Stephenson County, Illinois

MULTI-HAZARD MITIGATION PLAN

DRAFT: October 17, 2008

County Board Adoption: Date

Vandewalle & Associates

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Executive Summary

What is Hazard Mitigation Planning?

It is safe to say that "hazard mitigation" is not a term used by most people as they go about their lives. Still, hazard mitigation could be critical to people's basic health, safety, and welfare.

Simply put, hazard mitigation is defined as any action taken to reduce the chance of a natural hazard from happening, or to reduce a natural hazard's impact on people or property when it does happen. Stephenson County can be affected by any number of natural and human-made hazards. These include major storms, extreme temperatures, and disease outbreaks. However, over its history, Stephenson County has been most heavily impacted by one hazard in particular: flooding. In fact, during this planning process, the Pecatonica River flooded once again.

Hazard mitigation planning helps communities to develop consensus around actions to reduce or eliminate the long-term risk to human life, health, safety, and property from hazards. **This Multi-Hazard Mitigation Plan is a collection of the various actions that Stephenson County, Freeport, and other communities in the County may take to mitigate hazards.** The actions fall into various categories and priority levels, cover different geographic areas, and address different types of hazards. The organization, contents, and data in the Plan are driven in part by the planning requirements of the Federal Emergency Management Agency (FEMA).

Stephenson County's Planning Process

The City of Freeport and the Stephenson County Emergency Management Agency (SCEM) took the first steps towards preparing this Plan in 2006. The initial impetus was the City's desire to identify flood mitigation priorities for its East Side neighborhood, which has been subject to fairly regular and sometimes major flooding over its history. However, it quickly became clear that other places in the City and County were also subject to flooding—mainly originating from the Pecatonica River and Yellow Creek—and other natural hazards. The County and City then agreed that it would make sense to prepare a comprehensive multi-hazard mitigation plan for the whole County, without losing sight of important local issues and details. Another critical consideration in preparing this Plan is that, following adoption, **this Plan makes the County and its communities eligible to apply for competitive grant funding for mitigation projects through FEMA.**

A Hazard Mitigation Planning Committee guided the development of this Plan over the course of about a year. The Committee included people with interest and/or expertise in responding to natural and human-made hazards and disasters; a knowledge of the types, locations, and severity of natural hazards in the past; interest and experience in hazard mitigation; and connections to key communities and neighborhoods. The Committee, its staff, and consultants also pursued public input throughout the planning process. This included reaching out to local governments, state and federal agencies, neighborhood groups, property and business owners, and the general public. Chapter 1: Planning Process, beginning on page 11, further describes the process undertaken to develop this Plan.

Hazard Identification and Risk Assessment

The Multi-Hazard Mitigation Plan, in Chapter 2: Planning Context (beginning on page 17) begins by painting a picture of how natural and other hazards have affected the County and its communities today and in the past. Key information regarding the County's geography, geology, climate, demographics, housing, employment, political jurisdictions, infrastructure, and emergency services are laid out. For instance, much of the County's population historically developed around rivers and streams—and their floodplains.

Based on historical research and reports from residents and agencies, the hazards that people and property are at risk of in Stephenson County generally include:

- **Flooding**, particularly resulting from seasonal and sometimes unpredictable overflow of the Pecatonica River and its tributaries—most notably the Yellow Creek.
- **Severe storms**, including hail, lightning, tornadoes, and severe winds

- **Severe winter storms**, including snow storms, ice storms, and blizzards.
- **Extreme temperatures**, including periods of extreme heat and extreme cold associated with Stephenson County's position in the nation's interior.
- **Drought**, which can significantly affect the County's strong farm economy and peoples' water supply.
- **Earthquakes**, which can sometimes affect the County, particularly resulting from shifts in the New Madrid fault.
- **Human-caused and disease-outbreak hazards**, like animal-borne diseases and possibly spill-over from incidents in nearby areas.

The Plan includes a "risk assessment" for each of these identified hazards in Chapter 3: Hazard Identification and Risk Assessment, beginning on page 25. This assessment helps determine how severe each hazard is, and how important hazard mitigation actions would be to address it. The risk assessment includes a history of hazard occurrences, a projection of the future probability of occurrences of each hazard, an assessment of the County's vulnerability to each hazard (e.g., how many people would be affected), and a projection of potential damages from future occurrences of each hazard.

Hazard Mitigation Goals

Armed with knowledge of the hazards that most affect Stephenson County, the Hazard Mitigation Planning Committee developed the following seven hazard mitigation goals, with input and review from the public:

- **Protect human lives, both today and for future generations**
- **Protect human and environmental health**
- **Prevent future development from increasing hazard vulnerability**
- **Preserve open space, including environmentally sensitive and agriculturally productive areas**
- **Protect critical facilities**
- **Help people to protect themselves**
- **Promote the use of partnerships in hazard mitigation**

These goals were used to prioritize hazard mitigation actions and strategies to address each hazard. Other factors were also critical in identifying and prioritizing strategies. These included community support, whether the strategy was technically feasibility, where it would be cost-effective, and what groups were available to carry them out. Chapter 4: Mitigation Goals and Strategies, beginning on page 81, further describes the goal-setting process and then outlines all of the hazard mitigation strategies.

The rest of this summary covers some of the highest priority mitigation strategies identified in this Plan. Readers are encouraged to review the entire Plan for a more complete review of these and other strategies.

Priority Mitigation Strategies for Multiple Hazards

In the course of preparing the Plan, it became apparent that certain strategies could be carried out following Plan adoption to address nearly all of the hazards listed above, such as:

- **Pursuing Regular Community Outreach and Education**. Educational efforts should focus on simple changes in behavior that can minimize risks. Education also needs to be constantly reinforced to be effective. County and local governments can provide communities with information about the effect of disasters, methods for preventing damages, and the actions to take when disasters threaten a locality.
- **Improving Coordination and Communication Among Emergency Responders.** Disasters cross jurisdictional boundaries and affect numerous aspects of a community—from physical safety, to economic stability, to environmental conditions. The County intends to continue to enhance its communication and coordination system, like through better connection of the various emergency responders through radio and through participating in the multi-county Prairie Shield Regional Alliance designed to address hazards and take advantage of resources that cross County boundaries.

- **Promoting and Implementing Modern Hazard Warning Systems**. The County intends to continue outreach efforts to encourage all institutions, businesses, and residents to have a National Oceanic and Atmospheric Administration (NOAA) weather radio for up to date warnings and directions on pending hazards. Additionally, the County will explore expanding its system of warning the public and local governments about impending hazards, such as through automatic e-mails, phone or text messages, and/or an updated Web page.

Regional Flood Hazard Mitigation: Pecatonica River Watershed Alliance

Since Pecatonica River flooding is an issue that extends across counties and states, there is an opportunity for the County to expand its planning and problem-solving efforts to the regional scale. The County will explore advancing a bi-state Pecatonica River watershed regional alliance, perhaps using the Prairie Shield Regional Alliance as a model or launching pad. This new alliance could include representatives of local governments and people representing environmental, hazard mitigation, economic development, and recreation interests. This alliance would help bring together diverse interests to partner to promote the long-term health and vitality of the Pecatonica River watershed, with goals that would include but not be limited to flood mitigation. The Rock River Coalition in southern Wisconsin is a successful example of such an alliance.

Freeport-Pecatonica River Flood Mitigation: A Comprehensive Approach

Flooding of the Pecatonica in the City of Freeport has significant impacts on the City's East Side—an older, diverse neighborhood east of the river—as well as businesses in the "Arcade" area west of the river and in the Lancaster and Van Buren Road areas to the north. Flood events fairly regularly include road and bridge closures and washouts and street, yard, and basement flooding. Occasionally, flooding of the Pecatonica has had more devastating effects, particularly on Freeport's East Side. Major floods like those in 1969, 1975, 1990, 1993, 1996, and 2000 have submerged the neighborhood under several feet of water, threatened lives, and caused major property damage.

The seriousness of the Pecatonica flooding issue in the City of Freeport—combined with the spotty success of past initiatives—points to a need for a comprehensive approach to addressing the problem. This approach must address flooding in a manner that respects the concerns of residents, property owners, and businesses, while effectively addressing public health and safety. The comprehensive initiative recommended for mitigating flooding in the Freeport-Pecatonica River floodplain includes the following strategies (see page 107 for the full strategy):

- **Pursue Regular Community Outreach and Education**, including partnering with the East Side Resident Task Force to help get the word out on activities of the flood mitigation approach to the rest of the neighborhood.
- **Update Official Floodplain Maps**, using modern hydrologic (water) models that reflect current conditions in and around the river, particularly to map accurate floodway boundaries.
- **Enhance Stormwater Management and Erosion Control**, such as through better storm drainage and infiltration systems and removal of obstructions in the river, to minimize the effect of flooding on private property and business activities.
- **Advance an Initiative of Voluntary Acquisition and Relocation**, to eliminate vulnerability to the most significant and recurring flood hazards altogether. To successfully implement a voluntary relocation initiative on the East Side, it will be critical for the City to keep community concerns at the forefront of program design and ongoing communication with residents. The Hazard Mitigation Plan has a lot more detail on this strategy.

Freeport-Yellow Creek Flood Mitigation: A Focus on the Future

The Yellow Creek—a Pecatonica River tributary that runs from west to east through the southern edge of the County and Freeport—can exceed its normal banks, particularly when the Pecatonica is also at flood stage. Current flooding and possibly increasing flood hazards in the future has been raised as a concern by community members in Freeport, particularly as this southern part of the City continues to be an area of interest for new development. The highest priority strategies for mitigating future flooding in the Freeport-Yellow Creek floodplain include the following (see page 111 for the full strategy):

- **Update Official Floodplain Maps**, using modern hydrologic models that reflect the growth of Freeport and its south side over the two decades since the current floodplain map was developed.
- **Improve Planning and Regulatory Practices,** like reserving areas for flood storage and stormwater management, so that current issues can be minimized and future development does not create more flooding.
- **Practice and Require Progressive Stormwater Management and Erosion Control**, so that newly developed and redeveloped areas near the Yellow Creek might actually result in reduced stormwater runoff impacts.
- **Protect Critical Facilities and Infrastructure**, particularly to prevent hazards due to washouts of the Highway 26 bridge.

Small Community Flood Mitigation: Learning from the Past

Small communities like Orangeville, Winslow, McConnell, and Pearl City are also subject to recurring and sometimes severe flooding. Like Freeport, flooding often results from the Pecatonica River (in Winslow and McConnell), the Yellow Creek (in Pearl City), and other tributaries of the Pecatonica (in Orangeville and Winslow). Flood events have often occurred in June and August, due to periods of intense rainfall. These have included an event in June 2000 when roughly one-half of Pearl City was submerged underwater, resulting in a Gubernatorial Disaster Declaration. Flood mitigation for small communities in Stephenson County will vary on a community-by-community basis (beginning on page 113 of the Plan, but several common recommended strategies include:

- **Update Official Floodplain Maps**, based on modern hydrologic models and actual historic experiences, to give better information to property owners and greater credibility to future efforts to regulate building in the floodplain.
- **Improve Planning and Regulatory Practices**, including keeping flood-prone areas in open space, connecting houses in some yard-flooding areas to public sewer systems, and adopting a local floodplain ordinance in Pearl City once floodplain maps have been updated to become more accurate.
- **Increase Access to Flood Insurance**, through partnerships to educate property owners on its availability and by enrolling in the National Flood Insurance Program in Pearl City, once a floodplain ordinance has been adopted.
- **Enhance Stormwater Management and Erosion Control**, including addressing areas where the Yellow Creek and other tributaries are constrained (e.g., undersized culverts), undertaking community-wide stormwater management planning efforts, and requiring good stormwater management practices in new private development projects, like subdivisions.
- **Pursue Acquisition of Certain Properties Most Affected by Flooding**, through being ready when such properties come available for sale—such as near Highway 26 in Orangeville.
- **Protect Critical Facilities and Infrastructure**, particularly facilities like fire stations and bridges that washout during times of flooding, restricting emergency access and evacuation routes to and from the communities.
- **Pursue Regular Community Outreach and Education**, in partnership with the County and others, to clearly communicate the goals and impacts of floodplain maps, and floodplain and stormwater management regulations.

Implementing the Plan: Partnerships and Perseverance

Adoption of this Plan provides the County, the City, and smaller communities with a coordinated approach for prioritizing hazard mitigation activities over the next five or so years. Additional work, analysis, and participation will be necessary before many of these strategies can be carried out through action. Chapter 5: Plan Adoption and Implementation (beginning on page 131) details the implementation strategy.

Also, local communities will need the technical support of the Stephenson County Emergency Management Agency (SCEM) to implement many of the recommended mitigation strategies. SCEM will prioritize its mitigation efforts by focusing assistance on areas most vulnerable to the most significant hazards, and where there is visible and consistent community support for hazard mitigation. Communities demonstrated their commitment to

hazard mitigation through participation in this planning process, and can continue to do so by partnering with SCEM to implement this Plan.

Finally, many of the strategies recommended in the Plan can occur only if outside financial support through FEMA and other sources is garnered. The Plan has been written to position the County and its communities for this support, with full recognition and respect for the funding criteria of these agencies. The County, the City, and smaller communities will pursue funding for priority strategies identified in the Plan as opportunities present themselves.

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Chapter 1: Planning Process

Chapter 1 of the Stephenson County Multi-Hazard Mitigation Plan documents the process followed to develop the plan, including how it was prepared and who was involved in the planning process.

PLAN DEVELOPMENT

The development of this Plan was initiated by the City of Freeport and the Stephenson County Emergency Management Agency in 2006. The initial impetus for developing this Plan was the City's desire to identify flood mitigation priorities for the East Side neighborhood in Freeport (the most populated flood-prone area of the County), as part of the City's work to implement the East Side Revitalization Strategy that was in draft form at the time. Upon consulting with the Illinois Emergency Management Agency and Illinois Department of Natural Resources, the City and County determined that the best approach would be to develop a county-wide Multi-Hazard Mitigation Plan, compliant with the Disaster Mitigation Act of 2000 (described further below). Completion of this Plan would then make the County, City, and all other participating municipalities eligible for grant funding for mitigation projects.

In April 2006, Stephenson County and the City of Freeport worked together to prepare a Flood Mitigation Planning grant application to the Illinois Emergency Management Agency (IEMA). In October 2006, the County was awarded this grant. The County used this grant in conjunction with additional funding from both the County and the City of Freeport to hire Vandewalle & Associates to help create a Countywide Multi-Hazard mitigation plan. Work on the plan began in January 2007, and the Plan was submitted to the IEMA for review and approval in June 2008. The Plan received approval from IEMA and FEMA in October 2008, contingent on adoption by the participating jurisdictions. A final plan was approved by the Stephenson County Board on [To be determined].

Benefits of Hazard Mitigation Planning

Hazard mitigation planning serves as a very useful tool for the County and individual communities to develop consensus around a plan of action to reduce or eliminate the long-term risk to human life and property from hazards. Specifically, the development of this plan will:

- Increase public awareness of risks of hazards in the County
- Establish hazard mitigation goals and priority mitigation strategies
- Establish priorities for the use of public resources to mitigate hazards
- Identify strategic partners to help implement the mitigation strategies
- Enable the County and participating municipalities to become eligible to apply for grants from FEMA for both pre-disaster and post-disaster mitigation projects

Additionally, implementation of this plan will:

- Reduce the cost of recovering from natural hazards by decreasing damage
- Prevent injury and death to people exposed to hazards
- Speed emergency response to, and recovery from disasters

Disaster Mitigation Act of 2000

The development of the Stephenson County Multi-Hazard Mitigation Plan is a response to the passage of the Disaster Mitigation Act of 2000 (DMA), which was signed into law by the U.S. Congress on October 30, 2000, with the goal of reducing losses and future public and private expenditures, and improving response and recovery from disasters. This act, Public Law 106-390, amended the Robert T. Stafford Relief and Emergency Assistance Act.

The Act establishes that by November 1, 2004, local governments and tribal organizations must prepare a multi-hazard mitigation plan in order to be eligible for funding from the FEMA Pre-Disaster Mitigation Assistance Program and Hazard Mitigation Program. If a plan is not prepared by November 1, 2004, and a major disaster is declared, a

local government or tribal organization must agree to prepare a multi-hazard mitigation plan within one year to be eligible for funding from the Hazard Mitigation Grant Program.

The Act requirement that natural hazards be addressed in the risk assessment and vulnerability analysis sections of the multi-hazard mitigation plan. Assessment of human caused hazards, such as hazardous waste spills, is encouraged but not required.

PLANNING PROCESS

Process Overview

The first step in the planning process was to organize the resources available through local, state, and federal organizations, and to organize a Hazard Mitigation Planning Committee to bring together people in the County with interest and/or expertise in disaster response, disaster history, and hazard mitigation.

The local outreach effort was then expanded to include representatives of municipalities in the County as well as residents and other stakeholders to collect a thorough understanding of hazard vulnerability and history of disasters in each community. After the hazards were identified, the project team determined the potential damage and impact of each hazard.

Armed with an understanding of the risks posed by natural hazards and knowledge of vulnerable areas as identified by municipalities, local residents and business owners, and/or Stephenson County Emergency Management, the project team identified possible ways to avoid or minimize the damage to these areas through new as well as existing planning, education, and regulatory measures.

The project team then identified ways that the County and participating municipalities can bring the hazard mitigation plan to life. To ensure a successful long-term plan, a process for future reviews and updates to the plan and ways to measure the communities' progress in decreasing damage caused by hazards is identified in the plan.

Hazard Mitigation Planning Committee

The plan was prepared under the guidance of staff of the Stephenson County Emergency Management Agency (SCEM), the City of Freeport Community Development Department, and an advisory Hazard Mitigation Planning Committee. The Committee held four meetings during major junctures of the planning process. The Committee assisted in identifying areas and populations vulnerable to hazards, setting mitigation goals, evaluating mitigation strategies, and developing the implementation plan. The Committee also reviewed and approved draft reports prior to submittal to IEMA. The Committee included representatives of the following organizations:

- American Red Cross (Northwest Illinois Chapter)
- City of Freeport East Side Resident Task Force
- City of Freeport Fire Department
- City of Freeport Planning Commission
- City of Freeport Police Department
- FHN *(formerly referred to as Freeport Health Network)*
- Freeport Park District
- Freeport School District
- Stephenson County Health Department
- Stephenson County Board, Planning and Development Committee
- Stephenson County Sheriff's Office
- Stephenson County Soil & Water Conservation District
- University of Illinois Extension - Stephenson County
- Yellow Creek Watershed Partnership

GOVERNMENT, PUBLIC, AND STAKEHOLDER INVOLVEMENT

Involvement of Local Governments

Project Kick-off / Risk Assessment Public Meetings

SCEM and the City of Freeport organized two kick-off meetings in March and April 2007 to provide local government representatives and community members with information about the purpose and benefits of the plan and an overview of the planning process. Additionally, participants were asked at these meetings to provide information on historical occurrences of disasters and areas of disaster vulnerability. Participants were also asked to provide their goals for the hazard mitigation plan and to identify strategies that they wanted to be evaluated as part of the planning process.

The first kick-off meeting was held on March 29, 2007 in the City of Freeport and was aimed at Freeport residents and officials. The second meeting was held on April 4, 2007 at the County Highway Building and was targeted to the officials and residents of the ten villages and the unincorporated areas in the County. The meetings were advertised in public meeting notices through the County and City, press releases to local media, flyers posted in public places, and invitations sent directly to Stephenson County Board members, village officials, fire districts, townships, City of Freeport alderpersons and planning commission members, and City of Freeport East Side Resident Task Force members. The East Side has been particularly vulnerable to flooding over the years.

Officials from the City of Freeport, the Village of Orangeville, the Village of Ridott, and unincorporated areas of the County attended these meetings in addition to residents from throughout the County.

Mitigation Strategies Public Meetings

In July 2007, two public meetings were held to present the initial results of the hazard risk assessment and to seek input from local government representatives and County residents on potential mitigation strategies to be evaluated in the plan.

The first meeting was held on July 12, 2007 in the City of Freeport and was aimed specifically at Freeport officials, residents of Freeport's East Side neighborhood, and businesses within the Pecatonica River floodplain. The second meeting was held on July 17, 2007 at the County Highway Building and was targeted to officials and residents of the City of Freeport, the ten villages in the County, and the unincorporated areas. The meetings were advertised in public meeting notices through the County and City, press releases to local media, flyers posted in public places, and invitations sent directly to Stephenson County Board members, village officials, fire districts, townships, City of Freeport Alderpersons and Planning Commission members, City of Freeport East Side Resident Task Force members, and businesses within the Freeport Pecatonica River floodplain.

Officials from the City of Freeport, the Village of Orangeville, the Village of Ridott, the Village of Davis, the Village of Pearl City, and several unincorporated areas (townships) of the County attended these meetings in addition to residents from throughout the County.

Hazard Mitigation Planning Committee Meetings

Representatives of the County and all municipalities in the County were invited to participate in the Hazard Mitigation Planning Committee. The following jurisdictions were represented at these meetings:

March 9, 2007: Stephenson County and the City of Freeport

May 11, 2007: Stephenson County and the City of Freeport

September 26, 2007: Stephenson County, the City of Freeport, and the Villages of Dakota, German Valley, Orangeville, and Ridott

February 12, 2008: Stephenson County, City of Freeport, and the Villages of Pearl City, Ridott, Orangeville, and Winslow

Additional Local Government Outreach Efforts

On June 12, 2007, Vandewalle & Associates met separately with representatives of the two villages that are vulnerable to flooding hazards that were unable to participate in the April 4 public meeting: the Villages of Winslow and Pearl City. The goal of these meetings was to seek information on areas of hazard vulnerability, disaster, history, and input on potential mitigation strategies to be evaluated. Because vulnerability to hazards other than flooding was determined to be County-wide in nature (rather than unique for specific municipalities), only those communities with flooding hazard vulnerability were reached out to specifically in this follow-up effort.

Involvement of the Public and Project Stakeholders

Hazard Mitigation Planning Committee

The Hazard Mitigation Planning Committee, described above, was developed to represent a wide variety of local organizations that play a role in hazard mitigation and/or response. Consequently, the Committee served as a forum of involving some of the most critical stakeholders throughout the planning process.

Public Meetings

The four meetings described in the above section, held on March 29, April 4, and July 12, and July 17, 2007, provided an opportunity not only for local government representatives to participate in the planning process, but also for community residents and other stakeholders to participate.

Stephenson County Unified Command Planning Committee

On June 26, 2007, Vandewalle & Associates attended a meeting of the Stephenson County Unified Command Planning Committee. This Committee represents all of the local and regional government agencies and organizations responsible for emergency response services throughout the County, as described in the County's Emergency Operations Plan. At this meeting, Vandewalle & Associates presented an overview of the goals of and planning process for of the Multi-Hazard Mitigation Plan and elicited input from Committee members on hazard vulnerability in the County and potential mitigation strategies.

Businesses within the Freeport Pecatonica River Floodplain

On June 12, 2007, Vandewalle & Associates facilitated a focus group of businesses located within the Freeport Pecatonica River floodplain. The goal of this meeting was to understand historical experiences these businesses have had with flooding and to elicit input on potential mitigation strategies.

City of Freeport East Side Resident Task Force

On June 12, 2007, Vandewalle & Associates attended a meeting of the City of Freeport East Side Resident Task Force (ESRTF). The ESRTF is composed of residents and leaders from the East Side neighborhood that meets once per month with City of Freeport staff and works to implement the East Side Revitalization Strategy. At this meeting, Vandewalle & Associates and SCEM and City of Freeport staff presented on the purpose of the Multi-Hazard Mitigation Plan. The meeting also focused on potential flood mitigation strategies specific to the East Side neighborhood so that ESRTF members could provide input on strategies being evaluated. Lastly, the ESRTF was asked for input on the format and agenda of the July 12, 2007 public meeting targeted to East Side residents and businesses.

On February 12, 2008, Vandewalle & Associates met again with the ESRTF. An overview of the draft Plan was presented at this meeting. Vandewalle & Associates and the City asked ESRTF members to review the document during the public review period.

Local Disaster Historians Focus Group

One June 12, 2007, Vandewalle & Associates facilitated a meeting with County residents that were identified by SCEM and City of Freeport staff as having unique knowledge of disaster history in the City and County. Included in this group were two former Freeport mayors and other long time City of Freeport residents with keen interest in and knowledge of area history.

Involvement of Adjacent Jurisdictions and Government Agencies

SCEM extended an invitation for a meeting on June 12, 2007 to representatives of the National Weather Service (NWS) Quad Cities Office, Department of Natural Resources (IDNR) Office of Water Resources, Illinois Emergency Management Agency (IEMA) Region 2, Illinois Department of Transportation (IDOT) District 2, Army Corps of Engineers (ACE) Rock Island District, and the emergency management staff from all of the counties in Illinois and Wisconsin adjacent to Stephenson County. The purpose of this meeting was to discuss the goals of the Stephenson County Multi-Hazard Mitigation Plan, to discuss issues of hazard vulnerability in the region, and to discuss opportunities for cross-jurisdictional and intergovernmental mitigation efforts.

Meeting attendees included representatives from NWS, IEMA, ACE, SCEM, and Vandewalle & Associates. Additionally, Vandewalle & Associates had follow-up correspondence on mitigation techniques with IDNR, IEMA, and FEMA. Emergency management directors from adjacent counties were unable to attend the meeting on June 12. However, the draft Multi-Hazard Mitigation Plan was mailed to all of these counties on February 28, 2008 to seek their input on the draft plan. No comments were received from these adjacent counties.

Public Review Process

Opportunities for public comment and plan review were provided during the drafting stages and prior to adoption. A copy of the draft plan was made available for a two-month public comment period at the Freeport Public Library, at the Stephenson County Emergency Management Agency, and online. Comments and questions about the Plan were directed to the Stephenson County Emergency Management Department and City of Freeport Community Development Department. Revisions were made to the plan to address the comments received. Vandewalle & Associates gave a public presentation of the final plan at a Freeport City Council meeting on November 3, 2008, to which all participating jurisdictions were invited. After this presentation, each participation jurisdiction brought the Plan to its governing body for adoption.

INCORPORATED PLANS, STUDIES, REPORTS, & TECHNICAL DATA

The following is a list of some of the primary references and data sources used for preparation of this plan. Many other sources were used and are cited throughout the Plan.

- Stephenson County Disaster Plan (2006)
- Illinois Natural Hazard Mitigation Plan (2004)
- Flood Insurance Study for Stephenson County (Unincorporated Areas) (1982)
- Flood Insurance Study for the City of Freeport, Illinois (1976)
- Flood Insurance Study for the Village of Pearl City, Illinois (1989)
- Flood Insurance Study for the Village of Winslow, Illinois (1982)
- Future Land Use Plan for Stephenson County, Illinois (2000)
- County and local zoning and subdivision regulations
- National Oceanic and Atmospheric Administration (NOAA) National Database of U.S. Storm Events
- City of Freeport East Side Revitalization Strategy (2007)
- Army Corps of Engineers Reconnaissance Report for General Investigations Study: Freeport on Pecatonica River, Illinois (1995)
- County and municipal zoning and subdivision ordinances and land use plans

- Rock River Basin Assessment, Illinois EPA (2006)
- National Weather Service – Quad Cities Service Guide (2007)

Chapter 2: Planning Context

Chapter 2 of the Stephenson County Multi-Hazard Mitigation Plan provides geographic, demographic, and political context for the County. The information provided in this chapter provides a context for hazard mitigation strategies.

PHYSICAL GEOGRAPHY

Stephenson County is located in the northwestern corner of Illinois and covers 565 square miles. Stephenson County is bordered on the west by Jo Daviess County and on the east by Winnebago County. To the south, Stephenson shares a border with Ogle and Carroll Counties. The northern border is shared with Green and Lafayette Counties in Wisconsin.

Stephenson County is on the southeastern edge of an unglaciated hilly region of Wisconsin and northwestern Illinois called the Driftless Area. Approximately 73% of the County is comprised of prime farmland.[1]

The most prominent natural feature in Stephenson County is the Pecatonica River, which runs from Iowa County in southwest Wisconsin south into northern Illinois and east to the Rock River in Illinois' Winnebago County. Stephenson County is frequently affected by flooding of the Pecatonica River and various area creeks, primarily Yellow Creek. Most of these creeks are tributaries to the Pecatonica such that when the Pecatonica is at flood stage, the water levels in the tributaries are also significantly affected.

Adequately assessing flood hazards requires acknowledging that floods occur over geographical areas defined by a watershed which is not solely within the bounds of political jurisdictions. A watershed is an area that drains to a common waterway, such as a river, wetland, lake, or ocean. Every small watershed is part of a larger one; the Pecatonica River runs to the Rock River and subsequently the Mississippi River, and therefore the Pecatonica River's watershed is part of the Lower Rock and Upper Mississippi Watersheds.[2] This hierarchy of watersheds demands that jurisdictions within watersheds work together to effectively manage flood risk and minimize potential damage. Within a watershed, development upstream also directly affects communities downstream.

The Pecatonica River Watershed covers over 500,000 acres in Winnebago, Stephenson, Jo Daviess, and Carroll counties, and Stephenson County is located almost entirely within the watershed. [3] The City of Freeport, Stephenson County's largest municipality, is the largest city within the Pecatonica River Watershed. Stephenson County is also 91% encompassed by the Rock River Watershed—the third largest watershed in Illinois and is also the third most urbanized [4]

As the County is just on the outside edge of the Driftless Area, it gently rolling. The average slope in Stephenson County is 2.3% with a total relief range of about 470 feet.

[1] Illinois Environmental Protection Agency. *Rock River Basin Assessment*. 2006. http://www.epa.state.il.us/water/watershed/facility-planning/rock-basin.pdf
[2] UW-Extension Natural Ressources Education. *Grant-Platte and Sugar-Pecatonica Basins*. http://basineducation.uwex.edu/gpsp/
[3] Illinois Environmental Protection Agency, *Pecatonica River Watershed*, http://www.epa.state.il.us/water/water-quality/report-1996/fact-sheets/fact-sheet-07.html
[4] Illinois Environmental Protection Agency. *Rock River Basin Assessment.*

Within the Rock River Basin, the problem of soil erosion varies according to slope. Although flat upland areas have lower potential for soil erosion, they also have poor drainage, fine textured underlying sediments, high water tables, and wet soils. These conditions may result in stream and channel erosion and sedimentation in streams and lakes.[5] In the Sugar-Pecatonica Watershed, about half of the farmland is cultivated using soil saving methods. However, due to the slope of the ground, much of the region's soil is being eroded faster than it is being replaced.[6]

The erosion process is particularly damaging because it causes the slope of the landscape to increase, which results in poor growth of crops and more exposure of bare soil that can easily be eroded. This cycle has the potential to remove fertile soil and affect the farming yield. Farmers can use soil conservation methods to break this cycle and retain their topsoil, and help everyone in the watershed by decreasing flood potential, washouts, and water quality impacts.

[5] Ibid
[6] Illinois Department of Natural Resources. *The Sugar-Pecatonica Rivers Basin: An Inventory of the Region's Resources* http://dnr.state.il.us/orep/c2000/assessments/sugar_pecatonica/areataglance.htm

Map 1: Regional Context Land Cover

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GEOLOGY

Galena and Platteville dolomite make up the largest portion of bedrock in Stephenson County.[7] Dolomite is easily dissolved by weak acids in the groundwater and substantial dissolution can lead to the formation of sinkholes. Between the Sugar River and Raccoon Creek are some of the best dolomite prairies left in Illinois.[8] However, according to SCEM, sinkholes have not, to date, been documented in the County. Consequently, mitigation strategies for sinkholes are not included in this Plan.

CLIMATE

Illinois is at the crossroads of continental climate zones,[9] giving Stephenson County changeable weather with a wide range of temperature extremes.[10] This variation is driven by the major contrasts in solar energy experienced at this latitude between the seasons—three to four times as much solar energy in early summer than in early winter, resulting in warm summers and cold winters. This climatic variation is also caused by the unique weather system in Illinois. The polar jet stream is frequently located near or over Illinois resulting in a weather system of low-pressure storm systems including clouds, winds, and precipitation.[11]

The annual mean temperature in Stephenson County is 46.5 degrees F with average temperatures ranging from an average low of 9 degrees F in January to an average high of 82 degrees F in July.[12] Average precipitation is about 35 inches annually and the greatest precipitation occurs in March through September from thunderstorms. The average annual snowfall in the County is 32.5 inches.

DEMOGRAPHICS

According to the U.S. Census, in 2006, Stephenson County had an estimated population of 47,388. Over half of this population—estimated at 25,254—is in the City of Freeport. The County's population has remained relatively steady, growing by nearly 2% between 1990 and 2000 and decreasing by the same amount from 2000 to 2005. The Villages of Lena, Orangeville, and Winslow experienced the greatest percentage of population growth from 1990 to 2000, the Villages of Cedarville and Dakota decreased in population during this time, and the population in the City of Freeport and other Villages remained relatively steady.

