52 years where multiple (three or more) thunderstorms with damaging winds occurred. This indicates that the probability that multiple thunderstorms with damaging winds may occur during any given year within the County is 35%.

There have been 24 verified occurrences of hail that caused significant damage and/or was one inch in diameter or greater between 1960 and 2011. With 24 occurrences over the past 52 years, the probability or likelihood of a severe storm with hail occurring somewhere in Carroll County in any give year is 46%. There were five years over the last 52 years where two or more hail events occurred. This indicates that the probability that more than one severe storm with hail may occur during any given year within the County is 10%.

ASSESSING VULNERABILITY

Are the participating jurisdictions vulnerable to severe storms?

Yes. All of Carroll County is vulnerable to the dangers presented by severe storms due to the topography of the region and its location in relation to the movement of weather fronts across northwestern Illinois. Since 2001, Carroll County has experienced 67 thunderstorm and high wind events, 18 heavy rain events, nine severe hail events and two lightning strike events.



Damage sustained to trees during a thunderstorm with high wind event.

Photo provided by Sally Marken.

Of the participating municipalities, Milledgeville, Mount Carroll and Savanna have had more recorded occurrences of thunderstorm and high wind events than any of the other municipalities while Thomson and Mount Carroll have had the highest number of recorded hail events. The difference in the number of events recorded may be due to the fact that these municipalities, with the exception of Thomson, are among the largest in the County; thus, resulting in more storm reports. **Figure 21** details the number of severe storm events by category for the participating municipality.

Figure 21 Verified Severe Storm Events by Participating Municipality				
Participating Municipality	Number of Events			
	Thunderstorm & High Wind	Hail	Lightning	Heavy Rain
Chadwick	13	2	1	1
Lanark	15	4	1	1
Milledgeville	24	4	0	2
Mount Carroll	29	5	2	6
Savanna	25	2	1	3
Shannon	17	1	0	2
Thomson	10	6	0	0*

* While no verified heavy rain events were recorded for this municipality, there have been multiple verified heavy rain events that have impacted the entire County.

What impacts resulted from the recorded severe storms?

Severe storms as a whole have caused an estimated \$256,500 in crop damage and \$3,314,817 in property damages and resulted in two injuries. The following provides a breakdown of impacts by category. While severe summer storms frequently occur in Carroll County, the number of injuries and deaths is relatively low. While there are no hospitals in Carroll County, there are nearby hospitals in Galena (Jo Daviess County), Freeport (Stephenson County), Dixon (Lee County), Sterling (Whiteside County) and Clinton, Iowa which are equipped to provide care to persons injured during a severe storm. Consequently, the risk or vulnerability to public health and safety from severe storms is low.

Thunderstorms and High Winds

The data provided by the Storm Events Database and community records indicates that between 1960 and 2011, 46 thunderstorm & high wind events caused approximately \$2,914,089 in property damage and \$256,500 in crop damage. Damage information was either unavailable or none was recorded for the remaining 84 reported occurrences.

Included in the property damage figures provided above, the Superintendent of the Eastland CUSD #308 estimated that a thunderstorm with high winds and lightning caused approximately \$38,000 in property damage to the chimney, roof and some equipment at the Eastland Middle School in Shannon on July 27, 2009.



A thunderstorm with high winds downed corn near Shannon on April 10, 2011.

Photo provided by Sally Marken.

The Storm Events Database records report two injuries as a result of a single thunderstorm and high wind event on June 28, 1998. The two individuals were injured after being hit by flying debris.

Hail

The data provided by the Storm Events Database and community records indicates that between 1960 and 2011, four hail events caused approximately \$159,120 in property damage. Of the \$159,120 in damages reported, Country Financial records identified \$131,120 in damages sustained in Lanark when hail measuring 0.88 inches in diameter (nickel size) fell on August 13, 2011. Damage information was either unavailable or none was recorded for the remaining 20 reported occurrences. No injuries or deaths were reported as a result of any of the hail events.



Large diameter hail has occurred on multiple occasions in Carroll County.

Photo provided by Sally Marken.

Lightning

The data provided by Storm Events Database indicates that between 1996 and 2011, three lightning events caused approximately \$90,000 in property damage. Damage information was either unavailable or none was recorded for the remaining event. Lightning strikes caused \$30,000 in damage to the Immanuel Lutheran Church in Mount Carroll on May 24, 1996, \$10,000 in damage to the St. Paul's Episcopal Church in Savanna on June 6, 1999 and \$50,000 in damage to a house in Lanark on April 5, 2010. No injuries or deaths were reported as a result of any of the lightning strike events.

Heavy Rain

The data provided by the Storm Events Database and community records indicates that between 1993 and 2011, eight heavy rain events caused approximately \$151,608 in property damage. The Carroll County Health Department and Country Financial were responsible for providing

damage numbers for six of the events, including the heavy rain events which preceded the historic flash flooding of July 24th and 25th, 2010. During the heavy rain events on July 23rd and 24th, 2010 the Carroll County Health Department and four physician’s offices lost over \$40,000 in vaccine due to prolonged power outages. Damage information was either unavailable or none was recorded for the remaining 12 reported occurrences. In addition, no injuries or deaths were reported as a result of these events.

What other impacts can result from severe storms?

In Carroll County, the greatest risk to health and safety from severe storms is vehicle accidents. Hazardous driving conditions resulting from severe storms (i.e., wet pavement, poor visibility, high winds, etc.) can contribute to accidents that result in injury and death. Traffic accident data assembled by the Illinois Department of Transportation between 2006 and 2010 indicates that wet road surface conditions were present for 10.2% to 15.8% of all crashes recorded annually in the County.

While other circumstances cause wet road surface conditions (i.e., melting snow, condensation, light showers, etc.), law enforcement officials agree that hazardous driving conditions caused by severe storms add to the number of crashes. **Figure 22** provides a breakdown by year of the number of crashes and corresponding injuries and deaths that occurred when wet road surface conditions were present as well as the total number of crashes that occurred in the County for comparison.

Figure 22 Severe Weather Crash Data for Carroll County				
Year	Total # of Crashes	Presence of Wet Road Surface Conditions		
		# of Crashes	# of Injuries	# of Deaths
2006	452	60	16	0
2007	494	54	29	0
2008	482	76	15	0
2009	314	47	13	0
2010	334	34	6	1

Source: Illinois Department of Transportation.

Are existing buildings, infrastructure and critical facilities vulnerable to severe storms?

Yes. All existing buildings, infrastructure and critical facilities located in Carroll County and the participating jurisdictions are vulnerable to damage from severe storms. Structural damage to buildings is a relatively common occurrence with severe storms. Damage to roofs, siding, awnings and windows can occur from hail, flying and falling debris and high winds. Lightning strikes can damage electrical components and equipment (i.e., appliances, computers etc.) and can cause fires that consume buildings. If the roof is compromised or windows are broken, rain can cause additional damage to the structure and contents of a building.

Infrastructure and critical facilities tend to be just as vulnerable to severe storm damage as buildings. The infrastructure and critical facilities that are the most vulnerable to severe storms are related to power distribution and communications. High winds, lightning and flying and

falling debris have the potential to cause damage to communication and power lines; power substations, transformers and poles; and communication antennas and towers.

The damage inflicted by severe storms often leads to disruptions in communication and creates power outages. Depending on the damage, it can take anywhere from several hours to several days to restore service. Power outages and disruptions in communications can impair vital services, particularly when backup power generators are not available. Most of the participating jurisdictions acknowledged the need for emergency backup generators to allow continued operation of critical facilities such as emergency shelters, drinking water facilities, water towers, lift stations and wastewater treatment facilities.



Lightning has the potential to cause serious damage to communication and electrical service in the area.

Photo provided by Sally Marken.

In addition to affecting power distribution and communications, debris and flooding from severe storms can block state and local roads hampering travel. When transportation is disrupted, emergency and medical services are delayed, rescue efforts are hindered and government services can be affected.

Based on the frequency with which severe storms occur in Carroll County, the amount of property damage previously reported and the potential for disruptions to power distribution and communication; the risk or vulnerability to buildings, infrastructure and critical facilities from severe storms is medium to high.

Are future buildings, infrastructure and critical facilities vulnerable to severe storms?

Yes. Only one of the participating jurisdictions, Savanna, has building codes in place that will likely help lessen the vulnerability of new buildings and critical facilities to damage from severe storms. Infrastructure such as new communication and power lines also will continue to be vulnerable to severe storms. High winds, lightning and flying and falling debris can disrupt power and communication. Steps to bury all new lines would eliminate the vulnerability, but this action would be cost prohibitive in most areas. There is very little that can be done to totally eliminate the vulnerability of new critical facilities.

What are the potential dollar losses to vulnerable structures from severe storms?

Unlike other hazards, such as flooding, there are no standard loss estimation models or methodologies for severe storms. With only 61 of the 178 recorded events listing property and crop damage numbers for severe storms, there is no way to accurately estimate future potential dollar losses. Since all structures within Carroll County are vulnerable to damage it is likely that there will be future dollar losses from severe storms.

**Figure 11
(Sheet 1 of 12)
Severe Storms – Thunderstorms with Damaging Winds Reported in Carroll County
1960 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Death	Property Damage	Crop Damage	Description
9/18/1960	10:00 p.m.	Savanna [^]	0 kts	0	0	\$0	\$0	
9/4/1965	5:15 p.m.	Savanna [^]	0 kts	0	0	\$0	\$0	
7/1/1967	12:30 p.m.	Mount Carroll [^]	0 kts	0	0	\$0	\$0	
8/10/1971	2:20 p.m.	Lanark [^]	52 kts	0	0	\$0	\$0	
9/21/1973	12:30 p.m.	Savanna	0 kts	0	0	\$0	\$0	
6/20/1974	4:55 p.m.	Savanna	52 kts	0	0	\$0	\$0	
6/20/1974	5:25 p.m.	Milledgeville	0 kts	0	0	\$0	\$0	
6/22/1974	8:00 a.m.	Chadwick	0 kts	0	0	\$0	\$0	
7/3/1974	6:02 p.m.	Savanna	52 kts	0	0	\$0	\$0	
12/14/1975	5:30 a.m.	Shannon	0 kts	0	0	\$0	\$0	
8/4/1980	5:30 p.m.	Lanark	0 kts	0	0	\$0	\$0	
8/4/1980	6:00 p.m.	Chadwick	0 kts	0	0	\$0	\$0	
8/4/1980	7:35 p.m.	Milledgeville	0 kts	0	0	\$0	\$0	
7/13/1981	9:00 a.m.	Shannon	0 kts	0	0	\$0	\$0	
8/14/1981	6:05 p.m.	Milledgeville	52 kts	0	0	\$0	\$0	
12/28/1982	12:30 a.m.	Lanark [^]	0 kts	0	0	\$0	\$0	
8/3/1983	7:00 p.m.	Chadwick [^]	0 kts	0	0	\$0	\$0	
9/5/1983	11:45 p.m.	Savanna	0 kts	0	0	\$0	\$0	
9/6/1983	12:10 a.m.	Shannon	0 kts	0	0	\$0	\$0	
6/26/1984	8:55 p.m.	Savanna	0 kts	0	0	\$0	\$0	
Subtotal:				0	0	\$0	\$0	

[^] Thunderstorm with damaging winds verified in the vicinity of this location(s).

**Figure 11
(Sheet 2 of 12)
Severe Storms – Thunderstorms with Damaging Winds Reported in Carroll County
1960 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Death	Property Damage	Crop Damage	Description
5/26/1985	5:30 p.m.	Lanark	0 kts	0	0	\$0	\$0	
9/22/1986	6:15 p.m.	Mount Carroll	55 kts	0	0	\$0	\$0	
5/8/1988	3:39 p.m.	Milledgeville	0 kts	0	0	\$0	\$0	
6/25/1989	5:37 p.m.	Thomson	0 kts	0	0	\$0	\$0	
4/27/1990	3:55 p.m.	Milledgeville	52 kts	0	0	\$0	\$0	
6/17/1990	1:30 a.m.	Mount Carroll	0 kts	0	0	\$0	\$0	
6/28/1990	3:04 p.m.	Mount Carroll	0 kts	0	0	\$0	\$0	
6/29/1990	1:30 a.m.	Thomson	0 kts	0	0	\$0	\$0	
7/2/1992	12:57 p.m.	Mount Carroll	0 kts	0	0	\$0	\$0	
6/14/1994	12:40 p.m.	Milledgeville	60 kts	0	0	\$0	\$0	winds blew trees down
4/18/1995	9:00 a.m.	Mount Carroll	0 kts	0	0	\$0	\$0	
5/10/1996	2:30 a.m.	Hazelhurst Milledgeville	60 kts	0	0	\$0	\$0	numerous trees down
6/23/1996	7:02 p.m.	Mount Carroll	60 kts	0	0	\$0	\$0	winds downed trees across the city
6/23/1996	7:10 p.m.	Mount Carroll [^]	80 kts	0	0	\$50,000	\$0	winds caused a great deal of damage to trees around Timber Lake campground and blocked many roads; one large tree landed on a 32 ft. motor home
6/23/1996	7:15 p.m.	Chadwick	90 kts	0	0	\$1,000,000	\$0	winds destroyed a large warehouse
6/23/1996	7:15 p.m.	Milledgeville	61 kts	0	0	\$0	\$0	winds downed or damaged many trees
Subtotal:				0	0	\$1,050,000	\$0	

[^] Thunderstorm with damaging winds verified in the vicinity of this location(s).

**Figure 11
(Sheet 3 of 12)
Severe Storms – Thunderstorms with Damaging Winds Reported in Carroll County
1960 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Death	Property Damage	Crop Damage	Description
7/17/1996	7:50 p.m.	Fairhaven [^]	52 kts	0	0	\$0	\$0	trees and power lines were downed near the Carroll-Whiteside County line
10/29/1996	4:52 p.m.	Mount Carroll [^]	60 kts	0	0	\$0	\$0	winds downed trees, blocking roads
4/5/1997	4:16 p.m.	Mount Carroll	50 kts	0	0	\$0	\$0	trees downed
8/4/1997	4:08 p.m.	Savanna	57 kts	0	0	\$0	\$0	
3/27/1998	8:12 p.m.	Savanna	58 kts	0	0	\$0	\$0	trees and power lines were down across IL 40 east of Savanna
3/27/1998	8:16 p.m.	Savanna	60 kts	0	0	\$0	\$0	large tree fell blocking Wacker Rd.
5/15/1998	7:28 p.m.	Shannon	56 kts	0	0	\$0	\$0	
5/28/1998	7:50 p.m.	countywide	52 kts	0	0	\$4,000	\$0	strong winds downed numerous trees and power lines; a roof was blown off a building 1 mile south of Mount Carroll; buildings were blown across the road between Thomson and Savanna
6/18/1998	5:00 p.m.	Milledgeville [^]	0 kts	0	0	\$500	\$0	winds downed several trees
Subtotals:				0	0	\$4,500	\$0	

[^] Thunderstorm with damaging winds verified in the vicinity of this location(s).

**Figure 11
(Sheet 4 of 12)
Severe Storms – Thunderstorms with Damaging Winds Reported in Carroll County
1960 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Death	Property Damage	Crop Damage	Description
6/28/1998	1:20 a.m.	Mount Carroll Lanark	65 kts	0	0	\$5,000	\$0	strong winds broke tree branches and uprooted large trees; a large oak broke a patio door and punched through the roof of a garage at Lake Carroll; in Lanark a large tree damaged a home and crushed a swing set
6/28/1998	1:28 a.m.	Savanna	0 kts	0	0	\$500	\$0	winds toppled trees causing minor property damage
6/28/1998	1:30 a.m.	Shannon	0 kts	2	0	\$8,000	\$0	winds blew down trees and power lines and ripped the roof off a small building; two people were injured after they were hit by debris
8/24/1998	11:10 a.m.	Savanna	70 kts	0	0	\$0	\$0	winds blew down trees, limbs and power lines; numerous homes and farms were damaged; several vehicles were smashed by falling trees and branches; thousands of acres of corn and soybeans were damaged or destroyed
8/24/1998	11:15 a.m.	Mount Carroll Lanark	74 kts	0	0	\$0	\$0	
8/24/1998	10:23 p.m.	Savanna [^] Mount Carroll [^]	56 kts	0	0	\$0	\$0	numerous trees and branches were downed by strong winds at Palisades State Park and Timber Lake campground
Subtotals:				2	0	\$13,500	\$0	

[^] Thunderstorm with damaging winds verified in the vicinity of this location(s).

**Figure 11
(Sheet 5 of 12)
Severe Storms – Thunderstorms with Damaging Winds Reported in Carroll County
1960 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Death	Property Damage	Crop Damage	Description
5/16/1999	11:15 p.m.	Shannon	0 kts	0	0	\$90,000	\$0	winds blew apart a hog shed which caused power lines to fall onto a barn, sparking a fire that resulted in the loss of the barn and 300 hogs
6/1/1999	4:05 p.m.	Savanna	54 kts	0	0	\$0	\$0	winds blew down several large trees
6/1/1999	4:10 p.m.	Lanark	58 kts	0	0	\$0	\$0	winds blew numerous tree limbs down; a grain leg was dumped onto a large storage bin
6/1/1999	5:00 p.m.	Thomson	52 kts	0	0	\$0	\$0	
6/6/1999	1:53 p.m.	Savanna	72 kts	0	0	\$0	\$0	several 15 inch diameter trees were uprooted
6/6/1999	2:15 p.m.	Shannon	65 kts	0	0	\$5,000	\$0	straight-line winds damaged a tavern and tore part of a roof off a restaurant
6/8/1999	12:55 p.m.	Mount Carroll [^]	61 kts	0	0	\$0	\$2,500	wind and hail damaged a number of corn fields , approx. 40% of the plants were broken off
Subtotals:				0	0	\$95,000	\$2,500	

[^] Thunderstorm with damaging winds verified in the vicinity of this location(s).

**Figure 11
(Sheet 6 of 12)
Severe Storms – Thunderstorms with Damaging Winds Reported in Carroll County
1960 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Death	Property Damage	Crop Damage	Description
9/11/2000	12:50 p.m.	countywide	52 kts	0	0	\$0	\$0	winds downed several trees and limbs
9/11/2000	6:47 p.m.	Mount Carroll	55 kts	0	0	\$0	\$0	winds downed a tree on IL 64 at Center Hill; trees were also down on North Clay St. and on Jackson St.
9/11/2000	6:50 p.m.	Mount Carroll	52 kts	0	0	\$0	\$0	numerous trees were down
9/11/2000	8:00 p.m.	Mount Carroll	0 kts	0	0	\$25,000	\$0	windows were blown out of a building showroom; a corn auger was blown onto power lines
9/11/2000	8:13 p.m.	Mount Carroll	52 kts	0	0	\$0	\$0	trees were down on Rte 64 east of Mount Carroll and along Carroll and Center streets in Mount Carroll
6/14/2001	6:07 p.m.	Mount Carroll	52 kts	0	0	\$0	\$0	winds blew a tree down over IL 78 and downed power lines
6/14/2001	6:08 p.m.	Mount Carroll [^]	52 kts	0	0	\$0	\$0	winds destroyed a large machine shed and snapped large tree limbs
9/7/2001	6:20 p.m.	Savanna	52 kts	0	0	\$0	\$0	winds downed trees and limbs
7/8/2002	7:14 p.m.	Chadwick Lanark	61 kts	0	0	\$0	\$0	numerous trees were blown down
7/28/2002	10:30 p.m.	Mount Carroll Savanna	52 kts	0	0	\$0	\$0	trees were blown down
8/12/2002	7:30 p.m.	Mount Carroll [^]	52 kts	0	0	\$0	\$0	winds blew a large tree onto IL 78 north of Timberlake Rd.
Subtotals:				0	0	\$25,000	\$0	

[^] Thunderstorm with damaging winds verified in the vicinity of this location(s).

Figure 11
(Sheet 7 of 12)
Severe Storms – Thunderstorms with Damaging Winds Reported in Carroll County
1960 – 2011

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Death	Property Damage	Crop Damage	Description
7/5/2003	2:49 a.m.	Shannon	52 kts	0	0	\$10,000	\$200,000	numerous limbs down; a house under construction had the roof torn off
7/20/2003	11:20 p.m.	Savanna [^]	52 kts	0	0	\$0	\$0	winds blew tree limbs down onto IL 84
5/23/2004	3:20 a.m.	Savanna [^]	57 kts	0	0	\$10,000	\$0	winds blew several very large trees down and damaged a carport in Carroll Heights subdivision on the bluffs east of Savanna
5/31/2004	2:36 p.m.	Lanark	52 kts	0	0	\$5,000	\$0	winds blew six trees down along with several power lines
8/3/2004	7:00 p.m.	Marcus	57 kts	0	0	\$5,000	\$2,000	large tree limbs were downed on IL 84
3/30/2005	2:53 p.m.	Chadwick [^]	52 kts	0	0	\$1,500	\$0	winds blew trees down on IL 78 between Argo and Vinegar Hill Roads
3/30/2005	3:07 p.m.	Lanark [^]	52 kts	0	0	\$1,500	\$0	winds blew trees down on IL 64 just west of Otter Creek Rd.
3/30/2005	3:13 p.m.	Shannon	52 kts	0	0	\$2,000	\$0	winds blew power lines down
6/4/2005	10:19 p.m.	Mount Carroll	52 kts	0	0	\$1,000	\$0	winds blew trees down
8/19/2005	11:02 p.m.	Milledgeville	57 kts	0	0	\$3,000	\$0	winds downed limbs 8" to 10" diameter and pushed in a garage door
8/19/2005	11:02 p.m.	Thomson	52 kts	0	0	\$7,000	\$0	a tree came down on a camper
9/13/2005	3:10 p.m.	Chadwick	52 kts	0	0	\$0	\$0	numerous tree branches were downed
Subtotals:				0	0	\$46,000	\$202,000	

[^] Thunderstorm with damaging winds verified in the vicinity of this location(s).

**Figure 11
(Sheet 8 of 12)
Severe Storms – Thunderstorms with Damaging Winds Reported in Carroll County
1960 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Death	Property Damage	Crop Damage	Description
5/1/2006	3:47 p.m.	Shannon	57 kts	0	0	\$1,500	\$0	winds destroyed a metal shed
7/17/2006	8:10 p.m.	Shannon [^]	52 kts	0	0	\$2,000	\$2,000	winds downed a tree at the junction of Shannon and Locust Roads
7/17/2006	8:13 p.m.	Lanark	57 kts	0	0	\$3,000	\$0	winds blew trees down, blocking roads
8/10/2006	6:05 a.m.	Fairhaven [^]	52 kts	0	0	\$2,000	\$0	winds blew down limbs 6" to 12" diameter on a farm
8/10/2006	6:20 a.m.	Milledgeville [^]	52 kts	0	0	\$2,000	\$0	winds blew down 6" to 8" diameter limbs on the west side of IL 40
3/31/2007	5:05 p.m.	Savanna	52 kts	0	0	\$0	\$0	trees down across a road
6/1/2007	2:05 p.m.	Mount Carroll [^]	61 kts	0	0	\$0	\$0	tree were blown down on Funk Rd. northeast of Mount Carroll
6/1/2007	2:40 p.m.	Milledgeville [^]	52 kts	0	0	\$1,000	\$0	power lines were blown down
7/18/2007	7:40 p.m.	Savanna [^]	56 kts	0	0	\$0	\$0	wind blew down a tree onto IL 84 between Thomson and Savanna
7/18/2007	7:51 p.m.	Thomson [^]	61 kts	0	0	\$0	\$0	winds blew down several trees onto IL 84 just south of Thomson
7/18/2007	8:05 p.m.	Mount Carroll	56 kts	0	0	\$5,000	\$0	winds blew down several trees on Cory Rd.; some fuse boxes were damaged
7/18/2007	8:05 p.m.	Savanna	56 kts	0	0	\$0	\$0	winds blew down several trees onto Chicago Ave.
Subtotals:				0	0	\$16,500	\$2,000	

[^] Thunderstorm with damaging winds verified in the vicinity of this location(s).

**Figure 11
(Sheet 9 of 12)
Severe Storms – Thunderstorms with Damaging Winds Reported in Carroll County
1960 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Death	Property Damage	Crop Damage	Description
8/22/2007	1:15 a.m.	Mount Carroll	52 kts	0	0	\$0	\$0	winds blew down some branches in Mount Carroll
8/22/2007	1:15 a.m.	Savanna	61 kts	0	0	\$10,000	\$0	winds blew down trees and branches in Savanna with some landing on power lines and across Scenic Bluff Rd.; one tree fell on a car
8/22/2007	1:35 a.m.	Shannon	52 kts	0	0	\$0	\$0	winds blew down branches in Shannon
9/30/2007	8:30 p.m.	Mount Carroll	60 kts	0	0	\$0	\$0	winds blew a tree down on Clay St.
6/8/2008	9:10 a.m.	Chadwick [^]	56 kts	0	0	\$0	\$0	winds blew down several 6" diameter branches just north of Chadwick
6/8/2008	9:10 a.m.	Chadwick [^]	61 kts	0	0	\$25,000	\$0	winds blew a tree onto a house 4 miles southwest of Chadwick
6/8/2008	9:13 a.m.	Thomson [^]	52 kts	0	0	\$0	\$0	winds blew down several 3" diameter tree branches 2.5 miles northwest of Thomson
6/12/2008	5:20 p.m.	Thomson [^] Chadwick [^]	56 kts	0	0	\$0	\$0	winds blew down a large tree on Thomson Rd. just each of Thomson
6/12/2008	5:25 p.m.	Milledgeville [^]	56 kts	0	0	\$0	\$0	wind blew down 6 – 8" to 10" diameter tree limbs
6/12/2008	6:00 p.m.	Milledgeville [^]	52 kts	0	0	\$0	\$0	winds blew down some 2" diameter tree branches
Subtotals:				0	0	\$35,000	\$0	

[^] Thunderstorm with damaging winds verified in the vicinity of this location(s).

**Figure 11
(Sheet 10 of 12)
Severe Storms – Thunderstorms with Damaging Winds Reported in Carroll County
1960 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Death	Property Damage	Crop Damage	Description
7/2/2008	2:16 p.m.	Shannon	52 kts	0	0	\$0	\$0	winds blew down numerous tree branches, some 4" in diameter
7/31/2008	11:40 a.m.	Lanark [^]	56 kts	0	0	\$0	\$0	
8/4/2008	5:00 p.m.	Savanna [^] Shannon [^]	65 kts	0	0	\$100,000	\$0	winds blew down numerous trees and power lines across the county; power outages were observed
8/4/2008	5:20 p.m.	Milledgeville [^]	52 kts	0	0	\$0	\$0	8 trees were blown down at the county fairgrounds, some of which landed on cars; winds blew down some trees and branches in the vicinity of Milledgeville; a power outage was observed;
8/4/2008	5:30 p.m.	Milledgeville [^]	52 kts	0	0	\$0	\$0	
8/4/2008	5:50 p.m.	Milledgeville [^]	56 kts	0	0	\$5,000	\$0	winds blew down some large branches and power lines
6/27/2009	4:22 p.m.	Marcus [^]	61 kts	0	0	\$35,396	\$0	winds blew down some trees and branches 4 miles north of Savanna; a power outage was observed
6/27/2009	4:37 p.m.	Lanark [^]	52 kts	0	0	\$0	\$0	
6/27/2009	4:48 p.m.	Chadwick [^]	56 kts	0	0	\$0	\$50,000	winds flattened a corn field 3 miles west southwest of Chadwick
7/27/2009	8:44 p.m.	Shannon [^]	52 kts	0	0	\$39,642	\$0	winds and a lightning strike damaged a chimney, the roof and equipment at the Eastland Middle School
Subtotals:				0	0	\$180,038	\$50,000	

[^] Thunderstorm with damaging winds verified in the vicinity of this location(s).

**Figure 11
(Sheet 11 of 12)
Severe Storms – Thunderstorms with Damaging Winds Reported in Carroll County
1960 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Death	Property Damage	Crop Damage	Description
4/5/2010	7:45 p.m.	Milledgeville [^]	61 kts	0	0	\$0	\$0	winds uprooted 3 foot diameter trees north of the Village
4/5/2010	7:45 p.m.	Milledgeville [^]	52 kts	0	0	\$100,000	\$0	winds damaged some outbuildings west of the Village
4/5/2010	7:55 p.m.	Milledgeville [^]	61 kts	0	0	\$50,000	\$0	winds downed several large trees, which fell on power lines and destroyed the end of a machine shed
4/5/2010	7:58 p.m.	Milledgeville	61 kts	0	0	\$1,185,143	\$0	winds caused the west-facing wall of Trinity Lutheran Church to collapse
6/18/2010	1:00 p.m.	Lanark Milledgeville Thomson [^]	56 kts	0	0	\$41,669	\$0	winds downed tree limbs in Lanark and Milledgeville and blew down trees and power lines near Thomson; a large tree fell onto a camper trailer at Thomson Causeway; some power outages were observed
6/18/2010	1:05 p.m.	Mount Carroll	56 kts	0	0	\$0	\$0	
6/23/2010	3:30 p.m.	Savanna [^]	56 kts	0	0	\$1,830	\$0	winds blew a tree down across IL 84 just north of the City
8/20/2010	1:22 p.m.	Chadwick [^]	52 kts	0	0	\$12,056	\$0	
10/26/2010	4:46 a.m.	Thomson [^]	53 kts	0	0	\$7,975	\$0	winds blew a tree down
10/26/2010	5:05 a.m.	Chadwick [^]	52 kts	0	0	\$0	\$0	power lines downed
10/26/2010	5:18 a.m.	Shannon [^]	52 kts	0	0	\$0	\$0	power lines downed
Subtotals:				0	0	\$1,398,673	\$0	

[^] Thunderstorm with damaging winds verified in the vicinity of this location(s).

**Figure 11
(Sheet 12 of 12)
Severe Storms – Thunderstorms with Damaging Winds Reported in Carroll County
1960 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (Knots)	Injuries	Death	Property Damage	Crop Damage	Description
4/10/2011	8:30 p.m.	Shannon [^]	56 kts	0	0	\$10,000	\$0	winds blew down a tree across Ogle Rd. & IL 72 just east of the Village
5/22/2011	4:54 p.m.	Lanark [^]	52 kts	0	0	\$0	\$0	
5/22/2011	5:13 p.m.	Milledgeville [^]	52 kts	0	0	\$19,182	\$0	winds blew down some branches just east of the Village
5/22/2011	5:38 p.m.	Milledgeville [^]	52 kts	0	0	\$0	\$0	winds blew down some 8" to 10" diameter tree limbs
7/11/2011	5:25 a.m.	Mount Carroll [^]	56 kts	0	0	\$13,881	\$0	
8/8/2011	1:02 p.m.	Thomson	52 kts	0	0	\$6,815	\$0	winds snapped pine trees approx. 12" in diameter off near their bases on Main St. and West St.
Subtotals:				0	0	\$49,878	\$0	
GRAND TOTAL:				2	0	\$2,914,089	\$256,500	

[^] Thunderstorm with damaging winds verified in the vicinity of this location(s).

Sources: Country Financial.

NOAA, National Environmental Satellite, Data & Information Service, National Climatic Data Center, Storm Events Database.

**Figure 12
(Sheet 1 of 2)
Severe Storms – Hail Events Reported in Carroll County
1960 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (Diameter)	Injuries	Death	Property Damage	Crop Damage	Description
11/15/1960	7:15 a.m.	Chadwick [^]	1.00 in.	0	0	\$0	\$0	
4/23/1961	1:10 p.m.	Savanna [^]	1.50 in.	0	0	\$0	\$0	
7/1/1967	12:35 p.m.	Lanark [^]	1.00 in.	0	0	\$0	\$0	
6/4/1975	5:25 p.m.	Thomson	1.75 in.	0	0	\$0	\$0	
6/4/1975	6:45 p.m.	Shannon	1.75 in.	0	0	\$0	\$0	
7/26/1978	9:40 a.m.	Lanark	3.00 in.	0	0	\$0	\$0	
4/3/1981	7:08 a.m.	Mount Carroll [^]	1.75 in.	0	0	\$0	\$0	
5/26/1985	6:25 p.m.	Milledgeville	1.00 in.	0	0	\$0	\$0	
4/25/1986	6:30 p.m.	Milledgeville	1.00 in.	0	0	\$0	\$0	
4/5/1988	4:59 p.m.	Thomson	1.00 in.	0	0	\$0	\$0	
4/22/1988	7:35 p.m.	Thomson	1.75 in.	0	0	\$0	\$0	
3/27/1991	1:10 p.m.	Mount Carroll	1.75 in.	0	0	\$0	\$0	
5/18/1997	5:15 p.m.	Thomson	1.00 in.	0	0	\$0	\$0	
6/18/1998	5:15 p.m.	Thomson	1.00 in.	0	0	\$0	\$0	
6/8/1999	2:52 p.m.	Mount Carroll	1.00 in.	0	0	\$0	\$0	
4/18/2002	5:00 p.m.	Lanark	1.00 in.	0	0	\$0	\$0	
5/30/2002	8:55 p.m.	Savanna [^]	1.00 in.	0	0	\$0	\$0	
6/18/2003	3:06 p.m.	Thomson	1.00 in.	0	0	\$20,000	\$0	
Subtotal:				0	0	\$20,000	\$0	

[^] Hail event verified in the vicinity of this location(s).

**Figure 12
(Sheet 2 of 2)
Severe Storms – Hail Events Reported in Carroll County
1960 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (Diameter)	Injuries	Death	Property Damage	Crop Damage	Description
5/21/2004	6:08 p.m.	Chadwick	1.75 in.	0	0	\$0	\$0	
3/12/2006	8:58 p.m.	Milledgeville	1.00 in.	0	0	\$3,000	\$0	
4/16/2006	5:49 a.m.	Milledgeville	1.00 in.	0	0	\$5,000	\$0	
8/22/2007	1:22 a.m.	Mount Carroll	1.00 in.	0	0	\$0	\$0	
8/22/2007	1:26 a.m.	Mount Carroll	1.00 in.	0	0	\$0	\$0	
8/13/2011	1:45 p.m.	Lanark	0.88 in.	0	0	\$131,120	\$0	
Subtotal:				0	0	\$139,120	\$0	
GRAND TOTAL:				0	0	\$159,120	\$0	

^ Hail event verified in the vicinity of this location(s).

Sources: Country Financial.

NOAA, National Environmental Satellite, Data & Information Service, National Climatic Data Center, Storm Events Database.

**Figure 13
Severe Storms – Lightning Events Reported in Carroll County
1996 – 2011**

Date(s)	Start Time	Location(s)	Injuries	Death	Property Damage	Crop Damage	Description
5/24/1996	4:00 a.m.	Mount Carroll	0	0	\$30,000	\$0	lightning started a fire on the roof of the Immanuel Lutheran Church which spread to the interior; this fire was part of a widespread lightning event which damaged several structures, destroyed numerous trees and started four other fires
6/6/1999	2:30 p.m.	Savanna	0	0	\$10,000	\$0	lightning struck a bell tower at St. Paul's Episcopal Church causing significant smoke and fire damage
8/12/2002	7:00 p.m.	Chadwick Mount Carroll	0	0	\$0	\$0	lightning struck a large phone box; there were several reports of lightning damage and fires
4/5/2010	7:59 p.m.	Lanark	0	0	\$50,000	\$0	lightning struck a house causing a fire
GRAND TOTAL:			0	0	\$90,000	\$0	

Source: NOAA, National Environmental Satellite, Data & Information Service, National Climatic Data Center, Storm Events Database.

**Figure 14
(Sheet 1 of 4)
Severe Storms – Heavy Rain Events Reported in Carroll County
1993 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (inches)	Injuries	Death	Property Damage	Crop Damage	Description
6/24/1993	NA	countywide	6	0	0	\$0	\$0	heavy rain fell on the 24 th causing flash flooding; the flooding caused washouts to various county and township roads, culverts and bridges
5/12/1999	5:00 p.m.	Milledgeville	NA	0	0	\$20,000	\$0	localized heavy rain caused basement walls in 2 separate homes to collapse causing up to 4 ft. of mud to pour into the basements
1/20/2003	11:17 p.m.	Marcus [^]	NA	0	0	\$5,000	\$0	heavy rains accompanying a thunderstorm produced nuisance street flooding and resulted in a mudslide across IL 84 just northwest of Palisades State Park which caused a traffic accident, but no injuries
6/25/2006	7:44 p.m.	Savanna	3	0	0	\$0	\$0	heavy rains caused ponding of water on streets with depth of 1 to 4 inches
6/25/2006 thru 6/26/2006	9:40 p.m.	Wacker [^]	3	0	0	\$0	\$0	approximately 3 inches of rain fell overnight causing flash flooding; the railroad underpass on Wacker Rd. one mile east of town was impassable, covered with several feet of water
Subtotal:				0	0	\$25,000	\$0	

[^] Heavy rain event verified in the vicinity of this location(s).

**Figure 14
(Sheet 2 of 4)
Severe Storms – Heavy Rain Events Reported in Carroll County
1993 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (inches)	Injuries	Death	Property Damage	Crop Damage	Description
7/18/2007	9:15 p.m.	Mount Carroll	0.75 – 3	0	0	\$0	\$0	heavy rain fell in the evening, the rain combined with already saturated soils causing flash flooding; water covered portions of Mill St. near the city garage
5/13/2009	7:55 p.m.	Savanna Wacker [^]	NA	0	0	\$0	\$0	heavy rains resulted in flash flooding of a low lying railroad underpass near Savanna
5/13/2009	7:56 p.m.	Mount Carroll [^]	NA	0	0	\$0	\$0	heavy rains resulted in flash flooding of the intersection of Scenic Palisades Rd. and Quarry Rd. about two miles west of Mount Carroll
5/13/2009	8:19 p.m.	Milledgeville	NA	0	0	\$0	\$0	heavy rains caused flash flooding of a low lying railroad underpass
5/13/2009	9:30 p.m.	Lanark	NA	0	0	\$4,704	\$0	heavy rains caused flash flooding of roads; some of the roads on the south side of town eroded; residential property damage also occurred
6/19/2009	5:08 p.m.	Mount Carroll [^]	NA	0	0	\$5,154	\$0	heavy rains resulted in flash flooding of some county roads in the area; residential property damage also occurred
Subtotal:				0	0	\$9,858	\$0	

[^] Heavy rain event verified in the vicinity of this location(s).

**Figure 14
Sheet 3 of 4)
Severe Storms – Heavy Rain Events Reported in Carroll County
1993 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (inches)	Injuries	Death	Property Damage	Crop Damage	Description
7/27/2009 thru 7/28/2009	9:23 p.m.	Mount Carroll [^]	NA	0	0	\$5,260	\$0	heavy rains resulted in flash flooding of area roads; some roads were closed due to high water including Scenic Bluff Rd.; residential property damage also occurred
7/23/2010	3:00 a.m.	countywide	3-9	0	0	\$43,590	\$0	heavy rains caused flashed flooding over much of the county and power outages which led to the loss of vaccine at the County Health Department and four physician's offices; this event was part of a federally-declared disaster (Declaration #1935)
7/23/2010	3:00 a.m.	Shannon	8	0	0	\$0	\$0	this event was part of a federally-declared disaster (Declaration #1935)
7/24/2010	5:00 a.m.	countywide	3	0	0	\$47,783		an additional 3 inches of rain fell across the county resulting in flash flooding, especially along the Plum River, Carroll Creek (Wakarusa River) and Elkhorn Creek; residential property damage also occurred; this event was part of a federally-declared disaster (Declaration #1935)
Subtotal:				0	0	\$96,633	\$0	

[^] Heavy rain event verified in the vicinity of this location(s).

**Figure 14
(Sheet 4 of 4)
Severe Storms – Heavy Rain Events Reported in Carroll County
1993 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (inches)	Injuries	Death	Property Damage	Crop Damage	Description
7/27/2011 thru 7/29/2011	10:00 p.m.	Savanna Mount Carroll	2 – 5	0	0	\$20,117	\$0	torrential rains caused some flash flooding across the northern half of the county; residential property damage also occurred
7/27/2011	10:38 p.m.	Marcus [^]	4	0	0	\$0	\$0	
7/28/2011	6:00 a.m.	Shannon [^]	4	0	0	\$0	\$0	
7/28/2011	10:19 a.m.	Mount Carroll [^]	3	0	0	\$0	\$0	
8/8/2011	1:52 p.m.	Chadwick [^]	NA	0	0	\$0	\$0	
Subtotal:				0	0	\$20,117	\$0	

GRAND TOTAL:	0	0	\$151,608	\$0
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[^] Heavy rain event verified in the vicinity of this location(s).

Sources: Country Financial.
NOAA, National Environmental Satellite, Data & Information Service, National Climatic Data Center, Storm Events Database.

3.2 SEVERE WINTER STORMS (SNOW, ICE & EXTREME COLD)

IDENTIFYING THE HAZARD

What is the definition of a severe winter storm?

A severe winter storm can range from moderate snow over a few hours to significant accumulations of sleet and/or ice to blizzard conditions with blinding wind-driven snow that last several days. The amount of snow or ice, air temperature, wind speed and event duration all influence the severity and type of severe winter storm that results. In general there are three types of severe winter storms: blizzards, heavy snow storms and ice storms. The following provides a brief description of each type.

- **Blizzards.** Blizzards are characterized by strong winds of at least 35 miles per hour and are accompanied by considerable falling and/or blowing snow that reduces visibility to ¼ mile or less for at least three hours. Blizzards are the most dangerous of all winter storms.
- **Heavy Snow Storms.** A heavy snow storm occurs when a winter storm produces snowfall accumulations of four inches or more in 12 hours or less or six inches or more in 24 hours or less.
- **Ice Storms.** An ice storm occurs when substantial accumulations of ice, generally ¼ inch or more, build up on the ground, trees and utility lines as a result of freezing rain.

While extreme cold (i.e., dangerously low temperatures and wind chill values) often accompanies or is left in the wake of a severe winter storm, the National Weather Service (NWS) does not use it to define a severe winter storm. However, a discussion of extreme cold is included in this section since it has the ability to cause property damage, injuries and even death (whether or not it is accompanied by freezing rain, ice or snow).

What is snow?

Snow is precipitation in the form of ice crystals. These ice crystals are formed directly from the freezing of water vapor in wintertime clouds. As the ice crystals fall toward the ground, they cling to each other creating snowflakes. Snow will only fall if the temperature remains at or below 32°F from the cloud base to the ground.

What is sleet?

Sleet is precipitation in the form of ice pellets. These ice pellets are composed of frozen or partially frozen rain drops or refrozen partially melted snowflakes. Sleet typically forms in winter storms when snowflakes partially melt while falling through a thin layer of warm air. The partially melted snowflakes then refreeze and form ice pellets as they fall through the colder air mass closer to the ground. Sleet usually bounces after hitting the ground or other hard surfaces and does not stick to objects.

What is freezing rain?

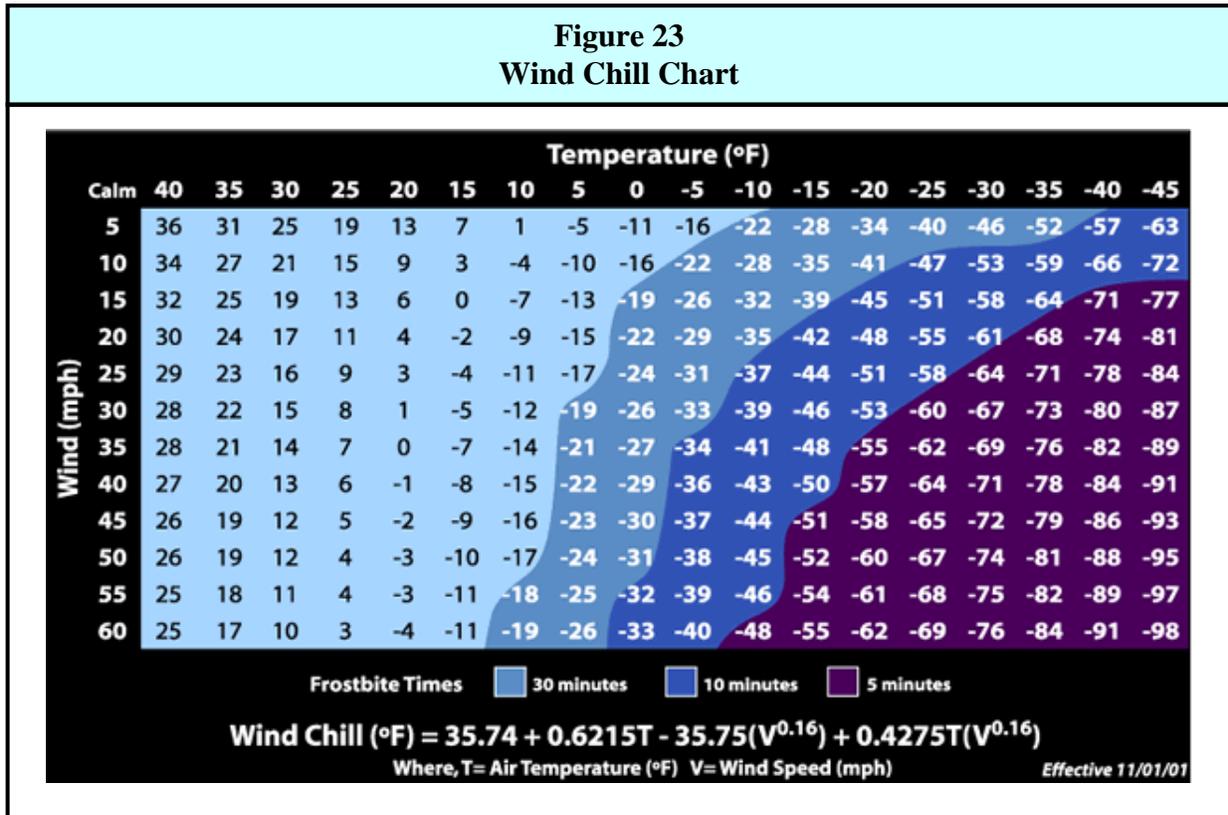
Freezing rain is precipitation that falls in the form of a liquid (i.e., rain drops), but freezes into a glaze of ice upon contact with the ground or other hard surfaces. This occurs when snowflakes

descend into a warmer layer of air and melt completely. When the rain drops that result from this melting fall through another thin layer of freezing air just above the surface they become “supercooled”, but they do not have time to refreeze before reaching the ground. However, because the rain drops are “supercooled”, they instantly refreeze upon contact with anything that is at or below 32°F (i.e., the ground, trees, utility lines, etc.).

What is the wind chill?

The wind chill, or wind chill factor, is a measure of the rate of heat loss from exposed skin resulting from the combined effects of wind and temperature. As the wind increases, heat is carried away from the body at a faster rate, driving down both the skin temperature and eventually the internal body temperature.

The unit of measurement used to describe the wind chill factor is known as the wind chill temperature. The wind chill temperature is calculated using a formula. **Figure 23** identifies the formula and calculates the wind chill temperatures for certain air temperatures and wind speeds.



Source: NOAA, National Weather Service.

As an example, if the air temperature is 5°F and the wind speed is 20 miles per hour, then the wind chill temperature would be -15°F. The wind chill temperature is only defined for air temperatures at or below 50°F and wind speeds above three miles per hour. In addition, the wind chill temperature does not take into consideration the effects of bright sunlight which may increase the wind chill temperature by 10°F to 18°F.

Use of the current Wind Chill Temperature (WCT) index was implemented by the NWS on November 1, 2001. The new WCT index was designed to more accurately calculate how cold air feels on human skin. The new index uses advances in science, technology and computer modeling to provide an accurate, understandable and useful formula for calculating the dangers from winter winds and freezing temperatures. The former index was based on research done in 1945 by Antarctic researchers Siple and Passel.

Exposure to extreme wind chills can be life threatening. As wind chills edge toward -19°F and below, there is an increased likelihood that exposure will lead to individuals developing cold-related illnesses.

What cold-related illnesses are associated with severe winter storms?

Frostbite and hypothermia are both cold-related illnesses that can result when individuals are exposed to dangerously low temperatures and wind chills during severe winter storms. The following provides a brief description of the symptoms associated with each.

- **Frostbite.** During exposure to extremely cold weather the body reduces circulation to the extremities (i.e., feet, hands, nose, cheeks, ears, etc.) in order to maintain its core temperature. If the extremities are exposed, then this reduction in circulation coupled with the cold temperatures can cause the tissue to freeze.

Frostbite is characterized by a loss of feeling and a white or pale appearance. At a wind chill of -19°F, exposed skin can freeze in as little as 30 minutes. Seek medical attention immediately if frostbite is suspected. It can permanently damage tissue and in severe cases can lead to amputation.

- **Hypothermia.** Hypothermia occurs when the body's temperature begins to fall because it is losing heat faster than it can produce it. If an individual's body temperature falls below 95°F, then hypothermia has set in and immediate medical attention should be sought.

Hypothermia is characterized by uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness and exhaustion. Left untreated, hypothermia will lead to death. Hypothermia occurs most commonly at very cold temperatures, but can occur at cool temperatures (above 40°F) if an individual isn't properly clothed or becomes chilled.

Are alerts issued for severe winter storms?

Yes. The National Weather Service Weather Forecast Office of the Quad Cities, Iowa/Illinois is responsible for issuing *winter storm watches* and *warnings* for Carroll County depending on the weather conditions. The following provides a brief description of each type of alert.

- **Watch.** Winter storm watches are issued when a significant winter storm may affect the area within 18 to 72 hours. A watch will often be issued when there is still uncertainty about the path and strength of a developing winter storm.
- **Advisories.** Winter advisories are issued for lesser winter weather events that will most likely cause significant inconvenience, but should not be life-threatening if caution is

exercised. The following advisories will be issued when an event is occurring, is imminent or has a high probability of occurring.

- ❖ **Winter Weather Advisory.** A winter weather advisory is issued for:
 - three to five inches of snow;
 - snow with strong winds that reduce visibility to less than ½ mile and cause considerable blowing and drifting;
 - freezing rain/drizzle resulting in less than ¼ inch of ice accumulation;
 - sleet accumulation of less than ½ inch; or
 - a mix of winter precipitation which will produce hazardous conditions.
- ❖ **Wind Chill Advisory.** A wind chill advisory is issued when the wind chill values are expected to be between -20°F and -29°F.

➤ **Warnings.** Winter weather warnings are issued for severe winter weather events that can be life threatening. The following warnings will be issued when an event is imminent or already occurring.

- ❖ **Winter Storm Warning.** A winter storm warning is issued for:
 - six inches or more of snow within 12 hours;
 - eight inches or more of snow within 24 hours; or
 - ½ inch or more of sleet accumulation is expected.
- ❖ **Blizzard Warning.** A blizzard warning is issued when sustained winds or frequent gusts of 35 mph or more are accompanied by falling/blowing/drifting snow that frequently reduces visibility to less than ¼ mile for three hours or more.
- ❖ **Ice Storm Warning.** An ice storm warning is issued when freezing rain will result in ¼ inch or more of ice accumulation.
- ❖ **Wind Chill Warning.** A wind chill warning is issued when wind chill values are expected to be -30°F or below.

PROFILING THE HAZARD

When have severe winter storms occurred previously? What is the extent of these previous severe winter storms?

Figures 24 and 25, located at end of this section, summarize the previous occurrences as well as the extent or magnitude of severe winter storms and extreme cold events recorded in Carroll County.

Severe Winter Storms

The Storm Events Database, the Illinois State Water Survey and community records have documented 61 reported occurrences of severe winter storms (snow, ice and/or a combination of both) in Carroll County between 1967 and 2011. Of

Severe Winter Storm Fast Facts – Carroll County

Number of Snow & Ice Events Reported (1967 – 2011): **61**
Number of Extreme Cold Events Reported (1996 – 2011): **11**
Maximum One-Day Snow Accumulation: **12.5 inches**
Coldest Temperature Recorded in Carroll County: **-31°F**
Most Likely Month for Snow & Ice Events to Occur: **December**
Most Likely Month for Extreme Cold Events to Occur: **January**

the 61 occurrences, 42 were heavy snow storms or blizzards, two were ice storms and 17 were a combination of freezing rain, sleet, ice and snow.

Since 1994, at least one severe winter storm has occurred each year in Carroll County with the exception of 2004. Anecdotal information shared by long-time residents suggests that severe winter storms have occurred with similar frequency between 1950 and 1994.

Figure 26 charts the reported occurrences of severe winter storms in Carroll County by month. Forty-one of the 61 events (67%) took place between December and January, with one of events spanning between December and January.

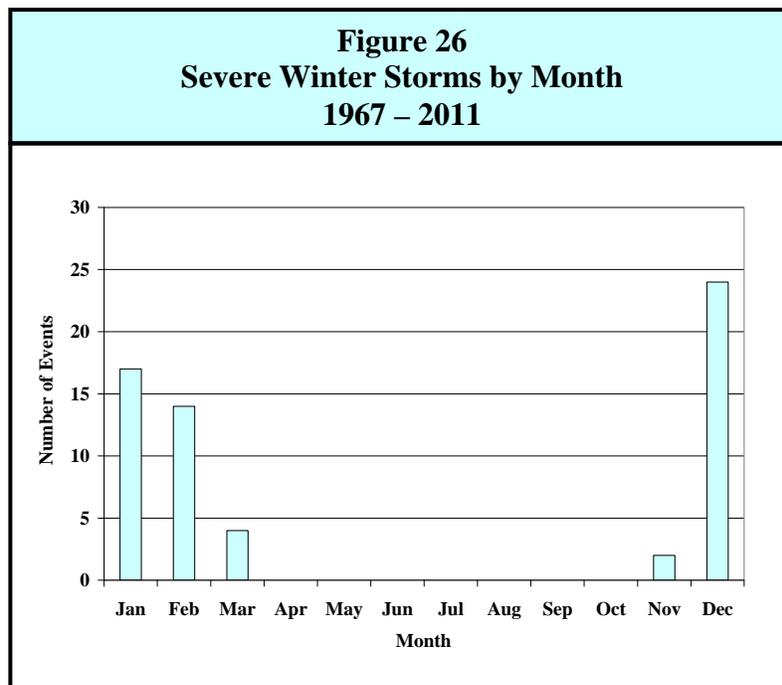


Figure 27 charts the reported occurrences of severe winter storms in Carroll County by hour. Of the 61 occurrences, start times were unavailable for five events (1967 through 1979). Of the remaining 56 severe winter storm events with recorded times, half (50%) began during the a.m. hours. Sixteen of the 56 events (29%) began between 1 a.m. and 5 a.m. An additional 16 events (29%) began between 1 p.m. and 5 p.m.

According to the Midwestern Regional Climate Center, the maximum one-day snow accumulation total recorded over a 100-year period in Carroll County was 12.5 inches which occurred on February 10, 1960. The heaviest seasonal snowfall on record for Carroll County was 77.5 inches which occurred during the winter of 1978-1979.

Extreme Cold

The Storm Events Database has documented 11 occurrences of extreme cold (dangerously low temperatures and wind chill values) in Carroll County between 1996 and 2011. Of the 11 occurrences, two preceded and three corresponded with a recorded severe winter storm.

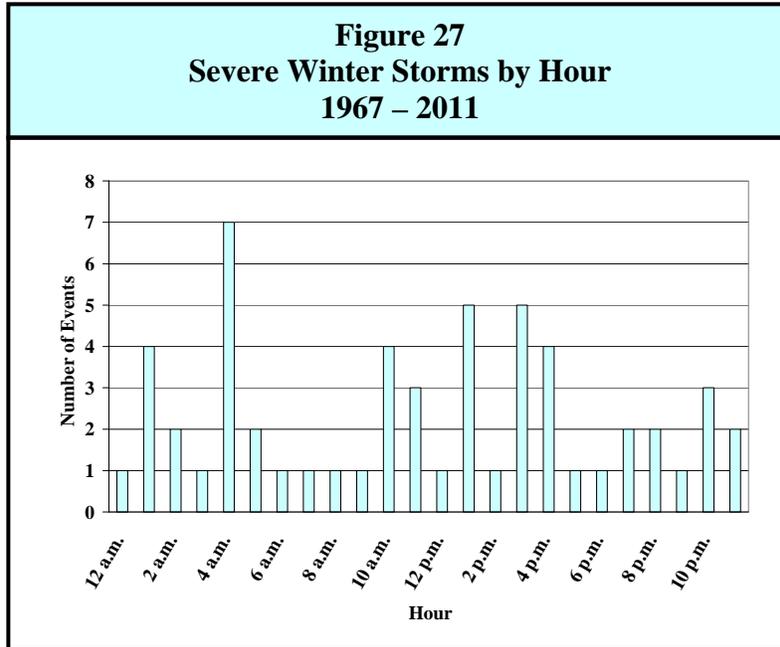
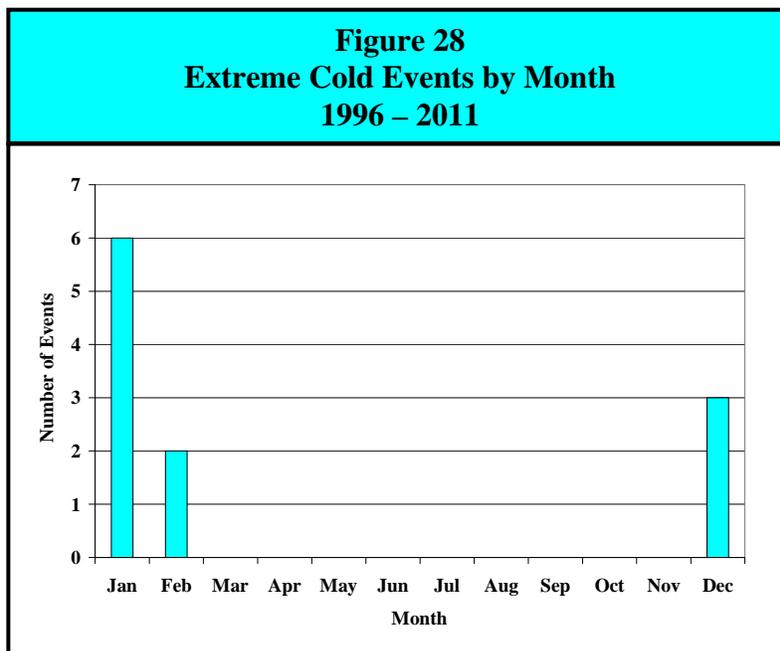


Figure 28 charts the reported occurrences of extreme cold events in Carroll County by month. Six of the 11 events (55%) took place in January, with one event spanning between January and February. Approximately 55% of all severe winter storms began during the a.m. hours. The coldest temperature recorded over a 100-year period in Carroll County was -31°F which occurred on January 7, 1910, according to records from the Midwestern Regional Climate Center.



What locations are affected by severe winter storms?

Severe winter storms affect the entire County. All communities in Carroll County have been affected by severe winter storms. Severe winter storms generally extend across the entire County and affect multiple locations. The *2010 Illinois Natural Hazard Mitigation Plan* prepared by the Illinois Emergency Management Agency classifies the Carroll County's hazard rating for severe winter storms as "high."

What is the probability of future severe winter storms occurring?

Severe Winter Storms

Carroll County has had 61 verified occurrences of severe winter storms between 1967 and 2011. With 61 occurrences over the past 45 years, Carroll County should expect to experience at least one severe winter storm each year. There were 14 years over the past 45 years where two or more severe winter storms occurred. This indicates that the probability that more than one severe winter storm may occur during any given year within the County is 31%. However, the gaps in data between 1967-1978 and 1979-1994 cause a distortion in both these probabilities.



Snow blocks a driveway following a winter storm which blanketed the County with 16 to 18 inches of snow in January, 1979.

Photo provided by Leroy Getz.

If only the events recorded by the Storm Events Database are analyzed, then there have been 56 verified occurrences of severe winter storms between 1994 and 2011. With 56 events in 18 years, Carroll County should expect to experience at least three severe winter storms each year. There were 13 years over the past 18 years where two or more severe winter storms occurred. This indicates that the probability that more than one severe winter storm may occur during any given year within the County is 72%. A probability based on 18 years of data may not be as accurate as a probability based on 45 years of data. However, a probability based on the 1994-2011 data may provide a more reliable representation of the threat the County faces from severe winter storms than a probability calculated from a longer time frame with gaps.

Extreme Cold

The County has had 11 verified occurrences of extreme cold between 1996 and 2011. With 11 occurrences over the past 16 years, the probability or likelihood of an extreme cold event occurring in Carroll County in any given year is 69%. There were three years over the past 16 years where two or more extreme cold events occurred. This indicates that the probability that two or more extreme cold events may occur during any given year with the County is 19%.

ASSESSING VULNERABILITY

Are the participating jurisdictions vulnerable to severe winter storms?

Yes. All of Carroll County, including the participating jurisdictions, is vulnerable to the dangers presented by severe winter storms. Severe winter storms are among the most frequently

occurring natural hazards in Illinois. There is one official state-designated warming center located at the Carroll County Health Department in Mount Carroll.