In 2000, Stephenson County's median household income was $40,366, a 42% increase from 1990. Median household income in Freeport rose at a similar rate as County income between 1990 and 2000—a 43% increase. However, at $35,399, Freeport's median household income in 2000 was 14% lower than that of the County as a whole.

The percent of residents in the County with a high school education or beyond increased from 77% in 1990 to 84% in 2000 and the percent of residents with a bachelor's degree or beyond increased from 14% in 1990 to nearly 16% in 2000. These trends were similar in the City of Freeport as percentage of high school graduates increased from 74% to 82% between 1990 and 2000 and percentage of residents with bachelor's degrees increased from 14% to 17%.

In 2000, 11% of Stephenson County residents were minorities and 19% of Freeport residents were minorities.

[7] Illinois State Geological Survey. *Illinois Bedrock Geology Map.* http://www.isgs.uiuc.edu/nsdihome/browse/statewide/bedgeob.gif
[8] Illinois Department of Natural Resources, *The Sugar-Pecatonica Rivers Basin.*
[9] Ibid.
[10] Illinois Environmental Protection Agency. *Rock River Basin Assessment.*
[11] Illinois Emergency Management Agency. *Illinois Natural Hazard Mitigation Plan.* 2004.
[12] Midwestern Regional Climate Center website. http://mcc.sws.uiuc.edu/climate_midwest/maps/il_mapselector.htm

HOUSING

Between 1990 and 2000, Stephenson County saw a 6.5% growth in total housing units and a 4.6% increase in occupied housing units. Among occupied units, owner occupancy remained steady at approximately 71% between 1990 to 2000. Monthly mortgage payments increased by nearly 50%, and the median rent increased by about 35% (U.S. Decennial Census).

EMPLOYMENT

The labor force in Stephenson County has remained relatively steady since 1990, increasing by about 2% between 1990 and 2000. However, the number of employed persons working in agriculture decreased by 83% during that decade. As of 2002, manufacturing, retail trade, administrative support, and waste management and remediation service were the industries employing the largest number of people in Stephenson County (U.S. Decennial Census).

POLITICAL JURISDICTIONS

Governmental units within the County include one city, 10 villages, and 18 townships. The City of Freeport is the County seat and contains approximately 55% of the County's population with 26,443 people. The County is governed by the Stephenson County Board, containing 22 supervisors elected from 11 urban and rural districts.

UTILITIES

"Lifeline" systems, including communication, transportation, power, water, and sewer, should be designed to be as hazard-resistant as economically possible. Damage to any one of these infrastructure components can cripple a community at any time, and can make disaster recovery much more difficult.

ComEd is the electricity provider to the County and Nicor Gas is the natural gas supplier. US Cellular and Verizon provide the majority of cellular phone coverage.

Currently, the City of Freeport and all villages except for the Village of Ridott have sanitary sewer and potable water systems. The unincorporated areas rely on private on-site waste treatment (septic) systems and private on-site wells other than the housing communities of Willow Lake and Lake Summerset which provide water and sewer. The City of Freeport and all of the villages maintain their own wastewater treatment facilities, as do the three manufactured home parks in the unincorporated areas of the county.

TRANSPORTATION INFRASTRUCTURE

The main highways in the County are US Highway 20 and State Highways 26, 73, and 75. Over 428 million average vehicle miles were traveled in Stephenson County in 2006 at an average of about 1,173,000 miles per day

A stretch of the Canadian National Railway runs generally east-west through Stephenson County and Freeport. The railway passes through Freeport, runs parallel to US Highway 20 to Lena and then runs parallel to West Stage Coach Road to the Stephenson-Jo Daviess county line. Freight on Canadian National line includes petroleum and chemicals, grain, fertilizers, coal, metals and minerals, forest products, and automobiles.[13]

The Pecatonica River is designated as a navigable waterway, but neither public nor private barges use this waterway for river transport.

[13] CN Website. *Company Information*. http://www.cn.ca/about/company_information/cn_snapshot/company_profile/en_AboutCompanyProfile.shtml

There are 13 airports/airfields in operation in Stephenson County. The Albertus Airport in Freeport is a publicly owned airport for public use. A full range of services is available at this airport as well as an active flight school. The Freeport/Dornink Airport is privately owned for public use. All other airfields in the county are privately owned for private use, and are usually quite small.

EMERGENCY SERVICES

During disaster events, the Stephenson County Emergency Management manages the Emergency Operations Center which supports the Unified Command and Incident Command functions in the County.

There are two Emergency 911 Communications Centers in the County—one for the City of Freeport and one for the rest of the County. These Centers broadcast to emergency service providers throughout the County.

Fire protection in Stephenson County is provided by 13 fire departments that participate in the Mutual Aid Box Alarm System, which allows fire departments to summon pre-determined additional resources. Fire Departments provide mutual aid in the case of extreme demand.

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Chapter 3: Hazard Identification and Risk Assessment

Analyzing the hazards in the County is an important and necessary step to help identify potential risks and to prioritize mitigation projects that will minimize those risks. This chapter includes an assessment of the hazards that can affect Stephenson County as well as an assessment of the risk of loss of life and property from hazards based on the future probability of and vulnerability to hazards.

HAZARD IDENTIFICATION

Stephenson County is at risk for the following natural hazards:

1. Flooding
2. Severe Storms (including hail, lightning, tornadoes, and severe winds)
3. Severe Winter Storms
4. Extreme Temperatures
5. Drought
6. Earthquakes

Additionally, the County is vulnerable to the following hazards that are either caused by humans or are disease outbreaks, as identified in the Stephenson County Disaster Plan.

1. Foreign animal disease outbreaks (including Foot and Mouth Disease, West Nile Virus, and Avian Flu)
2. Hazardous materials incidents
3. Transportation accidents on roadways, rail, or in aircraft
4. Major fires/explosions
5. Civil disturbances
6. Terrorism, including bomb threats and agroterrorism, occurring either in Stephenson County or nearby metropolitan areas
7. Regional or national health emergencies
8. Peacetime radioactive incidents, potentially associated with the nuclear power plant in nearby Byron
9. Energy shortages and blackouts

The sources that were used to identify the hazards that are addressed in this plan include the following:

- Illinois Natural Hazard Mitigation Plan (2004)
- Stephenson County Emergency Management (SCEM) records
- National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center
- Stephenson County Disaster Plan
- Hazard Mitigation Planning Committee members, local government representatives, and members of the public

Table 1 identifies the risk rating assigned to each of these hazards in the Illinois Natural Hazard Mitigation Plan. The hazard ratings were devised by scoring each County for each hazard in five areas:

1. Future Probability (based historical occurrences in past 50 years)
2. Vulnerability (based on calculating percentage of people in the County that could be impacted)
3. Severity of Impact (based on worst conceivable impacts to life and property)
4. Population (based on 2000 U.S. Census)
5. Population Growth (based on projected 10-year population increase)

The scores for items 1 – 3 were also each weighted six times as much as items 4 and 5. The scores were then totaled, and each score then corresponded to one of five categories:

1. Low (0 to 12 points)
2. Guarded (13 to 24 points)

3. Elevated (25 to 36 points)
4. High (37 to 48 points)
5. Severe (49 to 60 points)

Table 1: Illinois Natural Hazard Mitigation Plan Hazard Rating

Hazard	Illinois Hazard Rating
Flooding	Elevated
Severe Storms	Severe
Tornado	Elevated
Severe Winter Storms	High
Drought	Guarded
Extreme Heat	Elevated
Earthquake	Guarded

Stephenson County has been the subject of three Presidential Disaster Declarations due to flooding—one each in 1973, 1993, and 2007—and one Gubernatorial Disaster Declaration in 2000. Two Presidential Emergency Declarations are also on record as a result of Blizzards and/or Snowstorms in 1979 and 2006.

Although the history of Presidential and Gubernatorial Disaster Declarations in Stephenson County highlights the most severe disasters, it does not wholly capture the hazards that Stephenson County has experienced and to which it is vulnerable. The NOAA National Database of U.S. Storm Events identifies 290 severe weather events from 1950 to 2007, which have resulted in 1 death, 5 injuries, $12,932,000 of property damage, and $255,148,000 of crop damage. This database lacks full information on both the historical occurrences and impacts of disasters in the County. Consequently, this plan supplements NOAA data with information from additional organizations and local residents to fully understand the risk of disasters in Stephenson County.

Table 2: Presidential and Gubernatorial Disaster and Emergency Declarations

Date	Type of Declaration	Disaster Event	Total Damages
April, 1973	Disaster Declaration	Flood	Unknown
January, 1979	Emergency Declaration	Blizzard & Snowstorm	Unknown
September, 1983	Gubernatorial Disaster Declaration	High temperature and Drought	Unknown
July, 1993	Disaster Declaration	Flood	$21,000,000
July, 1996	Disaster Declaration	Flood	$575,000
June, 2000	Gubernatorial Disaster Declaration	Flood	$345,000
May, 2002	Gubernatorial Disaster Declaration	Flood (Pearl City only)	Unknown
November, 2006	Emergency Declaration	Snowstorm	$88,018
August, 2007	Disaster Declaration	Flood	Not yet calculated
Sources: FEMA, Illinois Natural Hazard Mitigation Plan, Stephenson County, City of Freeport			

RISK ASSESSMENT

The following section provides an assessment of risk associated with each of the hazards that have historically affected Stephenson County. The risk assessment incorporates the following for each hazard:

- A description of the hazard
- An overview of historical occurrences of the hazard in the County
- An assessment of vulnerability to the hazard throughout the County
- A projection of the future probability of occurrences of the hazard in the County
- An projection of potential damages from future occurrences of the hazard in the County

Areas of hazard vulnerability are illustrated in the maps at the end of this Chapter. Additionally, additional detail on historical occurrences of hazards in the County is provided in Appendix A.

Flooding

Flooding Hazard Overview

Flooding is defined as a partial or total inundation of normally dry land from the overflow of inland waters or rapid accumulation or run-off of surface waters from any source. Flooding severity is impacted by amount of rainfall (or other source of water such as melted snow), duration of rainfall, topography, land cover, frozen soil, soil saturation, reservoir capacity, river or stream levels, and frozen rivers or streams.[14] The Illinois Natural Hazard Mitigation Plan indicates that Stephenson County is at an elevated risk for flooding.

Major floods in Illinois have primarily been confined to specific streams and rivers or to locations that receive intense rainfall in a short time. Such riverine floods tend to occur in the early spring when melting snow adds to normal runoff when the ground is often still frozen, or in the summer and early fall after intense rainfall. Spring flooding is characterized by a slow buildup of flow and velocity in rivers over a period of days. This buildup continues until the river or stream overflows its banks, for weeks to months, and then slowly recedes. Generally, the timing and location of this type of flooding is predictable and allows substantial time for evacuation of people and most personal property.

Another form of riverine flooding is ice jam flooding which occurs when ice jams form in a waterway, constricting downstream water flow. At these locations, water rises rapidly, extending upstream. When the jam is cleared, flooding occurs downstream. Local anecdotal information also suggests that tree blockage can exacerbate flooding.

The primary form of flooding in Stephenson County is riverine flooding from the Pecatonica River and its tributaries. The Pecatonica is an unpredictable river known for exceeding its banks during spring thaws and periods of very heavy rain on a fairly regular basis. In rural areas, this mainly leads to temporary road closures, erosion, and crop damage. In places of greater population density and economic activity the flooding of the Pecatonica can threaten lives, health, economic activity, infrastructure, and the environment. Of its tributaries, the Yellow Creek, which runs through southern Freeport and Pearl City, is perhaps most vulnerable to flooding.

[14] Illinois Emergency Management Agency. *Illinois Natural Hazard Mitigation Plan.*

Flash flooding occurs in the event of intense rainfall within a short period of time, causing a rapid rise and fall of water levels. Four flash floods are on record with the National Weather Service between 1995 – 2007, two occurring in one year.

Flood events constitute 90% of federal disaster declarations; their occurrence is frequent and response and recovery costs can be extremely high. Historical flooding events prove that Stephenson County is no exception to this rule.

Table 3 illustrates some of the visible impacts of flooding at different stages of the Pecatonica River, measured at the gage located in the City of Freeport.

Table 3: Stephenson County Flooding Impacts, Pecatonica River

River Stage	Flooding Impacts
21.5'	Water reaches the bottom of the Illinois Highway 26 bridge deck in Freeport.
20'	Water reaches the bottom of the Stephenson Street bridge deck.
19'	Water affects the Depot near the Stephenson Street bridge.
17.5' *	In Winslow, Highway 73 is flooded.
17'	Water affects the parking lots of several businesses near the Stephenson Street bridge.
16.5'	Water affects Taylor Park School as well as Illinois Highway 75 east of Freeport.
16'	Beginning of Major Flooding Stage. Water affects parking lots of businesses near the Stephenson Street bridge and affects much of Taylor Park.
15.5'	Water affects Taylor Park and occurs entering the first floor level of a few homes.
15'	Water affects several streets and affects many back yards in Freeport. Water affects the lowest section of Illinois Highway 75 in Freeport and affects U.S. Highway 20 east of Freeport.
14'	Beginning of Moderate Flooding Stage. Street flooding occurs in Freeport and water affects a few back yards. Water also affects railroad tracks in Freeport and near Ridott.
13'	Official Flood Stage. Water affects sewers in low lying sections of Freeport.
11'	Agricultural flooding occurs.
Source: National Weather Service Advanced Hydrologic Prediction Service – Pecatonica River gage at Freeport ** This flooding impact was derived from the Pecatonica River gage at Martintown, WI*	

Historical Occurrences of Flooding

Flooding is the one of the frequent natural disasters that affects Stephenson County and it has resulted in millions of dollars of damage to property and crops in the past century.

Recent notable floods with considerable damage have occurred in Stephenson County in 1993, 1996, 2000, 2002, and 2007. The 1993 flood of the Pecatonica River peaked on July 8th, and damaged 247 homes, 21 businesses, and 86,000 acres of cropland and led to a Presidential Disaster Declaration. The worst hit municipalities included Winslow, Freeport, and McConnell; significant damage also occurred to farms in the unincorporated area of the County. Total damage from this storm totaled over $21 million. This flood was a part of the Great Flood of 1993 that resulted in the most damage along the Mississippi River in the recorded history of Illinois. The flood began following a particularly wet winter continuing into the spring with continuous and persistent precipitation.

Another Presidential disaster declaration was made in 1996 due to flooding along the Pecatonica River, Richland Creek, and Rock Run occurring for several days beginning July 17th, 1996. The Village of Orangeville and the townships of Rock Grove, Rock Run, Oneco, Buckeye, Dakota, Harlem, and Ridott incurred the most damages from the disaster. Damage amounts totaled more than $575,000.

Another major recent event occurred in June 2000 resulting in a Gubernatorial Disaster Declaration. The flood in June 2000 resulted in $3.4 million in crop damages (affecting 20,000 acres) and $345,000 in property damages. Altogether, the flood affected 800 people and 250 dwellings, resulting in evacuation of 100 people.

A flood in June 2002 also resulted in a Gubernatorial Disaster Declaration for Pearl City. The flood damaged numerous homes, resulted in the evacuation of 22 residents, flooded the sewage treatment plant, and closed several roads. The damage for this flood was estimated at $500,000.

Lastly, the most recent major flooding event involved flash flooding in August 2007. The County experienced a "2000 year flooding event." In other words, the level of precipitation experienced had a likelihood of occurring once in every 2,000 years, or a .05% chance. This flood impacted an estimated 365 properties throughout the County and resulted in a Presidential Disaster Declaration. Since the major flooding impacts were from flash flooding, the flooding was experienced in low lying areas throughout the County in areas both in and outside of mapped floodplains.

Overall, fifty-eight known flooding events have been documented in the County since 1914. These events have resulted in $2,311,500 in known damages to property and $22,720,500 in known damages to agricultural land—and that is only for events beginning in 1993 (quantifiable data on damages prior to 1993 is not available). Details on each of these events are provided in Table A1 in Appendix A.

In addition to the account of specific flooding events described in Table A1, Table 4 below summarizes the history of claims and number of flood insurance policies held in Stephenson County under the National Flood Insurance Program. As flooding damage to agricultural land is covered under crop insurance policies, this table only relates to non-agricultural properties. As compared to the nearly $3 million in property damages that have been experienced in the County from flooding since 1993, this table illustrates that flood insurance has historically only addressed a fraction of the damages experienced.

Table 4: History of National Flood Insurance Program Losses

Community	Total Losses	Closed Losses	Open Losses	CWOP Losses	Total Pay-ments	Policies In-force	Insurance In-force	Written Premium In-force
Freeport	38	25	0	13	$167,597	48	$2,682,400	$17,503
Orangeville	No statistics available					7	$385,200	$3,817
Winslow	3	1	0	2	$23,397	6	$766,000	$2,853
Unincorporated Stephenson County	20	14	0	6	$145,025	66	$6,784,600	$39,780

Source: NFIP Loss Statistics, 1/31/2007

Definitions

Total losses - All losses submitted regardless of the status.
Closed losses - Losses that have been paid.
Open losses - Losses that have not been paid in full.
CWOP losses - Losses that have been closed without payment.
Total Payments - Total amount paid on losses.
Policies In Force - Policies in force on the "as of" date of the report.
Insurance In Force - The coverage amount for policies in force.
Written Premium In Force - The premium paid for policies in force.

Flooding Hazard Vulnerability

Areas and populations vulnerable to flooding hazards were determined based on the following:

- Stephenson County Floodplain Maps
- Records of historical occurrences and impacts of flooding
- Input from the Hazard Mitigation Planning Committee, stakeholders, and County residents
- Aerial photographs
- Illinois National Flood Insurance Program Loss Statistics

The areas and populations most vulnerable to damage to life and/or property from flooding hazards in the County include the following, which are illustrated in the maps at the end of this Chapter:

- Areas with residents and/or businesses within a mapped 100-year floodplain
- Flood-prone areas with residents and/or businesses outside of a mapped floodplain

- Populations that are particularly vulnerable to injury or death from flooding include the elderly and residents of mobile home parks
- Agricultural land in the County which can result in significant damages/reduction of crop yields from significant flooding

Table 5, on the following page, illustrates the number, value, and acreage of properties located within the mapped 100-year floodplain throughout the County. The Table also projects potential damage from a 100-year flood measured in buildings, debris, and vehicle damage, based on FEMA's HAZUS software.

Table 5: Flooding Hazard Vulnerability of Properties within the Mapped 100-Year Floodplain

Location	Current Acreage, Parcels, and Land Value in Floodplain[1]								FEMA HAZUS Damage Projections – 100-year Flood[2]							
	Property Value (excluding non-farm land value)				Acreage			Total # Parcels	Total Building Damage			Debris (Tons)	Vehicle Damage		$ Vehicle Loss	
	Farm Land	Farm Improve-ments	Non-farm Improve-ments	Total Value	Farm Land	Non-Farm Land	Total Acres		Type	#	Value		# Day	# Night	Day	Night
City and Villages																
Freeport	$70,533	$7,800	$35,660,640	$35,738,973	279	737	**1,016**	591	Res. Gov. Ind.	212 1 2	$48,611,143	3,456	158	94	$878,448	$1,096,211
Cedarville	$4,521	$0	$360,729	$365,250	18	11	**29**	18	Res.	1	$452,010	65	0	0	$9,877	$23,588
Lena	$0	$0	$145,692	$145,692	0	74.9	**75**	1		0	0	0	0	0	$0	$0
Orange-ville	$5,877	$4,581	$1,452,459	$1,462,917	22	96	**118**	42	Res.	11	$2,099,564	94	4	2	$20,543	$53,665
Pearl City	$28,923	$870	$1,739,199	$1,768,992	68	34	**102**	48	Res.	12	$3,352,659	183	11	3	$38,685	$90,636
Ridott	$0	$0	$268,701	$268,701	0	2	**2**	6		0	$33,775	9	0	0	$838	$2,033
Winslow	$18,045	$7,014	$3,915,615	$3,940,674	102	40	**142**	116	Res.	30	$5,670,813	430	19	11	$139,967	$226,457
Townships (excludes incorporated areas of each township)																
Buckeye	$1,333,356	$757,071	$6,034,545	$8,124,972	6,544	253	**6,797**	178	Res.	7	$2,066,399	233	3	0	$39,012	$93,904
Dakota	$563,337	$286,563	$1,334,934	$2,184,834	1,876	39	**1,915**	31		0	$206,029	12	0	0	$2,601	$6,447
Erin	$0	$0	$0	$0	0	0	**0**	0		0	0	0	0	0	$0	$0
Florence	$2,198,166	$343,506	$6,161,847	$8,703,519	4,594	176	**4,770**	125	Res.	12	$3,320,976	498	3	0	$52,267	$123,771
Harlem	$1,802,736	$520,539	$6,897,984	$9,221,259	7,871	562	**8,433**	267	Res.	23	$4,964,242	361	23	10	$103,845	$212,698
Jefferson	$299,307	$305,217	$1,124,259	$1,728,783	1,887	68	**1,955**	38		0	$0	0	0	0	$0	$0
Kent	$2,598,054	$1,970,421	$5,569,785	$10,138,260	7,400	184	**7,584**	110		0	$2,157,412	119	0	0	$15,529	$36,949
Lancaster	$849,978	$545,178	$3,734,472	$5,129,628	3,733	293	**4,026**	289	Res.	31	$7,761,996	452	31	73	$523,073	$245,126
Loran	$2,161,365	$875,643	$3,108,099	$6,145,107	4,738	87	**4,825**	96	Res.	1	$993,617	168	0	0	$18,633	$45,255

Location	Current Acreage, Parcels, and Land Value in Floodplain[1]								FEMA HAZUS Damage Projections – 100-year Flood[2]							
	Property Value (excluding non-farm land value)				Acreage			Total # Parcels	Total Building Damage			Debris (Tons)	Vehicle Damage		$ Vehicle Loss	
	Farm Land	Farm Improve-ments	Non-farm Improve-ments	Total Value	Farm Land	Non-Farm Land	Total Acres		Type	#	Value		# Day	# Night	Day	Night
Oneco	$335,220	$210,981	$1,669,203	$2,215,404	1,354	50	**1,404**	61	Res. Ag.	0 1	$410,393	32	2	3	$23,608	$24,102
Ridott	$2,018,541	$417,408	$3,106,695	$5,542,644	7,140	239	**7,379**	61	Res.	4	$2,053,464	208	5	2	$45,558	$105,449
Rock Grove	$548,541	$232,248	$25,798,179	$26,578,968	2701	156	**2,857**	12		0	$458,027	3	0	0	$1,299	$3,142
Rock Run	$2,018,838	$831,915	$7,837,236	$10,687,989	8,176	298	**8,475**	171	Res.	2	$1,667,925	146	6	6	$40,999	$92,347
Silver Creek	$1,182,288	$134,595	$3,183,708	$4,500,591	3,333	373	**3,706**	109	Res.	9	$41,991,887	1,187	3	0	$89,021	$105,090
Waddams	$2,728,788	$1,062,468	$9,997,707	$13,788,963	10,764	428	**11,192**	337		0	$4,209,000	404	0	0	$33,807	$81,296
West Point	$117,228	$128,310	$919,311	$1,164,849	0	75	**75**	22	Res.	7	$49,136	4	0	0	$932	$2,447
Winslow	$2,061,417	$783,534	$3,562,980	$6,407,931	6,764	106	**6,870**	132	Res.	2	$1,806,844	184	5	0	$23,966	$58,682
TOTAL	**$22,945,059**	**$9,425,862**	**$133,583,979**	**$165,954,900**	**80,555**	**4,413**	84,969	**2,861**		**368**	**$134,337,312**	**8,248**	**275**	**204**	**$2,102,507**	**$2,729,296**

Data Sources:

1. Stephenson County GIS
2. FEMA HAZUS Flood Model (HAZUS-MH Version 1.3) – 9/2007, based on the following data:
   - U.S. Geological Survey Digital Elevation Model, 30m resolution
   - U.S. Census Bureau – Census 2000
   - Data on vehicle inventory, essential facilities, first floor flood elevations, general building stock, and general land from FEMA model, representing broad assumptions.
   - Agricultural data from conversations with Stephenson County Natural Resources Conservation Service staff, 01/2008
   - Regional curves from Federal Insurance and Mitigation Administration or US Army Corps of Engineers for depth damage curves and loss estimates

NOTE: Since the FEMA HAZUS Flood Model damage estimates are based on broad assumptions of property values from the U.S. Census and not from local property value data, these damage projections should be used solely as a broad estimate.

With over $165 million in property value in the floodplain, Stephenson County demonstrates significant vulnerability to property damage from flooding events. This vulnerability is supported by the HAZUS model projection of $134 million of potential building damage in the event of a 100-year flood. Please note that since the FEMA HAZUS Flood Model damage estimates are based on broad assumptions of property values from the U.S. Census and not from local property value data, these damage projections should be used solely as a broad estimate to understand the overall potential order of magnitude of potential damages rather than precise estimates.

Also, note that Table 5 does not include the value of land in other than farmland. The reason for this is that flooding can severely damage crops, but has less of a direct economic impact on other land.

Freeport, Winslow, and several townships each have over $1 million in property value in the floodplain. Freeport has the greatest value, over $35 million, and Rock Grove Township also stands out with nearly $26 million due to the value of properties in the Lake Summerset community.

The following sections describe specific issues contributing to flooding hazard vulnerability within individual communities in the County. Maps for each of these communities are included at the end of this Chapter.

Freeport – Pecatonica River

The Pecatonica is an unpredictable river known for exceeding its banks during spring thaws and periods of very heavy rain on a fairly regular basis. In rural areas, this mainly leads to temporary road closures, erosion, and crop damage. In places of greater population density and economic activity—like Freeport—the flooding of the Pecatonica can have more serious effects.

Highway 75 (Stephenson St.), Freeport, 2000

Flooding of the Pecatonica in the City of Freeport mostly affects the City's East Side—the neighborhood east of the river—as well as businesses in the "Arcade" area west of the river and in the Lancaster and Van Buren Road areas to the north. Flood events fairly regularly include road and bridge closures and washouts and street, yard, and basement flooding. These "nuisance" events negatively affect economic activity, the structural integrity of housing and other structures, and the quality of life in an area with a relatively vulnerable population as this area includes a concentration of low-income and elderly residents. Occasionally, flooding of the Pecatonica has had more devastating effects, particularly on Freeport's East Side. Major floods like those in 1969, 1975, 1990, 1993, 1996, and 2000 have submerged the neighborhood under several feet of water, threatened lives, and damaged property.

As a practical and legal matter, the Pecatonica has a large floodplain in the Freeport area, as designated by FEMA. Through the East Side in particular, the majority of the floodplain is also currently designated as a floodway. The floodway designation is intended to signal lands that carry flowing water during the 100-year flood event. In addition to signaling areas of flooding that have largely been confirmed by local observation, this designation carries with it fairly strict regulations intended to limit significant additional investment in the floodplain areas. These regulations have been a source of frustration for some East Side property owners over the years.

Over the last few decades, several initiatives have been proposed to address the flooding in this area. Some have successfully been implemented. The most obvious example is improvement related to the Currier Creek—a small tributary that enters the Pecatonica on the east edge of the City's East Side. Minor berming around that creek have helped divert floodwaters away from the neighborhood during minor flooding events. Other initiatives have not been carried out for various reasons. Over the years, these have included building a major levy (technical analysis revealed it would create more problems than it would solve), digging stormwater basins (selected areas had soil contamination

due to past industrial activities), and voluntary relocation of people to different parts of the Freeport area (neighborhood support was not effectively garnered and a proposal for a relocated neighborhood was abandoned).

Freeport – Yellow Creek

The Yellow Creek is a tributary of the Pecatonica River that runs from west to east through the southern edge of the City of Freeport. Waters in Yellow Creek can exceed the creek's normal banks, particularly when the Pecatonica is also at flood stage. In Freeport, rarely do Yellow Creek floodwaters affect homes and other structures near the creek. The most recent floods have resulted in considerable damages in the City of Freeport—$1,060,000 in the flood of 1993 and $284,000 in 2000 (These damage estimates include flooding of both the Pecatonica River and Yellow Creek).

The following are key issues contributing to current and future flooding vulnerability in the Freeport Yellow Creek floodplain:

- *Growth pressure*. Freeport is experiencing some interest for both residential and commercial growth along Yellow Creek, due to its amenity value and the fact that it crosses the Highway 26 commercial corridor. The Yellow Creek Risk Assessment map shows areas of likely future development. Development in this corridor will decrease pervious areas and may inadvertently be located in flood-prone areas that are not presently mapped as floodplain. Such development—if not properly located and designed—might lead to more flooding problems in the Yellow Creek corridor.
- *Constrained waterway*. There is an impression among many that much of the flooding that occurs in Yellow Creek could be mitigated in the creek if debris, such as fallen trees, was more regularly removed from the creek. Additionally, some of the bridges crossing the creek, such as the Walnut Road bridge, constrain water flow and contribute to ice jams.
- *Bridge washouts*. Several of the bridges that cross Yellow Creek have experienced washouts during times of flooding, such as the bridges at Gladewood Drive, Highway 26, and a railroad bridge.

Krape Park, Freeport, 2000

- *Flooding outside of mapped 100-year floodplain*. It is possible that the growth of Freeport over the past two decades, since the Freeport Flood Insurance Study and floodplain map was developed, has influenced the extent of flooding in the Yellow Creek corridor. Since the City's floodplain map has not been updated since the early 1980s, there are areas susceptible to flooding that are not identified as floodplain on the FEMA maps, such as the mobile home park at the east end of the Creek in Freeport.

Village of Cedarville

Cedar Creek runs along the northern and western edges of the Village of Cedarville and an unnamed Creek flows along the southern edge of the Village. The most significant instance of recent flooding occurred in June 2000, impacting two properties along Cedarville Road, which were actually outside of the Cedar Creek floodplain. This flooding occurred during the flood event that had County-wide impacts and resulted in a Gubernatorial disaster declaration. Cedarville is also susceptible to flooding along the Creek that runs along the southern boundary of the Village.

The following are key issues contributing to current and future flooding vulnerability in Cedarville:

Cedarville Road, Cedarville, 2000

- *Flooding outside of mapped 100-year floodplain.* The Village has experienced some flooding outside of a mapped 100-year floodplain and may benefit from updated floodplain maps.
- *New development.* The County's land use plan indicates potential commercial development south of the Creek in the southern portion of the Village along Highway 26, in an area that has previously experienced flooding. If developed, this area could be subject to future flooding and could exacerbate problems elsewhere.
- *Threats to water quality.* The sewage treatment plant is subject to flooding and therefore threatens water quality when flooded. There has apparently been some minor berming to reduce the potential for this.
- *Stormwater management.* New residential development in the southern portion of the Village, outside of the floodplain, is susceptible to flooding and may benefit from new stormwater infrastructure.

Village of Dakota

Dakota is outside of the floodplain and consequently flooding is not a major issue for the Village. There are two major north-south drainageways in the Village. One is west of the school property and does not appear to be related to any flooding issues. The second is on the east side of the Village, and there is occasionally yard flooding of a car dealership and another privately held lot. It does not appear that homes have ever been affected. The Village does not have a storm sewer system. Most drainage is over roads or in ditches, leading east or west to these two major drainageways.

The following are two issues contributing to future flooding vulnerability in Dakota:

- *Stormwater management.* While development pressure in Dakota is limited, development proposals have been made in the past for the area north of the Village. Consequently, the Village's vulnerability to flooding will increase if stormwater runoff from future growth leads to flooding issues downstream in the Village.
- *Threats to water quality.* The wastewater treatment plant, located southeast of the Village near the eastern drainageway, may have some capacity issues. Consequently, if capacity does become an issue, the plant may become more vulnerable to flooding.

Village of German Valley

German Valley is outside of the floodplain and consequently flooding is not a major issue for the Village. The Village has historically experienced flooding along Wickham Creek that runs through the east edge of the Village, away from developed areas. As German Valley considers any new development proposals, it should divert development activity away from this flood-prone area.

Village of Lena

Lena is primarily outside of the floodplain, with the exception of one property on the northeast edge of the Village, and consequently flooding is not a major issue for the Village. However, in the past, heavy rains have resulted in basement flooding due to backups in the storm sewer system. Additionally, Lena is the fastest growing area of the County and has the potential to experience residential growth as far east as the Pecatonica River floodplain. Proper development location and stormwater management strategies will be important in the future.

Village of Orangeville

Richland Creek runs through the western edge of the Village of Orangeville. The majority of the land use within the Creek's floodplain is agricultural and public open space; however, the floodplain does include two residential streets—Mill and South Streets. The Village most recently experienced a significant flood event in 1996, and to a much lesser extent experienced flooding in 2000.

The 1996 flood submerged Mill Street and also affected Main Street and Orangeville Road—resulting in $100,000 in damages to Orangeville Road itself. The flood also caused an estimated $500,000 in damages to ten homes and $20,000 in damages to two mobile homes. Some limited property acquisition has occurred since 1996 in the damaged areas.

The following are key issues contributing to current and future flooding vulnerability in Orangeville:

- *Residents in the floodplain.* Properties in the floodplain on Orangeville Road, Mill Street, South Street, and Ewing Road are still vulnerable to flooding, which puts both properties and public safety at risk in major flooding events.

- *Constrained waterway*. The bridge at Orangeville Road, which constrains Richland Creek, can exacerbate flooding during major events. Bends or blockages in the creek may also have the effect of increasing the incidence, severity, or duration of flooding in Orangeville.
- *Bridge washouts*. The bridge at Orangeville Road is also susceptible to washouts in flooding events, limiting access to and from the Village from the west, which is especially important because Highway 26 is on the Village's west edge.
- *Threats to water quality*. The sewage treatment plant is in the floodplain, and therefore can threaten water quality when flooded. Additionally, private wells and septic systems have flooded in the area, particularly south of the Village along Freeport Street, also threatening water quality and public health.

Richland Creek, Orangeville, 2007

Village of Pearl City

Pearl City is subject to flooding from Yellow Creek and the Goldenmine Road tributary. According to the 1989 Pearl City Flood Insurance Study, flooding in Pearl City has been most common during the winter and spring when floating ice can jam and partially dam the river. However, recent events have occurred in June and August due to periods of intense rainfall. In June 2000, the flood that resulted in a Gubernatorial Disaster Declaration resulted in roughly one-half Pearl City being submerged underwater. Significant flooding also occurred in June 2001. Additionally, in August 2002 flooding of Yellow Creek in Pearl City damaged numerous homes, led to the evacuation of 22 residents, and flooded the sewage treatment plant. In total, the Village estimates that four to five "100-year floods" and two "500-year floods" have occurred in last 10 years.

Pearl City, 2000

The following are key issues contributing to current and future flooding vulnerability in Pearl City:

- *Residents in the floodplain*. The large number of homes in the floodplain put both properties and public safety at risk in major flooding events. The Risk Assessment map for Pearl City shows the residential parts of the community that are most susceptible to flooding.
- *Constrained waterway*. Bridges crossing Yellow Creek at Pearl City Road and at Highway 73 north of Pearl City have constrained water flow through Yellow Creek within the Village during some of the major flooding events described above.
- *Flooding outside of mapped 100-year floodplain*. Pearl City has experienced significant flooding outside of the 100-year floodplain in residential areas. Also, there are areas within the mapped floodplain that have not flooded during major storm events. These facts, combined with the seemingly frequent occurrences of 100-year and 500-year floods, suggest that current floodplain boundaries may not be accurate in Pearl City. This negatively affects people's safety and the credibility of flood regulation and mitigation programs. (Pearl City was not enrolled in the National Flood Insurance Program at the time of writing—in part because of local concerns with the accuracy of floodplain maps and the implications the maps have on flood insurance and regulation requirements.)

- *Threats to water quality*. There are "brownfield" sites and several gas and auto repair shops in flood prone areas of the Village that pose a threat to water quality in the event of a flood. Additionally, the Village's municipal well and the sewage treatment plant are both in areas vulnerable to flooding.
- *Bridge washouts*. The Pearl City Road bridge is susceptible to flooding, limiting access in and out of the Village during major flood events.
- *Stormwater management*. During flood events, the Village has experienced storm sewer backups. The Village, in fact, has a very limited storm sewer system.

Village of Ridott

The Village of Ridott is bordered on the northwest side by the Pecatonica River floodplain and on the southeast side by the Wickham Creek floodplain. Neither floodplain currently contains any commercial or residential properties. However, the back yards of residential properties along Washington Street have experienced flooding in the past from Wickham Creek.

The following are key issues contributing to current and future flooding vulnerability in Ridott:

- *Threats to water quality*. Village residents rely on private wells for water supply and septic tanks for wastewater treatment. There is a concern that wastewater from private septic systems leaches during flooding events, which may contaminate well water.
- *Flooding outside of mapped 100-year floodplain*. The Village has experienced some flooding outside of the mapped floodplain and may benefit from updated floodplain maps.
- *Constrained waterway*. The Village has identified that the issue of debris in Wickham Creek and the Pecatonica River contributes to flooding vulnerability.

Village of Winslow

The Pecatonica River, which again is subject to flooding seasonally and during periods of heavy rain upstream, flows directly through the Village of Winslow. Additionally, the two creeks that flow into the Pecatonica in Winslow—Indian Creek and Cedar Creek—experience flooding, usually when the Pecatonica floods. According to the 1982 Village of Winslow Flood Insurance Study, flooding in the Village is primarily caused by intense rainfall but can also be affected by snowmelt. Years of known historical flooding in the Village include 1922, 1923 1929, 1969, 1993, and 2000. In 1993, the Village experienced $87,000 in damages from flooding—primarily at commercial properties.

The following are key issues contributing to current and future flooding vulnerability in Winslow:

- *Properties in the floodplain*. Flooding has historically primarily impacted the historic business district in downtown Winslow, threatening economic activity in instances of flooding. There are also a limited number of residences located in the floodplain, but these have reportedly not experienced flooding as severely or frequently as downtown commercial properties.
- *Critical facility*. The Village's fire station is located in the center of the community in the floodplain. It can be cut off from other parts of the community, particularly the north side, during major floods. In the past, if a flood is anticipated, the fire department has temporarily dispersed its trucks to different parts of the Village. Village administrative offices are also located in the floodplain.

Winslow, 2000

- *Threats to water quality.* A gas station in the floodplain (located in the downtown) and the wastewater treatment plant on the edge of the floodplain (located on the north edge of the Village) pose a potential risk of water contamination in the event of a major flood.
- *Bridge washouts.* The Winslow Road bridge, which crosses the Pecatonica, has also experienced flooding – up to waist deep in major events.

Other Villages

The Villages of Davis and Rock City are determined not to be vulnerable to flooding due to the lack of a floodplain in or near the Village, no reports of flooding in other areas, and no substantial vulnerability due to future growth.

Unincorporated Stephenson County

McConnell

McConnell is an unincorporated settlement in Stephenson County, directly adjacent to the Pecatonica River. The Pecatonica floods in this area on a fairly regular basis. Approximately the western one-half of the Village is located in the floodplain. Consequently, residential and commercial properties in the floodplain areas of the Village are highly vulnerable to flooding. In the major flood of 2000, McConnell experienced $3,000 in damages.

McConnell, 2000

Agricultural Land

Agricultural land within the County is vulnerable to crop damage, injured livestock, and soil erosion in the event of flooding. This vulnerability can significantly affect the economic stability of municipalities, farms, and agri-businesses, particularly since agriculture is so predominant in the County.

Three flooding events since 1993 have had a substantial economic impact on farmland. In July 1993, the County experienced a three-week flood event that affected 86,000 acres, resulting in $19,311,500 in agricultural damages. In 1996, one week of flooding impacted 25,000 – 30,000 acres (damages are unknown). In June 2000, another three-week flooding event resulted in $3,400,000 in agricultural damages for 20,000 acres.

Agricultural practices also contribute to the County's vulnerability to flooding. Crops that are grown all the way up to a river or creek contribute to stream erosion as well as threaten water quality from fertilizers and pesticides.

County Roadways

Road washouts pose an additional vulnerability in Stephenson County. When major County or State roadways in particular experience washouts, it limits emergency responders' ability to reach a flooded area, results in costs to improve damaged roadways, and impacts economic activity. In the 1996 flood, road washouts in the County resulted in $375,000 worth of damages, illustrating one aspect of the economic impact of road washouts.

Projected Future Probability of Flooding Hazards

Flooding is the most common disaster that affects Stephenson County and has resulted in millions of dollars of damage to property and crops in the past century.

Based on historical flood events identified by NOAA, local newspapers, SCEM, the Hazard Mitigation Planning Committee, jurisdictional representatives, and the public, 48 severe riverine floods were recorded from 1914 to the present. According to these records, significant flooding occurs approximately once every 2 years, which equates to a 50% chance of a severe flood event each year. However, if data from the past twenty years is considered a better representation of flooding trends due to changes in land use, extent of development within the County, and more

detailed accounts of flooding by NOAA and other sources, the probability increases to over one flood per year, as 24 flood events were recorded over the last 20 years.

Additionally, eight flash floods have been documented in the County over time, all since 1996, equating to a probability of flash flooding once every 1.5 years, or a 67% chance of a flash flood each year.

Projected Future Damages from Flooding Hazards

Since 1913, fifty-eight known flooding events have been documented in the County which have resulted in $2,311,500 in known damages to property and $22,720,500 in known damages to agricultural land (quantifiable data on damages prior to 1993 is not available). Based on the mean and median amount of damages from flooding since 1993, it is projected that the County could experience an average of $163,600 - $360,250 per year in property damage and $1.62 - $3.4 million in damage to agricultural land, as a result of future flooding, in 2008 dollars. With over $165 million in property value (excluding land value of non-farmland) in the floodplain—there is a significant risk of property damages from flooding in Stephenson County. Refer to Table 5 (pages 31-32) for projected value of damages to property and vehicles from flooding.

In addition to these quantitative damage estimates, the following potential damages from flooding are anticipated in the County based on data from the National Weather Service and input from SCEM, the Hazard Mitigation Planning Committee, stakeholders, and residents:

- *Public Health:* injury and death, particularly from flash flooding incidents, and respiratory health risks associated with living and working in flood-prone buildings due to mold growth
- *Transportation Network*: washed out roads and bridges, undermined riverbanks, embankment failures, and debris cleanup. The number one cause of death from flooding is drowning caused by people trying to drive cars through moving water.[15] Also, blockages to major roads can interrupt economic activity. Business interruption is a particular concern for businesses in Freeport in the "Arcade" area west of the river and in the Lancaster and Van Buren Road areas to the north, which can lose access to truck routes during flooding conditions.
- *Drainage Systems*: damaged and destroyed culverts and tubes and debris cleanup
- *Public Property*: flooded public facilities such as schools and parks and damaged recreational amenities, lands, and historic sites
- *Utilities*: downed transmission lines and poles, damaged transformers and telecommunication networks, damaged water treatment systems, diminished water quality from overflow and backup of sanitary sewer
- *Residential Structures*: flooded basements, collapsed foundations, damaged septic systems, collapsed wells, and destroyed/severely damaged homes
- *Agricultural Lands*: inundated cropland, injured livestock, soil erosion, delayed planting/growing season, washout of seed and agricultural chemicals into drainage systems, root and plant rotting, stunted crop growth and decreased nutritional value
- *Businesses*: inventory and revenue loss and permanent closure. According to FEMA, approximately 30% of flood-impacted businesses do not reopen following a disaster. These closures result in restricted access to goods and services, as well as lost tax revenue that can lead to decreased services provided by local governments.
- *Local Economy*: additional public expenditures for response and recovery personnel, repair materials, and equipment; and lost revenue from closed business and destroyed cropland and livestock.

Severe Thunderstorms and Windstorms

Severe Thunderstorms and Windstorms Hazard Overview

The National Weather Service defines a severe thunderstorm as a storm event that produces any of the following: downbursts with winds of 58 miles per hour (50.4 knots) or greater, hail of ¾ of an inch or greater, or a tornado. Severe thunderstorms constitute approximately 10% of all storm events.[16] A thunderstorm cell travels approximately

[15] Illinois Emergency Management Agency. *Illinois Natural Hazard Mitigation Plan.*
[16] Ibid

30-50 miles per hour and generally runs its course of creation and dissipation within 30 minutes. In Illinois, heavy rain, lightning, hail, tornadoes, and severe winds occur separately and in combination during severe storm events.[17] Thunderstorms can occur throughout the year, with the highest frequency between May and September between noon and midnight.

The following is a description of the characteristics and risks associated with thunderstorms.

Lightning

Lightning travels between and among the ground, clouds, and tall structures. Lightning can cause death and injury to humans and animals, set fire to buildings, cause damaging surges within the power and communications grids. Lighting is responsible for the death of more people in the U.S. each year than tornadoes or hurricanes. People are at greatest risk of fatality and injury from lighting when at outdoor recreation events or near trees.[18]

Hail

Hail is developed when there are sufficiently strong and persistent up-draft wind speeds and water has accumulated in a super-cool state in the upper parts of the storm. Although injury and loss of life is rarely associated with hailstorms, property damages can be extensive. Hail ranges in size from barely visible to the size of softballs and larger, and tend to fall in swaths of 20 to100 miles. The hail season peaks between April and June, and occurs primarily between noon and midnight.

Severe Windstorms

Severe Winds

In Illinois, thunderstorm winds actually cause more damage year-to-year than tornadoes, and this is no exception in Stephenson County. Severe winds (58 mph or greater) are most common between April and September, peaking in June. Severe wind events are most likely between noon at 10:00 p.m. and also (but to a less extent) frequent between 1:00 and 5:00 a.m.[19]

The following terms are used to describe causes and types of severe winds:[20]

- *Straight-line wind*: A straight-line wind includes any thunderstorm wind that is not associated with rotation, differentiating them from tornadic winds. Straight-line winds can be difficult to detect on radar. Most straight-line winds are a result of outflow generated by a thunderstorm downdraft. Straight-line winds can produce damage equivalent to an F0 or F1 tornado.
- *Downdraft*: A downdraft is a small-scale column of air that rapidly sinks toward the ground.
- *Downburst*: A downburst occurs when a strong downdraft wider than 4 km (2.5 miles) results in an outward burst of damaging winds on or near the ground. Downburst winds sometimes begin as a microburst and spread out over a wider area, sometimes producing damage similar to a strong tornado.
- *Microburst*: A microburst is a small concentrated downburst, less than 4 km (2.5 miles) that produces an outward burst of damaging winds at the surface. Microbursts generally last 5-10 minutes, with maximum wind speeds up to 168 mph.

Tornadoes

A tornado is a violently rotating, funnel shaped column of air that may or may not touch the ground. Average winds in a tornado are 175-250 miles per hour and may produce winds in excess of 300 miles per hour. The path of a tornado is generally not wider than ¼ mile or longer than 16 miles but can exceed these amounts. The destructive power of a tornado lies primarily in its high wind velocities and sudden changes in pressure, which are thought to account for over 90% of resulting damages. Tornados are associated with storm systems and therefore usually are accompanied by hail, torrential rain, and intense lightning. Tornados can strike anywhere and cause extensive damage.

[17] Ibid.
[18] Ibid.
[19] National Weather Service. *Quad Cities Service Guide.*
[20] National Oceanic and Atmospheric Administration. *National Severe Storms Laboratory Website.* http://www.nssl.noaa.gov/primer/wind/wind_basics.html

Tornadoes can occur in any month but are most common From March through August, between 3:00 – 7:00 p.m.[21] Illinois lies in the northeast portion of "tornado alley," which spans from Texas to Michigan.

In the U.S., tornados were historically classified using the Fujita Scale into six intensity categories, F0 to F5. These categories are based on the estimated maximum wind speed occurring within the funnel. Since February 2007, the Enhanced Fujita scale has been used, ranging from EF0 to EF5. The new EF-Scale improves upon the F-Scale by estimating the strongest 3-second wind gust based on the degree of damage to one or more of 28 classes of trees or structures.

Table 6 illustrates the damage experienced for each EF class as well as the average percentage of each class of tornado for both the National Weather Service Quad Cities Region as well as nationally. The national average was calculated based on a four-year period beginning in 1998 when Doppler radar greatly improved the ability to detect lower-intensity tornados. Consequently, the national average may be a better indicator of likelihood of each class of tornado than the regional estimate.

Table 6: Tornado Wind & Damage Scale

Enhanced Fujita Scale	3-second Gust Wind Speed (mph)	Damages	Average % of Tornados	
			NWS Quad Cities Region (Year – Year)	National Average - % of Tornados (1998-2002)
EF0	65–85	(Light Damage) Some damage to trees and TV antennas; Shallow rooted trees pushed over.	44%	64%
EF1	86–109	(Moderate Damage) Peels surface off roofs; windows broken; light mobile homes overturned; some trees uprooted or snapped; moving automobiles pushed off road.	30%	24%
EF2	110–137	(Considerable Damage) Roofs torn off frame homes; weak buildings and mobile homes destroyed; large trees snapped or uprooted; railroad boxcars pushed over; cars blown off highway.	18%	8%
EF3	138–167	(Severe Damage) Roofs and some walls torn off frame homes; some rural buildings demolished; trains overturned; steel-framed hangars and warehouses torn; most trees uprooted or snapped.	7%	3%
EF4	168–199	(Devastating Damage) Well-constructed frame homes leveled, leaving piles of debris; steel structures badly damaged; trees debarked by fling debris; cars and trains thrown or rolled considerable distances; missiles generated.	1%	Less than 1%
EF5	200–234	(Incredible Damage) Strong frame houses lifted off foundations and disintegrated; steel-reinforced concrete structures badly damaged; vehicle-sized missiles generated; incredible phenomena can occur.	Less than ½%	Less than ½%
Source: NOAA, NWS Storm Prediction Center				

[21] Illinois Emergency Management Agency. *Illinois Natural Hazard Mitigation Plan.*

Historical Occurrences of Severe Thunderstorms and Windstorms

Lightning

Between 1999 and 2007, Stephenson County experienced four occurrences of lightning that caused damage. The only quantified damages known was from a lightning event in Lena in 2000 that struck a home, causing $30,000 in damages. The other three events downed trees (1999 in Orangeville), struck a home (2006 in Freeport) and struck a municipal water tower, threatening the village's water supply such that a boil order was issued (Lena in August). Refer to Table A2 in Appendix A for a full list of these historical events.

Hail

Between 1971 and 2006, Stephenson County experienced 32 occurrences of severe hail causing $123,000 in property damages and $102,000 in crop damages. With five events, 2006 saw the greatest number of events reported in a single year. Refer to Table A3 in Appendix A for a full list of these historical events.

Tornadoes and Severe Winds

Severe Winds

There have been 89 reported occurrences of severe thunderstorm winds in Stephenson County between 1956 and 2006. These events have caused a reported $9,785,000 in property damages, $87,000 in crop damages, and five injuries. The greatest number of events was reported in 1997—eight instances of severe winds. Refer to Table A4 in Appendix A for a full list of these historical events.

These windstorms have been experienced throughout the County. However, according to SCEM, the most severe damages from severe winds have been experienced in the northern and southern portions of the County, and less so in Freeport. Map 2: Risk Assessment—Stephenson County, illustrates typical wind patterns for straight-line winds in the northern and southern parts of the County. It should be noted that although these areas may have been historically more vulnerable, severe winds are a regional weather condition and consequently the entire County is vulnerable to damages from severe windstorms. Refer to Table A4 in Appendix A for a full list of these historical events.

Tornadoes

Tornadoes most frequently occur between April and September, in late afternoon and early evening hours. This is true in Stephenson County with one exception—the worst tornado on record which registered F2 on the Fujita scale, occurred at almost midnight in October 1958. Since 1950, eight tornados have been recorded in Stephenson County by the National Weather Service—four F0 (light damage), three F1 (moderate damage), and one F2 (considerable damage) on the Fujita Scale. Additionally, a tornado was reported in July 1945 and in August 1965 (the location and F-scale of these tornados is not known). Four fatalities were reported from the 1945 tornado; no fatalities or injuries were reported from any of the other events. Total known damages from these events is $2,775,000 – with the bulk of this from the 1958 F2 tornado. Five of these ten tornado events occurred between 1998 and 2003; none have been reported since 2003. Refer to Table A5 in Appendix A for a full list of these historical events.

Severe Thunderstorms and Windstorms Hazard Vulnerability

Based on review of the historic patterns of thunderstorms and associated hail, lightning, wind, and tornado events, the entire County is vulnerable to damages from severe storms and tornadoes. However, according to SCEM, the worst damages from severe winds have been experienced in the northern and southern portions of the County, and less so in Freeport. According to SCEM, this could be due to the topography west of the County causing severe winds to be more directed to the north and southern portions of the County.

While topography may play a part, severe storms have been experienced throughout the County, including in Freeport, and therefore constitute a County-wide risk.

The Illinois Hazard Mitigation Plan assigned an "elevated" risk rating for severe storms and tornadoes in Stephenson County. According to that plan, approximately 80% of severe thunderstorms in Illinois are multicellular or a supercell hybrid, which can result in damaging wind and/or large hail over a 400 to 500 square mile area. The remainder of severe thunderstorms are squall lines, which can produce damage over 100% of the affected counties. Thus, counties

in Illinois, including Stephenson, are highly vulnerable to damage from severe storms. In fact, a study of thunderstorm damages in the 20th century ranked Illinois fourth in the country for thunderstorm catastrophes between 1949 and 1998.[22]

Lightning

People are at greatest risk of fatality and injury from lighting when at outdoor recreation events or near objects such as tall trees or water towers.[23]

Hail

Building roofs, vehicles, and other outdoor objects of value are most vulnerable to hail damage. Livestock is also vulnerable to damage.

Tornadoes and Severe Winds

Overall, Stephenson County is vulnerable to severe winds, although there is potentially greater vulnerability to frequency of these events in communities in the northern and southern portions of the County. As illustrated in Figure 1, the State of Illinois is located in the most severe wind zone in the U.S.

Generally, concentrations of population are areas that are vulnerable to tornados and severe winds. The City of Freeport is the largest developed area with a concentration of just over half of the population in Stephenson County.

Additionally, groups that are most at risk of injury or death from tornadoes or severe winds include: people in automobiles, people in mobile homes, the elderly, the very young, the physically or mentally impaired, and people who may not understand a warning due to a language barrier.

In Dakota, children are at risk as the schools are located on the west side of the village where a storm is likely to hit first.

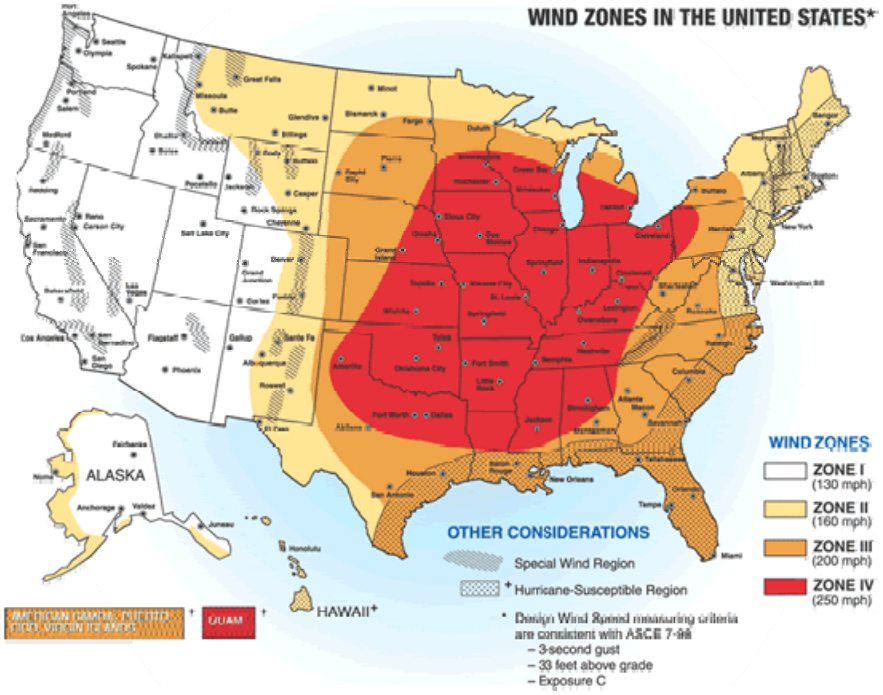
Mobile homes and camping trailers are more vulnerable to damage than traditionally built structures. According to research by the NWS, 40% of all tornado-related deaths between 1985 and 1998 occurred in mobile homes, 27% were in permanent homes, 11% were in vehicles, and 8% were out in the open (other locations, each accounting for less than 5% of deaths, included businesses, schools, and long-span roofs).[24] Although many mobile homes are scattered throughout the County, the majority are concentrated within mobile home parks. Locations of mobile home parks are identified on the risk assessment maps at the end of this chapter as "vulnerable populations."

In addition to mobile home parks, campgrounds and industrial parks are also vulnerable to damage from tornadoes and severe winds. Like mobile home parks, campers and pole-shed style industrial buildings do not provide protection against the wind velocities of a tornado, and often there is no shelter provided.

The risk assessment maps at the end of this chapter illustrate historical paths of severe winds through the County – through the northern and southern halves of the County. This pathway is suspected to be caused in part by the County's topography. However, severe winds and tornadoes have been known to affect a variety of topographies and consequently populations in the central portion of the County are just as at risk of severe wind and tornado damage.

[22] Chagnon, Stanley. *Thunderstorms Across the Nation - An Atlas of Storms, Hail, and Their Damages in the 20th Century*. Referenced in the *Illinois Natural Hazard Mitigation Plan.*
[23] Illinois Emergency Management Agency. *Illinois Natural Hazard Mitigation Plan.*
[24] Tornado Fatalities by Circumstance, 1985-1998, Storm Prediction Center. http://www1.ncdc.noaa.gov/pub/data/techrpts/tr9902/tr9902.pdf

Figure 1: Wind Zones in the United States



Projected Future Probability of Severe Thunderstorms and Windstorms

Probability is described below for each of the hazards associated with severe storms.

Lightning

Between 1999 and 2007, Stephenson County experienced four occurrences of lightning that caused damage. Based on this, there is a 50% probability of damaging lightning in any year, or the County can expect to experience one case of damaging lighting every two years.

Hail

Between 1971 and 2006, Stephenson County experienced 32 occurrences of severe hail. Based on this historic frequency, the County has an 89% chance of experiencing severe hail (3/4 of an inch or greater) in any year (or can expect to experience severe hail once every 1.13 years).

Tornadoes and Severe Winds

Severe Winds

There have been 89 reported occurrences of severe thunderstorm winds in Stephenson County between 1956 and 2006. Based on this, there is a likelihood of severe winds occurring one to two times in any given year in the County.

Tornadoes

Between 1950 and 2007, nine tornados have been recorded in Stephenson County by the National Weather Service. Based on this, there is a 15% probability of a tornado in Stephenson County in any given year. Table 7 illustrates the probability of a tornado by magnitude based on past occurrences.

Table 7: Probability of Tornados by Magnitude

	F0	F1	F2	F3	F4	F5
Number of Tornados Reported since 1950	4	3	1	0	0	0
Probability of each magnitude of tornado, when a tornado occurs – Stephenson County	50%	37.5%	12.5%	< 1%	< 1%	< 1%
Probability of each magnitude of tornado, when a tornado occurs – State of Illinois	70%		28%		2%	
Source: Illinois Emergency Management Agency, *Illinois Natural Hazard Mitigation Plan*.						

Combination of two means "high risk" – storm shelter is preferred method of protection from high winds

While no tornadoes over an F2 magnitude have been recorded by the National Weather Service in Stephenson County, tornadoes up to F5, the most severe, have occurred in Illinois. According to the Illinois Natural Hazard Mitigation Plan, "history proves that at any time of the day and on any day of the year an F5 tornado could strike any place in Illinois. This path of destruction could be over a mile wide and as much as 50 miles long."

Projected Future Damages from Severe Thunderstorms and Windstorms

In the past, severe thunderstorm events caused substantial property and infrastructure damage and it is logical to assume they will continue to do so. Potential damages from severe storms include the following:

- Utilities: downed and damaged electrical lines, poles, and antennae; damaged transformers, telephone lines, and interrupted radio communications
- Transportation Network: debris cleanup and road damage
- Drainage Network: debris cleanup, damaged and destroyed culverts and tubes
- Residences: damaged or destroyed houses, mobile homes, garages, trees, siding, roofs, and windows
- Businesses: closures, and building and inventory damages
- Agricultural Lands: damage or destroyed buildings, crops, and livestock, and soil erosion
- Personal Property: damaged cars, trucks, and recreational vehicles
- Death and injury to people and animals

Also based on historical data, the there are two levels of damages due to severe thunderstorms. Stephenson County incurred 31 moderate storms with damages ranging from $1,000 to $150,000, for a total of $398,000 and an average of $12,838. However, five much more severe storms constituted $9,474,000 in damages with an average of $1,894,800 for those storms. Based on damages in recent years, the County should be prepared for annual future damages to range from $2,000 to $13,000.

Additionally, severe storms in the County have resulted in six reported injuries.

Lightning

Since 1999, there have been no reported fatalities or injuries due to lightning. However, lighting is responsible for the death of more people in the U.S. each year than tornadoes or hurricanes. Illinois is also one of the highest ranking state for lightning fatalities, with 96 deaths in the last 40 years.[25] Consequently people in Stephenson County are still at risk of injury and death from lightning.

The only quantified damages known was from a lightning event in Lena in 2000 that struck a home, causing $30,000 in damages. The other three events downed trees (1999 in Orangeville), struck a home (2006 in Freeport) and struck a municipal water tower, threatening the village's water supply such that a boil order was issued (Lena in August).

[25] Illinois Emergency Management Agency. *Illinois Natural Hazard Mitigation Plan.*

Hail

NOAA data reports that there have been 36 occurrences of severe hail in Stephenson County, causing $123,000 in property damages and $102,000 in crop damages. Although hailstorms rarely cause injury and death, property damages can be extensive.

Most hail damage is in rural areas as the hail season corresponds with the growing and harvesting season for most crops.

Tornadoes and Severe Winds

Severe Winds

There have been 89 reported occurrences of severe thunderstorm winds in Stephenson County between 1956 and 2006. These events have caused a reported $9,785,000 in property damages, $87,000 in crop damages, and five injuries.

Tornadoes

NOAA data indicates that tornados have caused $2,873,000 of damage in Stephenson County from 1950 to 2007. Past impacts from tornado events have included injuries to people and livestock, downed utility lines, a toppled trailer, damaged trees, leveled barns and silos, and damaged homes. A tornado in 1965 resulted in the closing of over 60 streets.

With the exception of the $2.5 million dollars in damages from the 1958 tornado, on average, damages per tornado were $37,300.

Damages from future tornados are projected to predominantly impact a 1-2 mile long area, 100 yards wide, as most tornadoes will be weak. However, it is possible that a strong tornado will occur, resulting in a path ¼ - ½ mile wide and 20 miles long. It is also possible that a violent tornado will occur, resulting in a 1-mile wide path and extending greater than 20 miles. According to the Illinois Natural Hazard Mitigation Plan, it is estimated that less than 10% of a county would be impacted by such a tornado.

Severe Winter Storms

Severe Winter Storms Hazard Overview

Winter storms include heavy snowstorms, blizzards, and ice storms. The winter storm season in Illinois generally runs from November to March. According to the Illinois Natural Hazard Mitigation Plan, there are three categories of winter storms:

- *Blizzard*: The most dangerous of all winter storms, a blizzard combines low temperatures, heavy snowfall and winds of at least 35 miles per hour, reducing visibility to only a few yards.
- *Heavy Snow Storm*: A heavy snow storm produces six inches or more of snow in 48-hours or less.
- *Ice Storm*: An ice storm occurs when moisture falls and freezes immediately upon impact.

In addition to individual storm events, a severe winter occurs when an extremely cold period extends for over a month or when severe ice storms or heavy snowfall occur repeatedly for six weeks or more.

Historical Occurrences of Severe Winter Storms

56 severe winter storms events were recorded by NOAA in Stephenson County between 1994 and 2006. Refer to Table A6 in Appendix A for a full list of these historical events. These storms included heavy snow and ice storms. Stephenson County experiences four days of freezing rain per year on average, but this can vary from 0 to 10 days in any given year.[26]

These events have resulted in problems of drifting snow and hazardous roadway conditions. Additionally, blocked roadways have blocked in communities such as German Valley.

[26] National Weather Service. *Quad Cities Service Guide.*

Severe Winter Storms Hazard Vulnerability

In the Illinois Natural Hazard Mitigation Plan, Stephenson County was designated 'high' risk for severe winter storms. A review of historic patterns indicates no specific patterns or jurisdictions that have unusual risk of damage from severe winter storms. However, smaller, more isolated communities have greater potential of being blocked in from major storms.

Projected Future Probability of Severe Winter Storms

Based on historical frequency of 56 events over the 13 year period from 1994 to 2006 (based on events recorded in the NOAA U.S. Storms Database), Stephenson County can expect four to five major storm events per year. The Illinois Natural Hazard Mitigation plan projects an average of five severe storms per year in the State as a whole, so it is likely that some of the events recorded in the U.S. Storms Database for Stephenson County have been less severe, though still major storms.

Projected Future Damages from Severe Winter Storms

Damages and losses due to winter storms are generally minor and widespread. Increased automobile accidents and additional municipal expenditures for emergency response and snow removal are common, and such claims are not tracked. Potentially extreme impacts of winter storms usually involve ice storms. Damages were only reported for five recent storms since 2004, totaling $120,000 and averaging $24,000 per storm.