Since 2001, Carroll County has experienced 34 snow and ice events and five extreme cold events. During eight of those years, the County experienced two or more severe winter storm events. Severe winter storms have immobilized portions of the County, blocking roads, downing power lines, trees and branches causing power outages and property damage and contributing to vehicle accidents. In addition, the County and municipalities must budget for snow removal and de-icing of roads and bridges as well as for roadway repairs.

What impacts resulted from the recorded severe winter storms?

Of the 61 reported occurrences of severe winter storms, damages were only recorded for three events. Beginning on February 5, 2008 a winter storm blanketed the County with 10 to 15 inches of snow which led to school and road closures. The Carroll County Highway Department spent \$33,115 to provide emergency protective measures, including snow removal, during this storm. The second event, an ice storm, occurred on December 23, 2009 and caused \$1,335 in property damage.

The third and final event began on February 1, 2011 when a blizzard covered the County with 10 to 15 inches of snow. Most area roads were closed with numerous vehicles stuck in drifts or ditches, area schools were closed and events cancelled for several days as crews struggled to open rural roads and side streets. The Carroll County Highway Department, Chadwick, Lanark, Milledgeville and Savanna spent an estimated \$133,526 to provide emergency protective measures, including snow removal, and to repair storm-related infrastructure damage. This event was part of a federally-declared disaster.



Many roads drifted closed following the blizzard of February, 2011.

Photo provided by Sally Marken.

In comparison, the State of Illinois has averaged an estimated \$102 million annually in property damage losses from severe winter storms since 1950, ranking severe winter storms second only to flooding in terms of economic loss. While behind floods in terms of the amount of property damage caused, severe winter storms have a greater ability to immobilize larger areas, with rural areas being particularly vulnerable.



Cattle battle snow drifts and frozen water following winters storms in January, 1979.

Photo provided by Leroy Getz.

One injury, a heart attack, was reported as a result of the February 1, 2011 blizzard. In comparison, Illinois averages six deaths per year as a result of severe winter storms.

While severe winter storms occur regularly in Carroll County, the number of injuries and deaths is low.

The combination of treacherous road conditions and a temporary loss of power can make individuals who are not able to reach emergency shelters more vulnerable to hypothermia and other common winter-related injuries. However, even taking into consideration the increased impacts from a power outage, the risk to public health and safety from severe winter storms is relatively low.

What other impacts can result from severe winter storms?

In Carroll County, vehicle accidents are the largest risk to health and safety from severe winter storms. Hazardous driving conditions (i.e., reduced visibility, icing road conditions, strong winds, etc.) contribute to the increase in accidents that result in injury and death. A majority of all severe winter storm injuries result from vehicle accidents.

Traffic accident data assembled by the Illinois Department of Transportation between 2006 and 2010 indicates that treacherous road conditions caused by snow and ice were present for 5.5% to 21.4% of all crashes recorded annually in the County. **Figure 29** provides a breakdown by year of the number of crashes and corresponding injuries and deaths that occurred when treacherous road conditions caused by snow and ice were present as well as the total number of crashes that occurred in the County for comparison.

Figure 29 Severe Winter Weather Crash Data for Carroll County				
Year	Total # of Crashes	Presence of Treacherous Road Conditions caused by Snow and Ice		
		# of Crashes	# of Injuries	# of Deaths
2006	452	25	7	0
2007	494	101	21	0
2008	482	103	16	0
2009	314	47	8	0
2010	334	43	12	0

Source: Illinois Department of Transportation.

Persons who are outdoors during and immediately following severe winter storms can experience other health and safety problems. Frostbite to hands, feet, ears and nose and hypothermia are common injuries. Treacherous walking conditions also lead to falls which can result in serious injuries, including fractures and broken bones, especially for the elderly. Over exertion from shoveling driveways and walks can lead to life-threatening conditions such as heart attacks in middle-aged and older adults who are susceptible.

Are existing buildings, infrastructure and critical facilities vulnerable to severe winter storms?

Yes. All existing buildings, infrastructure and critical facilities located in Carroll County and the participating jurisdictions are vulnerable to damage from severe winter storms. Structural damage to buildings caused by severe winter storms is very rare, but can occur particularly to flat rooftops.

Information gathered from Carroll County residents indicates that snow and ice accumulations on communication and power lines as well as key roads presents the greatest vulnerability to infrastructure and critical facilities within the County. Snow and ice accumulations on communication and power lines often lead to disruptions in communication and create power outages. Depending on the damage, it can take anywhere from several hours to several days to restore service.

In addition to affecting communication and power lines, snow and ice accumulations on state and local roads hampers travel and can cause dangerous driving conditions. Blowing and drifting snow can lead to road closures and increases the risk of automobile accidents. Even small accumulations of ice can be extremely dangerous to motorists since bridges and overpasses freeze before other surfaces. When transportation is disrupted, schools close, emergency and medical services are delayed, some businesses close and government services can be affected. When a severe winter storm hits there is also an increase in cost to the County and municipalities for snow removal and de-icing. Road resurfacing and pothole repairs are additional costs incurred each year as a result of severe winter storms.



Plows work to clear roads near Shannon following the blizzard of February, 2011.

Photo provided by Carroll County Highway Department.

Extreme cold events can also have a detrimental impact on buildings, infrastructure and critical facilities. Pipes and water mains are especially susceptible to freezing during extreme cold events. This freezing can lead to cracks or ruptures in the pipes in buildings as well as in buried service lines and mains. As a result, flooding can occur as well as disruptions in service. Since most buried service lines and water mains are located under local streets and roads, fixing a break requires portions of the street or road to be blocked off, excavated and eventually repaired. These activities can be costly and must be carried out under less than ideal working conditions.

Based on the frequency with which severe winter storms occur in Carroll County, the amount of property damage previously reported and the potential for disruptions to power distribution and communication; the risk or vulnerability to buildings, infrastructure and critical facilities from severe winter storms is medium to high.

Are future buildings, infrastructure and critical facilities vulnerable to severe winter storms?

Yes. Only one of the participating jurisdictions, Savanna, has building codes in place that will likely help lessen the vulnerability of new buildings and critical facilities to damage from severe winter storms. Infrastructure such as new communication and power lines also will continue to be vulnerable to severe winter storms. Ice accumulations on power lines can disrupt power service. Rural areas of Carroll County have experienced extended periods without power due to severe winter storms. Steps to bury all new lines would eliminate the vulnerability, but this action would be cost prohibitive in most areas. There is very little that can be done to reduce or eliminate the vulnerability of new critical facilities such as roads and bridges to severe winter storms.

What are the potential dollar losses to vulnerable structures from severe winter storms?

Unlike other hazards, such as flooding, there are no standard loss estimation models or methodologies for severe winter storms. Since there were limited recorded events listing property damage numbers for severe winter storms, there is no way to accurately estimate future potential dollar losses. However, since all structures within Carroll County are vulnerable to damage it is likely that there will be future dollar losses from severe winter storms.

**Figure 24
(Sheet 1 of 10)
Severe Winter Storms – Snow & Ice Events Reported in Carroll County
1967 – 2011**

Date(s)	Start Time	Event Type	Magnitude	Injuries	Death	Property Damages
1/26/1967 thru 1/27/1967	NA	Winter Storm	approximately 20" of snow	0	0	\$0
12/1/1978 thru 12/3/1978	NA	Winter Storm	6" – 10" of snow	0	0	\$0
12/6/1978 thru 12/8/1978	NA	Winter Storm	freezing rain, 3" – 6" snow	0	0	\$0
12/30/1978 thru 1/1/1979	NA	Winter Storm	freezing rain, 10" – 12" snow	0	0	\$0
1/11/1979 thru 1/14/1979	NA	Winter Storm	16" – 18" of snow	0	0	\$0
12/6/1994	11:00 a.m.	Winter Storm	6" – 10" of snow	0	0	\$0
1/18/1995 thru 1/19/1995	6:00 p.m.	Heavy Snow	≥ 6" of snow; strong northwest winds of 20 to 30 mph with gusts of 40 mph caused blowing and drifting and reduced visibility	0	0	\$0
Subtotal:				0	0	\$0

Figure 24
(Sheet 2 of 10)
Severe Winter Storms – Snow & Ice Events Reported in Carroll County
1967 – 2011

Date(s)	Start Time	Event Type	Magnitude	Injuries	Death	Property Damages
11/10/1995	4:00 a.m.	Winter Storm	rain, sleet and 1” – 6” of snow; icy roads and winds gusting to 30 and 40 mph caused several accidents; hazardous travel conditions postponed high school semifinal football games across the area	0	0	\$0
11/27/1995	4:00 a.m.	Winter Storm	sleet and 4” – 7” of snow; conditions prompted early school closures; roads were slick causing numerous accidents	0	0	\$0
1/18/1996	4:30 a.m.	Winter Storm	1” – 3” of freezing rain, sleet and snow; most schools canceled classes or dismissed early; conditions created icy roads and disrupted electrical power	0	0	\$0
1/26/1996 thru 1/27/1996	4:00 a.m.	Winter Storm	1” – 3” of rain, sleet and snow; significant travel problems occurred due to a layer of glaze ice which came first and then was covered by snow; strong winds of 20 to 30 mph caused blowing and drifting and limited visibilities	0	0	\$0
1/15/1997	4:00 a.m.	Winter Storm	3” – 7” of snow; strong winds of 20 to 25 mph with gusts to 45 mph and sub-zero temperatures produced dangerous wind chills; schools were closed due to icy roads and considerable blowing and drifting; drifting snow in rural areas closed state roads and major highways through much of the weekend	0	0	\$0
1/24/1997	4:00 a.m.	Winter Storm	freezing drizzle and sleet coated streets and highways followed by 2” – 4” of snow; the wintry mix caused very slick roads and exterior surfaces; over 100 vehicle accidents were reported across southeast Iowa and northwestern Illinois	0	0	\$0
Subtotal:				0	0	\$0

Figure 24
(Sheet 3 of 10)
Severe Winter Storms – Snow & Ice Events Reported in Carroll County
1967 – 2011

Date(s)	Start Time	Event Type	Magnitude	Injuries	Death	Property Damages
2/3/1997 thru 2/4/1997	8:00 p.m.	Winter Storm	wintry mix of rain, freezing rain, sleet and 2” – 5” of snow; slick roads caused school delays and numerous accidents	0	0	\$0
12/24/1997	11:00 a.m.	Heavy Snow	3” – 6” of snow caused greatly reduced visibilities, slick roads and numerous accidents	0	0	\$0
12/6/1998	3:00 p.m.	Winter Storm	rain, freezing rain, sleet and 1” – 3” of snow; roads became slick and snow-packed resulting in treacherous driving conditions and numerous accidents	0	0	\$0
1/1/1999 thru 1/3/1999	5:17 a.m.	Winter Storm	8” – 12” of snow; blowing and drifting was a big problem, with roads and highways quickly becoming snow-packed	0	0	\$0
3/5/1999	3:00 p.m.	Winter Storm	rain and 3” – 5” of snow, with isolated areas receiving 6” of snow; roads were reported as slushy with slick spots in many areas; numerous traffic accidents were reported	0	0	\$0
3/8/1999	4:00 p.m.	Winter Storm	6” – 8” of snow; strong winds of 20 to 30 mph with gusts to 40 mph caused blowing and drifting with visibility near zero at times; conditions forced early closings of many area schools, businesses and shopping malls	0	0	\$0
12/19/1999 thru 12/20/1999	3:00 p.m.	Winter Storm	freezing rain and drizzle mixed with around 1” of snow; strong north winds produced some blowing and drifting snow and caused dangerously cold wind chill values between -15°F to -30°F; roads were slick in spots with several accidents reported	0	0	\$0
Subtotal:				0	0	\$0

**Figure 24
(Sheet 4 of 10)
Severe Winter Storms – Snow & Ice Events Reported in Carroll County
1967 – 2011**

Date(s)	Start Time	Event Type	Magnitude	Injuries	Death	Property Damages
1/19/2000	10:00 a.m.	Winter Storm	4" – 8" of snow; strong north winds gusting to 40 mph produced widespread blowing and drifting of snow and dangerously cold wind chill values between -20°F to -30°F; numerous accidents were reported; conditions forced early closure of many schools, businesses and shopping malls	0	0	\$0
1/29/2000 thru 1/30/2000	3:00 p.m.	Winter Storm	3" – 6" of snow; roads were slick and hazardous with numerous reports of accidents	0	0	\$0
2/17/2000 thru 2/18/2000	7:00 p.m.	Winter Storm	5" – 10" of snow; conditions forced the cancellation of many schools and closed businesses and shopping malls; numerous minor vehicle accidents were reported	0	0	\$0
12/10/2000 thru 12/11/2000	10:00 p.m.	Winter Storm	8" – 11" of snow; strong low pressure center produced wind gusts up to 40 mph which created near blizzard conditions, drifting many area roads shut and producing dangerous wind chill values between -20°F to -40°F; most schools were closed both Monday and Tuesday and many businesses closed early Monday	0	0	\$0
12/15/2000 thru 12/16/2000	1:00 p.m.	Ice Storm	mix of freezing rain, sleet and some snow with ice accumulations up to ½" made for very dangerous driving conditions and numerous reports of accidents and cars in ditches	0	0	\$0
Subtotal:				0	0	\$0

Figure 24
(Sheet 5 of 10)
Severe Winter Storms – Snow & Ice Events Reported in Carroll County
1967 – 2011

Date(s)	Start Time	Event Type	Magnitude	Injuries	Death	Property Damages
12/18/2000 thru 12/19/2000	4:00 a.m.	Winter Storm	3” – 5” of snow, with isolated areas receiving 6” of snow; strong northwest winds of 20 to 30 mph produced considerable blowing and drifting; the strong winds combined with temperatures near zero produced wind chill values as low as -40°F during the evening hours of 12/18 and the early morning hours of 12/19	0	0	\$0
12/28/2000 thru 12/29/2000	10:00 a.m.	Heavy Snow	4” – 6” of snow; numerous weather-related accidents were reported across the area	0	0	\$0
1/28/2001 thru 1/29/2001	10:00 a.m.	Ice Storm	1” – 2” of rain, sleet and 1” – 3” of snow with significant ice accumulations; snow and locally heavy rains with the storm contributed to the hazardous road conditions and some flooding of urban streets and rural roads; law enforcement also reported trees and power lines down due to the ice accumulations	0	0	\$0
2/8/2001 thru 2/9/2001	11:00 p.m.	Winter Storm	ice accumulations of around ¼” and 1” – 4” of snow; strong northwest winds gusting to around 40 mph created near whiteout conditions	0	0	\$0
2/23/2001 thru 2/24/2001	10:30 p.m.	Winter Storm	freezing rain, sleet and snow with ice accumulations ranging from ¼” to 1”;	0	0	\$0
1/30/2002 thru 1/31/2002	5:00 a.m.	Winter Storm	freezing rain and sleet with significant ice accumulations of ¼” to ½” followed by 7” – 11” of snow; the heavy snow and ice caused many schools to close; scattered power outages and tree damage were reported as a result of the ice accumulations	0	0	\$0
Subtotal:				0	0	\$0

**Figure 24
(Sheet 6 of 10)
Severe Winter Storms – Snow & Ice Events Reported in Carroll County
1967 – 2011**

Date(s)	Start Time	Event Type	Magnitude	Injuries	Death	Property Damages
3/1/2002 thru 3/3/2002	5:00 p.m.	Winter Storm	3” – 8” of snow; strong northwest winds sent wind chill values plummeting below zero; many events were postponed or cancelled	0	0	\$0
2/14/2003 thru 2/15/2003	4:00 p.m.	Winter Storm	4” – 8” of snow; strong winds of 20 to 30 mph produced considerable blowing and drifting snow, which greatly reduced visibility in open areas	0	0	\$0
3/4/2003 thru 3/5/2003	1:00 p.m.	Winter Storm	3” – 7” of snow	0	0	\$0
12/8/2005	3:00 a.m.	Winter Storm	3” – 6” of snow which resulted in numerous traffic accidents and either early dismissals or total cancellations by schools	0	0	\$0
12/1/2006	1:15 a.m.	Winter Storm	6” – 10” of snow fell across the eastern portion of the county while only 2” – 4” fell in the western portion	0	0	\$0
2/6/2007	7:05 a.m.	Winter Storm	2” – 5” of snow with isolated areas receiving 6” of snow	0	0	\$0
2/13/2007	1:45 a.m.	Winter Storm	3” – 6” of snow with strong winds gusting to over 40 mph causing considerable blowing and drifting; some roads were drifted shut or were impassable	0	0	\$0
2/24/2007 thru 2/25/2007	1:15 p.m.	Ice Storm/ Heavy Snow	ice accumulations of around 1” combined with east winds gusting over 50 mph brought down numerous tree branches and power lines, along with several thousand power poles causing widespread power outages; in addition to the ice, up to 7” of snow fell in the northern portion of the region and combined with the strong winds to create blizzard conditions	0	0	\$0
Subtotal:				0	0	\$0

**Figure 24
(Sheet 7 of 10)
Severe Winter Storms – Snow & Ice Events Reported in Carroll County
1967 – 2011**

Date(s)	Start Time	Event Type	Magnitude	Injuries	Death	Property Damages
12/1/2007	10:15 a.m.	Ice Storm	ice accumulations of ¼” to ¾” combined with winds gusting to 30 to 40 mph knocked down some branches and trees causing scattered power outages; law enforcement reported many cars that slid into ditches	0	0	\$0
12/11/2007	1:26 a.m.	Ice Storm	ice accumulations of ¼” to 1” with snow and sleet mixed with the freezing rain in some areas; the ice knocked down some tree branches and caused scattered power outages	0	0	\$0
12/28/2007	6:30 a.m.	Heavy Snow	3” – 6” of snow with a band of 6” – 7” falling from the Quad Cities to Freeport	0	0	\$0
12/31/2007	1:15 p.m.	Winter Storm	3” – 6” of snow	0	0	\$0
1/21/2008 thru 1/22/2008	1:15 a.m.	Winter Storm	3” – 9” of snow with a trained weather spotter measuring 7.5” at Mount Carroll and Thomson	0	0	\$0
2/3/2008	3:40 p.m.	Winter Storm	4” – 7” snow with a trained weather spotter measuring 6.3” in Mount Carroll	0	0	\$0
2/5/2008 thru 2/6/2008	2:15 p.m.	Winter Storm	10” – 15” of snow; schools were closed and there were many cars that were stuck in the deep snow or that had slid into ditches, roads were closed	0	0	\$33,115
2/11/2008 thru 2/12/2008	1:00 p.m.	Winter Storm	3” – 6” of snow	0	0	\$0
Subtotal:				0	0	\$33,115

**Figure 24
(Sheet 8 of 10)
Severe Winter Storms – Snow & Ice Events Reported in Carroll County
1967 – 2011**

Date(s)	Start Time	Event Type	Magnitude	Injuries	Death	Property Damages
2/25/2008 thru 2/26/2008	4:00 p.m.	Winter Storm	6" – 8" of snow with a trained weather spotter measuring 8" near Shannon	0	0	\$0
12/16/2008	11:30 a.m.	Winter Storm	3" – 5" of snow with isolated areas receiving 6" of snow	0	0	\$0
12/18/2008 thru 12/19/2008	9:15 p.m.	Winter Storm	6" – 10" of snow	0	0	\$0
1/9/2009 thru 1/10/2009	7:15 p.m.	Heavy Snow	5" – 9" of snow	0	0	\$0
1/13/2009 thru 1/14/2009	10:00 p.m.	Heavy Snow	6" – 8" of snow with a trained weather spotter measuring 6.3" at Mount Carroll	0	0	\$0
12/8/2009 thru 12/9/2009	2:00 a.m.	Winter Storm	10" – 15" of snow with a trained weather spotter measuring 10.8" at Chadwick; this powerful winter storm produced very heavy snowfall, blizzard conditions and bitterly cold temperatures; conditions caused scattered power outages and some tree branches to break; numerous accidents and vehicles sliding into ditches were reported across the region; many schools and businesses were also closed	0	0	\$0
Subtotal:				0	0	\$0

Figure 24
(Sheet 9 of 10)
Severe Winter Storms – Snow & Ice Events Reported in Carroll County
1967 – 2011

Date(s)	Start Time	Event Type	Magnitude	Injuries	Death	Property Damages
12/23/2009	9:00 a.m.	Ice Storm	ice accumulations of ¼” to ½” coated trees and power lines but temperatures in the lower 30s kept most roads wet; scattered power outages and some broken tree branches were reported as winds gusted to 35 mph	0	0	\$1,335
12/25/2009 thru 12/27/2009	12:15 p.m.	Winter Storm	3” – 8” of snow with a CoCoRaHS observer measuring 5.5” at Chadwick	0	0	\$0
1/6/2010 thru 1/7/2010	8:15 p.m.	Winter Storm	6” – 9” of snow with a CoCoRaHS observer measuring 6.5” at Chadwick	0	0	\$0
2/8/2010 thru 2/9/2010	12:30 a.m.	Winter Storm	5” – 9” of snow	0	0	\$0
12/3/2010 thru 12/4/2010	4:15 p.m.	Winter Storm	≥ 6” of snow with a trained weather spotter measuring 9.4” at Thomson; numerous accidents as well as cars sliding into ditches were reported	0	0	\$0
12/11/2010 thru 12/12/2010	11:00 p.m.	Winter Storm	1” – 4” of snow with strong winds gusting to 40 to 50 mph generating blizzard conditions in some locations	0	0	\$0
Subtotal:				0	0	\$1,335

Figure 24
(Sheet 10 of 10)
Severe Winter Storms – Snow & Ice Events Reported in Carroll County
1967 – 2011

Date(s)	Start Time	Event Type	Magnitude	Injuries	Death	Property Damages
1/17/2011	2:30 a.m.	Winter Storm	3” – 6” of snow with a trained weather spotter measuring 5” at Thomson; south winds gusting to around 35 mph produced considerable drifting	0	0	\$0
2/1/2011 thru 2/2/2011	8:00 a.m.	Winter Storm	10” – 15” of snow; blizzard conditions were widespread with visibilities near zero in heavy snow and winds gusting to over 50 to 60 mph; most roads were closed with numerous vehicles stuck in drifts or sliding into ditches, but no major accidents were reported; many schools and events were cancelled or closed for a couple of days, as crews struggled to open rural roads and side streets; one injury, a heart attack, was reported as a result of this storm; This event was part of a federally-declared disaster (Declaration #1960.)	1	0	\$133,526
Subtotal:				1	0	\$133,526
GRAND TOTAL:				1	0	\$167,976

Sources: Country Financial.
 NOAA, National Environmental Satellite, Data & Information Service, National Climatic Data Center, Storm Events Database.
 Illinois State Water Survey.

**Figure 25
(Sheet 1 of 2)
Extreme Cold Events Reported in Carroll County
1996 – 2011**

Date(s)	Start Time	Event Type	Magnitude	Injuries	Death	Property Damages
1/30/1996 thru 2/4/1996	8:00 p.m.	Extreme Cold	all time record low temperatures (-25°F to -32°F)	0	0	\$0
1/10/1997 thru 1/12/1997	4:00 a.m.	Extreme Cold	single digit temperatures (above and below zero) causing many schools to close on the 10 th	0	0	\$0
1/17/1997 thru 1/19/1997	4:00 a.m.	Extreme Windchill	single digit temperatures (above and below zero) combined with winds ranging from 20 to 25 mph with gusts to 45 mph	0	0	\$0
12/16/2000 thru 12/17/2000	2:00 p.m.	Extreme Windchill	dangerously cold wind chill values (-25°F to -50°F) as a strong northwest wind gusting to 35 mph buffeted the area	0	0	\$0
12/21/2000 thru 12/22/2000	4:00 a.m.	Extreme Windchill	low temperatures (-5°F to -10°F) with extremely dangerous wind chill values (-40°F to -50°F)	0	0	\$0
12/23/2000 thru 12/24/2000	10:00 p.m.	Extreme Windchill	low temperatures (-5°F to -10°F) with dangerous wind chill values (-25°F to -45°F)	0	0	\$0
2/2/2007 thru 2/5/2007	4:00 a.m.	Extreme Cold/Windchill	low temperatures (-15°F to -20°F) with dangerous wind chill values (-20°F to -40°F)	0	0	\$0
Subtotal:				0	0	\$0

**Figure 25
(Sheet 2 of 2)
Extreme Cold Events Reported in Carroll County
1996 – 2011**

Date(s)	Start Time	Event Type	Magnitude	Injuries	Death	Property Damages
1/22/2008	4:00 a.m.	Extreme Cold/Windchill	low temperatures (-15°F to -25°F) with dangerous wind chill values (-30°F to -35°F) causing some schools to delay start of classes	0	0	\$0
1/29/2008 thru 1/30/2008	10:00 p.m.	Extreme Cold/Windchill	low temperatures (-5°F to -10°F) with dangerous wind chill values (-30°F to -40°F) causing some schools to delay start of classes	0	0	\$0
2/10/2008	1:00 a.m.	Extreme Windchill	very cold temperatures and northwest wind of 20 to 30 mph with gusts near 45 mph created dangerous wind chill values (-30°F to -40°F)	0	0	\$0
1/14/2009 thru 1/16/2009	10:00 p.m.	Extreme Cold/Windchill	very low temperatures (-20°F to -40°F) with extremely dangerous wind chill values (-30°F to -50°F)	0	0	\$0
Subtotal:				0	0	\$0
GRAND TOTAL:				0	0	\$0

Sources: NOAA, National Environmental Satellite, Data & Information Service, National Climatic Data Center, Storm Events Database.

3.3 FLOODS

IDENTIFYING THE HAZARD

What is the definition of a flood?

The Federal Emergency Management Agency (FEMA) defines a “flood” as a general or temporary condition where two or more acres of normally dry land or two or more properties are inundated by:

- overflow of inland or tidal waters;
- unusual and rapid accumulation or runoff of surface waters from any source;
- mudflows; or
- a sudden collapse or subsidence of shoreline land.

The severity of a flooding event is determined by a combination of topography and physiography, ground cover, precipitation and weather patterns and recent soil moisture conditions. On average, flooding causes more than \$2 billion in property damage each year in the United States. Floods cause utility damage and outages, infrastructure damage (both to transportation and communication systems), structural damage to buildings, crop loss, decreased land values and impede travel.

What types of flooding occur in Carroll County?

There are two main types of flooding that affect Carroll County: flash flooding and general flooding. General flooding can be broken down into two categories: riverine flooding and shallow or overland flooding. The following provides a brief description of each type.

Flash Floods

A flash flood is a rapid rise of water along a stream or low-lying area. This type of flooding generally occurs within six hours of a significant rain event and is usually produced when heavy localized precipitation falls over an area in a short amount of time. Considered the most dangerous type of flood event, flash floods happen quickly with little or no warning. Typically, there is no time for the excess water to soak into the ground nor are the storm sewers able to handle the shear volume of water. As a result, streams overflow their banks and low-lying (such as underpasses, basements etc.) areas can rapidly fill with water.

Flash floods are very strong and can tear out trees, destroy buildings and bridges and scour out new channels. Flash flood-producing rains can also weaken soil and trigger mud slides that damage homes, roads and property. Six inches of fast-moving water can knock a person off their feet, while it takes only two feet of water to carry away most vehicles.

Riverine Floods

A riverine flood is a gradual rise of water in a river or stream that results in the waterway overflowing its banks. This type of flooding affects low lying areas near rivers, streams, lakes and reservoirs and generally occurs when:

- persistent storm systems enter the area and remain for extended periods of time,

- winter and spring rains combine with melting snow to fill river basins with more water than the river or stream can handle,
- ice jams create natural dams which block normal water flow, and
- torrential rains from tropical systems make landfall.

Shallow/Overland Floods

A shallow or overland flood is the pooling of water outside of a defined river or stream. There are a couple of types of overland flooding including sheet flow and ponding. Overland flooding generally occurs when the ground is still frozen or persistent storm systems have left the ground saturated and additional rainfall can not soak in.

If the surface runoff can not find a channel, it may flow out over a large area at a somewhat uniform depth in what's called sheet flow. In other cases the runoff may collect in depressions and low-lying areas where it cannot drain out, creating a ponding effect. Ponding floodwaters do not move or flow away, they remain in the temporary ponds until the water can infiltrate the soil, evaporate or are pumped out.

What is a base flood?

A base flood refers to any flood having a 1% chance of occurring in any given year. It is also known as the 100-year flood or the one percent annual chance flood. The base flood is the national standard used by the National Flood Insurance Program (NFIP) and the State of Illinois for the purposes of requiring the purchase of flood insurance and regulating new development.

Many individuals misinterpret the term "100-year flood". This term is used to describe the risk of future flooding; it does not mean that it will occur once every 100 years. Statistically speaking, a 100-year flood has a 1/100 (1%) chance of occurring in any given year. In reality, a 100-year flood could occur two times in the same year or two years in a row, especially if there are other contributing factors such as unusual changes in weather conditions, stream channelizations or changes in land use (i.e., open space land developed for housing or paved parking lots). It is also possible not to have a 100-year flood event over the course of 100 years.

While the base flood is the standard most commonly used for floodplain management and regulatory purposes in the United States, the 500-year flood is the national standard for protecting critical facilities, such as hospitals and power plants. A 500-year flood has a 1/500 (0.2%) chance of occurring in any given year.

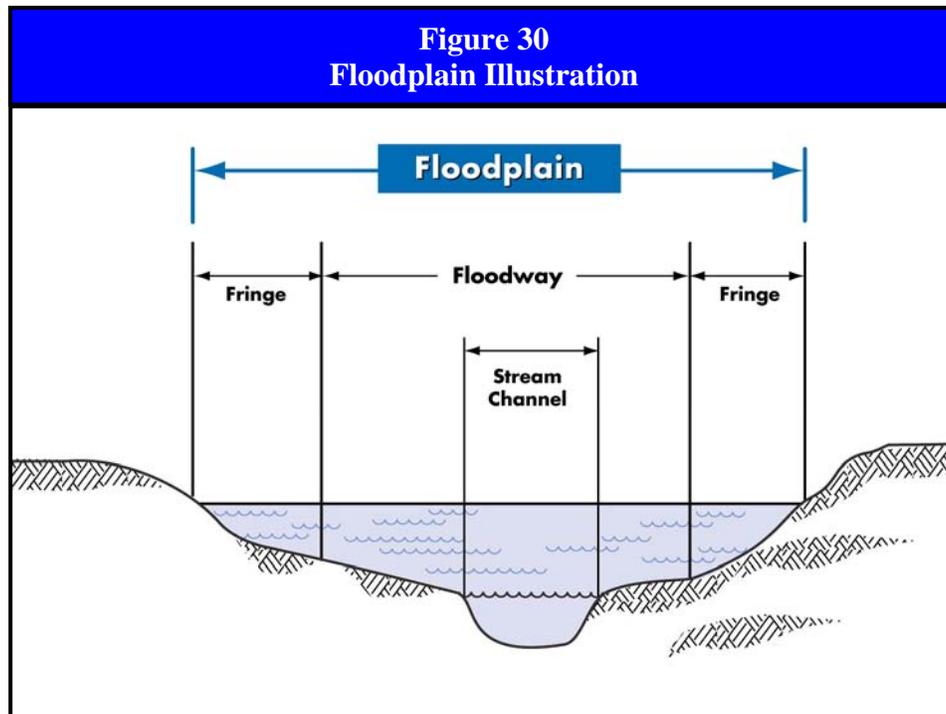
What is a floodplain?

The general definition of a floodplain is any land area susceptible to being inundated or flooded by water from any source (i.e., river, stream, lake, estuary, etc.). This general definition differs slightly from the regulatory definition of a floodplain.

A regulatory or base floodplain is defined as the land area that is covered by the floodwaters of the base flood. This land area is subject to a 1% chance of flooding in any given year. The base floodplain is also known as the 100-year floodplain or a Special Flood Hazard Area (SFHA). It

is this second definition that is generally most familiar to people and the one that is used by the NFIP and the State of Illinois.

A base floodplain is divided into two parts: the floodway and the flood fringe. **Figure 30** illustrates the various components of a base floodplain.



Source: Illinois Department of Natural Resources, Quick Guide to Floodplain Management.

The floodway is the channel of a river or stream and the adjacent floodplain that is required to store and convey the base flood without increasing the water surface elevation. Typically the floodway is the most hazardous portion of the floodplain because it carries the bulk of the base flood downstream and is usually the area where water is deepest and is moving the fastest. Floodplain regulations prohibit construction within the floodway that results in an increase in the floodwater's depth and velocity.

The flood fringe is the remaining area of the base floodplain, outside of the floodway, that is subject to shallow inundation and low velocity flows. In general, the flood fringe plays a relatively insignificant role in storing and discharging floodwaters. The flood fringe can be quite wide on large streams and quite small or nonexistent on small streams. Development within the flood fringe is typically allowed via permit if it will not significantly increase the floodwater's depth or velocity and the development is elevated above or otherwise protected to the base flood elevation.

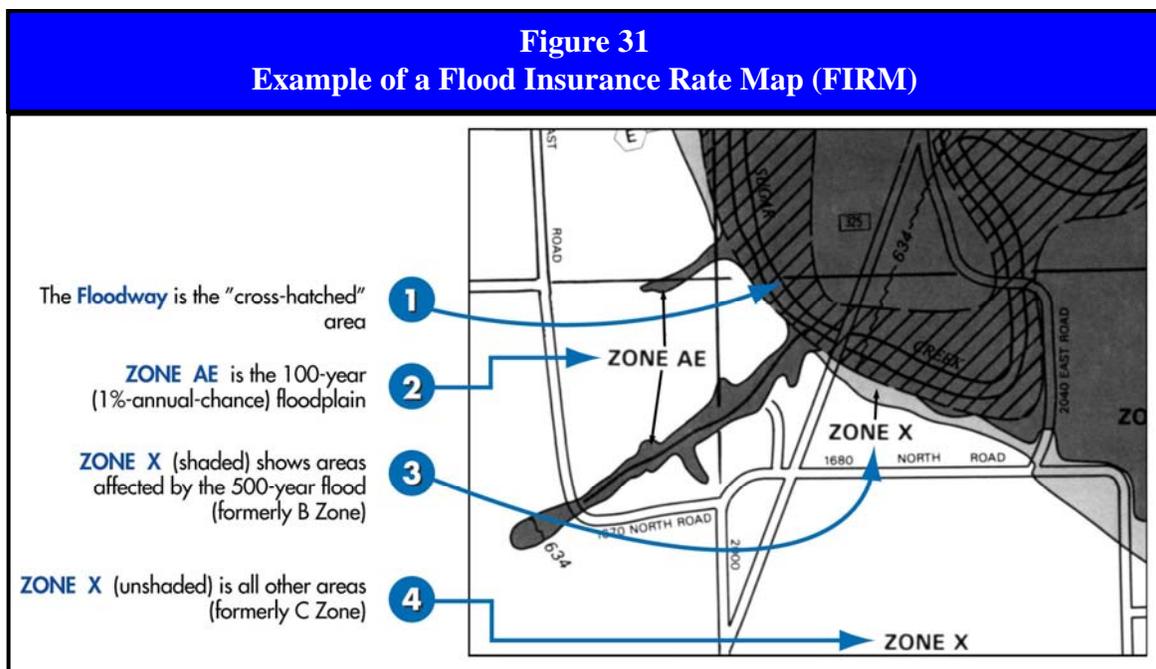
What is a Special Flood Hazard Area?

A Special Flood Hazard Area (SFHA) is the base floodplain. As discussed previously, this is the land area that is covered by the floodwaters of the base flood and has a 1% chance of flooding in

any given year. The term SFHA is most commonly used when referring to the based floodplain on the Flood Insurance Rate Maps (FIRM) produced by FEMA. The SFHA is the area where floodplain regulations must be enforced by a community as a condition of participation in the NFIP and the area where mandatory flood insurance purchase requirements apply. Special Flood Hazard Areas are delineated on the FIRMs and may be designated as Zones A, AE, A1-30, AO, AH, AR, and A99 depending on the amount of flood data available, the severity of the flood hazard or the age of the flood map.

What are Flood Insurance Rate Maps?

Flood Insurance Rate Maps (FIRMs) are maps that identify both the Special Flood Hazard Areas and the risk premium zones applicable to a community. These maps are produced by FEMA in association with the NFIP for floodplain management and insurance purposes. Digital versions of these maps are referred to as DFIRMs. **Figure 31** shows an example of a FIRM.



Source: Illinois Department of Natural Resources, Quick Guide to Floodplain Management.

A FIRM will generally shows a community's base flood elevations, flood zones and floodplain boundaries. The information presented on a FIRM is based on historic, meteorological, hydrologic and hydraulic data as well as open-space conditions, flood-control projects and development. *These maps only define flooding that occurs when a creek or river becomes overwhelmed. They do not define overland flooding that occurs when an area receives extraordinarily intense rainfall and storm sewers and roadside ditches are unable to handle the surface runoff.*

What are flood zones?

Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk. These zones are depicted on a community's FIRM. Each zone reflects the severity or type

of flooding in the area. The following provides a brief description of each of the flood zones that may appear on a community's FIRM.

- **Zone A.** Zone A, also known as the Special Flood Hazard Area (SFHA) or base floodplain, is defined as the floodplain area that has a 1% chance of flooding in any given year. There are multiple Zone A designations, including Zones A, AO, AH, A1-30, AE, AR or A99. Land areas located within Zone A are at a high risk for flooding.

A home located with Zone A has a 26% chance of suffering flood damage over the life of a 30 year mortgage. In communities that participate in the NFIP, structures located within Zone A are required to purchase flood insurance.

- **Zone X (shaded).** Zone X (shaded), formerly known as Zone B, is defined as the floodplain area between the base flood (Zone A) and the 500-year flood. Land areas located within Zone X (shaded) are affected by the 500-year flood and are considered at a moderate risk for flooding.

Zone X (shaded) is also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, shallow flooding areas with average depths of less than one foot or drainage areas less than one square mile. In communities that participate in the NFIP, structures located within Zone X (shaded) are not required to purchase flood insurance, however it is made available to all property owners and renters.

- **Zone X (unshaded).** Zone X (unshaded), formerly known as Zone C, is defined as all other land areas outside of Zone A and Zone X (shaded). Land areas located in Zone X (unshaded) are considered to have a low or minimal risk of flooding. In communities that participate in the NFIP, structures located with Zone X (unshaded) are not required to purchase flood insurance, however it is made available to all property owners and renters.

What is a Repetitive Loss Structure or Property?

FEMA defines a "repetitive loss structure" as a National Flood Insurance Program-insured structure that has received two or more flood insurance claim payments of more than \$1,000 each within any 10-year period since 1978. Historically, these structures account for approximately one-third of the nation's flood insurance claim payments. Identifying these structures and working with local jurisdictions to implement the appropriate mitigation measures to eliminate or reduce the damages caused by repeated flooding to these structures is important to FEMA and the NFIP. These structures not only increase the NFIP's annual losses, they drain funds needed to prepare for catastrophic events.

What is floodplain management?

Floodplain management is the administration of an overall community program of corrective and preventative measures to reduce flood damage. These measures take a variety of forms and generally include zoning, subdivision or building requirements, special-purpose floodplain ordinances, flood control projects, education and planning. Where floodplain development is permitted, floodplain management provides a framework that minimizes the risk to life and property from floods by maintaining a floodplain's natural function. Floodplain management is a key component of the National Flood Insurance Program.

What is the National Flood Insurance Program?

The National Flood Insurance Program (NFIP) is a federal program, administered by FEMA, that:

- mitigates future flood losses nationwide through community-enforced building and zoning ordinances; and
- provides access to affordable, federally-backed insurance protection against losses from flooding to property owners in participating communities.

It is designed to provide an insurance alternative to disaster assistance to meet escalating costs of repairing damage to buildings and their contents due to flooding. The U.S. Congress established the NFIP on August 1, 1968 with the passage of the National Flood Insurance Act of 1968. This Program has been broadened and modified several times over the years, most recently with the passage of the Flood Insurance Reform Act of 2004.

Prior to the creation of the NFIP, the national response to flood disasters was generally limited to constructing flood-control projects such as dams, levees, sea-walls, etc. and providing disaster relief to flood victims. While flood-control projects were able to initially reduce losses, their gains were offset by unwise and uncontrolled development practices within floodplains. In light of the continued increase in flood losses and the escalating costs of disaster relief to taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for protection.

Participation in the NFIP is voluntary and based on an agreement between local communities and the federal government. If a community agrees to adopt and enforce a floodplain management ordinance to reduce future flood risks to new construction in a Special Flood Hazard Area (base floodplain), then the government will make flood insurance available within the community as a financial protection against flood losses.

If a community chooses not to participate in the NFIP or a participating community decides not to adopt new floodplain management regulations or amend its existing regulations to reference new flood hazard data provided by FEMA, then the following sanctions will apply.

- Property owners will not be able to purchase NFIP flood insurance policies and existing policies will not be renewed.
- Federal disaster assistance will not be provided to repair or reconstruct insurable buildings located in identified flood hazard areas for presidentially-declared disasters that occur as a result of flooding.
- Federal mortgage insurance and loan guarantees, such as those written by the Federal Housing Administration and the Department of Veteran Affairs, will not be provided for acquisition or construction purposes within an identified flood hazard areas. Federally-insured or regulated lending institutions, such as banks and credit unions, are allowed to make conventional loans for insurable buildings in identified flood hazard areas of non-participating communities. However, the lender must notify applicants that the property

is in an identified flood hazard area and that it is not eligible for federal disaster assistance.

- Federal grants or loans for development will not be available in identified flood hazard areas under programs administered by federal agencies such as the Environmental Protection Agency, Small Business Administration and the Department of Housing and Urban Development.

What is the NFIP's Community Rating System?

The NFIP's Community Rating System (CRS) is a voluntary program developed by FEMA to provide incentives (in the form of flood insurance premium discounts) for NFIP participating communities that have gone beyond the minimum NFIP floodplain management requirements to develop extra measures to provide protection from flooding. CRS discounts on flood insurance premiums range from 5% up to 45%. Those discounts provide an incentive for new flood protection activities that can help save lives and property in the event of a flood.

Are alerts issued for flooding?

Yes. The National Weather Service Weather Forecast Office of the Quad Cities, Iowa/Illinois is responsible for issuing *flood watches* and *warnings* for Carroll County depending on the weather conditions. The following provides a brief description of each type of alert.

- **Watch.** A flash flood or flood watch is issued when current or developing hydrologic conditions are favorable for flash flooding or flooding to develop in or close to the watch area. It does not mean that flooding is imminent, just that individuals need to be alert and prepared.
- **Warning.** A flash flood or flood warning is issued when flooding is in progress, imminent or highly likely. Warnings indicate imminent danger to life and property for those who are in the area of the flooding.

PROFILING THE HAZARD

When has flooding occurred previously? What is the extent of these previous floods?

Figures 32 and 33, located at end of this section, summarize the previous occurrences as well as the extent or magnitude of flood events recorded in Carroll County. The flood events are separated into two categories: floods and flash floods.

Floods

The Storm Events Database, Illinois State Water Survey, U.S. Geological Survey and records of past events from the National Weather Service Weather Forecast Office of the Quad Cities have documented 17 reported occurrences of general flooding in Carroll County between 1965 and 2011.

Flood Fast Facts – Carroll County

Number of Floods Reported (1965 – 2011): **17**
Number of Flash Floods Reported (1993 – 2011): **16**
Record-Setting Mississippi River Flood: **April 1965**
Most Likely Month for Floods to Occur: **April or June**
Most Likely Time for Floods to Occur: **morning**
Most Likely Month for Flash Floods to Occur: **July**
Most Likely Time for Flash Floods to Occur: **evening**

Included in these 17 events are several historic Mississippi River floods. Based on historical gage data from Lock and Dam #12 Tailwater at Bellvue, Iowa (just north of Carroll County), the record setting Mississippi River flood in this area occurred in 1965. On April 26, 1965 the Mississippi River crested at a 23.51 feet, 3 ½ feet above major flood stage. The second and third highest crest at this location occurred during 2001 (22.58 feet) and 1993 (21.5 feet), respectively.

Flash Floods

The Storm Events Database and Planning Committee member records have documented 16 reported occurrences of flash flooding in Carroll County between 1993 and 2011. Included in these 16 events is the historic flash flooding of July 23, 24 and 25, 2010. Heavy rains started on the evening of the 22nd and continued for approximately 48 hours. A total of 6 to 13 inches of rain fell during this time period, causing creeks and streams to rise rapidly and resulting in flash flooding to an extent that had never before been seen in Carroll County.

Figure 34 charts the reported occurrences of flooding and flash flooding in Carroll County by month. Fourteen of the 17 flood events (82%) took place in April and June. Of the 14 events, two began in April, five took place in April and seven took place in June. Two of the April events spanned more than one month; however, for illustration purposes only the month the event started is graphed. In comparison, 15 of the 16 flash flood events took place between May and July, with six occurring in July.

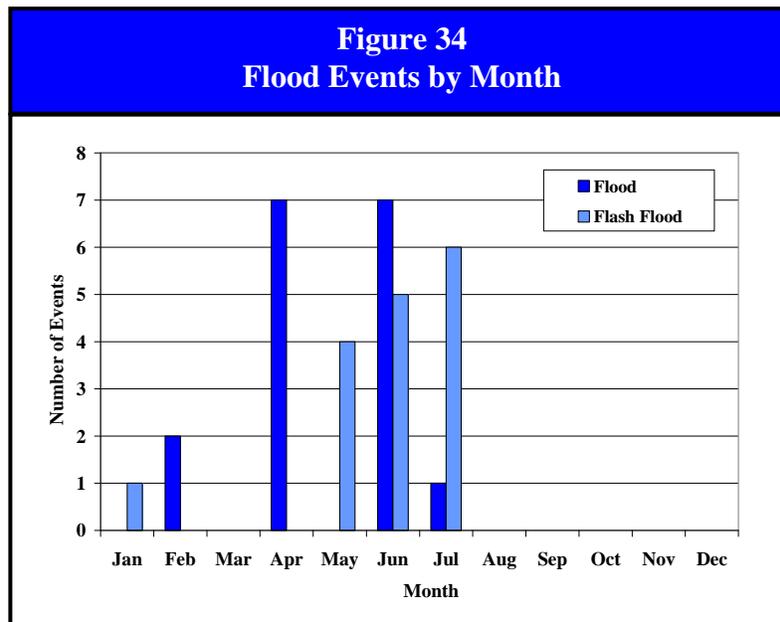
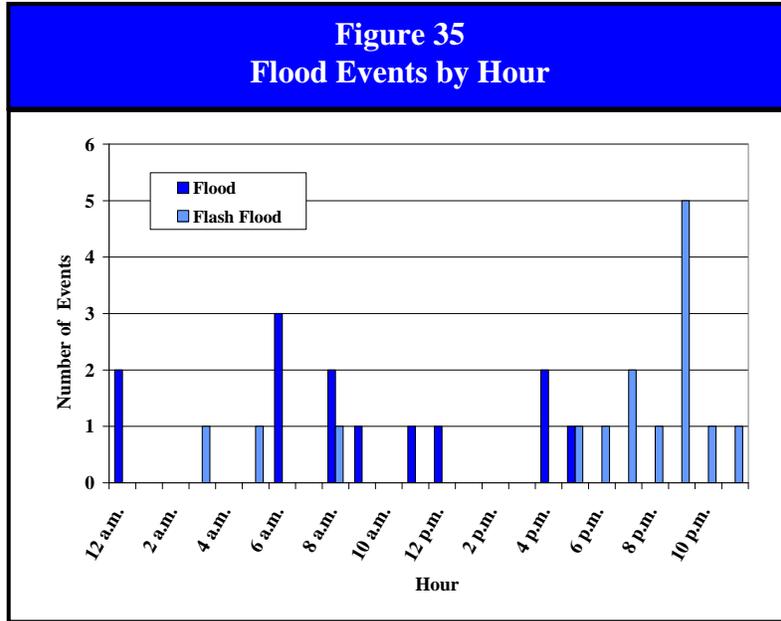


Figure 35 charts the reported occurrences of flooding and flash flooding in Carroll County by hour. Of the 17 flood events, start times were unavailable for four events. Of the remaining 13 flood events with recorded times, nine (69%) began during the a.m. hours, with six of the events beginning between 6 a.m. and 9 a.m. Of the 16 flash flood events, start times were unavailable for one event. Of the 15 flash flood events with recorded times, 12 (80%) began during the p.m. hours, with eight of the events beginning between 7 p.m. and 9 p.m.



What locations are affected by floods?

While specific locations are affected by riverine flooding, many areas of the County can be impacted by overland and flash flooding because of the topography and seasonally high water table of the area. The areas along the Mississippi River, Plum Creek and Carroll Creek (Wakarusa River) are very susceptible to flooding. Approximately 11.6% of the area in Carroll County is designated as being within the base floodplain and susceptible to riverine floods. The 2010 Illinois Natural Hazard Mitigation Plan by the Illinois Emergency Management Agency classifies Carroll County’s hazard rating for floods as “elevated.”

Figure 36 identifies the bodies of water by participating jurisdictions that are known to cause flooding or have the potential to flood.

Figure 36 Bodies of Water Subject to Flooding	
Participating Jurisdiction	Water Bodies
Chadwick	unnamed tributary of Rock Creek
Lanark	---
Milledgeville	Elkhorn Creek, unnamed tributary of Otter Creek
Mount Carroll	Carroll Creek (Wakarusa River), unnamed intermittent tributary of Carroll Creek
Savanna	Mississippi River, Plum River
Shannon	---
Thomson	---
Unincorporated Carroll County	Apple River, Camp Creek, Carroll Creek (Wakarusa River), Cheek Slough, Eagle Creek, East Fork Plum River, East Johnson Creek, Elkhorn Creek, Goose Creek, Horseshoe Lake, Johnson Creek, Lake Carroll, Little Rock Creek, Lundy Lake, Middle Creek, Mississippi River, Otter Creek, Plum River, Rock Creek, Rush Creek, Sand Creek, Spring Lake, Straddle Creek

Source: FEMA, FIRMs.

Figure 37 identifies the floodplains in Carroll County. This figure is based on the DFIRMs for Carroll County that became effective December 17, 2010. While a large portion of the area prone to riverine flooding is in the unincorporated portions of the County, Milledgeville, Mount Carroll and Savanna are also susceptible to riverine flooding because of their proximity to floodplains. To view the DFIRMs for the NFIP-participating municipalities, see **Appendix K**.

Do any of the participating jurisdictions take part in the NFIP?

Yes. Carroll County, Lanark, Milledgeville, Mount Carroll and Savanna all participate in the NFIP. **Figure 38** provides information about each jurisdiction’s participation in the NFIP, including the date each participant joined and the date of the most recently adopted floodplain zoning ordinance. Chadwick and Shannon have no identified flood hazard boundaries within their corporate limits and are not required to participate.

At this time Thomson is not participating in the NFIP. Since the Village’s current effective DFIRMs identify a Special Flood Hazard Area within the corporate limits they are presently sanctioned by the Program.

Figure 38 NFIP Participating Jurisdictions				
Participating Jurisdictions	Participation Date	Current Effective FIRM Date	CRS Participation	Most Recently Adopted Floodplain Zoning Ordinance
Carroll County	12/15/1983	12/17/2010	No	9/16/2010
Lanark	11/10/2011	12/17/2010 (NSFHA)	No	9/7/2010
Milledgeville	6/18/1987	12/17/2010	No	8/2/2010
Mount Carroll	9/29/1986	12/17/2010	No	12/7/2010
Savanna	6/4/1980	12/17/2010	No	10/26/2010

Source: FEMA, Community Status Book.

What is the probability of future flood events occurring?

Flood Events

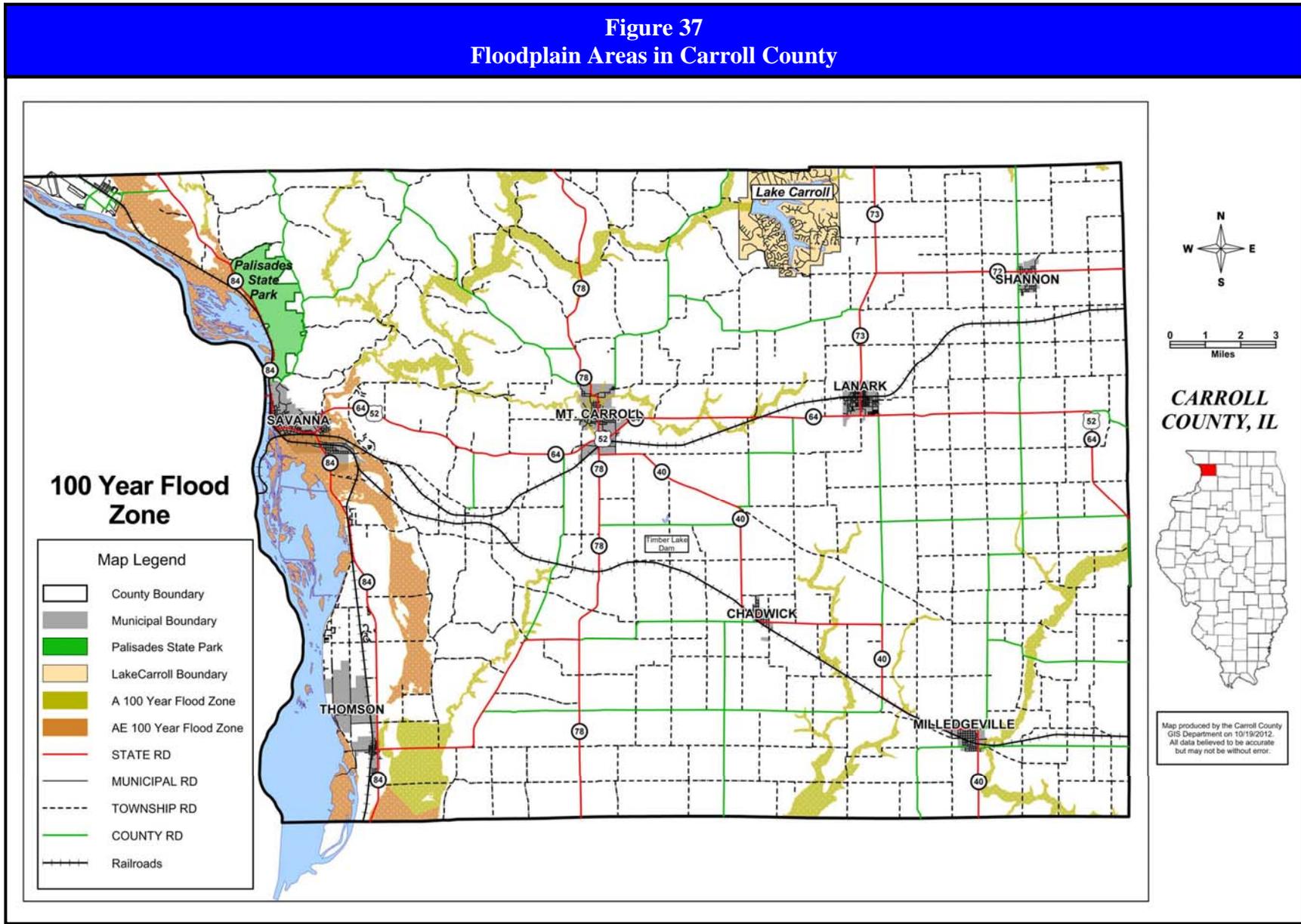
Carroll County has had 17 verified occurrences of general flooding between 1965 and 2011. With 17 occurrences over the past 51 years, the probability or likelihood of a flood event occurring in Carroll County in any given year is 33%. There were four years over the past 51 years where two or more general flood events occurred. This indicates that the probability that more than one general flood event may occur during any given year within the County is 8%. However, the gaps in flood data between 1965 and 1997 cause a distortion in both these probabilities.



Men fill sandbags in downtown Savanna during the 1965 Mississippi River flood.

Photo provided by Larry Stebbins.

Figure 37
Floodplain Areas in Carroll County



If only the events recorded by the Storm Events Database are analyzed, then there have been 13 verified occurrences of general flooding between 1997 and 2011. With 13 events in 15 years, the probability or likelihood of a flood event occurring in Carroll County in any given year is 87%. There were four years over the past 15 years where two or more general flood events occurred. This indicates that the probability that more than one general flood event may occur during any given year within the County is 27%. A probability based on 15 years of data may not be accurate as a probability based on 51 years of data. However, a probability based on the 1997-2011 data may provide a more reliable representation of the threat the County faces from flooding than a probability calculated from a longer time frame with gaps.



Carroll Creek swamped farm fields during the June, 1981 flood.

Photo provided by Leroy Getz.

Flash Flood Events

The County has experienced 16 verified occurrences of flash flooding between 1993 and 2011. With 16 occurrences over the past 19 years, the probability or likelihood of a flash flood event occurring in Carroll County in any given year is 84%. There were four years over the past 19 years where two or more flash flood events occurred. This indicates that the probability that two or more flash flood events may occur during any given year with the County is 21%.

ASSESSING VULNERABILITY

Several factors including topography, precipitation and an abundance of rivers and streams make Illinois especially vulnerable to flooding. Since the 1940s, Illinois climate records show an increase in heavy precipitation which has led to increased flood peaks on Illinois rivers.

Are the participating jurisdictions vulnerable to flooding?

Yes. Carroll County, including the participating jurisdictions, is vulnerable to the dangers presented by flooding. Precipitation levels, a high seasonal water table, and topography that includes the Mississippi River and its associated watersheds are factors that cumulatively make



Carroll Creek overflowed its banks and flooded Rock Point Park in Mount Carroll during the historic flash flood event of July, 2010.

Photo provided by Sally Marken.

virtually the entire County susceptible to some form of flooding. Flooding occurs along the floodplains of all the rivers and streams within the County as well as outside of the floodplains in low-lying areas where drainage problems occur due to culvert or drainage ditches that need improvement or proper maintenance. **Figure 39** details the number of recorded flood and flash flood events by participating jurisdiction.

Vulnerability to flooding can change depending on several factors, including land use. As land used primarily for agricultural and open space purposes is

converted for residential and commercial/industrial uses, the number of buildings and impervious surfaces (i.e., parking lots, roads, sidewalks, etc.) increases. As the number of buildings and impervious surfaces increases, so too does the potential for flash flooding. Rather than infiltrating the ground slowly, rain and snowmelt that falls on impervious surfaces runs off and fills ditches and storm drains quickly creating drainage problems and flooding.

Figure 39 Flood Events by Participating Jurisdiction				
Participating Jurisdiction	Flood Events		Flash Flood Events	
	Number	Year	Number	Year
Countywide	8	1981, 1997, 1997, 2000, 2000, 2001, 2002, 2004	3	1993, 2010, 2010
Western Portion of the County	7	1965, 1973, 1993, 2001, 2008, 2008, 2011	0	---
Unincorp. Areas	0	---	3	2003, 2006, 2009
Chadwick	0	---	0	---
Lanark	0	---	1	2009
Milledgeville	1	2010*	1	2009
Mount Carroll	2	1981, 2004*	7	2002, 2007*, 2007, 2009*, 2009*, 2009*, 2011
Savanna	1	2000	3	2006, 2009, 2011
Shannon	0	---	0	---
Thomson	0	---	0	---

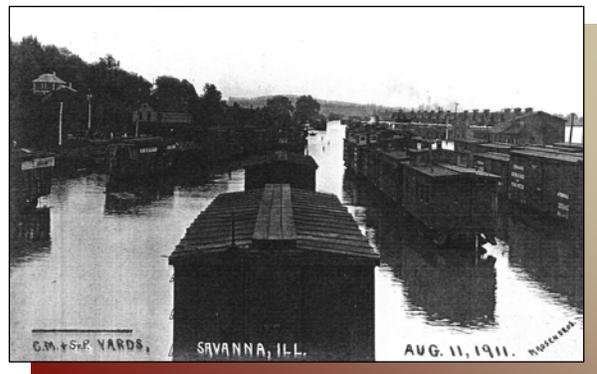
* Flooding occurred in the vicinity of this location.

As described in Section 1.3, substantial changes in land use (from forested, open and agricultural land to residential, commercial and industrial) are not anticipated within the County in the immediate future. No substantial increases in residential or commercial/industrial developments are expected within the next five years.

What impacts resulted from the recorded floods?

Flooding as a whole has caused an estimated \$2,200,000 in agricultural losses and \$13,896,122 in property damages. In comparison, the State of Illinois has averaged an estimated \$257 million annually in property damage losses from flooding since 1983, making flooding the single most financially damaging weather hazard in Illinois. The following provides a breakdown of impacts by category.

Words alone cannot fully convey the scope of the damages caused by floods in Carroll County. Select photographs provided by Planning Committee members are located throughout this section and additional photographs of historic flood events are located in **Appendix L**.



Historic photographs show floodwaters from the Plum River impacting the rail yards in Savanna during August, 1911.