Possible damages that could occur from winter storms include the following:

- *Infrastructure*: temporarily closed/blocked roadways, additional hours and equipment for emergency services, and diminished operation of public facilities and schools.
- *Utilities*: downed power lines and frozen pipes.
- *Private Property*: damaged or collapsed roofs; ice damming; and damaged vehicles.
- *Businesses*: diminished profits due to closure or destroyed inventory.
- *Agriculture*: injured or killed livestock.
- *Injury and Death*: people are at risk of injury or death in particular when driving conditions are hazardous due to slick road, winds, and decreased visibility from snow. Extremely cold temperatures accompanied by strong winds can result in temperatures that can cause frostbite, hypothermia, and death.

Drought

Drought Hazard Overview

Drought can be agricultural or hydrologic. Agricultural drought is a dry period of sufficient length and intensity that markedly reduces crop yields. Hydrologic drought is a dry period of sufficient length and intensity to affect lake and stream levels and the height of the groundwater table. Agricultural and hydrologic droughts may, but do not necessarily, occur at the same time.

Drought conditions may vary from below normal precipitation for a few weeks to severe lack of normal precipitation for a couple of months to years. Additionally, the onset and end of a drought can be difficult to detect. Weather conditions, soil moisture, runoff, water table conditions, water quality and streamflow affect drought conditions. Specifically, high temperature, high wind and low relative humidity can all contribute to drought severity.[27]

In Stephenson County, agricultural land is the most vulnerable to drought as the amount and timing of precipitation has a significant impact on crop production. Therefore, the severity of a drought must be measured in terms of crop yield as well as precipitation. Drought mitigation measures focus on conservation and preparation management.

[27] Illinois Emergency Management Agency. *Illinois Natural Hazard Mitigation Plan.*

Historical Occurrences of Drought

In Stephenson County, NOAA's drought records begin only since 2005 when a major drought impacted the County. The drought began in June 2005 and lasted through March 2006. In total, this drought caused $228,600,000 in crop damage. This drought was experienced in Illinois, Missouri, and Iowa.

As an indicator of earlier droughts in the County, historical low water levels of the Pecatonica River in Stephenson County occurred in July 1988 (0 feet), September 2003 (2.4 feet), and December 2005 (1.9 feet).[28]

In the State of Illinois, there have been five drought events between 1996 and 2006. Additionally, major droughts were documented in September 1983 when a state-wide disaster declaration was made for high temperatures and drought, in June – October 1988, and May 1992 when communities in northern Illinois recorded the driest May on record. Additionally, precipitation was less than 88% of normal between September 1994 to June 1995 (though this was not officially considered a drought).[29]

One way of measuring drought is through the Palmer Drought Severity Index (PDSI), which takes into account both temperature and precipitation in determining the severity of drought. Based on the PDSI, the risk of drought has historically been evenly distributed across the State since drought is in part a result of regional weather patterns.[30]

Drought Hazard Vulnerability

Agricultural areas of the County are most vulnerable to the impacts of drought. Municipal water systems have the potential to be impacted by drought. However, Illinois communities have not historically experienced serious impacts of drought.[31]

Projected Future Probability of Drought

Since the NOAA records of drought begin in 2005, there is not sufficient historical data specific to the County to project future drought. However, since drought is experienced regionally, data for the State of Illinois can be used to project future drought. The Illinois Natural Hazard Mitigation Plan estimates that moderate to severe drought occurs about 17% of the years in Illinois, or about once every six years.

Damages from previous droughts vary; however, farmers are most severely affected.

Projected Future Damages from Drought

Since data is so limited for Stephenson County, it is difficult to quantify future damages from drought. However, the drought of 2005 – 2006 caused $228,600,000 crop damage, indicating that damages can be very significant.

Extreme Temperatures

Extreme Temperatures Hazard Overview

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for several weeks. Additionally, high humidity contributes to extreme heat by retarding the body's ability to cool from evaporation of perspiration, causing the body to work much harder to cool down. Sunburn also slows the skin's ability to release heat. Stagnant atmospheric (humid and muggy) conditions and poor air quality can also induce heat-related illnesses.

The urban heat island effect refers to greater increases in temperatures in dense urban areas than rural areas due to greater areas of surfaces that store heat and release it at night, contributing to higher nighttime temperatures. Another result of extreme heat is greater electricity demands for air conditioning systems, which can lead to power outages.

[28] National Weather Service. *Advanced Hydrologic Prediction Service: Pecatonica River at Freeport* http://www.crh.noaa.gov/ahps2/hydrograph.php?wfo=dvn&gage=feei2&view=1,1,1,1,1,1 .
[29] Illinois Emergency Management Agency. *Illinois Natural Hazard Mitigation Plan.*
[30] Ibid.
[31] Ibid.

Extremely cold temperatures accompanied by strong winds can result in temperatures that can cause frostbite, hypothermia, and death.

Historical Occurrences of Extreme Temperatures

NOAA data for temperature extremes in Stephenson County are only recorded as far back as 1996 and are listed in detail in Table A7 in Appendix A. There have been two instances of extreme heat and seven instances of extreme cold since 1996. The most severe instance of extreme heat occurred from July 19 to July 31, 1999. Heat indices of 105 to 125 degrees were reported during this time. One person was injured and one person died due to this heat.

Additionally, records of injuries and illnesses related to extreme heat and cold documented by the local healthcare provider FHN are documented in Table A8. FHN's records from 1998 to 2007 include 17 cases of illness or injury from extreme cold. Of these, two were paid by Medicaid (health care coverage for low income persons) and 11 by Medicare (health care coverage for people 65 and over and some disabled persons). FHN also documented 6 illnesses or injuries due to extreme heat, of which 3 were paid by Medicare.

In addition to the extreme temperatures documented by the NOAA since 1996, the Illinois Natural Hazard Mitigation Plan indicates that major cases of extreme heat also occurred state-wide in 1983 and 1995. In September 1983, all counties in Illinois were proclaimed a disaster area due to high temperatures and insufficient precipitation that began in June. In 1995, heat waves caused record death and injury in the state when heat indices remained around 120 degrees between July 12 and 17. The effects of the heat itself were exacerbated by scattered power outages by ComEd which serves northern Illinois.

Extreme Temperatures Hazard Vulnerability

The Illinois Hazard Mitigation Plan assigned an "elevated" risk rating for extreme heat in Stephenson County. The plan does not specifically rate extreme cold, but does assign a "high" risk for severe winter storms, with which extreme cold is associated.

Populations that are particularly susceptible to illness, injury, and death from extreme temperatures include the elderly, low-income persons (particularly if they cannot afford sufficient heating or cooling), people in urban areas, young children, sick persons, overweight persons, persons with alcohol problems, and men in general (because they sweat more and become more quickly dehydrated). Usually the victims have been overexposed to heat or have over-exercised for their age and physical condition. Excessive heat also puts strain on a person's respiratory and cardiovascular system, particularly impacting toddlers and the elderly.

Heat waves kill more people in the U.S. on average than all other natural disasters combined.[32] Risk is particularly high in the most urbanized areas, such as the Chicago area, which experiences exacerbated heat due to the urban heat island effect, and also has a higher concentration of poor and elderly persons.

Stephenson County has an aging population and consequently its residents are becoming more vulnerable to extreme temperatures over time. Based on data from the U.S. Census, Stephenson County's population of persons over 65 grew by 4% from 1990 to 2000, now totaling 7,586 individuals in this age cohort—15% of the total County total population.

Projected Future Probability of Extreme Temperatures

Based on NOAA accounts of extreme temperatures from 1996 – 2006, there is an 18% probability of an extreme heat event and 64% probability of an extreme cold event in any given year.

Projected Future Damages from Extreme Temperatures

Extremely high or extremely low temperatures pose significant threat to the health of people and animals. Although such extremes cannot be avoided, planning for their occurrence will minimize their impact.

There is no record of quantified damages to property due to severe temperatures in Stephenson County. However, damages are possible, as described in the list of potential damages from extreme temperatures below:

[32] New York Times. *Most Deadly of the Natural Disasters: The Heat Wave*. August 13, 2002. Referenced by Illinois Emergency Management Agency, *Illinois Natural Hazard Mitigation Plan.*

- Human illness or death including heatstroke, respiratory problems, frostbite, and hypothermia
- Livestock and pet illness or death due to extended exposure to extreme temperatures
- Electricity outages due to high usage, causing interruptions in communications infrastructure and business productivity
- Buckling pavement
- Loss of water pressure when fire hydrants opened in urban areas
- Broken plumbing pipes resulting from freezing water

Earthquakes

Earthquake Hazard Overview

An earthquake is caused by slipping plates that make up the earth's crust. Earthquakes result in a sometimes violent shaking or trembling of the ground. An earthquake does not need to be of large magnitude to cause extensive damage. Areas that are less prone to this hazard event are usually less prepared, which can result in significant damage. In the U.S., earthquake intensity is monitored using the Modified Mercalli Scale on a scale of I, meaning relatively low intensity, to XII meaning very high intensity. Earthquake magnitude is measured by the Richter Scale of 1 – 8, with 8 being the most severe. The Richter Scale measures an entire earthquake event whereas the Modified Mercalli Scale measures the effects of an earthquake at different sites.

Earthquakes in Illinois originate at depths of 1 to 20 km below the earth's surface. Bedrock in the central U.S. is flat-lying, old, intact, and strong and consequently earthquake vibrations travel very far through this bedrock in comparison to the young, broken, weak bedrock of the west coast. Consequently, earthquakes in the central U. S. are felt and cause damage in an area 15 to 20 times greater than west coast earthquakes of similar magnitudes.[33]

Historic Occurrences of Earthquakes

In the past two centuries, over 250 earthquakes have been recorded in Illinois, 80% of which have occurred in southern Illinois. Significant earthquakes that have been felt in Stephenson County include the following:[34]

- December 1811 – February 1812: Strongest historic earthquakes in North America (estimated 8.3 to 8.7 on Richter Scale) occurred in the New Madrid Fault Zone near New Madrid, Missouri.
- May 26, 1909: 5.1 magnitude earthquake believed to originate in Aurora, Illinois reached over 500,000 square miles.
- 1968: Largest earthquake officially recorded in Illinois, 5.3 magnitude, intensity VII, occurred in Dale, Illinois. The earthquake was felt over all or parts of 23 States, including people in multi-story buildings in Boston, Massachusetts and southern Ontario, Canada.
- 1972: Magnitude 4.0 earthquake in the Village of Amboy (just south of Rockford)
- September 15, 1972: This magnitude 4.5 earthquake originated near Sterling, Illinois and was felt in most of northern Illinois and neighboring states. It caused minor damage such as cracks in chimneys and plaster.
- September 2, 1999: A 3.5 magnitude earthquake originating near Dixon, Illinois.
- June 2004: A 4.2 magnitude earthquake centered near LaSalle/Peru, Illinois.
- January 2006: A 3.6 magnitude earthquake originating near Equality, Illinois
- March 2006: A 3.0 magnitude earthquake centered about 15 miles south of Marion, Illinois.

The earthquakes that have originated in Northern Illinois are not directly linked to any known Northern Illinois faults as no measurable movement has been recorded on any of these faults since the beginning of the last Ice Age, 1 million years ago.

[33] by Illinois Emergency Management Agency. *Illinois Natural Hazard Mitigation Plan.*
[34] Illinois State Geological Survey. *Earthquake Facts,* 1999. http://www.isgs.uiuc.edu/research/earthquake-hazards/pdf-files/eq-fct-nrth.pdf

Earthquake Hazard Vulnerability

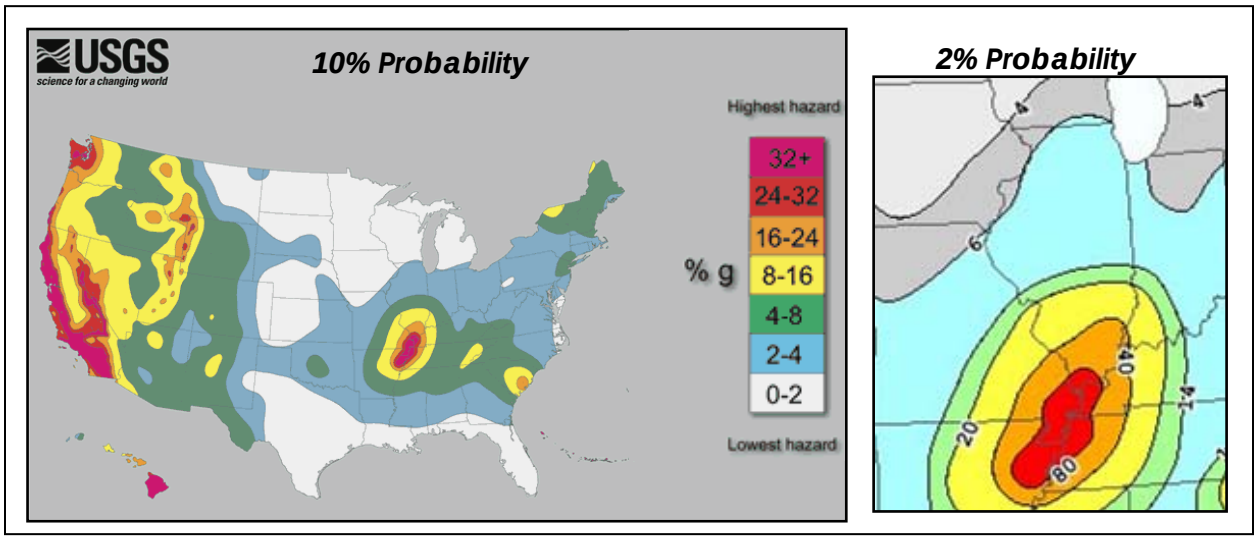
Because earthquakes are so infrequent in the Midwest, the population tends to neither be aware of, nor prepared for, the potential impacts. Consequently, in the event of a large magnitude earthquake from the New Madrid Fault, all residents in Stephenson County would be vulnerable to the impacts.

Projected Future Probability of Earthquakes

According to the Illinois State Geological Survey, of the several earthquakes that have originated in northern Illinois in the 20th century, none greater than a magnitude 5 on the Richter scale (which causes minor damage within 10 to 20 miles of the epicenter) have occurred. The ISGS also does not anticipate earthquakes larger than a magnitude 5 originating in northern Illinois.

Figure 2 illustrates the probable peak horizontal acceleration of earthquakes within 50 years that have a 10% and 2% probability of occurring. Peak horizontal acceleration is measured in % ground motion units ("g") where 1g = 980.5 cm/s/s. [35] Stephenson County is in a relatively low hazard for both 10% and 2% probability earthquakes.

Figure 2: Peak Horizontal Acceleration With 10% and 2% Probability Of Exceedance In 50 Years



Source: USGS Earthquake Hazards Program

[35] United States Geological Survey. *National & Regional Seismic Hazard Maps Website*. http://earthquake.usgs.gov/research/hazmaps/products_data/images/nshm_us02.gif

Table 8: Probability of Earthquakes by Magnitude

Probability of Exceedance within 50 years	Modified Mercalli Intensity Scale		
	%g	Intensity Value	Intensity Description
10% probability	2 - 4%	IV (1.5 - 2% g)	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing automobiles rocked noticeably.
		V (3 - 4% g)	Felt by nearly everyone, many awakened. Some dishes, windows, and so on broken; cracked plaster in a few places; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
2% probability	6 - 14%	VI (6 - 7% g)	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster and damaged chimneys. Damage slight.
		VII (10 - 15% g)	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving cars.
Source: USGS Earthquake Hazards Program and Bolt, Bruce A. *Earthquakes - Newly Revised and Expanded*., 1993, Appendix C. Referenced by St. Louis University, Department of Earth & Atmospheric Sciences Website. http://mnw.eas.slu.edu/Earthquake_Center/mercalli.html			

Projected Future Damages from Earthquakes

There is not a record of damages from past earthquakes experienced in Stephenson County. However, the types of damages that may be experienced for each intensity of earthquake of the Modified Mercalli Scale is identified in Table 8 above.

Human-Caused and Disease Outbreak Hazards

Hazard Overview

The County is vulnerable to the following hazards that are either caused by humans or are disease outbreaks, as identified in the Stephenson County Disaster Plan:

10. Foreign animal disease outbreaks (including Foot and Mouth Disease, West Nile Virus, and Avian Flu)
11. Hazardous materials incidents
12. Transportation accidents on roadways, rail, or in aircraft
13. Major fires/explosions
14. Civil disturbances
15. Terrorism, including bomb threats and agroterrorism, occurring either in Stephenson County or nearby metropolitan areas
16. Regional or national health emergencies
17. Peacetime radioactive incidents, potentially associated with the nuclear power plant in nearby Byron
18. Energy shortages and blackouts

A thorough assessment of the risk in Stephenson County for each of these hazards, and detailed strategies for addressing them, is beyond the scope of this Plan. The Stephenson County Disaster Plan should be referenced for more detailed information on how the County intends to respond to these types of disasters. However, the following Hazard Vulnerability section provides an overview of the primary factors contributing to vulnerability to hazards caused by humans or disease outbreaks.

Hazard Vulnerability

Generally speaking, hazards caused by humans or due to disease outbreaks cannot always be as easily predicted, and therefore mitigated, as naturally-occurring hazards. However, there are several factors that can put a community at greater risk of experiencing loss of life and property when these types of hazards become apparent or incidents occur as a result of them. The factors that contribute to the County's vulnerability to human-created or disease-based hazards include the following:

- *Hazard Detection and Response Preparedness*: Communication systems within the County and between the County and regional and national agencies greatly impact the County's ability to detect a hazard when it occurs or is expected to occur and then to respond quickly and effectively to the disaster. Stephenson County recognizes that hazard detection and communication is an area that can use continual improvement and therefore the County continually updates and improves its communications systems. These efforts are overseen by the County Unified Command Committee, which involves all agencies and organizations that play a role in emergency response in the County. The Unified Command Committee follows the operations detailed in the Stephenson County Disaster Plan.

  Additionally, the Prairie Shield Regional Alliance has been recently formed to improve regional coordination and communications to improve detection and response to regional-scale disasters. This group includes sheriff's offices, police and fire departments, emergency management groups and other local governmental entities from Boone, DeKalb, McHenry, Ogle, Stephenson, and Winnebago counties.

- *Land Use, Economy, and Population Density:* The land use, population, and economic makeup of the County plays a role in the County's vulnerability to certain manmade and disease outbreak hazards. In Stephenson County, agriculture is the primary land use and consequently plays a major role in the local economy. This, therefore, makes the County more susceptible to loss of life and property from foreign animal disease outbreaks such as Foot and Mouth disease.

  Conversely, the rural nature of the County reduces its risk of terrorism disasters as compared to more densely populated areas. That said, acts of terrorism can threaten a broader regional area, making it still a real risk. This is particularly true for Stephenson County as it relates to the Byron nuclear power plant. The power plant is only about 8 miles away from the Stephenson County line. It is potentially vulnerable to both terrorism and operational accidents. Additionally, Stephenson County is approximately 1 ½ hours west of Chicago, which faces greater threats from terrorism due to its position as a major economic and population center. These factors make the County population vulnerable to a major nuclear disaster and also a destination for people evacuating the Byron or Chicago areas in the case of disasters there.

- *Standing Water:* Vulnerability of exposure to mosquitoes carrying West Nile Virus is greatly exacerbated by presence of standing water rich in organic content, such as water impounded at the bottom of catch basins/storm drains. Flood waters remaining stagnant for periods of time could also lead to greater mosquito populations.

- *Building Code, Fire and Hazardous Materials Safety Regulations and Enforcement*: Vulnerability to explosions, fires, and hazardous materials incidents is greatly dependent on the strength and enforcement of ordinances regulating building construction, use of fire, and use/storage of hazardous materials. Knowing the locations of sites that manage hazardous materials—and contingency plans if there is a problem with containment—is also a key factor affecting vulnerability. The Risk Assessment maps in Chapter 3 attempt to present the most recent record of these sites.

- *Infrastructure Maintenance*: Vulnerability to road, rail, and air accidents is related both to weather conditions and the quality of transportation infrastructure. Consequently, improved transportation systems maintenance reduces vulnerability to this hazard.

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Pages 51 – 75 include the following maps:

Map 2: Risk Assessment: Stephenson County

Map 3: Risk Assessment: City of Freeport

Map 4: Risk Assessment: City of Freeport Pecatonica River

Map 5: Risk Assessment: City of Freeport Yellow Creek

Map 6: Risk Assessment: Village of Cedarville

Map 7: Risk Assessment: Village of German Valley

Map 8: Risk Assessment: Village of Lena

Map 9: Risk Assessment: Village of Orangeville

Map 10: Risk Assessment: Village of Pearl City

Map 11: Risk Assessment: Village of Ridott

Map 12: Risk Assessment: Village of Winslow

Map 13: Risk Assessment: Villages of Dakota, Rock City, and Davis

Map 14: Risk Assessment: McConnell (unincorporated)

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Chapter 4: Mitigation Goals and Strategies

Chapter 4 discusses mitigation strategies for the hazards that have occurred and are probable in Stephenson County, as indicated in Chapter 3. This Chapter also identifies parties that would be responsible for implementation of the strategies and potential partners that could provide assistance. At the core of these mitigation strategies is education and cooperation. Community members are more likely to embrace mitigation measures if they understand how those actions can limit the economic, social, and environmental impact of hazards. Further, governmental agencies and jurisdictions are more likely to develop information networks when there is a clearly understood common goal of decreasing the impact of disasters. Following Tables 9 through 13 in this section, mitigation strategies that are applicable to all hazards are discussed, followed by disaster specific mitigation strategies, presented county-wide and for the communities that are most affected.

HAZARD MITIGATION GOALS

At the second Hazard Mitigation Planning Committee meeting, held on May 11, 2007, the Committee participated in an exercise to identify the highest priority goals for this Multi-Hazard Mitigation Plan. A list of 36 potential mitigation goals was provided to each committee member. These included both goals focused on outcomes of the plan (e.g. "protect human lives") as well as outcomes focused on the process of implementing the plan (e.g. "help people to protect themselves"). Each member was then asked to use this list as a starting point to brainstorm the five mitigation goals they believed to be the highest priority for Stephenson County. Committee members wrote each goal on a separate sticky note, and then posted it on a large board. As the members brought their five notes to the board, they were asked to group each of their notes with others on the board that were most similar. At the end of the exercise, project consultants conducted a final sort of the notes to group them into the following seven categories. These are the goal statements upon which this Plan is based:

1. **Protect human lives, both today and for future generations**
2. **Protect human and environmental health**
3. **Prevent future development from increasing hazard vulnerability**
4. **Preserve open space, including environmentally sensitive and agriculturally productive areas**
5. **Protect critical facilities**
6. **Help people to protect themselves**
7. **Promote the use of partnerships in hazard mitigation**

The Committee then achieved consensus at this meeting on these seven priority goals. These goals were presented at the community meetings held on July 12 and July 17 and input on the goals was sought from meeting attendees. Feedback from attendees reinforced these seven priority goals.

HAZARD MITIGATION STRATEGY PRIORITIZATION PROCESS

Vandewalle & Associates identified potential hazard mitigation strategies for each hazard, in part from a FEMA State and Local Mitigation Planning How-To Guide.[36] Additionally, Committee members and members of the public were asked to identify any additional strategies that may not have been on the list developed by Vandewalle & Associates.

A five-stage process was undertaken to identify priority mitigation strategies in this Plan.

[36] Federal Emergency Management Agency. *State and Local Mitigation Planning How-To Guide: Developing the Mitigation Plan.* April 2003.

Stage One: Hazard Mitigation Planning Committee Initial Priority Strategies

At the May 11, 2007 Committee meeting, members were asked to help prioritize a list of potential mitigation strategies for each hazard, described in Chapter 3. Committee members were given a list of potential strategies for each hazard and asked to circle the five strategies they believed should be the highest priority for each hazard. Committee members could also write in any strategies not included on the list. After this exercise, a discussion was facilitated with the group during which each Committee member identified and explained his or her top strategy, so that the group had an opportunity to further examine the strategies through a dialogue. After this meeting, Vandewalle & Associates analyzed the results of this prioritization exercise, which then impacted the second stage of prioritization.

Stage Two: Community / Jurisdiction Meetings

With an understanding of hazard risks in the County, the Committee's initial input on mitigation strategy priorities, and initial community and jurisdictional input on mitigation strategies voiced in the March and April community meetings, Vandewalle & Associates narrowed down the list of potential strategies for each hazard and presented these strategies at two community meetings on July 12 and July 17, 2007. Since the July 12 meeting was focused specifically on the issue of flooding in Freeport's Pecatonica River floodplain (which primarily targets the East Side neighborhood), that meeting focused solely on flood mitigation strategies for the Freeport Pecatonica River floodplain. After each of the strategies was presented, Vandewalle & Associates facilitated a dialogue with participants to elicit input, questions, and concerns for each strategy.

At the July 17 meeting, strategies for each hazard were briefly presented. Participants were then asked to identify their highest priority strategies for the community they were representing.

Stage Three: Draft Strategy Prioritization

Armed with a more thorough understanding of benefits, drawbacks, and perceptions of each strategy based on input from the Committee, local governments, and the public, Vandewalle & Associates then evaluated the benefits and drawbacks/costs of each strategy to develop a preliminary prioritization. This analysis is summarized in Tables B1 – B6 in Appendix B

The following ten elements were considered when identifying the benefits and drawbacks of each strategy. Elements 3 through 10 are a part of a prioritization system developed by FEMA called STAPLEE (based on the first letter of each strategy, as highlighted below). Some communities have used a quantitative process to score each strategy for each of the STAPLEE criteria. In the case of Stephenson County, it was determined that a qualitative, holistic evaluation process would produce the most meaningful prioritization.

1. Ability to achieve one or more of the Stephenson County Hazard Mitigation Goals
2. Community support
3. Ability to be implemented (potential funding available)
4. **S**ocial impacts
5. **T**echnical feasibility
6. **A**dministrative requirements
7. **P**olitical support
8. **L**egality
9. **E**nvironmental impacts
10. **E**conomic impacts / costs of implementing

Stage Four: Committee and Jurisdiction Input on Prioritization and Identification of Responsible Parties and Partners

After developing the draft strategy prioritization, Vandewalle & Associates presented the resulting prioritization of strategies—organized into "high," "medium," and "low" priority categories at the September 26, 2007 Committee meeting. Representatives of several of the County's local governments also attended this meeting.

After presenting this list and seeking input on suggested modifications to the priorities, Vandewalle & Associates then sought Committee input on potential responsible parties and partners for implementation.

Stage Five: Draft Multi-Hazard Mitigation Plan

Based on the input provided at the September 2007 Committee meeting, Vandewalle & Associates then refined the list of priority mitigation strategies and also identified responsible parties, potential partners, and implementation timelines. A full draft of the Multi-Hazard Mitigation Plan was then made available to Committee members and representatives of all of the jurisdictions in the County, who provided input on the draft Plan at and following the February 6, 2008 Committee meeting.

PRIORITY HAZARD MITIGATION STRATEGY SUMMARY TABLES

The following tables summarize the mitigation strategies, responsible parties, potential partners, and implementation timelines for each potential natural hazard in the County. These strategies are then discussed in further detail following these tables.

Table B1 – B6 in Appendix B lists all of the potential mitigation strategies that were evaluated for each hazard and describes the benefits and drawbacks/costs of each strategy. It should be noted that there are several "Tier 3" strategies included in Tables B1 – B6 that, although they are not currently priorities, should be considered to be a part of a larger menu of potential strategies that the County may employ as it advances implementation of this Plan.

Since the applicability of different flood mitigation actions differ among communities depending on the specific issues of flooding vulnerability, strategies are prioritized at the local community level. Only those communities where flooding is a risk are identified in the table. Consequently, the Villages of Dakota, Davis, and Rock City do not have specific flood mitigation strategies as there is not river or creek in these areas to pose a riverine flooding hazard.

Mitigation strategies are separated into tiers. Tiers One and Two are described in detail in this chapter. Additionally, future strategies for consideration for each hazard are included as Tier Three strategies listed in B1 – B6 in Appendix B

- *Tier One Priority*: Includes highest priority strategies; begin implementation in Years 1 through 3, following adoption of this Plan.
- *Tier Two Priority*: Includes second-highest priority strategies; begin implementation in Years 1 through 5, generally after Tier One priorities are underway. Note that priorities listed as "Tier Two" are still high priorities.
- *Tier Three Priority*: Includes strategies that are not currently identified as priorities, but are included for future consideration as the County moves forward with implementation of this Plan.