Photo provided by Larry Stebbins.

No injuries or deaths were reported as a result of any of the recorded flood events in Carroll County. In comparison, Illinois averages four deaths per year from flooding. Even though 11.6% of the area within the County lies in a floodplain, the number of injuries and deaths is very low. As a result, the risk or vulnerability to public health and safety from general flooding is seen as relatively low. However, approximately half of the recorded flood events were a result of flash flooding. Since there is very little warning associated with flash flooding, the risk to public health and safety from flash flooding is elevated to medium.

Floods

The data provided by the Storm Events Database, the Illinois Emergency Management Agency and U.S. Geological Survey records indicate that between 1965 and 2011, four general flood events caused approximately \$2,344,622 in property damage and \$2,200,000 in agricultural losses. Of the four events with damage estimates, three were part of federally-declared disasters. Damage information was either unavailable or none was recorded for the remaining 13 events.



Carroll Creek floodwaters cover Mill Street in Mount Carroll during the June 13, 1981 flood.

Photo provided by Leroy Getz.

The first event began on June 13, 1981 and was included in Presidential Disaster Declaration 643. Four to seven inches of rain fell within a 48 hour period causing flooding along Carroll Creek (Wakarusa River) and the Plum River. Damages in Carroll County were estimates at \$2.7 million, including 2.2 million in agricultural losses.



The 1993 Mississippi River flooding inundated many businesses in Savanna including the elevator located along the river front.

Photo provided by Leroy Getz.

The second event was the 1993 flood on the Mississippi River, covered under Presidential Disaster Declaration 997. Higher than average precipitation through the spring and summer caused the Mississippi River to overflow its banks. The subsequent flooding damaged 10 homes and 40 businesses in Savanna. In Carroll County, a minimum of \$1,289,083 in property damages was identified.

The third event began on April 14, 2001 and was included in Presidential Disaster Declaration 1368. Rapid snow melt coupled with severe thunderstorms produced near record flooding along the Mississippi River. In Carroll County, a minimum of \$305,539 in property damages was identified. The Mississippi River crested at 22.58 feet on April 23, 2001 at Lock and Dam #12 in Bellevue, Iowa (just north of Carroll County), making this event the second highest crest at this gauge.

The final event began on April 18, 2011 when water from snow-melt in the upper Midwest moved south through the Mississippi River basin causing major flooding along the Mississippi River. Approximately \$250,000 in property damages was recorded in Carroll County.

Flash Floods

The data provided by the Storm Events Database and community records indicate that between 1993 and 2011, eight flash flood events caused approximately \$11,551,500 in property damage. Damage information was either unavailable or none was recorded for the remaining eight events.

Included in the property damage figures is the historical flash flooding of July 23, 24 and 25, 2010 which was included in Presidential Disaster Declaration 1365. A total of 6 to 13 inches of rain fell over a 48 hour period causing creeks and streams to rise rapidly and resulting in flash flooding to an extent that had never before been seen in Carroll County. The property damage estimates for this event alone totaled \$11.1 million.



Flash flooding during July, 2010 seriously damaged many homes.

Photo provided by Sally Marken.

Included in the property damage figures provided above, the Village of Milledgeville estimated that flash flooding of Elkhorn Creek caused approximately \$100,000 in damage to the Village's wastewater treatment plant. In Mount Carroll, Carroll Creek (Wakarusa River) flooded the City's wastewater treatment plant and forced the evacuation of approximately 80 homes.



The Illinois 84 bridge over the rail lines was damaged by flood waters during the July, 2010 flash flood event.

Photo provided by Sally Marken.

In Savanna, the Plum River overflowed/breached a high bank sending flood waters through the rail yard to the Mississippi River. An estimated 625 people were evacuated, mainly from the eastern and southern portions of the City. Approximately 10 homes were completely destroyed and an additional 75 seriously damaged. A number of rail cars were overturned and both the DM&E and BNSF suffered damage to their rail lines. The raging flood waters also washed away more than 30 yards of embankment and two rows of support pylons at the Illinois 84 bridge, forcing its closure and cutting off the primary access route to Savanna from the south.

The other major event included in the property damage figures was the July 27, 28 and 29, 2011 flash flooding that occurred across the northern half of the County and included Mount Carroll and Savanna. This event caused approximately \$260,000 in property damages. In Savanna, both rail yards were inundated and several streets flooding forcing the evacuation of 80 residents.

What other impacts can result from flooding?

One of the primary threats from flooding is drowning. Nearly half of all flash flood deaths occur in vehicles as they are swept downstream. Most of these deaths take place when people drive into flooded roadway dips and low drainage areas. It only takes two feet of water to carry away most vehicles.

Floodwaters also pose biological and chemical risks to public health. Flooding can force untreated sewage to mix with floodwaters. The polluted floodwaters then transport the biological contaminants into buildings and basements and onto streets and public areas. If left untreated, the floodwaters can serve as breeding grounds for bacteria and other disease-causing agents. Even if floodwaters are not contaminated with biological material, basements and buildings that are not properly cleaned can grow mold and mildew which can pose a health hazard, especially for small children, the elderly and those with specific allergies.



Many businesses were flooded during the 1965 Mississippi River flood.

Photo provided by Larry Stebbins.

Flooding can also cause chemical contaminants such as gasoline and oil to enter the floodwaters if underground storage tanks or pipelines crack and begin leaking during a flood event. Depending on the time of year, floodwaters also may carry away agricultural chemicals that have been applied to farm fields.

Structural damage, such as cracks forming in foundation, can also result from flooding. In most cases, however, the structural damage sustained during a flood occurs to the flooring, drywall and wood framing. In addition to structural damage, a flood can also cause serious damage to a building's content.

Are there any repetitive loss structures/properties within Carroll County?

Yes. There are four repetitive flood loss properties located within Carroll County. There is a single family dwelling located in Mount Carroll and three single family dwellings and one non-residential structure located in unincorporated Carroll County. As described previously, FEMA defines a "repetitive loss structure" as an NFIP-insured structure that has received two or more flood insurance claim payments of more than \$1,000 each within any 10-year period since 1978.

Figure 40 identifies the repetitive flood loss structures/properties by participating jurisdiction and provides the total flood insurance claim payments. The exact location and/or addresses of the insured properties are not included in this Plan to protect the owners' privacy. According to FEMA, there have been 13 flood insurance claim payments totaling \$198,490.15 for the four repetitive flood loss structures/properties located in Carroll County.

Figure 40 Repetitive Flood Loss Properties					
Participating Jurisdiction	Structure Type	Number of Flood Insurance Claim Payments	Flood Insurance Claim Payments		Total Flood Insurance Claim Payments
			Structure	Content	
Mount Carroll	Single Family	2	\$31,824.37	\$11,589.00	\$43,413.37
Unincorp. Carroll Co.	Non-Residential	4	\$27,151.81	\$0	\$27,151.81
Unincorp. Carroll Co.	Single Family	2	\$7,502.80	\$46.00	\$7,548.80
Unincorp. Carroll Co.	Single Family	3	\$53,074.86	\$6,965.00	\$60,039.86
Unincorp. Carroll Co.	Single Family	2	\$20,336.31	\$40,000	\$60,336.31
Totals:		13	\$139,890.15	\$58,600.00	\$198,490.15

Source: Purchis, Bryan, Hazard Mitigation Planner, Illinois Emergency Management Agency, “FW: Repetative (sic) Loss Properties,” Email to Greg R. Michaud, January 19, 2012.

Are existing buildings, infrastructure and critical facilities vulnerable to flooding?

Yes. **Figure 41** identifies the existing buildings, infrastructure and critical facilities by participating jurisdiction located within the floodplain and vulnerable to flooding. These counts were prepared by the Carroll County Zoning Administrator and the Carroll County GIS Department.

Figure 41 Existing Buildings, Infrastructure and Critical Facilities Vulnerable to Flooding						
Participating Jurisdiction	Residential Buildings		Residential Garages	Businesses	Farm Buildings	Infrastructure/ Critical Facilities
	Homes	Apartment Buildings				
Chadwick	0	0	0	0	0	0
Lanark	0	0	0	0	0	0
Milledgeville	0	0	0	2	0	1
Mount Carroll	13	2	5	0	0	2
Savanna	34	0	1	40	0	3
Shannon	0	0	0	0	0	0
Thomson	0	0	0	0	0	0
Unincorp. Carroll County	85	0	0	8	90	*

* No specific infrastructure/critical facilities, aside from roads and bridges, were identified for Unincorporated Carroll County.

Source: Carroll County Zoning Administrator and GIS Department.

Specific infrastructure and critical facilities located within or adjacent to the floodplain and vulnerable to flooding include Savanna’s drinking water wells, wastewater treatment facility and fire station, Mount Carroll’s wastewater treatment facility and Point Rock Park, and Milledgeville’s wastewater treatment facility. These facilities have experienced repeated flooding issues. Savanna is planning to build a new wastewater treatment facility in a less vulnerable area. The land has been acquired and design plans are complete. Funding is being sought to start construction of the new facility.

In general, roadways, culverts and bridges are vulnerable to all forms of flooding. Floodwaters can weaken infrastructure and cause washouts and collapses. Buried power and communication lines are also vulnerable to flooding. Water can infiltrate the lines and cause disruptions.

While only 11.6% of the land area in Carroll County lies within the base floodplain and is susceptible to riverine flooding, almost the entire County is vulnerable to flash flooding. As a result, a majority of the buildings, infrastructure and critical facilities that may be impacted by flooding are located outside of the base floodplain and are not easily identifiable.

Based on the frequency and severity of recorded flood events within the County, the fact that most of the County is vulnerable to flash flooding and a majority of the buildings, infrastructure and critical facilities that may be impacted are located outside of the base floodplain, the risk or vulnerability of existing buildings, infrastructure and critical facilities to all forms of flooding is considered to be medium to high.

Are future buildings, infrastructure and critical facilities vulnerable to flooding?

The answer to this question depends on the type of flooding being discussed. In terms of riverine flooding, the vulnerability of future buildings, infrastructure and critical facilities located within NFIP-participating jurisdictions (Carroll County, Lanark, Milledgeville, Mount Carroll and Savanna) is low as long as the existing floodplain ordinances are enforced. Enforcement of the floodplain ordinance is the mechanism that ensures that new structures either aren't built in flood-prone areas or are elevated or protected to the base flood elevation.

At this time Thomson's current effective DFIRM identifies a Special Flood Hazard Area within the corporate limits of the village; however the Village is not a participant in the NFIP. As a result, future structures built in or near the base floodplain in Thomson would be vulnerable to riverine flooding.

In terms of flash flooding, all future buildings, infrastructure and critical facilities are still vulnerable depending on the amount of precipitation that is received, the topography and any land use changes undertaken within the participating jurisdictions.

What are the potential dollar losses to vulnerable structures from flooding?

An estimate of the potential dollar losses to vulnerable residential structures located within the participating municipalities can be calculated if several assumptions are made. These assumptions represent a probable scenario based on the reported occurrences of flooding in Carroll County.

The purpose of providing an estimate is to help residents and municipal officials make informed decisions about how they can better protect themselves and their communities. These estimates are meant to provide a *general idea* of the magnitude of the potential damage that could occur from a flood event in each of the municipalities.

To calculate the overall potential dollar losses to vulnerable residential structures from a flood, a set of decisions/assumptions must be made regarding the:

- type of flood event;
- scope of the flood event;
- number of potentially-damaged housing units;
- value of the potentially-damaged housing units; and
- percent damage sustained by the potentially-damaged housing units (i.e., damage scenario.)

The following provides a detailed discussion of each decision/assumption.

Type of Flood Event

The first step towards calculating the potential dollar losses to vulnerable residential structures is to determine the type of flood event that will be used for this scenario. While flash flooding events have caused the greatest amount of recorded flood damages in the County, identifying residential structures vulnerable to flash flooding is problematic because most are located outside of the base floodplain. In addition, the number of structures impacted can change with each event depending on the amount of precipitation received, the topography and the land use of the area.

Assumption #1

A riverine flood event will impact vulnerable residential structures within each municipality.

Therefore, a riverine flood event will be used since it is relatively easy to identify vulnerable residential structures (i.e., those structures located within the base floodplain or Special Flood Hazard Areas) within each municipality using the DFIRMs and the number of structures impacted is generally the same from event to event.

Scope of the Flood Event

To establish the number of vulnerable residential structures or potentially-damaged housing units, the scope of the riverine flood event within each municipality must first be determined. In this scenario, the scope refers to the number of rivers and creeks that overflow their banks and the degree of flooding experienced along base floodplains for each river and creek.

Assumption #2

All base floodplains within a municipality will flood and experience the same degree of flooding.

Generally speaking, a riverine flood event only affects one or two rivers or streams at a time depending on the cause of the event (i.e., precipitation, snow melt, ice jam, etc.) and usually does not produce the same degree of flooding along the entire length of the river or creek. However, for this scenario, it was decided that:

- ❖ all rivers and creeks with base floodplains would overflow their banks, and
- ❖ the base floodplains of each river and/or creek located within the corporate limits of each municipality would experience the same degree of flooding.

This assumption results in the following conditions for each municipality:

- ❖ Chadwick, Lanark, Shannon and Thomson would not experience any flooding since there are no rivers or creeks with base floodplains within their municipal limits;
- ❖ Elkhorn Creek would overflow its banks and flood the eastern portion of Milledgeville;
- ❖ Carroll Creek (Wakarusa River) and an Unnamed Intermittent Tributary of Carroll Creek would overflow their banks and flood portions of Mount Carroll; and
- ❖ Plum River and the Mississippi River would overflow their banks and flood portions of Savanna.

Number of Potentially-Damaged Housing Units

Since this scenario assumes that a riverine flood will impact all base floodplains within a municipality, the number of potentially-damaged housing units can be determined by counting the number of existing residential structures located within the base floodplain(s) in each municipality. These counts were prepared by the Carroll County Zoning Administrator and the GIS Department.

Assumption #3

The number of existing residential structures located within the base floodplain in each municipality will be used to determine the number of potentially-damaged housing units.

The following municipalities have existing residential buildings located within the base floodplains of their communities:

- ❖ Mount Carroll has 13 residential buildings and two apartment buildings, and
- ❖ Savanna has 34 residential buildings.

Value of Potentially-Damaged Housing Units

Now that the number of potentially-damaged housing units has been determined, the monetary value of each unit must be calculated. Typically when damage estimates are prepared after a natural disaster such as a flood, they are based on the market value of the structure. Since it would be impractical to determine the individual market value of each potentially-damaged housing unit, the average market value for a residential structure in each municipality will be used to calculate the potential dollar losses.

Assumption #4

The average market value for a residential structure in each municipality will be used to determine the value of potentially-damaged housing units.

To determine the average market value, the average assessed value must first be calculated. The average assessed value is determined by taking the total assessed value of non farm buildings within a municipality and dividing that number by the total number of housing units in the municipality. **Figure 42** provides a sample calculation. The total assessed value is based on 2011 tax assessment information provided by the Carroll County Chief County Assessment Office.

Figure 42
Calculation of Average Assessed Value

Total Assessed Value of Non Farm Buildings ÷ Total Housing Units = Average Assessed Value
(Rounded to the Nearest Penny)

Chadwick: \$6,007,131 ÷ 227 housing units = \$26,463.13

To determine the average market value, the average assessed value is multiplied by three (the assessed value of a structure in Carroll County is approximately one-third of the market value). **Figure 43** provides the average assessed value and average market value for each participating municipality.

Figure 43 Average Market Value of Housing Units				
Participating Jurisdiction	Total Assessed Value of Non Farm Buildings (2011)	Total Housing Units (2000)	Average Assessed Value	Average Market Value
Chadwick	\$6,007,131	227	\$26,463.13	\$79,389
Lanark	\$16,126,584	694	\$23,237.15	\$69,711
Milledgeville	\$13,460,077	499	\$26,974.10	\$80,922
Mount Carroll	\$16,982,569	854	\$19,885.91	\$59,658
Savanna	\$26,639,043	1,796	\$14,832.43	\$44,497
Shannon	\$11,081,880	361	\$30,697.73	\$92,093
Thomson	\$5,868,781	239	\$24,555.57	\$73,667

Source: Eberle, Leah, Carroll County Chief County Assessment Office.

Damage Scenario

The final decision that must be made to calculate potential dollar losses is to decide on the percent damage sustained by the structure and the structure’s contents during the flood event. In order to determine the percent damage using FEMA’s flood loss estimation tables, assumptions must be made regarding a) the type of residential structure flooded (i.e., manufactured home, one story home without a basement, one or two story home with a basement, etc.) and b) the flood depth. For this scenario, it is assumed that the potentially-damaged housing units are one or two story homes with basements and the flood depth is two feet. With these assumptions the expected percent damage sustained by the *structure* is estimated to be 20% and the expected percent damage sustained by the structure’s *contents* is estimated to be 30%.

Assumption #5

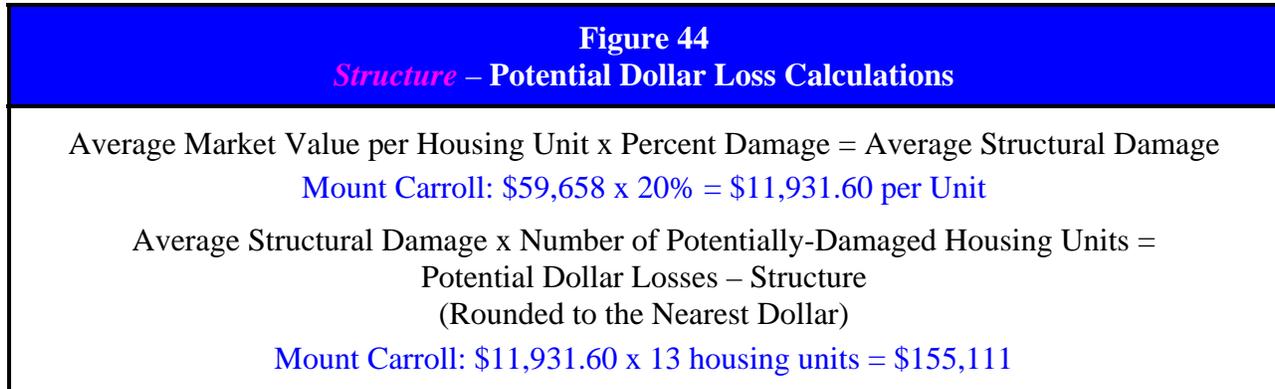
The potentially-damaged housing units are one or two story homes with basements and the flood depth is two feet.

Structural Damage = 20%
Content Damage = 30%

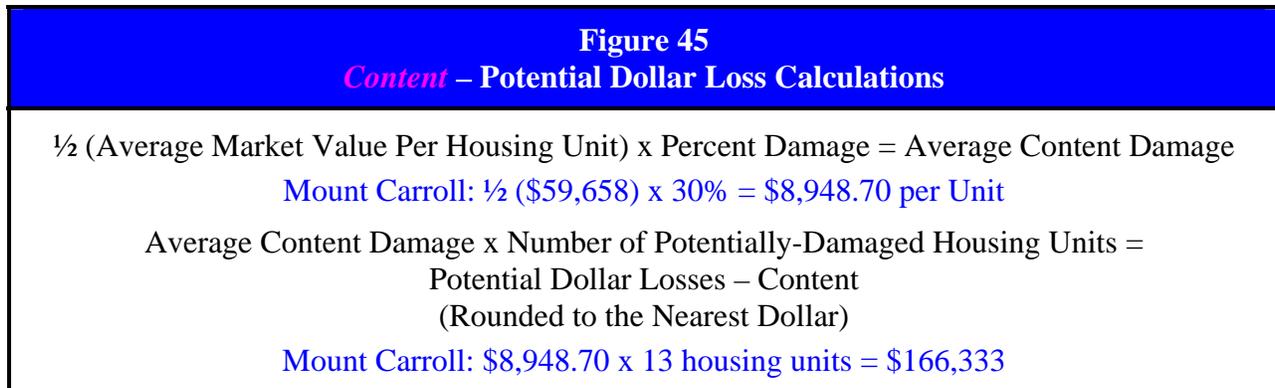
Potential Dollar Losses

Now that all of the decisions/assumptions have been made, the potential dollar losses can be calculated. First the potential dollar losses to the *structure* of the potentially-damaged housing

units must be determined. This is done by taking the average market value for a residential structure and multiplying that by the percent damage (20%) to get the average structural damage per unit. Next the average structural damage per unit is multiplied by the number of potentially-damaged housing units. **Figure 44** provides a sample calculation.



Next the potential dollar losses to the *content* of the potentially-damaged housing units must be determined. Based on FEMA guidance, the value of a residential housing unit’s content is approximately 50% of its market value. Therefore, start by taking one-half the average market value for a residential structure and multiply that by the percent damage (30%) to get the average content damage per unit. Next the average content damage per unit is multiplied by the number of potentially-damaged housing units. **Figure 45** provides a sample calculation.



Finally the *total potential dollar losses* may be calculated by adding together the potential dollar losses to the structure and the content. **Figure 46** gives a breakdown of the total potential dollar losses by municipality.

This assessment illustrates why potential residential dollar losses should be considered when municipalities are deciding which mitigation projects to pursue. Potential dollar losses caused by riverine flooding to vulnerable residences within the participating municipalities would be expected to range from \$270,000 to \$530,000. There are five participating municipalities in this scenario who do not have any residences considered vulnerable to riverine flooding.

Figure 46					
Estimated Potential Dollar Losses to Potentially-Damaged Housing Units from a Riverine Flood Event					
Participating Jurisdiction	Average Market Value	Potentially Damage Housing Units	Potential Dollar Losses		Total Potential Dollar Losses
			Housing Unit	Content	
Chadwick	\$79,389	0	\$ 0	\$ 0	\$ 0
Lanark	\$69,711	0	\$ 0	\$ 0	\$ 0
Milledgeville	\$80,922	0	\$ 0	\$ 0	\$ 0
Mount Carroll	\$59,658	13	\$155,111	\$116,333	\$271,444
Savanna	\$44,497	34	\$302,580	\$226,935	\$529,515
Shannon	\$92,093	0	\$ 0	\$ 0	\$ 0
Thomson	\$73,667	0	\$ 0	\$ 0	\$ 0

The calculations presented above are meant to provide the reader with a sense of the scope or magnitude of a large riverine flood event in dollars. These calculations do not include the physical damages sustained by businesses or other infrastructure. Monetary impacts to businesses can include loss of sales revenue either through the temporary closure or loss of crucial services (i.e., power, drinking water and sewer). The damage sustained by infrastructure from a flood event can far surpass the damage experienced by residential structures. As a result, the cumulative monetary impacts to businesses and infrastructure can exceed the cumulative monetary impacts to residences. While average dollar amounts can not be supplied for these items at this time, they should be taken into account when discussing the overall impacts that a large-scale riverine flood event could have on the participating jurisdictions.

Infrastructure & Critical Facilities

The wastewater treatment facilities in Milledgeville, Mount Carroll and Savanna are all located within the floodplain and have experienced repeated flooding issues. Savanna is working to construct a new facility in an area less vulnerable to flood damage. The potential dollar loss to relocate these facilities will be several million dollars, respectively. In addition to the wastewater treatment facility, Savanna’s drinking water wells are also located within the floodplain.

No other above-ground infrastructure or critical facilities within the participating jurisdictions, other than key roads and bridges, were identified as being vulnerable to riverine flooding.

Considerations

While the potential dollar loss scenario did not take into consideration a flash flood event, the participating jurisdictions should consider the impacts associated with such events. Within the last three years, Carroll County has experienced several large-scale flash flood events. The two events that occurred in July, 2010 were extraordinary in magnitude and resulted in approximately \$11 million in damages, impacting many of the participating jurisdictions within the County, including a few that had never flooded before. The July, 2011 event, while smaller in size, impacted the northern portion of the County, including Savanna and Mount Carroll, and caused approximately \$260,000 in recorded damages.

These recent events illustrate the fact that all forms of flooding can and will impact the County and should be considered when officials discuss the overall monetary impacts of flooding on their communities. All participants should carefully consider the types of activities and projects that can be taken to minimize their vulnerability to flooding.

**Figure 32
(Sheet 1 of 5)
Flood Events Reported in Carroll County
1965 – 2011**

Date(s)	Start Time	Location(s)	Magnitude	Injuries	Death	Property Damages
4/25/1965	NA	western portion of the county	<p>Heavy rains fell across much of the northern Mississippi River region in early to mid April. The rain, coupled with snow melt and the still frozen ground led to flooding of many rivers, including the Mississippi.</p> <p>The Mississippi River crested at 23.51 feet on April 26 at Lock and Dam #12 in Bellevue, IA (just north of Carroll County). This was the record crest for this gage, which still stands today. This event was part of a federally-declared disaster (Declaration #194.)</p> <p>Flood stage at this location is 17.0 feet and major flood stage is 20.0 feet. At 19.0 feet the treatment plant at Savanna is unable to keep up with infiltration; at 20.2 feet, basements in homes and businesses begin to flood in Savanna; at 21.9 feet water begins flowing over the railroad tracks and into businesses in Savanna and at 22.0 feet IL 84 north of the bridge at Savanna becomes inundated.</p>	0	0	\$0
4/26/1973	NA	western portion of the county	<p>Higher-than-average precipitation in March and early April led to flooding along the Mississippi River.</p> <p>The Mississippi River crested at 19.13 feet on April 24 at Lock and Dam #12 in Bellevue, IA (just north of Carroll County.) This event was part of a federally-declared disaster (Declaration #373.)</p> <p>Flood Stage at this location is 17.0 feet and moderate flood stage is 18.0 feet. At 17.5 feet floodwaters affect the operation of the grain elevator in Savanna; at 18.4 feet the lock and dam closes; and at 19.0 feet the treatment plant at Savanna is unable to keep up with infiltration.</p>	0	0	\$0
Subtotal:				0	0	\$0

**Figure 32
(Sheet 1 of 5)
Flood Events Reported in Carroll County
1965 – 2011**

Date(s)	Start Time	Location(s)	Magnitude	Injuries	Death	Property Damages
6/13/1981 thru 6/14/1981	NA	Mount Carroll countywide	4" – 7" of rain fell within a 48 hour period causing flooding along Carroll Creek (Wakarusa River) and the Plum River. Local reports indicated that stage and discharge were very likely at record levels. Damages were estimated at \$2.7 million, including \$2.2 million in agricultural losses. This event was part of a federally-declared disaster (Declaration #643.)	0	0	\$2,700,000
4/13/1993 thru 10/22/1993	NA	western portion of the county	Higher-than-average precipitation through the spring and summer and the occurrence of this precipitation on a more or less continuous basis caused the Mississippi River to overflow its banks. The subsequent flooding damaged 10 homes and 40 businesses in Savanna. The Mississippi River crested at 21.5 feet on July 1 at Lock and Dam #12 in Bellevue, IA (just north of Carroll County), making it the third highest crest at this gage. This event was part of a federally-declared disaster (Declaration #997.) Flood Stage at this location is 17.0 feet and major flood stage is 20.0 feet. At 19 feet the treatment plant at Savanna is unable to keep up with infiltration; at 20.2 feet, basements in homes and businesses begin to flood in Savanna and at 20.4 feet the grain elevator in Savanna begins to sustain damage.	0	0	\$1,289,083
2/20/1997 thru 2/24/1997	4:00 p.m.	countywide	2" – 4" of rain fell on partially frozen soils. Flooding was exacerbated by rivers/streams already high from recent snowmelt.	0	0	\$0
Subtotal:				0	0	\$3,989,083

**Figure 32
(Sheet 3 of 5)
Flood Events Reported in Carroll County
1965 – 2011**

Date(s)	Start Time	Location(s)	Magnitude	Injuries	Death	Property Damages
4/8/1997 thru 4/30/1997	6:00 a.m.	countywide	Spring snowmelt from heavy snow cover across the upper basin brought significant flooding to portions of the Mississippi River. The Mississippi River crested at 20.16 feet on April 17 at Lock and Dam #12 in Bellevue, IA (just north of Carroll County), making it the fourth highest crest at this gage. Flood Stage at this location is 17.0 feet and major flood stage is 20.0 feet. At 17.5 feet floodwaters affect the operation of the grain elevator in Savanna; at 18.4 feet the lock and dam closes; and at 19.0 feet the treatment plant at Savanna is unable to keep up with infiltration and at 20.2 feet, basements in homes and businesses begin to flood in Savanna.	0	0	\$0
6/2/2000 thru 6/28/2000	8:30 a.m.	countywide	An unusually wet month with northwest Illinois averaging 2" – 4" above normal on rainfall led to countywide flooding.	0	0	\$0
6/13/2000	6:50 a.m.	Savanna	Heavy rain fell on already saturated ground resulting in several roads being covered in water in Savanna.	0	0	\$0
6/13/2000	4:04 p.m.	countywide	Afternoon thunderstorms erupted, producing heavy rain resulting in urban and small stream flooding in a few areas.	0	0	\$0
2/24/2001	9:00 a.m.	countywide	1" – 1.5" rain caused numerous reports of street and small stream flooding.	0	0	\$0
Subtotal:				0	0	\$0

**Figure 32
(Sheet 4 of 5)
Flood Events Reported in Carroll County
1965 – 2011**

Date(s)	Start Time	Location(s)	Magnitude	Injuries	Death	Property Damages
4/14/2001 thru 5/30/2001	5:00 p.m.	western portion of the county	Several severe thunderstorm systems coupled with prolonged, abnormally warm conditions resulted in rapid snow melt and produced near record flooding along the Mississippi River. The Mississippi River crested at 22.58 feet on April 23 at Lock and Dam #12 in Bellevue, IA (just north of Carroll County), making it the second highest crest at this gage. This event was part of a federally-declared disaster (Declaration #1368.) Flood Stage at this location is 17.0 feet and major flood stage is 20.0 feet. At 19.0 feet the treatment plant at Savanna is unable to keep up with infiltration; at 20.2 feet, basements in homes and businesses begin to flood in Savanna; at 21.9 feet water begins flowing over the railroad tracks and into businesses in Savanna and at 22 feet IL 84 north of the bridge at Savanna becomes inundated.	0	0	\$305,539
6/4/2002	8:00 a.m.	countywide	6" – 10" of rain fell during the first week of June causing widespread and significant river flooding. The Plum River flooded parts of two roads.	0	0	\$0
6/16/2004 thru 6/24/2004	12:24 p.m.	countywide Mount Carroll [^]	The Mississippi River crested at 17.28 feet on June 19 at Lock and Dam #12 in Bellevue, IA (just north of Carroll County.) Flood Stage at this location is 17.0 feet. At 17.0 feet Broderick Drive and Wayne King Drive flood in Savanna and yards begin flooding.	0	0	\$0
Subtotal:				0	0	\$305,539

[^] Flood event verified in the vicinity of this location(s).

**Figure 32
(Sheet 5 of 5)
Flood Events Reported in Carroll County
1965 – 2011**

Date(s)	Start Time	Location(s)	Magnitude	Injuries	Death	Property Damages
4/1/2008 thru 4/30/2008	12:00 a.m.	western portion of the county	Major to record flooding occurred during April as a result of a series of moderate to record high rainfall events. The flood event affected the Mississippi River as well as many of its tributaries. All forecast points on the Mississippi River from Dubuque to Keokuk topped flood stage.	0	0	\$0
6/1/2008 thru 6/30/2008	12:00 a.m.	western portion of the county	Major to record flooding occurred during June with most forecast points above the flood stage for the majority of the month. The flooding during June was more prolific and severe than the flooding in April. Both the Mississippi and Rock Rivers rose above flood stage at most locations around June 10 th .	0	0	\$0
7/24/2010	11:00 a.m.	Milledgeville [^]	Heavy rains caused Rock Creek to flow over the road approximately two miles west of Milledgeville.	0	0	\$0
4/18/2011 thru 4/24/2011	6:00 a.m.	western portion of the county	Water from snow-melt in the upper Midwest moved south through the Mississippi River basin causing major flooding along the Mississippi River.	0	0	\$250,000
Subtotal:				0	0	\$250,000
GRAND TOTAL:				0	0	\$4,544,622

[^] Flood event verified in the vicinity of this location(s).

Sources: Illinois Department of Natural Resources, Office of Water Resources.

Illinois State Water Survey.

NOAA, National Environmental Satellite, Data & Information Service, National Climatic Data Center, Storm Events Database.

NOAA, National Weather Service, Weather Forecast Office – Quad Cities, Iowa/Illinois, Past Events.

U.S. Geological Survey.

Figure 33
(Sheet 1 of 4)
Flash Flood Events Reported in Carroll County
1993 – 2011

Date(s)	Start Time	Location(s)	Magnitude	Injuries	Death	Property Damages
6/24/1993	NA	countywide	6" of rain fell on the 24 th causing flash flooding. The flooding caused washouts to various county and township roads, culverts and bridges. More rain fell on July 2 nd adding to the damage.	0	0	\$188,000
6/4/2002	8:00 a.m.	Mount Carroll	Water from flash flooding covered roads around and west of the city.	0	0	\$0
1/20/2003	11:17 p.m.	Marcus [^]	heavy rains accompanying a thunderstorm produced nuisance street flooding and resulted in a mudslide across IL 84 just northwest of Palisades State Park which caused a traffic accident, but no injuries	0	0	\$0
6/25/2006 thru 6/26/2006	9:40 p.m.	Savanna	3" of rain fell overnight causing flash flooding. A few feet of water ran across US 52 just south of the business district and the railroad underpass on Scenic Bluff Road was impassable, covered by several feet of water.	0	0	\$5,000
6/25/2006 thru 6/26/2006	9:40 p.m.	Wacker [^]	3" of rain fell overnight causing flash flooding. The railroad underpass on Wacker Road one mile east of town was impassable, covered with several feet of water.	0	0	\$3,000
7/9/2007	6:32 p.m.	Mount Carroll [^]	Flash flooding caused a gravel and dirt road to wash onto IL 78 near Blue Mountain Road, approximately three miles north of the city.	0	0	\$500
7/18/2007	9:15 p.m.	Mount Carroll	0.75" – 3" of heavy rain fell in the evening across Carroll County. The rain combined with already saturated soils causing flash flooding. Water covered portions of Mill St. near the city garage.	0	0	\$0
5/13/2009	7:55 p.m.	Savanna Wacker [^]	Heavy rains resulted in the flash flooding of a low lying railroad underpass near Savanna.	0	0	\$0
Subtotal:				0	0	\$196,500

[^] Flash flood event verified in the vicinity of this location(s).

Figure 33
(Sheet 2 of 4)
Flash Flood Events Reported in Carroll County
1993 – 2011

Date(s)	Start Time	Location(s)	Magnitude	Injuries	Death	Property Damages
5/13/2009	7:56 p.m.	Mount Carroll [^]	Heavy rains resulted in the flash flooding of the intersection of Scenic Palisades Road and Quarry Road about two miles west of Mount Carroll.	0	0	\$0
5/13/2009	8:19 p.m.	Milledgeville	Heavy rains caused flash flooding of a low lying railroad underpass in Milledgeville.	0	0	\$0
5/13/2009	9:30 p.m.	Lanark	Heavy rains caused flash flooding of roads near Lanark. Some of the roads on the south side of town eroded.	0	0	\$5,000
6/19/2009	5:08 p.m.	Mount Carroll [^]	Heavy rains resulted in flash flooding of some county roads near Mount Carroll.	0	0	\$0
7/27/2009 thru 7/28/2009	9:23 p.m.	Mount Carroll [^]	Heavy rains resulted in flash flooding near Mount Carroll. Roads were closed due to high water. In particular, Scenic Bluff Road was barricaded by law enforcement officials.	0	0	\$0
7/23/2010	3:00 a.m.	countywide	Heavy rains of 3” – 9” fell across much of the County resulting in flash flooding. Areas that had never flooded before were flooded. This event was part of a federally-declared disaster (Declaration #1935.) <ul style="list-style-type: none"> ➤ Several roads, especially in the northern half of the County, were closed. ➤ Shannon received 8” of rain and was in need of sludge pumps to assist with flooding issues. 	0	0	\$1,000,000
Subtotal:				0	0	\$1,005,000

[^] Flash flood event verified in the vicinity of this location(s).

Figure 33
(Sheet 3 of 4)
Flash Flood Events Reported in Carroll County
1993 – 2011

Date(s)	Start Time	Location(s)	Magnitude	Injuries	Death	Property Damages
7/24/2010 thru 7/25/2010	5:00 a.m.	countywide	<p>After about 12” of rain in two days, creek and small river basins rose rapidly on the morning of the 24th. This event was part of a federally-declared disaster (Declaration #1935.)</p> <ul style="list-style-type: none"> ➤ Numerous roads, shoulders, culverts and bridges throughout the county suffered from washouts and excessive erosion. ➤ In Mount Carroll, flooding of the Carroll Creek (Wakarusa River) forced evacuations of about 80 homes, mainly on or near Mill Street. The wastewater treatment plant was under water. ➤ In Savanna, the Plum River overflowed/breached a high bank along Scenic Bluff Road sending flood waters through the railroad yard to the Mississippi River. Residents described the water as rising about 4’ in literally a few minutes. An estimated 625 people were evacuated, mainly from the eastern and southern portions of city. Emergency management estimated 10 homes completely destroyed and 75 seriously damaged in Savanna alone. Numerous train cars in the rail yard were overturned and both the DM&E and BNSF suffered damage to their rail lines. ➤ Raging flood waters washed away more than 30 yards of embankment supporting an overpass on the IL 84 viaduct, washing away two rows of pylons that were supporting the bridge, closing the primary access south of Savanna. ➤ In Milledgeville, the Elkhorn Creek overflowed its banks flooding the wastewater treatment plant. 	0	0	\$10,100,000
Subtotal:				0	0	\$10,100,000

Figure 33
(Sheet 4 of 4)
Flash Flood Events Reported in Carroll County
1993 – 2011

Date(s)	Start Time	Location(s)	Magnitude	Injuries	Death	Property Damages
7/27/2011 thru 7/29/2011	10:00 p.m.	Savanna Mount Carroll	Torrential rains of 2” – 5” caused some flash flooding across the northern half of the County, including Savanna and Mount Carroll. ➤ In Savanna, several streets were in the city were flooded forcing the evacuation of 80 residents. Both railroad yards were inundated with flood waters. A large breach in the Portland Avenue Levee on the Plum River also caused flooding in parts of the city. ➤ Portions of Mount Carroll along the Carroll Creek (Wakarusa River) were also flooded.	0	0	\$260,000
Subtotal:				0	0	\$260,000
GRAND TOTAL				0	0	\$11,551,500

Sources: Carroll County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee Member responses to Carroll County Natural Hazard Events Questionnaire distributed February 2, 2012.
NOAA, National Environmental Satellite, Data & Information Service, National Climatic Data Center, Storm Events Database.

3.4 TORNADOES

IDENTIFYING THE HAZARD

What is the definition of a tornado?

A tornado is a violently rotating column of air, usually characterized by a twisting, funnel-shaped cloud, that extends from the cloud formation of a thunderstorm to the ground. The strongest tornadoes have rotating wind speeds of more than 250 miles per hour and can create damage paths in excess of one mile wide and 50 miles long.

Not all tornadoes have a visible funnel cloud. Some may appear nearly transparent until dust and debris are picked up or a cloud forms within the funnel. Generally, tornadoes move from southwest to northeast, but they have been known to travel in any direction, even backtracking. The average forward speed of a tornado is 30 mile per hour, but this may vary from nearly stationary to 70 miles per hour.

About 1,000 tornadoes hit the United States yearly. The destruction caused by a tornado may range from light to catastrophic depending on the intensity, size and duration of the storm. Tornadoes cause crop and property damage, power outages, environmental degradation, injury and death. Tornadoes are known to blow off roofs, move cars and tractor trailers and demolish homes. Typically tornadoes cause the greatest damage to structures of light construction, such as residential homes. On average, tornadoes kill 60 people per year, mostly from flying or falling debris.

How are tornadoes rated?

Originally tornadoes were rated using the Fujita Scale (F-Scale), which related the degree of damage caused by a tornado to the intensity of the tornado's wind speed. The Scale identified six categories of damage, F0 through F5. **Figure 47** gives a brief description of each category.

Use of the original Fujita Scale was discontinued on February 1, 2007 in favor of the Enhanced Fujita Scale. The original scale had several flaws including basing a tornado's intensity and damages on wind speeds that were never scientifically tested and proven. It also did not take into consideration that a multitude of factors (i.e. structure construction, wind direction and duration, flying debris, etc.) affect the damage caused by a tornado. In addition, the process of rating the damage itself was based on the judgment of the damage assessor. In many cases, meteorologists and engineers highly experienced in damage survey techniques often came up with different F-scale ratings for the same damage.

The Enhanced Fujita Scale (EF-Scale) was created to remedy the flaws in the original scale. It continues to use the F0 through F5 categories, but it classifies the level of damage (one through eight) as calibrated by engineers and meteorologists to 28 different types of damage indicators (mainly various building types, towers/poles and trees.) The wind speeds assigned to each category are estimates, not measurements, based on the damage assessment. **Figure 47** identifies the Enhanced Fujita Scale.

Figure 47 Fujita & Enhanced Fujita Tornado Measurement Scales				
F-Scale		EF-Scale		Description
Category	Wind Speed (mph)	Category	Wind Speed (mph)	
F0	40 – 72	EF0	65 – 85	Light damage – some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; damage to sign boards
F1	73 – 112	EF1	86 – 110	Moderate damage – peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads
F2	113 – 157	EF2	111 – 135	Considerable damage – roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground
F3	158 – 207	EF3	136 – 165	Severe damage – roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off ground and thrown
F4	208 – 260	EF4	166 – 200	Devastating damage – well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated
F5	261 – 318	EF5	Over 200	Incredible damage – strong frame houses lifted off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 yards; trees debarked; incredible phenomena will occur

Source: National Oceanic and Atmospheric Administration, Storm Prediction Center.

The idea behind the EF-Scale is that a tornado scale needs to take into account the typical strengths and weaknesses of different types of construction, instead of applying a “one size fits all” approach. This is due to the fact that the same wind speed can cause different degrees of damage to different kinds of structures. In a real life application, the degree of damage to each of the 28 indicators can be mapped together to create a comprehensive damage analysis. As with the original scale, the EF-Scale rates the tornado as a whole based on the most intense damage within the tornado’s path.

While the EF-Scale is currently in use, *the historical data presented in this report is based on the original F-Scale*. None of the tornadoes rated before February 1, 2007 will be re-evaluated using the EF-Scale.

Are alerts issued for tornadoes?

Yes. The National Weather Service Weather Forecast Office of the Quad Cities, Iowa/Illinois is responsible for issuing *tornado watches* and *warnings* for Carroll County depending on the weather conditions. The following provides a brief description of each type of alert.

- **Watch.** A tornado watch is issued when conditions are favorable for tornadoes and severe thunderstorms to develop in the next several hours. It does not mean that a tornado is imminent, just that individuals need to be alert and prepared.

- **Warning.** A tornado warning is issued when a tornado has been spotted or indicated by radar. Warnings indicate imminent danger to life and property for those who are in the path of the tornado. Individuals should see shelter immediately.

PROFILING THE HAZARD

When have tornadoes occurred previously? What is the extent of these previous tornadoes?

Figure 48, located at end of this section, summarizes the previous occurrences as well as the extent or magnitude of tornado events recorded in Carroll County. The Storm Events Database and records of past events from the National Weather Service Weather Forecast Office of the Quad Cities have documented 12 occurrences of tornadoes in Carroll County between 1950 and 2011. In comparison, there have been 2,047 tornadoes statewide between 1950 and November 30, 2009.

Tornado Fast Facts – Carroll County

Number of Tornadoes Reported (1950 – 2011): **12**

Highest F-Scale Rating Recorded: **F3**

Most Likely Month for Tornadoes to Occur: **June**

Most Likely Time for Tornadoes to Occur: **Afternoon**

Average Length of a Tornado: **2.8 miles**

Average Width of a Tornado: **82 yards**

Average Damage Pathway of a Tornado: **0.13 sq. mi.**

Longest Tornado: **9 miles**

Widest Tornado: **500 yards**

Figure 49 charts the reported occurrences of tornadoes by magnitude. Of the 12 reported occurrences, two were classified as F3 tornadoes, two were classified as F2 tornadoes, three were classified as F1 tornadoes, and five were classified as F0 tornadoes. These 12 tornadoes were produced by 11 separate weather events. There was one weather event where three tornadoes were produced.

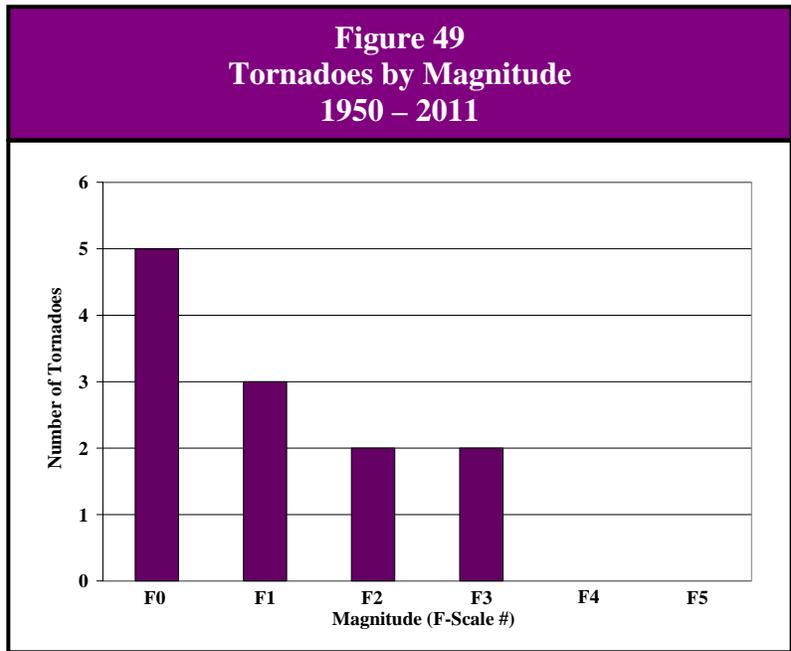


Figure 50 charts the reported tornadoes in Carroll County in Carroll County by month. Nine of the 12 tornadoes (75%) took place between April and June. Of the nine tornadoes, five occurred during June. In comparison, 1,355 of the 2,047 tornadoes (66%) recorded in Illinois since 1950 took place between April and June.

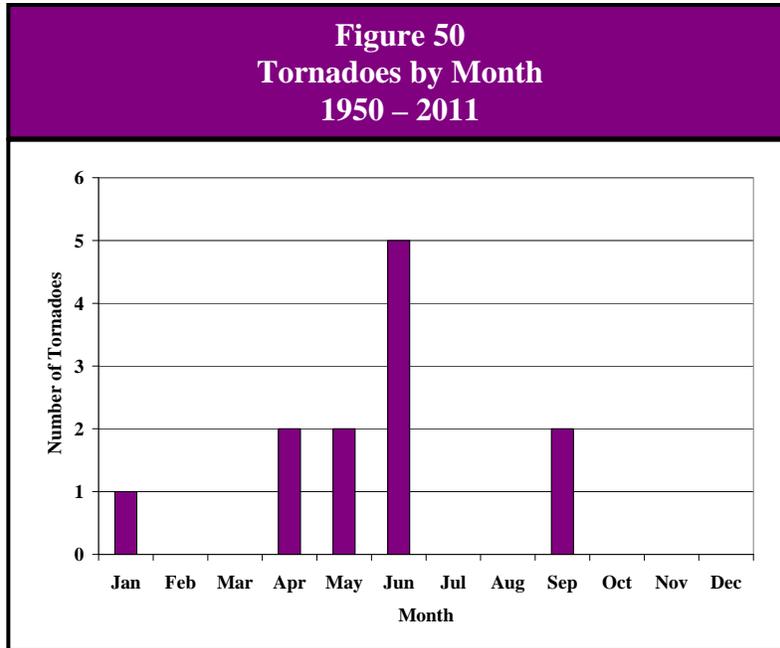
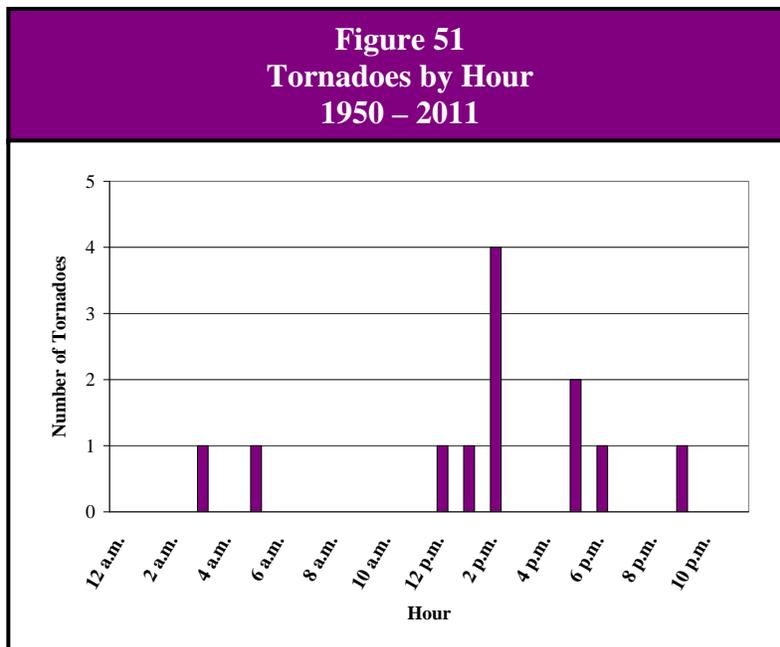


Figure 51 charts the reported tornadoes in Carroll County in Carroll County by hour. Ten of the 12 tornadoes (83%) occurred during the p.m. hours, with six of the tornadoes taking place between 12 p.m. and 2 p.m. In comparison, more than half of all Illinois tornadoes occur between 3 p.m. and 7 p.m.



The tornadoes that have touched down in Carroll County have varied from 0.1 miles to 9.0 miles in length and from 3 yards to 500 yards in width. The average length of a tornado in Carroll County is 2.8 miles and the average width is 82 yards (0.047 miles).

Figure 52 shows the pathway of each reported tornado. Records indicate that most of these tornadoes generally moved from southwest to northeast across the County. Unlike other natural hazards (i.e., severe winter storms, drought and extreme heat), tornadoes impact a relatively small area. Typically the area impacted by a tornado is less than four square miles. In Carroll County, the average damage pathway or area impacted for a tornado is 0.13 square miles.

The longest tornado recorded in Carroll County occurred on April 18, 1955. This F2 tornado touched down approximately two miles west of Lake Carroll and traveled east for nine miles dissipating one mile northeast of Shannon. The damage pathway of this tornado covered approximately 0.4 square miles.

The widest tornado recorded in Carroll County occurred on May 9, 1995. This F3 tornado, measuring 500 yards wide, touched down approximately one mile northeast of Albany in Whiteside County. It meandered around the western portion of Whiteside County before traveling north-northeast into Carroll County where it dissipated four miles southeast of Mount Carroll. The damage pathway of this tornado covered approximately 2.27 square miles within Carroll County.

What locations are affected by tornadoes?

Tornadoes have the potential to affect the entire County. All of the participating municipalities, with the exception of Savanna, have had reported occurrences of tornadoes in or near their locations. The *2010 Illinois Natural Hazard Mitigation Plan* prepared by the Illinois Emergency Management Agency classifies Carroll County's hazard rating for tornadoes as "elevated."

What is the probability of future tornadoes occurring?

Carroll County has had 12 verified occurrences of tornadoes between 1950 and 2011. With 12 tornadoes over the past 62 years, the probability or likelihood that a tornado will touchdown somewhere in the County in any given year is 19%. There was only one year over the last 62 years where more than one tornado has occurred. This indicates that the probability that more than one tornado may occur during any given year within the County is 2%.

ASSESSING VULNERABILITY

Are the participating jurisdictions vulnerable to tornadoes?

Yes. All of Carroll County is vulnerable to the dangers presented by tornadoes. According to the Storm Events Database, a majority of the tornadoes have touched down in the central portion of the County. Only Mount Carroll, Milledgeville and Thomson have had tornadoes either touch down or pass through their municipal limits. **Figure 53** lists the verified tornadoes that have touched down in or near each participating municipality.

Figure 52
Tornado Touchdowns in Carroll County: 1950 – 2011

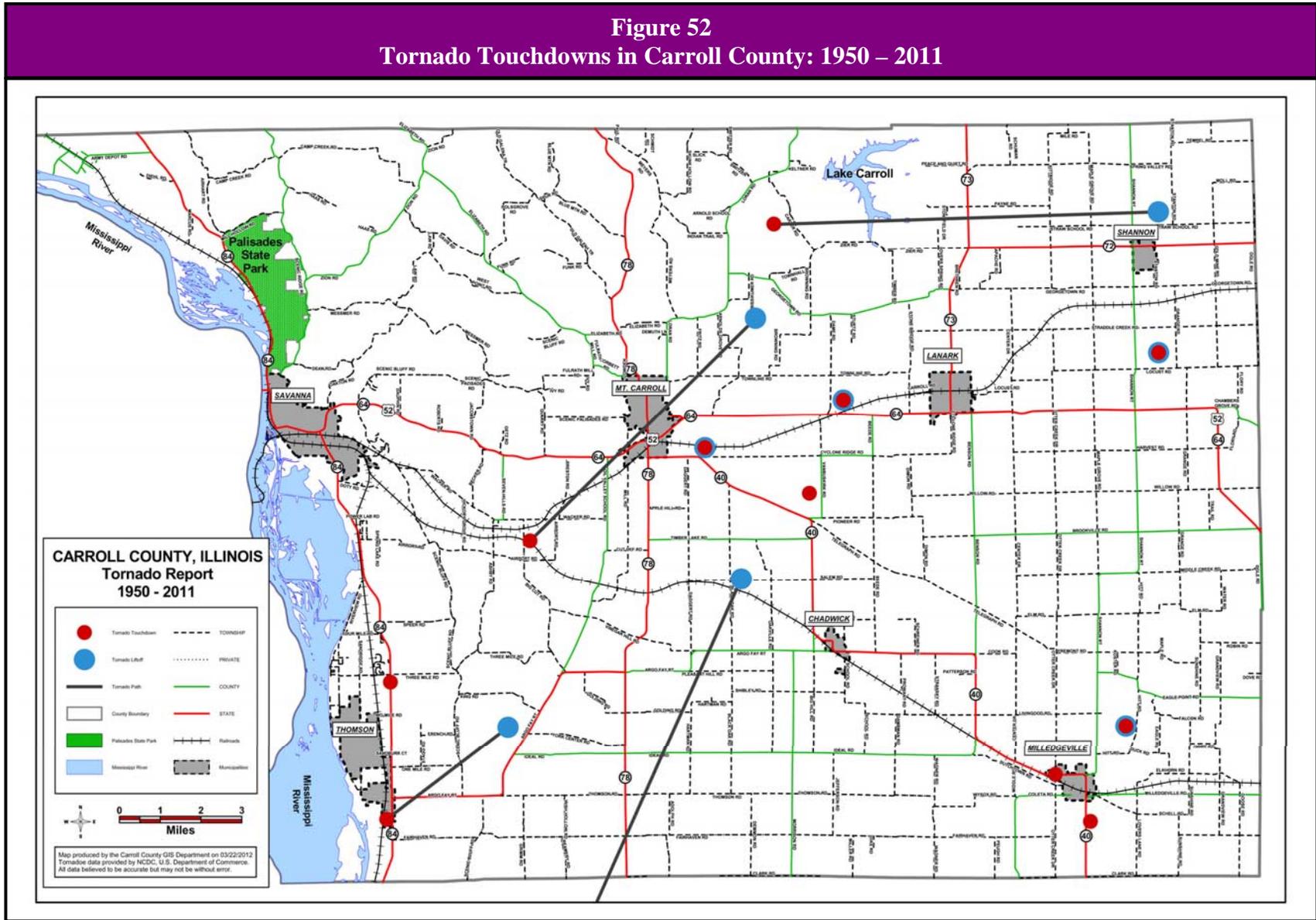


Figure 53 Verified Tornado Touchdowns In or Near Participating Municipalities		
Participating Municipality	Tornado Event	
	Number	Year
Chadwick	1	1984
Lanark	1	2003
Milledgeville	3	1950, 1988*, 2003
Mount Carroll	3	1967*, 1995, 2003
Savanna	0	---
Shannon	2	1955, 2003
Thomson	2	1956, 1959*

* Tornado touched down or passed through the municipal limits.

What impacts resulted from the recorded tornadoes?

The data provided by the Storm Events Database indicates that between 1950 and 2011, six of the twelve tornadoes caused approximately \$577,500 in property damage and \$15,000 in crop damage. There were two tornado events where property damages totaled \$250,000 each. Damage information was either unavailable or none was recorded for the remaining six reported occurrences.

Detailed damage information was only available for one event. The F3 tornado that passed through Mount Carroll on January 24, 1967 destroyed three homes and caused extensive barn and roof damage, resulting in approximately \$250,000 in property damage.

The Storm Events Database records report 12 injuries as a result of the July 24, 1967 tornado. Detailed information on the injuries sustained was unavailable. There were no fatalities and no other reported injuries associated with any of the other tornadoes. In comparison, Illinois averages approximately four tornado fatalities annually; however, this number varies widely from year to year.

The recorded tornadoes have historically touched down in rural areas away from concentrated populations. The location of these tornadoes has contributed to the low number of injuries and deaths. Adequate health care received soon after an injury occurs reduces vulnerability by preventing further health complications and deaths stemming from injury.

While there are no hospitals in Carroll County, there are nearby hospitals in Galena (Jo Daviess County), Freeport (Stephenson County), Dixon (Lee County), Sterling (Whiteside County) and Clinton, Iowa which are equipped to provide care to persons injured during a tornado. Tornado location, number of events, impact area and proximity of health care facilities combine for a relatively low risk or vulnerability to public health and safety of the residents in Carroll County. However, if a tornado were to touchdown in any of the municipalities, the risk or vulnerability for that location would be elevated to high.

What other impacts can result from tornadoes?

In addition to causing damage to buildings and properties, tornadoes can damage infrastructure and critical facilities such as roads, bridges, railroad tracks, drinking water treatment plants, water towers, communication towers, antennae, power substations, transformers and poles. Depending on the damage done to the infrastructure and critical facilities, indirect impacts on individuals could range from inconvenient (i.e., adverse travel) to life-altering (i.e., loss of utilities for extended periods of time).

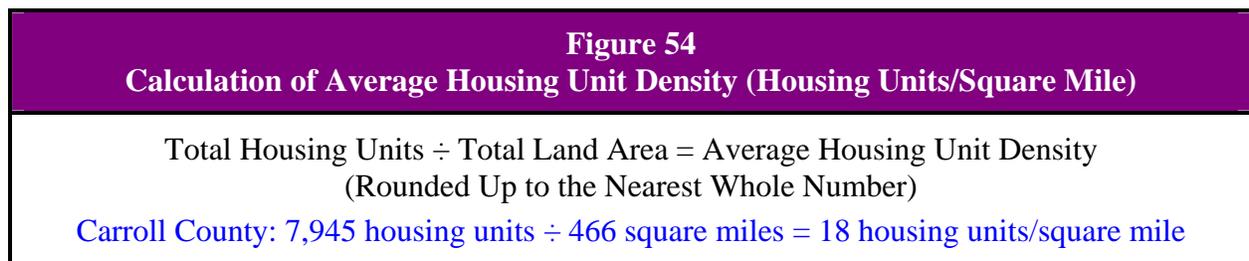
Are existing buildings, infrastructure and critical facilities vulnerable to tornadoes?

Yes. All existing buildings, infrastructure and critical facilities located within the County and the participating municipalities are vulnerable to damage from tornadoes. Buildings, infrastructure and critical facilities located in the path of a tornado usually suffer extensive damage, if not complete destruction. There is a high probability that power, communication and transportation will be disrupted in and around the affected area.

While some buildings adjacent to a tornado's path may remain standing with little or no damage, all are vulnerable to damage from flying debris. It is common for flying debris to cause damage to roofs, siding and windows. In addition, mobile homes, homes on crawlspaces and buildings with large spans (i.e., schools, barns, airport hangers, factories, etc.) are more likely to suffer damage. Most workplaces and many residential units do not provide sufficient protection from tornadoes.

Assessing the Vulnerability of Existing Residential Structures

One way to assess the vulnerability of existing residential structures is to estimate the number of housing units that may be potentially damaged if a tornado were to touchdown or pass through the County. A quick and simple method for accomplishing this is to calculate the average housing unit density in the County. This can be done by taking the number of housing units in the County and dividing that by the land area in the County. **Figure 54** calculates the average housing unit density in Carroll County. The result suggests that there is an average of 18 housing units per square mile.



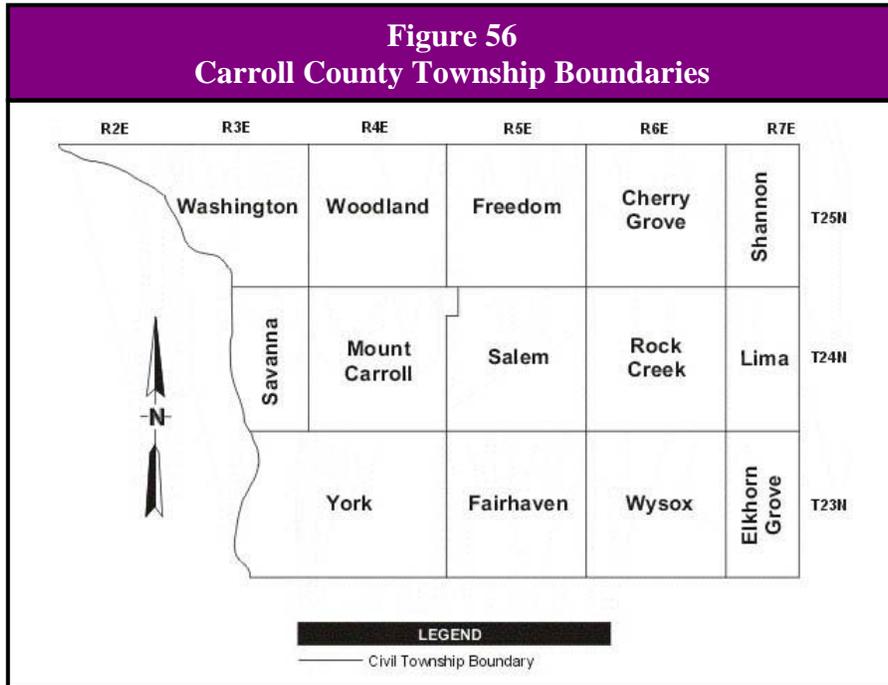
While this method provides an adequate assessment of the number of housing units that may be potentially damaged in a densely populated county, it does not provide a realistic assessment for those counties with large, sparsely populated rural areas such as Carroll County.

In Carroll County, as well as many other northwestern Illinois counties, differences in housing density must be considered when assessing the vulnerability of existing residential buildings to tornado damage. Approximately 63% of all housing units and 75% of mobile homes are located

in four of the County’s 12 townships (Mount Carroll, Rock Creek – Lima, Savanna and York.) **Figure 55** provides a breakdown of housing units by township and **Figure 56** shows the township boundaries. Tornado damage to buildings (especially mobile homes), infrastructure and critical facilities in these more densely populated townships is likely to be greater than in the rest of the County.

Figure 55 Existing Housing Units by Township				
Township	Total Housing Units (2000)	Mobile Homes (2000)	Land Area (Sq. Miles) (2000)	Housing Unit Density (Units/Sq. Mile) (Rounded Up)
Cherry Grove - Shannon	683	11	53.47	13
Elkhorn Grove	93	13	19.44	5
Fairhaven	404	4	37.95	11
Freedom	628	13	35.68	18
Mount Carroll	1,121	48	37.41	30
Rock Creek – Lima	935	17	54.01	18
Salem	162	2	35.58	5
Savanna	2,066	164	13.35	155
Washington	197	55	35.39	6
Woodland	145	6	36.62	4
Wysox	644	3	37.83	18
York	867	92	47.48	19
Carroll County	7,945	428	444.21	18

Sources: Illinois Department of Commerce and Economic Opportunity, Census 2000 Data for Illinois. U. S. Census Bureau, Geography, Census 2000 U.S. Gazetteer Files.



Source: Illinois Secretary of State.

To more accurately assess building vulnerability to existing residential housing units in Carroll County, the average housing unit density for each township was calculated. **Figure 55** illustrates the substantial differences in housing unit density between the various townships. By comparing the average county housing unit density to the average township housing unit densities, the shortcomings of using a countywide average for counties such as Carroll becomes apparent.

For seven of the 12 townships, the average county housing unit density is greater (in some cases considerably) than the average township housing unit densities. In addition, the average county housing unit density is considerably less than the housing unit densities calculated for the two most populated townships.

With the housing unit density calculated, it is relatively simple to provide an estimate of the number of existing housing units that could potentially be damaged by a tornado in Carroll County. This can be done by taking the average housing unit density and multiplying that by the average area impacted by a tornado. The average area impacted by a tornado in Carroll County is 0.13 square miles. This average is based on 60 years of recorded tornado events in the County. **Figure 57** provides a sample calculation.

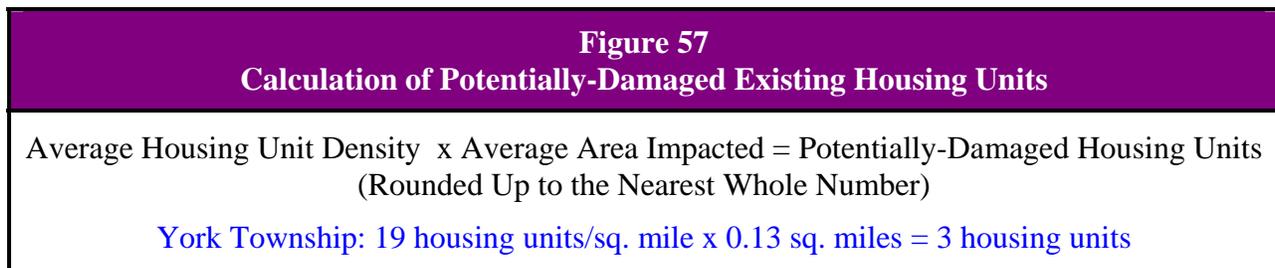


Figure 58 provides a breakdown of the number of potentially-damaged housing units by township. It is important to note that for the two townships with the highest housing unit densities, the potential damage estimates would only be reached if a tornado's pathway included the major municipality within the township. If the tornado pathway remained in the rural portion of the township, then the number of potentially-damaged housing units would be considerably lower.

Carroll County ranks among the bottom 30 counties in Illinois in terms of tornado frequency. This fact suggests that the overall risk posed by tornadoes in Carroll County is medium to low. While frequency is important, other factors must be examined when assessing vulnerability.

When such factors as population distribution, the absence of high risk living accommodations (such as high rise buildings, etc.), and the largely rural pathway of the previously recorded tornadoes are taken into consideration, the overall risk posed by tornadoes becomes relatively low. While the risk to the County is relatively low, if a tornado were to touchdown in any of the municipalities, the risk or vulnerability for that location would be elevated to high.

Are future buildings, infrastructure and critical facilities vulnerable to tornadoes?

Yes. Only one of the participating jurisdictions, Savanna, has building codes in place that will likely lessen the vulnerability of new buildings and critical facilities to damage from tornadoes.

Infrastructure such as new communication and power lines also will continue to be vulnerable to tornadoes. Steps to bury all new lines would eliminate the vulnerability, but this action would be cost prohibitive in most areas. There is very little that can be done to reduce or eliminate the vulnerability of critical facilities constructed in the future other than enacting building codes where none exist and enforcing existing building codes.

Figure 58 Estimated Number of Housing Units by Township Potentially Damaged by a Tornado		
Township	Housing Unit Density (Units/Sq. Mile)	Potentially-Damaged Housing Units (Units/0.13 Sq. Mile) (Rounded Up)
Cherry Grove - Shannon	13	2
Elkhorn Grove	5	1
Fairhaven	11	2
Freedom	18	3
Mount Carroll	30	4
Rock Creek – Lima	18	3
Salem	5	1
Savanna	155	21
Washington	6	1
Woodland	4	1
Wysox	18	3
York	19	3
Carroll County	18	3

What are the potential dollar losses to vulnerable structures from tornadoes?

Unlike other hazards, such as flooding, there are no standard loss estimation models or methodologies for tornadoes. However, a rough estimate of potential dollar losses to vulnerable *residential structures* located within the *participating municipalities* can be calculated if several assumptions are made. These assumptions represent a *probable scenario* based on the reported historical occurrences of tornadoes in Carroll County.

The purpose of providing a rough estimate is to help residents and municipal officials make informed decisions to better protect themselves and their communities. These estimates are meant to provide a *general idea* of the magnitude of the potential damage that could occur from a tornado event in each of the municipalities.

To calculate the overall potential dollar losses to vulnerable residential structures from a tornado, a set of decisions/assumptions must be made regarding the:

- area impacted by the tornado;
- position of the area impacted;
- method used to estimate potentially-damaged housing units;
- value of the potentially-damaged housing units; and

- percent damage sustained by the potentially-damaged housing units (i.e., damage scenario).

The following provides a detailed discussion of each decision/assumption.

Size of the Area Impacted

The first step towards calculating the potential dollar losses to vulnerable residential structures is to determine the size of the area impacted by the tornado. While the largest or most destructive tornado recorded could be used for this scenario, it was decided that the area impacted would be based on the average length and width of the recorded tornadoes in the County. In Carroll County, the average length is 2.84 miles, the average width is 0.05 miles (approximately 82 yards) and the average area is 0.13 square miles. The average area offers a reasonable alternative to the worst case scenario and is more likely to recur.

Assumption #1
Size of Area Impacted = 0.13 sq. miles

Position of the Area Impacted

To estimate the number of vulnerable residential structures or potentially-damaged housing units, the average area impacted must be positioned with the boundaries of each municipality. There are two ways this can be done.

Assumption #2
The entire area impacted by the tornado falls within the limits of each municipality.

Method #1. The first method involves creating an outline of the average area impacted and overlaying it on top of a map of each municipality. If any portion of the average area impacted falls outside of the corporate limits of the municipality due its size or shape, then additional calculations would be required.

- ❖ This method is more precise; however, it requires future updates of the Plan to place the outline in the same position previously used in order for the results to be consistent and comparable since changing the placement of the overlay on the municipal maps may produce differences in the number of potentially-damaged housing units.
- ❖ *Method #2.* The second method requires no positioning of an impact area outline or calculations and just assumes that the entire average area impacted would fall within the municipal limits. As a result, the average area impact measurement previously identified in Assumption #1 is used for all the municipalities to estimate the number of potentially-damaged housing units.

This method is quicker, easier to duplicate and is more likely to produce consistent results when the Plan is updated. There is, however, a greater likelihood that the number of potentially-damaged housing units will be overestimated for those municipalities that have irregular shaped boundaries or occupy less than one square mile.

Both methods were applied to select municipalities within Carroll County and the areas compared. While the two methods did produce different results, the differences were not significant. Therefore, it was decided that the second method would be used since it is quick and much easier to duplicate.

Method Used to Estimate Potentially-Damaged Housing Units

To estimate the number of potentially-damaged housing unit for this scenario, a decision must first be made on the method used to count the units. There are two ways this can be done.

Assumption #3

The average housing unit density for each municipality will be used to determine the number of potentially-damaged housing units.

- ❖ *Method #1.* The first method involves overlaying the average area impacted on top of a map of each municipality and then counting the number of housing units that are located within *both* the area impacted and the municipal limits. This approach has its drawbacks – it is time consuming and changes in the position of the overlay can and will produce different estimates.
- ❖ *Method #2.* The second method uses the average housing unit density for each municipality to estimate the number of potentially-damaged housing units. The average housing unit density can be calculated by taking the number of housing units within a municipality and dividing that number by the land area in the municipality. **Figure 54** provides a sample calculation.

This method is most useful for municipalities with housing unit densities that are relatively constant and do not substantially change between the edges and center of town. In large urban areas where there are substantial differences in housing unit densities (i.e., Chicago and the collar counties) this method has the potential to either over or under estimate the number of potentially-damaged housing units depending on the placement of the average impact area.

It was decided that the second method would be used to help estimate the number of potentially-damaged housing units because it is quick and much easier to duplicate. **Figure 59** provides the average housing unit density for each participating municipality. The average housing unit density was not calculated for those municipalities that cover less than one square mile.

With the average housing unit density calculated, the number of potentially-damaged housing units can be estimated. As described in **Figure 57**, this is done by taking the average housing unit density for each municipality and multiplying that by the average area impacted (0.13 square miles). **Figure 59** provides a breakdown of the number of potentially-damaged housing units by municipality.

For those municipalities that cover less than one square mile, the average housing unit density cannot be used to calculate the number of potentially-damaged housing units. The average housing unit density assumes that the land area in the municipality is at least one square mile and as a result underestimates the number of potentially-damaged housing units.

To calculate the number of potentially-damaged housing units for these municipalities, start by taking the average area impacted and divide that by the land area in the municipality to get the impacted land area within the municipality. The percent of impacted land area is then multiplied by the total number of housing units in the municipality. **Figure 60** provides a sample calculation.

Figure 59 Estimated Number of Housing Units by Municipality Potentially Damaged by a Tornado				
Participating Municipality	Total Housing Units (2000)	Land Area (Sq. Miles) (2000)	Average Housing Unit Density (Units/Sq. Mile) (Rounded Up)	Potentially-Damaged Housing Units (Units/0.13 Sq. Miles) (Rounded Up)
Chadwick	227	0.32	---	93
Lanark	694	1.04	668	87
Milledgeville	499	0.71	---	92
Mount Carroll	854	1.90	450	59
Savanna	1,796	2.61	689	90
Shannon	361	0.48	---	98
Thomson	239	2.21	109	15
Unincorporated County	3,275	434.94	8	2
County*	7,945	444.21	18	3
County†	2,956	291.96	11	2

* Uses the average county housing unit density (23 housing units per square mile)

† Uses the average housing unit density for the 8 least populated townships (11 housing units per square mile)

Sources: Illinois Department of Commerce and Economic Opportunity, Census 2000 Data for Illinois.
 U. S. Census Bureau, Geography, Census 2000 U.S. Gazetteer Files.

Figure 60 Calculation of Potentially-Damaged Housing Units for Municipalities Covering Less Than One Square Mile	
Average Area Impacted (Sq. Miles) ÷ Land Area (Sq. Miles) = Impacted Land Area Chadwick: 0.13 sq. mile ÷ 0.32 sq. miles = 0.40625	
Impacted Land Area x Total Housing Units = Potentially-Damaged Housing Units (Rounded Up to the Nearest Whole Number) Chadwick: 0.40625 x 227 housing units = 93 housing units	

Value of Potentially-Damaged Housing Units

Now that the number of potentially-damaged housing units has been estimated, the monetary value of the units must be calculated. Typically when damage estimates are prepared after a natural disaster such as a tornado, they are based on the market value of the structure. Since it would be impractical to determine the individual market value of each potentially-damaged housing unit, the average market value for a residential structure in each municipality will be used to calculate the potential dollar losses.

Assumption #4

The average market value for a residential structure in each municipality will be used to determine the value of potentially-damaged housing units.

To determine the average market value, the average assessed value must first be calculated. The average assessed value is determined by taking the total assessed value of non-farm buildings within a municipality and dividing that number by the total number of housing units in the municipality. **Figure 61** provides a sample calculation of the average assessed value for housing units within a municipality. The total assessed value is based on 2011 tax assessment information provided by the Carroll County Chief County Assessment Office.

Figure 61 Calculation of Average Assessed Value	
Total Assessed Value of Non-Farm Buildings ÷ Total Housing Units = Average Assessed Value (Rounded to the Nearest Penny)	
Chadwick: \$6,007,131 ÷ 227 housing units = \$26,463.13	

To determine the average market value, the average assessed value is multiplied by three (the assessed value of a structure in Carroll County is approximately one-third of the market value). **Figure 62** provides the average assessed value and average market value for each participating municipality. For comparison, the average assessed value and average market value for unincorporated Carroll County as well as the entire County were also calculated.

Figure 62 Average Market Value of Housing Units				
Participating Jurisdiction	Total Assessed Value of Non Farm Buildings (2011)	Total Housing Units (2000)	Average Assessed Value	Average Market Value
Chadwick	\$6,007,131	227	\$26,463.13	\$79,389
Lanark	\$16,126,584	694	\$23,237.15	\$69,711
Milledgeville	\$13,460,077	499	\$26,974.10	\$80,922
Mount Carroll	\$16,982,569	854	\$19,885.91	\$59,658
Savanna	\$26,639,043	1,796	\$14,832.43	\$44,497
Shannon	\$11,081,880	361	\$30,697.73	\$92,093
Thomson	\$5,868,781	239	\$24,555.57	\$73,667
Unincorporated County	\$147,605,495	3,275	\$45,070.38	\$135,211
County	\$243,771,560	7,945	\$30,682.39	\$92,047

Sources: Eberle, Leah, Carroll County Chief County Assessment Office.

When comparing the average assessed values and average market values of housing units in unincorporated Carroll County to those in any of the participating municipalities, there is a substantial difference. This difference is attributed to several factors including larger parcel sizes, the inclusion of outbuildings (i.e., sheds, barns, etc.) and a trend toward building new, larger residences around Lake Carroll in unincorporated Carroll County.

Damage Scenario

The final decision that must be made to calculate potential dollar losses is to determine the percent damage sustained by the structure and the structure’s content during the tornado. For this scenario, the expected percent damage sustained by the structure and its contents is 100%; in other words, all of the potentially-damaged housing units would be completely destroyed. While it is highly unlikely that each and every housing unit would sustain the maximum percent damage, identifying and calculating different degrees of damage within the average area impacted gets complex and provides an additional complication when updating the Plan.

Assumption #5

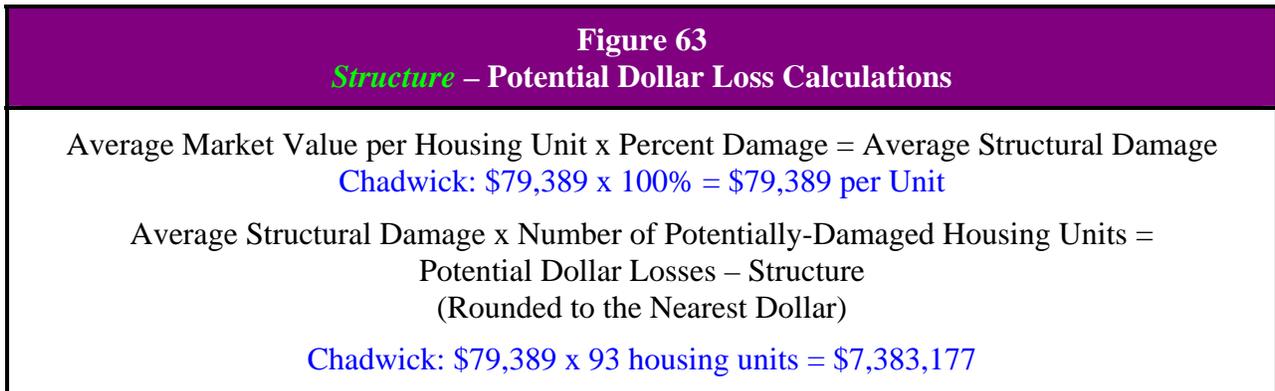
The tornado would completely destroy the potentially-damaged housing units.

Structural Damage = 100%

Content Damage = 100%

Potential Dollar Losses

Now that all of the decisions/assumptions have been made, the potential dollar losses can be calculated. First the potential dollar losses to the **structure** of the potentially-damaged housing units must be determined. This is done by taking the average market value for a residential structure and multiplying it by the percent damage (100%) to get the average structural damage per unit. The average structural damage per unit is then multiplied by the number of potentially-damaged housing units. **Figure 63** provides a sample calculation.



Next, the potential dollar losses to the **content** of the potentially-damaged housing units must be determined. Based on FEMA guidance, the value of a residential housing unit’s content is approximately 50% of its market value. Therefore, start by taking one-half the average market value for a residential structure and multiply by the percent damage (100%) to get the average content damage per unit. The average content value per unit is then multiplied by the number of potentially-damaged housing units. **Figure 64** provides a sample calculation.

Finally the **total potential dollar losses** may be calculated by adding together the potential dollar losses to the structure and content. **Figure 65** gives a breakdown of the total potential dollar losses by municipality.

Figure 64
Content – Potential Dollar Loss Calculations

$\frac{1}{2}$ (Average Market Value of a Housing Unit) x Percent Damage = Average Content Damage
 Chadwick: $\frac{1}{2}$ (\$79,389) x 100% = \$39,694.50 per Unit

Average Content Damage x Number of Potentially-Damaged Housing Units =
 Potential Dollar Losses – Content
 (Rounded to the Nearest Dollar)
 Chadwick: \$39,694.50 x 93 housing units = \$3,691,589

Figure 65
Estimated Potential Dollar Losses to Potentially-Damaged Housing Units from a Tornado

Participating Jurisdiction	Average Market Value (2011)	Potentially-Damaged Housing Units (Rounded Up)	Potential Dollar Losses		Total Potential Dollar Losses
			Structure	Content	
Chadwick	\$79,389	93	\$7,383,177	\$3,691,589	\$11,074,766
Lanark	\$69,711	87	\$6,064,857	\$3,032,429	\$9,097,286
Milledgeville	\$80,922	92	\$7,444,824	\$3,722,412	\$11,167,236
Mount Carroll	\$59,658	59	\$3,519,822	\$1,759,911	\$5,279,733
Savanna	\$44,497	90	\$4,004,730	\$2,002,365	\$6,007,095
Shannon	\$92,093	98	\$9,025,114	\$4,512,557	\$13,537,671
Thomson	\$73,667	15	\$1,105,005	\$552,503	\$1,657,508
Unincorporated County	\$135,211	2	\$270,422	\$135,211	\$405,633
County*	\$92,047	3	\$276,141	\$138,071	\$414,212
County†	\$92,047	2	\$184,094	\$92,047	\$276,141

* Uses the average county housing unit density (18 housing units per square mile)

† Uses the average housing unit density for the 8 least populated townships (11 housing units per square mile)

For comparison, an estimate of the potential dollar losses from tornadoes within the entire County, unincorporated Carroll County, and the eight least populated townships was also calculated. If the average county housing unit density of 18 housing units per square mile is used, then the total number of housing units potentially-damaged would be three. However, as discussed earlier, the average county housing unit density does not take into consideration the differences in housing density in the County. If an average housing unit density is calculated for the eight least populated townships (2,956 housing units divided by 297.0 square miles equals approximately 10 housing units per square mile), then the total number of housing units damaged is reduced to two. While the difference in the number of potentially-damaged housing units is not substantial, it still makes a difference in the total potential dollar losses estimated for the County.

This assessment illustrates why potential residential dollar losses should be considered when municipalities are deciding which mitigation projects to pursue. Potential dollar losses caused by an average tornado in Carroll County would be expected to *exceed at least \$5 million* in any of the participating municipalities, with the exception of Thomson.

**Figure 48
Tornadoes Reported in Carroll County
1950 – 2011**

Date(s)	Start Time	Location(s)	Magnitude (Fujita Scale)	Length (Miles)	Width (Yards)	Injuries	Deaths	Property Damage	Crop Damage
6/13/1950	3:00 a.m.	Milledgeville [^]	F1	--	--	0	0	\$25,000	\$0
4/18/1955	6:45 p.m.	Shannon [^]	F2	9.0	77	0	0	\$0	\$0
6/17/1956	5:30 a.m.	Thomson [^]	F1	2.0	33	0	0	\$25,000	\$0
9/26/1959	1:05 p.m.	Thomson Argo	F2	3.3	40	0	0	\$25,000	\$0
1/24/1967	5:30 p.m.	Mount Carroll Mount Carroll [^]	F3	7.4	77	12	0	\$250,000	\$0
4/29/1984	9:00 p.m.	Chadwick [^]	F1	1.0	3	0	0	\$250,000	\$0
9/19/1988	12:40 p.m.	Milledgeville	F0	0.1	10	0	0	\$2,500	\$0
5/9/1995	5:01 p.m.	Mount Carroll [^]	F3	8.0*	500	0	0	\$0	\$0
5/12/1999	2:56 p.m.	Milledgeville [^]	F0	0.1	10	0	0	\$0	\$0
6/14/2003	2:20 p.m.	Lanark [^]	F0	0.1	50	0	0	\$0	\$5,000
6/14/2003	2:26 p.m.	Mount Carroll [^]	F0	0.1	50	0	0	\$0	\$5,000
6/14/2003	2:30 p.m.	Shannon [^]	F0	0.1	50	0	0	\$0	\$5,000
GRAND TOTAL:						12	0	\$577,500	\$15,000

[^] Tornado touchdown verified in the vicinity of this location(s).

* This tornado touched down in Whiteside County northeast of Albany and proceeded north lifting off approximately four miles southeast of Mount Carroll. Based on the data provided by the Storm Events Database, this tornado was 50 miles long; however most of the tornadoes path was in Whiteside County with only about 8 miles occurring in Carroll County before the tornado dissipated.

Sources: NOAA, National Environmental Satellite, Data & Information Service, National Climatic Data Center, Storm Events Database.
NOAA, National Weather Service, Weather Forecast Office – Quad Cities IA/IL, Past Events.

3.5 DROUGHT

IDENTIFYING THE HAZARD

What is the definition of a drought?

While there is no universally accepted definition of drought, it can generally be defined as a period of unusually persistent dry weather that continues long enough to cause serious problems such as crop damage and/or water supply shortages. A drought may also be defined as the cumulative deficit of precipitation relative to what is normal for a region 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.

There are four types of drought. They are differentiated based on the use and need for water. The following provides a brief description of each type.

- **Meteorological Drought.** Meteorological drought is a period of well-below-average precipitation that spans a few months to a few years. It can be identified by a shortfall in precipitation. Due to climate differences, what might be considered a drought in one location of the country may not be in another location.
- **Agricultural Drought.** An agricultural drought is a period when soil moisture no longer meets the needs of a particular crop to germinate and grow. It can be identified by a deficit in soil moisture.
- **Hydrological Drought.** Hydrological drought is a period when surface and subsurface water supplies (i.e., streams, lakes, aquifers, etc.) drop below normal levels. It can be identified by a deficit in surface and groundwater.
- **Socioeconomic Drought.** Socioeconomic drought is a period when water shortages begin to affect people. In this case, there is not enough water to meet human and environmental needs.

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. It is generally difficult to pinpoint the beginning and the end of a drought. Because the impacts of a drought accumulate slowly at first, a drought may not be recognized until it has become well established. Even during a drought there may be one or two months with above average precipitation totals. These wet months do not necessarily signal the end of a drought and generally do not have a major impact on moisture deficits.

Droughts can be short, lasting just a few months, or they can persist for several years before regional climate conditions return to normal. While drought conditions can occur at any time throughout the year, the most apparent time is during the summer months. Nationally, drought impacts often exceed \$1 billion due in part to the sheer size of the areas affected.

How are droughts measured?

There are several quantitative measures (indices) that have been developed to measure drought in the United States. How these indices measure drought depends on the discipline affected (i.e., agriculture, hydrology, meteorology, etc.) and the region being considered. Although none of

the major indices are inherently superior to the rest, some are better suited than others for certain uses. Two of the indices highlighted in this plan are:

- the Palmer Drought Severity Index (PDSI) and
- the U.S. Drought Monitor.

The PDSI was the first comprehensive drought index developed in the United States and is still in use today. It is designed to indicate when weather conditions have been abnormally dry or wet and provides a standardized method of identifying and comparing drought conditions regardless of time or location.

The U.S. Drought Monitor is a relatively new index that combines quantitative measures with input from experts in the field. It is designed to provide the general public, media, government officials and others with an easily understandable “big picture” overview of drought conditions across the United States. In the last several years, the National Oceanic and Atmospheric Administration has begun including the U.S. Drought Monitor’s drought intensity ratings along with the weather information provided for drought events recorded with the National Climate Data Center.

The following provides a more detailed discussion of these two indices to aid the plan’s developers and the general public in understanding how droughts are identified and categorized. The information used to prepare this section utilizes one or both of these indices to identify previous drought events recorded in the County.

Palmer Drought Severity Index (PDSI)

The Palmer Drought Severity Index (PDSI), developed in 1965, was the first comprehensive drought index used in the United States. The PDSI is a long-term meteorological index that indicates when weather conditions have been abnormally dry or abnormally wet. It is most effective at measuring impacts that are sensitive to soil moisture conditions, such as agriculture.

The PDSI is calculated based on precipitation and temperature data, as well as the local available water content of the soil and the cumulative patterns of previous months. The index ranges from +4 (extremely moist) to -4 (extreme drought). **Figure 66** shows the classification system utilized by the PDSI.

The PDSI has been useful as a drought monitoring tool and many federal and state agencies rely on it to trigger drought relief programs. It provides a standardized method to measure moisture conditions so that comparisons can be made between various locations and times. The PDSI is most useful when working with large areas of uniform

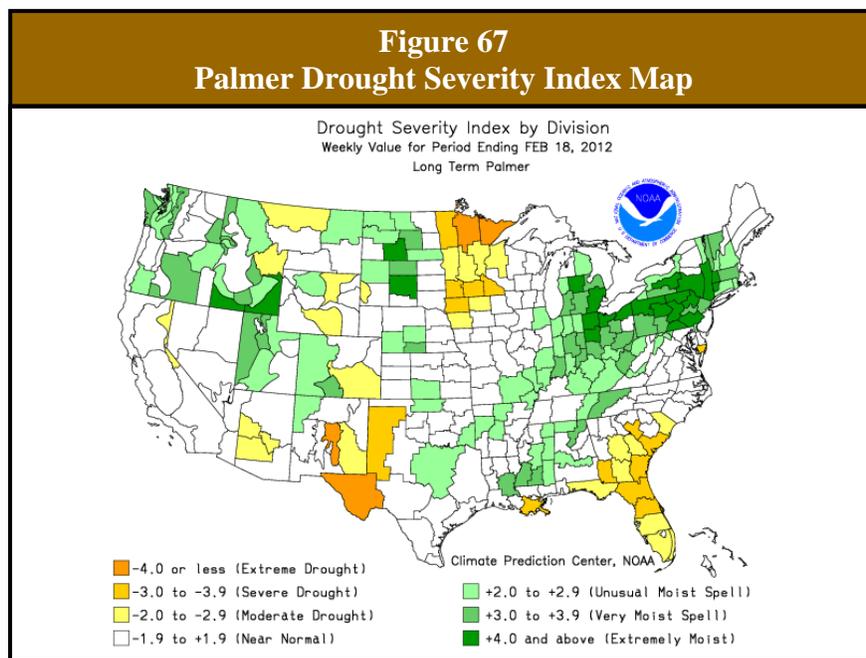
Figure 66 Palmer Classification System	
Index Value	Description
4.0 or more	extremely wet
3.0 to 3.99	very wet
2.0 to 2.99	moderately wet
1.0 to 1.99	slightly wet
0.5 to 0.99	incipient wet spell
0.49 to -0.49	near normal
-0.5 to -0.99	incipient dry spell
-1.0 to -1.99	mild drought
-2.0 to -2.99	moderate drought
-3.0 to -3.99	severe drought
-4.0 or less	extreme drought

Source: National Drought Mitigation Center.

topography. It is not as well suited for use in the western states, with their mountainous terrain and varying climate extremes.

Calculations of the PDSI are made for 350 climate divisions in the United States and Puerto Rico. PDSI values have typically been calculated on a monthly basis. The National Climate Data Center has records on the monthly PDSI values for every climate division in the United States dating back to 1895.

In addition to the monthly calculations, weekly PDSI values are now being calculated for the climate divisions during every growing season. NOAA's Climate Prediction Center produces a weekly map that shows the climate divisions and their PDSI value by color. **Figure 67** shows an example of this map.



Source: National Weather Service, Climate Prediction Center.

U.S. Drought Monitor

A relatively new index used for assessing drought conditions is the U.S. Drought Monitor. The U.S. Drought Monitor is unique in that it blends multiple numeric measures of drought with the best judgments of experts to create a weekly map that depicts drought conditions across the United States. It began in 1999 as a federal, state and academic partnership, growing out of a Western Governors' Association initiative to provide timely and understandable scientific information on water supplies and drought for policymakers.

The Drought Monitor is produced by a rotating group of authors from the U.S. Department of Agriculture, the National Oceanic and Atmospheric Administration and the National Drought Mitigation Center located at the University of Nebraska – Lincoln. It incorporates reviews from a group of 250 climatologists, extension agents and others across the nation.

The Drought Monitor utilizes five drought intensity categories, D0 through D4, to identify areas of drought. **Figure 68** provides a brief description of each category.

Figure 68 U.S. Drought Monitor – Drought Severity Classifications	
Category	Possible Impacts
D0 (Abnormally Dry)	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.
D1 (Moderate Drought)	Some damage to crops, pastures; streams, reservoirs, or wells low; some water shortages developing or imminent; voluntary water-use restrictions requested
D2 (Severe Drought)	Crop or pasture losses likely; water shortages common; water restrictions imposed
D3 (Extreme Drought)	Major crop/pasture losses; widespread water shortages or restrictions
D4 (Exceptional Drought)	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies

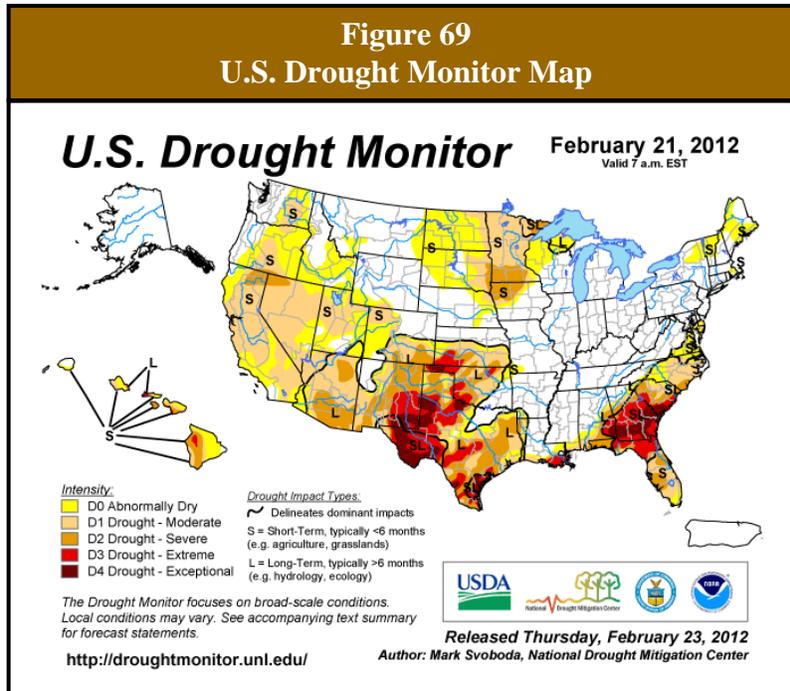
Source: National Drought Mitigation Center.

The drought intensity categories are based on five key indicators and numerous supplementary indicators. The five key indicators include the Palmer Drought Severity Index, Climate Prediction Center’s Soil Moisture Model (percentiles), United States Geological Survey Weekly Streamflow (percentiles), Standardized Precipitation Index and Objective Short and Long-term Drought Indicator Blends (percentiles).

Because the ranges of the various indicators often don’t coincide, the final drought category tends to be based on what a majority of the indicators show. The authors also weight the indices according to how well they perform in various parts of the country and at different times of the year. While the maps are based in part on the key indices and other measures of moisture, they also incorporate real-world conditions as reported by numerous experts throughout the country, providing a more comprehensive approach to identifying and monitoring drought conditions.

In addition to identifying and categorizing general areas of drought, the weekly map also identifies whether a drought’s impacts are agricultural (crops, pastures and grasslands) and/or hydrological (rivers, groundwater and reservoirs). **Figure 69** shows an example of the U.S. Drought Monitor weekly map. A summary also accompanies the map outlining the general conditions by regions.

The U.S. Drought Monitor is designed to provide a general and up-to-date overview of current drought conditions. It is not designed to depict local conditions. As a result, there could be water shortages or crop failures within areas not designated as drought, just as there could be locations with adequate water supplies in an area designated as D3 or D4.



Source: National Drought Mitigation Center.

PROFILING THE HAZARD

When have droughts occurred previously? What is the extent of these previous droughts?

According to the Storm Events Database, the Illinois State Water Survey and the Illinois Emergency Management Agency, there have been three reported drought events in Carroll County between 1983 and 2011. The following provides a summary of these previous occurrences as well as the extent or severity of each event.

- In 1983, all 102 Illinois counties were proclaimed state disaster areas because of high temperatures and insufficient precipitation beginning in mid-June.
- In 1988, approximately half of all Illinois counties (including Carroll County) were impacted by drought conditions, although none of the counties were proclaimed state disaster areas.
- In 2005-2006, drought conditions impacted much of the state, including Carroll County. A dry winter and spring developed into full blown drought conditions by the middle of June. By late July much of the state was declared an agricultural disaster area by the USDA. Northern Illinois was classified as “D3” or in extreme drought for most of the summer and much of the winter of 2005. The dry conditions reached a historic level of severity in some parts of Illinois and ranked as one of the three most severe droughts in Illinois based on 112 years of data.

For the 1988 and 2005-2006 events, lower than normal precipitation levels were recorded between April and June and unusually dry weather conditions persisted throughout the summer months.

The Illinois State Water Survey records indicate that droughts also occurred in the region in 1931, 1934 and 1936; however, the extent to which Carroll County was impacted was unavailable.

What locations are affected by drought?

Drought events affect the entire County. All communities in Carroll County have been affected by drought. Droughts, like extreme heat and severe winter storms, tend to impact large areas, extending beyond county boundaries. The *2010 Illinois Natural Hazard Mitigation Plan* classifies Carroll County’s hazard rating for drought as “high.”

What is the probability of future drought events occurring?

Carroll County has experienced three droughts between 1983 and 2011. With three occurrences over 29 years, the probability or likelihood that Carroll County may experience a drought in any given year is 10%. However, if earlier recorded droughts are factored in, then the probability that Carroll County may experience a drought in any given year decreases slightly to 7%.

ASSESSING VULNERABILITY

Are the participating jurisdictions vulnerable to drought?

Yes. All of Carroll County is vulnerable to drought. Neither the amount nor distribution of precipitation, soil types, topography, or water table conditions provides protection for any area within the County.

What impacts resulted from the recorded drought events?

Comprehensive damage information was either unavailable or none was reported for any of the three recorded events. Disaster relief payment information was only available for one of the recorded events. Landowners and farmers in Illinois were paid in excess of \$382 million in disaster relief payments for the 1988 drought.

No injuries or deaths were reported as a result of any of the recorded drought events in Carroll County. Consequently, the risk or vulnerability to public health and safety from drought is low.

What other impacts can result from drought events?

Based on statewide drought records available from the Illinois State Water Survey, the most common impacts that result from severe drought events in Illinois include reductions in crop yields and drinking water shortages. Even though no drought-related impact information was provided for Carroll County, information gathered from County residents indicates the impacts experienced during the recorded drought events were similar to those seen statewide.

Crop Yield Reductions

Agriculture is the main enterprise in Carroll County. According to the 2007 Census of Agriculture, there were 676 farms in Carroll County occupying 265,153 acres. Farm land accounts for approximately 89% of all the land in Carroll County. Of the 265,153 acres of farm land, approximately 86% or 228,142 acres of this land was in crop production. Less than four percent of this land is irrigated.

Crop sales accounted for \$111,691,000 in revenue while livestock sales accounted for \$95,334,000. Carroll County ranks in the top five Illinois counties for livestock cash receipts and in the top 45 counties for crop cash receipts. A severe drought would have a financial impact on the large agricultural community, particularly if it occurred during the growing season. Dry weather conditions, particularly when accompanied by excessive heat, can result in diminished crop yields and place stress on livestock.

A reduction in crop yields was seen as a result of the 1983, 1988 and 2005 droughts. **Figure 70** illustrates the reduction in yields seen for corn and soybeans during the three recorded drought events.

Figure 70 Crop Yield Reductions Due To Drought in Carroll County				
Year	Corn		Soybeans	
	Yield (bushel)	% Reduction from Previous Year	Yield (bushel)	% Reduction from Previous Year
1982	130	---	39.5	---
1983	91	30%	37.5	5%
1984	110	---	33.5	11%
1987	137	---	47	---
1988	56	59%	31	34%
2004	189	---	56	---
2005	163	14%	57	---
2006	185	---	58	---

Source: United States Department of Agriculture, National Agricultural Statistics Service.

Records obtained from the United States Department of Agriculture’s National Agricultural Statistics Service show that the 1983 drought resulted in corn yield reductions of 30% and soybeans yield reductions of just 5% while the 1988 drought resulted in corn yield reductions of 59% and soybean yield reductions of 11%. In 2005, the drought caused a 14% reduction in corn yields and no reduction in soybeans.

Drinking Water Shortages

Municipalities that rely on surface water sources for their drinking water supplies are more vulnerable to shortages as a result of drought. However, in Carroll County, **none of the participating municipalities rely on surface water sources** for their drinking water supplies. All obtain water from relatively deep underground wells. As a result, they are less vulnerable to drinking water shortages, although a prolonged drought or a series of droughts in close

succession do have the potential to impact water levels in aquifers used for providing drinking water wells that primarily serve farms.

Are existing buildings, infrastructure and critical facilities vulnerable to drought?

No. In general, existing buildings, infrastructure and critical facilities located in Carroll County and the participating jurisdictions are not vulnerable to drought. As with extreme heat events, droughts typically do not cause damage to buildings, infrastructure or critical facilities. The true concern centers on the financial impacts that result from loss of crop yields and livestock.

While buildings do not typically sustain damage from drought events, in rare cases infrastructure and critical facilities may be directly or indirectly impacted. While uncommon, droughts can contribute to damage caused to roadways. Severe soil shrinkage can compromise the foundation of a roadway and lead to cracking and buckling.

Prolonged heat associated with drought can also increase the demand for energy to operate air conditioners, fans and other devices. This increase in demand places stress on the electrical grid which increases the likelihood of power outages. Additionally, droughts have the potential to impact drinking water supplies. Reductions in the water levels of wells and surface water supplies can cause water shortages that require water conservation measures to be enacted in an effort to maintain a sufficient supply of water to provide drinking water and fight fires.

In general, the risk or vulnerability to buildings, infrastructure and critical facilities from drought is low, even taking into consideration the potential impact a drought may have on drinking water supplies and the stress that prolonged heat may place on the electrical grid.

Are future buildings, infrastructure and critical facilities vulnerable to drought?

No. Future buildings, infrastructure and critical facilities within the County are no more vulnerable to drought than the existing building, infrastructure and critical facilities. As discussed above, buildings do not typically sustain damage from drought. Infrastructure and critical facilities may, in rare cases, be damaged by drought, but very little can be done to prevent this damage.

What are the potential dollar losses to vulnerable structures from drought?

Unlike other natural hazards that affect the County, drought does not typically damage buildings. The primary concern associated with drought is loss of crop yields and the potential impacts to drinking water supplies. With no comprehensive damage information available for previous occurrences there is no way to accurately estimate future potential dollar losses. However, since a major portion of the County is involved in farming activities, it is likely that there will be future dollar losses to drought. In addition, reduced water levels and the water conservation measures that typically accompany a drought will most likely impact businesses and industries that are water-dependent (i.e., car washes, landscapers etc.).

3.6 EXTREME HEAT

IDENTIFYING THE HAZARD

What is the definition of extreme heat?

Extreme heat is characterized by temperatures that hover 10 degrees or more above the average high temperature of a region for a prolonged period of time (several days to several weeks) and is often accompanied by high humidity. In comparison, a heat wave is generally defined as a prolonged period of excessive heat and humidity. While there is no universally agreed upon definition of a heat wave, for most the United States the “standard” definition is a period of three or more consecutive days of highs reaching at least 90°F.

Extreme heat events are usually a result of both high temperatures and high relative humidity. (Relative humidity refers to the amount of moisture in the air.) The higher the relative humidity or the more moisture in the air, the less likely that evaporation will take place. This becomes significant when high relative humidity is coupled with soaring temperatures.

On hot days the human body relies on the evaporation of perspiration or sweat to cool and regulate the body’s internal temperature. Sweating does nothing to cool the body unless the water is removed by evaporation. When the relative humidity is high, then the evaporation process is hindered, robbing the body of its ability to cool itself.

On average, more than 1,000 people die each year in the United States from extreme heat. In fact, extreme heat claims more lives each year than floods, lightning, tornadoes and hurricanes combined.

What is the Heat Index?

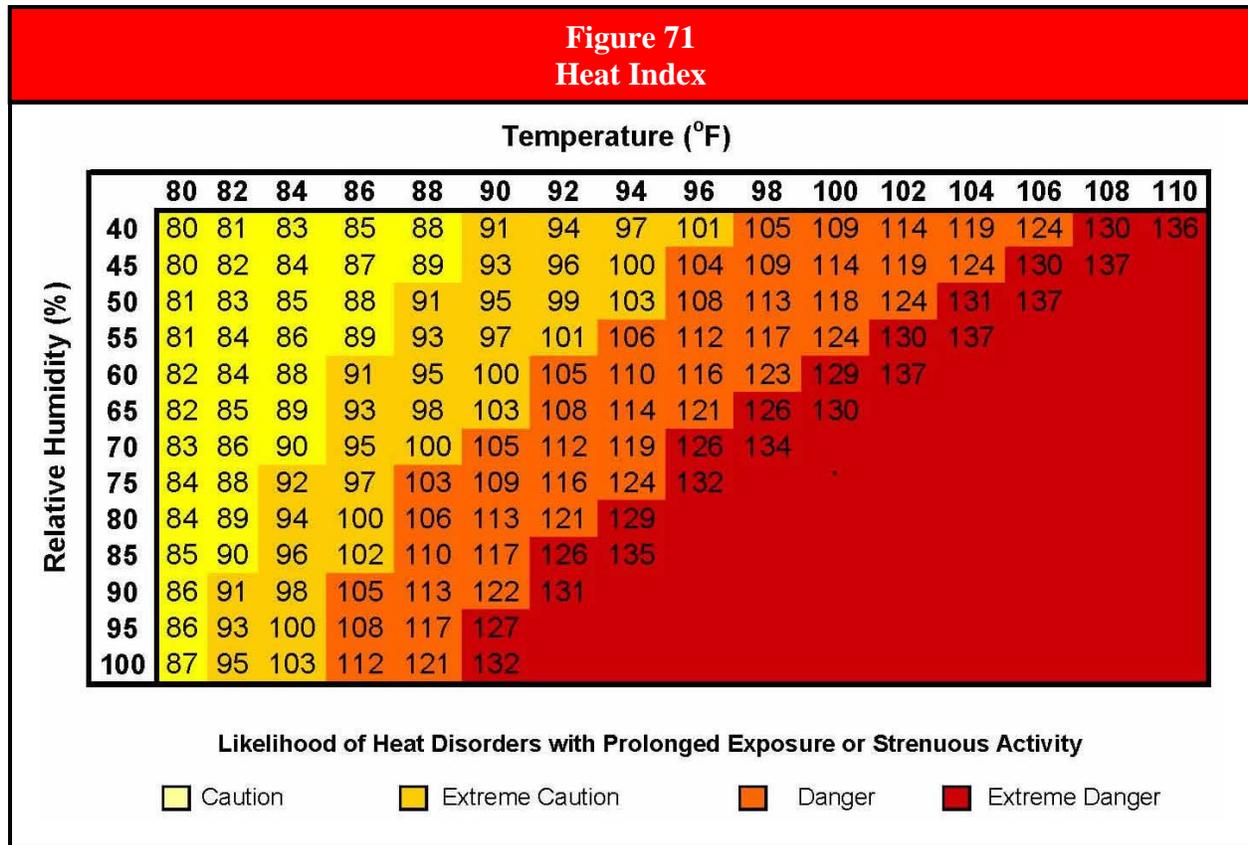
In an effort to raise the public’s awareness of the hazards of extreme heat, the National Weather Service devised the “Heat Index”. The Heat Index, sometimes referred to as the “apparent temperature”, is a measure of how hot it feels when relative humidity is added to the actual air temperature. **Figure 71** shows the Heat Index as it corresponds to various air temperatures and relative humidity.

As an example, if the air temperature is 96°F and the relative humidity is 65%, then the Heat Index would be 121°F. It should be noted that the Heat Index values were devised for shady, light wind conditions. Exposure to full sunshine can increase Heat Index values by up to 15°F. Also strong winds, particularly with very hot, very dry air, can be extremely hazardous. When the Heat Index reaches 105°F or greater, there is an increased likelihood that continued exposure and/or physical activity will lead to individuals developing severe heat disorders.

What are heat disorders?

Heat disorders are a group of illnesses caused by prolonged exposure to hot temperatures and are characterized by the body’s inability to shed excess heat. These disorders develop when the heat gain exceeds the level the body can remove or if the body cannot compensate for fluids and salt lost through perspiration. In either case the body loses its ability to regulate its internal

temperature. All heat disorders share one common feature: the individual has been overexposed to heat, or over exercised for their age and physical condition on a hot day. The following describes the symptoms associated with the different heat disorders.



Source: NOAA, National Weather Service.

- **Sunburn.** Sunburn is characterized by redness and pain of skin exposed too long to the sun without proper protection. In severe cases it can cause swelling, blisters, fever and headaches. It can significantly retard the skin’s ability to shed excess heat.
- **Heat Cramps.** Heat cramps are characterized by heavy sweating and painful spasms, usually in the muscles of the legs and possibly the abdomen. The loss of fluid through perspiration leaves the body dehydrated resulting in muscle cramps. This is usually the first sign that the body is experiencing trouble dealing with heat.
- **Heat Exhaustion.** Heat exhaustion is characterized by heavy sweating, weakness, nausea, exhaustion, dizziness and faintness. Breathing may become rapid and shallow and the pulse thready (weak). The skin may appear cool, moist and pale. Blood flow to the skin increases, causing blood flow to decrease to the vital organs. This results in a mild form of shock. If not treated, the victim’s condition will worsen.
- **Heat Stroke (Sunstroke).** Heat stroke is a life-threatening condition characterized by a high body temperature (106°F or higher). The skin appears to be dry and flushed with very little perspiration present. The individual may become mentally confused and

aggressive. The pulse is rapid and strong. There is a possibility that the individual will faint or slip into unconsciousness. If the body is not cooled quickly, then brain damage and death may result.

Studies indicate that, all things being equal, the severity of heat disorders tend to increase with age. Heat cramps in a 17-year-old may be heat exhaustion in someone 40 and heat stroke in a person over 60. Elderly persons, small children, chronic invalids, those on certain medications and persons with weight or alcohol problems are particularly susceptible to heat reactions.

Figure 72 below indicates the heat index at which individuals, particularly those in higher risk groups, might experience heat-related disorders. Generally, when the heat index is expected to exceed 105°F, the National Weather Service will initiate extreme or excessive heat alert procedures.

Figure 72 Relationship between Heat Index and Heat Disorders	
Heat Index (°F)	Heat Disorders
80°F – 90°F	Fatigue is possible with prolonged exposure and/or physical activity
90°F – 105°F	Heat cramps, heat exhaustion and heat stroke possible with prolonged exposure and/or physical activity
105°F – 130°F	Heat cramps, heat exhaustion and heat stroke likely; heat stroke possible with prolonged exposure and/or physical activity
130°F or Higher	Heat stroke highly likely with continued exposure

Source: NOAA, Heat Wave: A Major Summer Killer.

What is an excessive heat alert?

An excessive heat alert is an advisory or warning issued by the National Weather Service when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat determines the type of alert issued. There are four types of alerts that can be issued for an extreme heat event. The following provides a brief description of each type of alert based on the *excessive heat advisory/warning criteria* established by National Weather Service Weather Forecast Office of the Quad Cities, Iowa/Illinois. The Quad Cities office is responsible for issuing alerts for Carroll County.

- **Outlook.** An excessive heat outlook is issued when the potential exists for an excessive heat event to develop over the next three to seven days.
- **Watch.** An excessive heat watch is issued when conditions are favorable for an excessive heat event to occur within the next 12 to 28 hours.
- **Advisory.** An excessive heat advisory is issued when the heat index is expected to equal or exceed 100°F.
- **Warning.** An excessive heat warning is issued when the heat index is expected to equal or exceed 105°F and the minimum heat index is expected to equal or exceed 75°F during a 48-hour period or the heat index is expected to equal or exceed 100°F for four consecutive days.

PROFILING THE HAZARD

When have extreme heat events occurred previously? What is the extent of these events?

According to the Storm Events Database, there have only been two recorded extreme heat events in Carroll County between 1996 and 2011. The following provides a summary of these previous occurrences as well as the extent or severity of each event.

- The first recorded extreme heat event took place between July 25, 1997 and July 27, 1997 when high humidity and temperatures combined to produce excessive heat index values reaching 105°F to 110°F across northwestern Illinois.
- The second extreme heat event took place between July 19, 1999 and July 31, 1999 when a strong ridge of high pressure over the central United States produced very hot and humid conditions. Temperatures around the 100°F mark combined with dew points in the 70s to produce heat index values between 105°F and 125°F across the region.

Historical records maintained by the Midwestern Regional Climate Center show that the highest temperature recorded in Carroll County between 1897 and 2003 was 108°F on July 12, 1936 at the Mount Carroll monitoring station. This temperature was reached again in July, 1996.

What locations are affected by extreme heat?

Extreme heat events affect the entire County. A single extreme heat event will generally extend across an entire region and affect multiple counties. The *2010 Illinois Natural Hazard Mitigation Plan* classifies Carroll County's hazard rating for extreme heat as "elevated."

What is the probability of future extreme heat events occurring?

Carroll County has only experienced two verified extreme heat events between 1996 and 2011. With two occurrences over the past 16 years, the probability or likelihood that the County may experience an extreme heat event in any given year is 12.5%.

ASSESSING VULNERABILITY

Are the participating jurisdictions vulnerable to extreme heat?

Yes. All of Carroll County is vulnerable to extreme heat. The County has experienced two recorded extreme heat events over the past 15 years. There is one official state-designated cooling center located at the Carroll County Health Department in Mount Carroll.

What impacts resulted from the recorded extreme heat events?

Information on property and crop damage was either unavailable or none was recorded for the two events. In addition, there were no heat-related injuries or deaths recorded in Carroll County for either event. This does not mean, however, that none occurred; it simply means that extreme heat was not identified as the primary cause. This is especially true for deaths. Usually heat is not listed as the primary cause of death, but rather an underlying cause. During the two recorded events the heat indices were sufficiently high to produce heat cramps or heat exhaustion with the possibility of heat stroke in cases of prolonged exposure or physical activity.

In comparison, Illinois averages 74 deaths per year as a result of extreme heat. Extreme heat has triggered more deaths than any other natural hazard in Illinois. More deaths are attributed to extreme heat than the combined number of deaths attributed to floods, tornadoes, lightning and extreme cold.

Even if injuries and death due to extreme heat are under reported in Carroll County, the risk or vulnerability to public health and safety is relatively low for the general population. The risk or vulnerability is elevated to medium for sensitive populations such as the elderly, small children, chronic invalids, those on certain medications and persons with weight or alcohol problems who are more susceptible to heat reactions.

What other impacts can result from extreme heat events?

Other impacts of extreme heat include road buckling, power outages, early school dismissals and school closings. In addition, extreme heat events can also lead to an increase in water usage and may result in municipalities imposing water use restrictions. In Carroll County, extreme heat should not impact municipal water supplies since none obtain their water from surface water bodies.

Are existing buildings, infrastructure and critical facilities vulnerable to extreme heat?

No. In general, existing buildings, infrastructure and critical facilities located in Carroll County and the participating jurisdictions are not vulnerable to extreme heat events. Unlike other natural hazards such as floods, severe storms or tornadoes, extreme heat events typically do not cause damage to buildings, infrastructure or critical facilities. The primary concern is for the health and safety of those living in the County and municipalities.

While buildings do not typically sustain damage from extreme heat events, in rare cases infrastructure and critical facilities may be directly or indirectly damaged by an event. While uncommon, extreme heat events have been known to contribute to damage caused to roadways within Carroll County. The combination of extreme heat and vehicle loads has caused pavement cracking and buckling.

Extreme heat events have also been known to indirectly contribute to disruptions in the electrical grid. When the temperatures rise, the demand for energy also rises in order to operate air conditioners, fans and other devices. This increase in demand places stress on the electrical grid components, increasing the likelihood of power outages. While not common in Carroll County, there is the potential for this to occur. The potential may increase over the next two decades if new power plants are not built to replace the state's aging nuclear power facilities that are expected to be decommissioned.

In general, the risk or vulnerability to buildings, infrastructure and critical facilities from extreme heat events is low, even taking into consideration the potential for disruptions to the electrical grid.

Are future buildings, infrastructure and critical facilities vulnerable to extreme heat?

No. Future buildings, infrastructure and critical facilities within the County are no more vulnerable to extreme heat events than the existing building, infrastructure and critical facilities.

As discussed above, buildings do not typically sustain damage from extreme heat events. Infrastructure and critical facilities may, in rare cases, be damaged by extreme heat, but very little can be done to prevent this damage.

What are the potential dollar losses to vulnerable structures from extreme heat?

Unlike other natural hazards that affect the County, extreme heat events do not typically damage buildings. The primary concern associated with extreme heat is the health and safety of those living in the County and municipalities, especially vulnerable populations such as the elderly, infants, young children and those with medical conditions.

Unlike other counties within the region, Carroll County does not have large urban areas where living conditions such as older, poorly-ventilated high rise buildings and low-income neighborhoods tend to contribute to heat-related deaths and injuries during extreme heat events because air-conditioning units, fans and cooling centers are unavailable.

3.7 EARTHQUAKES

IDENTIFYING THE HAZARD

What is the definition of an earthquake?

An earthquake is a sudden shaking of the ground caused when rocks forming the earth's crust slip or move past each other along a fault (a fracture in the rocks). Most earthquakes occur along the boundaries of the earth's tectonic plates. These slow-moving plates are being pulled and dragged in different directions, sliding over, under and past each other. Occasionally, as the plates move past each other, their jagged edges will catch or stick causing a gradual buildup of pressure (energy).

Eventually, the force exerted by the moving plates overcomes the resistance at the edges and the plates snap into a new position. This abrupt shift releases the pent-up energy, producing vibrations or seismic waves that travel outward from the earthquake's point of origin. The location below the earth's surface where the earthquake starts is known as the hypocenter or focus. The point on the earth's surface directly above the focus is the epicenter.

The destruction caused by an earthquake may range from light to catastrophic depending on a number of factors including the magnitude of the earthquake, the distance from the epicenter, the local geologic conditions as well as construction standards and time of day (i.e., rush hour). Earthquake damage may include power outages, general property damage, road and bridge failure, collapsed buildings and utility damage (ruptured gas lines, broken water mains, etc.).

Most of the damage done by an earthquake is caused by its secondary or indirect effects. These secondary effects result from the seismic waves released by the earthquake and include ground shaking, surface faulting, liquefaction, landslides and, in rare cases, tsunamis.

According to the U.S. Geological Survey earthquakes pose a significant risk to more than 75 million Americans in 39 states. Twenty-six urban areas across the United States, including St. Louis, Missouri, are at risk of significant seismic activity. The Federal Emergency Management Agency has estimated future annual earthquake losses in the United States at \$5.6 billion a year.

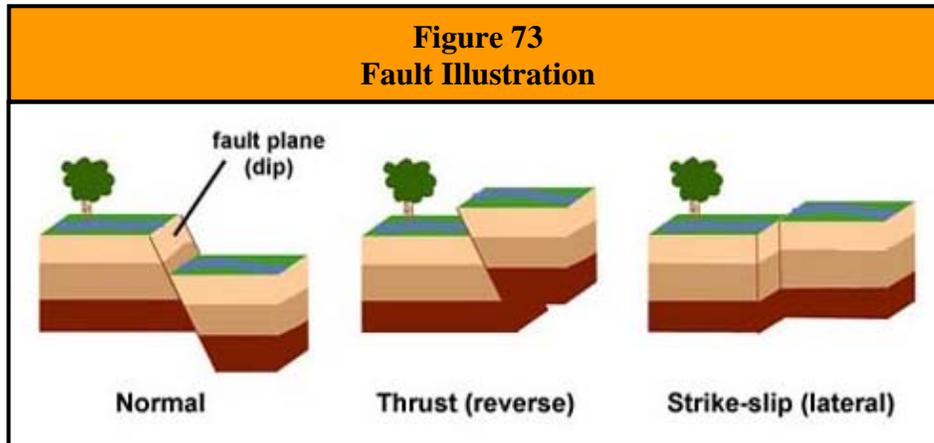
What is a fault?

A fault is a fracture or zone of fractures in the earth's crust between two blocks of rock. They may range in length from a few millimeters to thousands of kilometers. Many faults form along tectonic plate boundaries.

Faults are classified based on the angle of the fault with respect to the surface (known as the dip) and the direction of slip or movement along the fault. There are three main groups of faults: normal, thrust (reverse) and strike-slip (lateral). **Figure 73** provides an illustration of each type of fault.