The following acronyms are used in the identification of responsible parties and potential partners:

- ACE Army Corps of Engineers
- FEMA Federal Emergency Management Agency
- IDOT Illinois Department of Transportation
- IEMA Illinois Emergency Management Agency
- IDNR Illinois Department of Natural Resources
- IEPA Illinois Environmental Protection Agency
- ISWS Illinois State Water Survey
- NRCS Natural Resources Conservation Service
- NICAA Northwest Illinois Community Action Agency
- SCEM Stephenson County Emergency Management
- SCHD Stephenson County Health Department
- SCSWCD Stephenson County Soil & Water Conservation District
- UIEX University of Illinois-Extension
- USGS United States Geological Survey
- YCWP Yellow Creek Watershed Partnership

Table 9: Priority All Hazards Mitigation Strategies

Mitigation Strategy	Responsible Parties	Potential Partners	Implementation Timeline
Tier 1 Priority			
Pursue Regular Community Outreach and Education	SCEM, Red Cross, local governments	Utilities, IEMA, local media, school districts, real estate community	Ongoing; identify opportunities to improve within 3 years
Improve Coordination and Communication Among Emergency Responders	SCEM, Unified Command Committee, police, fire and sheriff's departments, Red Cross, County and local governments	Prairie Shield Regional Alliance, regional watershed groups	Continue efforts to implement County-wide communications trunking system within 3 years; ongoing efforts to improve coordination
Promote and Implement Modern Hazard Warning Systems	SCEM, County and local governments	IEMA, school districts, owners/managers of facilities with vulnerable populations	Ongoing - continue and expand existing efforts to promote use of NOAA radios; maximize use of EMnet; increase coordination with local governments, fire and police departments, schools, and other partners
Tier 2 Priority			
Protect Critical Facilities and Infrastructure	SCEM, County and local governments, utilities, police, fire and sheriff's departments, County highway department	Schools, hospitals, owners/managers of places of assembly	Initiate within 5 years; ongoing maintenance
Improve Planning and Regulatory Practices	County and local government zoning departments	SCEM, park and recreation departments, local and water conservation departments	Initiate within 5 years; ongoing enforcement

Table 10: Priority Flood Mitigation Strategies

Mitigation Strategy	Responsible Parties	Potential Partners	Timeframe	Communities Where Strategy to be Implemented											
				County-wide	Freeport Pecatonica	Freeport Yellow Creek	Cedarville	Dakota	German Valley	Lena	McConnell	Orangeville	Pearl City	Ridott	Winslow
Tier 1 Priority															
Pursue Regular Community Outreach and Education	SCEM, Red Cross, County and local governments (particularly Freeport)	Utilities, IEMA, IDNR, local media, local organizations & community groups, lenders, contractors	Ongoing; identify opportunities to improve within 3 years	■	■	■					■	■	■		
Update Official Floodplain Maps	SCEM, local governments	IEMA, IDNR, FEMA, ACE	Initiate procuring funding source within 1 year; complete within 5 years	■	■	■	■						■	■	
Improved Planning and Regulatory Practices	County government, local governments	SCEM	Initiate within 3 years; ongoing enforcement	■		■	■	■	■	■		■	■	■	
Enhance Stormwater Management and Erosion Control	County and local governments, SCS&WCD, NRCS, property owners	YCWP, Natural Land Institute, SCEM	Initiate within 3 years; ongoing enforcement	■	■	■	■				■	■	■	■	
Advance an Initiative of Voluntary Acquisition of Structures and Relocation of People	SCEM, affected local governments	IEMA, Neighbor-hood Housing Services, ESRTF, local institutions, community leaders	Initiate development of program within 3 years		■						■	■			
Maintain	SCEM	IEMA,	Continued	■											■

Mitigation Strategy	Responsible Parties	Potential Partners	Timeframe	Communities Where Strategy to be Implemented											
				County-wide	Freeport Pecatonica	Freeport Yellow Creek	Cedarville	Dakota	German Valley	Lena	McConnell	Orangeville	Pearl City	Ridott	Winslow
River Gages		USGS, NWS, Winslow, Freeport	communication with USGS to ensure commitment to river gages												
Promote Floodproof-ing of Buildings Where Appropriate and Cost-effective	Property owners	SCEM, local govern-ments, property owners	Ongoing effort to educate property owners on effective techniques												
Tier 2 Priority															
Protect Critical Facilities and Infrastruct-ure	SCEM, County and local governments, utilities, fire, police, and sheriff's departments, County highway department	Schools, hospitals, IDOT	Initiate within 5 years; ongoing maintenance												
Protect Water Quality (e.g. brownfield cleanup, hazardous spill prevention, & erosion control)	County and local governments, property owners, businesses	IEPA, SCEM, IDNR	Initiate addressing threats to water quality within 5 years												
Increase Access to Flood Insurance	SCEM, Red Cross, property owners, local governments	Insurance providers, IEMA	Improve outreach efforts to property owners within 3 years												
Promote and Implement	SCEM, County and local	IEMA	Ongoing - continue and												

Mitigation Strategy	Responsible Parties	Potential Partners	Timeframe	Communities Where Strategy to be Implemented											
				County-wide	Freeport Pecatonica	Freeport Yellow Creek	Cedarville	Dakota	German Valley	Lena	McConnell	Orangeville	Pearl City	Ridott	Winslow
Modern Hazard Warning Systems	governments		expand existing efforts to promote use of NOAA radios												

Table 11: Priority Severe Storm, Tornado, and Winter Storm Mitigation Strategies

Mitigation Strategy	Responsible Parties	Potential Partners	Implementation Timeline
Tier 1 Priority			
Pursue Regular Community Outreach and Education	SCEM, Red Cross, County and local governments, County health department, County highway department	Utilities, IEMA, local media, local organizations, IDOT, insurance agencies	Ongoing; identify opportunities to improve within 3 years
Promote and Implement Modern Hazard Warning Systems	SCEM, local governments	IEMA	Ongoing - continue and expand existing efforts to promote use of NOAA radios; increase coordination with schools; identify opportunities to improve warning systems within 3 years
Promote Active Tree Management	County Highway Dept., utilities, property owners	SCEM, River/creek volunteer organizations	Investigate need within 3 years; take advantage of opportunities that present themselves
Identify Or Construct Saferooms	SCEM, owners/managers of at-risk properties	County and local governments, County zoning department	Identify needed saferooms within 2 years; promote construction of needed saferooms within 5 years; ongoing outreach efforts to residents on use/location of saferooms
Protect Critical Facilities and Infrastructure	SCEM, local governments, utilities, fire, police, and sheriff's departments, County highway department	Schools, hospitals, IDOT	Initiate within 5 years; ongoing maintenance
Tier 2 Priority			
Improve Planning and Regulatory Practices	County zoning, local governments		Initiate within 5 years; ongoing enforcement
Improve Coordination and Communication Among Emergency Responders	SCEM, Unified Command Committee	Fire, police, and sheriff's departments., local governments, Red Cross, EMS	Continue efforts to implement County-wide communications trunking system within 5 years; ongoing efforts to improve coordination

Table 12: Priority Drought Mitigation Strategies

Mitigation Strategy	Responsible Parties	Potential Partners	Implementation Timeline
Tier 1 Priority			
Pursue Regular Community Outreach and Education	SCEM, Farm Bureau, SCS&WCD, UIEX, County and local governments	ISWS, local media	Ongoing; identify opportunities to improve within 3 years
Promote Use of Best Management Practices for Yards and Agriculture	SCEM, Farm Bureau, SCS&WCD, UIEX, County and local governments	ISWS	Initiate within 3 years
Tier 2 Priority			
Improve Planning and Regulatory Practices	SCEM, County government, local governments	ISWS	Initiate within 5 years

Table 13: Priority Extreme Temperatures Mitigation Strategies

Mitigation Strategy	Responsible Parties	Potential Partners	Implementation Timeline
Tier 1 Priority			
Pursue Regular Community Outreach and Education	NICAA, SCEM, County and local governments, Red Cross	Utilities	Ongoing; identify opportunities to improve actions within 3 years
Promote And Improve Use Of Cooling Centers (Possibly Similar Spaces As Saferooms)	Red Cross, SCEM, County and local governments	Multifamily housing property owners	Continue current promotion efforts; identify strategies to improve usage within 3 years
Tier 2 Priority			
Monitor Locations of Vulnerable Populations and Improve Access to Adequate Heating/Cooling	NICAA	Utilities	Initiate within 5 years
Promote Home Weatherization	Property owners, NICAA	SCEM, local governments, utilities	Continue current efforts of NICAA; identify opportunities to expand their outreach activities within 5 years

Table 14: Priority Earthquake Mitigation Strategies

Mitigation Strategy	Responsible Parties	Potential Partners	Implementation Timeline
Tier 1 Priority			
Promote and Implement Modern Hazard Warning Systems	SCEM, local governments	IEMA	Ongoing - continue and expand existing efforts to promote use of NOAA radios
Tier 2 Priority			
Pursue Regular Community Outreach and Education	SCEM, Red Cross	Schools, local governments	Ongoing; identify opportunities to improve within 5 years
Protect Critical Facilities And Infrastructure	SCEM, County and local governments, utilities, fire, police, and sheriff's departments	Schools, hospitals	Initiate within 5 years

Table 15: Priority Human-Caused Hazard and Disease Outbreak Mitigation Strategies

Mitigation Strategy	Responsible Parties	Potential Partners	Implementation Timeline
Tier 1 Priority			
Improve Coordination and Communication Among Emergency Responders	SCEM, SCHD, Unified Command Committee, County and local governments, fire, police, and sheriff's departments, Red Cross, EMS	IEMA, Prairie Shield Regional Alliance	Continue efforts to implement County-wide communications trunking system within 3 years; ongoing efforts to improve coordination
Pursue Regular Community Outreach and Education	SCEM, SCHD, Red Cross, local governments	IEMA, utilities, local media	Ongoing; identify opportunities to improve within 3 years
Promote and Implement Modern Hazard Warning Systems	SCEM, local governments	IEMA	Ongoing; continue and expand existing efforts to promote use of NOAA radios
Tier 2 Priority			
Identify and Address Infrastructure Hazard Vulnerability	SCEM, County and local government public works staff	Railroads, airports, utilities, IDOT	Initiate evaluation within 5 years; ongoing evaluation and maintenance

PRIORITY MITIGATION STRATEGIES FOR ALL HAZARDS

The following five mitigation strategies are applicable to all types of hazards. These strategies should be considered and implemented in a comprehensive approach addressing multiple hazards.

1. Pursue Regular Community Outreach & Education – Tier One Priority

County and local governments are best equipped to provide communities with information about the effect of disasters, methods for preventing damages, and the actions to take when disasters threaten a locality. Ideally, such information would be distributed annually or at the beginning of each hazard season. Traditional points of contact between governmental agencies and the community are effective means to provide information and resources. Such points of contact include municipal and County meetings, building, zoning, and burning permitting processes, parks and recreation permitting processes, and school classrooms. Web sites, e-mail list-servs, local closed-circuit cable and radio stations, newspaper articles, and informational fliers (that could, for example, be included with utility or tax bill mailings) can also reach a large audience at little to no cost.

Stephenson County has demonstrated its ability to effectively work with local communities to thoroughly notify the public during severe weather events, and these efforts have been recognized by the National Weather Service as Stephenson County was declared in 2008 to be a StormReady community. To be given this designation, the County demonstrated that it:

- Has established a 24-hour warning point and emergency operations center;
- Has more than one way to receive severe weather forecasts and warnings and to alert the public;
- Has created a system that monitors local weather conditions;
- Promotes the importance of public readiness through community seminars;
- Has developed a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.

The County's should build on its success as a StormReady community by focusing more directly on community outreach related to hazard mitigation. Often there are misconceptions about the costs, benefits, and implementation of hazard mitigation strategies. Governmental jurisdictions, agencies, and organizational partners should lead by example to educate the public about good practices and disaster resistance. Visual and economic proof that mitigation strategies reduce the economic and social impact of disasters is one of the most effective educational tools available. Elected officials and department heads should be educated on the financial and social impacts of disasters, mitigation strategies, and the need to work together in order implement this Multi-Hazard Mitigation Plan most effectively.

Educational efforts should focus on the simple changes in behavior that can minimize risks. Self instigated mitigation strategies can be accomplished at the household level; for example, clearing dead and down timber and other debris from drainage areas or storm sewer inlets, observing construction site and farmland soil conservation practices, and using construction methods that reduce damage from hazards. Insurance agencies and lenders can help disseminate information on household mitigation strategies, as damages due to hazards have a direct impact on a property owner's investment and possible insurance payouts.

Other specific examples of education and outreach tools include the following:

- *Web*: SCEM could develop a simple website that each municipality could link to providing information on disaster preparedness and hazard mitigation. The website would target both government agencies within the County as well as the public. Government agencies could be provided with e-mail notices when content is updated.
- *Elementary and Secondary Curriculum*: Curriculum may be enhanced by programs such as Red Cross' "Master of Disaster" Program or the Project WET program on the water cycle.
- *Public Access Television*: The local public access cable station can be used to play mitigation videos developed by state and national organizations and agencies.
- *Construction Education*: Instructors of building trades vocations should be provided up-to-date information on hazard resistant construction techniques.

- *Severe Weather Awareness Week*: This week occurs in March as a tool to promote awareness of hazard preparedness and mitigation. This week is an opportunity for schools, businesses, individuals, and organizations to review their severe weather action plans.
- *Education Targeting Vulnerable Populations*: Education and outreach efforts should be balanced between efforts to communicate to people County-wide and focusing particular attention on high risk groups, such as people residing in the floodplain, the elderly, low-income persons, and people residing in mobile homes.
- *Real Estate Deed Disclosure*: Informational fliers that identify rights and requirements of buyers, sellers, and lenders, as well as and provide resources to conduct additional research on properties could prevent investing in problematic properties. Such prevention will benefit everyone, as tax dollars fund disaster assistance and subsidize floodplain insurance payments, and high-risk properties inflate insurance premiums.

Responsible Parties and Potential Partners

- *Responsible:* Stephenson County Emergency Management, Red Cross, local governments
- *Partners:* IEMA, Utilities, Local media, schools districts, real estate community

2. Improve Coordination and Communication Among Emergency Responders and Regional Groups – Tier One Priority

Disasters cross jurisdictional boundaries and affect numerous aspects of a community, from physical safety, to economic stability and environmental condition. Therefore, effective mitigation requires that mitigation strategies also cross jurisdictional boundaries to include neighboring townships, villages, cities, counties, and states, as well as across department and agency lines.

Improved intergovernmental/inter-agency coordination does not require signed agreements or contracts. Just being aware of neighboring communities' plans for growth and development or infrastructure improvements and expansions can lead to better decision making regarding land use and hazard mitigation.

Coordinated regional approaches would improve rapid and cost-effective delivery of emergency services, given that the majority of disasters cause physical, economic, and environmental impacts at the regional scale. Stephenson County's Unified Command serves as an effective tool to ensure clear communication among emergency responders within the County. The County is working to enhance its communication system in two ways that should continue to be pursued as a strategy under this Plan:

Clean-up Kits provided to Freeport residents at Taylor Park, 2000

- *County Trunking System:* The County is working to consolidate and streamline radio communication among emergency responders through a new trunking system, whereby different communities, fire districts, and police districts can all access the same radio frequencies to communicate.
- *Prairie Shield Regional Alliance:* This group was founded in 2005 and is composed of a collection of sheriff's offices, police and fire departments, emergency management groups and other local governmental entities from Boone, DeKalb, McHenry, Ogle, Stephenson, and Winnebago counties. The goal of this group is to assemble a multi-county radio and video communications system to improve coordination during disaster events that may require assistance among counties. The group recently received a major state grant to implement this effort.

Responsible Parties and Potential Partners

- *Responsible:* Stephenson County Emergency Management, SCEM Unified Command, Fire Departments, Police Departments, Sheriff's Department, Red Cross, Local Governments, EMS

- *Partners:* IEMA, Prairie Shield Regional Alliance, regional watershed groups, local governments

3. Promote and Implement Modern Hazard Warning Systems – Tier One Priority

The County should continue education and outreach efforts to encourage residents to have a National Oceanic and Atmospheric Administration (NOAA) weather radio on hand to provide up to date warnings and directions regarding pending hazard events. NOAA weather radio continuously broadcasts National Weather Service (NWS) forecasts, warnings and other crucial weather information as well as provides direct warnings to the public for natural, man-made, or technological hazards 24-hours a day. This network of radio stations is the primary trigger for activating the national Emergency Alert System (EAS) on commercial radio, television, and cable networks. NWS broadcasts also include post-event information for natural and human caused hazards.

In addition to NOAA radios, the County should continue to update and expand its system of warning the public and local governments about impending hazards. Illinois recently began using the communication tool Emergency Management Network, EMnet for short. The County should identify opportunities to take advantage of this communication system to better warn agencies and individuals about hazards through its text message, e-mail, and voice message options. An automated phone message system may be particularly effective in smaller, more isolated communities that do not have sirens. This has been identified as a potential strategy in places like Dakota, where the Village schools are on the edge of the community and therefore the first to be impacted by most storms.

Responsible Parties and Potential Partners

- *Responsible:* Stephenson County Emergency Management, local governments
- *Partners:* IEMA, school districts, fire and police departments, owners/managers of facilities with vulnerable populations

4. Protect Critical Facilities and Infrastructure – Tier Two Priority

Protection of critical facilities is a vital hazard mitigation measure to ensure that emergency responders and their facilities are protected from disasters so that they are able to respond quickly during hazard events. Critical facilities include emergency operations centers, police and fire stations, courthouses, rescue/ambulance services, medical facilities (hospitals, nursing homes, and clinics), utilities (water, sewer, electric, gas, and communications), and transportation facilities (critical roads, bridges, and airports). These critical facilities are illustrated on the maps at the end of Chapter 3.

In addition to these critical facilities, major places of assembly should also be particularly prioritized in the event of disaster to protect these concentrations of people. Major places of assembly include schools, major employers, large multi-family housing complexes, auditoriums, and other large facilities. Protection of safe routes and communications to and from these places should be prioritized, as well as evacuation plans. Many places of assembly are also illustrated in the Risk Assessment maps in Chapter 3.

One strategy specific to a major place of assembly in Stephenson County—Highland Community College—is for the County to encourage the College to apply for PreDisaster University funds so that the College can strengthen its own mitigation plan.

Lastly, protection of critical infrastructure, including major roads and utilities, is critical to ensuring access to/from communities during disasters as well as providing needed services including water, communications, and power, to residents and businesses in the County.

Responsible Parties and Potential Partners

- *Responsible:* Stephenson County Emergency Management, local governments, utilities, fire departments, police departments, sheriff's department, County highway department
- *Partners:* schools, hospitals, owners/managers of places of assembly

5. Improve Planning and Regulatory Practices – Tier Two Priority

This Multi-Hazard Mitigation Plan should be considered an integral part of the local and County-wide planning and land use management efforts since land use is a major factor in hazard vulnerability. A number of specific examples of

planning and regulatory practices are identified below that should be a part of the County's multi-hazard mitigation strategy:

Incorporate Hazard Mitigation into Comprehensive Planning

Comprehensive planning efforts, both local and County-wide, provide opportunities to integrate hazard mitigation strategies into daily planning and land use policy decisions. The public participation component of local comprehensive planning efforts provides a venue to educate the public about the connections between planning and hazard mitigation, encourages public buy-in, and validates the role of hazard mitigation planning within the long-range goals of the community.

Land use planning establishes guidelines for the use and development of land, and is generally used to guide decisions on zoning changes and subdivisions. Land use planning also helps communities organize the use of lands and their resources according to the land's capabilities to best meet people's needs over time. Land that is prone to natural disaster, due to location, topography, soils, geology, or plant cover should be identified as hazard-prone within the land use element of the comprehensive plan. The Risk Assessment maps from this Plan should be used when updating County and local land use plan maps. Overall, a good land use element and associated future land use map within a comprehensive plan has the capability of:

- Guiding development towards areas that are not subject to hazards
- Reducing population and building density in the hazardous areas
- Encouraging limitations on new development in hazardous areas
- Encouraging use of best agricultural, soil erosion, and stormwater management practices

This strategy appears particularly applicable in the City of Freeport, which intends to prepare a Comprehensive Plan in the coming years. When this plan is prepared, particular attention should be paid to land use planning in the Yellow Creek corridor to address the interrelated issues of flood mitigation, environmental protection, land use, open space and recreation, and economic development.

Include Mitigation Goals on Official Maps

The purpose of an Official Map is to ensure that areas planned for future public facilities are reserved in the face of new development of adjoining private lands. An Official Map may show general alignments of planned roads, expanded rights-of-way for certain existing roads, drainageways, planned parks, and other planned public facilities. When development is proposed in an area of a feature shown on an Official Map, the local government may obtain land for that feature through dedication, purchase, or reservation. Related to hazard mitigation, an Official Map can be particularly useful in identifying and preserving drainageways to limit future flooding. An Official Map is adopted by ordinance by a city or village, and may be periodically amended.

Zoning Code Amendments and Enforcement

When enforced, zoning is a powerful mitigation tool. A zoning ordinance is the set of rules that a local or County government adopts to regulate the future use of land, particularly when new development is proposed. Zoning ordinances may also include rules for certain qualities of new development such as site planning, landscaping, and signage. The County Zoning Administrator is charged with enforcing zoning ordinances and is responsible for issuing zoning permits for unincorporated areas. Cities and villages with adopted local ordinances are responsible for enforcement and permit issuance within their jurisdictions.

In small communities, there is often hesitancy to "regulate one's neighbor" by enacting or enforcing permit and code requirements. However, a favor to one person can be damaging to the downstream neighbor or the community as a whole when disaster damages result in additional local and County expenditures for overtime of emergency response and recovery assistance. Permitting officials are the frontline defense against substandard, unsafe construction methods and risky development investments that result in additional, unplanned public expenses.

County and local zoning ordinances should be updated, as necessary, to include the following provisions:

- Require site plan review for larger projects and projects in flood-prone areas. A site plan is a map of a proposed development usually submitted as part of an application for zoning change, variance, or conditional/special use permit, and indicates site topography, drainage, vegetation, building location, parking, access, and utility locations..
- Mobile homes should have anchored tie downs to protect these homes from severe storms.
- Require new or expanded mobile home parks, campgrounds, RV parks, and other similar facilities to provide a storm shelter.
- Include the latest wetland and floodplain zoning models and standards to insure that hazard-prone areas are considered in the process of obtaining a zoning or building permit.
- New utility lines should be installed underground.

What are Best Management Practices (BMPs)?

BMPs are policies, practices, procedures, or structures that are recognized to be the most effective and practical means of managing a system, such as stormwater management or erosion control

Overlay zones are one option to integrate hazard-prone areas into zoning. Overlay zones are a version of traditional zoning; however, requirements of overlay zones are applied to an area in addition to their "base" or underlying zoning requirements. Overlay zones that have special standards based on underlying environmental conditions are common. Overlay zones are especially effective in hazard mitigation because areas that are vulnerable to hazards are rarely contiguous with existing regulatory, jurisdictional, parcel, or land use boundaries.

Subdivision Ordinance Amendments and Enforcement

When enforced, subdivision ordinances are effective hazard mitigation tools. A subdivision ordinance is the set of rules that a government adopts to regulate the division of larger parcels of land into smaller lots for sale and development. A subdivision ordinance typically defines requirements that the subdivider must meet before lots may be sold. These may include requirements for lot sizes, roads, utilities, grading, and stormwater management. Land in a city or village is only subject to that city or village's ordinance, and land outside of cities and villages is subject to the County's subdivision ordinance and possibly that of a nearby city or village.

Currently, the County's subdivision ordinance includes an innovative Land Evaluation and Site Assessment tool that is geared toward directing development away from prime agricultural lands. The use of this type of system should be expanded in the County's ordinance—and also be adopted into local subdivision ordinances—to direct development away from hazard-prone areas. Additional requirements of County and local subdivision ordinances should include the following, as needed (some of these requirements are already incorporated in County and some local ordinances):

- Inclusion of a requirement that the developer of each new subdivision plat provide, with preliminary submittals, a detailed "site assessment checklist" that would identify natural features (and potential hazards) in and around a site before land is divided.
- Inclusion of a detailed preliminary plat or certified survey map with floodplain and wetland boundaries clearly identified. At times, this will require a detailed survey of the property, and its environmental features.
- Quantified stormwater management requirements that are based on the area of impervious surfaces, such as pavement and roofs, and Best Management Practices for stormwater management.
- Requirements that all new buildable lots should be kept out of the floodplain.
- A requirement that developers of mobile home parks and industrial parks should provide a storm shelter.

Comprehensive Outdoor Recreation Planning

If prepared and regularly updated, these plans enable

communities to obtain grants for park and open space land acquisition, which may serve multiple recreation and hazard mitigation objectives (e.g. acquiring floodplain lands for open space and recreational purposes).

Capital Improvement Planning

Decisions to extend roads, waste water treatment facilities, or utilities into hazard-prone areas will increase the risk that additional public funds will be necessary at some point to repair damage. Additionally, public investment in, and expansion of, public infrastructure in an area implies that the area is "safe" for development and private investment and may inadvertently promote private developments in hazard prone areas. Expansion of existing capital improvements, or investment in new capital improvements should be evaluated for "disaster sustainability"--location and investment should be directed by risk assessment and best management land use practices, in addition to existing capital improvement criterion. This evaluation is extremely important in rapidly developing areas.

Purchase of Conservation Easements and Development Rights

By purchasing an easement, a local government, utility or non-profit land conservation agency compensates an owner for partial rights to use a property. A common example is a utility easement: a property owner will provide the right to lay public utilities across their land and then agrees not to build in the area. As a hazard mitigation strategy, easements can prevent a property from being developed if to do so would not be in accordance with a community's land use plan. The County should consider purchasing development rights (easements) of vacant, hazard-prone properties where fee simple acquisition is not practical or desired. Currently, development easements have been purchased on the four properties that were acquired by the FEMA buyout program discussed above.

Responsible Parties and Potential Partners

- *Responsible:* Stephenson County and local government zoning departments
- *Partners:* SCEM, park and recreation departments, land and water conservation departments

PRIORITY FLOOD MITIGATION STRATEGIES

Priority Flood Mitigation Strategies: County-wide

Flood mitigation strategies addressed in this section can apply to riverine or flash flooding, and most may be applied throughout the County in areas susceptible to flooding. Additional strategies for future consideration are included in Table B1: Flood Mitigation Strategies Prioritization Matrix in Appendix B. Since the causes and impacts of flooding are unique to each community, a number of priority mitigation strategies have been identified.

1. Pursue Regular Community Outreach and Education – Tier One Priority

Strategy 1 under the "Priority Mitigation Strategies for All Hazards" section above provides an overview of the Community Outreach and Education strategy.

As it relates to flooding specifically, continual outreach with the community is critical to ensure that the objectives of the flood mitigation program are understood and that residents, businesses, and property owners have several mechanisms for getting accurate information, voicing opinions, and shaping the actions. Specifically, the flood mitigation outreach and education should focus on communications in the following areas:

- *Flood Mitigation Techniques*: First and foremost, the County, local governments, and partners including the Red Cross, should continue to focus education efforts on techniques individuals and businesses can employ to protect their lives, health, and property from flood damage both in the near term and long term.
- *Flood Mitigation Strategy:* As the County, local jurisdictions, and other partners work to implement this Multi-Hazard Mitigation Plan, it will be critical to keep the community continually up-to-date and treat community members as implementation partners on the objectives, details, and progress of the flood mitigation actions being proposed and carried out. Updates should be made through information shared with community organizations, community-wide meetings and direct project update mailings to residents, property owners, and business owners in areas vulnerable to flooding.
- *Floodplain Regulations:* A frequently voiced struggle for County residents, particularly those in Freeport's East Side neighborhood, is understanding the limitations to improvements that can be made to structures in the floodplain and floodway due to local, state, and federal floodplain regulations. The City can help allay these frustrations by providing published materials that explain the regulations in lay terms and also give clear definitions and examples of what does and does not constitute a "substantial improvement" to property; this threshold initiates stricter regulations.
- *Floodproofing:* The County, local governments, and the Red Cross could distribute materials to residents and business owners in floodprone areas that clearly explain and provide examples of floodproofing actions that residents can take themselves to protect properties from flood damage, such as elevating utilities and appliances in basements.
- *Flood Insurance:* To improve access to flood insurance, residents need accurate, up-to-date information. To help in this regard, the County and local governments intend to connect property owners with flood insurance carriers through periodic flood insurance open houses and printed materials.

Responsible Parties and Potential Partners

- *Responsible:* SCEM, Stephenson County government, Red Cross, local governments (particularly Freeport)
- *Partners:* Utilities, IEMA, local media, local organizations and community groups, lenders, contractors

2. Update Official Floodplain Maps – Tier One Priority

There has been some concern over how accurate and current floodplain maps are in the County, as they are based on County data and computer models completed in the early 1980s. Given that these maps dictate decisions that have community, legal, and financial ramifications, they should be accurate. FEMA floodplain maps are based on historical flood data, hydrologic and hydraulic rainfall and river-flow data, topography, wind velocity, existing flood control

measures, and existing and planned development. This information is fed through a computer model and then adjusted based on the number of National Floodplain Insurance Program policyholders, flood damage claims, and the prevalence of repetitive loss properties. Funding limitations allow the agency to update maps only every 15-20 years.

The County should seek resources to update floodplain maps based on modern hydrologic models that reflect current conditions in the watershed. This updated information would prove to be an invaluable tool for future decision-making. This strategy is suggested for specific communities in the County where specific issues with floodplain maps have been identified; however, the most efficient, effective strategy may be to gather new data on a County-wide level in order to update the maps County-wide.

One particular funding source that should be explored is the Army Corps of Engineers Planning Assistance to States. Another possible source for assistance is the FEMA Cooperative Technical Partners (CTP) Program. The program provides the opportunity to pool local and national resources. CTP works with communities to use local analysis, permitting, and planning data as the basis for the NFIP map. This cooperative process provides an opportunity to interject a tailored, local focus into the national floodplain program. Therefore, where unique conditions exist, the community can take special approaches to flood hazard identification, resulting in more efficient floodplain management. For participating in the CTP Program, community partners will receive Community Rating System credits, which may lead to discounted flood insurance premiums for property owners. Eligibility requirements and benefits can be found at http://www.fema.gov/fhm/ctp_qa1.shtm.

Following completion of a floodplain map update, amendments and revisions should be made to Flood Insurance Rate Maps. This updated information will help provide more accurate warning to residents in the floodplain and better identify the risk of flooding in the community, and provide a more defensible regulatory tool.

SCEM should initiate contact with the FEMA Cooperating Technical Partners Program to determine the specific requirements and timeframe for a formal update. The County Planning and Zoning Department and SCEM should direct the FIRM update, with assistance from FEMA and Army Corps of Engineers (ACE) and cooperation from local governments. In the meantime, SCEM and the County and local planning and zoning departments should collectively annotate the existing floodplain map.

A cost-effective alternative to a full NFIP update or the CTP is to supplement the official floodplain delineations with additional areas known to flood. This could be done using information compiled and mapped during this hazard mitigation planning process. Although these areas will not be held to the regulations of properties that are within the FEMA designated floodplain, County Zoning and Emergency Management will have record of areas of concern and will be better able to educate and warn property owners and developers of potential risk.

The County and local governments may also pursue initiatives to assist property owners with accurately depicting the elevations of their property, either as part of this floodplain mapping update or as a separate initiative. Understanding property elevations is critical in determining if and how much floodplain regulations affect further property improvements. As with many strategies described in this Plan, communities will likely be dependent on securing outside funding to implement this initiative.

Responsible Parties and Potential Partners

- *Responsible:* SCEM, County and local governments
- *Partners:* IEMA, FEMA, ACE

Pecatonica River Watershed Alliance

Since Pecatonica River flooding is a regional issue, there is an opportunity for the County to expand its planning and problem-solving efforts to the regional scale. The County should explore developing a bi-state Pecatonica River watershed regional alliance. This group would include representatives of local governments and people representing environmental, hazard mitigation, economic development, and recreation interests in the region. This alliance would help bring together diverse interests to work in partnership to promote the long-term health and vitality of the Pecatonica River watershed.

3. Improve Planning and Regulatory Practices – Tier One Priority

Strategy 5 under the "Priority Mitigation Strategies for All Hazards" section above provides an overview of this strategy including tools for planning for and regulating flood hazard areas.

As it relates to flooding, a specific emphasis should be place on

amending County and municipal subdivision and zoning ordinances, where requirements are not already in place, to require developers to conduct a detailed evaluation of floodplain boundaries and include them on site plans, certified survey maps, and subdivision plats for any proposed development near the floodplain or other known flood-prone areas. This certified data would ultimately help hone a formally updated County floodplain map.

Additionally, a regional approach to flood mitigation planning should be explored, as described in the sidebar on this page.

Responsible Parties and Potential Partners

- *Responsible:* Stephenson County government, local governments
- *Partners:* SCEM

4. Enhance Stormwater Management and Erosion Control – Tier One Priority

Erosion control and stormwater management programs and ordinances attempt to reduce stormwater run-off from construction sites and new development projects. The overall goals of these efforts are to encourage erosion control practices during private development site construction and ongoing stormwater management after construction for subdivisions and other larger projects to prevent flooding and protect water quality. Improved stormwater management and erosion control practices have the potential to minimize the effect of flooding on private property and business activities.

In addition to enacting stormwater management plans and ordinances, the range of approaches that the County, local governments, and other partners may pursue include:

- Adopting community-wide stormwater management plans to identify potential upgrades to existing stormwater management systems, and the best locations and configurations for stormwater basins and conveyance routes in new development areas.
- Adopting modern erosion control and stormwater management regulations to assure that new development projects do not exacerbate flooding and soil erosion through use of Best Management Practices. Stormwater management and erosion control ordinances could be either stand-alone regulations, or could be integrated into subdivision and zoning ordinances. Such ordinances can identify construction site erosion control requirements that include bank stabilization such as sloping or grading techniques, planting vegetation on slopes, or terracing hillsides. At a minimum, the County and local jurisdictions should update subdivision and zoning ordinances to quantify stormwater management requirements. The County and local governments in the County could share the same or similar ordinance language, which may also enable the County and local governments to share enforcement responsibilities through a contracted staff person.
- Regular inspections of culverts, ditches, and stormwater inlets to assure that they are free from blockage. Clearing blockages and improving the function of existing systems (e.g., ditch dredging) will be pursued where problems are identified.
- Promoting erosion control techniques, such as vegetative swales, over key properties to minimize soil erosion onto public roads and nearby properties.
- Regular inspection of the river and streams to identify problematic obstructions. Cities and villages are responsible for maintaining storm drainage systems within their incorporated areas, but private property owners are responsible for maintaining streams or drainage systems that traverse their land. However, many private property owners are hesitant to act on maintenance needs for fear of repercussions from the DNR.

Local governments can work with citizens groups and property owners to identify and help clear these obstructions. The Yellow Creek Watershed Partnership is an example of a group that has organized citizen cleanup days to clear the Yellow Creek. Stephenson County Soil and Water Conservation Service and the University of Illinois-Extension may also help educate property owners on stream management techniques.

- Directing development away from wetlands and ensuring wetland protection regulations are enforced. Wetlands serve as natural collection basins for floodwaters as their unique soils and hydrology function as sponges by collecting water, filtering it, and slowly releasing it into rivers, streams, and the water table.
- Promoting Best Management Practices for agriculture to reduce stormwater runoff erosion. Examples of such practices include: contour farming, planting hydrophyte crops that have a high water absorption rate, conserving crop residues after harvesting, limiting tillage depth and speed, extending crop rotations to reduce incidence of summer fallow, strip cropping, and fertilization with animal manure.
- Installation of inlet control valves. Basement flooding caused by the back up of combined storm water/sewer systems is a common problem associated with flooding. Inlet control valves slow the flow of the water into the system to prevent the system from exceeding capacity. The City of Chicago secured a FEMA mitigation project grant to install these valves in its sewer system, reducing damages by 90%.
- Promoting site and building designs that go beyond minimum stormwater management requirements to reduce impervious surface coverage such as through use of pervious pavement, installation of "green" roofs (roofs that incorporate planting beds to absorb stormwater), or installation of "rain gardens." This strategy should be considered in particular for the Yellow Creek corridor in Freeport as some community members have expressed concern over the impacts of existing and proposed new development on exacerbating Yellow Creek flooding.
- Exploring other more comprehensive stormwater management solutions, such as additional storm sewer and/or storm/floodwater detention and storage basins. As part of this, considerations should include the benefits to flood mitigation of such initiatives, potential negative side effects (e.g., disturbing contaminated soils), and cost-effectiveness before implementing any solution.
- Considering adoption of a stormwater utility, particularly for the City of Freeport. Recognizing that the costs of repairing damage and maintaining drainage systems is increasing, many communities have initiated a stormwater utility, which charges properties for off-site stormwater management based on the impermeable surface area of a property and makes stormwater management public improvements funded by local property tax revenues. Types of improvements funded by a stormwater utility include: maintenance and/or construction of a drainage systems and reservoir networks; acquisition, relocation, and/or demolition of structures; and development of a regulatory system.