Normal faults occur in response to pulling or tension along the two blocks of rock causing the overlying block to move down the dip of the fault plane. Most of the faults in Illinois are normal faults. Thrust or reverse faults occur in response to squeezing or compression of the two blocks

of rock causing the overlying block to move up the dip of the fault plane. Strike-slip or lateral faults can occur in response to either pulling/tension or squeezing/compression causing the blocks to move horizontally past each other.



Source: U. S. Geological Survey.

Geologists have found that earthquakes tend to recur along faults, which reflect zones of weakness in the earth's crust. Even if a fault zone has recently experienced an earthquake, there is no guarantee that all the stress has been relieved. Another earthquake could still occur.

What are tectonic plates?

Tectonic plates are large, irregularly-shaped, relatively rigid sections of the earth's crust that float on the top, fluid layer of the earth's mantle. There are about a dozen tectonic plates that make up the surface of the planet. These plates are approximately 50 to 60 miles thick and the largest are millions of square miles in size.

How are earthquakes measured?

The severity of an earthquake is measured in terms of its magnitude and intensity. A brief description of both terms and the scales used to measure each are provided below.

Magnitude

Magnitude refers to the amount of seismic energy released at the hypocenter of an earthquake. The magnitude of an earthquake is determined from measurements of ground vibrations recorded by seismographs. As a result, magnitude is represented as a single, instrumentally determined value. A loose network of seismographs has been installed all over the world to help record and verify earthquake events.

There are several scales that measure the magnitude of an earthquake. The most well known is the Richter Scale. This logarithmic scale provides a numeric representation of the magnitude of an earthquake through the use of whole numbers and decimal fractions. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold

increase in ground vibrations measured. In addition, each whole number increase corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number. It is important to note that the Richter Scale is used only to determine the magnitude of an earthquake, it does not assess the damage that results.

Once an earthquake’s magnitude has been confirmed, it can be classified. **Figure 74** categorizes earthquakes by class based on their magnitude (i.e., Richter Scale value). Any earthquake with a magnitude less than 3.0 on the Richter Scale is classified as a microquake while any earthquake with a magnitude of 8.0 or greater on the Richter Scale is considered a “great” earthquake. Earthquakes with a magnitude of 2.0 or less are not commonly felt by individuals. The largest earthquake to occur in the United States since 1900 took place off the coast of Alaska on March 28, 1964 and registered a 9.2 on the Richter Scale.

Figure 74 Earthquake Magnitude Classes	
Class	Magnitude (Richter Scale)
micro	smaller than 3.0
minor	3.0 – 3.9
light	4.0 – 4.9
moderate	5.0 – 5.9
strong	6.0 – 6.9
major	7.0 – 7.9
great	8.0 or larger

Source: Michigan Technological University, Department of Geological and Mining Engineering and Sciences, UPSeis an educational site for budding seismologists.

Intensity

Intensity refers to the effect an earthquake has on a particular location. The intensity of an earthquake is determined from observations made of the damage inflicted on individuals, structures and the environment. As a result, intensity does not have a mathematical basis; instead it is an arbitrary ranking of observed effects. In addition, intensity generally diminishes with distance. There may be multiple intensity recordings for a region depending on a location’s distance from the epicenter.

Although numerous intensity scales have been developed over the years, the one currently used in the United States is the Modified Mercalli Intensity Scale. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. The lower numbers of the intensity scale are based on human observations (i.e., felt only by a few people at rest, felt quite noticeably by persons indoors, etc).

The higher numbers of the scale are based on observed structural damage (i.e., broken windows, general damage to foundations etc.). Structural engineers usually contribute information when assigning intensity values of VIII or greater. **Figure 75** provides a description of the damages associated with each level of intensity as well as comparing Richter Scales values to Modified Mercalli Intensity Scale values.

Generally the Modified Mercalli Intensity value assigned to a specific site after an earthquake is a more meaningful measure of severity to the general public than magnitude because intensity refers to the effects actually experienced at that location.

Figure 75 Comparison of Richter Scale and Modified Mercalli Intensity Scale		
Richter Scale	Modified Mercalli Scale	Observations
1.0 – 1.9	I	Felt by very few people; barely noticeable. No damage.
2.0 – 2.9	II	Felt by a few people, especially on the upper floors of buildings. No damage.
3.0 – 3.9	III	Noticeable indoors, especially on the upper floors of buildings, but may not be recognized as an earthquake. Standing cars may rock slightly; vibrations similar to the passing of a truck. No damage.
4.0	IV	Felt by many indoors and a few outdoors. Dishes, windows, and doors disturbed. Standing cars rocked noticeably. No damage.
4.1 – 4.9	V	Felt by nearly everyone. Small, unstable objects displaced or upset; some dishes and glassware broken. Negligible damage.
5.0 – 5.9	VI	Felt by everyone. Difficult to stand. Some heavy furniture moved. Weak plaster may fall and some masonry, such as chimneys, may be slightly damaged. Slight damage.
6.0	VII	Slight to moderate damage to well-built ordinary structures. Considerable damage to poorly-built structures. Some chimneys may break. Some walls may fall.
6.1 – 6.9	VIII	Considerable damage to ordinary buildings. Severe damage to poorly built buildings. Some walls collapse. Chimneys, monuments, factory stacks, columns fall.
7.0	IX	Severe structural damage in substantial buildings, with partial collapses. Buildings shifted off foundations. Ground cracks noticeable.
7.1 – 7.9	X	Most masonry and frame structures and their foundations destroyed. Some well-built wooden structures destroyed. Train tracks bent. Ground badly cracked. Landslides.
8.0	XI	Few, if any structures remain standing. Bridges destroyed. Wide cracks in ground. Train tracks bent greatly. Wholesale destruction.
> 8.0	XII	Total damage. Lines of sight and level are distorted. Waves seen on the ground. Objects thrown up into the air.

Sources: Michigan Technological University, Department of Geological and Mining Engineering and Sciences, UPSeis an educational site for budding seismologists.
U.S. Geological Survey.

When and where do earthquakes occur?

Earthquakes can strike any location at any time. However, history has shown that most earthquakes occur in the same general areas year after year, principally in three large zones around the globe. The world’s greatest earthquake belt, the circum-Pacific seismic belt (nicknamed the “Ring of Fire”), is found along the rim of the Pacific Ocean, where about 81 percent of the world’s largest earthquakes occur.

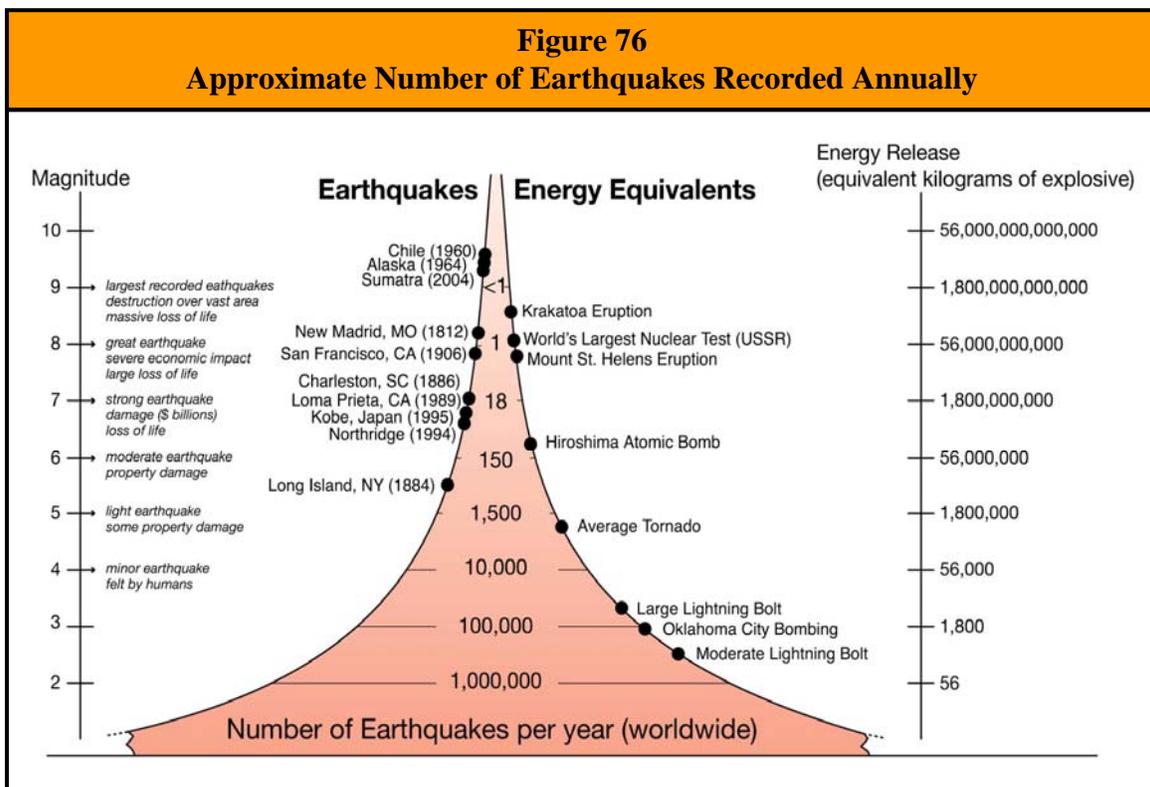
The second prominent belt is the Alpide, which extends from Java to Sumatra and through the Himalayan Mountains, the Mediterranean Sea and out into the Atlantic Ocean. It accounts for about 17 percent of the world’s largest earthquakes, including those in Iran, Turkey and Pakistan. The third belt follows the submerged mid-Atlantic Ridge, the longest mountain range in the world, nearly splitting the entire Atlantic Ocean north to south.

While most earthquakes occur along plate boundaries some are known to occur within the interior of a plate. (As the plates continue to move and plate boundaries change over time,

weakened boundary regions become part of the interiors of the plates.) Earthquakes can occur along zones of weakness within a plate in response to stresses that originate at the edges of the plate or from deep within the earth's crust. The New Madrid earthquakes of 1811 and 1812 occurred within the North American plate.

How often do earthquakes occur?

Earthquakes occur everyday. Worldwide, small earthquakes, such as magnitude 2 earthquakes, occur several hundred times a day. These earthquakes are known as microquakes and are generally not felt by humans. Major earthquakes, such as magnitude 7 earthquakes, generally occur more than one a month. **Figure 76** illustrates the approximate number of earthquakes that occur worldwide per year based on magnitude. This figure also identifies manmade and natural events that release approximately the same amount of energy for comparison.



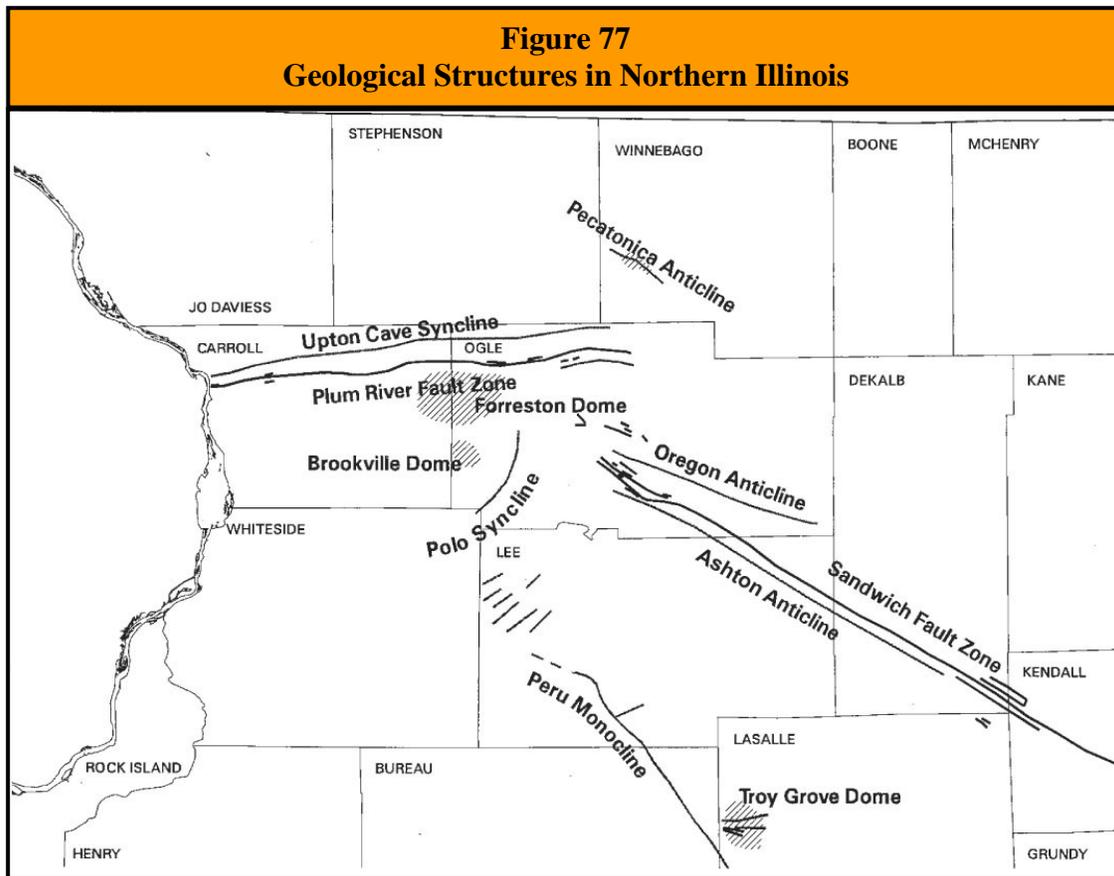
Source: Incorporated Research Institutions for Seismology, Education and Outreach Series – Educational One-Pagers, How Often Do Earthquakes Occur?

PROFILING THE HAZARD

Are there any fault zones located within the County?

Yes. There is one known fault zone in Carroll County, the Plum River Fault Zone. The Plum River Fault Zone is 112 miles long and trends slightly northeast across eastern Iowa and northwestern Illinois, from Linn County, Iowa to Ogle County, Illinois. It varies in width from a few hundred feet

to approximately 3,900 feet. **Figure 77** illustrates the location of the Plum River Fault Zone in Illinois.



Source: Illinois State Geological Survey, Earthquake Facts 1999-1, Northern Illinois Earthquakes.

When have earthquakes occurred previously? What is the extent of these previous quakes?

According to the Illinois State Geological Survey’s *Northern Illinois Earthquakes* fact sheet and the *Earthquakes in Northern Illinois: 1795 – 2012* map, one minor earthquake originated in Carroll County during the last 200 years. This earthquake occurred at 3:19 a.m. CST on January 23, 1928. The epicenter of the earthquake was located about one mile east of Argo Fay and approximately seven miles south-southwest of Mount Carroll and does not appear to be associated with the Plum River Fault Zone. This earthquake was originally assessed as a magnitude 3.5; however, this magnitude was based on the area in which the earthquake was felt, not seismographic data. A recent re-evaluation of the historical data by the Illinois State Geological Survey (ISGS) determined that this event was more likely a magnitude 3.1 earthquake.

Northern Illinois

In addition to the earthquake recorded in Carroll County, there have been approximately two dozen other earthquakes that have occurred in northern Illinois in the last century, though none of them were greater than a magnitude 5.1. These earthquakes generally caused minor damage

within 10 to 20 miles of the epicenter and were felt over several counties. Earthquakes greater than a magnitude 5 are generally not expected in this region.

The most recent earthquake to take place in northern Illinois occurred on January 30, 2012. The epicenter was located just east of McHenry in unincorporated McHenry County and was felt in eastern McHenry County and western Lake County. The preliminary U.S. Geological Survey report lists this event as a magnitude 3.1 earthquake, while the ISGS's *Earthquakes in Northern Illinois: 1795 – 2012* map lists it as a magnitude 2.4 earthquake. No structural damage was reported.

There have been several other recent earthquakes to take place in northern Illinois.

- On February 10, 2010, a magnitude 3.8 earthquake took place approximately two miles northeast of Virgil in Kane County. This earthquake was felt over much of Illinois, Indiana and central and southern Wisconsin. Some minor structural damage was reported.
- A magnitude 4.2 earthquake took place on June 28, 2004 approximately eight miles northwest of Ottawa in La Salle County. Ground shaking was felt over six states.
- On September 2, 1999, an earthquake was reported in northern Illinois near Dixon in Lee County. Ground shaking was felt over several counties. The earthquake was originally assessed as a magnitude 3.5; however, ISGS recently re-evaluated the data and determined this event was actually a magnitude 3.7 earthquake.

The September 2, 1999 earthquake occurred in roughly the same vicinity as a September 15, 1972 earthquake which took place near Amboy in Lee County. Minor structural damage, such as cracks in chimneys and plaster, was reported. Ground shaking was felt over most of northern Illinois. The earthquake was originally assessed as magnitude 4.5; however, ISGS recently re-evaluated this event and determined that it was a magnitude 4.4 earthquake.

The largest earthquake to take place in northern Illinois in the past several hundred years occurred on May 26, 1909. The exact location of this magnitude 5.1 earthquake isn't known, but the greatest damage occurred in and near Aurora where many chimneys fell and gas lines were ruptured. Minor structural damage was reported across northern and central Illinois and southern Wisconsin. Ground shaking was felt over seven states.

Southern Illinois

Carroll County has also felt ground shaking caused by several earthquakes that have originated in southeastern Illinois.

- On April 18, 2008, a magnitude 5.4 earthquake was reported in southeastern Illinois near Belmont in Wabash County. The earthquake was located along the Wabash Valley seismic zone. Minor structural damage was reported in several towns in Illinois and Kentucky. Ground shaking was felt over all or parts of 18 states in the central United States and southern Ontario, Canada.
- A magnitude 5.1 earthquake took place on June 10, 1987 in southeastern Illinois near Olney in Richland County. This earthquake was also located along the Wabash Valley

seismic zone. Only minor structural damage was reported in several towns in Illinois and Indiana. Ground shaking was felt over all or parts of 17 states in the central and eastern United States and southern Ontario, Canada.

The strongest earthquake in the central United States during the 20th century occurred along the Wabash Valley seismic zone in southeastern Illinois near Dale in Hamilton County. This magnitude 5.4 earthquake occurred on November 9, 1968 with an intensity estimated at VII for the area surrounding the epicenter. Moderate structural damage was reported in several towns in south-central Illinois, southwest Indiana and northwest Kentucky. Ground shaking was felt over all or parts of 23 states in the central and eastern United States and southern Ontario, Canada.

Three of the ten largest earthquakes ever recorded within the continental United States took place in 1811 and 1812 along the New Madrid seismic zone which lies within the central Mississippi Valley, extending from northeast Arkansas, through southeast Missouri, western Tennessee, western Kentucky and southern Illinois. These magnitude 7.7 and 7.5 major earthquakes were centered near the town of New Madrid, Missouri and caused widespread devastation to the surrounding region and rang church bells 1,000 miles away in Boston.

The quakes locally changed the course of the St. Francis and Mississippi Rivers and created Reelfoot Lake, which covers an area of more than 10 square miles in northwestern Tennessee. These earthquakes were not an isolated incident. The New Madrid seismic zone is one of the most seismically active areas of the United States east of the Rockies. Since 1974 more than 4,000 earthquakes have been recorded within this seismic zone, most of which were too small to be felt.

What locations are affected by earthquakes?

Earthquake events affect the entire County. Earthquakes, like drought and extreme heat, impact large areas, extending beyond county boundaries. Carroll County's proximity to two earthquake fault zones (the Plum River and the Sandwich) makes the entire area likely to be affected by an earthquake if these faults become seismically active. The *2010 Illinois Natural Hazard Mitigation Plan* classifies Carroll County's hazard rating for earthquakes as "guarded."

What is the probability of future earthquake events occurring?

As with flooding, calculating the probability of future earthquakes changes depending on the magnitude of the event. According to the ISGS, Illinois is expected to experience a magnitude 3.0 earthquake every year, a magnitude 4.0 earthquake every four years and a magnitude 5.0 earthquake every 20 years. The likelihood of an earthquake with a magnitude of 6.3 or greater occurring somewhere in the central United States within the next 50 years is between 86% and 97%.

ASSESSING VULNERABILITY

Are the participating jurisdictions vulnerable to earthquakes?

Yes. All of Carroll County is vulnerable to earthquakes. The unique geological formations topped with glacial drift soils found in the central United States conduct an earthquake's energy farther than in other parts of the Nation. Consequently, earthquakes that originate in the

Midwest tend to be felt at greater distances than earthquakes with similar magnitudes that originate on the West Coast.

This vulnerability, found throughout most of Illinois, exists to a lesser degree in the glaciated portion of Carroll County and northwest Illinois. In these areas the bedrock is closer to the surface and the depth of the glacial soils is not the same as exists elsewhere in Illinois and the lower Midwestern states.

The infrequency of major earthquakes, coupled with relatively low magnitude/intensity past events, has led the public to perceive that Carroll County is not vulnerable to damaging earthquakes. This perception has allowed the County and participating jurisdictions to develop largely without regard to earthquake safety.

What impacts resulted from the recorded earthquake events?

Damage information was either unavailable or none was recorded for the 1928 earthquake that originated in Carroll County. Given its location and magnitude, residents most likely felt the ground shaking but it is unlikely that any major structure damage or injuries were sustained during this event.

While Carroll County residents felt the earthquakes that occurred in northern Illinois in 2010, 2004, 1999, 1972 and 1909, no damages or injuries were reported. Given the magnitude of the great earthquakes of 1811 and 1812, it is almost certain that individuals in what is now Carroll County felt those quakes; however historical records do not indicate the intensity or impacts that these quakes had on the County. If another earthquake the magnitude of those recorded in 1811 and 1812 occurs again along the New Madrid seismic zone, the damage that will be experienced in northern Illinois is not expected to be substantial.

The risk or vulnerability to public health and safety from an earthquake is dependent on the intensity and location of the event. As mentioned previously, earthquakes greater than a magnitude 5 are generally not expected in this region. This, coupled with the fact that no earthquakes have been associated with the Plum River Fault Zone in over 200 years, decreases the likelihood that an earthquake originating along the fault will cause significant damage in Carroll County. As a result the risk or vulnerability to public health and safety is considered to be low.

Even if another minor earthquake, such as the January 23, 1928 event, takes place in Carroll County the risk or vulnerability to public health and safety is still considered to be low. There is a greater likelihood that Carroll County residents will experience impacts from earthquakes that originate outside of the County and then the risk to public health and safety is still low.

What other impacts can result from earthquakes?

Earthquakes can impact human life, health and public safety. **Figure 78** details the potential impacts that may be experienced by the County should a magnitude 6.0 or greater earthquake occur in the region.

**Figure 78
Potential Earthquake Impacts**

Direct	Indirect
<p><i>Buildings</i></p> <ul style="list-style-type: none"> • Temporary displacement of businesses, households, schools and other critical services where heat, water and power are disrupted • Long-term displacement of businesses, households, schools and other critical services due to structural damage or fires <p><i>Transportation</i></p> <ul style="list-style-type: none"> • Damages to bridges (i.e., cracking of abutments, subsidence of piers/supports, etc.) • Cracks in the pavement of critical roadways • Increased traffic on U.S. Route 52 and IL Route 78 as residents move out of the area to seek shelter and medical care and as emergency response, support services and supplies move south to aid in recovery • Misalignment of rail lines due to landslides (most likely near stream crossings), fissures and/or heaving <p><i>Utilities</i></p> <ul style="list-style-type: none"> • Downed power and communication lines • Breaks in drinking water and sanitary sewer lines resulting in the temporary loss of service • Disruptions in the supply of natural gas due to cracking and breaking of pipelines <p><i>Health</i></p> <ul style="list-style-type: none"> • Injuries/deaths due to falling debris and fires <p><i>Other</i></p> <ul style="list-style-type: none"> • Cracks in the earthen dams of the lakes and reservoirs within the County which could lead to dam failures 	<p><i>Health</i></p> <ul style="list-style-type: none"> • Use of County health facilities to treat individuals injured closer to the epicenter • Emergency services (ambulance, fire, law enforcement) may be needed to provide aid in areas where damage was greater <p><i>Other</i></p> <ul style="list-style-type: none"> • Disruptions in land line telephone service throughout an entire region (i.e., northern Illinois) • Depending on the seasonal conditions present, more displacements may be expected as those who may have enough water and food supplies seek alternate shelter due to temperature extremes that make their current housing uninhabitable

Are existing buildings, infrastructure and critical facilities vulnerable to earthquakes?

Yes. All existing buildings, infrastructure and critical facilities located in Carroll County and the participating jurisdictions are vulnerable to damage from earthquakes. Unreinforced masonry buildings are most at risk during an earthquake because the walls are prone to collapse outward. Steel and wood buildings have more ability to absorb the energy from an earthquake. Wood buildings with proper foundation ties have rarely collapsed in earthquakes.

Depending on the intensity of the earthquake, building damage in Carroll County could range from negligible to moderate in well-built structures and considerable in poorly-built structures. An earthquake has the ability to damage infrastructure and critical facilities such as roads and utilities. In the event of a strong earthquake, bridges are expected to experience moderate

damage such as cracking in the abutments and subsidence of piers and supports. The structural integrity may be compromised to the degree where safe passage is not possible, resulting in adverse travel times as alternate routes are taken. Some rural families may become isolated where alternate paved routes do not exist. In addition, cracks may form in the pavement of key roadways.

An earthquake may also down overhead power and communication lines causing power outages and disruptions in communications. Cracks or breaks may form in natural gas pipelines and drinking water and sewage lines resulting in temporary loss of service. In addition, an earthquake could cause cracks to form in the earthen dams located within the County, increasing the likelihood of a dam failure.

As with public health and safety, the risk or vulnerability to buildings, infrastructure and critical facilities is dependent on the intensity and location of the event. The risk to buildings, infrastructure and critical facilities from a moderate earthquake is likely to be low, while the risk from a great earthquake is likely to be high.

Are future buildings, infrastructure and critical facilities vulnerable to earthquakes?

Yes. All future buildings, infrastructure and critical facilities located in Carroll County and the participating jurisdictions are vulnerable to damage from earthquakes. While Savanna has building codes in place, these codes do not contain seismic provisions that address structural vulnerability for earthquakes. As a result, future buildings, infrastructure and critical facilities face the same vulnerabilities as those of existing buildings, infrastructure and critical facilities described previously.

What are the potential dollar losses to vulnerable structures from earthquakes?

With no reports of property damage associated with the recorded earthquake events, there is no way to accurately estimate future potential dollar losses to vulnerable structures in Carroll County. Sufficient information was not available to make useful predictions regarding potential earthquake damage through the use of computer modeling. Since all structures within Carroll County are vulnerable to damage, it is likely that there will be future dollar losses from a strong earthquake. As a result, participating jurisdictions were asked to develop mitigation projects that could provide wide ranging benefits for reducing the impacts or damages associated with earthquakes.

3.8 DAMS

IDENTIFYING THE HAZARD

What is the definition of a dam?

A dam is an artificial barrier constructed across a stream channel or a man-made basin for the purpose of storing, controlling or diverting water. Dams typically are constructed of earth, rock, concrete or mine tailings. The area directly behind the dam where water is impounded or stored is referred to as a reservoir.

According to the National Inventory of Dams (NID), there are approximately 84,130 dams in the United States and Puerto Rico, with 1,504 dams located in Illinois. (The NID is maintained by the U.S. Army Corps of Engineers and is updated approximately every two years.) Ninety-four percent of the dams in Illinois are constructed of earth.

What is the definition of a dam failure?

A dam failure is the partial or total collapse, breach or other failure of a dam that causes flooding downstream. In the event of a dam failure, the people, property and infrastructure downstream could be subject to devastating damages. The potential severity of a full or partial dam failure is influenced by two factors:

- the capacity of the reservoir and
- the extent and type of development and infrastructure located downstream.

There are two categories of dam failures, “flood” or “rainy day” failures and “sunny day” failures. A “flood” or “rainy day” failure usually results when excess precipitation and runoff cause overtopping or a buildup of pressure behind a dam which leads to a breach. Even normal storm events can lead to “flood” failures if debris plugs the water outlets. Given the conditions that lead to a “flood” failure (i.e., rainfall over a period of hours or days), there is usually a sufficient amount of time to warn and evacuate residents downstream.

Unlike a “flood” failure, there is generally no warning associated with a “sunny day” failure. A “sunny day” failure is usually the result of improper or poor dam maintenance, internal erosion, vandalism or an earthquake. This unexpected failure can be catastrophic because it may not allow enough time to warn and evacuate residents downstream.

No one knows precisely how many dam failures have occurred in the United States, however, it is estimated that hundreds have taken place over the last century. Some of the worst failures have caused catastrophic property and environmental damage and have taken hundreds of lives. The worst dam failure in the last 50 years occurred on February 26, 1972 in Buffalo Creek, West Virginia. A tailings dam owned by the Buffalo Mining Company failed, taking the lives of 125 people, injuring 1,100 people, destroying 500 homes and causing more than \$400 million in damages.

Dam failures have been documented in every state, including Illinois. According to the Dam Incident Database compiled by the National Performance of Dams Program, there have been 20 reported dam failures in Illinois between 1950 and 2001.

What causes a dam failure?

Dam failures can result from one or more of the following:

- *prolonged periods of rainfall and flooding* (the cause of most failures);
- *inadequate spillway capacity* resulting in excess flow overtopping the dam;
- *internal erosion* caused by embankment or foundation leakage ;
- *improper maintenance* (including failure to remove trees, repair internal seepage problems, maintain gates, valves and other operational components, etc.);
- *improper design* (including use of improper construction materials and practices);
- *negligent operation* (including failure to remove or open gates or valves during high flow periods);
- *failure of an upstream dam on the same waterway;*
- *landslides into reservoirs* which cause surges that result in overtopping of the dam;
- *high winds* which can cause significant wave action and result in substantial erosion; and
- *earthquakes* which can cause longitudinal cracks at the tops of embankments that can weaken entire structures.

How are dams classified?

Each dam in Illinois is assigned a hazard classification based on the potential for loss of life and damage to property in the event of a dam failure. The three classifications are Class I, Class II and Class III. **Figure 79** provides a brief description of each hazard classification. The hazard classifications used in Illinois are similar to those used by the U.S. Army Corps of Engineers to classify dams listed in the National Inventory of Dams. It is important to note that the hazard classification assigned is not an indicator of the adequacy of the dam or its physical integrity and in no way reflects the current condition of the dam.

Figure 79 Dam Hazard Classification System	
Class	Description
Class I	Dams located where failure has a high probability of causing loss of life or substantial economic loss downstream (i.e., a dam located where its failure may cause additional damage to such structures as a home, a hospital, a nursing home, a highly travelled roadway, a shopping center or similar type facilities where people are normally present downstream of the dam).
Class II	Dams located where failure has a moderate probability of causing loss of life or may cause substantial economic loss downstream (i.e., a dam located where its failure may cause additional damage to such structures as a water treatment facility, a sewage treatment facility, a power substation, a city park, a U.S. Route or Illinois Route highway, a railroad or similar type facilities where people are downstream of the dam for only a portion of the day or on a more sporadic basis).
Class III	Dams located where failure has a low probability of causing loss of life, where there are no permanent structures for human habitation, or minimal economic loss downstream (i.e., a dam located where its failure may cause additional damage to agricultural fields, timber areas, township roads or similar type areas where people seldom are present and where there are few structures).

Source: Illinois Administrative Code.

Are there any classified dams owned by any of the participating jurisdictions?

No. The only publicly-owned dam within Carroll County is the Upper Spring Lake Dam which is owned by the U.S. Army Corps of Engineers. This Class III rockfill dam was built to create a fish and wildlife pond.

Are there any privately-owned classified dams within the County?

Yes. There are six privately-owned classified dams located within Carroll County. **Figure 80** provides a brief description of each dam. Five of the privately-owned dams are a part of Lake Carroll approximately five miles northwest of Lanark. This private recreational community contains approximately 2,550 lots and 933 permanent homes spread across a 5,000 acre complex. The amenities include a 640 acre lake, 130 site campground, swimming pool complex, golf course, trails and lodge complex.

Figure 80 Privately-Owned Classified Dams Located in Carroll County					
Name	Owner	Type	Purpose	Completion Date	Classification
Lake Carroll Dam	Lake Carroll Property Owners Association	Earth	Recreation	1974	Class I
Lake Carroll Sedimentation Pond 1 Dam	Lake Carroll Property Owners Association	Earth	Debris Control	1987	Class III
Lake Carroll Sedimentation Pond 2 Dam	Lake Carroll Property Owners Association	Earth	Debris Control	1988	Class III
Lake Carroll Sedimentation Pond 3 Dam	Lake Carroll Property Owners Association	Earth	Debris Control	1989	Class III
Lake Carroll Sedimentation Disposal Area 5 Dam	Lake Carroll Property Owners Association	Earth	Debris Control	1992	Class III
Timber Lake Dam	Timber Lake Campground	Earth	Recreation	1960	Class II

Sources: Diedrichsen, Mike, Illinois Department of Natural Resources, Office of Water Resources. U.S. Army Corps of Engineers, National Inventory of Dams Interactive Report.

PROFILING THE HAZARD

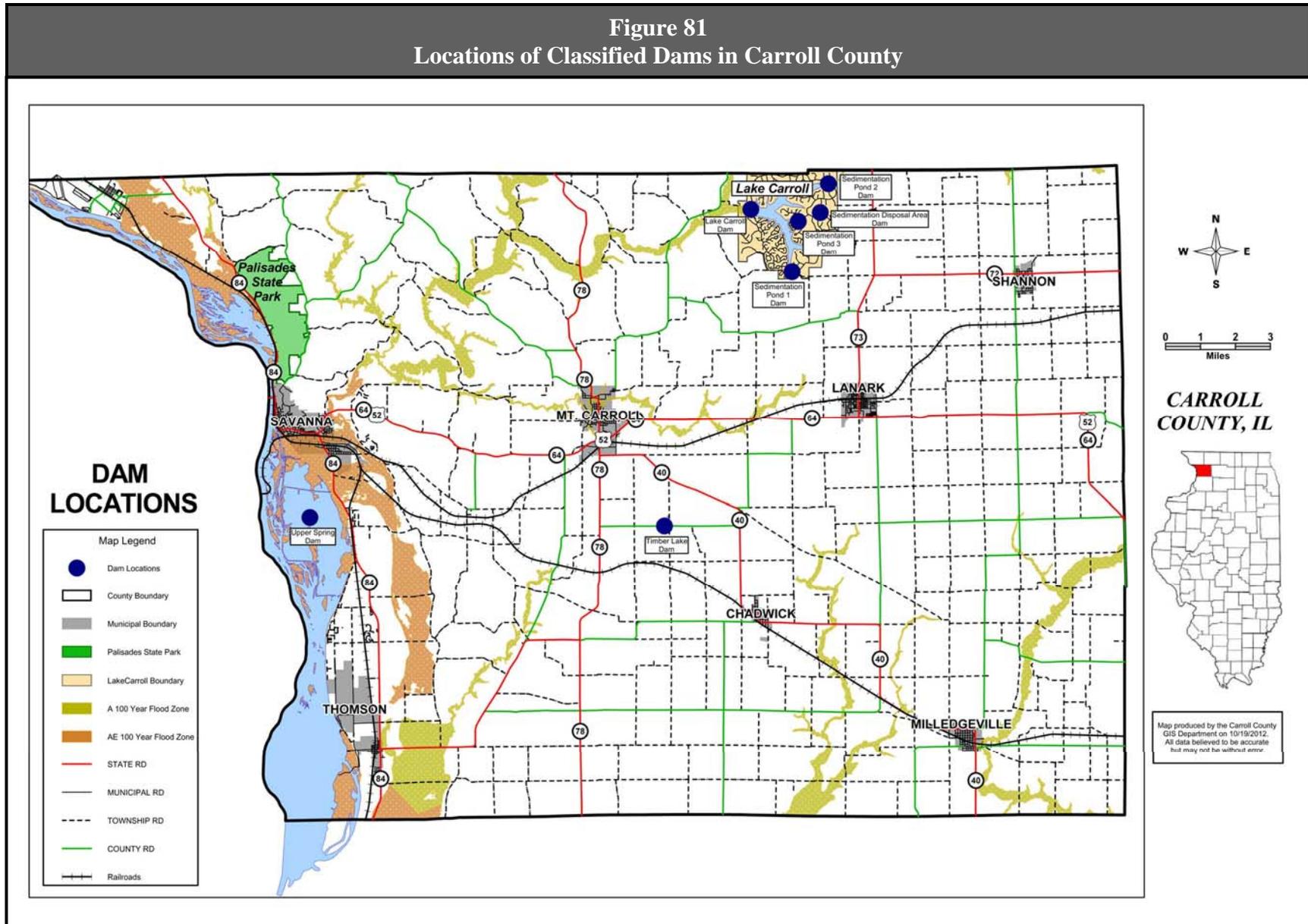
When have dam failures occurred previously? What is the extent of these previous dam failures?

According to the Dam Incident Database compiled by the National Performance of Dams Program, there has been one recorded dam failure in Carroll County between 1930 and 2001. In May, 1990 the Lake Carroll Sedimentation Pond 2 Dam was breached due to a “flood” failure event caused by excessive rainfall. The extent to which the community and surrounding agricultural areas were impacted was unavailable.

What locations are affected by dam failure?

Dam failures have the potential to affect unincorporated portions of Carroll County, including the private recreational community of Lake Carroll. **Figure 81** shows the locations of the publicly and privately-owned classified dams in Carroll County.

Figure 81
Locations of Classified Dams in Carroll County



What is the probability of future dam failure events occurring?

Carroll County has only experienced one dam failure during the life of all seven of its classified dams. Based on the age of the Lake Carroll Sedimentation Pond 2 Dam and the fact that it has experienced only one recorded dam failure during its life, the probability that it will experience another dam failure depends largely on proper maintenance, including maintaining the reservoir's capacity. Since none of the other dams have experienced a dam failure, it is difficult to specifically establish the probability of a future failure; however, it is estimated to be relatively low.

ASSESSING VULNERABILITY

Are the participating jurisdictions vulnerable to dam failures?

Yes. While unincorporated Carroll County is vulnerable to the dangers presented by dam failures, none of the other participants are considered vulnerable.

What impacts resulted from the recorded dam failures?

Damage information was either unavailable or none was recorded for the May, 1990 breach of Lake Carroll Sedimentation Pond 2 Dam.

What other impacts can result from dam failures?

The impacts from a dam failure are similar to those of a flood. There is the potential for injuries, loss of life and property damage. Depending on the type of dam failure, there may be little, if any warning that an event is about to occur, similar to flash flooding. As a result, one of the primary threats to individuals is from drowning. Motorists who choose to drive over flooded roadways run the risk of having their vehicles swept off the road and downstream. Flooding of roadways is also a major concern for emergency response personnel who would have to find alternative routes around any section of road that becomes flooded due to a dam failure.

In addition to concerns about injuries and death, the water released by a dam failure poses the same biological and chemical risks to public health as floodwaters. The flooding that results from a dam failure has the potential to force untreated sewage to mix with floodwaters. The polluted floodwaters then transport the biological contaminants into buildings and basements and onto roads and public areas. If left untreated, the floodwaters can serve as breeding grounds for bacteria and other disease-causing agents. Even if floodwaters are not contaminated with biological material, basements and buildings that are not properly cleaned can grow mold and mildew which can be pose a health hazard, especially for small children, the elderly and those with specific allergies.

Flooding from dam failures can also cause chemical contaminants such as gasoline and oil to enter floodwaters if underground storage tanks or pipelines crack and begin leaking during a dam failure event. Depending on the time of year, the water released by a dam failure may also carry away agricultural chemicals that have been applied to farm fields and cause damage to or loss of crops.

The risk or vulnerability to public health and safety from a dam failure is dependent on several factors including the severity of the event, the capacity of the reservoir and the extent and type of

development and infrastructure located downstream. Based on the locations, size and classification of the dams located in Carroll County, the risk from a dam failure is low to medium.

Are existing buildings, infrastructure and critical facilities vulnerable to dam failures?

Yes. The Emergency Action Plan for the Lake Carroll Dam identifies 63 structures (primarily residences) that are vulnerable to a dam failure. Information was unavailable on the number and type of structures vulnerable to a dam failure for the remaining dams; although a visual inspection of the area surrounding several of the dams indicates that there are buildings and infrastructures that could be vulnerable to a failure.

Depending on whether there is a full or partial dam failure, all of the vulnerable buildings, infrastructure and critical facilities may be inundated by water and structural damage may result. Because none of the reservoirs are immense in size, the damage sustained from dam failure flooding may not be to the structure, but to the contents of the building or nearby critical facility.

In addition to impacting structures, a dam failure can damage roads and utilities. Roadways, culverts and bridges can be weakened by dam failure floodwaters and may collapse under the weight of a vehicle. Power and communication lines, both above and below ground, are also vulnerable to dam failure flooding. Depending on their location and the velocity of the water as it escapes the dam, power poles may be snapped causing disruptions to power and communication. Water may also get into any buried lines causing damage and disruptions.

As with public health and safety, the risk or vulnerability to buildings, infrastructure and critical facilities is dependent on several factors including the severity of the event, the capacity of the reservoir and the extent and type of development and infrastructure located downstream. In general, the risk to buildings, infrastructure and critical facilities from a dam failure is relatively low.

Are future buildings, infrastructure and critical facilities vulnerable to dam failures?

Yes. All future buildings, infrastructure and critical facilities located within the flood path of one of the classified dams are vulnerable to damage from a dam failure. As a result, future buildings, infrastructure and critical facilities face the same vulnerabilities as those of existing buildings, infrastructure and critical facilities described previously.

What are the potential dollar losses to vulnerable structures from dam failures?

Unlike other hazards, such as flooding, there are no standard loss estimation models or methodologies for dam failures. Given that there has only been one recorded dam failure in Carroll County, sufficient information was not available to prepare a reasonable estimate of future potential dollar losses to vulnerable structure from dam failures.

4.0 MITIGATION STRATEGY

4.0 MITIGATION STRATEGY

This section focuses on determining how to reduce or eliminate the potential loss of life and property damage that results from the natural hazards identified in the Risk Assessment section of this Plan. In order to accomplish this objective, the Planning Committee developed a mitigation strategy that included the following steps:

- formulating mitigation goals to reduce or eliminate long-term vulnerabilities to natural hazards;
- identifying, analyzing and prioritizing a comprehensive range of specific mitigation actions including those related to continued compliance with the National Flood Insurance Program; and
- describing how each jurisdiction will implement the mitigation actions identified.

Provided below is a detailed discussion of each mitigation strategy step.

4.1 HAZARD MITIGATION GOALS

The first step outlined in the mitigation strategy is to develop mitigation goals that aim to reduce or eliminate long-term vulnerabilities to the natural hazards identified. The mitigation goals are general guidelines that explain what the participants want to achieve in terms of hazard and loss prevention.

A preliminary list of eight hazard mitigation goals was developed and distributed to the Planning Committee members at the first meeting on February 2, 2012. Members were asked to review the list before the second meeting and consider whether any changes needed to be made or if additional goals should be included. At the Planning Committee’s March 29, 2012 meeting, the group discussed the preliminary list of goals and approved them with no changes or additions. **Figure 82** lists the approved goals.

Figure 82 Hazard Mitigation Goals	
Goal 1	Educate people about the natural hazards they face and the ways they can protect themselves, their homes, and their businesses from those hazards.
Goal 2	Protect the lives, health, and safety of the people and animals in the County from the dangers of natural hazards.
Goal 3	Protect existing infrastructure and design new infrastructure (roads, bridges, utilities, water supplies, sanitary sewer systems, etc.) to be resilient to the impacts of natural hazards.
Goal 4	Incorporate natural hazard mitigation into community plans and regulations.
Goal 5	Place a priority on protecting public services, including critical facilities, utilities, roads and schools.
Goal 6	Preserve and protect the rivers and floodplains in our County.
Goal 7	Ensure that new developments do not create new exposures to damage from natural hazards.
Goal 8	Protect historic, cultural, and natural resources from the effects of natural hazards.

4.2 IDENTIFYING, ANALYZING & PRIORITIZING MITIGATION ACTIONS

The second step outlined in the mitigation strategy involves identifying, analyzing and prioritizing a comprehensive range of specific mitigation actions. Mitigation actions include any projects, plans, activities or programs identified by participants that helps achieve one or more of the goals identified above.

4.2.1 Identification and Analysis

After developing hazard mitigation goals and reviewing the results of the risk assessment, Committee members representing the County and participating municipalities were asked to consult with their respective government entities to identify a comprehensive range of mitigation actions specific to the hazards and vulnerabilities associated with their jurisdiction. Representatives of Carroll County, Lanark, Milledgeville, Mount Carroll and Savanna were asked to identify mitigation actions that ensure their continued compliance with the National Flood Insurance Program.

The compiled lists of mitigation actions were reviewed to assure the appropriateness and suitability of each action. Those actions that were not deemed appropriate and/or suitable were either reworded or eliminated. Next, each mitigation action was assigned to one of six broad categories which allowed Committee members to compare and consolidate similar actions. **Figure 83** identifies each category and provides a brief description.

Figure 83 Mitigation Action Categorization	
Category	Description
Regulatory Activities (RA)	Regulatory activities are designed to reduce a jurisdiction’s vulnerability to specific hazard events. These activities are especially effective in hazard prone areas where development has yet to occur. Examples include: planning and zoning, floodplain regulations and local ordinances (i.e., building codes, etc.).
Structural Projects (SP)	Structural projects lessen the impact that a hazard has on a particular structure through design and engineering. Examples include: storm sewers, road and bridge projects, storm/tornado shelters, flood walls and seismic retrofits.
Public Information & Awareness (PI)	Public information and awareness activities are used to educate individuals about the potential hazards that affect their community and the mitigation strategies that they can take part in to protect themselves and their property. Examples include: outreach programs, school programs, brochures and handout materials, evacuation planning and drills, volunteer activities (i.e., culvert cleanout days, initiatives to check in on the elderly/disabled during hazard events such as storms and extreme heat events, etc.).
Studies (S)	Studies are used to identify activities that can be undertaken to reduce the impacts associated with certain hazards. Examples include: hydraulic and drainage studies.
Miscellaneous Projects (MP)	Miscellaneous projects is a catchall for those activities or projects that help to reduce or lessen the impact that a hazard may have on a critical facility or community service. Examples include: snow fences, generators, warning sirens, etc.
Property Protection (PP)	Property protection activities are designed to retrofit existing structures to withstand natural hazards or to remove structures from hazard prone areas. In Illinois, this category of activities primarily pertains to flood protection. Examples include: acquisition, relocation, foundation elevation, insurance (i.e., flood, homeowners, etc.) and retrofitting (i.e., impact resistant windows, etc.).

Finally, each mitigation action was analyzed to determine:

- which hazard or hazards are being mitigated for;
- whether the impacts associated with a particular hazard(s) would be reduced or eliminated;
- the general size of the population affected by the action (i.e., small, medium or large);
- what goal or goals would be fulfilled;
- whether the effects on new or existing buildings and infrastructure would be reduced; and
- continued compliance with the National Flood Insurance Program.

4.2.2 Prioritization

After reviewing and analyzing the identified mitigation actions, the Planning Committee members worked together to develop a method to prioritize each action. **Figure 84** identifies and describes the four-tiered prioritization methodology adopted by the Committee. The methodology developed provides a means of objectively determining which actions have a greater likelihood of eliminating or reducing the long-term vulnerabilities associated with the most frequently-occurring natural hazards.

While prioritizing the projects is useful and does provide the participants with additional information, it is important to keep in mind that the implementation of all the mitigation actions identified is desirable regardless of which prioritization category an action falls under.

Figure 84			
Mitigation Action Prioritization Methodology			
		Hazard	
		Most Significant Hazard (M) (i.e., severe storms, severe winter storms, floods, tornadoes)	Less Significant Hazard (L) (i.e., drought, extreme heat, earthquakes, dam failures)
Mitigation Action	Mitigation Action with the Potential to Virtually Eliminate or Significantly Reduce Impacts (H)	HM mitigation action will virtually eliminate damages and/or significantly reduce the probability of deaths and injuries from the most significant hazards	HL mitigation action will virtually eliminate damages and/or significantly reduce the probability of deaths and injuries from less significant hazards
	Mitigation Action with the Potential to Reduce Impacts (L)	LM mitigation action has the potential to reduce damages, deaths and/or injuries from the most significant hazards	LL mitigation action has the potential to reduce damages, deaths and/or injuries from less significant hazards

4.3 IMPLEMENTING MITIGATION ACTIONS

The final step outlined in the mitigation strategy involves describing how each jurisdiction will implement the mitigation actions identified. For each of mitigation action identified by the participants, the appropriate government entity was asked to:

- identify the party or parties responsible for oversight and administration;
- determine what funding source(s) are available or will be pursued; and
- describe the time frame for completion.

In addition, a preliminary qualitative cost/benefit analysis was conducted on each mitigation action. The costs and benefits were analyzed in terms of the general overall cost to complete an action as well as the action's likelihood of permanently eliminating or reducing the risk associated with a specific hazard. The general descriptors of high, medium and low were used. These terms are not meant to translate into a specific dollar amount, but rather to provide a relative comparison between the actions identified by each jurisdiction.

The analysis is only meant to give the participants a starting point to compare which actions are likely to provide the greatest benefit based on the financial cost and staffing effort needed. It is understood that when a grant application is submitted for a specific action, a detailed cost/benefit analysis will most likely be required to receive funding.

4.4 MITIGATION STRATEGY RESULTS

Figures 85 through **96** summarize the results of the mitigation strategy. The mitigation actions identified are arranged by participating jurisdiction.

**Figure 85
(Sheet 1 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
ESDA												
HM	Design and construct a new multi-use Emergency Operations Center.	DF, EH, EQ, F, SS, SWS, T	SP	Reduces	Large	2, 3, 5	Yes	NA	ESDA	5 years	75% Federal 25% Local	High/High
HM	Purchase and install storm warning sirens at strategic locations in unincorporated Carroll County.	SS, T	MP	Reduces	Medium	2	NA	NA	ESDA	2 years	TBD	Medium/High
HM	Replace storm warning sirens as needed.	SS, T	MP	Reduces	Medium	2	NA	NA	ESDA	TBD	TBD	Medium/High
HM	Identify additional County storm/emergency shelter locations and then develop Memorandums of Agreement with the entities designating them as storm/ emergency shelters.	EQ, F, SS, SWS, T	MP	Reduces	Medium	2	NA	NA	ESDA	TBD	County	Low/High
HM	Purchase portable emergency backup generators for use at designated storm/emergency shelters within the County to provided uninterrupted power during prolonged power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Medium	2	NA	NA	ESDA	TBD	TBD	Low/High
HM	Purchase and install electrical hookups (pigtails) at designated storm/emergency shelters within the County for use with portable emergency backup generators to provide uninterrupted power during prolonged power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Medium	2	NA	NA	ESDA	TBD	TBD	Low/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 2 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
ESDA Continued...												
HM	Design and construct storm shelters with emergency backup generators at strategic locations in unincorporated Carroll County.	SS, SWS, T	SP	Reduces	Medium	2	NA	NA	ESDA	7 years	75% Federal 25% Local	High/High
Health Department												
HM	Purchase and install an emergency backup generator at the Carroll County Health Department (a state-designated heating/cooling center) to provide uninterrupted power during power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	NA	Yes	Health Department	TBD	TBD	Low/High
HM	Purchase NOAA weather radios for nursing homes and residential group homes within the County.	EH, F, SS, SWS, T	MP	Reduces	Small	2, 3, 5	NA	Yes	Health Department	TBD	TBD	Low/High
Zoning Office												
LM	Make the most recent Flood Insurance Rate Maps available at the County Zoning Office to assist the public in considering where to construct new buildings and make County Officials aware of these maps and issues related to construction in a floodplain.*	F	RA	Reduces	Large	1, 6, 7	Yes	Yes	Zoning Office	1 year	County	Low/High
LM	Make information materials available to the public about the National Flood Insurance Program's voluntary Community Rating System.*	F	PP	Reduces	Large	1, 6, 7	Yes	Yes	Zoning Office	1 year	County	Low/High

* Mitigation action to ensure continued compliance with NFIP.

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 3 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Highway Department												
HM	Purchase additional ROW and move ditches back at various locations along CH #1 (Georgetown Rd.) to address drifting during winter storms.	SWS	SP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Medium/Medium
HM	Replace CH #3 (Brookville Rd.) structure(s) over Otter Creek to address scour damage caused by repeated scouring and increase flow capacity.	F, SS	SP	Reduces	Small	2, 3, 5	Yes	Yes	Highway Department	TBD	TBD	High/Medium
HM	Pave shoulders at various locations along CH #4 (Benson Rd.) to alleviate shoulder erosion/washouts.	F, SS	SP	Eliminates	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Medium/High
HM	Excavate backslope banks at various locations along CH #5 (Morrison Rd.) to address drifting issues.	SWS	SP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Medium/Medium
HM	Remove trees at various locations along CH #6 (Argo Fay Rte.) to address downed limbs and trees blocking the roadway during high winds and heavy rains and drifting during winter storms.	SS, SWS	MP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Low/Medium
HM	Remove trees at various locations along CH #9 (Scenic Ridge Rd.) to address downed limbs and trees blocking the roadway during high winds and heavy rains and drifting during winter storms.	SS, SWS	MP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Low/Medium

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 4 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Highway Department Continued...												
HM	Install armour (riprap) on spill-through abutments at Plum River Bridge on CH #10 (Elizabeth Rd.) just south of Polsgrove Rd. to protect the bridge and road from erosion and scour caused by flooding.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Medium/High
HM	Clean out drainage ditches along CH #11 (Oil Valley School Rd.) to alleviate overtopping of the roadway and erosion caused by flooding.	F, SS	MP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	County	Low/Medium
HM	Replace culvert(s) along CH #12 (Coleta Rd.) alleviate overtopping of the roadway caused by flooding.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Medium/Medium
HM	Install concrete ditch checks in the drainage ditches along CH #14 (Corbett Rd.) to protect the ditches from erosion caused by field runoff.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Low/Medium
HM	Remove trees at various locations along CH #15 (Loran Rd.) between Mt. Carroll and Georgetown Rd. to address downed limbs and trees blocking the roadway during high winds and heavy rains and drifting during winter storms.	SS, SWS	MP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Low/Medium

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 5 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Highway Department Continued...												
HM	Install armour (riprap) on slopes at various locations along CH #15 (Loran Rd.) between Georgetown Rd. and the County Line and at the structure over the East Fork of the Plum River to protect the road from erosion caused by flooding.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Medium/High
HM	Clean out drainage ditches along CH #17 (Seven Hills Rd.) to alleviate shoulder erosion caused by flooding.	F, SS	MP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	County	Low/Medium
HM	Install armour (riprap) on foreslopes at various locations along CH #19 (Shannon Rd.) between IL Route 64 and Milledgeville to protect the road from erosion caused by flooding.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Medium/High
HM	Install armour (riprap) on foreslope of Structure #3916 on CH #19 (Shannon Rte.) to protect the road from erosion caused by flooding.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Medium/High
HM	Remove trees at various locations along CH #19 (Shannon Rte.) between IL Route 72 and the County Line to address drifting during winter storms.	SWS	MP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Low/Low
HM	Pave shoulders at various locations along CH #19 (Shannon Rte.) between IL Route 72 and the County Line to alleviate shoulder erosion.	F, SS	SP	Eliminates	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Medium/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 85
(Sheet 6 of 22)
Carroll County Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Highway Department Continued...												
HM	Install culverts along CH #21 (Eagle Point Rd.) west of the structure over Elkhorn Creek to alleviate repeated flooding of the roadway.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Medium/High
HM	Install armour (riprap) on slopes of CH #24 (Ogle Rd.) north of the structure over Elkhorn Creek to protect the road from erosion caused by flooding.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Medium/High
HM	Replace CH #25 (Milledgeville Rd.) structure over Elkhorn Creek to address scour damage caused by repeated flooding and to increase flow capacity.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	High/Medium
HM	Install channel armour (riprap) along CH #105 (Savanna Army Depot Road) to protect the road from erosion caused by flooding of the Apple River.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Medium/High
HM	Pave shoulders at various locations along CH #110 (Crim Drive) to alleviate shoulder erosion.	F, SS	SP	Eliminates	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Medium/Medium
HM	Pave shoulders at various locations along CH #130 (C.N. Road) to alleviate shoulder erosion.	F, SS	SP	Eliminates	Small	2, 3, 5	NA	Yes	Highway Department	TBD	TBD	Medium/Medium
HM	Clean out storm drains along CH #135 (Lederman Drive).	F, SS, SWS	MP	Reduces	Small	2, 3, 5	Yes	Yes	Highway Department	Ongoing	County	Low/Medium

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 7 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Cherry Grove-Shannon Township												
HM	Cut deeper ditches to alleviate drifting along township roads during winter storms.	SWS	SP	Reduces	Large	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Purchase additional ROW and cut wider, deeper ditches to alleviate drifting along township roads during winter storms.	SWS	SP	Reduces	Large	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Remove trees along Timber Rd. to alleviate drifting during winter storms.	SWS	MP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Low/Medium
HM	Raise Georgetown Rd. 3 feet between Maple Grove Rd. and Shannon Rte. and cut deeper ditches to alleviate drifting during winter storms.	SWS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Raise Apache Rd. 3 feet and cut deeper ditches to alleviate drainage issues and drifting during winter storms.	F, SS, SWS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
LM	Conduct study to determine the cause of recurring drainage issues at various location, including but not limited to Gold Mine Rd., Locust Rd., Maple Grove Rd., Peace and Quiet Rd., Payne Rd. east of IL Rte. 73, Stonefield Rd., Stone Bridge Rd., and Straw School Rd.	F, SS, SWS	S	Reduces	Medium	2, 3, 5	Yes	Yes	Township	Ongoing	TBD	Medium/Medium

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 8 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Cherry Grove-Shannon Township Continued...												
HM	Select, design and construct appropriate drainage remedy to alleviate recurring drainage issues at various location, including but not limited to Gold Mine Rd., Locust Rd., Maple Grove Rd., Peace and Quiet Rd., Payne Rd. east of IL Rte. 73, Stonefield Rd., Stone Bridge Rd., and Straw School Rd.	F, SS, SWS	SP	Reduces	Medium	2, 3, 5	Yes	Yes	Township	Ongoing	TBD	High/Medium
HM	Install larger culverts to alleviate drainage and flooding issues at various locations, including, but not limited to Grange Rd., Kittridge Rd., Lover's Spring Rd., Moll Rd., Otter Creek Dr., Stanton Rd., Straddle Creek Rd., and Zier Rd.	F, SS	SP	Reduces	Medium	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Replace Schuman Rd. structure #008-3302 to alleviate drainage and flooding issues and to increase flow capacity.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Install culvert on Center Dr. by structure #008-3311 to alleviate drainage and flooding issues.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Install 4,200 feet of curb and gutter on Payne Rd. west of IL Rte. 73 to alleviate drainage and flooding issues.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 9 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Cherry Grove-Shannon Township Continued...												
LM	Determine the appropriate remedy to alleviate drainage and flooding issues on Spring Valley Rd. near structure #008-3301.	F, SS	S	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Select, design and construct appropriate drainage remedy to alleviate drainage and flooding issues on Spring Valley Rd. near structure #008-3301.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
Elkhorn Grove Township												
HM	Clean out the drainage ditch along the east side of Eagle Rd. for 2,600 ft. from Falcon Rd. to the bridge over Eagle Creek to alleviate shoulder erosion caused by flooding.	F, SS	MP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	Township	Low/Medium
HM	Clean out the drainage ditch along the east side of Sunshine Rd. for 2,600 ft. from Barclay Rd. to the bridge over Elkhorn Creek to alleviate shoulder erosion caused by flooding.	F, SS	MP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	Township	Low/Medium

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 10 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Fairhaven Township												
HM	Clean out the drainage ditch along west side of Miller Rd. south of the bridge over Rock Creek for 800 ft. to alleviate shoulder erosion caused by flooding.	F, SS	MP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	Township	Low/Medium
HM	Place breaker run (small stone) on the north side of Shibley Rd. for 700 ft. east of Black Oak Rd. to alleviate roadway washouts caused by flooding.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Cut shoulders on both sides of Clark Rd. for 1,000 ft. east of Demmon Rd. to alleviate roadway washouts caused by flooding.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Low/Medium

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 11 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Freedom Township												
HM	Install larger culvert and armour the downstream foreslope at the intersection of Slick Rd. and Switzer Rd. to alleviate flooding issues.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Purchase additional ROW and move the fence at the intersection of Slick Rd. and Switzer Rd. to eliminate obstructions caused by collecting debris.	F, SS, SWS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Install six – 48” diameter reinforced concrete pipes through Keltner Rd. east and west of Structure #008-3201 over the East Fork of the Plum River to alleviate repeated roadway flooding issues. The roadway will be patched using 6 inches of hot mix asphalt.	F, SS, SWS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Chip and seal 0.3 miles of Indian Trail Rd. from Meyers Rd. east to address roadway washouts caused by drainage and flooding issues.	F, SS, SWS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Purchase additional ROW along Zier Rd. from the Silver Moon Winery (near Lake Carroll) east 1,500 feet to lay the slope of the ditch back and create wider, deeper ditches to alleviate drifting along the roadway during winter storms.	SWS	SP	Reduces	Medium	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 12 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Freedom Township Continued...												
HM	Purchase additional ROW along Zier Rd. from the intersection of Lake Carroll Blvd. east 1,500 feet to lay the slope of the ditch back and create wider, deeper ditches to alleviate drifting along the roadway during winter storms.	SWS	SP	Reduces	Medium	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Armour (riprap) the ditch on the west side of Zier Rd. from Carter Rd. north 300 feet to alleviate flooding at the intersection and protect the road from erosion.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Replace existing battery of culverts at Short Rd. with a bridge to alleviate flooding and to increase flow capacity.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/High
HM	Purchase additional ROW to shape ditch back slopes and create wider, deeper ditches to alleviate drifting during winter storms at various locations, including but not limited to Arnolds Grove Rd., Bissikumer Rd., Browning Rd., Dame Rd., Elizabeth Rd., Schmidt Rd., Switzer Rd., Townhall Rd., and Townline Rd.	SWS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 13 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Freedom Township Continued...												
HM	Purchase additional ROW along Meyers Rd. from Loran Rd. north 1.5 miles and raise the road 2 to 3 feet at various locations to alleviate drifting during winter storms.	SWS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Replace Meyers Rd. structure #008-3213 to alleviate roadway flooding and to increase flow capacity.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Install larger culvert at bend in Schmidt Rd. and create deeper ditches to alleviate flooding issues.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Place 6" of hot mix asphalt on Skunk Hollow Rd. at the approaches to structure #008-3222 to alleviate overtopping and roadway and approach washouts caused by flooding.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Purchase additional ROW to raise the road 2 to 3 feet and shape ditch back slopes and create wider, deeper ditches to alleviate drifting during winter storms at various locations, including but not limited to Fritz Rd. and Sturtz Rd.	SWS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 14 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Freedom Township Continued...												
HM	Purchase ROW and construct a new clear span bridge on new alignment on Townline Rd. (replacing existing structure #008-3223) to alleviate roadway flooding and increase flow capacity.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Replace Carter Rd. bridge (structure #008-3221) over the East Fork of the Plum River with a spill-through abutment type bridge to alleviate flooding and to increase flow capacity.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Clean out the drainage ditches on both sides of the roadway for 0.4 miles north of the Carter Rd. structure #008-3221 to alleviate flooding issues.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Low/Medium
HM	Replace 18-foot closed abutment bridge on Timber Rd. with a spill-through abutment type bridge and install riprap along southwest ditchline to alleviate flooding issues.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Install larger culvert at personal entrance north of bridge on Timber Rd. and create deeper ditches in the same location to alleviate flooding issues.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 15 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Mount Carroll Township												
HM	Purchase additional ROW along Dauphin Rd. to relocate the ditch, create deeper ditches and install larger culvert(s) as needed to alleviate loss of surface (aggregate) caused by drainage issues.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Pave various locations along Hickory Grove Rd. to alleviate the loss of roadway surface (aggregate) that occurs during heavy rains.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Pave the north end of Jacobstown Rd. (1,000 ft.) with 6" of hot mix asphalt to alleviate roadway washouts caused by flooding from Carroll Creek.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Clean out channel and install 2,000 ft. of channel bank armour (riprap) along Scenic Palisades Rd. east of structure #008-3601 to protect the roadbed and shoulders from erosion caused by flooding of Carroll Creek and its tributaries.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/High
HM	Install 1,000 ft. of channel bank armour (riprap) along Scenic Palisades Rd. southeast of existing riprap on structure #008-3631 to protect the roadbed and shoulders from erosion caused by flooding of Carroll Creek and its tributaries.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 16 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Mount Carroll Township Continued...												
HM	Install 300 ft. of channel bank armour (riprap) along Scenic Palisades Rd. at the southwest corner of structure #008-3631 to protect the roadbed and shoulders from erosion caused by flooding of Carroll Creek and its tributaries.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/High
HM	Install armour (riprap) on east abutment of structure #008-3601 on Scenic Palisades Rd. to protect the structure and road from erosion caused by flooding of Carroll Creek and its tributaries.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/High
HM	Pave 2,000 ft. of Scenic Bluff Rd. west of Jacobstown Rd. with 6" of hot mix asphalt to alleviate roadway washouts caused by flooding from Carroll Creek.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Pave Vinegar Hill Rd. between Big Cut Rd. and Oil Valley School Rd. to alleviate the loss of roadway surface (aggregate) that occurs during heavy rains.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Raise Wacker Circle and install large culvert(s) to alleviate recurring drainage issues.	F, SS, SWS	SP	Reduces	Small	2, 3, 5	Yes	Yes	Township	TBD	TBD	Medium/Medium

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 17 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Rock Creek – Lima Township												
HM	Replace Brookville Rd. bridge over Rock Creek to address flooding issues and to increase flow capacity.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Install riprap at Rock Creek culvert on Cyclone Ridge Rd. located 1,300 ft. south of IL Rte 64 to stabilize downstream channel.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	1 year	TBD	Medium/Medium
HM	Install larger culvert on Harvest Rd. west of Grange Rd. to alleviate flooding issues associated with Middle Creek.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Replace Willow Rd. bridge (structure #008-3816) over Otter Creek to address flooding issues and to increase flow capacity.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Install armour (riprap) on foreslope of structure #008-3821 over Rock Creek on Dimon Rd. to protect the bridge from erosion caused by flooding.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Install armour (riprap) on foreslope of structure #008-3811 over Otter Creek on Watch Dog Rd. to protect the bridge from erosion caused by flooding.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 18 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Rock Creek – Lima Township Continued...												
HM	Install 5 – 60” x 42 foot (min.) culverts through Elm Rd. to alleviate roadway flooding issues associated with Elkhorn Creek.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/High
HM	Replace closed abutment type bridge on Otter Creek Rd. with a spill-through abutment type bridge to alleviate flooding issues.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
Salem Township												
HM	Purchase additional ROW along Daggert Rd. between Timber Lake Rd. and IL Rte. 40 to create wider, deeper ditches to address the loss of roadway surface (aggregate) that occurs during heavy rains and floods.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 19 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Savanna Township												
HM	Install riprap near abutment on east side of structure #008-3503 on Wacker Rd. to protect the structure and road from erosion caused by flooding of the Plum River.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/High
Washington Township												
HM	Purchase additional ROW along Camp Creek Rd. to create wider, deeper ditches to address the loss of roadway surface (aggregate) that occurs during heavy rains and floods.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Purchase additional ROW along Oakton Rd. to create wider, deeper ditches to address the loss of roadway surface (aggregate) that occurs during heavy rains and floods.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Purchase additional ROW along Mill Hollow Rd. to create wider, deeper ditches to address the loss of roadway surface (aggregate) that occurs during heavy rains and floods.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 20 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Woodland Township												
HM	Purchase additional ROW to create wider, deeper ditches to address the loss of roadway surface (aggregate) that occurs during heavy rains and floods at various locations including, but not limited to Meyers Rd., Messmer Rd., and Oakton Rd.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Clean out the drainage ditches to alleviate roadway washouts caused by flooding at various locations including, but not limited to Meyers Rd. and Oakton Rd.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	Township	Low/Medium
HM	Build up Spur Rd. and install additional culverts to alleviate flooding issues associated the Plum River and the East Fork of the Plum River.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Replace Davis Rd. bridge (structure #008-3106) over a tributary of the Plum River to address flooding issues and to increase flow capacity	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Replace Old Galena Trail bridge (structure #008-3116) over the Plum River to address erosion of partial spill-through abutments caused by flooding and to increase flow capacity.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 21 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
Wysox Township												
HM	Raise Wagner Rd. north and south of Fairhaven Rd., riprap shoulders and install additional culverts to alleviate flooding associated with Otter Creek.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
York Township												
HM	Purchase additional ROW along Big Cut Rd. from the township line south 1,000 ft. to relocate the ditch, create deeper ditches and instal larger culvert(s) as needed to alleviate flooding drainage issues.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Pave King Rd. for 800 ft. south of the bridge over Johnson Creek with 6" of hot mix asphalt to alleviate roadway washouts caused by flooding.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
HM	Purchase additional ROW along York Center Rd. from IL Rte. 78 west 300 ft. to relocate the ditch to protect the road from erosion.	F, SS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	Medium/Medium
HM	Purchase additional ROW along Thomson Rd. from IL Rte. 78 east ½ mile to move the ditch back and eliminate the steep bank to address drifting during winter storms.	SWS	SP	Reduces	Small	2, 3, 5	NA	Yes	Township	TBD	TBD	High/Medium
LM	Obtain permit from U.S. Army Corps. of Engineers to dredge Johnson Creek.	F, SS, SWS	MP	Reduces	Small	2, 3, 5	NA	NA	Township	TBD	Township	Low/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 85
(Sheet 22 of 22)
Carroll County Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
York Township Continued...												
HM	Dredge Johnson Creek to the Mississippi River to prevent a levee break near structure #008-4009 on Fairhaven Rd. caused by flooding.	F, SS, SWS	MP	Reduces	Small	2, 3, 5	Yes	Yes	Township	TBD	TBD	High/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 86
Chadwick Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
HM	Purchase and install an emergency backup generator at the Village's water treatment plant to maintain operations during power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Large	2, 3, 5	Yes	Yes	Village Board	2 years	TBD	Low/High
LM	Purchase 6-inch diesel pump(s) for removal of excess water during flooding.	F, SS, SWS	MP	Reduces	Small	2, 3, 5	Yes	Yes	Village Board	2 years	TBD	Low/High
HM	Purchase lightning notification system/electricity sensor for baseball diamond at Handel Park.	SS	MP	Reduces	Medium	2	NA	NA	Village Board	3 years	TBD	Low/High
LM	Develop public information materials that inform residents about the risks to life and property associated with natural hazards and the proactive actions that they can take to reduce or eliminate their risk.	DR, EH, EQ, F, SS, SWS, T	PI	Reduces	Large	1, 2	Yes	Yes	Village Board	2 years	TBD	Low/High
LM	Conduct mock natural disaster drill(s) to provide community officials with hands-on experience in dealing with different disaster scenarios.	EQ, F, SS, SWS, T	PI	Reduces	Large	1, 2	NA	NA	Village Board	2 years	Village	Low/High
HM	Purchase a new remote alarm system for the wastewater treatment plant to notify officials of any disruptions in the operation of the plant.	EQ, F, SS, SWS, T	MP	Reduces	Large	2, 3, 5	Yes	Yes	Village Board	2 years	TBD	Low/High
HM	Bury electric utility service lines to limit service disruptions during natural hazard events.	SS, SWS, T	MP	Reduces	Large	2, 3, 5	Yes	Yes	Village Board	2 years	TBD	Medium/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 87
Eastland Community Unit School District #308 Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
HM	Re-grade/contour areas around school building foundations and landscape to improve water runoff and alleviate water seepage into crawl spaces.	F, SS	MP	Reduces	Medium	2, 3, 5	NA	Yes	CUSD #308	TBD	TBD	Low/High
LM	Purchase and install new softball field light poles.	SS	MP	Reduces	Small	2	NA	NA	CUSD #308	TBD	TBD	Low/Medium
HM	Purchase and install emergency backup generators to provide uninterrupted power during extended power outages to school buildings designated as emergency shelters/warming centers.	EQ, F, SS, SWS, T	MP	Eliminates	Large	2, 3, 5	NA	Yes	CUSD #308	TBD	TBD	Medium/High
HM	Purchase and install new school bus radios that comply with the FCC Narrowband Initiative.	EQ, F, SS, SWS, T	MP	Reduces	Medium	2	NA	NA	CUSD #308	TBD	TBD	Medium/High
HM	Install shatter-proof glass windows at all District buildings.	EQ, SS, T	SP	Reduces	Medium	2, 3, 5	NA	Yes	CUSD #308	TBD	75% Federal 25% Local	Low/High
LM	Grade and seed the site of the former Eastland Elementary School to ensure proper drainage.	F, SS	MP	Reduces	Small	2, 3	NA	Yes	CUSD #308	TBD	TBD	Medium/Low

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 88
(Sheet 1 of 3)
Lanark Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
HM	Construct storm water detention pond with associated drainage lines to alleviate recurring flooding at two residential properties located along South Argyle and East Prairie Streets.	F, SS, SWS	SP	Eliminates	Small	2, 5	NA	Yes	City Council	1 year	75% Federal 25% Local	Medium/Low
HM	Install additional drainage pipes, catch-basins and curb-and-gutter at the intersection of West Pearl and Truman Streets to alleviate recurring street flooding and flooding of a residential yard adjacent to the intersection.	F, SS, SWS	SP	Eliminates	Small	2, 3, 5	NA	Yes	City Council	1 year	75% Federal 25% Local	Medium/Medium
LM	Convert acquired military surplus Hummer to an all-terrain type vehicle for use in response to incidents associated with natural hazard events.	EQ, F, SS, SWS, T	MP	Reduces	Small	2	NA	NA	Police Department	TBD	TBD	Medium/Medium
LM	Trim or remove decaying, dying or dangerous trees along the public way and city parkway to minimize disruptions to electrical power and communication networks.	SS, SWS, T	MP	Reduces	Large	2, 3, 5	Yes	Yes	City Tree Board	Yearly	City	Low/High
LM	Conduct sewer line reconnaissance study to identify locations where storm water infiltrates the lines.	F, SS	S	Reduces	Medium	2, 3, 5	Yes	Yes	Public Works Dept.	Yearly	75% Federal 25% Local	Low/High
HM	Repair sewer line sections where storm water infiltration is occurring to prevent sewage backups and bypass pumping.	F, SS	SP	Eliminates	Small	2, 3, 5	Yes	Yes	City Council	TBD	75% Federal 25% Local	High/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 88
(Sheet 2 of 3)
Lanark Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
LM	Conduct drainage study to identify recurring drainage problems within the City and to recommend appropriate drainage remedies.	F, SS, SWS	S	Reduces	Medium	2, 3, 5	NA	NA	City Council	TBD	75% Federal 25% Local	Medium/High
HM	Select, design and construct the appropriate remedy to alleviate recurring drainage problems within the City.	F, SS, SWS	SP	Reduces	Medium	2, 3, 5	Yes	Yes	City Council	TBD	75% Federal 25% Local	Medium/High
HM	Design and construct the appropriate drainage remedies along East Lanark Ave. and West Lanark Ave to alleviate recurring drainage problems.	F, SS, SWS	SP	Reduces	Small	2, 3, 5	NA	Yes	City Council	3 Years	75% Federal 25% Local	Medium/Medium
HM	Purchase and install storm sirens.	SS, T	MP	Reduces	Large	2	NA	NA	City Council	TBD	TBD	Medium/High
LM	Develop and adopt a storm water collection system maintenance and management ordinance.	F, SS, SWS	RA	Reduces	Large	1, 2, 3, 4, 5, 7	Yes	Yes	City Council	1 year	City	Low/High
HM	Purchase and install a stand-by backup generator with automatic transfer switch at the East sanitary lift station to maintain operations during power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	Yes	Yes	City Council	2 years	TBD	Low/High
HM	Purchase and install an emergency backup generator at the North sanitary lift station to be able to operate the station in manual turn-on mode during power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	NA	Yes	City Council	5 years	TBD	Low/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 88
(Sheet 3 of 3)
Lanark Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
HM	Purchase and install an emergency backup generator at Well #4 to provide power to pump water during extended power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	NA	Yes	City Council	4 years	TBD	Low/High
HM	Purchase and install a stand-by backup generator at the Police Station to provide uninterrupted power during and after a natural hazard event.	EQ, F, SS, SWS, T	MP	Eliminates	Small	2, 3, 5	NA	Yes	City Council	2 years	TBD	Low/High
HM	Purchase and install an emergency backup generator to provide uninterrupted power during extended power outages at the Heritage Community Center which serves as an evacuation shelter/warming & cooling center.	EQ, F, SS, SWS, T	MP	Eliminates	Large	2, 3, 5	NA	Yes	City Council	5 year	TBD	Low/High
LM	Make the most recent Flood Insurance Rate Maps available at the City Clerk's Office to assist the public in considering where to construct new buildings and make City Officials aware of these maps and issues related to construction in a floodplain.*	F	RA	Reduces	Medium	1, 6, 7	Yes	Yes	City Council	1 year	City	Low/High
LM	Make information materials available to the public about the National Flood Insurance Program's voluntary Community Rating System.*	F	PP	Reduces	Medium	1, 6, 7	Yes	Yes	City Council	1 year	City	Low/High

* Mitigation action to ensure continued compliance with NFIP.

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 89
(Sheet 1 of 3)
Milledgeville Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
LM	Distribute brochures/fact sheets on weather emergencies including the locations of the heating/cooling centers and what to do in the event of an emergency.	EH, EQ, F, SS, SWS, T	PI	Reduces	Large	1, 2	Yes	Yes	Village	3 years	TBD	Low/High
HM	Designate a heating/cooling center within Milledgeville for use by village residents.	EH, SWS	MP	Reduces	Medium	2	NA	NA	Village	3 years	Village	Low/High
LM	Conduct drainage study to identify the appropriate remedy to alleviate recurring drainage problems within the Village.	F, SS, SWS	S	Reduces	Medium	2, 3, 5	NA	NA	Village	10 years	75% Federal 25% Local	Medium/High
HM	Select, design and construct the appropriate remedy to alleviate recurring drainage problems within the Village.	F, SS, SWS	SP	Reduces	Medium	2, 3, 5	Yes	Yes	Village	10 years	75% Federal 25% Local	Medium/High
HM	Purchase and install an automatic emergency backup generator at the wastewater treatment plant to maintain operations during power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Large	2, 3, 5	Yes	Yes	Village	3 years	TBD	Low/High
HM	Purchase an emergency backup generator for Well #5 to provide power to pump water during power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	Yes	Yes	Village	5 years	TBD	Low/High
HM	Purchase an emergency backup generator at Village Hall/Police Station to provide uninterrupted power during power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Small	2, 3, 5	NA	Yes	Village	3 years	TBD	Low/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 89
(Sheet 2 of 3)
Milledgeville Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
HM	Purchase emergency backup generators at the emergency shelters to provide uninterrupted power during power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Large	2, 3, 5	NA	Yes	Village	5 years	TBD	Low/High
HM	Purchase a reverse 911 system to notify residents of emergency information.	EH, EQ, F, SS, SWS, T	MP	Reduces	Large	2	NA	NA	Village	3 years	75% Federal 25% Local	Medium/High
LM	Replace culverts throughout the Village as need to alleviate drainage problems.	F, SS	SP	Reduces	Small	2, 3, 5	Yes	Yes	Village	10 years	75% Federal 25% Local	Medium/Medium
HM	Install stormwater relief drains.	F, SS, SWS	SP	Reduces	Medium	2, 3, 5	Yes	Yes	Village	10 years	75% Federal 25% Local	Medium/Medium
HM	Install rip rap along Elkhorn Creek near the wastewater treatment plant.	F, SS, SWS	SP	Reduces	Large	2, 3, 5	NA	Yes	Village	10 years	75% Federal 25% Local	Medium/Medium
HM	Install stream gauge(s) along the Elkhorn Creek to alert wastewater treatment plant of potential flooding risks.	F, SS, SWS	MP	Reduces	Large	2, 3, 5	NA	Yes	Village	5 years	75% Federal 25% Local	Medium/High
LM	Conduct sewer line reconnaissance study to identify locations where storm water infiltrates the lines.	F, SS	S	Reduces	Medium	2, 3, 5	Yes	Yes	Village	10 years	75% Federal 25% Local	Low/High
HM	Repair sewer line sections where storm water infiltration is occurring to prevent sewage backups.	F, SS	SP	Eliminates	Small	2, 3, 5	Yes	Yes	Village	10 years	75% Federal 25% Local	High/High
HM	Remove fallen trees & stumps from Elkhorn Creek to maintain the maximum storage capacity of the floodway near the wastewater treatment plant..	F, SS	MP	Reduces	Large	2, 3, 5	No	Yes	Village	2 years	Village	Low/Medium

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 89
(Sheet 3 of 3)
Milledgeville Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
HM	Install and test sewer backflow prevention devices at wastewater treatment plant.	F, SS	SP	Reduces	Large	2, 3, 5	NA	Yes	Village	10 years	75% Federal 25% Local	Low/High
LM	Conduct man-hole survey and replace damaged units as needed.	F, SS	SP	Reduces	Small	2, 3, 5	NA	NA	Village	10 years	75% Federal 25% Local	Low/Medium
HM	Bury electric utility service lines to limit service disruptions during natural hazard events.	SS, SWS, T	MP	Reduces	Large	2, 3, 5	Yes	Yes	Village	5 years	TBD	Medium/High
HM	Purchase NOAA weather radios and distribute to Village residents.	EH, F, SS, SWS, T	MP	Reduces	Large	2	NA	NA	Village	5 years	TBD	Low/High
LM	Make the most recent Flood Insurance Rate Maps available at the Village Clerk's Office to assist the public in considering where to construct new buildings and make Village Officials aware of these maps and issues related to construction in a floodplain.*	F	RA	Reduces	Medium	1, 6, 7	Yes	Yes	Village	1 year	Village	Low/High
LM	Make information materials available to the public about the National Flood Insurance Program's voluntary Community Rating System.*	F	PP	Reduces	Medium	1, 6, 7	Yes	Yes	Village	1 year	Village	Low/High

* Mitigation action to ensure continued compliance with NFIP.

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 90
Milledgeville Park District Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
LM	Purchase lightning notification systems/electricity sensors for the baseball diamonds and parks in the Village.	SS	MP	Reduces	Small	2	NA	NA	Park District	2 years	TBD	Low/High
LM	Purchase and install signs at the baseball diamonds that instruct individuals where to seek shelter during a severe weather event.	SS, T	MP	Reduces	Small	1, 2	NA	NA	Park District	2 years	TBD	Low/High
HM	Design and construct storm shelters near the baseball diamonds at Stover and Millwheel Parks.	SS, T	SP	Reduces	Small	2	NA	NA	Park District	5 years	75% Federal 25% Local	High/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 91
Mount Carroll Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
HM	Retrofit the wastewater treatment plant to reduce its vulnerability to flooding.	F, SS	SP	Reduces	Large	2, 3, 5	NA	Yes	City	TBD	75% Federal 25% Local	Medium/High
HM	Clean brush and debris from drainage ditches and culverts to reduce flooding issues.	F, SS, SWS	MP	Reduces	Medium	2, 3, 5	Yes	Yes	City	TBD	City	Low/High
LM	Conduct drainage study to identify the appropriate remedy to alleviate recurring drainage problems at various locations within the City.	F, SS, SWS	S	Reduces	Medium	2, 3, 5	NA	NA	City	TBD	75% Federal 25% Local	Medium/High
HM	Select, design and construct the appropriate remedy to alleviate recurring drainage problems at various locations within the City.	F, SS, SWS	SP	Reduces	Medium	2, 3, 5	Yes	Yes	City	TBD	75% Federal 25% Local	Medium/High
HM	Separate combined wastewater/stormwater system.	F, SS, SWS	SP	Reduces	Large	2, 3, 5	Yes	Yes	City	TBD	75% Federal 25% Local	High/High
HM	Purchase and install storm siren(s).	SS, T	MP	Reduces	Large	2	NA	NA	City	TBD	TBD	Medium/High
HM	Purchase NOAA weather radios and distribute to special needs households.	EH, F, SS, SWS, T	MP	Reduces	Small	2	NA	NA	City	TBD	TBD	Low/High
LM	Make the most recent Flood Insurance Rate Maps available at the City Clerk's Office to assist the public in considering where to construct new buildings and make City Officials aware of these maps and issues related to construction in a floodplain.*	F	RA	Reduces	Medium	1, 6, 7	Yes	Yes	City	1 year	City	Low/High
LM	Make information materials available to the public about the National Flood Insurance Program's voluntary Community Rating System.*	F	PP	Reduces	Medium	1, 6, 7	Yes	Yes	City	1 year	City	Low/High

* Mitigation action to ensure continued compliance with NFIP.

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 92
(Sheet 1 of 2)
Savanna Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
HM	Construct new wastewater treatment plant outside of the floodplain.	F, SS	SP	Eliminates	Large	2, 3, 5	Yes	Yes	City	7 years	75% Federal 25% Local	High/High
HM	Acquire properties in flood-prone areas and remove any existing structures.	F, SS	PP	Eliminates	Small	2, 6	NA	Yes	City	20 years	75% Federal 25% Local	Medium/High
HM	Inspect flood control gates and make necessary repairs.	F, SS	SP	Reduces	Medium	2, 3, 5	NA	Yes	City	2 years	TBD	Medium/High
HM	Perform regular maintenance on flood control gates.	F, SS	SP	Reduces	Medium	2, 3, 5	NA	Yes	City	Ongoing	City	Low/High
HM	Purchase and install an emergency backup generator with automatic transfer switch at the wastewater treatment plant to maintain operations during power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Large	2, 3, 5	Yes	Yes	City	2 years	TBD	Low/High
HM	Purchase a portable emergency backup generator for drinking water wells to be able to pump water during prolonged power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Large	2, 3, 5	Yes	Yes	City	2 years	TBD	Low/High
HM	Insulate Pinnacle Water Tower to guard against freezing.	SWS	MP	Eliminates	Medium	3, 5	Yes	Yes	City	2 years	TBD	Medium/High
LM	Conduct storm sewer line reconnaissance study to identify locations where storm water infiltrates the lines and where previous flooding has eroded or weakened the lines..	F, SS	S	Reduces	Medium	2, 3, 5	Yes	Yes	City	6 years	75% Federal 25% Local	Low/High
HM	Repair storm sewer line sections where storm water infiltration is occurring or where the line is eroded due to past flooding.	F, SS	SP	Reduces	Small	2, 3, 5	Yes	Yes	City	6 years	75% Federal 25% Local	High/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 92
(Sheet 2 of 2)
Savanna Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
LM	Make the most recent Flood Insurance Rate Maps available at the City Clerk's Office to assist the public in considering where to construct new buildings and make City Officials aware of these maps and issues related to construction in a floodplain.*	F	RA	Reduces	Medium	1, 6, 7	Yes	Yes	City	1 year	City	Low/High
LM	Make information materials available to the public about the National Flood Insurance Program's voluntary Community Rating System.*	F	PP	Reduces	Medium	1, 6, 7	Yes	Yes	City	1 year	City	Low/High

* Mitigation action to ensure continued compliance with NFIP.

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 93
Shannon Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
HM	Install sewer relief bypass line.	F, SS	SP	Reduces	Large	2, 3, 5	Yes	Yes	Village	TBD	75% Federal 25% Local	Medium/High
HM	Purchase and install a natural gas emergency backup generator with automatic transfer switch at drinking water wells #4 & #5 to maintain the ability to pump water during power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	Yes	Yes	Village	TBD	TBD	Low/High
HM	Purchase and install a natural gas emergency backup generator with automatic transfer switch at the wastewater treatment plant to maintain operations during power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Large	2, 3, 5	Yes	Yes	Village	TBD	TBD	Low/High
HM	Purchase and install a natural gas emergency backup generator with automatic transfer switch to provide uninterrupted power during extended power outages at the fire station which serves as an emergency storm shelter..	EQ, F, SS, SWS, T	MP	Eliminates	Large	2, 3, 5	Yes	Yes	Village	TBD	TBD	Low/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 94
(Sheet 1 of 2)
Thomson Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
HM	Construct a storm shelter (built to seismic standards and equipped with an emergency backup generator) as an addition to the Thomson Fire Protection District Building in Thomson that would function as a heating/cooling center and a shelter for residents of the Village. [^]	EH, F, SS, SWS, T	SP	Reduces	Large	2, 3, 5	NA	Yes	Thomson Fire Protection District [^]	TBD	75% Federal 25% Local	High/High
HM	Purchase and install an emergency backup generator at the Police Department/Village Hall to maintain operations during power outages.	EQ, F, SS, SWS, T	MP	Eliminates	Large	2, 3, 5	NA	Yes	Village Board	TBD	TBD	Low/High
HM	Install shatter-proof glass at the Police Department/Village Hall.	EQ, SS, T	SP	Reduces	Small	2, 3, 5	NA	Yes	Village Board	TBD	75% Federal 25% Local	Low/High
HM	Purchase and install new storm warning siren(s). [^]	SS, T	MP	Reduces	Large	2	NA	NA	Village Board [^]	TBD	TBD	Medium/High
HM	Clean out and rehabilitate the dry wells and culverts within the Village to alleviate drainage and street flooding issues.	F, SS, SWS	MP	Reduces	Medium	2, 3, 5	Yes	Yes	Village Board	TBD	Village	Low/High
LM	Purchase diesel pump(s) for removal of excess water during flooding	F, SS	MP	Reduces	Small	2, 3, 5	Yes	Yes	Village Board	TBD	TBD	Low/Medium
LM	Develop public information material packets on natural hazards and the actions that residents can take to protect themselves and their property.	EH, EQ, F, SS, SWS, T	PI	Reduces	Large	1, 2	Yes	Yes	Village Board	TBD	75% Federal 25% Local	Low/High

[^] The Village of Thomson may partner with the Thomson Fire Protection District on this project.

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 94
(Sheet 2 of 2)
Thomson Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
HM	Purchase a reverse 911 system to notify residents of emergency information.	EH, EQ, F, SS, SWS, T	MP	Reduces	Large	2	NA	NA	Village Board	TBD	TBD	Medium/High
LM	Purchase lightning notification systems/electricity sensors for the softball/baseball diamonds and parks in the Village.	SS	MP	Reduces	Small	2	NA	NA	Village Board	TBD	TBD	Low/High
HM	Design and construct storm shelters near the softball/baseball diamonds and in the Village parks.	SS, T	SP	Reduces	Small	2	NA	NA	Village Board	TBD	75% Federal 25% Local	High/High
LM	Purchase and install new light poles at the softball/baseball diamonds and Village parks.	SS	MP	Reduces	Small	2	NA	NA	Village Board	TBD	TBD	Medium/Low
HM	Purchase NOAA weather radios and distribute to residents within the Village/Fire Protection District. [^]	EH, F, SS, SWS, T	MP	Reduces	Large	2	NA	NA	Village Board [^]	TBD	TBD	Low/High
HM	Purchase a portable emergency backup generator for use during power outages.	EQ, EH, F, SS, SWS, T	MP	Eliminates	Small	2, 3, 5	Yes	Yes	Village Board	TBD	TBD	Low/High

[^] The Village of Thomson may partner with the Thomson Fire Protection District on this project.

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

Figure 95

Thomson Fire Protection District Hazard Mitigation Actions

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
HM	Construct a storm shelter (built to seismic standards and equipped with an emergency backup generator) as an addition to the Thomson Fire Protection District Building in Thomson that would function as a heating/cooling center and a shelter for those served by the fire protection district, including the residents of Thomson. [^]	EH, F, SS, SWS, T	SP	Reduces	Large	2, 3, 5	Yes	NA	Fire Protection District [^]	TBD	75% Federal 25% Local	High/High
HM	Purchase and install shatter-proof glass windows at the existing Thomson Fire Protection District Building. [^]	EQ, SS, T	SP	Reduces	Medium	2, 3, 5	NA	Yes	Fire Protection District [^]	TBD	75% Federal 25% Local	Low/High
HM	Purchase and install storm warning sirens at strategic locations within the fire protection district.	SS, T	MP	Reduces	Large	2	NA	NA	Fire Protection District	TBD	TBD	Medium/High

[^] The Village of Thomson will partner with the Thomson Fire Protection District on this project.

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

**Figure 96
West Carroll Community Unit School District #314 Hazard Mitigation Actions**

Priority	Activity/Project Description	Hazard(s) to be Mitigated	Type of Mitigation Activity	Degree of Mitigation	Size of Population Affected	Goal(s) Met	Reduce Effects of Hazard(s) on Buildings & Infrastructure		Organization / Department Responsible for Implementation & Administration	Time Frame to Complete Activity	Funding Source(s)	Cost/Benefit Analysis
							New	Existing				
HM	Purchase and install emergency backup generator(s) at the West Carroll Intermediate School which serves as a heating/cooling center and emergency shelter location in the aftermath of a hazard event	EQ, EH, F, SS, SWS, T	MP	Eliminates	Medium	2, 3, 5	NA	Yes	CUSD #314	TBD	TBD	Low/High
HM	Install shatter-proof glass at the West Carroll Intermediate School.	EQ, SS, T	SP	Reduces	Medium	2, 3, 5	NA	Yes	CUSD #314	TBD	75% Federal 25% Local	Medium/High

Acronyms

Hazard(s) to be Mitigated:

DF	Dam Failure	F	Flood
DR	Drought	SS	Severe Storms (Thunderstorms, etc.)
EH	Extreme Heat	SWS	Severe Winter Storms (Snow, etc.)
EQ	Earthquake	T	Tornado

Type of Mitigation Activity:

RA	Regulatory Activities	S	Studies
SP	Structural Projects	MP	Miscellaneous Projects
PI	Public Involvement	PP	Property Protection

5.0 RECOMMENDATIONS

5.0 RECOMMENDATIONS

The following recommendations came about as a result of the planning process. These recommendations should be reviewed and discussed periodically by the professional staff and elected officials of each participating jurisdiction to determine if appropriate actions should be taken.

<i>GENERAL</i>

Mitigate Repetitive Loss Structures and Critical Facilities. Mitigation is strongly encouraged for all structures in the mapped floodplain, with a higher priority given to repetitive loss structures and critical facilities, as funding or other resources become available.

Emergency Management Plans for Schools. Develop and annually update Emergency Operation Plans for elementary, middle and high schools. These plans should include sections about how to mitigate risks from natural hazards, structural failures, shooters and hostage situations, fires and bombs. A no-match federal grant has been used to develop these plans and conduct tabletop and full-scale exercises involving health, law enforcement, fire, and emergency management personnel. While the grant is not being offered this year, it is expected to resume in the future.

Stormwater Management to Reduce Flooding Issues. Stormwater management practices should be required for new subdivisions and other larger development projects, including commercial and industrial, to reduce flooding problems associated with excess runoff. Management practices could include the construction and use of retention and detention basins.

Developing and Disseminating Hazard Information. Public information materials should be prepared that will help residents take protective actions prior to natural hazard events. These materials should be based on risk communication principles to improve their effectiveness. In addition to developing printed materials, feedback from Carroll County residents indicates that radio, television and the internet should be utilized to disseminate information.

Identifying Special Needs Persons. Physical and mental impairments can hinder persons from being able to escape the dangers posed by natural hazards such as floodwaters or tornadoes. During periods of temperature extremes or severe snow or ice storms, persons with special needs may not be able to obtain vital health care and other services needed to avoid severe injury or survive. To serve special needs persons, consideration should be given to assemble a database that includes persons who live in municipalities and unincorporated areas throughout Carroll County. To make the database inclusive, a county-wide effort spearheaded through the joint efforts of the Emergency Services and Disaster Agencies and the Health Department may be needed.

Auxiliary Power to Maintain Vital Services. Disruptions to electrical power from downed lines can adversely affect necessary services including drinking water, wastewater treatment, law enforcement, and other government functions. Restoring electrical power, particularly in rural areas, can take longer than expected as evidenced on previous occasions in Carroll County. To

increase municipal and county resilience to severe weather, backup generators should be considered since they provide a cost effective solution for maintaining critical services when electrical power is lost.

Roadway Drainage and Erosion Issues. Moderate to heavy rainfall, snowmelt, and flooding cause drainage and erosion problems on Illinois roadways every year. Roadway drainage and erosion problems can be found in every township in Carroll County. Structural projects, such as installation of riprap and larger culverts and bridges, and studies are needed to alleviate many of the recurring drainage problems within the County. In addition to these projects, discussions among county and township road commissioners in Carroll County suggest that general maintenance, such as removing accumulated debris from culverts and ditches, can effectively reduce drainage problems at most locations and should be encouraged.

<i>JURISDICTION-SPECIFIC</i>

Lanark

Certain areas within the City experience flooding during excessive rain events. These events have caused sewage backups into residences, excess infiltration of stormwater into the wastewater treatment system, and damage to roadways. Lanark is encouraged to continue making improvements to the wastewater treatment system as described in their Five Year Capital Improvement Plan 2012-2016. These improvements can reduce, if not eliminate, these problems.

Milledgeville

The Village is encouraged to continue with efforts started in 2012 to reduce shoreline erosion on Elkhorn Creek which, if not controlled, could damage the municipal wastewater treatment facility.

Mount Carroll

The wastewater treatment facility is located in an area within the City that is vulnerable to flooding. As part of Mount Carroll's critical infrastructure, a high priority should be placed on implementing steps to reduce this vulnerability.

The condition and age of Mount Carroll's wastewater collection system makes it highly vulnerable to stormwater inflow from different sources. Broken service laterals, tree root intrusions, roof drain connections, cross-connections, and open pick hole manhole covers are among the deficiencies contributing to stormwater inflow. Sewage backups into homes and discharges of untreated sewage result during periods of excessive rainfall or snowmelt. Consequently, efforts to rehabilitate the wastewater collection system will benefit residents and the environment.

Savanna

The City should continue discussions with railroad officials and the Illinois Department of Transportation to determine what preventive steps can be taken to help downtown businesses and residents be better prepared when Mississippi River and Plum River flooding recurs.

The City's wastewater treatment facility and drinking water wells are located within areas vulnerable to flooding. As part of Savanna's critical infrastructure, a high priority should be placed on implementing steps to help maintain these vital services.

Thomson

Protecting Village employees and residents from weather extremes and severe weather such as tornadoes can substantially improve through the designation of a storm shelter. The Village is currently partnering with the Thomson Fire Protection District to construct a new storm shelter at the back of the new Fire Station. In the interim, the Village should consider developing a Memorandum of Agreement and formally designating a temporary shelter location, such as the West Carroll Intermediate School, to provide an emergency shelter for local residents.

6.0 PLAN MAINTENANCE

6.0 PLAN MAINTENANCE

This section focuses on the Federal Emergency Management Agency (FEMA) requirements for maintaining and updating the Plan once it has been approved by FEMA and adopted by the participating jurisdictions. These requirements include:

- establishing the method and schedule for monitoring, evaluating and updating the Plan;
- describing how the mitigation strategy will be incorporated into existing planning processes; and
- detailing how continued public input will be obtained.

These requirements ensure that the Plan remains an effective and relevant document. Provided below is detailed discussion of each requirement.

6.1 MONITORING, EVALUATING & UPDATING THE PLAN

The County must establish a method and schedule for monitoring, evaluating and updating the Plan. This method allows the participating jurisdictions to review and adjust the planning process as needed, make necessary changes and updates to the Plan and track the implementation and results of the mitigation actions that have been undertaken.

6.1.1 Monitoring and Evaluating the Plan

The Plan will be monitored and evaluated by a Plan Maintenance Subcommittee on an annual basis. The Plan Maintenance Subcommittee will be composed of key members from the original Planning Committee, including representatives from all of the participating jurisdictions. The Subcommittee will be chaired by the Carroll County Emergency Services and Disaster Agencies (ESDA). All meetings held by the Subcommittee will be open to the public. The information gathered at each Subcommittee meeting will be documented and provided to all participating jurisdictions for their review and use in the Plan update.

The Carroll County ESDA will be responsible for monitoring the status of the mitigation actions identified in the Plan and providing the Illinois Emergency Management Agency (IEMA) with an annual progress report. It will be the responsibility of each participating jurisdiction to provide a progress report on the status of their mitigation actions at each Subcommittee meeting.

The Plan Maintenance Subcommittee will also evaluate the Plan on an annual basis to determine the effectiveness of the planning process and the implemented mitigation actions. In addition, the Subcommittee will decide whether any changes need to be made. As part of the evaluation of the planning process, the Subcommittee will review the goals to determine whether they are still relevant or if new goals need to be added; assess whether other natural hazards need to be addressed or included in the Plan and review any

Monitoring & Evaluating

- ❖ A Plan Maintenance Subcommittee will be formed to monitor and evaluate the Plan.
- ❖ The Plan will be monitored and evaluated on an *annual basis*.
- ❖ Each participating jurisdiction will be responsible for providing an annual progress report on the status of their mitigation actions.
- ❖ New mitigation actions can be added by participating jurisdictions during the annual evaluation.

new hazard data that may affect the Risk Assessment portion of the Plan. The Subcommittee will also evaluate whether other County departments should be invited to participate.

In terms of evaluating the effectiveness of the mitigation actions that have been implemented, the Subcommittee will assess whether a project is on time, in line with the budget and moving ahead as planned; whether the project achieved the goals outlined and had the intended result; and whether losses were avoided as a result of the project. In addition, each of the participating jurisdictions will be given an opportunity to add new mitigation actions to the Plan and modify or discontinue mitigation actions already identified. In some cases a project may need to be removed from the list of mitigation actions because of unforeseen problems with implementation.

6.1.2 Updating the Plan

The Plan must be updated within five years of the date the first participating jurisdiction adopts the Plan. (This date can be found in Section 7, Plan Adoption.) This ensures that all the participating jurisdictions will remain eligible to receive federal grant money to implement those mitigation actions identified in this Plan.

It will be the responsibility of the Plan Maintenance Subcommittee to update the Plan. The update will incorporate all of the information gathered and changes proposed at the previous annual monitoring and evaluation meetings. In addition, any government entity that did not take part in the original planning process that now wishes to participate may be added. It will be the responsibility of these entities to provide all of the information needed to be integrated into the Plan.

A public forum will be held to present the updated Plan to the public for review and comment. The comments received at the public forum will be reviewed and incorporated into the updated Plan. The Subcommittee will then present the updated Plan to the participating jurisdictions for approval.

Once the Subcommittee has received approval from all of the participating jurisdictions, it will submit the updated Plan to IEMA and FEMA for review. ***Once the updated Plan has received approval, FEMA requires that each of the participating jurisdictions re-adopt the Plan to remain eligible to receive federal grant money to implement identified mitigation actions.***

Updating	
❖	The Plan Maintenance Subcommittee will be responsible for updating the Plan.
❖	The Plan <i>must be updated within 5 years</i> of the date the first participating jurisdiction adopts the Plan.
❖	Any government entities that did not take part in the original planning process but who now wish to participate may do so.
❖	Once the updated Plan has received FEMA/IEMA approval, each participating jurisdiction <i>must re-adopt the Plan</i> to remain eligible to receive federal grant money.

6.2 INCORPORATING THE MITIGATION STRATEGY INTO EXISTING PLANNING MECHANISMS

As part of the planning process, the Planning Committee identified current plans, policies/ordinances and maps that supplement or help support mitigation planning efforts. **Figure 7** identifies the existing planning mechanism available by jurisdiction. It will be the

responsibility of each participating jurisdiction to incorporate, where applicable, the mitigation strategy and other information contained in the Plan into the planning mechanisms identified for their jurisdiction.

6.3 CONTINUED PUBLIC INVOLVEMENT

The County and participating jurisdictions understand the importance of continued public involvement and will seek public input on the Plan throughout the plan maintenance process. A copy of the approved Plan will be maintained and available for review at the Carroll County Emergency Services and Disaster Agencies Office. Individuals will be encouraged to provide feedback and submit comments for the Plan update to the Carroll County Emergency Services and Disaster Agencies Coordinator.

The comments received will be compiled and presented at the annual Plan Maintenance Subcommittee meetings where members will consider them for incorporation into the updated Plan. All meetings held by the Plan Maintenance Subcommittee will be noticed and open to the public. A separate public forum will be held prior to updating the Plan to provide the public an opportunity to comment on the proposed updates.

7.0 PLAN ADOPTION

7.0 PLAN ADOPTION

The final step in the planning process is the adoption of the approved Plan by each participating jurisdiction. Each jurisdiction must formally adopt the Plan to be eligible for federal grant money to implement mitigation actions identified in this Plan.

7.1 PLAN ADOPTION PROCESS

Before the Plan can be adopted by the participating jurisdictions, it must be made available for public review and comment through a public forum and comment period. Any comments received are incorporated into the Plan and the Plan is then submitted to the Illinois Emergency Management Agency (IEMA) and the Federal Emergency Management Agency (FEMA) for their review and approval.

Once IEMA and FEMA have reviewed and approved the Plan, it will be presented to the County and each participating jurisdiction for adoption. *Each participating jurisdiction must formally adopt* the Plan to become eligible to receive federal grant money to implement the mitigation actions identified in this Plan. If any of the jurisdictions choose not to adopt the Plan, their choice will not affect the eligibility of those that do adopt the Plan.

Figure 97 identifies the participating jurisdictions and the date each formally adopted the Plan. Signed copies of the adoption resolutions are located in **Appendix M**.

Figure 97 Plan Adoption Dates	
Participating Jurisdiction	Plan Adoption Date
Carroll County	04/18/2013
Milledgeville, Village of	04/29/2013
Chadwick, Village of	05/06/2013
Thomson, Village of	05/06/2013
Lanark, City of	05/07/2013
Shannon, Village of	05/09/2013
Mount Carroll, City of	05/14/2013
Savanna, City of	05/14/2013
Milledgeville Park District	06/18/2013
Thomson Fire Protection District	06/18/2013
Eastland Community Unit School District #308	06/19/2013
West Carroll Community Unit School District #314	06/19/2013

8.0 REFERENCES

8.0 REFERENCES

Provided below is a listing, by section, of the resources utilized to create this document.

1.0 INTRODUCTION

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**COUNTY RESOLUTION AUTHORIZING THE
DEVELOPMENT OF THE PLAN**

RESOLUTION FOR PURSUIT OF THE PREPARATION OF A NATURAL HAZARD MITIGATION PLAN

WHEREAS, Carroll County, Illinois would like to obtain grant money through the Disaster Mitigation Act of 2000, as money is available for Planning and Projects that can reduce or eliminate the damages caused by natural hazards such as rain, snow, wind, ice storms, floods, drought and earthquakes; and

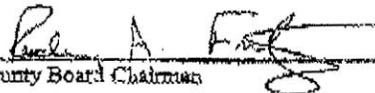
WHEREAS, Carroll County, Illinois must prepare an A Natural Hazard Mitigation Plan before money can be released for projects; and

WHEREAS, this plan will include a listing of potential projects that can help reduce the damages caused by these storms; and

WHEREAS, Carroll County will follow the next step in this process, which will be to prepare a grant application through Johnson, Depp & Quisenberry, an environmental and engineering consulting firm, for the preparation of this plan.

NOW THEREFORE, BE IT RESOLVED; that the CARROLL COUNTY BOARD does Hereby pass this resolution to pursue the preparation of an A Natural Hazard Mitigation Plan.

Passed this 17th day of DECEMBER, 2009



County Board Chairman

ATTEST:



County Clerk and Recorder

**PLANNING COMMITTEE MEETING
ATTENDANCE SHEETS**

Attendance Sheet
 Carroll County Multi-Jurisdictional
 Natural Hazards Mitigation Planning Committee Meeting
 February 2, 2012

Name (Please Print)	Representing (Jurisdiction/Organization)
1. Gregory Miller	Carroll County
2. Andrea Postwick	Johnson, Depp & Quisenberry
3. Brian K Koch	cherrygrove shannon Twp.
4. Craig Mathers	West Carroll CUSD #314
5. Krista Ottem	Village of Milledgeville
6. Mark Hansen	Eastland CUSD #308
7. Ed Stern	City of Lanark
8. KEN WELLS	city of Lanark
9. Chad Wilce	Carroll Co Farm Bureau
10. Randy Johnston	County Financial
11. Bill Geng enbach	CC Review
12. Mike Doty	Carroll County
13. Julie Yuskowak	CC Planning
14. Jeremy Hughes	Carroll County GIS
15. Kim Proberts	Carroll Co ES&DA
16. Leah Eberle	Carroll Co Assmt Office
17. Brian Wessner	Carroll Co. Clerk / Recorder
18. Jim Klinefelter	Shannon FWS

Attendance Sheet
 Carroll County Multi-Jurisdictional
 Natural Hazards Mitigation Planning Committee Meeting
 February 2, 2012

	Name (Please Print)	Representing (Jurisdiction/Organization)
1.	GREG MICHAUD	Johnson, Depp & QUISENBERRY
2.	Jessie Michele	Village of SHANNON
3.	Zelma Mc Neal	Village of Chadwick
4.	Les Gwenzler	City of Lanark
5.	Beth Baulk	Village of Thomson
6.	Scott Allshouse	Red Cross
7.	Julie Cuelker	City of Mt. Carroll
8.	Long Stebbins	City of Savanna
9.	Ken Saway	SHERRIFFS OFF
10.	Sally Marken	Carroll Costbook Dept
11.	Janet Hockman	Carroll Ca Hwy Dept
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Attendance Sheet
 Carroll County Multi-Jurisdictional
 Natural Hazards Mitigation Planning Committee Meeting
 March 29, 2012

	Name (Please Print)	Representing (Jurisdiction/Organization)
1.	BRYAN PURCHES	I.E.M.A.
2.	Ed Stern	City of Lanark - Mayor
3.	BUD K KOEHL	Cherrygrove Shanno - Twp
4.	Larry Stebbins	City of Savanna
5.	LUKE FAWCETT	LAYLE CARROLL
6.	Zelman McNeal	Chadwick - Mayor
7.	Greg Mullen	CC ESDA
8.	Janet Heckman	Co. Hwy
9.	GREG MICHAUD	JDD
10.	Andrea Bostwick	JDD
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Attendance Sheet
 Carroll County Multi-Jurisdictional
 Natural Hazards Mitigation Planning Committee Meeting
 March 29, 2012

	Name (Please Print)	Representing (Jurisdiction/Organization)
1.	Sally Marken	Carroll Co Health Dept
2.	Chris Welch	Carroll Co Farm Bureau
3.	Ken Vislister	Harark, IL
4.	Dwight O'Brien	Milledgeville, IL WIOSI
5.	Chris Cappelletti	Village of Shannon
6.	Craig Matson	West Carroll CUSD #314
7.	Beth Ball	Johnson Police Dept.
8.	Mark Hanna	Eastland CUSD #308
9.	Deah Storde	CC Asmt Office
10.	Vivian Moxie	ESDA
11.	Lynnette Fortak	Prairie Advocate
12.	Amy Buss	County Clerk
13.	Kevin Vandendoren	Carroll Haz Dept.
14.	Randy Johnston	Savanna IL
15.	Julie Yundall	Carroll Co
16.	Jeremy Hughes	Carroll Co GIS
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Attendance Sheet
 Carroll County Multi-Jurisdictional
 Natural Hazards Mitigation Planning Committee Meeting
 May 24, 2012

	Name (Please Print)	Representing (Jurisdiction/Organization)
1.	Gary Archer, Pole, IL	Natural Weather Service, 3F Forecast
2.	Beth Bach	Thomson Police Dept.
3.	Jason Michele	Village of Shawan
4.	Larry Stebbins	City of Saunna
5.	Ann Nobles	ESDA
6.	Chris Welch	Carroll Co Farm Bureau
7.	Candice Johnston	County Financial Insurance
8.	Bill Langenbach	CC Renewal
9.	Kory Gubies	Stephenson County EMA Zoning
10.	Seremy Hughes	Carroll County GIS
11.	Greg Miller	Carroll County ESDA
12.	Andrea Bestwick	JDA
13.	Aue Coers	JEMA
14.	GREG MICHAUD	JDA
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Attendance Sheet

Carroll County Multi-Jurisdictional
Natural Hazards Mitigation Planning Committee Meeting

May 24, 2012

	Name (Please Print)	Representing (Jurisdiction/Organization)
1.	Mike Doty	Carroll County
2.	Ed Stern	City of Lanark
3.	Ken Vignetta	City of Lanark
4.	Jerry Hebel	City of Thomson
5.	Sally Marken	Carroll Co Health Dept.
6.	Bruce Koch	Cherrygrove Shannon Twp
7.	Felma McNeal	Shadwick
8.	Janet Offens	Milledgeville
9.	Sally Franklin	Milledgeville
10.	Jake A. Cudde	Mount Carroll City
11.	Scott Kleshore	Red Cross
12.	Janet Hockman	Carroll Co. Hwy.
13.	Deah Eborle	Carroll Co. Post Office
14.	Mark Hansen	Eastland CUSD #308
15.	Julie Ymswood	Carroll Co. Zoning
16.	A. H. H. H.	Carroll EMS
17.	Doug Butler	Whiteside Co. ESDA
18.	Graig Mathew	West Carroll CUSA #314

Attendance Sheet
Carroll County Multi-Jurisdictional
Natural Hazards Mitigation Planning Committee Meeting
September 27, 2012

	Name (Please Print)	Representing (Jurisdiction/Organization)
1.	Ed Stern	City of Lanark
2.	Bill Fenzgenbach	EC Renew
3.	Scott Wilkerson	Red Cross
4.	Mark Hancock	Eastford CWD #308
5.	Jason Demichole	Village of SHANNON
6.	Kevin Vandenberg	Carroll Co.
7.	GREG MICHAUD	Johnson, Depp & Quisenberry
8.	Andrea Bostwick	NDA
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Attendance Sheet

Carroll County Multi-Jurisdictional
Natural Hazards Mitigation Planning Committee Meeting

September 27, 2012

	Name (Please Print)	Representing (Jurisdiction/Organization)
1.	Larry Acker	NWS + 3F Forecasts
2.	Ken Viglette	Lanark, IL
3.	Sally Marken	CCFD
4.	Leon Stebbins	Springs
5.	Christa Hester	Village of Millidgeville + Millville Park Dist
6.	Zabral McNeal	Village of Unadilla
7.	Pat Fuller	Mt Carroll EMS
8.	Randy Johnston	Insurance / Insurance
9.	Gary Juden	CARROLL County ESDA
10.	Beth Bahr	Thomson Police Dept.
11.	Mary Eberle	Thomson Fire Dept
12.	Joan Eberle	CC Asmt Office
13.	Mike Doty	Carroll County
14.	Jodie Cocher	Mount Carroll City GF
15.	LeAnn Meyler	City of Lanark
16.	Kim Morrison	ESDA / Sheriff
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Attendance Sheet
Carroll County Multi-Jurisdictional
Natural Hazards Mitigation Planning Committee Meeting
December 13, 2012

	Name (Please Print)	Representing (Jurisdiction/Organization)
1.	Harry Acker	NWS & BF Forecasts
2.	Gary Miller	Carroll County ES&A
3.	Christy Ottens	Village of Milledgeville - WV Park Dist
4.	Leah Eberke	Carroll County Asst. Office
5.	Chas Walker	Carroll Co. Farm Bureau
6.	Janet Hockman	Carroll Co. Hwy. Dept
7.	Ken Vignetta	Carroll County / FE
8.	Brian Koch	Cherrygrove Shannontop
9.	Ren Sandy	CARROLL COUNTY SHERIFF
10.	Larry Stebbins	Savanna
11.	Mary Stebbins	Savanna
12.	Beth Bair	Shomson Police Dept
13.	Bruce Bair	Village of Thomason
14.	Jodie Coelter	City of Mount Carroll
15.	Paul Forth	Mt. Carroll Ambulance
16.	Henry Getz	Farm Bureau
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Attendance Sheet
Carroll County Multi-Jurisdictional
Natural Hazards Mitigation Planning Committee Meeting
December 13, 2012

	Name (Please Print)	Representing (Jurisdiction/Organization)
1.	GREG MICHAUD	
2.	Andrea Postwick	Johnson, Depp & Quisenberry
3.	Julmal McNeal	Chadwick
4.	Ed Steen	Lanark
5.	Julie Yuskak	Carroll Co
6.	Kim Mobley	ESDA
7.	Gary Iben	Thomson Fire
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PLANNING COMMITTEE MEETING MINUTES

Meeting Minutes

Carroll County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee Meeting

February 2, 2012
Carroll County Farm Bureau
811 S. Clay Street, Mount Carroll
1:00 p.m.

Committee Members

American Red Cross
Carroll County Offices:
Administrator
Assessor
Clerk/Recorder
ESDA
Floodplain & Zoning
Farm Bureau
GIS/IT
Highway Department
Public Health
Sheriff's Office
Chadwick, Village of
Cherry Grove -Shannon Township
Country Financial Insurance

Eastland CUSD #308
Lanark, City of
Milledgeville, Village of
Mitigation Planning Consultants
Johnson, Depp & Quisenberry
Mount Carroll, City of
Savanna, City of
Shannon, Village of
Thomson, Village of
West Carroll CUSD #314

Other Attendees:

Carroll County Review
Lanark Fire Department
Shannon Fire Department

Welcome and Introductions

Greg Miller, Chairman of the Carroll County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee, welcomed attendees. He thanked attendees for agreeing to serve on this Committee. Before asking attendees to introduce themselves by providing their name and who they represent, he announced the date and location of NIMS training that will be held for Carroll County and municipal officials in February.

Binders and handout materials were distributed to each member.

What Is A Natural Hazard Mitigation Plan and Why Should We Prepare It?

Greg Michaud, Johnson, Depp & Quisenberry (JDQ), explained why the Federal Emergency Management Agency (FEMA) is seeking mitigation plans from municipalities and counties.

This natural hazard mitigation plan is aimed at reducing or eliminating damages to human health and property caused by natural hazards. FEMA is encouraging counties throughout the United

States to prepare natural hazard mitigation plans. Natural hazards in Illinois primarily refers to floods, tornadoes, severe summer storms (including thunderstorms, hail, heavy rain and lightning events), severe winter storms (including ice and snow storms), extreme heat, drought, and earthquakes. Hurricanes and mud slides do not typically occur in the Midwest although it was later pointed out that Savanna has experienced at least one mud slide. Mitigation refers to projects and activities that can reduce or eliminate damages from these natural hazards.

A recent news article described how in 2011 the U.S. experienced more weather catastrophes that caused at least \$1 billion in damages than in any previous year. Of the millions of dollars spent annually on damages caused by natural disasters, FEMA has calculated that for every dollar spent on mitigation, \$3 to \$4 dollars can be reaped in savings not spent on storm damages.

Carroll County and all participating municipalities should develop a Plan that identifies projects and activities to be taken before natural hazards occur. The Committee's third and fourth meetings will be devoted to identifying mitigation projects and activities for each participating jurisdiction. This process is not a competition between municipalities and the County, but is rather the opportunity to identify projects and activities so that they will be eligible for state/federal funding.

The Planning Process

Greg Michaud noted that the persons participating on this Mitigation Planning Committee, whether elected or appointed, are all community leaders. They have the opportunity to do something that should have lasting benefits for current and future generations of Carroll County residents.

The purpose of the Committee meetings is to develop a Plan that can be adopted by the County and each participating municipality. Specific activities for the Committee meetings include:

<u>Meeting/Activity</u>	<u>Purpose & Objectives</u>
1 st Committee Meeting	Mission, Goals & Objectives Critical Infrastructure Identification Planning Document Identification Hazard Event Identification Committee Member Storm Survey Citizen Questionnaire
2 nd Committee Meeting	Risk Assessment Discussion Prioritization (Categorization) Strategy & Subcommittee Formation Goal Setting Mitigation Introduction
3 rd Committee Meeting	Vulnerability Assessment Mitigation Projects/Activities

4th Committee Meeting

Mitigation Projects/Activities
Public Forum Discussion

Public Forum

Annual Update & Five Year Renewal
Commendation Ceremony
Public Comment & Questions
Start of Two Week Public Comment Period

Andrea Bostwick, JDQ, is a certified risk assessor who will work with Greg to prepare the Risk Assessment. Critical Facilities for each participating municipality and the County must be identified. Andrea distributed the Critical Facilities form for each municipality and the County to complete and return no later than the next Committee meeting.

Andrea also distributed the List of Existing Planning Documents Relevant to the Natural Hazard Mitigation Plan. This list includes Land Use Plans, Flood Ordinances, and related documents. If comprehensive municipal plans have been developed, copies these of these documents should be sent to Andrea or Greg Michaud so that these documents can be evaluated and described in the Plan.

Mission Statement & Goals

Since the mission statement and goals are related to natural hazards, Committee members were asked to recount some natural hazards that were particularly vivid. Among the events described by Committee members were the following:

- Severe thunderstorm and flooding—both flash flooding and river flooding—that impacted Savanna, Milledgeville and Mount Carroll and the entire county in July, 2010. Drinking water and waste water treatment services were disrupted in Mount Carroll, Savanna and Milledgeville, and Shannon facility was close to taking on water, along with damage to homes, roads and the railroad.
- Severe wind storm impacted Milledgeville on April 5, 2010 causing damages to crops, agricultural buildings, a church, and residences.
- Severe thunderstorm and flooding in July, 2011, an almost exact repeat from one year previous. The Mount Carroll wastewater treatment facility was under water and the Savanna facility was disrupted, along with damage to homes, roads and railroads.
- A severe wind storm that caused substantial damage in and around Shannon in July, 2003.
- A major snow blizzard impacting the County, along with much of northern and central Illinois, on Feb. 1, 2011.
- A series of severe snow storms with high winds hit the County in the winter of 1979/1980.
- Severe snowstorm in January, 1967, that dumped approximately 20 inches of snow across the entire County disrupting travel and school.