Responsible Parties and Potential Partners

- *Responsible:* Stephenson County government, local governments, Stephenson County Soil & Water Conversation District, Stephenson County Natural Resources Conservation Service, property owners
- *Partners:* Yellow Creek Watershed Partnership, Natural Land Institute, and similar non-profit organizations, University of Illinois-Extension, SCEM

5. Advance an Initiative of Voluntary Acquisition of Structures and Relocation of People – Tier One Priority

Voluntary acquisition of properties and relocation of people out of a floodplain is a mitigation strategy that offers the potential to *eliminate* vulnerability to flood hazards is heavily and repeatedly affected areas. A detailed discussion of

this strategy specific to different flood-prone communities, particularly in the Freeport Pecatonica River floodplain, is provided at the end of this "Priority Flood Mitigation Strategies" section. In general, relocation in certain areas offers several potential benefits, including the following:

- *Getting people out of harm's way*: preventing damage to property, and more importantly eliminating the risk of injury and death in the event of a major flood event. Additionally, reducing the number of people living the floodplain in turn reduces the risk to emergency responders who are responsible for evacuating these residents.
- *Opening the door to new housing alternatives*: as oftentimes homes in floodprone areas have become subject to disinvestment, and even homeowners seeking to make improvements are limited in doing so due to floodplain regulations. Relocation offers an opportunity for residents to move into homes that are not subject to limitations on improvements and will not be damaged due to *flooding*.
- *Opportunities to create new public open space amenities*: such as riverfront pathways, recreation areas, gardens, and other uses.

Responsible Parties and Potential Partners

- *Responsible:* SCEM, Stephenson County government, affected local governments
- *Partners:* IEMA, Neighborhood Housing Services, Freeport East Side Resident Task Force, local institutions, community leaders

6. Maintain River Gages – Tier One Priority

To predict future riverine flooding and evaluate historical flooding events, SCEM relies heavily on the Advanced Hydrologic Prediction Service provided by the National Weather Service. This online tool that is available to anyone (http://www.weather.gov/ahps/) includes daily updates of river stages and uses this data to project the river stage for the following seven days. The river gages that provide the daily data on river stages that Stephenson County relies on are maintained by the USGS and are located in Martintown, Wisconsin (north of Winslow) and in Freeport.

Due to limited resources, USGS must sometimes decide to no longer maintain a river gage, and one or both of these gages have been threatened in the past due to funding cuts. As a result, the County should periodically convey the critical importance of these gages to the USGS and NWS and stay in communication with these agencies to ensure that they are maintained in the future.

Responsible Parties and Potential Partners

- *Responsible:* SCEM
- *Partners:* USGS, NWS, IEMA, Winslow, Freeport

7. Promote Floodproofing of Buildings Where Appropriate and Cost-effective – Tier One Priority

Where relocation of buildings out of the floodplain is not feasible, there are a multitude of floodproofing measures that can help reduce the risk of damage to structures—the most appropriate floodproofing tool depends on the type and structural integrity of a building as well as the long-term benefit of floodproofing versus the cost. The following are potential floodproofing techniques available to property owners.

- *Installation of Backflow Valves and Sump Pumps:* To minimize potential damages to foundations and household utilities, property owners can install sump-pumps in basements to remove floodwater and backflow valves to deter sewage backups.
- *Wet Floodproofing*: Using water resistant paints or other materials can allow for easy cleanup after floodwater exposure in accessory structures or in a garage area below an elevated residential structure. Wet floodproofing also entails elevating items such as electric circuit breakers or appliances high enough to prevent damage from most instances of flooding. In a basement, wet floodproofing may be preferable to attempting to keep water out completely, because it allows for the pressure of exterior and interior water forces to balance, thereby discouraging structural collapse. Wet floodproofing may only be used for basements in cases of new construction, substantial improvement, or substantial damage. Information about such building practices should be made available through a hazard mitigation link on a potential future SCEM website and issued at the time of building and zoning permits for properties within a flood-prone area.

- *Dry Floodproofing*: Strengthening walls, sealing openings, or using waterproof compounds or plastic sheeting on walls can help keep building interiors dry; however, retrofitting a structure is cost prohibitive unless a substantial improvement or repair is underway. According to the Illinois Department of Natural Resources, dry floodproofing is only appropriate for structures built on concrete slab floors, without basements, and with no cracks. Accordingly, dry floodproofing is usually not applicable to residential structures and is prohibited as a floodproofing measure for residential structures in local floodplain management ordinances. Where dry floodproofing is appropriate, an engineering analysis is recommended to ensure that the slab is watertight and sound. When allowed, new construction in areas prone to foundation collapse should not employ dry floodproofing. Information about such building practices should be made available through a hazard mitigation link on a potential future SCEM website and on the Red Cross website and issued at the time of building and zoning permits for properties within a flood-prone area.
- *Elevation:* A fourth floodproofing technique includes elevating a structure so that the lowest habitable floor is raised above the base flood elevation. Such lifting should include elevation of utilities or other mechanical devices above expected flood levels. This strategy, however, should be reserved for buildings with particular historic or cultural value, as the cost of elevation is usually prohibitive unless supported by outside funding, and the State of Illinois supports relocation over elevation for the use of hazard mitigation grant funds.

Responsible Parties and Potential Partners

- *Responsible:* Property owners
- *Partners:* SCEM, local governments, contractors

8. Protect Critical Facilities and Infrastructure – Tier Two Priority

Protection of critical facilities from flooding is a vital hazard mitigation measure to ensure that emergency responders and their facilities are protected from disasters so that they are able to respond quickly during hazard events. This strategy applies to all hazards and consequently is discussed in detail as Strategy 4 in the "Priority All Hazards Mitigation Strategies" Section above.

As it applies specifically to flooding, protection of critical infrastructure is also an important strategy. For residents, it can be a matter of making sure people have a route to dry land and safety. For businesses, it is critical to have reliable property access to maintain cost-effective operations. Without such reliable access, businesses that rely on local roads for shipping and receiving, as well as customer and employee access, will suffer. Floodplains in the County, including Freeport's Pecatonica River floodplain, affect several employers that contribute significantly to the County's economic base. Some of these facilities are subject to flooding themselves; others are impacted when flooding renders nearby truck routes impassable. Consequently, when these employers are affected by flooding, this has considerable economic impact on these businesses and ultimately the economy as a whole.

Mitigation actions to either floodproof these roadways (e.g., by raising them) or constructing new or improved roads should be evaluated and implemented as appropriate.

Responsible Parties and Potential Partners

- *Responsible:* SCEM, County government (highway department), local government, utilities, fire departments, police departments, sheriff's department

9. Protect Water Quality – Tier Two Priority

Containers of hazardous materials such as petroleum or chemicals should not be located in a flood-prone area, and local and county zoning regulations should be amended to implement this recommendation. If such a location is necessary, containers need to be anchored and sealed to limit the potential for water contamination and damaging effects of flooding by causing fires or explosions, or by otherwise making structures unusable due to contamination. Emergency response to a hazardous materials spill is delineated in the Stephenson County Disaster Plan. Locations of hazardous materials are illustrated on the risk assessment maps included in Chapter 3. In addition to these sites, auto-oriented businesses located in the floodplains in Pearl City and Winslow pose a threat to water quality in the event of flooding.

There are other sites that historically contained industrial operations, with the greatest concentration in the Freeport Pecatonica River floodplain, that pose a concern regarding impacts to water quality during flood events. The County and the City of Freeport have both developed successful brownfields cleanup initiatives. The County, the City of Freeport, and other local governments should continue to focus on assessing and cleaning up properties in the floodplain with the greatest potential for threatening water quality, which can be exacerbated in instances of flooding.

In addition to addressing sites with hazardous materials, the County and local governments can also help address threats to water quality through maintenance of sanitary sewers to prevent leaching that may occur during flooding events.

Responsible Parties and Potential Partners

- *Responsible:* Stephenson County government, local governments, property owners, business owners
- *Partners:* SCEM, IEPA

10. Promote and Implement Modern Hazard Warning Systems – Tier Two Priority

Refer to Strategy 3 in the "Priority All Hazards Mitigation Strategies" section above.

11. Increase Access to Flood Insurance – Tier Two Priority

Insurance against property damage due to flooding can help to prevent financial devastation when damaging flooding occurs. Although flood insurance does not prevent flood damage from occurring, it may help mitigate a property owner's financial exposure to flood damage. Property owners should be educated about the limitations of policies provided by private insurance providers as well as the National Flood Insurance Program (NFIP), as often coverage is inadequate to enable full recovery from a flood event. In addition to awareness of limitations, consumers should be aware of the documentation required in their private insurance policies in order to be reimbursed for personal property and property improvements; without requisite documentation, insurance agencies can refuse payouts. The National Flood Insurance Program also has significant limitations; often the FEMA damage assessment process is inconsistent and underestimates damage reimbursements. To remedy the inconsistencies, an audit team should follow the FEMA assessment teams to survey the quality of residents' experience and evaluate the accuracy and consistency of the agency's damage estimates.

National Flood Insurance Program policies are available to all property owners and renters in communities that participate in the program. Communities that choose to participate in the NFIP must adopt ordinances that at a minimum meet base-level federal and state requirements. Communities may pass more stringent ordinances that further reduce risk.

Properties do not have to be located in a floodplain to be eligible for flood insurance, and consequently, owners of properties in flood-prone areas outside of mapped 100-year floodplains should consider purchasing NFIP insurance.

The following areas of the County participate in the NFIP:

- Unincorporated Stephenson County
- City of Freeport
- Village of Winslow
- Village of Orangeville

The County and local governments can help increase flood insurance program participation rates through the outreach and education efforts on the National Flood Insurance Program (NFIP), such as through printed materials and workshops. According to FEMA, often insurance agents are either uneducated about the benefits and applicability of the NFIP, or simply do not inform customers of its availability because its processing costs are high, profit to the agent is low, and it requires significant paperwork. SCEM should work with local insurance agents as well as IEMA, FEMA, and the NFIP to create and undertake an outreach and educational effort to enroll municipalities that currently do not participate in the program, and inform property owners of flood-prone property of the availability of flood insurance and provide a guide to enrollment.

Additionally, increased access to flood insurance could be improved by reducing the cost of flood insurance. The best way to accomplish this may be for jurisdictions that participate in the NFIP to enroll in the Community Rating System

(CRS). The CRS is a FEMA-sponsored program that rewards communities for taking flood mitigation actions above NFIP minimal requirements by reducing flood insurance premiums in the community. Conducting this hazard mitigation process earns the municipality points in the CRS, as will conducting on-going outreach with residents, among other initiatives. Specific actions that can be taken to reduce premiums include:

- Updated topographic mapping
- Adopting floodplain zoning ordinances above and beyond state and federal minimums
- Implementing of educational outreach programs
- Requiring open space dedication of floodplain areas
- Participating in the National Weather Service Storm Ready Program. This is a program that recognizes those communities that are prepared for natural disasters; to participate, the NWS inspects a community to verify that it has resources to receive weather information and warnings, the means to disseminate warnings to critical facilities, and that community preparedness activities have been accomplished and are ongoing.

Responsible Parties and Potential Partners

- *Responsible:* SCEM, Red Cross, property owners, local governments
- *Partners:* Insurance providers, IEMA

Priority Flood Mitigation Strategies: Freeport Pecatonica River

The seriousness of the Pecatonica flooding issue in the City of Freeport—combined with the spotty success of past initiatives—points to a need for a comprehensive approach to addressing the problem. This approach must address flooding in a manner that respects resident and homeowner concerns on the City's East Side. A successful approach must also address business, commerce, and public health concerns and issues not only on the East Side, but also in the Arcade and Lancaster/Van Buren areas as well.

So, in order for a flood mitigation strategy for the Pecatonica River in Freeport to be successful, it must contain several pieces that work together and gain necessary public support. Each piece of the strategy must also pass muster with local, state, and federal funding and regulatory agencies. "Solutions" that are not cost effective or arguably could result in more problems then they solve (or shift them elsewhere) are not likely to be approved by such agencies.

A successful flood mitigation strategy should be realistic but ambitious; should provide both short- and long-term solutions; and will involve tasks that are relatively simple and those that are very challenging. Because of these characteristics—and past false starts on flood mitigation in this area—community outreach and education throughout the refinement and implementation of flood mitigation strategies will be critical. It is essential that East Side residents and area business people are fully aware and intimately involved in crafting the details and carrying out the recommended flood mitigation strategies. This is a key to success.

Each of the seven mitigation actions recommended below is proposed as a contributing part of a complete mitigation package to address Pecatonica River flooding in Freeport. The actions include short-term improvements to reduce hazard vulnerability as well as long-term strategies aimed at eliminating vulnerability to flooding hazards altogether and protecting future generations. The recommended actions should be viewed as starting points, not the be-all, end-all of flood mitigation in this area. The details of each recommended action have yet to be worked out. For some, it may take several months or even years to fill in all the details. This is because some of the recommended actions are complicated and, again, because public involvement is absolutely essential.

The following are recommended mitigation actions for the Freeport Pecatonica River Floodplain.

1. Pursue Regular Community Outreach and Education – Tier One Priority

Critical to the success of any of the identified actions that follow is continual outreach with the community to ensure that the objectives of the flood mitigation program are understood and that residents, businesses, and property owners have several mechanisms for both getting accurate information, voicing opinions, and shaping the actions. Regular outreach efforts, particularly aimed at residents and businesses in the floodplain, will be critical for the City to

continue to strengthen a trusting relationship with these community members. The City has been keeping lines of communication open with the East Side through regular meetings of the East Side Resident Task Force (ESRTF), and intends to continue to use this group to help get the word out on activities of the flood mitigation program to the rest of the neighborhood. In addition to relying on the ESRTF as a key liaison, the City and County will directly focus education, outreach, and feedback to and from residents, property owners, and business owners in the floodplain on the following issues specifically:

- *Flood Mitigation Strategy*: As the City, County, and other partners work to implement this Natural Hazard Mitigation Plan, it will be critical to keep the community continually up-to-date and treat community members as implementation partners on the objectives, details, and progress of the flood mitigation actions being proposed and carried out. In addition to updates through the ESRTF, updates should be made through periodic community-wide meetings and direct project update mailings to residents, property owners, and business owners on the East Side and adjacent business-focused areas.
- *Floodplain Regulations*: A frequently voiced struggle for East Side residents is understanding the limitations to improvements that can be made to structures on the East Side due to local, state, and federal floodplain regulations. The City can help allay these frustrations by providing published materials that explain the regulations in lay terms and also give clear definitions and examples of what does and does not constitute a "substantial improvement" to property.
- *Floodproofing:* The City can distribute materials to East Side residents and business owners that clearly explain and provide examples of floodproofing actions that residents can take themselves to protect homes from flood damage, such as elevating utilities and appliances in basements.
- *Flood Insurance*: To improve access to flood insurance, residents need accurate, up-to-date information. To help in this regard, the City can help to connect property owners with flood insurance carriers through periodic flood insurance open houses and printed materials.

Outreach will also be directed specifically to businesses impacted by Pecatonica River flooding on both sides of the river. This outreach will involve periodic updates to businesses on the flood mitigation program. Additionally, the City will maintain open communication with businesses to give them the opportunity to share concerns with flooding with the City so that timely strategies can be developed to address any concerns.

2. Update Official Floodplain Maps – Tier One Priority

There has been some concern over how accurate and current floodplain maps are in the Freeport area, as they are based on computer models completed many years ago. Therefore, the City of Freeport may seek resources to undertake a study of the Pecatonica River watershed in order to update floodplain maps (especially the floodway boundaries) based on modern hydrologic models that reflect current conditions in the watershed. This updated information would prove to be an invaluable tool for future decision-making. The City may also pursue initiatives to assist property owners in accurately depicting the elevations of their property, either as part of this floodplain mapping update or as a separate initiative. Understanding property elevations is critical in determining if and how much floodplain regulations affect further property improvements. This City effort could be undertaken as part of a broader County initiative as described in Strategy 2 in the "Priority Flood Mitigation Strategies: County-wide" section above.

3. Enhance Stormwater Management and Erosion Control – Tier One Priority

Improved stormwater management and erosion control practices in and near the Pecatonica River floodplain in Freeport have the potential to minimize the effect of flooding on private property and business activities. The range of approaches the City and County may pursue are as follows:

- *Regular inspections of stormwater infrastructure*, including culverts, ditches, and stormwater inlets to assure that they are free from blockage. Clearing blockages and improving the function of existing systems (e.g., ditch dredging) will be pursued where problems are identified.
- *Regular inspection of the river* to identify problematic obstructions. The City could work with citizens groups and property owners to identify and help clear these obstructions. Paddle the Pec, a citizens group focused on improving the use and environment of the Pecatonica River as a recreational paddling area, has helped to mobilize community service organizations to clean up river debris periodically. Stephenson County Soil and Water

Conservation Service and the University of Illinois-Extension may also help educate property owners adjacent to the Pecatonica River on stream management techniques.

As a result, Creek maintenance is not consistent and contributes to constrained areas of the waterway from debris and fallen trees, exacerbating flooding. SCEM, Stephenson County Soil & Water Conservation District, Stephenson County Natural Resource Conservation Service, University of Illinois Extension, and the Yellow Creek Watershed Partnership should all work together to develop an educational effort aimed at property owners along the creek to improve property owners understanding of their rights and responsibilities for creek maintenance.

- *Promoting erosion control techniques*, such as vegetative swales, over key properties in the area, particularly farms in the Lancaster Road area, to minimize soil erosion onto public roads and nearby properties.
- *Adopting modern erosion control and stormwater management regulations* to assure that new development projects do not exacerbate flooding and soil erosion issues through use of Best Management Practices.
- *Exploring other more comprehensive stormwater management solutions*, such as additional storm sewer and/or storm/floodwater detention and storage basins. Consider both the benefits to flood mitigation of such initiatives, potential negative side effects (e.g., disturbing contaminated soils), and cost-effectiveness before implementing any solution.

4. Advance an Initiative of Voluntary Acquisition and Relocation – Tier One Priority

Voluntary acquisition of properties and relocation of people out of a floodplain is a mitigation strategy that offers the potential to *eliminate* vulnerability to flood hazards, and therefore is a part of the Freeport Pecatonica River flood mitigation strategy. Relocation offers several potential benefits, including the following:

- *Getting people out of harm's way*—preventing damage to property, and more importantly eliminating the risk of injury and death in the event of a major flood event. Additionally, reducing the number of people living the floodplain in turn reduces the risk to emergency responders who are responsible for evacuating these residents.
- *Opening the door to new housing alternatives*, as many homes in the Pecatonica River floodplain have become subject to disinvestment, and even homeowners seeking to make improvements are limited in doing so due to floodplain regulations. Relocation offers an opportunity for residents to move into homes that are not subject to limitations on improvements and will not be damaged due to flooding.
- *Opportunities to create new public open space amenities* such as riverfront pathways, recreation areas, gardens, and other uses.

The topic of voluntary relocation of East Side residents as a flood mitigation strategy has periodically emerged over the past several decades as different City administrations and community groups have focused on the issue of East Side flooding. The key concerns with relocation discussions in the past have included the following:

- perception that acquired property will then be re-sold to a developer for profit, or other issues associated with the mistrust of government;
- perception that relocation will, in fact, be forced upon local residents;
- concern of losing the cohesive social connections in the East Side community through dispersal of relocated residents; and
- concern that residents will not be able to afford housing outside of the East Side once they are relocated—either the initial purchase cost, or ongoing maintenance or property tax costs, or both.

To successfully implement a voluntary relocation initiative on the East Side, it will be critical for the City to keep these four key concerns at the forefront of program design and ongoing communication with residents. The first two concerns can be addressed through continued outreach and education. Any properties that are acquired with the use of FEMA grant funds must be deed-restricted for permanent open space, and consequently many never be sold for development by anyone at any time. Secondly, any properties acquired with the use of FEMA grant funds can only be done voluntarily at the will of the property owner. Concerns over losing neighborhood cohesion and being able to

afford housing elsewhere are somewhat more challenging to address, and need to be a focus of successful program design.

The following is a guideline for initial and long-term implementation of a voluntary relocation program for the East Side, which should and will be subject to many more discussions before the program is detailed, funded, and carried out. There will need to be significant community education, outreach, and feedback during every stage of the process.

- *Phase 1 Implementation* Potential priority areas for voluntary relocation in the initial implementation phase include the following:
  - *"Fringe areas" of the East Side.* Areas where there is a very low concentration of residents should be targeted, such as in several blocks closest to the river. This will result in a smaller area that emergency responders are responsible for in the event of a flood, and may not significantly impact neighborhood cohesion.
  - *Vacant buildings.* Acquisition and demolition of vacant buildings when they come available reduces hazards that potential future residents might face. This approach also provides an opportunity to reduce impervious surfaces on the East Side, increasing open space for water infiltration.
  - *NFIP Repetitive loss properties.* FEMA defines a *repetitive loss property* as a property that is insured through the NFIP and has made two or more flood loss claims for $1,000 or more for each loss within the span of ten years. There are three repetitive loss properties in the Pecatonica River floodplain.
  - *Particularly vulnerable populations.* Elderly and disabled residents that seek to relocate (and can do so financially with the relocation assistance that the City is able to secure through grant programs and other sources) should be given priority for initial relocation implementation.
- *Phase 2 Implementation* For many East Side residents, relocation from the East Side may be undesirable and/or economically unfeasible unless certain conditions are met. Consequently, in implementing a more comprehensive voluntary relocation program (above the Phase 1 proposal above) that can be made available throughout the East Side, the following three considerations should first be made:
  - *Cost of living.* The median home price in Freeport is over 11 times higher than the median home price on the East Side. Additionally, many East Side residents are living on fixed incomes, often due to retirement. As a result, the cost of moving out of the East Side is prohibitive for many residents. Consequently, relocation may only be possible for some residents if they are able to afford the purchase price, maintenance costs, and property taxes associated with new housing. To achieve this, the City will likely need to employ a combination of funding tools to help residents relocate. These may include FEMA Hazard Mitigation Project Grants, HUD Community Development Block Grants, property tax abatement, enterprise zone incentives, low-interest loans, state and federal legislative appropriations, corporate and non-profit grants, and others.
  - *Maintaining the East Side Community.* To many residents, the East Side is not just a physical place to live, but a community rich with history, strong connections among neighbors and families, and celebrated institutions. Consequently, prior to proposing relocation as an available alternative throughout the East Side, the City and County should work to identify potential areas for relocation that would help to maintain these important connections. Additionally, the City would work with East Side institutions such as churches and businesses to provide information and assistance, wherever possible, with floodproofing. Floodproofing is likely to be more cost-effective for these larger institutions than for individual homes.
  - *Relocation phasing based on community priorities.* Limited resources may prohibit the City from offering relocation as an option to all residents at the same time. Consequently, if it appears that more people are interested in relocating than there are resources to assist with at one time, the community may need to set priorities. These priorities would be developed input from East Side residents. Priorities may include owner-occupants (already identified by East Siders in the development of this plan), particularly vulnerable populations like the elderly or handicapped, or certain parts of the East Side over others based on the degree of flood hazard or other factors agreed to by the East Side community and the City.

5. Protect Critical Facilities and Infrastructure – Tier Two Priority

Access to property during flood events is a significant concern. For residents, it can be a matter of making sure people have a route to dry land and safety. For businesses, it is critical to have reliable property access to maintain cost-effective operations. Without such reliable access, businesses that rely on local roads for shipping and receiving, as well as customer and employee access, will suffer. The Pecatonica River floodplain includes and affects several employers that contribute significantly to Freeport's economic base. Some of these facilities are subject to flooding themselves; others are impacted when flooding renders adjacent truck routes impassable. Consequently, when these employers are affected by flooding, this has considerable economic impact on these businesses and ultimately Freeport's economy as a whole.

Hancock Avenue, Stephenson Street, and Henderson, Van Buren, and Lancaster Roads have been identified as roadways that, when flooded, hinder business activity and access to people and property. As an example, if the Hancock Avenue bridge floods, this isolates businesses in the Arcade with semis that are unable to pass under the railroad viaduct that would otherwise connect them to Highway 20 to the south. Consequently, mitigation actions to either floodproof these roadways (e.g., by raising them) or constructing new or improved roads will be evaluated and implemented as appropriate.

6. Increase Access to Flood Insurance – Tier Two Priority

In 2005, the City conducted a survey of the East Side. This survey identified that while 47% of residents have experienced flooding in their home, only 18% currently have flood insurance. Additionally, in the case of a flood, only 16% indicated they would have sufficient funding to pay for repairs, if needed.

Increased access to flood insurance would help to protect residents from bearing unexpected costs in the event of a flood. The City intends to help increase flood insurance program participation rates through outreach and education efforts on the National Flood Insurance Program (NFIP), such as through printed materials and workshops. Additionally, access could be improved by reducing the cost of flood insurance. The best way to accomplish this may be through the City enrolling in the Community Rating System (CRS). The CRS is a FEMA-sponsored program that rewards communities for taking actions above NFIP minimal requirements by reducing flood insurance premiums in the community. Conducting this hazard mitigation process earns the City points in the CRS, as will conducting on-going outreach with residents, among other initiatives.

7. Protect Water Quality – Tier Two Priority

The historic concentration of industrial properties in the Pecatonica River floodplain poses a concern regarding impacts to water quality during flood events. The City has developed a successful brownfields cleanup initiative. The City intends to continue to focus its efforts on assessing and cleaning up properties in the floodplain with the greatest potential for threatening water quality, which can be exacerbated in instances of flooding.

8. Promote and Implement Modern Hazard Warning Systems – Tier Two Priority

Refer to Strategy 3 in the "Priority All Hazards Mitigation Strategies" section above.

Priority Flood Mitigation Strategies: Freeport Yellow Creek

The following priority flood mitigation strategies should be employed specifically to address flooding issues in Freeport in the area of the Yellow Creek floodplain.

1. Update Official Floodplain Maps – Tier One Priority

The growth of Freeport over the past two decades since the Freeport Flood Insurance Study and floodplain map was developed has, in the opinion of many in this area, influenced the actual extent of the Yellow Creek floodplain. Since the City's floodplain map has not been updated since the early 1980s, there are areas susceptible to flooding that are not identified as floodplain on the FEMA maps, such as the mobile home park at the east end of the Creek in Freeport. In order for the City to best regulate new development in flood hazard areas, the official FEMA floodplain

map for the City should be updated. Refer to Strategy 7 in the "Priority Flood Mitigation Strategies: County-wide" Section earlier in this chapter for further detail on this strategy.

2. Improve Planning and Regulatory Practices – Tier One Priority

Freeport is experiencing some interest in both residential and commercial growth along Yellow Creek, due to its amenity value and the fact that it crosses the Highway 26 commercial corridor. The Yellow Creek Risk Assessment map, in Chapter 3, shows areas of likely future development. Development in this corridor will decrease pervious areas and may inadvertently be located in flood-prone areas that are not presently mapped as floodplain. Additionally, there is currently land in this that is area prone to flooding but is not within the mapped floodplain. There is concern that new development—if not properly located and designed—could lead to more flooding problems in the Yellow Creek corridor.

To ensure that future development does not exacerbate flooding problems in this corridor, Freeport should incorporate areas susceptible to flooding in this corridor in future land use plans, zoning maps, and decision making so that development is directed away from these flood-prone areas. Additionally, updated floodplain maps (described above as Strategy 1) will enable the City to best plan for land use in this area based on an improved understanding of flood hazard areas.

3. Enhance Stormwater Management and Erosion Control – Tier One Priority

Community residents and groups such as the Yellow Creek Watershed Partnership have expressed concern that new development proposed near Yellow Creek (including areas outside of the floodplain) could exacerbate flooding problems in the Yellow Creek corridor. This concern is compounded by a perception that current floodplain maps in this area are out of date.

To ensure that new development does not exacerbate Yellow Creek flooding, the City should implement more stringent stormwater management requirements in the Yellow Creek corridor with the goal that redeveloped areas near the Yellow Creek (including areas outside of the floodplain) could actually result in reduced stormwater impacts on Yellow Creek than impacts from what currently exists on a site. This could be accomplished by incorporating innovative techniques to reduce impervious surface coverage such as through use of pervious pavement, installation of "green" roofs (roofs that incorporate planting beds to absorb stormwater), or installation of "rain gardens" as examples.

Another stormwater management issue stems from the fact that the Yellow Creek is not a legally navigable waterway, and adjacent property owners have jurisdiction over the portion of the Creek adjacent to their property. As a result, Creek maintenance is not consistent and contributes to constrained areas of the waterway from debris and fallen trees, exacerbating flooding. SCEM, Stephenson County Soil & Water Conservation District, Stephenson County Natural Resource Conservation Service, University of Illinois Extension, and the Yellow Creek Watershed Partnership should all work together to develop an educational effort aimed at property owners along the creek to improve property owners understanding of their rights and responsibilities for creek maintenance.

Additionally, some of the bridges crossing the creek, such as the Walnut Road bridge, constrain water flow and contribute to ice jams. Additionally, the Krape Park Dam constrains water flow west of the dam, which contributes to Krape Park flooding. The City, working in coordination with County highway department and the DNR, should explore structural solutions to these infrastructure concerns. This may include removal or upgrading of the dam, and widening of the bridge.

4. Protect Critical Facilities and Infrastructure – Tier One Priority

Several of the bridges that cross Yellow Creek have experienced washouts during times of flooding, such as the bridges at Gladewood Drive, Illinois-26, and a railroad bridge. Mitigation actions to either floodproof these roadways (IL-26 in particular), such as by raising them, or constructing new or improved roads should be evaluated and implemented as appropriate.

Additionally, the Yellow Creek corridor contains some populations that should be monitored during flooding events. Specifically, this includes mobile home parks and residents gathered at the County fairgrounds during events.

5. Promote and Implement Modern Hazard Warning Systems – Tier Two Priority

Refer to Strategy 3 in the "Priority All Hazards Mitigation Strategies" section above.

Priority Flood Mitigation Strategies: Village of Cedarville

The following priority flood mitigation strategies should be employed specifically to address flooding issues in Cedarville.

1. Update Official Floodplain Maps – Tier One Priority

Cedarville has experienced flooding along the creeks that run through the Village; however, there is no mapped 100-year floodplain in the Village. Consequently, the Village should participate in and support a County-wide initiative to update floodplain maps based on an updated study of County hydrology.

2. Improve Planning and Regulatory Practices – Tier One Priority

The County's land use plan indicates potential commercial development south of the unnamed creek that runs along the southern border of the Village that has previously contributed to flooding along Highway 26. If developed, these areas could be subject to flooding and could exacerbate problems elsewhere.

To ensure that future development does not exacerbate flooding problems in this corridor, Cedarville should incorporate areas susceptible to flooding in this corridor in future land use plans, zoning maps, and decision making so that development is directed away from these flood hazard areas. Additionally, updated floodplain maps (described above as Strategy 1) will enable the Village to best plan for land use in this area based on an improved understanding of flood hazard areas.

3. Enhance Stormwater Management and Erosion Control – Tier One Priority

The Village has recently experienced new residential development in the southern area of the Village near the unnamed Creek and already this area has experienced susceptibility to flooding. Consequently, new stormwater management infrastructure serving this development would greatly reduce future susceptibility to flooding.

4. Protect Water Quality – Tier Two Priority

The Village's wastewater treatment plant is subject to flooding and therefore threatens water quality when flooded. There are some minor earth berms in place to reduce risk of flooding the plant; however, these may not suffice in protecting the plant from a major flooding event. The Village should explore working with a qualified engineer to protect the plant and water quality in the area in the event of more extensive flooding.

Priority Flood Mitigation Strategies: Village of Dakota

1. Improve Planning and Regulatory Practices – Tier One Priority

Dakota is outside of the floodplain and consequently flooding is not a major issue for the Village. However, while development pressure in Dakota is limited, development proposals have been made in the past for the area north of the Village. If the Village does experience development in this area, it will be important to plan for progressive stormwater management systems to minimize potential downstream flooding in the Village.

2. Protect Water Quality – Tier Two Priority

If Dakota experiences any considerable growth in the future, the Village wastewater treatment plant may experience capacity issues. This could pose a risk to water quality during major floods since the plant is located near the eastern drainageway in the Village. The Village should complete an engineering study of plant capacity and expand the plant if warranted to address projected needs over the next several years if necessary.

Priority Flood Mitigation Strategies: Village of German Valley

1. Improve Planning and Regulatory Practices – Tier One Priority

German Valley is outside of the floodplain and consequently flooding is not a major issue for the Village. However, the Village has historically experienced flooding along Wickham Creek that runs through the east edge of the Village, away from developed areas. As German Valley considers any new development proposals, it should divert development activity away from this flood-prone area.

Priority Flood Mitigation Strategies: Village of Lena

1. Improve Planning and Regulatory Practices – Tier One Priority

Lena is outside of the floodplain and consequently flooding is not a major issue for the Village. However, Lena is the fastest growing area of the County and has the potential to experience residential growth as far east as the Pecatonica River floodplain. Consequently, as the Village continues to grow it should regularly update its land use plan and as part of this, direct development away from areas that are, or have the potential to be, flood hazard areas.

Priority Flood Mitigation Strategies: Village of Orangeville

Richland Creek runs through the western edge of the Village of Orangeville. The majority of the land use within the Creek's floodplain is agricultural and public open space, however the floodplain does include two residential streets—Mill and South Streets. The Village most recently experienced a significant flood event in 1996, and to a lesser extent experienced flooding in 2000.