Greg Michaud asked Committee members to answer two questions on a distributed form:

- 1) What is the **most frequently encountered** natural hazard where you live?
- 2) What natural hazard do you believe **causes the most damage** where you live?

Committee members were then given a hazard event questionnaire to complete. This questionnaire asked Committee members to describe as many natural hazards as they can recall that caused damages. Committee members were also given the option of bringing this questionnaire to the jurisdiction they represent to gather additional information from their colleagues.

A draft of a proposed mission statement and goals was distributed. The goals were drafted in a manner that should help cover most, if not all, mitigation projects that are anticipated to be submitted. However, specific goals related to where you live can be added to this list. Every project included in the Plan should be aimed at one or more of the goals developed by this Committee. Committee Members were asked to review and discuss this draft at the next meeting.

Community Participation

In addition to the requirement that members attend Committee meetings to help assure that the Plan can be approved by IEMA and FEMA, Greg Michaud added that substitute representatives are acceptable. He pointed out that a mayor who wants to participate may not be able to attend every meeting because of other obligations; however, a substitute representative can be designated to participate in the Committee meetings.

What Happens Next?

Greg Michaud told Committee members that the risk assessment, goal setting, and the mission statement would be the main topics of the next committee meeting.

Committee members were also asked to make copies of a citizen questionnaire available to residents. Andrea will provide electronic copies as requested. Results of the citizen questionnaire will be included in the Plan.

Paper copies of this questionnaire and a fact sheet titled “Frequently Asked Questions,” should be made available to the public at the offices of participating municipalities. Andrea can provide electronic copies.

The second meeting of the Committee was set for:

**Thursday, March 29
Carroll County Farm Bureau
811 S. Clay Street, Mt. Carroll
1 p.m.**

Public Comment

With no further comments or questions, Chairman Miller thanked the Committee members for their attendance.

He described how the process to obtain a grant to prepare this mitigation plan has unfolded over the past few years. He emphasized the importance of this planning process and why Committee members' active participation can help develop a plan that best fits the needs of Carroll County and all of the participating municipalities.

The meeting was adjourned.

Meeting Minutes

Carroll County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee Meeting

March 29, 2012
Carroll County Farm Bureau
811 S. Clay Street, Mount Carroll
1:00 p.m.

Committee Members:

Carroll County Farm Bureau	Eastland CUSD #308
Carroll County Offices:	Illinois Emergency Management Agency
Assessor	Lake Carroll Homeowners Assoc.
Clerk/Recorder	Lanark, City of
ESDA	Milledgeville, Village of
Floodplain & Zoning	Mitigation Planning Consultants
GIS/IT	Johnson, Depp & Quisenberry
Highway Department	Savanna, City of
Public Health	Shannon, Village of
Chadwick, Village of	Thomson, Village of
Cherry Grove -Shannon Township	West Carroll CUSD #314
Country Financial Insurance	

Other Attendees:

Prairie Advocate Newspaper

Welcome and Introductions

Chairman Greg Miller opened the meeting and asked Committee members to introduce themselves and identified who they represent. To help expedite Committee meetings, Greg Miller asked that any changes to the meeting minutes be provided to Andrea Bostwick after the meeting. Meeting minutes for future meetings will be attached to e-mail meeting reminders.

Handout materials were distributed to each member.

Risk Assessment

Greg Michaud began the presentation by noting that over \$17.3 million in damages have resulted from 288 severe storms and natural hazards verified in Carroll County over approximately 50 years. Carroll County has had nine Federal disaster declarations since 1965, the majority due to flooding.

An overview of the Risk Assessment tables contained in the handout materials was provided. The frequency, magnitude and property damages for each category of natural hazard were described.

Severe Storms

Severe storms are the most frequently occurring natural hazard in Carroll County with 166 events verified. Over \$2.5 million in damages has resulted from severe thunderstorms with damaging winds, hail, lightning and heavy rain. At least 81 injuries and one fatality can be attributed to severe storms.

Severe Winter Storms

Seventy-two events involving excessive snow, ice, or extreme cold have been verified since 1995. At least 64 injuries can be attributed to severe winter storms.

Floods

Floods have caused the most damage in Carroll County despite not being among the top two most frequently occurring natural hazards. Floods contributed to seven of the nine Federal disaster declarations. At least 32 floods have been documented since 1965 causing at least \$14.5 million in property and crop damage.

Tornadoes

Since 1950, 12 tornadoes have been verified in Carroll County. In comparison, Illinois has averaged 36 tornadoes per year. Tornadoes have caused at least \$593,000 in damages in Carroll County and are suspected to have caused an additional \$2.5 million in damages. Twelve injuries have been verified as a result of tornadoes.

The average tornado in Carroll County is approximately 82 yards wide and nearly 3 miles long. There have been two F3, two F2, three F1 and five FO tornadoes. The worst tornado in the county occurred in 1967 approximately seven miles southwest of Mount Carroll.

Extreme Heat

Two extreme heat events have been reported since 1996, one in 1997 and the other in 1999. Road buckling and crop damage often occur, but crop damage is usually not measurable unless drought occurs.

Drought

Three major droughts have occurred during the last three decades—1983, 1988 and 2005. Following each drought, crop yield reductions were substantial.

<u>Year</u>	<u>Corn</u>	<u>Soybeans</u>
1983	30%	05%
1988	59%	34%
2005	14%	00%

Earthquakes

Carroll County lies in the immediate vicinity of three faults but none of these are active. Consequently, only one earthquake has originated in Carroll County since 1795. This earthquake occurred in January, 1928, and was located approximately seven miles

southwest of Mount Carroll, but no damages were likely. In the last two decades, four earthquakes were felt in northern Illinois, but no effects were noticed in Carroll County.

Greg Michaud noted that information on severe winter storms and flooding prior to 1995 is lacking. While records of catastrophic floods between 1965 and 1994 have been identified, there may have been more floods than have been found in available records. Committee members were asked to provide information on events not included in the tables in the Risk Assessment handout.

The two page handout titled “*Critical Facilities*” and the one page handout “*List of Existing Planning Documents*” were collected from the Committee members.

To help better identify storm damages to critical facilities, Andrea distributed a Critical Facilities Damage Questionnaire. Committee members were requested to provide information on this form about dates, type of hazard event, critical facility damaged, and, if available, the amount of damages incurred. Information provided by the Committee will be used to supplement other information to complete the Vulnerability Assessment for each participating jurisdiction.

Mission Statement & Goals

Andrea Bostwick reminded members that a draft mission statement and goals were provided at the previous committee meeting.

She asked if any revisions were needed for the mission statement. No revisions were proposed.

She then asked if any additions were needed to the draft goals to reflect any specific situation in Carroll County. No additions were proposed.

Mitigation

Greg Michaud reminded Committee Members that the purpose of the next meeting is to bring ideas for mitigation projects.

He referred everyone to the two handouts that lists examples of mitigation projects for the County and municipalities.

While *structural projects* typically are the most frequently mentioned category of mitigation projects, other categories should be considered including:

Public information/education activities are useful to alert people about how to protect themselves and their property.

Studies may be needed to identify the cause of the problem. A drainage problem may exist in your jurisdiction. However, the most effective remedy may be uncertain. Debris in culverts, undersized culverts, and changes in land use all contribute to drainage problems. A drainage study may be needed to determine the cause or group of causes for the situation you are encountering.

Regulatory measures such as the use of zoning, permits and codes to control development in susceptible areas and to provide the kind of buildings that will be more protective of residents.

He emphasized that **long-term permanent solutions and studies** should be considered when proposing mitigation actions. Tree trimming is helpful in reducing downed power lines during an ice storm and it should be included in your Plan, but it is not an activity that FEMA will fund because it is not considered a long-term permanent solution.

On the Hazard Mitigation Projects form provided, participants should identify:

- I. Projects **underway** or about to start
- II. **Studies** to identify the cause of a problem
- III. Projects/Activities you must do to **remain compliant with NFIP or are thinking about as a result of this planning process**

For those participants in the NFIP—Lanark, Milledgeville, Mount Carroll, Savanna and Carroll County--there are two administrative activities that will need to be added to their list of projects.

What Happens Next?

The Committee chose May 24 for their next meeting. The location and starting time will remain the same.

Public Comment

No additional questions or comments were raised and the meeting was adjourned.

Meeting Minutes

Carroll County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee Meeting

May 24, 2012

Carroll County Farm Bureau
811 S. Clay Street, Mount Carroll
1:00 p.m.

Committee Members

American Red Cross
Carroll County Farm Bureau
Carroll County Government
Administrator
Assessor
ESDA
Floodplain & Zoning
GIS/IT
Highway Department
Public Health
Chadwick, Village of
Cherry Grove -Shannon Township
Country Financial Insurance

Eastland CUSD #308
4F Forecasting, Larry Acker
IEMA – Region 2
Lanark, City of
Milledgeville, Village of
Mitigation Planning Consultants
Johnson, Depp & Quisenberry
Mount Carroll, City of
Savanna, City of
Shannon, Village of
Thomson, Village of
West Carroll CUSD #314

Other Attendees:

Carroll County Review
Stephenson County EMA
Whiteside County ESDA

Welcome and Introductions

Chairman Greg Miller opened the meeting by informing attendees that a severe wind advisory was in effect until 8 p.m. While tornadoes were not expected, blowing dust from farm fields might cause temporary vision impairments along state, county and township roads. He noted that there were two special guests in attendance: Doug Buhler, ESDA Coordinator, Whiteside County, and Terry Groves, EMA Director, Stephenson County. He asked Committee members to introduce themselves and identify who they represent.

Review of Meeting Minutes

Greg Miller asked the Committee if there were any questions or changes needed to the meeting minutes from the previous Committee meeting. There were no questions or changes requested. Chairman Miller added that Committee members should see Andrea Bostwick or Greg Michaud before leaving if they have any questions.

Critical Facilities and the Vulnerability Assessment

Greg provided a brief recap to help reorient Committee members as to what has been accomplished and what will be covered at this meeting. He noted that the Committee has accomplished all of its objectives up to this point and are ahead of schedule.

A two page form titled “**Critical Facilities**” was distributed to the municipalities and the County at the first Committee meeting. This form is needed because the information will be included in the Plan.

The Critical Facilities lists will be used along with the property tax assessment figures to complete the Vulnerability Assessment. To strengthen this assessment, Greg also asked the Committee to provide information on damages to critical facilities on a second form, “**Damages To Critical Facilities,**” which was distributed at the previous Committee meeting.

Potential damages to each participating municipality caused by floods and tornadoes were presented. Leah Eberle, Julie Yuswak and Jeremy Hughes were acknowledged for their special efforts to provide tax assessment figures and building counts that were used for these estimates. Flood damage estimates were based on riverine flooding. Using tax assessment values for residential structures from 2011, damages were calculated to include structures and contents. Potential dollar losses caused by riverine flooding to vulnerable residences within the participating municipalities would be expected to range from approximately \$350,000 in Mount Carroll to \$750,000 in Savanna.

Flash flooding is harder to calculate, but it has impacted every municipality in Carroll County. To illustrate the wider range of damages caused by flash flooding in the County and to compare these damages to riverine flooding, flash flooding caused approximately \$260,000 in damages in July 2011, but in July, 2010 resulted in approximately \$11 million in damages.

While tornadoes occur less frequently than flooding in Carroll County, the dollar damages can be larger. Damages were based on an “average” tornado for Carroll County by taking tornado impact information for the past 50 years. Housing densities were calculated from U.S. Census Bureau information for each of the participating jurisdictions. Potential dollar losses for residences and contents in three of the participating municipalities are estimated to exceed \$11 million. Potential dollar losses caused by an average tornado in Carroll County would be expected to exceed at least \$5 million for all of the participating jurisdictions, with the exception of Thomson.

Project Prioritization Method

A Project Prioritization Method is required by FEMA in the Plan. The term Project Prioritization Method actually refers to a method to classify each project.

Greg identified the two primary factors in the development of this strategy:

- 1) Frequency of hazard—severe storms occur more frequently than drought.
- 2) Degree of mitigation—some projects will *eliminate* damages while most projects will *reduce*, but not eliminate damages.

Greg acknowledged that while this methodology does not take cost or politics into consideration, these factors may affect the order in which projects are implemented.

Mitigation Projects

Committee members were asked to submit their Mitigation Projects forms. Andrea Bostwick then proceeded to illustrate how the Project Prioritization Method, the lists of Mitigation Projects, and other information will be presented for Committee review.

A tornado shelter was used as an example by Andrea to show how a typical project is prioritized and entered into the Plan on a Mitigation Table. Since the Plum River Fault Zone is located in Carroll County, she used an example for a shelter that would be built to be less vulnerable to seismic activity. A sufficiently large-size chart was placed on the wall so that everyone in the room could read it from where they sat. Andrea entered information about each category describing various factors that will be used to make determinations about each project and activity.

She explained that all mitigation projects submitted will be organized by participating jurisdiction.

Andrea noted that each municipality should have at least one mitigation project in the Plan before it is submitted to IEMA/FEMA. Mitigation projects can be added to the Plan after it is adopted because this Plan is a living document that will be periodically updated.

What Happens Next?

With the planning process ahead of schedule, additional time will be allotted for Committee members to complete their lists of mitigation projects. After a short discussion, the Committee agreed to schedule the next meeting on:

Thursday, September 27
Carroll County Farm Bureau
1 p.m.

Public Comment

With no additional questions or comments, Chairman Miller adjourned the meeting.

Meeting Minutes

Carroll County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee Meeting

September 27, 2012

Carroll County Farm Bureau
811 S. Clay Street, Mount Carroll
1:00 p.m.

Committee Members

American Red Cross
Carroll County Government
 Administrator
 Assessor
 ESDA
 Highway Department
 Public Health
Chadwick, Village of
Country Financial
Eastland CUSD #308
3F Forecasting, Larry Acker

Lanark, City of
Milledgeville, Village of
Mitigation Planning Consultants
 Johnson, Depp & Quisenberry
Mount Carroll, City of
Mount Carroll EMS
Savanna, City of
Shannon, Village of
Thomson, Village of
Thomson Fire Protection District

Other Attendees:

Carroll County Review

Welcome and Introductions

Chairman Greg Miller opened the meeting by noting that cooperation from the Committee Members has resulted in this planning project being ahead of schedule. He asked Committee members to introduce themselves and identify who they represent.

Mitigation Project Submittal & Action Tables

Before beginning this presentation, Greg Michaud provided a brief recap to help reorient Committee members as to what has been accomplished and what will be covered at this meeting.

Greg Michaud commended the Committee Members for assembling their lists of mitigation projects and activities. Approximately 170 projects and activities were described and prioritized in the Action Tables with roadway projects dominating the improvements needed.

Committee members were provided approximately 20 minutes during the meeting to review the Action Tables containing the descriptions of mitigation projects and activities. Any clarifications or additions to these tables are to be given to the consultants within a month of today's meeting. Andrea Bostwick and Greg Michaud moved throughout the room to discuss questions with each member.

This review and discussion prompted several jurisdictions to inquire about potential additions to their lists.

Risk/Vulnerability Assessment

An analysis of potential residential damages to each participating jurisdiction that might be caused by tornado and flood events was presented to the Committee at the previous meeting in May. This information will be included in the Plan. The Committee was asked if there was any additional information they wanted to insert. No additional information or clarification was requested.

Plan Maintenance and Update

Andrea described the Plan maintenance and update commitments that are described in the Plan. A subgroup of the Natural Hazard Mitigation Committee will meet annually under the direction of the Carroll County ESDA to report on the progress of their projects and make any additions or edits to their list of projects. There is no penalty for not building any project. The intent of the planning process is to encourage mitigation, not to penalize municipalities or counties.

Every five years, the Plan is formally updated and resubmitted to IEMA/FEMA. At the five year update, any jurisdiction who wants to become part of the Plan may do so. Any new jurisdiction must supply the same information that all of the current jurisdictions supplied.

The first jurisdiction to formally adopt the Plan begins the five year clock. If a jurisdiction decides not to adopt the Plan, FEMA will still approve the Plan and those jurisdictions who adopt the Plan become eligible for state/federal funds.

What Happens Next?

Although much of today's meeting has focused on mitigation projects and activities, the primary purpose for preparing this Plan is to make sure the participating jurisdictions can be better prepared for natural hazards and in a position to receive all of the money that is due when the next federal declaration occurs. Greg Michaud noted that since the planning process in Carroll County began, a severe drought being touted as the worst in Illinois in over 50 years has occurred.

The final Committee meeting will be conducted in the early evening as an open-house style public forum where the draft Plan will be presented for review and comment. Contrary to conventional public meetings, at an open-house style public forum the public can come and go at their convenience.

Committee Members were asked to select an evening date in December for the public forum. After a short discussion, the Committee agreed to schedule the next meeting on:

Thursday, December 13
Carroll County Farm Bureau
Mount Carroll
5 p.m. to 7 p.m.

After this public forum, there are three important milestones:

1. **Submission of the Plan** to IEMA and FEMA for their approval;
2. **Adoption of the Approved Plan** by each participating jurisdiction through a resolution; and
3. **Submission of the resolutions to JDQ** so that each participating jurisdiction is eligible for state/federal funding.

Following the close of the *two week public comment period*, the Plan will be readied for submission. When FEMA approves the Plan, an e-mail will be sent to the Committee Members asking them to adopt the Plan. A model adoption resolution will be attached to the e-mail for members to use. The Plan should **not** be adopted until after FEMA approval. Andrea will provide paper copies of a model resolution to the Committee members at the public forum.

Committee members were asked where copies of the draft Plan should be made available for public comment. Committee members asked that copies of the Plan be made available at the Carroll County Courthouse. Mike Doty, County Administrator, will make sure the draft copy of the Plan is made available for public review and comment. Electronic copies of the Plan will be sent to the municipalities to help with the Plan adoption process.

Public Comment

With no additional questions or comments, Chairman Miller adjourned the meeting. He thanked Andrea and Greg for all of their help with the planning process, and he encouraged Committee members to attend the public forum in December.

CITIZEN QUESTIONNAIRE

QUESTIONNAIRE

Carroll County Multi-Jurisdictional Natural Hazards Mitigation Plan

You can help protect lives and property from storm damage in Carroll County by taking a few moments to complete this questionnaire.

1. Please indicate where you live in Carroll County:

<input type="checkbox"/> Argo (Fay Station)	<input type="checkbox"/> Mt. Carroll
<input type="checkbox"/> Chadwick	<input type="checkbox"/> Savanna
<input type="checkbox"/> Fair Haven	<input type="checkbox"/> Shannon
<input type="checkbox"/> Georgetown	<input type="checkbox"/> Thomson
<input type="checkbox"/> Lanark	<input type="checkbox"/> Unincorporated Carroll County
<input type="checkbox"/> Milledgeville	<input type="checkbox"/> Wacker
<input type="checkbox"/> Other (please specify): _____	

2. Please place a check mark next to each of the natural hazards listed below that you have experienced in Carroll County. (Please check all that apply.)

<input type="checkbox"/> Severe Summer Storms (thunderstorms, hail and/or lightning strikes)
<input type="checkbox"/> Floods
<input type="checkbox"/> Severe Winter Storms (snow, sleet, ice and/or extreme cold)
<input type="checkbox"/> Extreme Heat
<input type="checkbox"/> Tornadoes
<input type="checkbox"/> Earthquakes
<input type="checkbox"/> Drought
<input type="checkbox"/> Other (please specify): _____

3. Which of the natural hazards above have you encountered most frequently?

4. Rank the natural hazards listed below in sequential order from 1 to 7 based on which hazard you feel poses the greatest threat. (1 = greatest threat and 7 = least threat). *Each number should only be used once.*

<input type="checkbox"/> Severe Summer Storms
<input type="checkbox"/> Floods
<input type="checkbox"/> Severe Winter Storms
<input type="checkbox"/> Extreme Heat
<input type="checkbox"/> Tornadoes
<input type="checkbox"/> Earthquakes
<input type="checkbox"/> Drought
<input type="checkbox"/> Other (please specify): _____

5. What types of mitigation projects or activities are most needed in Carroll County?
(Please check the **five** you feel are most important.)

Public information fact sheets and brochures describing actions residents can take to protect themselves and their property against natural hazard impacts

Floodplain Ordinances

Building Codes and Enforcement

Sirens or other Alert Systems

Flood or Drainage Protection (If selected, please check the type of flood or drainage activity that is needed below.)

Culvert and drainage ditch maintenance

Retention pond construction

Dam or levee construction/maintenance

Hydraulic studies to determine cause of drainage problems

Maintain power during storms by burying power lines, trimming trees and/or purchasing a back-up generator

Tornado Safe Shelters

Maintain roadway passage during snow storms and heavy rains

Provide sufficient water supply during drought

Identify residents with special needs in order to provide assistance during a natural hazard event

Retrofit critical infrastructure(public water supplies, schools, sewage treatment facilities, bridges, hospitals and other important services) to reduce potential damages

Other (please specify): _____

6. What are the most effective ways **for you** to receive information about how to make your household and property safer from natural disasters? (Please check all that apply.)

Newspapers

Television

Radio

Internet

Schools

Mail

Fact Sheet/Brochure

Extension Service

Public Workshops/Meeting

Fire Department/Law Enforcement

Public Health Department

Municipal/County Government

Other (please specify): _____

*Thank you for your time in assisting with the development of the
County's Natural Hazards Mitigation Plan.*

Carroll County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee

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FREQUENTLY ASKED QUESTIONS FACT SHEET

Frequently Asked Questions

Carroll County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee

1) What is the Carroll County Natural Hazards Mitigation Plan?

The Carroll County Natural Hazards Mitigation Plan evaluates damage to life and property from storms and other natural hazards in this county and identifies projects and activities that can reduce these damages. The Plan is considered to be multi-jurisdictional because it includes municipalities and institutions who want to participate.

2) What is natural hazard mitigation?

Natural hazard mitigation is any action taken to reduce or eliminate long-term risk to life and property from a natural hazard. Storms are the most frequently occurring natural hazards, but other natural hazards being considered in this Plan include drought and earthquakes.

3) Why is this Plan being developed?

The Plan fulfills federal planning requirements of Section 104 of the Disaster Mitigation Act of 2000 and the Stafford Act. Three key benefits this plan will provide Carroll County are:

- a) Funding following declared disasters.
- b) Funding for mitigation projects and activities before disasters occur.
- c) Increased awareness about natural hazards and closer cooperation among the various organizations and political jurisdictions involved with emergency planning and response.

4) Who is developing this Plan?

The Carroll County Natural Hazards Mitigation Planning Committee is preparing the Plan with assistance from technical experts in emergency planning, environmental matters, and infrastructure. The Committee includes members from agriculture, business and economic development, emergency services, municipal, county and state government, health care, insurance, law enforcement, and institutions such as the American Red Cross.

5) How can I participate?

You are invited to attend public meetings of the Carroll County Natural Hazards Mitigation Planning Committee. In addition you are encouraged to provide photographs, other documentation, and anecdotal information about damages you experienced with natural hazards in Carroll County. Surveys will be available at participating municipalities and through Carroll County to help gather specific information from residents. All of this information will be used to draft the Plan. The draft Plan will be presented in a public forum for further public input.

More information can be obtained by contacting:

Greg Miller, Coordinator
Carroll County Emergency Services & Disaster Agencies
713 Holcomb Ave.
Milledgeville, Illinois 61051
Telephone: (815) 631-8844

**NEWSPAPERS SERVING CARROLL COUNTY AND
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Newspapers Serving Carroll County

Carroll County Mirror Democrat (weekly)

308 N. Main St.

Mount Carroll, IL 61053

(815) 244-2411

www.mycarrollcountynews.com

Carroll County Review (weekly)

809 Main St.

Thomson, IL 61285

(815) 259-2131

Prairie Advocate News (weekly)

446 S. Broad St.

Lanark, IL 61046

(815) 493-2560

www.pacc-news.com

CC planning team meets Feb. 2

MT. CARROLL—Carroll County will begin preparing a countywide plan that will identify activities and projects to reduce the damages caused by natural hazards such as floods, snow storms, tornadoes, drought and ice storms.

The plan is called a Natural Hazard Mitigation Plan and will be funded through a grant from the Federal Emergency Management Agency (FEMA).

Carroll County is vulnerable to severe storms, flooding, and tornado damage. Since 1965, Carroll County has had 11 federally declared disasters with flooding causing or contributing to seven of these disasters. These disasters occurred in 1965, 1969, 1973, 1974, 1981, 1993, 2001, 2005, 2008, 2010 and 2011.

“Developing this plan will help us be better prepared before storms hit. The focus of this plan is to reduce the harm to property

and residents. We have an emergency response plan. The mitigation plan we want to prepare is aimed at prevention so it will complement our response plan. The county and each participating municipality who adopts the plan will become eligible for federal funds for projects that might not otherwise be constructed,” said Greg Miller, Carroll County ESDA Coordinator.

Carroll County municipalities expected to participate in this planning process include: Chadwick, Lanark, Milledgeville, Mt. Carroll, Savanna, Shannon, and Thomson.

A Carroll County Hazard Mitigation Planning Committee has been created with representatives from each participating municipality along with technical partners and other stakeholders. Meetings of this committee will be conducted as working

sessions so that any interested resident can attend and ask questions. The purpose of these working sessions is to gather and discuss information that will be used to prepare the plan.

The first meeting of this team will be held at 1:00 p.m. at the Carroll County Farm Bureau on Thursday, February 2, in Mt. Carroll. The committee will meet periodically through the next several months to develop a draft plan. Carroll County residents are welcome to attend every meeting.

“Typically the public is asked to comment after a plan is drafted. With this hazard mitigation plan, input from the public will be gathered before and during its development. We will also hold a public forum after the plan is drafted, but our focus will be to gather input before the draft is completed,” added Greg Miller.

Work toward preventing hazard risks

by Bill Gengenbach

A group of 26 people from Carroll County gathered at the Naaman Diehl Auditorium last Thursday for the first of four meetings that will be held to develop a natural hazards mitigation plan.

The group included representatives from each of the municipalities in the county and Carroll County Courthouse Department, including sheriff, county clerk, assessments, zoning, GIS,

health and highway. Others attending included the county administrator, school superintendents from Eastland and West Carroll and Farm Bureau manager.

The purpose of the committee

is to create a plan that identifies activities and projects that participating municipalities and Carroll County can pursue before a natural hazard occurs to protect lives and to encourage the adoption of the plan by the County and participating municipalities.

The plan will be funded through a grant from the Federal Emergency Management Agency (FEMA) and is being coordinated by Greg Miller, Carroll County ESDA Coordinator and Greg Michaud of the engineering firm of Johnson, Depp & Quisenberry of Springfield.

Mitigation is a sustained action that reduces or eliminates long-term risk to people and property from natural hazards and their impacts. A sustained action can be an activity or program regarding development in a flood plain or conducting evacuation drills at a school or business. Projects could include building a storm shelter, retrofitting municipal buildings, insulating water mains and conducting a flood study.

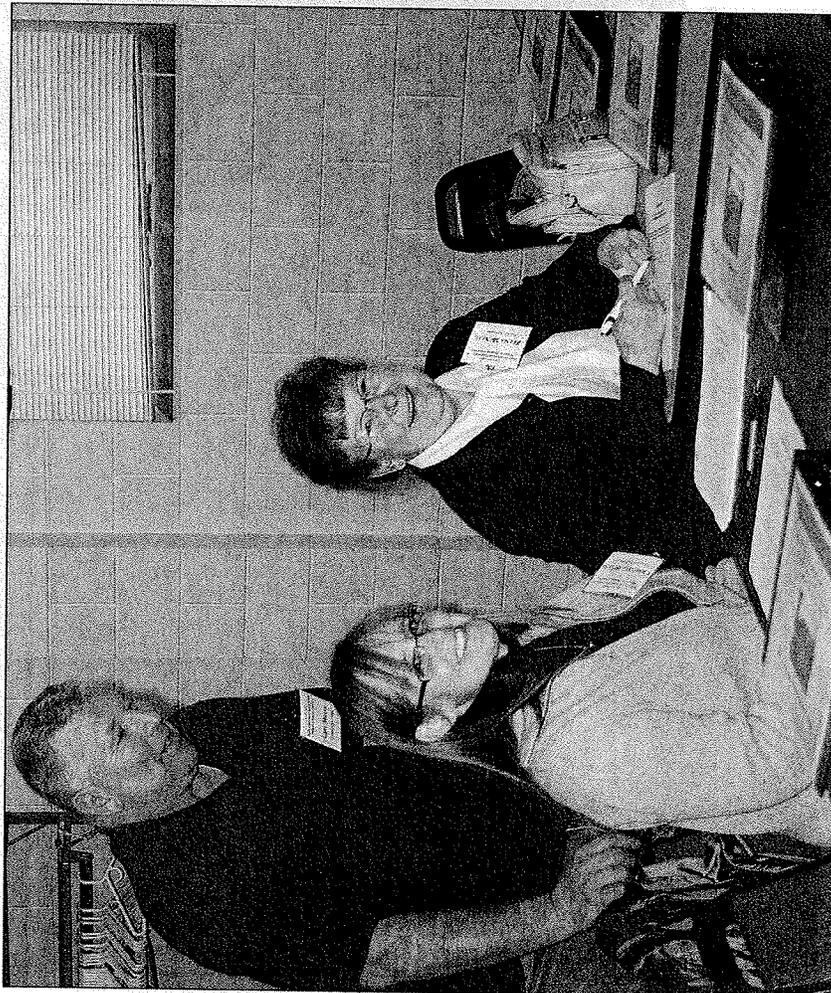
property and to encourage adoption of the plan by the

County and municipalities.

Participants will be compiling information about their municipalities in the form of surveys that will be used in developing the plan, including a list of existing planning documents, questionnaires relating to natural hazards occurring and the magnitude of damage as well as pinpointing the hazards in certain areas.

The plan is being developed in order to fulfill federal planning requirements of the Disaster Mitigation Act of 2000 and the Stafford Act. This plan will provide three key benefits to Carroll County including 1) funding following declared disasters. A plan is needed to receive FEMA funding; 2) funding for mitigation projects and activities before disasters occur; and 3) increase awareness about natural hazards and closer cooperation among the various organizations and political jurisdictions involved with emergency planning and response.

The next meeting of the group was scheduled for March 29. Michaud emphasized that attendance is necessary in order to receive federal funding when disasters occur.



Greg Miller, Carroll County ESDA (Emergency Services Disaster Agency) Coordinator for visits with Christy Ottens, left, Milledgeville Village Clerk and Zelma McNeal, Chadwick Village President, before the Mitigation committee meeting that was held at the Naaman Diehl Auditorium last Thursday.

—Review photo (Bill Gengenbach)

Hazard committee to meet

The heavy rains and severe storms encountered in Carroll County the last two years raise important questions.

What are the most frequently occurring natural hazards in the county? How much damage do storms and other natural hazards, such as drought, cause?

These questions and other related issues will be discussed when representatives from Carroll County and local municipalities meet at 1 p.m. Thursday, March 29, at the Carroll County Farm Bureau, 811 S. Clay St., Mount Carroll.

The Carroll County Hazard Mitigation Committee will meet through the next several months to prepare the plan to reduce damages caused by natural hazards. Committee meetings are open to the public.

"This plan will become our best resource for determining how to prepare for storms and other natural hazards," said Greg Miller of Milledgeville, chairman of the Carroll County Hazard Mitigation Committee.

"After this plan is completed, comprehensive information will be available in one document to help guide those who are making decisions about how to better protect Carroll County residents," said Miller.

Mount Carroll, Savanna, Thomson, Chadwick, Lanark, Milledgeville and Shannon are participating in the planning process.

Developing public information materials, building storm shelters, designing roads, bridges, water supplies and other services to better withstand natural disasters are some examples of the kind of projects and activities that can reduce storm damages.

Interested persons can provide input at these Carroll County Hazard Mitigation Committee meetings or submit their comments and ques-

tions to their municipal or county representatives.

Public comments will be used to develop a draft plan and after it is developed, a public forum will be held where the draft plan will be presented for review and comment.

Miller said the draft plan will be revised based on comments from the public and the state and federal government agencies. Following these revisions the plan will be presented for adoption at public meetings held by the county and at each of the participating municipalities.

"Identifying the frequency of these natural hazards and the severity of damages caused throughout our county is the goal at this committee meeting," said Miller. "Based on this information we will begin to develop lists of activities and projects to reduce damages caused by these events."

Preventing damage caused by severe weather

by Greg Miller
Carroll County Emergency Services Coordinator
MT. CARROLL—The heavy rains and severe storms encountered in Carroll County the last two years raise important questions.

What are the most frequently occurring natural hazards in the County? How much damage do storms and other natural hazards, such as drought, cause? These questions and other related issues will be discussed when representatives from Carroll County and local municipalities meet Thursday, March 29, at the Carroll County Farm Bureau on 811 South Clay Street in Mt. Carroll.

This group, the Carroll County Hazard Mitigation Committee, will meet through the next several months to prepare the plan to reduce damages caused by natural hazards. The Commit-

tee meeting begins at 1 p.m. and all Committee Meetings are open to the public.

"This Plan will become our best resource for determining how to prepare for storms and other natural hazards. After this Plan is completed, comprehensive information will be available in one document to help guide those who are making decisions about how to better protect Carroll County residents," said Greg Miller, Chairman for the Carroll County Hazard Mitigation Committee.

Chadwick, Lanark, Milledgeville, Mt. Carroll, Savanna, Shannon and Thomson are participating in the planning process.

Developing public information materials, building storm shelters, designing roads, bridges, water supplies and other services to better withstand natural disasters, are some exam-

ples of the kind of projects and activities that can reduce storm damages.

Interested persons can provide input at these Carroll County Hazard Mitigation Committee meetings, or submit their comments and questions to their municipal or county representatives.

Public comments will be used to develop a draft plan. After the draft plan is developed, a public forum will be held where the draft plan will be presented for review and comment. The draft plan will be revised based on comments from the public and the state and federal government agencies. Following these revisions, the plan will be presented for adoption at public meetings held by the County and at each of the participating municipalities.

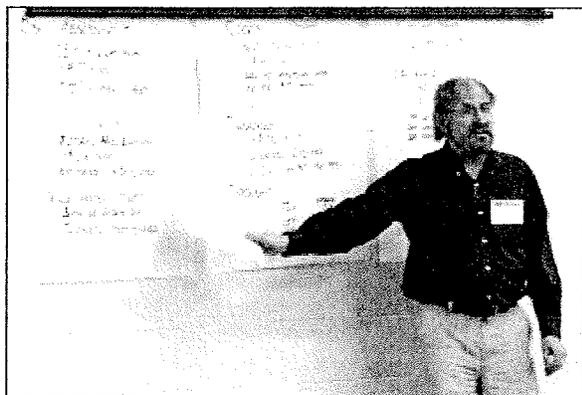
"Identifying the frequency of these natural hazards and the

severity of damages caused throughout our county is the goal at this Committee Meeting. Based on this information we will begin to develop lists of activities and projects to reduce damages caused by these events," added Miller.

Carroll County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee

http://www.pacc-news.com/4-4-12/ems4_4_12.html

April 5, 2012



The Prairie Advocate
April 5, 2012

Greg Michaud of Johnson, Depp, & Quisenberry points out the number of weather related events in the area during the second meeting of the Carroll County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee Meeting held on March 29th. A large group of community members were in attendance.
(PA photo/Lynnette Forth)

By Lynnette Forth For The Prairie Advocate News

MOUNT CARROLL - A second meeting was held on Thursday, March 29th at the Carroll County Farm Bureau to continue discussion on Natural Hazard Mitigation.

The first meeting of the group was held on February 2nd. At the initial meeting, members heard from Greg Michoud of Johnson, Depp & Quisenberry (JDQ), who explained why the Federal Emergency Management Agency is seeking mitigation plans from municipalities and counties. The natural hazard mitigation plan is aimed at reducing or eliminating damage to human health and property caused by natural hazards.

FEMA is encouraging counties throughout the United States to prepare natural hazard mitigation plans. Natural hazards in Illinois primarily refers to floods, tornadoes, severe summer storms, severe winter storms, extreme heat, drought, and earthquakes. Hurricanes and mud slides do not typically occur in the Midwest, although it was pointed out that Savanna has experienced at least one mud slide. Mitigation refers to projects and activities that can reduce or eliminate damages from these natural hazards. Carroll County and all participating municipalities should develop a plan that identifies projects and activities to be taken before natural hazards occur.

Appendix F

The Committee's third and fourth meetings will be devoted to identifying mitigation projects and activities for each participating jurisdiction. This process is not a competition between municipalities and the County, but is rather the opportunity to identify projects and activities so that they will be eligible for state/federal funding. The fourth meeting will focus on Mitigation Projects and activities, as well as a public forum discussion.

Andrea Bostwick of JDQ is a certified risk assessor who will work with Greg Miller, Carroll County Emergency Operations Coordinator, to prepare the Risk Assessment. Critical Facilities for each participating municipality and the County must be identified.

At the second meeting, risk assessments stating the hazards and frequency in the area, the probability of future occurrences, and vulnerability were discussed by Greg Michaud of JDQ. Michaud had reviewed fifty years of weather data from Carroll County and reported \$17 million in storm damages. Members were given handouts identifying the definition of a severe storm, the kinds of damaging winds produced by a thunderstorm, how the severity of a hail event is measured, what is lightning, and the types of weather alerts issued. Data was available with weather reports from 1960–2011. Members also learned about privately owned classified dams within the County, and where dam failures have occurred previously.

Michaud urged members in attendance to make a list of potential projects that each municipality or county might consider for the plan. "Just because you put down an intended project, doesn't mean you are obligated to complete it," Michaud informed the Committee. It was noted that funding varies for each project. A list of grants will be made available for members to review.

The mission statement was approved: The mission of the Carroll County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee is to develop a mitigation plan that can reduce the negative impacts of natural hazards on citizens, infrastructure, private property, and critical facilities. Goals for the plan included:

- Educating people about the natural hazards they face and ways they can protect themselves, their homes, and their businesses from those hazards.
- Protecting the lives, health, and safety of the people and animals in the County from the dangers of natural hazards, to protect the existing infrastructure and design new infrastructure to be resilient to the impacts of natural hazards.
- Incorporating natural hazard mitigation into community plans and regulations, place a priority on protecting public services, utilities and roads, preserve and protect the rivers and floodplains in our county, ensure that new developments do not create new exposures to damage from natural hazards, and protect historic, cultural, and natural resources from the effects of natural hazards.

Members were given lists of mitigation actions from surrounding areas for review to help aide in assembling their own project lists.

Miller thanked everyone in attendance, and urged them to invite anyone who may be missing to the next meeting. "We want every town included," Miller said.

The next meeting is currently scheduled for May 24th at 1 p.m. at the Carroll County Farm Bureau in Mount Carroll.

Appendix F

May 16, 2012/The Carroll County Review/Thomson, IL /Page 5

Mitigation meeting May 24

by Greg Miller

MT. CARROLL—Steps to prevent injuries and deaths while maintaining vital services for Carroll County residents when floods and severe storms hit will be discussed when the Carroll County Natural Hazard Mitigation Planning Committee meets at 1:00 p.m. on May 24 at the Carroll County Farm Bureau in Mount Carroll.

Committee meetings are open to the public.

This Committee began work in February to prepare a plan that will identify projects and activities to protect Carroll County residents and property from storms and other natural disasters. This plan, unlike all other emergency plans, is aimed at identifying projects and activ-

ities that can be taken before these disasters occur.

“Other emergency plans are directed at responding after a storm or natural disaster hits. This is the first time in Carroll County that we are looking at actions that can reduce or eliminate damages caused by specific types of storms and other natural disasters,” said Greg Miller, committee chairperson.

Chadwick, Lanark, Milledgeville, Mount Carroll, Savanna, Shannon, Thomson, Carroll County along with the school districts, Country Financial insurance, and the Lake Carroll Homeowners Association are participating in this planning process. These municipalities and various county departments

(Continued on Page 19)

—committee meet

(Continued from Page 5) will be identifying the kinds of projects that should be included in the Plan.

Building storm shelters, resolving drainage problems, retrofitting water supplies and other critical facilities to better withstand natural disasters are a few examples of the kinds of projects that might be included in the plan. Developing public

information materials and conducting drainage studies are examples of other activities that might also be included in the Natural Hazard Mitigation Plan.

“Developing a Plan that is approved by the Federal Emergency Management Agency will help all the participating jurisdictions become eligible for state and federal grant money,” added Miller.



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Preventing Damages Caused By Natural Disasters

Steps to prevent injuries and deaths while maintaining vital services for Carroll County residents when floods and severe storms hit will be discussed when the Carroll County Natural Hazard Mitigation Planning Committee meets at 1:00 p.m. on May 24 at the Carroll County Farm Bureau in Mount Carroll. Committee meetings are open to the public.

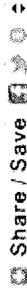
This Committee began work in February to prepare a plan that will identify projects and activities to protect Carroll County residents and property from storms and other natural disasters. This plan, unlike all other emergency plans, is aimed at identifying projects and activities that can be taken before these disasters occur.

"Other emergency plans are directed at responding after a storm or natural disaster hits. This is the first time in Carroll County that we are looking at actions that can reduce or eliminate damages caused by specific types of storms and other natural disasters," said Greg Miller, Committee Chairperson.

Chadwick, Lanark, Milledgeville, Mount Carroll, Savanna, Shannon, Thomson, Carroll County along with the school districts, Country Financial insurance, and the Lake Carroll Homeowners Association are participating in this planning process. These municipalities and various County departments will be identifying the kinds of projects that should be included in the Plan.

Building storm shelters, resolving drainage problems, retrofitting water supplies and other critical facilities to better withstand natural disasters are a few examples of the kinds of projects that might be included in the plan. Developing public information materials and conducting drainage studies are examples of other activities that might also be included in the Natural Hazard Mitigation Plan.

"Developing a Plan that is approved by the Federal Emergency Management Agency will help all the participating jurisdictions become eligible for state and federal grant money," added Miller.



Carroll County Natural Hazards Mitigation Planning Committee holds hazards meeting Sept. 27

Posted: Wednesday, September 19, 2012 12:22 pm

Steps to protect residents and property from storms and other hazards will be discussed during the Carroll County Natural Hazards Mitigation Planning Committee meeting at 1 p.m. Thursday, Sept. 27 at the Carroll County Farm Bureau in Mount Carroll. The meeting is open to the public.

Mount Carroll, Savanna, Thomson, Chadwick, Lanark, Milledgeville, Shannon and Carroll County representatives are participating in the planning process. Agriculture, insurance, school districts and the American Red Cross are also represented on the Committee.

“Severe storms frequently cause damages to buildings, crops, roads and other critical infrastructure in this area and across Illinois,” said Greg Miller, Carroll County Emergency Services and Disaster Agency coordinator. “Since 1960 Carroll County has experienced at least one federal declared disaster every decade. Severe thunderstorms and floods are the most frequently occurring natural disasters in our county.”

Carroll County has an emergency response plan, but not a mitigation plan.

“Emergency response plans prescribe what actions should be taken after a storm hits, this mitigation plan identifies actions that should be taken before a storm occurs,” said Miller.

Carroll County and the participating municipalities have been assembling lists of mitigation projects and activities. The mitigation plan is expected to be finished this winter.

While the public has provided input on portions of the plan, the entire plan will be presented for public review and comment before it is submitted to the state and federal government for approval.

A public forum will be conducted to review the plan and ask questions of committee members. A two-week public comment period will be established to accommodate interested persons who are unable to attend the forum.

“We want to make sure that anybody who is interested has an opportunity to review and comment on the draft plan,” said Miller.

The public can submit questions and comments to the committee members or directly to the Carroll County Emergency Services and Disaster Agency.

Committee to prevent hazards meets Sept. 27

MT. CARROLL—Steps to protect residents and property from storms and other hazards will be discussed during the Carroll County Natural Hazards Mitigation Planning Committee meeting on September 27 at the Carroll County Farm Bureau in Mt. Carroll. The meeting begins at 1 p.m. and is open to the public.

Chadwick, Lanark, Mill-edgeville, Mt. Carroll, Savanna, Shannon, Thomson and Carroll County representatives are participating in the planning process. Agriculture representatives, insurance agents, school districts and the American Red Cross are also represented on the Committee.

“Severe storms frequently cause damages to buildings, crops, roads, and other critical infrastructure in this area and across Illinois. Since 1960 Carroll County has experienced at least one federally declared disaster every decade. Severe thunderstorms and floods are the most frequently occurring natural disasters in our county,” according to Greg Miller, Carroll County Emergency Services and Disaster Agency Coordinator.

Carroll County has an emergency response plan, but not a

mitigation plan. “Emergency response plans prescribe what actions should be taken after a storm hits; this mitigation plan identifies actions that should be taken before a storm occurs,” added Miller.

Carroll County and the participating municipalities have been assembling lists of mitigation projects and activities. The mitigation plan is expected to be finished in this winter.

While the public has provided input on portions of the plan, the entire plan will be presented for public review and comment before it is submitted to the state and federal government for approval.

A public forum will be conducted for interested persons to review the plan and ask questions of Committee members. A two week public comment period will be established to accommodate interested persons who are unable to attend the forum. “We want to make sure that anybody who is interested has an opportunity to review and comment on the draft plan,” emphasized Miller.

Interested persons can submit questions and comments to the committee members or directly to the Carroll County Emergency Services and Disaster Agency.

Reducing Damage Caused By Storms

Steps to protect residents and property from storms and other hazards will be discussed during the Carroll County Natural Hazards Mitigation Planning Committee meeting on September 27 at the Carroll County Farm Bureau in Mount Carroll. The meeting begins at 1 p.m. and is open to the public.

Chadwick, Lanark, Milledgeville, Mount Carroll, Savanna, Shannon, Thomson and Carroll County representatives are participating in the planning process. Agriculture, insurance, school districts and the American Red Cross are also represented on the Committee.

“Severe storms frequently cause damages to buildings, crops, roads, and other critical infrastructure in this area and across Illinois,” according to Greg Miller, Carroll County Emergency Services and Disaster Agency Coordinator. “Since 1960 Carroll County has experienced at least one federal declared disaster every decade. Severe thunderstorms and floods are the most frequently occurring natural disasters in our county.”

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Interested persons can submit questions and comments to the Committee members or directly to the Carroll County Emergency Services and Disaster Agency. Please contact Greg Miller at 815-631-8844 for more information.

Prairie Advocate
September 19, 2012

3rd  *Thursdays*

Historic
Downtown
Mount Carroll, Illinois
First Annual
Art Walk

ART • MUSIC • COMMUNITY
Downtown Mount Carroll business
sponsors (displaying this poster) open
their doors to host local area artists/
artisans and musicians for a monthly
ART WALK April thru October

September 20th, 2012
6 pm-8 pm

This event brought to
you by:
Main Street Art Guild,
NFP

Mount Carroll
Community
Development Corp.

Brick Street Cafe
Photography by Elly

Are you a Mount
Carroll business, artist
or musician interested
in participating in these
events?
Photography by Elly:
elly@photographybyelly.com
815-291-5478

December 5, 2012/The Carroll County Review/Thomson, IL /Page 15

Public forum on plan to reduce storm damages

MT. CARROLL—Projects and activities to prevent injuries, deaths and property damage from major storms will be presented for public comment in the Carroll County Natural Hazards Mitigation Plan.

The plan will be available for review at a public forum on December 13 from 5 p.m. to 7 p.m. at the Carroll County Farm Bureau in Mt. Carroll. Members from the Carroll County Natural Hazards Mitigation Planning Committee will be available to discuss the plan.

“Persons can come and go at their convenience to review the plan and comment. If an interested person only has a few minutes to review the plan, ask a question, or make a comment, they can easily do so at anytime during the forum. This forum is designed to accommodate busy schedules. Unlike conventional meetings, there are no formal presentations forcing attendees to wait before providing input,” according to Greg Miller, Carroll County Hazard Mitigation Committee chairperson.

This committee has been conducting working meetings open to the public since February to prepare a plan that will identify projects and activities to protect Carroll County residents and property from storms and other natural disasters. This plan, unlike all other emergency plans, is aimed at iden-

tifying projects and activities that can be taken before a natural disaster occurs.

“We have received public input to develop this plan since we began meeting in February. This input has included photographs and insurance claims about damages caused by storm events as well as suggestions about potential projects that could reduce harm to people and property. This forum is an opportunity to see the draft plan in its entirety,” added Miller.

Chadwick, Lanark, Milledgeville, Mt. Carroll, Savanna, Shannon and Thomson are participating in the planning process. These municipalities and various county departments have been identifying the kinds of projects that should be included in the plan.

The public comment period will remain open until December 28. Comments can be directed to the Carroll County Emergency Services and Disaster Agency. Following the public comment period, any revisions that are needed will be made before the plan is submitted to the Illinois Emergency Management Agency and the Federal Emergency Management Agency for approval.

Each participating jurisdiction must adopt the plan to become eligible for project funds distributed by the state and federal emergency management agencies.

The Prairie Advocate December 5, 2012

Public Forum on Plan to Reduce Storm Damages

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"Persons can come and go at their convenience to review the plan and comment. If an interested person only has a few minutes to review the plan, ask a question, or make a comment, they can easily do so at anytime during the forum. This forum is designed to accommodate busy schedules. Unlike conventional meetings, there are no formal presentations forcing attendees to wait before providing input," according to Greg Miller, Carroll County Hazard Mitigation Committee Chairperson.

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Each participating jurisdiction must adopt the plan to become eligible for project funds distributed by the state and federal emergency management agencies.

For more information, contact Greg Miller at 815-631-8844.

Final Approval of Natural Hazards Mitigation Plan Planned for April 2013

By LYNNETTE FORTH
For The Prairie Advocate News

MT. CARROLL – A public meeting to view the proposed Natural Hazards Mitigation Plan was held at the Neiman Diehl Auditorium in Mount Carroll on Thursday December 13th. The plan was developed through the Carroll County Multi-Jurisdictional Natural Hazards Mitigation Committee.

The planning committee included representatives from each participating jurisdiction, the general public, as well as agriculture, business, emergency services (ambulance, fire and law enforcement), healthcare, GIS, and insurance. The committee met five times between February 2012, and December 2012.

The plan includes natural hazards such as:

Severe storms (thunderstorms, hail, lightning, and heavy rain); Severe winter storms (snow, ice, and extreme cold); Flood; Tornadoes; Drought; Extreme heat; Earthquakes; and Dams.

The plan is divided into sections that cover the planning process; the risk assessment conducted on each of the previously identified natural hazards; the mitigation strategy, including the list of mitigation actions identified for each participating jurisdiction; recommendations; and plan maintenance, and adoption. The majority of the plan is devoted to the risk assessment.

The risk assessment identifies the natural hazards that pose a threat to the County and includes a profile of each natural hazard which describes the location and severity of past occurrences, reported damages to public health, and property, and the likelihood of future occurrences. It also provides a vulnerability

assessment that evaluates the assets of the participating jurisdictions, and estimates the potential impacts each natural hazard would have on the health and safety of the residents of Carroll County, as well as the buildings, critical facilities and infrastructure located within the County.

Comments received at the public forum will be incorporated into the plan before it is submitted to the Illinois Emergency Management Agency (IEMA) and the Federal Emergency Management Agency (FEMA) for review. Once IEMA and FEMA have reviewed and approved the plan, it will be presented to the County and each participating jurisdiction for formal adoption. After adopting the plan, each participating jurisdiction can apply for federal mitigation funds and begin implementation of the mitigation actions identified in the plan.

Greg Michaud, Environmental Engineer with Johnson, Depp & Quisenberry, stated "We figure approximately 3 months for FEMA to approve the plan, and three weeks for IEMA, so it will be awhile. Hopefully by April, we can have final approval."

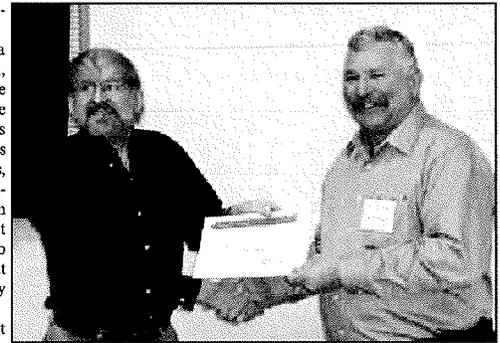
Each year natural hazards cause damage to property and threaten the lives and health of Carroll County residents. Since 1965, Carroll County has had 9 federally-declared disasters. In addition, between 2001 and 2011, there have been 67 thunderstorms with damaging winds, 34 severe winter storms, 23 flood and flash flood events, 18 heavy rain events, 9 severe hail storms, 5 extreme cold events, 3 tornadoes, 2 lightning strike events, 1 drought, and 3 earthquakes felt by residents of Carroll County. While natural hazards cannot be avoided, their impacts can be reduced through

effective hazard mitigation planning.

By preparing and adopting a natural hazards mitigation plan, participating jurisdictions become eligible to apply for and receive federal hazard mitigation funds to implement mitigation actions identified in the plan. These funds, made available through the Disaster Mitigation Act of 2000, can help provide local government entities with the opportunity to complete mitigation projects that would not otherwise be financially possible.

Recognizing the benefits that could be gained from preparing a natural hazards mitigation plan, the Carroll County Board passed a resolution on December 17th, 2009 authorizing the development of the Carroll County Multi-Jurisdictional Natural Hazards Mitigation Plan. The County then invited all the local government entities within Carroll County to participate. The following jurisdictions chose to participate in the plan's development:

- Chadwick
- Eastland CUSD #308
- Lanark
- Milledgeville
- Milledgeville Park District
- Mount Carroll
- Savanna
- Shannon
- Thomson
- Thomson Fire Protection District
- West Carroll CUSD #314



Greg Michaud (R), Environmental Engineer with Johnson, Depp & Quisenberry, presented Gregg Miller of Milledgeville with a certificate of appreciation for serving as chairman of the Carroll Multi-Jurisdictional Natural Hazards Mitigation Planning Committee on December 13th. (PA photo/L. Forth)

PUBLIC FORUM – PLANNING PROCESS HANDOUT

CARROLL COUNTY MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN

PUBLIC FORUM – OPEN HOUSE

DECEMBER 13, 2012

CARROLL COUNTY FARM BUREAU

5:00 P.M. – 7:00 P.M.

Each year natural hazards (i.e., severe thunderstorms, tornadoes, severe winter storms, flooding, etc.) cause damage to property and threaten the lives and health of Carroll County residents. Since 1965, Carroll County has had 9 federally-declared disasters.

In addition, between 2001 and 2011 there have been 67 thunderstorms with damaging winds, 34 severe winter storms (snow and ice), 23 flood and flash flood events, 18 heavy rain events, 9 severe hail storms, 5 extreme cold events, 3 tornadoes, 2 lightning strike events, 1 drought and 3 earthquakes felt by residents in the County. While natural hazards cannot be avoided, their impacts can be reduced through effective hazard mitigation planning.

What is hazard mitigation planning?

Hazard mitigation planning is the process of determining how to reduce or eliminate the loss of life and property damage resulting from natural hazards. This process helps the County and participating municipalities reduce their risk by identifying vulnerabilities and developing mitigation actions to lessen and sometimes even eliminate the effects of a hazard. The results of this process are documented in a natural hazards mitigation plan.

Why prepare a natural hazards mitigation plan?

By preparing and adopting a natural hazards mitigation plan, participating jurisdictions become eligible to apply for and receive federal hazard mitigation funds to implement mitigation actions identified in the Plan. These funds, made available through the Disaster Mitigation Act of 2000, can help provide local government entities with the opportunity to complete mitigation projects that would not otherwise be financially possible.

Who participated in the development of the Carroll County Multi-Jurisdiction Natural Hazards Mitigation Plan?

Recognizing the benefits that could be gained from preparing a natural hazards mitigation plan, the Carroll County Board passed a resolution on December 17, 2009 authorizing the development of the Carroll County Multi-Jurisdictional Natural Hazards Mitigation Plan. The County then invited all the local government entities within Carroll County to participate. The following jurisdictions chose to participate in the Plan's development:

- ❖ Chadwick
- ❖ Eastland CUSD #308
- ❖ Lanark
- ❖ Milledgeville
- ❖ Milledgeville Park District
- ❖ Mount Carroll
- ❖ Savanna
- ❖ Shannon
- ❖ Thomson
- ❖ Thomson Fire Protection District
- ❖ West Carroll CUSD #314

CARROLL COUNTY MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN

How was the Plan developed?

The Carroll County Multi-Jurisdictional Natural Hazards Mitigation Plan was developed through the Carroll County Multi-Jurisdictional Natural Hazards Mitigation Planning Committee. The Planning Committee included representatives from each participating jurisdiction, the general public as well as agriculture, business, emergency services (ambulance, fire and law enforcement), healthcare, GIS and insurance. The Planning Committee met five times between February, 2012 and December, 2012.

Which natural hazards are included in the Plan?

After much discussion, the Planning Committee chose to include the following natural hazards in this Plan:

- ❖ severe storms (thunderstorms, hail, lightning & heavy rain)
- ❖ severe winter storms (snow, ice & extreme cold)
- ❖ flood
- ❖ tornadoes
- ❖ drought
- ❖ extreme heat
- ❖ earthquakes
- ❖ dams

What is included in the Plan?

The Plan is divided into sections that cover the planning process; the risk assessment conducted on each of the previously identified natural hazards; the mitigation strategy, including lists of mitigation actions identified for each participating jurisdiction; recommendations; and plan maintenance and adoption. The majority of the Plan is devoted to the risk assessment.

This risk assessment identifies the natural hazards that pose a threat to the County and includes a profile of each natural hazard which describes the location and severity of past occurrences, reported damages to public health and property, and the likelihood of future occurrences. It also provides a vulnerability assessment that evaluates the assets of the participating jurisdictions (i.e., residential buildings, critical facilities and infrastructure) and estimates the potential impacts each natural hazard would have on the health and safety of the residents of Carroll County as well as the buildings, critical facilities and infrastructure located within the County.

What happens next?

Any comments received at tonight's public forum will be incorporated into the Plan before it is submitted to the Illinois Emergency Management Agency (IEMA) and the Federal Emergency Management Agency (FEMA) for review. Once IEMA and FEMA have reviewed and approved the Plan, it will be presented to the County and each participating jurisdiction for formal adoption. After adopting the Plan, each participating jurisdiction can apply for federal mitigation funds and begin implementation of the mitigation actions identified in the Plan.

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PUBLIC FORUM – PLAN COMMENT SHEET

**Mr. Greg Miller
Carroll County ESDA
713 Holcomb Ave.
Milledgeville, IL 61051**

Place
Stamp
Here

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BUSINESS COMMUNITY PARTICIPATION PACKET



**CARROLL COUNTY
EMERGENCY SERVICE & DISASTER AGENCY
301 NORTH MAIN
MT. CARROLL, ILLINOIS 61053**

**Emergency Operation Center Located at
10735 Mill Road
Mt. Carroll, Illinois 61053**

July 9, 2012

Example Letter

Mike Lenz
President, Mt. Carroll Chamber of Commerce
320 N. Main Street
Suite 101
P.O. Box 94
Mt. Carroll, IL 61053

Dear Mr. Lenz:

Maintaining business operations after a natural disaster strikes, such as a flood, snow storm, or tornado, can be vital to customers and employees. In some instances, the ability to recover quickly can make the difference between staying in business or closing.

Carroll County is developing a plan, called the Carroll County Natural Hazard Mitigation Plan, to prevent and reduce damages caused by natural disasters. As part of this planning process, I am contacting you to inform you that the Chamber and businesses throughout Carroll County will have the opportunity to review and comment on this draft plan later this year. A public forum will be held in Mount Carroll at the Carroll County Farm Bureau and a two week public comment period will begin the evening of the forum.

Enclosed is a brochure about how businesses can prepare for disasters and a fact sheet that provides more information about the Carroll County Natural Hazard Mitigation Plan. If you have any questions, feel free to contact me.

Sincerely,

Greg Miller
Coordinator
Carroll County ESDA

Carroll County Natural Hazard Mitigation Plan Frequently Asked Questions

1. What is the Carroll County Natural Hazard Mitigation Plan?

The Carroll County Natural Hazard Mitigation Plan evaluates damage to life and property from storms and other natural hazards in this county and identifies projects and activities that can reduce these damages. The Plan is considered to be multi-jurisdictional because it includes municipalities and other public organizations, such as schools, who want to participate.

2. What is hazard mitigation?

Hazard mitigation is any action taken to **reduce or eliminate long-term risk to life and property** from a natural or man-made hazard.

3. Why is this Plan being developed?

The Plan fulfills federal planning requirements of Section 104 of the Disaster Mitigation Act of 2000 and the Stafford Act. Three key benefits this plan will provide Carroll County are:

- 1) Increased awareness about the risks and closer cooperation among various organizations to take steps that can reduce damages from natural and man-made hazards.
- 2) Funding following declared disasters
- 3) Funding for mitigation projects and activities before disasters occur

4. Who is developing this Plan?

The Carroll County Hazard Mitigation Committee is preparing the Plan with assistance from technical experts in emergency planning, environmental matters, and infrastructure. The Committee includes members from agriculture, business and economic development, emergency services, municipal, county and state government, health care, insurance, and law enforcement.

5. How can I participate?

You are invited to attend public meetings of the Carroll County Hazard Mitigation Committee. In addition you are encouraged to provide photographs, other documentation, and anecdotal information about damages you experienced with natural hazards in Carroll County. Surveys will be available at participating municipalities and through Carroll County to help gather specific information from residents. All of this information will be used to draft the Plan. The draft Plan will be presented in a public forum for further public input.

More information can be obtained by contacting:

Greg Miller, Coordinator
Carroll County Emergency Services & Disaster Agency
Phone: 815/631-8844 E-Mail: gsvmmiller@frontiernet.net



**Why bother?
Disasters don't happen here.**

Even if you think you are not in a disaster-prone area, something like a chemical tanker truck overturning can prevent you and your employees from getting to your facility.

Even if a flood doesn't put your business under water, customers and supplies may not be able to get to you.

Power outages, brown-outs or surges can affect your daily business operations.

Many disasters, like wind storms, tornadoes and earthquakes, can strike quickly and with little or no warning.



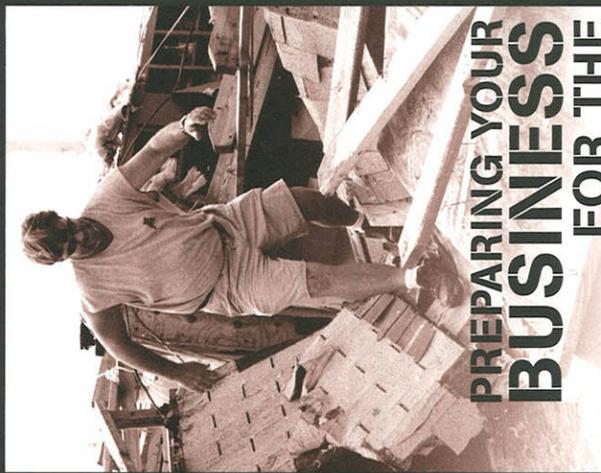
What can I do?

Find out which natural and technological hazards can happen in your area.

Get information about how to prepare your employees and clients to respond to possible hazards and provide help. Disaster safety information and CPR/first aid training are available from your local Red Cross chapter. Get more information at www.redcross.org.

Network with others who have or need to develop risk or contingency management plans.

Attend seminars and get information from local risk management associations or chapters.



PREPARING YOUR BUSINESS FOR THE UNTHINKABLE

Disasters can happen anywhere, often with little or no warning.

Is your business prepared?

What can you do to protect your business, employees and customers?

Where should you begin?

www.redcross.org

American Red Cross

ARC 1235
April 2001



Disaster Recovery Begins Before a Disaster

No business should risk operating without a disaster plan. While reports vary, as many as 40 percent of small businesses do not reopen after a major disaster like a flood, tornado or earthquake. These shuttered businesses were unprepared for a disaster; they had no plan or backup systems.

When you start to develop your disaster plan, consider three subjects: human resources, physical resources and business continuity. Think about how a disaster could affect your employees, customers and workplace. Think about how you could continue doing business if the area around your facility is closed or streets are impassable. Think about what you would need to serve your customers even if your facility is closed.

Develop a Plan

Start building your plan now.

Here are some suggestions you may want to consider:

- Keep phone lists of your key employees and customers with you, and provide copies to key staff members.
- If you have a voice mail system at your office, designate one remote number on which you can record messages for employees. Provide the number to all employees.
- Arrange for programmable call forwarding for your main business line(s). Then, if you can't get to the office, you can call in and reprogram the phones to ring elsewhere.
- If you may not be able to get to your business quickly after an emergency, leave keys and alarm code(s) with a trusted employee or friend who is closer.

- Install emergency lights that turn on when the power goes out. They are inexpensive and widely available at building supply retailers.
- Back up computer data frequently throughout the business day. Keep a backup tape off site.
- Use UL-listed surge protectors and battery backup systems. They will add protection for sensitive equipment and help prevent a computer crash if the power goes out.
- Purchase a NOAA Weather Radio with a tone alert feature. Keep it on and when the warning signal sounds, listen for information about possible severe weather and protective actions to take.
- Stock a minimum supply of the goods, materials and equipment you would need for business continuity.
- Consult with your insurance agent about special precautions to take for disasters that may directly impact your business. Remember, most policies do not cover earthquake and flood damage. Protect valuable property and equipment with special riders. Discuss business continuity insurance with your agent.
- Keep emergency supplies handy, including—
 - Flashlights with extra batteries.
 - First aid kit.
 - Tools.
 - Food and water for employees and customers to use during a period of unexpected confinement at your business, such as if a tanker truck overturned nearby and authorities told everyone in the area to stay put for an extended period.

For more information on suggested disaster supplies, see <http://www.redcross.org/services/disaster/prepared/supplies.html>.

- **Reduce Potential Damage**
Prevent or reduce disaster damage in your facility by taking precautions, such as—
 - Bolting tall bookcases or display cases to wall studs.
 - Protecting breakable objects by securing them to a stand or shelf using hook-and-loop fasteners.
 - Moving to lower shelves large objects that could fall and break or injure someone.
 - Installing latches to keep drawers and cabinets from flying open and dumping their contents.
 - Using closed screw eyes and wire to securely attach framed pictures and mirrors to walls.
 - Using plumber's tape or strap iron to wrap around a hot water heater to secure it to wall studs.

You should also consider having a professional install—

- Flexible connectors to appliances and equipment fueled by natural gas.
- Shutters that you can close to protect windows from damage caused by debris blown by a hurricane, tornado or severe storm.
- Automatic fire sprinklers.

Protect Your Employees, Customers and Business

Designate one employee from each work shift to be the safety coordinator. This person will make all decisions relating to employee and customer safety and to the safety of the business itself. Safety coordinators should know how to contact the owner or operator at all times.

Everyone in your facility should know how to prepare for a disaster and what to do if a disaster occurs.

Contact your local Red Cross chapter for specific information about how to stay safe in a tornado, earthquake, fire, flood, hurricane or other hazard.

You may also want to get a copy of the *Emergency Management Guide for Business and Industry* from your Red Cross chapter or <http://www.redcross.org/services/disaster/beprepared>.

Another source of useful information is *Open for Business*, a booklet developed by the Institute for Business and Home Safety and the Small Business Administration. It is available at <http://www.ibhs.org>.



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**HAZARD MITIGATION PLANNING LETTER SENT TO
ADJACENT COUNTIES**

From: Greg Miller [mailto:gsvmmiller@frontiernet.net]
Sent: Sunday, April 22, 2012 6:34 PM
To: Stephenson County; Whiteside County; Jo Daviess County; Ogle County
Cc: Greg R. Michaud
Subject: Hazard Mitigation Planning Committee meeting
Importance: High

Hi Everyone

Attached is information on a meeting to be held in Carroll County.

Thank You

Gregory S. Miller
Carroll County Emergency Services Coordinator
Cell - 815-631-8844
gsvmmiller@frontiernet.net



**CARROLL COUNTY
EMERGENCY SERVICE & DISASTER AGENCY
301 NORTH MAIN
MT. CARROLL, ILLINOIS 61053**

**Emergency Operation Center Located at
10735 Mill Road
Mt. Carroll, Illinois 61053**

From: Greg Miller, Carroll County Natural Hazard Mitigation Committee Chairperson

Subject: Hazard Mitigation Planning Meeting

Date: April 22, 2012

The purpose of this memorandum is to invite you to attend a planning meeting of the Carroll County Natural Hazards Mitigation Committee. This committee is preparing a countywide Natural Hazards Mitigation Plan. Since we share a common border, there may be issues and concerns you have regarding this Plan. We are preparing this plan to meet the Federal Emergency Management Agency's (FEMA) prerequisite for hazard mitigation funds.

The next meeting of the Committee will be:

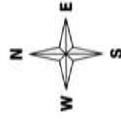
Thursday, May 24
Carroll County Farm Bureau
811 South Clay Street
Mt. Carroll, IL
1 p.m. – 2 p.m.

If you have questions or comments on our mitigation planning effort, or if you would like to participate, please feel free to contact me. You may also contact Greg Michaud, our mitigation planning consultant, at 217/529-4534. Johnson, Depp & Quisenberry, an environmental and engineering consulting firm experienced in preparing these plans, is leading our planning process.

The Committee meetings are open to the public.

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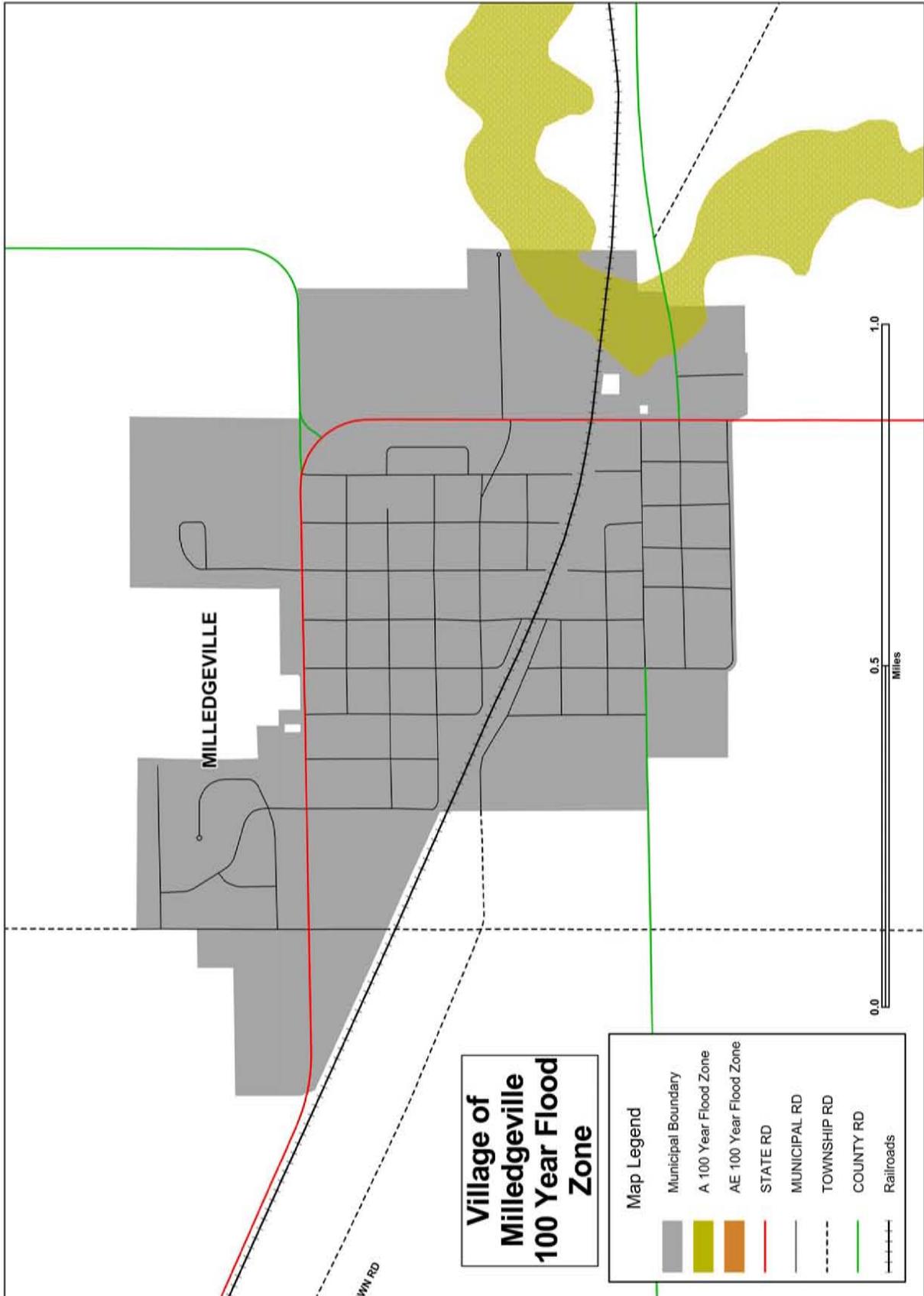
**FLOODPLAIN MAPS FOR NFIP-PARTICIPATING
MUNICIPALITIES**

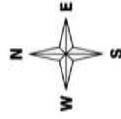


**CARROLL
COUNTY, IL**



Map produced by the Carroll County
Geographic Information Office in 2016.
All data believed to be accurate,
but may not be without error.

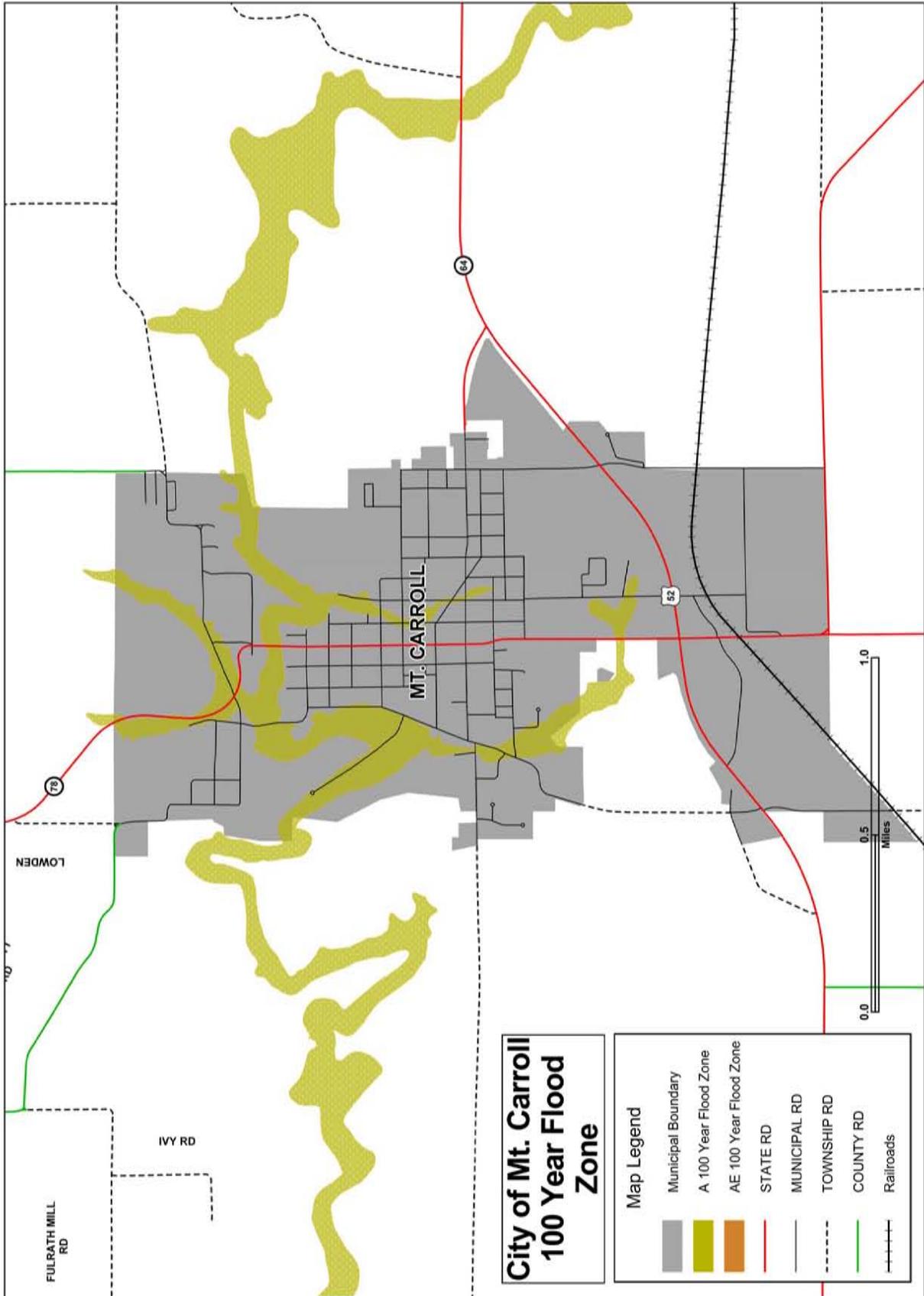


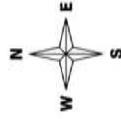


**CARROLL
COUNTY, IL**



Map produced by the Carroll County
Geographic Information Office
All data believed to be accurate
but may not be without error.

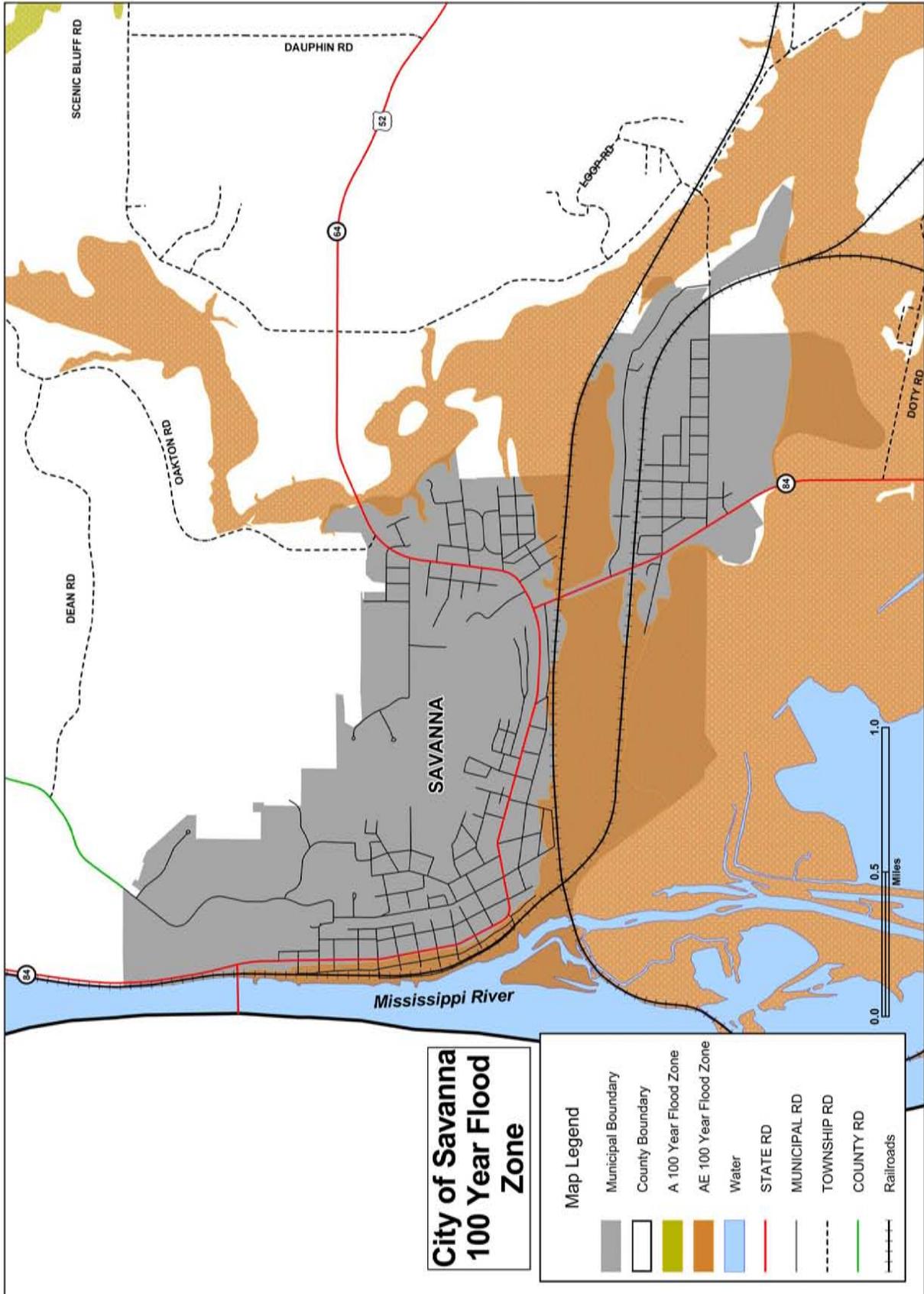




**CARROLL
COUNTY, IL**



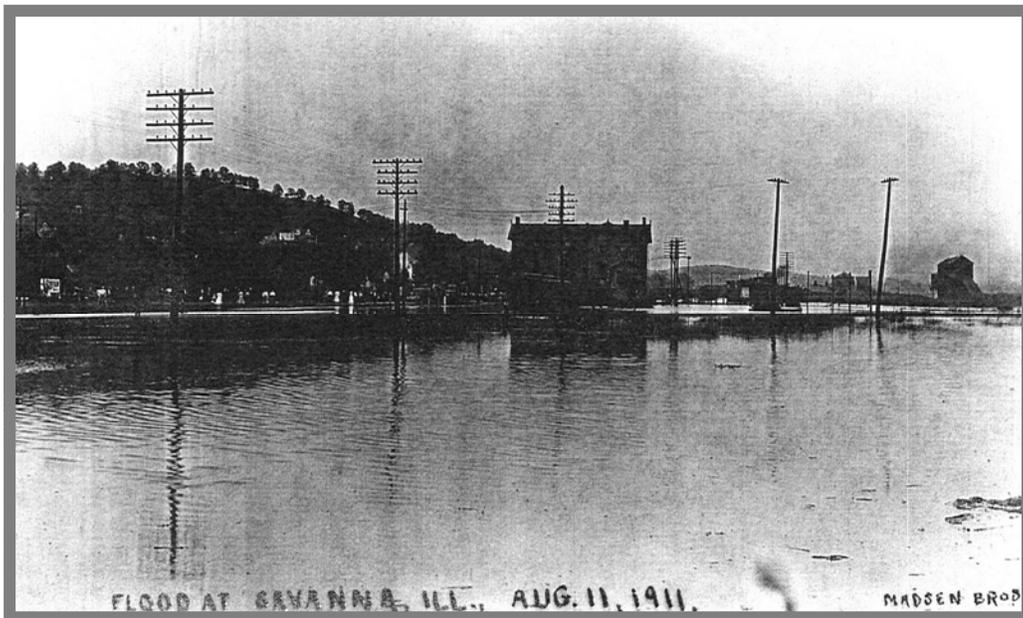
Map produced by the Carroll County
Geographic Information Office.
All data believed to be accurate,
but may not be without error.



HISTORIC FLOOD PHOTOGRAPHS



C.B. & Q. Yard Office after Plum River Flood - August 11, 1911, Savanna, Ill.

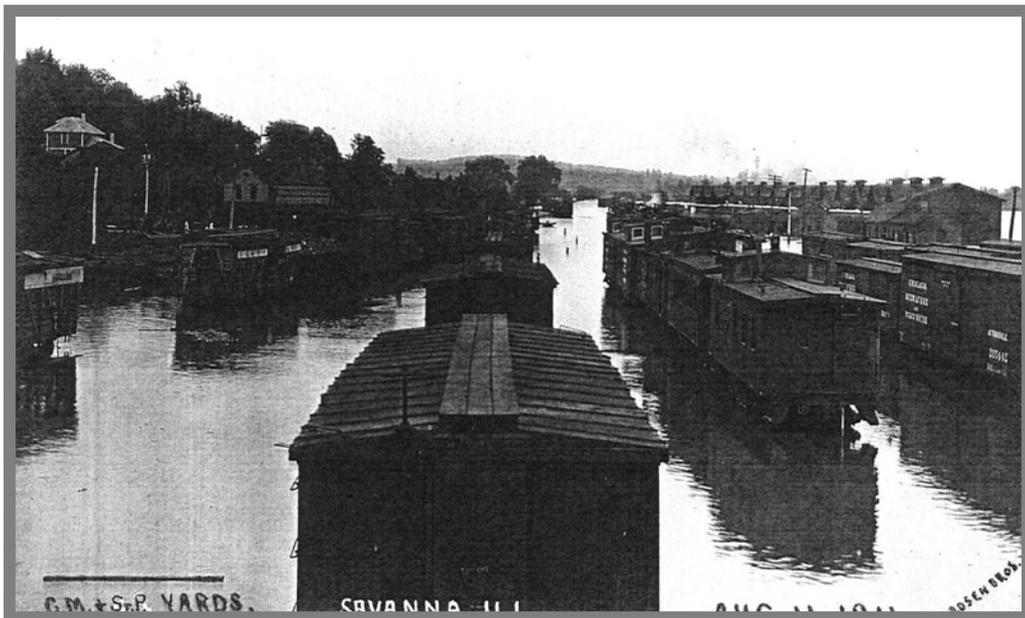


Plum River Flood at Savanna, Ill. - August 11, 1911

Photographs provided by Larry Stebbins



C.B. & Q. Rail Line Washout after Plum River Flood - August 11, 1911, Savanna, Ill.

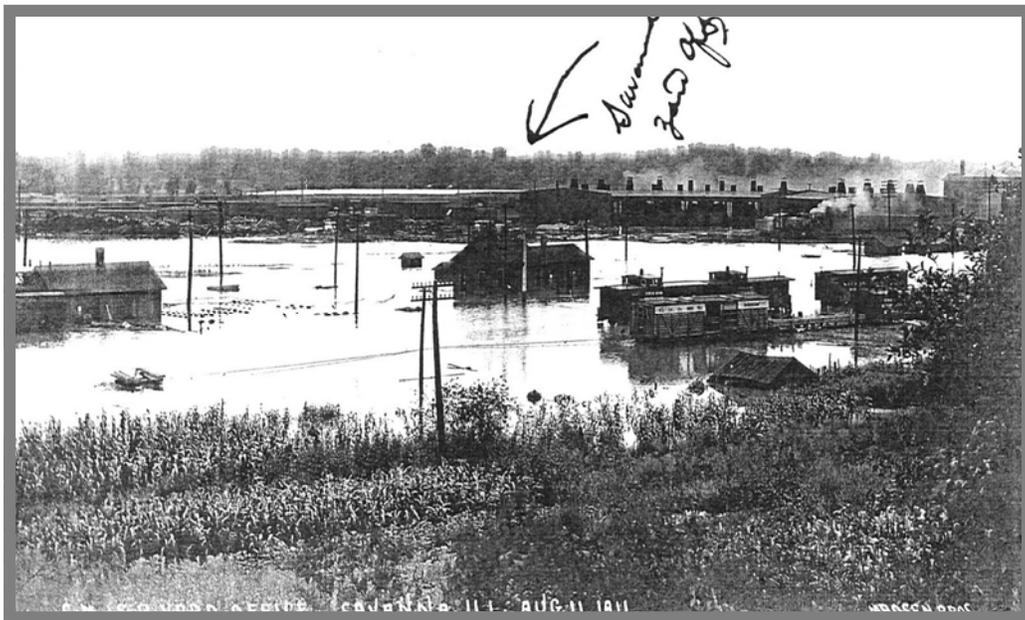


C.M. & St.P. Yards after Plum River Flood, Savanna, Ill. - August 11, 1911

Photographs provided by Larry Stebbins



C.M. & St.P. Yards after Plum River Flood, Savanna, Ill - August 11, 1911

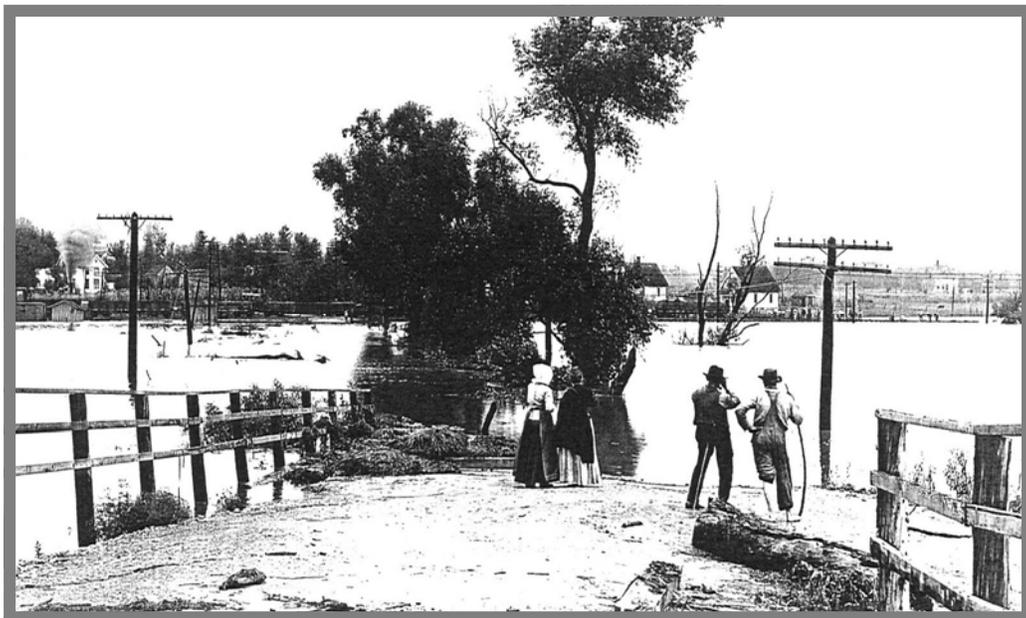


C.M. & St.P. Yards Office after Plum River Flood, Savanna, Ill. - August 11, 1911

Photographs provided by Larry Stebbins



C.M. & St.P. Depot after Plum River Flood, Savanna, Ill - August 11, 1911



Savanna, Ill. - August 11, 1911

Photographs provided by Larry Stebbins



Mississippi River Flooding
In Savanna, Ill. - 1965



Photographs provided by Larry Stebbins



Mississippi River Flooding
In Savanna, Ill. - 1965



Photographs provided by Larry Stebbins



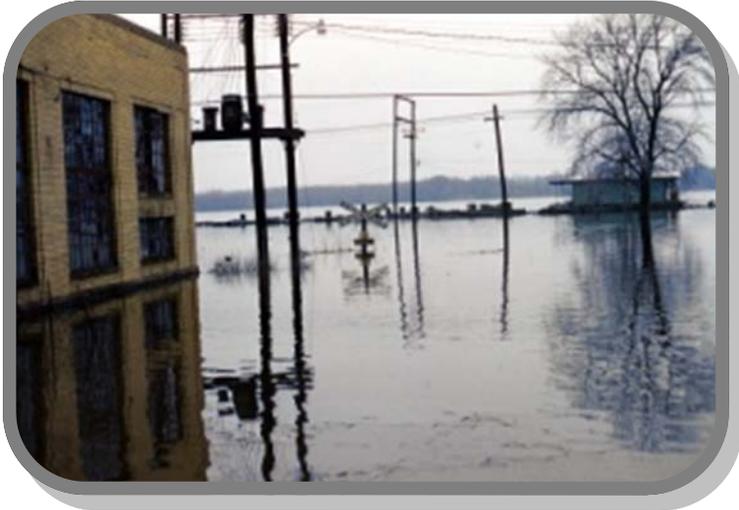
Mississippi River Flooding
In Savanna, Ill. - 1965



Photographs provided by Larry Stebbins



Mississippi River Flooding
In Savanna, Ill. - 1965



Photographs provided by Larry Stebbins



Mississippi River Flooding
In Savanna, Ill. - 1965



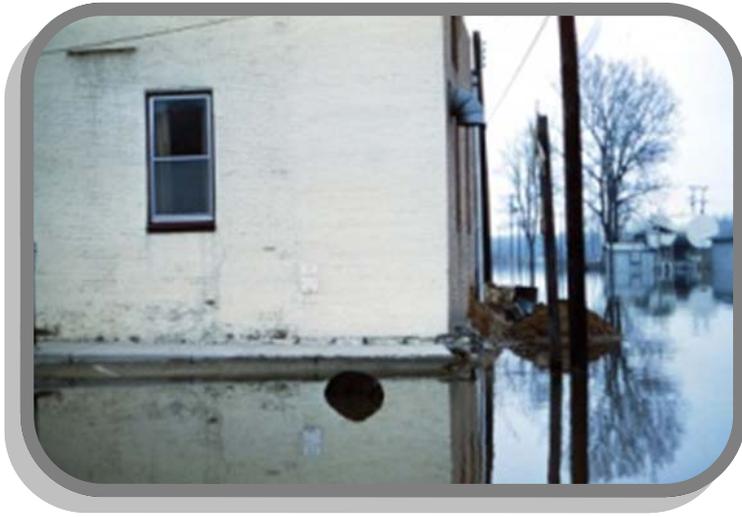
Photographs provided by Larry Stebbins



Mississippi River Flooding
In Savanna, Ill. - 1965



Photographs provided by Larry Stebbins



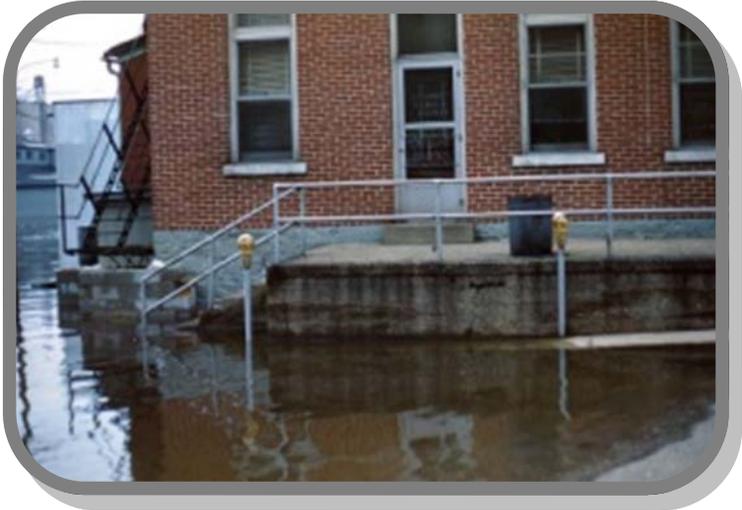
Mississippi River Flooding
In Savanna, Ill. - 1965



Photographs provided by Larry Stebbins



Mississippi River Flooding
In Savanna, Ill. - 1965



Photographs provided by Larry Stebbins



Mississippi River Flooding
In Savanna, Ill. - 1965



Photographs provided by Larry Stebbins



Land flooded in Jacobstown after
Carroll Creek (Wakarusa River)
Flood - June, 15 1981

Point Rock Park after Carroll
Creek Flood - June 15, 1981,
Mount Carroll, Ill.



Fulrath Mill Road washed out in
Fecke Flats - June 15, 1981,

Photographs provided by Leroy Getz



Rail yards (near Swiss Colony Factory) flooded by Plum River

Savanna, Illinois
July, 2010 Historic Flash
Flood Event



Rail lines flooded by Plum River

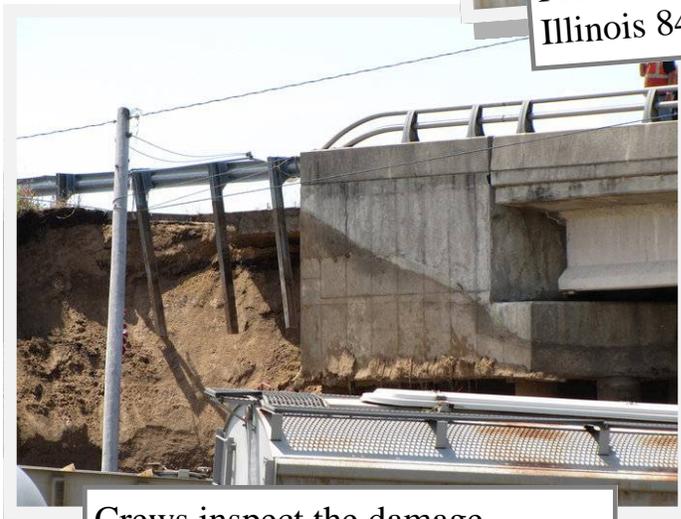


Rail lines under Illinois 84
flooded by Plum River

Photographs provided by Sally Marken

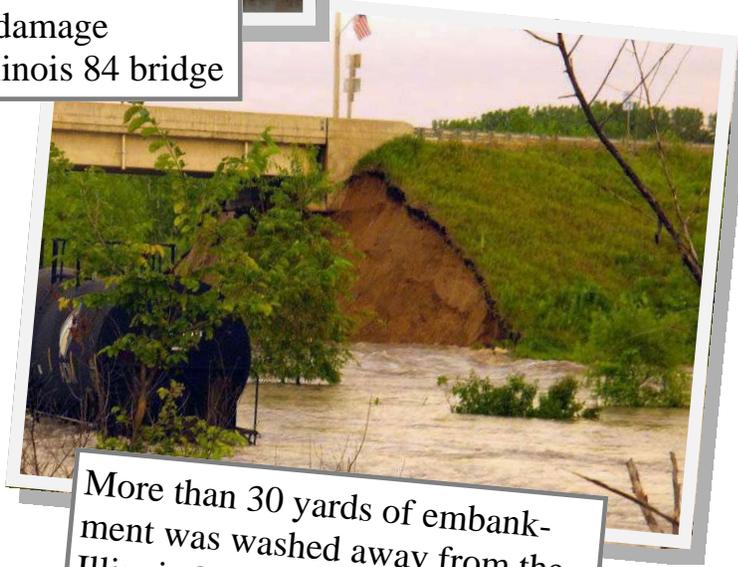


Flooded railroad tracks under the Illinois 84 bridge



Crews inspect the damage sustained by the Illinois 84 bridge

Savanna, Illinois
July, 2010 Historic Flash
Flood Event



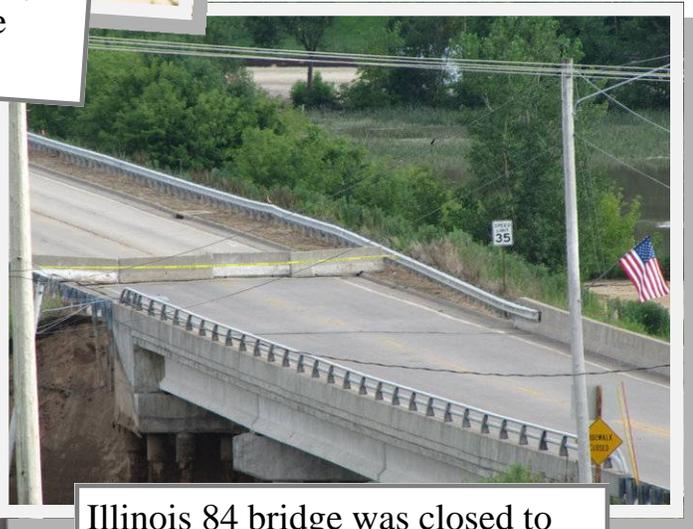
More than 30 yards of embankment was washed away from the Illinois 84 bridge

Photographs provided by Sally Marken

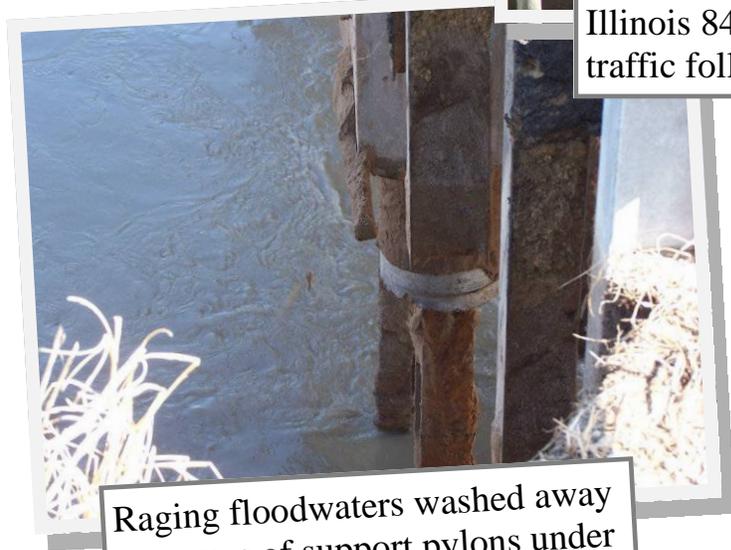


The floodwaters washed away part of the Illinois 84 bridge embankment

Savanna, Illinois
July, 2010 Historic Flash
Flood Event



Illinois 84 bridge was closed to traffic following the flood event



Raging floodwaters washed away two rows of support pylons under the Illinois 84 bridge

Photographs provided by Sally Marken



Many homes sustained serious damage as a result of the flood



July, 2010 Historic Flash Flood Event



Carroll Creek flooded Rock Point Park in Mount Carroll

Photographs provided by Sally Marken



Many streets and roads were closed due to flooding

July, 2010 Historic Flash Flood Event



Area farms also experienced flood damage

Photographs provided by Sally Marken



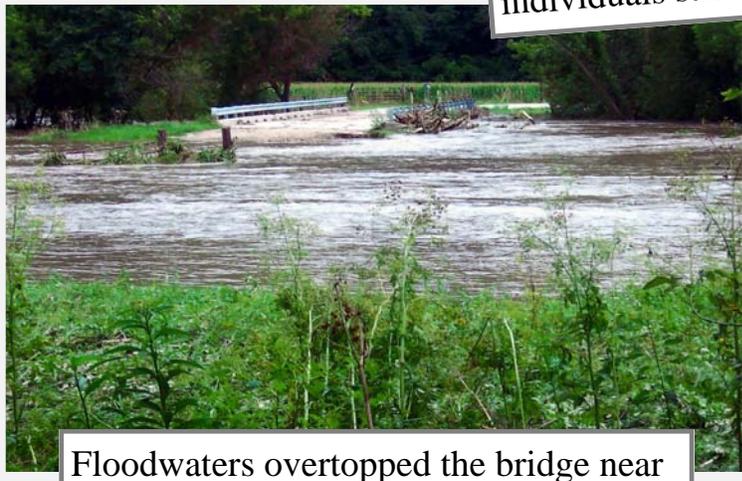
July, 2010 Historic Flash
Flood Event

Flooding on Illinois 84 north of
Savanna - in the background a
crane is submerged in water

Photographs provided by Sally Marken

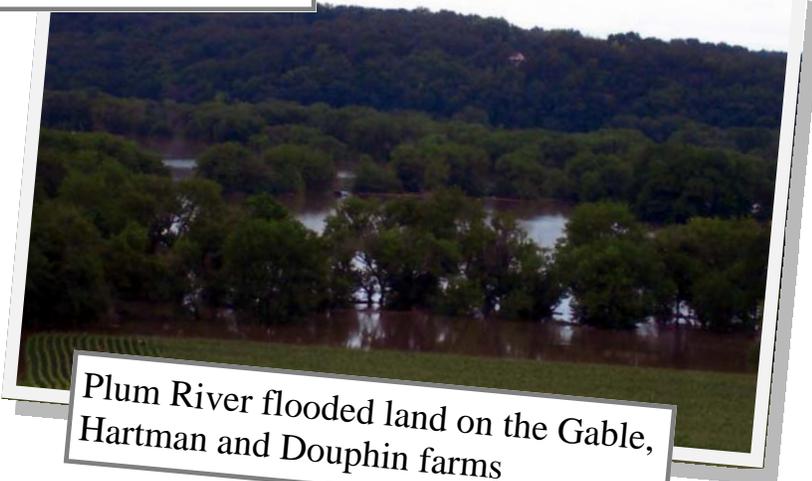


Savanna Fire and Rescue use a boat to help individuals stranded in flooded homes



Floodwaters overtopped the bridge near the intersection of Scenic Bluff Rd. and Jacobstown Rd.

July, 2010 Historic Flash Flood Event



Plum River flooded land on the Gable, Hartman and Douphin farms

Photographs provided by Leroy Getz

PLAN ADOPTION RESOLUTIONS

Carroll County, Illinois
Resolution of Adoption
of the
Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan

WHEREAS, Carroll County is subject to natural hazards including floods, tornadoes, severe winter storms, severe thunderstorms, and drought among others, that pose risks to public health and property; and

WHEREAS, the County of Carroll desires to prepare and mitigate for such natural hazards; and

WHEREAS, under the Disaster Mitigation Act of 2000, the United States Federal Emergency Management Agency (FEMA) requires that local jurisdictions have in place a FEMA-approved Hazard Mitigation Plan as a condition of receipt of certain future Federal mitigation funding after November 1, 2004; and

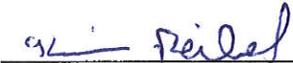
WHEREAS, the Carroll County Multi-Jurisdictional Natural Hazards Mitigation Plan was developed in accordance with the regulations of the Disaster Mitigation Act of 2000 and the guidance provided by FEMA; and

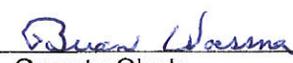
WHEREAS, Carroll County has participated in developing the Carroll County Multi-Jurisdictional Natural Hazards Mitigation Plan covering member jurisdictions of Carroll County:

NOW THEREFORE, be it resolved that the County of Carroll hereby:

1. Adopts the Carroll County Multi-Jurisdictional Natural Hazards Mitigation Plan as the official Hazard Mitigation Plan of Carroll County and
2. Agrees to participate in the annual and 5-year updates to this Plan.

ADOPTED on April 18, 2013

CERTIFIED by 
County Board Chairman

ATTESTED by  (SEAL)
County Clerk

Milledgeville, Illinois
Resolution of Adoption
of the
Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan

WHEREAS, the Village of Milledgeville is subject to natural hazards including floods, tornadoes, severe winter storms, severe thunderstorms, and drought among others, that pose risks to public health and property; and

WHEREAS, the Village of Milledgeville desires to prepare and mitigate for such natural hazards; and

WHEREAS, under the Disaster Mitigation Act of 2000, the United States Federal Emergency Management Agency (FEMA) requires that local jurisdictions have in place a FEMA-approved Hazard Mitigation Plan as a condition of receipt of certain future Federal mitigation funding after November 1, 2004; and

WHEREAS, the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan was developed in accordance with the regulations of the Disaster Mitigation Act of 2000 and the guidance provided by FEMA; and

WHEREAS, the Village of Milledgeville has participated in developing the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan covering member jurisdictions of Carroll County:

NOW THEREFORE, be it resolved that the Village of Milledgeville hereby:

1. Adopts the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan as the official Hazard Mitigation Plan of the Village of Milledgeville; and
2. Agrees to participate in the annual and 5-year updates to this Plan.

ADOPTED on April 29, 2013

CERTIFIED by Galen Wirth (SEAL)
Galen Wirth, President

ATTESTED by Christine Ottens
Christine Ottens, Clerk

Village of Chadwick, Illinois
Resolution of Adoption
of the
Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan

WHEREAS, the Village of Chadwick is subject to natural hazards including floods, tornadoes, severe winter storms, severe thunderstorms, and drought among others, that pose risks to public health and property; and

WHEREAS, the Village of Chadwick desires to prepare and mitigate for such natural hazards; and

WHEREAS, under the Disaster Mitigation Act of 2000, the United States Federal Emergency Management Agency (FEMA) requires that local jurisdictions have in place a FEMA-approved Hazard Mitigation Plan as a condition of receipt of certain future Federal mitigation funding after November 1, 2004; and

WHEREAS, the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan was developed in accordance with the regulations of the Disaster Mitigation Act of 2000 and the guidance provided by FEMA; and

WHEREAS, the Village of Chadwick has participated in developing the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan covering member jurisdictions of Carroll County:

NOW THEREFORE, be it resolved that the Village of Chadwick hereby:

1. Adopts the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan as the official Hazard Mitigation Plan of the Village of Chadwick; and
2. Agrees to participate in the annual and 5-year updates to this Plan.

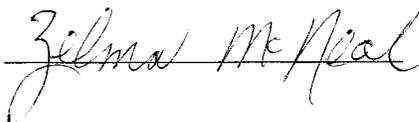
ADOPTED on

May 6, 2013

CERTIFIED by



ATTESTED by



Village of Thomson, Illinois
Resolution of Adoption
of the
Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan #434

WHEREAS, the Village of Thomson is subject to natural hazards including floods, tornadoes, severe winter storms, severe thunderstorms, and drought among others, that pose risks to public health and property; and

WHEREAS, the Village of Thomson desires to prepare and mitigate for such natural hazards; and

WHEREAS, under the Disaster Mitigation Act of 2000, the United States Federal Emergency Management Agency (FEMA) requires that local jurisdictions have in place a FEMA-approved Hazard Mitigation Plan as a condition of receipt of certain future Federal mitigation funding after November 1, 2004; and

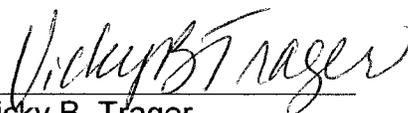
WHEREAS, the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan was developed in accordance with the regulations of the Disaster Mitigation Act of 2000 and the guidance provided by FEMA; and

WHEREAS, the Village of Thomson has participated in developing the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan covering member jurisdictions of Carroll County:

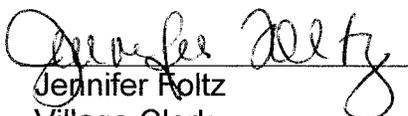
NOW THEREFORE, be it resolved that the Village of Thomson hereby:

1. Adopts the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan as the official Hazard Mitigation Plan of the Village of Thomson; and
2. Agrees to participate in the annual and 5-year updates to this Plan.

ADOPTED on May 06, 2013

CERTIFIED by 
Vicky B. Trager
Village President

VILLAGE SEAL

ATTESTED by 
Jennifer Holtz
Village Clerk

City of Lanark, Illinois
Resolution of Adoption
of the
Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan

WHEREAS, the City of Lanark is subject to natural hazards including floods, tornadoes, severe winter storms, severe thunderstorms, and drought among others, that pose risks to public health and property; and

WHEREAS, the City of Lanark desires to prepare and mitigate for such natural hazards; and

WHEREAS, under the Disaster Mitigation Act of 2000, the United States Federal Emergency Management Agency (FEMA) requires that local jurisdictions have in place a FEMA-approved Hazard Mitigation Plan as a condition of receipt of certain future Federal mitigation funds after November 1, 2004; and

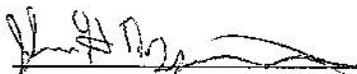
WHEREAS, the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan was developed in accordance with the regulations of the Disaster Mitigation Plan of 2000 and the guidance provided by FEMA; and

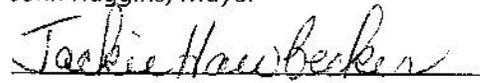
WHEREAS, the City of Lanark has participated in developing the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan covering member jurisdictions of Carroll County:

NOW THEREFORE, be it resolved that the City of Lanark hereby:

1. Adopts the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan as the official Hazard Mitigation Plan of the City of Lanark; and
2. Agrees to participate in the annual and 5-year updates of this Plan.

ADOPTED on 5-7-13

CERTIFIED by 
John Huggins, Mayor

ATTESTED by 
Jackie Hawbecker, City Clerk

The Village of Shannon, Illinois
Resolution of Adoption
of the
Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan

WHEREAS, the Village of Shannon is subject to natural hazards including floods, tornadoes, severe winter storms, severe thunderstorms, and drought among others, that pose risks to public health and property; and

WHEREAS, the Village of Shannon desires to prepare and mitigate for such natural hazards; and

WHEREAS, under the Disaster Mitigation Act of 2000, the United States Federal Emergency Management Agency (FEMA) requires that local jurisdictions have in place a FEMA-approved Hazard Mitigation Plan as a condition of receipt of certain future Federal mitigation funding after November 1, 2004; and

WHEREAS, the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan was developed in accordance with the regulations of the Disaster Mitigation Act of 2000 and the guidance provided by FEMA; and

WHEREAS, the Village of Shannon has participated in developing the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan covering member jurisdictions of Carroll County:

NOW THEREFORE, be it resolved that the Village of Shannon agrees to participate in the annual and 5-year updates to this Plan.

ADOPTED on May 9, 2013

CERTIFIED by Bonnie Foust (SEAL)
Village President

ATTESTED by Denise Borman
Village Clerk

City of Mt. Carroll, Illinois
Resolution of Adoption
of the
Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan

WHEREAS, the City of Mt. Carroll is subject to natural hazards including floods, tornadoes, severe winter storms, severe thunderstorms, and drought among others, that pose risks to public health and property; and

WHEREAS, the City of Mt. Carroll desires to prepare and mitigate for such natural hazards; and

WHEREAS, under the Disaster Mitigation Act of 2000, the United States Federal Emergency Management Agency (FEMA) requires that local jurisdictions have in place a FEMA-approved Hazard Mitigation Plan as a condition of receipt of certain future Federal mitigation funding after November 1, 2004; and

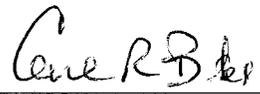
WHEREAS, the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan was developed in accordance with the regulations of the Disaster Mitigation Act of 2000 and the guidance provided by FEMA; and

WHEREAS, the City of Mt. Carroll has participated in developing the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan covering member jurisdictions of Carroll County:

NOW THEREFORE, be it resolved that the City of Mt. Carroll hereby:

1. Adopts the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan as the official Hazard Mitigation Plan of the City of Mt. Carroll; and
2. Agrees to participate in the annual and 5-year updates to this Plan.

ADOPTED on May 14, 2013

CERTIFIED by 
Carl R. Bates, Mayor

ATTESTED by 
Julie A. Cuckler, Clerk

(SEAL)

RESOLUTION # 1049

City of Savanna, Illinois
Resolution of Adoption
of the
Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan

WHEREAS, the City of Savanna is subject to natural hazards including floods, tornadoes, severe winter storms, severe thunderstorms, and drought among others, that pose risks to public health and property; and

WHEREAS, the City of Savanna desires to prepare and mitigate for such natural hazards; and

WHEREAS, under the Disaster Mitigation Act of 2000, the United States Federal Emergency Management Agency (FEMA) requires that local jurisdictions have in place a FEMA-approved Hazard Mitigation Plan as a condition of receipt of certain future Federal mitigation funding after November 1, 2004; and

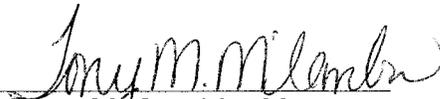
WHEREAS, the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan was developed in accordance with the regulations of the Disaster Mitigation Act of 2000 and the guidance provided by FEMA; and

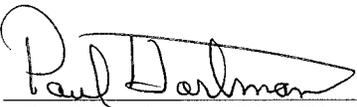
WHEREAS, the City of Savanna has participated in developing the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan covering member jurisdictions of Carroll County:

NOW THEREFORE, be it resolved that the City of Savanna hereby:

1. Adopts the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan as the official Hazard Mitigation Plan of the City of Savanna; and
2. Agrees to participate in the annual and 5-year updates to this Plan.

ADOPTED on May 14, 2013

CERTIFIED by 
Tony McCombie, Mayor

ATTESTED by 
Paul Hartman, City Clerk

SEAL

Milledgeville Illinois
Resolution of Adoption
Of the
Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan

WHEREAS, the Park District of Milledgeville is subject to natural hazards including floods, tornadoes, severe winter storms, severe thunderstorms, and drought among others, that pose risks to public health and property; and

WHEREAS, the Park District of Milledgeville desires to prepare and mitigate for such natural hazards; and

WHEREAS under the Disaster Mitigation Act of 2000, the United States Federal Emergency Management Agency (FEMA) requires that local jurisdictions have in place a FEMA-approved Hazard Mitigation plan as a condition of receipt of certain future Federal Mitigation funding after November 1, 2004; and

WHEREAS, the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan was developed in accordance with the regulations of the Disaster Mitigation Act of 2000 and the guidance provided by FEMA; and

WHEREAS, the Park District of Milledgeville has participated in developing the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan covering member jurisdictions of Carroll County;

NOW THEREFORE, be it resolved that the Park District of Milledgeville hereby:

1. Adopts the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan as the official Hazard Mitigation plan of the Park District of Milledgeville; and
2. Agrees to participate in the annual and 5-year updates to this plan.

ADOPTED ON: June 18, 2013

CERTIFIED BY: Kim Brown
 Kim Brown, President

ATTESTED BY: Corinne L. Nye
 Corinne L. Nye



THOMSON FIRE PROTECTION DISTRICT

P.O. BOX 276
THOMSON, ILLINOIS 61285

PHONE: (815) 259-8255
FAX: (815) 259-8255

Thomson Fire Protection District
Thomson, Illinois
Resolution of Adoption
of the
Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan

WHEREAS, the Thomson Fire Protection District is subject to natural hazards including floods, tornadoes, severe winter storms, severe thunderstorms, and drought among others, that pose risks to public health and property; and

WHEREAS, the Thomson Fire Protection District desires to prepare and mitigate for such natural hazards; and

WHEREAS, under the Disaster Mitigation Act of 2000, the United States Federal Emergency Management Agency (FEMA) requires that local jurisdictions have in place a FEMA-approved Hazard Mitigation Plan as a condition of receipt of certain future Federal mitigation funding after November 1, 2004; and

WHEREAS, the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan was developed in accordance with the regulations of the Disaster Mitigation Act of 2000 and the guidance provided by FEMA; and

WHEREAS, the Thomson Fire Protection District has participated in developing the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan covering member jurisdictions of Carroll County:

NOW THEREFORE, be it resolved that the Thomson Fire Protection District hereby:

1. Adopts the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan as the official Hazard Mitigation Plan of the Thomson Fire Protection District; and
2. Agrees to participate in the annual and 5-year updates to this Plan.

ADOPTED on 06/18/2013

CERTIFIED by Gary Iben
Gary Iben
Fire Chief

ATTESTED by Kenneth Walk President of District
Paul Moltmann
Fire District Trustee *for Paul*

Eastland Community Unit School District #308, Lanark, Illinois
Resolution of Adoption
of the
Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan

WHEREAS, Eastland Community Unit School District #308 is subject to natural hazards including floods, tornadoes, severe winter storms, severe thunderstorms, and drought among others, that pose risks to public health and property; and

WHEREAS, the Eastland Community Unit School District #308 desires to prepare and mitigate for such natural hazards; and

WHEREAS, under the Disaster Mitigation Act of 2000, the United States Federal Emergency Management Agency (FEMA) requires that local jurisdictions have in place a FEMA-approved Hazard Mitigation Plan as a condition of receipt of certain future Federal mitigation funding after November 1, 2004; and

WHEREAS, the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan was developed in accordance with the regulations of the Disaster Mitigation Act of 2000 and the guidance provided by FEMA; and

WHEREAS, Eastland Community Unit School District #308 has participated in developing the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan covering member jurisdictions of Carroll County:

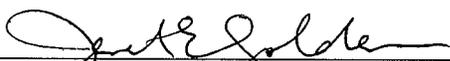
NOW THEREFORE, be it resolved that the Eastland Community Unit School District #308 hereby:

1. Adopts the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan as the official Hazard Mitigation Plan of Eastland Community Unit School District #308, and
2. Agrees to participate in the annual and 5-year updates to this Plan.

ADOPTED on June 19, 2013

CERTIFIED by 
(William Woesser, Board President)

(SEAL)

ATTESTED by 
(Jan Golden, Board Secretary)

West Carroll CUSD #314, Illinois
Resolution of Adoption
of the
Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan

WHEREAS West Carroll CUSD #314 is subject to natural hazards including floods, tornadoes, severe winter storms, severe thunderstorms, and drought among others, that pose risks to public health and property; and

WHEREAS, the West Carroll CUSD #314 desires to prepare and mitigate for such natural hazards; and

WHEREAS, under the Disaster Mitigation Act of 2000, the United States Federal Emergency Management Agency (FEMA) requires that local jurisdictions have in place a FEMA-approved Hazard Mitigation Plan as a condition of receipt of certain future Federal mitigation funding after November 1, 2004; and

WHEREAS, the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan was developed in accordance with the regulations of the Disaster Mitigation Act of 2000 and the guidance provided by FEMA; and

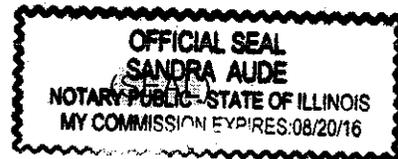
WHEREAS, West Carroll CUSD #314 has participated in developing the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan covering member jurisdictions of Carroll County:

NOW THEREFORE, be it resolved that the West Carroll CUSD #314 hereby:

1. Adopts the Carroll Multi-Jurisdictional Natural Hazards Mitigation Plan as the official Hazard Mitigation Plan of Carroll County; and
2. Agrees to participate in the annual and 5-year updates to this Plan.

ADOPTED on June 19, 2013

CERTIFIED by Craig A. Mathers
Craig A. Mathers,
Superintendent



ATTESTED by Sandra Aude
(NAME & TITLE)
Sandra Aude
Supt. Secretary