The 1996 flood submerged Mill Street and also affected Main Street and Orangeville Road—resulting in $100,000 in damages to Orangeville Road itself. The flood also caused an estimated $500,000 in damages to ten homes and $20,000 in damages to two mobile homes. Some limited property acquisition has occurred since 1996 in the damaged areas.

The following priority flood mitigation strategies should be employed specifically to address flooding issues in Orangeville.

1. Advance an Initiative of Voluntary Acquisition– Tier One Priority

One of the mitigation priorities for Orangeville is to eliminate the risk of vulnerability to those most vulnerable to flooding—residents in the floodplain, particularly homes that have experienced significant flooding in the past along Mill Street, South Street, and in the area of Ewing Road.

Voluntary acquisition of properties in a floodplain is a mitigation strategy that offers the potential to *eliminate* vulnerability to flood hazards. Voluntary acquisition offers several potential benefits, including the following:

- *Getting people out of harm's way*—preventing damage to property, and more importantly eliminating the risk of injury and death in the event of a major flood event. Additionally, reducing the number of people living the floodplain in turn reduces the risk to emergency responders who are responsible for evacuating these residents.
- *Opening the door to new housing alternatives*, as oftentimes homes in floodprone areas have become subject to disinvestment, and even homeowners seeking to make improvements are limited in doing so due to floodplain regulations.
- *Opportunities to create new public open space amenities* such as riverfront pathways, recreation areas, gardens, and other uses. Any properties that are acquired with the use of FEMA grant funds must be deed-restricted for permanent open space, and consequently many never be sold for development by anyone at any time.

The Village would like to be in a position to acquire a property in the above identified flood-prone areas when a property is put on the market for sale. To do this, the Village should engage in frequent communication with owners of targeted properties in this area so that the Village can anticipate when a property may become available. With this knowledge, the

Village can then work to secure outside funding, such as through the FEMA Hazard Mitigation Grant Program, to help with the acquisition cost.

In addition to acquiring these properties when they become available, the Village should also evaluate the feasibility of promoting voluntary acquisition and relocation to residents of properties most at risk, and work with these property owners to identify relocation alternatives.

2. Enhance Stormwater Management and Erosion Control – Tier One Priority

Flooding severity can be addressed by improvements to the Village's stormwater management system and regulations. A specific stormwater management issue that should be addressed is the bridge at Orangeville Road, as this infrastructure constrains Richland Creek, exacerbating flooding in this area. Consequently, the Village should work with the County to include upgrades to this bridge in the County's capital improvement program to reduce this constraint on the creek.

The Village should also ensure that regular inspections of stormwater infrastructure and the creek are undertaken to prevent blockages from exacerbating flooding.

3. Protect Critical Facilities and Infrastructure – Tier One Priority

In addition to constraining Richland Creek which exacerbates flooding, the bridge at Orangeville Road is also susceptible to washouts in flooding events, limiting access to and from the Village from the west. Access at this point is very important for emergency responders and Village residents as it connects the Village to Highway 26. Mitigation actions to either floodproof this bridge through reconstruction or other techniques should be evaluated and implemented as appropriate.

4. Pursue Regular Community Outreach and Education – Tier One Priority

As the Village of Orangeville begins implementing these strategies as part of its hazard mitigation program, it will be important to provide clear and consistent information to Village residents about the mitigation program as well as about strategies that property owners and residents can take to reduce their vulnerability to flooding damage. Additional community outreach and education techniques are described in the County-wide Priority Flood Mitigation Strategies section.

5. Improve Planning and Regulatory Practices – Tier One Priority

Since the Richland Creek floodplain extends through such a significant area of Orangeville, the Village should update its land use plan and zoning regulations, as necessary, to ensure that future development is directed away from the floodplain and other flood hazard areas.

6. Protect Water Quality – Tier Two Priority

The Village's wastewater treatment plant is subject to flooding and therefore threatens water quality when flooded. The Village should explore working with a qualified engineer to protect the plant and water quality in the area in the event of more extensive flooding.

Another threat to water quality due to flooding in Orangeville are properties located just outside of the incorporated area on Freeport Street. These properties experience frequent backyard flooding. As they are unincorporated, these properties use private septic systems to manage waste and private wells for drinking water. During major flooding events, leaching from these septic systems threatens water quality in wells and in the stream.

To address this threat to water quality, the Village should evaluate the costs of annexing these properties and connecting these homes with the Village's sanitary sewer system. A FEMA grant may help to defray these costs as well as the costs homeowners would bear to properly abandon these septic systems.

7. Promote and Implement Modern Hazard Warning Systems – Tier Two Priority

Refer to Strategy 3 in the "Priority All Hazards Mitigation Strategies" section above.

Priority Flood Mitigation Strategies: Village of Pearl City

1. Update Official Floodplain Maps – Tier One Priority

Pearl City has experienced significant flooding outside of the 100-year floodplain in residential areas. Also, there are areas within the mapped floodplain that have not flooded during major storm events. This fact, combined with the seemingly frequent occurrences of 100-year and 500-year floods, suggest that these mapped floodplain boundaries are not accurate in Pearl City. This negatively affects people's safety and the credibility of flood regulation and mitigation programs. (Pearl City was not enrolled in the National Flood Insurance Program at the time of writing—in part because of local concerns with the accuracy of floodplain maps and the implications the maps have on flood insurance and regulation requirements.)

Consequently, the Village should participate in a County-wide effort to update floodplain maps based on up-to-date data and modeling.

2. Improve Planning and Regulatory Practices – Tier One Priority

Property owners and residents of properties in Pearl City that are vulnerable to flooding currently do not have the ability to purchase flood insurance because the Village has not enrolled in the National Flood Insurance Program (NFIP) due to concerns with floodplain map accuracy as described in Strategy 1, above.

Once the Village has undertaken efforts to update its floodplain maps, the Village should work with SCEM and Illinois DNR develop and adopt a local floodplain ordinance based on a state model.

3. Increase Access to Flood Insurance – Tier One Priority

Once the Village has adopted a floodplain ordinance, it can then enroll the Village in the NFIP. Once enrolled in the NFIP, the Village should continue to work with SCEM and insurance providers to educate local residents and property owners on flood insurance policies to encourage enrollment.

4. Enhance Stormwater Management and Erosion Control – Tier One Priority

Flooding severity can be addressed by improvements to the Village's stormwater management system and regulations. A specific stormwater management issue that should be addressed are the bridges crossing Yellow Creek at Pearl City Road and at Highway 73. These bridges constrain Yellow Creek, exacerbating flooding in this area. Consequently, the Village should work with the County to include upgrades to this bridge in the County's capital improvement program to reduce this constraint on the creek.

The Village should also undertake a community-wide stormwater management plan to identify opportunities to improve the Village infrastructure and also to prevent future development from exacerbating flooding. The Village should also conduct regular inspections of stormwater infrastructure and the creek to prevent blockages from exacerbating flooding. Ice jams, as documented in the 1989 Pearl City Flood Insurance Study, were noted to be a particular problem exacerbating flooding in Pearl City.

5. Protect Critical Facilities and Infrastructure – Tier One Priority

In addition to constraining Yellow Creek which exacerbates flooding, the bridge at Pearl City Road is also susceptible to washouts in flooding events, limiting access to and from the Village from the east. Access at this point is very important for emergency responders and Village residents to enter and exit the community. Mitigation actions to either floodproof this bridge through reconstruction or other techniques should be evaluated and implemented as appropriate.

6. Pursue Regular Community Outreach and Education – Tier One Priority

Although community outreach and education is a flood mitigation strategy that should be implemented County-wide, it will be particularly important in Pearl City, particularly as the Village evaluates adopting floodplain regulations and enrolling in the NFIP. An outreach effort in Pearl City should strive in particular to clearly explain the benefits and responsibilities associated with floodplain regulations and flood insurance to residents and property owners.

7. Protect Water Quality – Tier Two Priority

There are "brownfield" and other higher-risk sites including historical industrial properties and gas and auto repair shops in floodprone areas of the Village that pose a threat to water quality in the event of a flood. Additionally, the Village's municipal well and the wastewater treatment plant are both in areas vulnerable to flooding, and in fact the wastewater treatment plant was flooded in the major flood of August 2002.

The Village is participating in the Stephenson County Brownfields Initiative and should continue to do so, targeting sites for assessment and cleanup with the potential to threaten water quality in flooding events. Additionally, the Village should work to relocate existing operations such as gas and auto repair shops to sites out of the floodplain. The Village should explore working with a qualified engineer to protect the plant and water quality in the area in the event of more extensive flooding.

8. Promote and Implement Modern Hazard Warning Systems – Tier Two Priority

Refer to Strategy 3 in the "Priority All Hazards Mitigation Strategies" section above.

Priority Flood Mitigation Strategies: Village of Ridott

1. Improve Planning and Regulatory Practices – Tier One Priority

The Village of Ridott is bordered on the northwest side by the Pecatonica River floodplain and on the southeast side by the Wickham Creek floodplain. The floodplain does not contain any commercial or residential properties. However, the back yards of residential properties along Washington Street have experienced flooding in the past from Wickham Creek.

To ensure that the threat of flooding continues to exist predominantly in areas containing yards or agricultural land, the Village should incorporate areas susceptible to flooding in future land use plans, zoning maps, and decision making so that future development is directed away from these flood hazard areas.

2. Update Official Floodplain Maps – Tier One Priority

The Village of Ridott has experienced some flooding outside of the mapped floodplain. Consequently, the Village should participate in a County-wide effort to update floodplain maps based on up-to-date data and modeling.

3. Enhance Stormwater Management and Erosion Control – Tier One Priority

The Village has identified that the issue of debris in Wickham Creek and the Pecatonica River contributes to flooding vulnerability. The Village should ensure that regular inspections of the creek and river are undertaken to prevent blockages from exacerbating flooding.

4. Protect Water Quality – Tier One Priority

Residents of Ridott rely on private wells for water supply and septic tanks for wastewater treatment. There is a concern that wastewater from private septic systems leaches during flooding events, which may contaminate well water. To address this problem, the Village should explore establishing a centralized wastewater treatment plant and wastewater utility district. The Village should also encourage or require regular testing of septic systems to make sure they are functioning property. Lastly, the Village should encourage property owners to properly seal wells to protect them from inflow of contaminated water during flooding events.

Priority Flood Mitigation Strategies: Village of Winslow

1. Protect Critical Facilities and Infrastructure – Tier One Priority

A critical facility in the Village of Winslow—the Village fire station—is located in the center of the community in the floodplain. It can be cut off from other parts of the community, particularly the north side, during major floods. In the past, if a flood is anticipated, the fire department has temporarily dispersed its trucks to different parts of the

Village. However, in the long term, the Village should consider a new location for the fire station in order to reduce the vulnerability of this critical facility to flooding.

Lastly, the Winslow Road bridge that crosses the Pecatonica River has been washed out during floods—up to waist-deep in major events. This limits access to the Village from the east which is very important for emergency responders and Village residents to enter and exit the community. Mitigation actions to either floodproof this bridge through reconstruction or other techniques should be evaluated and implemented as appropriate.

2. Promote Floodproofing of Buildings Where Appropriate and Cost-effective – Tier One Priority

The floodplain in Winslow includes the commercial buildings in the center of the Village as well as a few residential properties. There are a multitude of floodproofing measures that can help reduce the risk of damage to structures—the most appropriate floodproofing tool depends on the type and structural integrity of a building as well as the long-term benefit of floodproofing versus the cost. Several floodproofing techniques are described in the "Priority Flood Mitigation Strategies: County-wide" section, including installation of backflow valves, wet floodproofing, and dry floodproofing.

3. Maintain River Gages – Tier One Priority

Maintaining the Pecatonica River gages in Martintown, Wisconsin and in Freeport, is critical for prediction of riverine flooding for the County as a whole. However, this strategy is also identified specifically for the Village of Winslow since the Village relies heavily on the Martintown gage, and this gage in particular has been threatened in the past to be removed due to funding cuts at USGS. Consequently, the Village should periodically work with SCEM to convey the critical importance of this gage to the USGS and NWS to ensure that it is maintained in the future.

4. Protect Water Quality – Tier Two Priority

Within the 100-year mapped floodplain in the Village of Winslow is a gas station as well as the Village wastewater treatment plan. Both of these uses pose the potential to threaten water quality in the Village during major flooding events. The Village should work with the property owner to relocate the gas station to a site out of the floodplain, or at a minimum to assure that risks of water contamination during flooding events is minimized. Additionally, the Village should ensure that the Artesian well is protected in case of flooding events.

5. Promote and Implement Modern Hazard Warning Systems – Tier Two Priority

Refer to Strategy 3 in the "Priority All Hazards Mitigation Strategies" section above.

Priority Flood Mitigation Strategies: McConnell

McConnell, located on the Pecatonica River, is the primary unincorporated settlement in Stephenson County in which residences and commercial properties are vulnerable to flooding. Approximately one-half of McConnell is located in the floodplain.

1. Advance an Initiative of Voluntary Acquisition and Relocation – Tier One Priority

One of the highest mitigation priorities for McConnell is to eliminate the risk of vulnerability to those most vulnerable to flooding—residents in the floodplain, particularly homes that are most vulnerable to flooding, nearest to the river, south of Main Street.

Voluntary acquisition of properties in a floodplain is a mitigation strategy that offers the potential to *eliminate* vulnerability to flood hazards. Voluntary acquisition offers several potential benefits, including the following:

- *Getting people out of harm's way*—preventing damage to property, and more importantly eliminating the risk of injury and death in the event of a major flood event. Additionally, reducing the number of people living the floodplain in turn reduces the risk to emergency responders who are responsible for evacuating these residents.
- *Opening the door to new housing alternatives*, as oftentimes homes in floodprone areas have become subject to disinvestment, and even homeowners seeking to make improvements are limited in doing so due to floodplain regulations.

- *Opportunities to create new public open space amenities* such as riverfront pathways, recreation areas, gardens, and other uses. Any properties that are acquired with the use of FEMA grant funds must be deed-restricted for permanent open space, and consequently many never be sold for development by anyone at any time.

The County, working with Waddams Township officials, should identify highest priority properties for acquisition that could be included in a Countywide voluntary acquisition program funded in part through a FEMA Hazard Mitigation grant. SCEM and Township officials should then begin a dialogue with property owners of properties most at risk to determine interest in voluntary acquisition and to explore relocation alternatives.

2. Enhance Stormwater Management and Erosion Control – Tier One Priority

To mitigate the impacts of flooding in McConnell, the County should work with the Township to implement an improved stormwater management system and techniques. This effort would also be aided by the County adopting improved stormwater management ordinance. Stormwater management techniques are further described in Strategy 4 in "Priority Flood Mitigation Strategies" Section above.

3. Pursue Regular Community Outreach and Education – Tier One Priority

As the County and McConnell work together to begin implementing these strategies as part of this hazard mitigation program, it will be important to provide clear and consistent information to residents about the mitigation program as well as about strategies that property owners and residents can take to reduce their vulnerability to flooding damage. Additional community outreach and education techniques are described in the "Priority Flood Mitigation Strategies: County-wide" section above.

4. Promote Floodproofing of Buildings Where Appropriate and Cost-effective – Tier One Priority

The floodplain in McConnell includes such a significant portion of properties in the community that voluntary relocation will not be able to address all flooding vulnerability concerns, at least in the near term. There are a multitude of floodproofing measures that can help reduce the risk of damage to structures—the most appropriate floodproofing tool depends on the type and structural integrity of a building as well as the long-term benefit of floodproofing versus the cost. Several floodproofing techniques are described in the "Priority Flood Mitigation Strategies: County-wide" section above, including installation of backflow valves, wet floodproofing, and dry floodproofing. This may be most appropriate to consider for the commercial properties along Main Street.

PRIORITY SEVERE STORMS MITIGATION STRATEGIES

Stephenson County is vulnerable to thunderstorms, severe wind (including tornadoes), and winter storms. Although the frequency, severity, and other characteristics of these different storms, vary, the mitigation strategies associated with them are similar enough that they are grouped in this overall Severe Storms category.

1. Pursue Regular Community Outreach and Education – Tier One Priority

Strategy 1 under the "Priority All Hazards Mitigation Strategies" section above provides an overview of the Community Outreach and Education strategy.

As it relates to storms specifically, continual outreach with the community is critical to ensure that residents, businesses, and property owners are sufficiently prepared to protect themselves and their property from damages due to storm events. Specifically, severe storm preparedness should focus on:

- *Vulnerable properties:* Mobile homes, certain industrial buildings (e.g. pole sheds), and camping trailers are most vulnerable to damage from severe storms. Additionally, certain elements of a building are most vulnerable to storm damage, including windows, doors, garage doors, and roofs, and consequently the County can educate property owners on structural retrofitting techniques.
- *Vulnerable populations:* The following populations are most vulnerable to injury or death due to severe storms: people in automobiles; people that occupy vulnerable properties including mobile homes, industrial buildings, and camping trailers; the elderly, the very young; the physically or mentally impaired; people who may not understand a severe storm warning due to language barriers; and livestock. In order to best reach these groups, educational efforts can be directed to places such as driver's education courses, campgrounds, English as a Second Language courses, etc.
- *Vulnerable times of year*: Educational efforts should be most concentrated at the beginning of the severe storm and winter storm seasons each year. Illinois has established a Lightning Safety Awareness Week in June and a Winter Weather Awareness Week in November.

Responsible Parties and Potential Partners

Stephenson County Emergency Management, the health department, and highway department could team with local utilities and insurance agencies to provide household and traveling preparedness information annually or with new accounts. Additionally, SCEM could communicate with the County Highway Department and local public works departments to ensure these departments are apprised of severe weather developments that may require response.

- *Responsible:* SCEM, County and local governments, County health department, County highway department, Red Cross
- *Partners:* Utilities, IEMA, local media, local organizations, IDOT, insurance agencies

2. Promote and Implement Modern Hazard Warning Systems – Tier One Priority

Refer to Strategy 3 in the "Priority All Hazards Mitigation Strategies" section above. As it relates to severe storms, specifically, a vulnerable population that should be targeted are people in campgrounds. One strategy for reaching campers would be for campground managers to maintain a list of campers' cell phone numbers, updated on a daily basis, so that they could be sent messages through SCEM (if SCEM sets up a phone system) to warn of the onset of a severe storm.

Responsible Parties and Potential Partners

- *Responsible:* SCEM, local governments
- *Partners:* IEMA

3. Promote Active Tree Management – Tier One Priority

Tree pruning can reduce the potential for trees falling on and breaking power lines or damaging buildings. SCEM and the Stephenson County Highway Department could work with local utilities to educate property owners on the benefits of proper tree management. The Highway Department could develop a community outreach method to provide subject property owners with educational materials regarding the benefits of tree management, and provide a contact that can help with questions and concerns well before trimming activities take place. Annually, local utilities could distribute educational information regarding the benefits of tree management with customer bills, or when establishing a new account.

Responsible Parties and Potential Partners

- *Responsible:* Stephenson County Highway Department, Utilities, property owners
- *Partners:* SCEM, river/creek volunteer organizations

4. Identify or Construct Saferooms – Tier One Priority

Stephenson County Emergency Management should continue its work with property owners to ensure that people in the County are aware of the safest place to congregate in severe storm events. SCEM should continue to offer assistance in identifying safe areas in structures. The availability of this service could be advertised or noticed at the start of the severe wind/tornado season though local newspapers, radio stations, and a future SCEM website.

SCEM could work with communities to develop a survey procedure and guidance document to inventory structural and non-structural hazards in and near designated shelter sites. Survey results can be used to determine mitigation priorities that can be incorporated into local and County capital improvement plans. Such surveys should take into account that existing shelter sites are often constructed of brick and mortar, which is intolerant of earth shaking movements.

This effort should be targeted to places where people are most at risk as well as where large numbers of people congregate, including:

- Mobile home parks
- Park and recreation areas
- Major employers
- Multi-family housing
- Schools
- Health care centers
- Other places of assembly
- Industrial buildings
- Prefabricated slab-on-grade construction buildings

Additionally, the County and local subdivision and zoning ordinances should be amended to require that developers of new or expanding mobile home and industrial parks provide saferooms.

Responsible Parties and Potential Partners

- *Responsible:* SCEM, Red Cross, owners/managers of at-risk properties identified above
- *Partners:* local governments, County zoning department

5. Protect Critical Facilities and Infrastructure – Tier One Priority

This strategy, as it relates to storms, focuses on protecting critical facilities (e.g. police and fire stations, emergency operations centers, and hospitals) and major roadways and utility lines from storm damage to ensure that emergency responders are able to respond quickly during hazard events. This can be accomplished in the following ways:

- *Active Tree Management:* Owners and operators of critical facilities should ensure that trees on or near critical facilities are well managed, therefore not posing a significant risk of damage during a major windstorm. Additionally, SCEM should work with local utilities to ensure active tree management along above-ground utility transmission and distribution lines.
- *Undergrounding Utilities:* When serving new development in the County, utilities in Stephenson County should be required to underground new electric and communications infrastructure. Additionally, opportunities to underground existing infrastructure should be explored as infrastructure improvements are made.
- *Structural Retrofitting:* Existing critical facilities that exhibit vulnerability to severe storms should undergo structural retrofitting, such as bracing roofs, doors, and windows.
- *Maintenance of Winter Storm Equipment:* Communities should prepare for severe winter weather by ensuring that plowing and sanding equipment is operational and prepared to handle potential emergencies.
- *Snow Fences*: Using snow fences or "living snow fences" (rows of trees or other vegetation) can limit blowing and drifting snow over critical segments of roads. Living snow fences are longer lasting than standard snow fences and are permanent so they do not require the time of municipal staff to seasonally install and dismantle them. SCEM should work with the County Highway Department to prioritize areas for snow fences. The Highway Department and Illinois Department of Transportation could develop a community outreach method to provide adjacent property owners with educational materials regarding the property specific and community benefits of snow fences, provide a contact that can help with questions and concerns, and clarify that such fences are a component of the rights-of-way privileges for maintenance of County roads to help garner support and/or acceptance for installation of snow fences.

Responsible Parties and Potential Partners

- *Responsible:* County government (highways department), SCEM, local government, utilities, fire departments, police departments, sheriff's department
- *Partners:* IDOT, schools, hospitals

6. Improve Planning and Regulatory Practices – Tier Two Priority

Strategy 5 under the "Priority All Hazards Mitigation Strategies" section above provides an overview of this strategy. As it relates to severe storms, this strategy should involve updating zoning codes and subdivision regulations to require saferooms and undergrounding utilities associated with new development.

Responsible Parties and Potential Partners

- *Responsible:* County and local government zoning departments
- *Partners:* SCEM

7. Improve Coordination and Communication Among Emergency Responders – Tier Two Priority

Refer to Strategy 2 in the "Priority All Hazards Mitigation Strategies" section.

PRIORITY DROUGHT MITIGATION STRATEGIES

1. Pursue Regular Community Outreach and Education – Tier One Priority

Drought is a long-term condition and therefore is best mitigated through improved water use and conservation practices that take time to understand and implement. Consequently, a priority drought mitigation strategy is community outreach and education to property owners, particularly agricultural land owners, to encourage implementation of the following strategies:

- *Agriculture and Irrigation Best Management Practices*: Area organizations that support agriculture should coordinate to provide educational materials and programs to farmers on Best Management Practices for agriculture and irrigation including erosion control techniques, use of drought-resistant crops, and irrigation practices to ensure that irrigation systems are used most efficiently and soil retains water most efficiently. These agencies include the Stephenson County Soil and Water Conservation District, Natural Resources Conservation Service, University of Illinois-Extension, Stephenson County Farm Bureau, and the USDA Farm Service Agency.
- *Yard Irrigation Best Management Practices*: Area organizations that educate property owners on lawn and garden maintenance, such as University of Illinois Extension, should focus educational materials on Best Management Practices for yard irrigation. These practices include using native plants, capturing rainwater through cisterns or rainbarrels, promoting stormwater infiltration through rain gardens, mowing at proper frequency, and watering in the evening.
- *Water Saving, Storage and Use Restrictions:* When the County experiences a drought, techniques to conserve water should be employed, including prohibiting use of water for certain non-essential activities such as washing vehicles, prescribing certain days of the week that lawns can be watered, etc.
- *Drought-Proofing Wells*: SCEM can educate residents of unincorporated areas of the County that rely on well water about drought-proofing wells. Drought-proofing entails either improving the pumping system within the well or digging a deeper well.
- *Emergency Assistance Programs*: Agricultural droughts typically trigger the availability of several USDA emergency assistance programs; SCEM should work with the organizations responsible for these programs to ensure that information is clear and readily available to farmers. These programs include Farmers Home Administration loans, Agricultural Stabilization and Conservation Service disaster assistance payments, Natural Resource Conservation Service technical assistance, and Federal Crop Insurance Corporation loss claims.

Responsible Parties and Potential Partners

- *Responsible:* SCEM, County and local governments, Farm Bureau, Stephenson County Soil and Water Conservation District, Natural Resources Conservation Service, University of Illinois-Extension
- *Partners:* Illinois State Water Survey

2. Promote Use of Best Management Practices For Yards and Agriculture – Tier One Priority

In addition to educating farmers and property owners on Best Management Practices for yards and agriculture (BMPs are described in Priority Strategy 1 above), the County and local governments can help to ensure the use of these practices by:

- *Passing Water Conservation Ordinances:* Such an ordinance can reduce water consumption, thereby using community water systems more efficiently, through provisions such as limiting lawn watering to early morning and evenings and on alternate days of the week and requiring that hoses for washing vehicles have automatic shut-off nozzles.

- *Using BMPs on Publicly-owned Land*: County and local governments can set an example by using BMPs for lawns (drought resistant plants, rain gardens, etc.) on publicly-owned lands.
- *Providing Incentives for Use of BMPs on Privately-owned Land*:: Incentives can be provided to encourage more efficient water use. For example, water utilities can provide a rebate on the purchase of rain barrels and high efficiency washing machines and the Stephenson County Soil and Water Conservation district provides incentives to farmers who plant grass strips along water bodies to reduce erosion.

Responsible Parties and Potential Partners

- *Responsible:* SCEM, County and local governments, Farm Bureau, Stephenson County Soil and Water Conservation District, Natural Resources Conservation Service, University of Illinois-Extension
- *Partners:* Illinois State Water Survey

3. Improve Planning and Regulatory Practices – Tier Two Priority

Stephenson County should work with local agricultural-related agencies to develop a drought contingency plan to provide detailed steps to be taken during a drought to preserve local water resources. As part of this effort, areas in the County that are identified as having potentially problematic groundwater levels should be monitored for decreasing levels.

Additionally, land use plans for the County should continue to call for the preservation of wetland areas and stormwater management ordinances should be updated to promote maximum erosion control (stormwater management ordinances are described in more detail in Strategy 5 in the "Priority Flood Mitigation Strategies—County-wide" Section above).

Responsible Parties and Potential Partners

- *Responsible:* SCEM, County and local governments
- *Partners:* Illinois State Water Survey

PRIORITY EXTREME TEMPERATURES MITIGATION STRATEGIES

1. Pursue Regular Community Outreach and Education – Tier One Priority

Exposure to extreme temperatures poses a considerable risk of illness, injury, and even death, particularly for vulnerable populations. Armed with good information about the risks of exposure to severe temperatures and ways to avoid exposure, this risk can be avoided. Consequently, education and outreach is a key strategy for mitigating extreme temperature disasters.

As described in the Risk Assessment chapter of this Plan, the following are populations most vulnerable to illness or injury from extreme temperatures and should be targeted in educational programs and materials:

- Elderly persons
- Low-income persons (at risk of not being able to afford sufficient heating or cooling)
- Young children
- Sick persons
- Overweight persons
- Persons with alcohol problems
- Men (due to higher rate of sweating and increased dehydration)
- People in urban areas (higher urban temperatures due to urban heat island effect)

Educational materials should provide information about:

- *Avoiding and Recognizing Illness/Injury from Extreme Temperatures:* These materials should focus on steps to avoid overexposure to extreme heat or cold as well as warning signs for recognizing the onset of heat stroke, hypothermia, and other temperature-related illnesses.
- *Cooling Centers:* Locations and hours of centers, transportation to/from centers, and rules (e.g. parents/guardians must accompany children, alcohol is not allowed, etc.)
- *Heating and Cooling Assistance:* Programs sponsored through the Northwest Illinois Community Action Agency (NICAA) provide financial assistance to low-income persons for heating and cooling
- *Home Weatherization:* The NICAA has educational programming and assistance programs to encourage home weatherization

Responsible Parties and Potential Partners

- *Responsible:* Northwest Illinois Community Action Agency, SCEM, County and local governments, Red Cross
- *Partners:* Utilities, IEMA

2. Promote and Improve Use of Cooling Centers – Tier One Priority

Currently, the County has cooling centers in place during periods of extreme temperatures. While the number of these centers is adequate, the use of them could be improved. In particular, centers have been used improperly in the past as children have been left unaccompanied without parents/guardians. Consequently, improved education and outreach about the availability and rules associated with these centers would improve their efficacy.

Responsible Parties and Potential Partners

- *Responsible:* SCEM, County and local governments, Red Cross
- *Partners:* Owners of major multi-family housing complexes, schools, community building operators

3. Monitor Vulnerable Populations and Improve Access to Adequate Heating/Cooling – Tier Two Priority

This strategy refers to continuing the important efforts already undertaken by the NICAA to provide assistance to low-income populations with utility costs for heating and cooling.

Responsible Parties and Potential Partners

- *Responsible:* Northwest Illinois Community Action Agency
- *Partners:* SCEM

4. Promote Home Weatherization – Tier Two Priority

This strategy refers to continuing the important efforts already undertaken by the Northwest Illinois Community Action Agency to provide assistance to low-income populations with home weatherization to reduce vulnerability to extreme temperatures.

Responsible Parties and Potential Partners

- *Responsible:* Northwest Illinois Community Action Agency, utilities
- *Partners:* SCEM, County and local governments

PRIORITY EARTHQUAKE MITIGATION STRATEGIES

Although progress is being made in our ability to predict earthquakes, the most effective mitigation tools are community education and managing the built environment.

1. Promote and Implement Modern Hazard Warning Systems – Tier One Priority

Refer to Strategy 3 in the "Priority All Hazards Mitigation Strategies" Section above. In particular, since earthquakes cannot always be easily detected, hazard warning systems can be used to warn people of potential aftershocks.

2. Pursue Regular Community Outreach and Education – Tier Two Priority

Because earthquakes are so infrequent in the Midwest, the population tends to neither be aware of, nor prepared for, the potential impacts. And, as described in the Risk Assessment section of this Plan, Stephenson County is at relatively low risk of experiencing significant impacts of earthquakes due to its distance from the New Madrid fault.

That said, Stephenson County has felt several earthquakes originating from different parts of the region. Consequently, SCEM, the Red Cross, and their partners should include earthquake preparedness as part of a comprehensive hazard mitigation educational program. Specifically, education should focus on:

- *Having a home disaster kit and plan*: including a few days supply of food and water, a fire extinguisher, smoke alarms, a properly equipped first aid kit complete with any necessary prescription medication in sufficient quantities to last a few days to a few weeks; organizing and testing a family emergency plan which would help ensure each family member's survival; having residents know how to turn off gas supply to building.
- *Eliminating/reducing earthquake hazards in properties*: such as free standing water heaters, stoves, and other gas or electric appliances which could move or fall during an earthquake; bookshelves or filing cabinets which are free standing or bookshelves with objects stored above head level; water or gas pipes which are not fastened well to walls or ceiling and large panes of glass which could fracture and fly apart.
- *Steps to take in the event of an earthquake*: These steps include staying inside a building (if already inside), and ducking, covering, and holding. Find protection next to or under heavy furniture. Avoid running outside as falling building parts can fall. Avoid rooms with a lot of ceiling fixtures. Avoid large spanses of windows. Avoid large rooms with open-span ceilings or roofs.

Responsible Parties and Potential Partners

- *Responsible:* SCEM, Red Cross
- *Partners:* schools, local governments

3. Protect Critical Facilities and Infrastructure – Tier Two Priority

Public buildings, such as schools and community halls, are critical facilities not only because of the large, and often-vulnerable population they accommodate, but also because they are often identified as shelter sites for a community. Therefore, it is essential that these buildings are safe and can function after a seismic event. SCEM could work with communities to develop a survey procedure and guidance document to inventory structural and non-structural hazards in and near designated shelter sites. Survey results can be used to determine mitigation priorities that can be incorporated into capital improvement plans. Such surveys should take into account that existing shelter sites are often constructed of brick and mortar, which is intolerant of earth shaking movements.

Additionally, SCEM should evaluate access to communications and power utilities to each Village. This infrastructure should be "looped"; that is, utility distribution lines should enter a community from at least two points so that if damaged on one end, the community is still served from the lines entering from the other location**.**

Responsible Parties and Potential Partners

- *Responsible:* SCEM, County government and local governments, utilities, fire departments, police departments, sheriff's department

- *Partners:* schools, hospitals

PRIORITY HUMAN-CAUSED HAZARD AND DISEASE OUTBREAK MITIGATION STRATEGIES

Based on the primary vulnerability factors identified in Stephenson County for human-caused hazards and disease outbreaks, the priority mitigation strategies will be pursued.

1. Improve Coordination and Communication Among Emergency Responders – Tier One Priority

One of the County's most critical hazard mitigation tools is an efficient communication and coordination system among emergency responders in the County as well as with agencies in the region and State. The County's Unified Command Committee should continue to meet regularly to identify ways to strengthen the existing communication system and to also conduct periodic updates of the Stephenson County Disaster Plan. Also, the County should be actively involved in the Prairie Shield Regional Alliance as a forum for strengthening regional communication and coordination. This Strategy is discussed in further detail as Strategy 2 in the "Priorities Strategies for All Hazards" section of this Plan.

Responsible Parties and Potential Partners

- *Responsible:* Stephenson County Emergency Management, SCEM Unified Command, Fire Departments, Police Departments, Sheriff's Department, Red Cross, Local Governments, Stephenson County Health Department, EMS
- *Partners:* IEMA, Prairie Shield Regional Alliance, local governments

2. Pursue Regular Community Outreach and Education – Tier One Priority

Another key hazard mitigation tool for human-caused hazards and disease outbreaks is education and outreach. This strategy is discussed in further detail as Strategy 1 in the "Priorities Strategies for All Hazards" section of this Plan. Specifically, for human-caused hazards and disease outbreaks, education and outreach can play a role in educating people on:

- Developing family emergency plans and home emergency kits
- Safety guidelines and regulations, such as for handling hazardous materials, traffic safety, and fire safety
- Signs for recognizing foreign animal disease outbreaks in livestock
- Ways to prevent vulnerability to disease outbreaks, such as by identifying and removing standing water to reduce vulnerability to West Nile Virus
- Energy conservation strategies

Responsible Parties and Potential Partners

- *Responsible:* Stephenson County Emergency Management, Red Cross, Local Governments, Stephenson County Health Department, families
- *Partners:* IEMA, Utilities, Local media

3. Promote and Implement Modern Hazard Warning Systems – Tier One Priority

The County should continue education and outreach efforts to encourage residents to have a National Oceanic and Atmospheric Administration (NOAA) weather radio on hand to provide up to date warnings and directions regarding hazard events. NOAA weather radios provide information on all hazards. Additionally, the County should continue to update and expand its system of warning the public and local governments about impending hazards. This strategy is discussed in further detail as Strategy 3 in the "Priorities Strategies for All Hazards" section.

Responsible Parties and Potential Partners

- *Responsible:* Stephenson County Emergency Management, local governments
- *Partners:* IEMA

4. Identify and Address Infrastructure Hazard Vulnerability – Tier Two Priority

Transportation, communications, and energy infrastructure are all critical tools for emergency response during disasters and, if not well maintained, can also increase the County's vulnerability to loss of life and property from disasters. Additionally, stormwater catch basins have the potential to create areas of standing water that increase the County's vulnerability to West Nile Virus.

To reduce vulnerability to hazards from infrastructure, SCEM should work with County and local government public works staff and utilities to undergo periodic evaluations of infrastructure for identify areas of hazard vulnerability so that improvements can be incorporated in County, municipal, state, and utility upgrade plans.

Responsible Parties and Potential Partners

- *Responsible:* Stephenson County Emergency Management, County and local government public works staff, utilities
- *Partners::* airports, railroad, utilities, IDOT

Chapter 5: Plan Adoption and Implementation

PLAN ADOPTION

This plan should be adopted by the County Board and by the governing bodies of all of the municipalities in the County. Adoption of the Stephenson County Multi-Hazard Mitigation Plan accomplishes the following:

- Confirms the commitment of community leaders and citizens to mitigate the effects of disasters.
- Provides a definitive guide for community leaders and officials of the County and local jurisdictions to initiate changes that will decrease damages incurred from disasters.
- Ensures the long-term continuity of mitigation policies and programs through changes in political leadership, County and municipal staff, and community decision makers.
- Provides confirmation to Illinois Emergency Management and FEMA that the plan's recommendations were assessed and approved by the governing authority of Stephenson County.

Before the County, city, and villages adopted the plan, it was first reviewed by the Illinois Emergency Management Agency (IEMA) to insure compliance with the Disaster Mitigation Act of 2000 and any additional state requirements. An Illinois State Hazard Mitigation Officer from IEMA oversaw the review process. Upon IEMA's approval, the Plan was submitted to FEMA Region V for review and approval. Once approved by FEMA, the Plan was proposed for adoption by the County and by each of the municipalities in the County.

Cities and villages that do not adopt the plan cannot apply for mitigation grant funds unless they prepare, adopt, and submit a mitigation plan of their own. Adoption of the plan gives the jurisdiction legal authority to implement mitigation strategies and to enact ordinances, policies, and programs with the goal of reducing disaster related losses. Unincorporated areas (townships) do not have to formally adopt the plan.

PLAN IMPLEMENTATION

SCEM Role

Upon approval of the plan, the County should inform all participating jurisdictions and stakeholders, and the Director of County Emergency Management should distribute copies of the plan to these parties. Additionally, the County should make the plan available to the public by placing it on the County's Emergency Management website that should continue to be expanded and enhanced.

Stephenson County Emergency Management should take the lead on plan implementation, which would include making sure that the plan is referenced by future planning efforts and is used to provide guidance on political decisions, public expenditures, and policy directives. With assistance from the Hazard Mitigation Planning Committee and the Unified Command Committee, SCEM should monitor implementation progress and effects of mitigation strategies. Monitoring the plan will help implement the recommendations put forth in the plan.

In addition to overseeing implementation and plan monitoring, SCEM and the Hazard Mitigation Planning Committee should prioritize mitigation projects and spearhead fund procurement to finance mitigation projects. Such efforts could include preparation of grant proposals as well as provision of assistance to local jurisdictions in preparation of grant proposals to state, federal, and non-profit funding opportunities.

As discussed in Chapter 4, education about self-initiated mitigation strategies that can be employed to reduce potential disaster-related damages can be a cost effective method of building local support for mitigation. SCEM should undertake creative outreach programs to community members, business owners, and non-profit personnel to encourage involvement, in and understanding of, local mitigation efforts.

County and local jurisdiction staff and elected officials should insure that the recommended mitigation strategies in Chapter 4 are considered in budgets. In addition to the grant opportunities discussed in this plan, as political will dictates, administrators and elected officials should contemplate the use of volunteer efforts, bonds, loans, fees, and taxes to finance high priority mitigation projects.

Focus on Highest Priority Items

This Plan presents mitigation strategies in three tiers of priorities. SCEM should keep its focus on highest priority strategies that exhibit the greatest ability to reduce hazard vulnerability. Specifically, the following are some of the key initial areas of focus:

- *Assist Communities with Local Will to Implement Mitigation Strategies:* Some communities, due to local interest and vulnerability to hazards, will exhibit greater commitment to implementing mitigation strategies than others. SCEM should focus on assisting communities that demonstrate this commitment to help them achieve their local mitigation goals.
- *Freeport Pecatonica River Flood Mitigation*: Flooding on Freeport's East Side in the Pecatonica River floodplain was a major driver behind the development of this Plan. The County and City of Freeport should keep a consistent focus on moving forward the flood mitigation strategies program for this area.
- *Freeport Yellow Creek Flood Mitigation*: Flooding in the Yellow Creek corridor on Freeport's south side was also a key area of vulnerability identified in this Plan. The City should focus on ensuring that new development in this area incorporates stormwater management that goes above and beyond minimum code requirements to ultimately reduce flooding impacts on the Creek.
- *Pearl City Flood Mitigation:* Pearl City has experienced some of the most severe flooding events in the County, yet its residents cannot currently access flood insurance. Stephenson County should work with Pearl City and other flood-prone communities to get technical assistance to update official floodplain maps so that Pearl City can enroll in the National Flood Insurance Program. Along with this, Pearl City should evaluate methods to improve its stormwater management system.

Promote Project Success Stories

As successful mitigation projects come to fruition, SCEM and participating local jurisdictions and agencies should promote their accomplishments so that the community is aware that the plan is being implemented and involvement of multiple organizations, jurisdictions, and agencies continues. Opportunities to showcase successful projects include posting descriptions on the Stephenson County Emergency Management or local web sites and through newspaper articles.

PLAN EVALUATION & MAINTENANCE

Planning is an ongoing process, and for this Multi-Hazard Mitigation Plan to remain current and applicable, periodic updates will be necessary. The Disaster Mitigation Act of 2000 requires that local mitigation plans are evaluated and updated at least every five years. Consequently, SCEM will continually evaluate the Plan implementation progress once every six months, at a minimum, to track progress toward implementing the mitigation strategies. SCEM will then initiate updating this plan by June 2012 at the latest, to ensure an update is complete by June 2013. To expedite this process, SCEM should begin to maintain a record of disaster related damages that will help to further hone the vulnerability and risk assessments, and should track mitigation projects to determine implementation progress and results. Additionally, vulnerability, risk, and mitigation recommendations should be reviewed following a disaster to determine if any changes are warranted based on degrees of damage and patterns of the event. The County Board must approve all additions and updates to the plan, and all updates should include public involvement and stakeholder outreach. The Stephenson County Hazard Mitigation Planning Committee will be involved as the advisory body for this evaluation and update process.

Appendices

APPENDIX A: DISASTER HISTORY TABLES

The tables on the following pages provide a detailed record of the history of disasters in the County. Note that these tables only include reported events and therefore should not be considered fully exhaustive.

Table A1: Historical Occurrences of Flooding: 1914 – 2007

Date	Location	Type	River Height*	Reported Property Damage	Reported Crop Damage	Notes
9/16/1914	Freeport	Riverine	18.45 ft			Kilgrubbin neighborhood in East Freeport flooded, some residents rescued by boat in the nights, fear of illness developing as water receded; trains delayed for days.
2/27/1915	Ridott, County-wide	Riverine	17.27 ft			Farms along banks of the river submerged, much land in Ridott submerged
3/28/1916	Freeport	Riverine	19.40 ft			East Freeport entirely under water, water company had difficulty providing service, some residents evacuated from their homes, railroad tracks under water, homes in Kilgrubben under 8 feet of water, several businesses damaged.
3/16/1919	Freeport	Riverine	17.60 ft			Kilgrubbin heavily impacted by flooding, Henderson Street submerged for ¼ mile, factories suffered flooding
2/24-25/1922	Winslow, Freeport	Riverine	18.82 ft			Pecatonica River flooding affected East Freeport, railway traffic delayed, minor flood damage to electric company, water leaked into gas mains. Flooding also on west side of river as far as Adams. Winslow isolated from train service, farms flooded
4/6/1923	Freeport, Winslow	Riverine	18.36 ft			In Winslow, large area flooded including many basements and some 1st floors
3/16/1929	County-wide	Riverine	19.76 ft			Greatest flood recorded on Pecatonica River, washed out 400 feet of railroad track, some roads impassible, Taylor Park submerged, some people used boats to get around, some families evacuated from homes.
4/3/1933	Freeport	Riverine	17.41 ft			
03/8/1937	Freeport	Riverine	16.98 ft			
2/28-3/4/1948	Freeport	Riverine	13.10-14.70 ft			
3/20-3/21/1948	Freeport	Riverine	13.17-14.02 ft			
3/10/1949	Freeport	Riverine	13.61 ft			
3/11-3/12/1950	Freeport	Riverine	13.05-13.10 ft			
7/21-	Freeport	Riverine	13.27-			

Date	Location	Type	River Height*	Reported Property Damage	Reported Crop Damage	Notes
7/23/1950			13.56 ft			
7/10-7/14/1951	Freeport	Riverine	13.35-13.67 ft			
3/13-3/15/1952	Freeport	Riverine	13.00-13.16 ft			
2/21-2/26/1952	Freeport	Riverine	13.20-13.85 ft			
3/29/1967	Freeport	Riverine	13.29 ft			
7/3/1969	Freeport, Winslow	Riverine	17.16 ft			90% of Freeport's East Side submerged and flood waters went as far west as Adams St. on west side of River. Kilgrubbin submerged, three major county highways closed, 15,000 acres of farmland flooded, 200 families evacuated.
2/20/1971	Freeport	Riverine	16.33 ft			
04/1973	Freeport	Riverine				State-wide flooding Presidential disaster declaration
3/25/1975	Freeport	Riverine	17.13 ft			100 to 200 residents evacuated, flooding widespread, sewage plant pumped near capacity, East Freeport under up to 5 feet of water, many roads closed in the county, impacted phone service, National Guard called to help. City acquired and demolished over 70 homes afterward.
3/23-3/27/1986	Freeport	Riverine	13.07-13.39 ft			
Fall 1986	Pearl City	Riverine				One of worst floods in Pearl City (noted in Flood Insurance Study)
3/17/1989	Freeport	Riverine	13.07			
7/1-7/8-1990	Freeport	Riverine	13.48-16.20 ft			
8/21-8/25/1990	Freeport	Riverine	13.01-13.26 ft			
3/24-4/6/1993	Freeport	Riverine	13.20-14.86 ft			Closed Taylor Park School. Residents evacuated from housing project.
6/25 – 27/1993	Freeport	Riverine	13.03 – 13.18 ft			
6/30-7/23/1993	Freeport, Winslow, McConnell	Riverine	13.01-16.60 ft	Public: $265,000 Private: $140,000 Business: $100,000	$19,311,500	This flood was a Presidential declared disaster. The flood damaged 247 homes, 21 businesses, and 86,000 acres of cropland. The worst hit municipalities included Winslow, Freeport, and McConnell; significant

Date	Location	Type	River Height*	Reported Property Damage	Reported Crop Damage	Notes
						damage also occurred to farms in the unincorporated area of the County.
2/21-3/1/1994	Freeport	Riverine	13.18-14.41 ft			
7/19-7/25/1996	Orangeville, and the townships of Rock Grove, Rock Run, Oneco, Buckeye, Dakota, Harlem, and Ridott most affected	Riverine and flash flooding	13.25-14.49 ft	Orangeville: $520,000 County roads: $375,500		Stephenson County received 6 to 14 inches of rain, along with ten other Illinois counties, second highest 24-hour rainfall amount in the nation's history. Presidential declared flood disaster. Flooding along the Pecatonica River, Richland Creek, and Rock Run occurred for several days beginning July 17th, 1996. Damages more than $575,000. Stephenson County residents claimed just over $84,000 in disaster housing grants and loans from FEMA. Orangeville most affected - under 6 feet of water. Closed IL-26. 25,000 - 30,000 acres of cropland affected.
2/20 – 3/3/1997	County-wide	Riverine	16.40 ft			Flooding affected multiple northwestern Illinois counties.
4/6-4/7/1998	Freeport	Riverine	13.01-13.02 ft			
08/98	Loran Township	Riverine				Five roads washed out in Loran Township (Block, Butze, Heshery, Lott, Koch)
1999 or 2000		Flash flood				Orangeville mostly underwater
4/30/1999	Freeport	Riverine	13.00 ft			
5/21-5/25/1999	Freeport	Riverine	13.07-13.79 ft			
6/6/1999	Freeport	Riverine	10.30 ft			Affected Locust and Chestnut Streets in Freeport
7/23/1999	County-wide	Riverine	8.0 ft			Flooding in four northwestern Illinois counties including Stephenson
5/11/2000	Freeport	Riverine	5.72 ft			Small stream flooding; several roads and ditches submerged in water north of Freeport
5/30 – 6/21/2000	Freeport, Pearl City, Orangeville, Cedarville, Winslow, McConnell, County-wide	Riverine and Flash Flooding	12.80-15.55 ft	$345,000	$3,400,000	Gubernatorial declared flood disaster. Crested in Freeport at 15.55 ft on June 6. Several streets closed for several days in Freeport. Highways 20 and 26 closed in spots due to standing water. Approximately 20,000 acres of farmland flooding in areas adjacent

Date	Location	Type	River Height*	Reported Property Damage	Reported Crop Damage	Notes
						to the Pecatonica River and Richland Creek. Areas of Pearl City under several feet of water due to flash flooding. Affected 800 people and 250 dwellings, resulting in evacuation of 100 people. Red Cross expended $4,000 on response assistance.
8/2001	Loran, Pearl City	Flash flood				North side of Pearl City flooded, several homes flooded
9/20/2001	Freeport	Riverine	9.24 ft			Route 26 near Reed Ave in Freeport closed due to standing water.
6/3-6/9/2002	Freeport, County-wide	Riverine	13.07-13.55 ft			Water in fields, significant damage to homes, businesses, farmland, and public property; basement flooding and some roads closed; Busch Road washed out in Loran Township; creek in Freeport's Taylor Park out of its banks. Red Cross expended $4,000 on response.
8/22/2002	Eleroy, Freeport, Lena, Pearl City	Flash flood	10.81	$500,000 (Pearl City)		Intersection of Highway 20 and Dameier Road impassable; Yellow Creek overflow in Pearl City; numerous homes damaged and 22 residents evacuated; numerous roads closed; sewage treatment plant flooded
8/23-8/24/2002	Freeport, Rock Run	Riverine	13.40-13.98 ft			Maize Road washed out in Rock Run.
7/5 – 7/8/2003	Freeport, Pearl City, Lena	Flash flood		F: $6,000 PC: $15,000		Several instances of heavy rains over four days. Rainfall rates of 1 to 2 inches an hour were common with the storms. Ditches full. Some erosion along edges of Pearl City to Elroy Rd. Red Cross expended $32,000 on response.
5/27-6/4-2004	Freeport	Riverine	13.00-14.06 ft			Flooding occurred in May and June, with the river above the 13' flood stage for 9 days.
6/16/2004	Cedarville, Harlem Township and Lena	Flash flood		HT: $30,000 L: $10,000	C: $6,000 L: $3,000	Harlem Township: Culvert washed out on Scioto Mills Rd. Lena: Waddams Creek out of banks; intersection of Unity and Louisa Roads closed; Yellow Creek out of banks; Sunnyside Road closed; Wagner Road closed
2/14/2005	Rock Run	Flash flood				Maize Road washed out
2/14 – 2/20/2005	County-wide	Riverine	13.63-14.24 ft	$5,000		Minor flooding in county; moderate flooding in Freeport

Date	Location	Type	River Height*	Reported Property Damage	Reported Crop Damage	Notes
7/20/2006	Loran Township	Flash flood				Ditches full with some water on the highway, four miles east of Pearl City
9/4/2006	County-wide	Flash flood				The sheriff department reported some minor small stream flooding across the eastern half of the county.
8/7/2007	County-wide	Flash flood				Heavy rains County-wide, worst effects in Freeport. Flash flooding was a 2000-year event. Impacted 365 properties throughout the County and resulted in a Presidential Disaster Declaration.
TOTAL				**$2,311,500**	**$22,720,500**	

Sources: National Climatic Data Center: U.S. Storm Event Database
Army Corps of Engineers, Reconnaissance Report for General Investigations Study, Freeport on Pecatonica River
National Weather Service Freeport Pecatonica River Gage
Information from local residents and government officials

**Crest at Pecatonica River Gage in Freeport*

Table A2: Historical Occurrences of Severe Storms: 1956 – 2007

Date	Time (CST)	Location	Wind Speed (knots)	Reported Injuries	Reported Property Damage	Notes
5/9/1956	1730	Countywide				
10/8/1958		Countywide		1		Near-tornado velocity winds leveled corn fields and knocked down trees, power lines, and trailer homes.
8/26/1965		Countywide				Gale-force winds and heavy rains overturned trailer homes and felled trees in Freeport and the surrounding area, impacting electric and water service in the city.
7/29/1967	1715	Countywide				
8/6/1968	2227	Countywide				
8/16/1968	1440	Countywide				
6/6/1971	0445	Countywide				
6/19/1971	2219	Countywide	50			
6/24/1971	2030	Countywide	52			
6/12/1972	2020	Countywide	65			
9/28/1972	1640	Countywide				
6/8/1974	2030	Countywide				
6/14/1974	1845	Countywide	61			Heavy rain fell in the northeast corner of the county near Davis and Dakota. Livestock were killed in the area.
6/14/1974	1900	Countywide				
6/20/1974	1715	Countywide				A series of bad storms hit northern Illinois over a 3-day period. Winds were reported at 60-85 mph. Generators were brought in for emergency power and many buildings suffered damage. Several people were injured in the region.
6/20/1974	1725	Countywide				
6/22/1974	0840	Countywide	56			
6/22/1974	0915	Countywide				
11/29/1975	2120	Countywide				Strong winds and rain caused power outages and knocked over trees in the Freeport area.
11/29/1975	2130	Countywide				
6/30/1978	1800	Countywide				
6/14/1980	0200	Countywide				
7/16/1980	0200	Countywide	52			
8/4/1980	1755	Countywide	52			
7/13/1981	0855	Countywide				
9/30/1981	1835	Countywide	50			
7/6/1982	1400	Countywide				
7/1/1983	0700	Countywide	52			

Date	Time (CST)	Location	Wind Speed (knots)	Reported Injuries	Reported Property Damage	Notes
4/29/1984	2110	Countywide	69			
7/10/1984	1845	Countywide				
8/12/1985	2145	Countywide				
9/28/1986	1610	Countywide				
5/27/1987	1830	Countywide				A rainstorm affected Orangeville and high winds felled an oak-tree, snapping power lines.
5/27/1987	1955	Countywide				
7/6/1987	1330	Countywide				
8/16/1987	1705	Countywide	58	1		
5/8/1988	1545	Countywide				
8/8/1988	1830	Countywide				
4/27/1990	1605	Countywide	54			
4/27/1990	1613	Countywide	52			
6/29/1990	0015	Countywide				
6/29/1990	0125	Countywide				
8/19/1990	1605	Countywide	52			
7/2/1992	1120	Countywide				
4/18/1995	0945	Freeport				
4/18/1995	0948	Freeport				
4/19/1996	2010	Pearl City	90		$1,200,000	Roof damage, barn damage, winds in excess of 100 mph
4/19/1996	2015	Freeport	52			
10/29/1996	1710	Countywide	52			
1/10/1997	0400	Countywide		1		
1/17/1997	0400	Countywide				
4/5/1997	1636	Freeport	52			
4/5/1997	1636	Lena	50			
4/6/1997	0800	Countywide	54		$1,600,000	Significant damage to trees , roofs, and power lines,
5/7/1997	2230	Countywide	60			
6/21/1997	0525	Pearl City	52			
9/16/1997	1950	Countywide	52			
9/29/1997	1100	Countywide	52	1	$15,000	
03/1998		Freeport				Red Cross response in outskirts of Freeport, west and south
05/1998		Countywide				Straight-line winds

Date	Time (CST)	Location	Wind Speed (knots)	Reported Injuries	Reported Property Damage	Notes
6/18/1998	1415	Freeport	56		$1,000	
6/28/1998	0135	Pearl City			$1,000	
7/3/1998	1810	Freeport	52			
8/24/1998	1118	Pearl City	65			*8/26? DHW – damaged 8 barns, four roofs of homes, a grain bin, a silo, trees, and cows A microburst Power out for three days
8/24/1998	1130	Freeport	70			
8/24/1998	1145	German Valley	65			German Valley lost power for three days. The storm left downed trees throughout the Village (ultimately clearing the majority of trees vulnerable to damage from high winds). Costs of recovery were minor.
11/9/1998	0400	Countywide	57			
2/11/1999	1346	Dakota	52			
5/16/1999	2305	Freeport			$8,000	
5/16/1999	2325	Orangeville		1	$40,000	
5/16/1999	2330	Freeport			$15,000	
6/6/1999	1410	Freeport	65		$5,000	
6/6/1999	1522	Freeport	55			
6/1/2000	1830	Freeport			$2,000	
6/1/2000	1850	Rock City			$1,000	
9/11/2000	1920	Freeport	52			
9/11/2000	2016	Lena	52			
12/16/2000	1400	Countywide				
12/21/2000	0400	Countywide				
12/23/2000	2200	Countywide				
02/25/2001	0200	Countywide	50			
4/23/2001	1000	Countywide				
6/14/2001	1735	Freeport	61			
6/14/2001	1820	Pearl City	61			
6/14/2001	1820	Pearl City	64			
6/14/2001	1845	Freeport	61			

Date	Time (CST)	Location	Wind Speed (knots)	Reported Injuries	Reported Property Damage	Notes
9/7/2001	1800	Lena	52			
9/7/2001	1810	Orangeville	52			
3/9/2002	1300	Countywide	49			
5/30/2002	1940	Lena	52			
6/10/2002	1705	Freeport	52			
6/10/2002	1712	Lena	52			
6/10/2002	1730	Freeport	52			
8/12/2002	1715	Freeport	52			
2/11/2003	1615	Countywide	64			
7/5/2003	0235	Countywide	61		$2,550,000	More than 15,000 people in the Freeport area without electricity. Wind gusts were up to 70 miles/hour and damage was caused to cars and houses by fallen branches. High voltage power poles downed. Mobile homes overturned.
7/5/2003	0243	Freeport	61		$165,000	
7/5/2003	0250	Pearl City	55	1	$30,000	
7/5/2003	0253	Freeport	52		$50,000	
11/12/2003	1300	Countywide	54		$100,000	
4/17/2004	0033	Winslow	52		$10,000	
6/16/2004	1551	Cedarville	52		$1,000	
7/5/2004		Ridott				High winds and rain, middle to north end of village, numerous limbs and trees, electrical wires downed, power out in village for 3 days
10/29/2004	2146	Lena	52		$3,000	
10/29/2004	2202	Freeport	52		$3,000	
6/2005		Ridott				High winds and rain, electrical wire downed by tavern
6/25/2005	1835	Lena	52		$12,000	
6/25/2005	1856	Mc Connell	52		$5,000	
6/25/2005	1905	Orangeville	52		$5,000	
8/18/2005	1929	Orangeville	52		$5,000	
9/13/2005	1615	Freeport	57		$20,000	
3/12/2006	2012	German Valley	70		$2,000	
5/29/2006	1230	Freeport	52			
6/21/2006	0350	Freeport	52		$2,000	
6/21/2006	0440	Mc Connell	52		$1,000	

Date	Time (CST)	Location	Wind Speed (knots)	Reported Injuries	Reported Property Damage	Notes
6/21/2006	0558	Davis	52		$1,000	
6/21/2006	0558	Pearl City	50			
7/17/2006	1958	Loran	61		$4,000	
7/17/2006	2015	Freeport	57		$5,000	
7/17/2006	2021	Bolton	61		$4,000	
7/20/2006	0230	Freeport	57		$5,000	
7/22/2006	1238	Rock City	52		$1,000	
TOTAL				**6**	**$ 4,157,000**	
Source: National Climatic Data Center: U.S. Storm Event Database						

Table A3: Historical Occurrences of Lightning Damage: 1999 – 2007

Date	Time (CST)	Location	Reported Injuries	Reported Deaths	Est. Damage	Notes
7/23/1999	1850	Orangeville	0	0		Trees downed
9/11/2000	1030	Lena	1	0	$30,000	Lightning struck a home, ignited a fire, and killed a police officer outside of his vehicle.
6/21/2006	0345	Freeport	0	0		house struck by lightning causing unknown damage.
8/7/2007		Lena				Water tower struck, led to a Village boil order
TOTAL					**$30,000**	

Source: National Climate Data Center: U.S. Storm Event Database, Stephenson County Hazard Mitigation Planning Committee

Table A4: Historical Occurrences of Hail Damage: 1971 – 2007

Date	Time (CST)	Location	Magnitude (in.)	Property Damage	Crop Damage	Notes
6/21/1971	1900	Freeport and north				Marble-sized hail reported in Freeport, larger hail to the north, associated with tornado on same day
6/12/1972	2020	Stephenson	1.00			
6/16/1973	1245	Stephenson	2.00			
6/14/1974	1845	Stephenson	0.75			Hail fell in the northeast corner of the county near Davis and Dakota and 2 ½ inch hail fell at Taylor Ridge
3/21/1975	2130	Stephenson	1.75			
6/04/1975	1835	Stephenson	1.75			
6/04/1975	1840	Stephenson	1.75			
7/03/1975	1958	Stephenson	1.75			
4/10/1981	1830	Stephenson	1.00			
6/13/1984	0220	Stephenson	1.75			
7/26/1987	1435	Stephenson	0.75			
4/5/1988	1750	Stephenson	1.75			
3/27/1991	1309	Stephenson	0.75			
4/10/1992	1900	Stephenson	1.00			
4/10/1992	1900	Stephenson	1.00			
6/16/1992	1550	Stephenson	0.75			
6/16/1992	1550	Stephenson	0.75			
4/19/1996	2028	Dakota	1.75			
4/19/1996	2028	Davis	1.75			
4/19/1996	2028	Rock City	1.75			
6/18/1998	1705	Pearl City	1.00			
6/06/1999	1310	Freeport	0.75			
7/23/1999	1800	Freeport	0.75			
4/16/2000	1850	Pearl City	N/A			
5/11/2000	0815	Orangeville	0.75			
6/01/2000	1820	Freeport	0.75			
6/01/2000	1830	Winslow	1.50			
10/23/2001	2036	Winslow	0.75			
10/23/2001	2196	Winslow	1.00			
10/23/2001	2150	Rock City	1.50			

Date	Time (CST)	Location	Magnitude (in.)	Property Damage	Crop Damage	Notes
4/18/2002	1320	Pearl City	0.75			
4/18/2002	1711	Pearl City	1.00			
5/30/2002	1945	Cedarville	0.88			
7/31/2003	1745	Rock City	0.75	$15,000	$5,000	
8/01/2003	0125	Kent	0.75	$10,000	$10,000	
8/01/2003	0145	Eleroy	1.00	$20,000	$15,000	
8/01/2003	0148	Cedarville	0.75	$10,000	$10,000	
8/01/2003	0148	Freeport	1.50	$25,000	$20,000	
8/01/2003	0030	Pearl City	0.75	$10,000	$10,000	
8/01/2003	0044	Kent	0.75	$10,000	$10,000	
8/01/2003	0052	Kent	1.00	$20,000	$15,000	
5/22/2004	0345	Eleroy	0.88	$0	$5,000	
5/19/2005	1334	Lake Summerset	0.88	$0	$0	
4/13/2006	2029	Freeport	0.75	$0	$0	
4/16/2006	0622	Eleroy	1.00	$2,000	$0	
4/16/2006	0642	German Village	0.75	$0	$0	
4/16/2006	1055	Freeport	0.75	$0	$0	
5/29/2006	1215	Freeport	1.00	$0	$0	
8/25/2006	0151	Lena	0.75	$0	$1,000	
9/04/2006	1318	German Village	1.00	$1,000	$1,000	
TOTAL				**$123,000**	**$102,000**	

Source: National Climate Data Center: U.S. Storm Event Database

Table A5: Historical Occurrences of Tornadoes: 1958 – 2007

Date	Time	F-Scale	Location	Length (miles)	Width (yds)	Reported Damages	Notes
10/8/1958	2330	F2	Cedarville, Rock City, Davis	38	33	$2,500,000	Downed wires and trees, leveled corn fields, turned over house trailers
4/17/1959	1400	F1	Southwest Stephenson	2	3	$25,000	Tornado traveled about 2 mi. through southwest of County near Freeport, toppling a trailer and sheds and blowing a vehicle off the road, touched down first 6 miles southwest of Freeport, farm buildings damaged
8/27/1965							60+ streets closed. Power lines down. Some injuries (people at the County fair). Law enforcement came from Rockford. No fatalities
6/1/1971	1715	F1	Orangeville and Northeast Stephenson	u/k	u/k	$250,000	Tornado touched down south of Orangeville and impacted northeast part of County, leveling barns and silos and damaging homes, including removing a roof and an entire room, electrical outages reported
5/28/1998	1923	F0	Lena	0	0	$0	
5/28/1998	1946	F0	Eleroy	0	1	$1,000	Brief tornado damaged and uprooted trees.
8/24/1998	1130	F1	Pearl City	1	50	$80,000	Several barns damaged or lost, houses lost roofs, grain bin and silo damaged, livestock. A woman and a goat were injured by fallen tents at the fair.
6/1/1999	1750	F0	Florence	0	10	$0	Brief tornado touchdown
6/6/1999	1414	F0	Freeport	0	10	$0	Brief tornado touchdown
6/14/2003	1415	F0	German Valley	u/k	u/k	$1,000	Only crop damage reported
6/14/2003	1430	F0	Florence	1	50	$15,000	Dissipated near IL 26 & Park Rd, only crop damage reported
6/14/2003	1503	F0	German Valley	u/k	u/k	$1,000	Near Montague Rd. and Bunker Hill Rd.
TOTAL						**$2,873,000**	

Source: National Climatic Data Center: U.S. Storm Event Database

Table A6: Historical Occurrences of Severe Winter Storms: 1994 - 2007

Date	Time (CST)	Type	Estimated Damage	Notes
12/6/1994	1100	Winter Storm		
1/18/1995	1800	Heavy Snow		
11/10/1995	0400	Snow/sleet/freezing Rain		
11/27/1995	0400	Snow/sleet/freezing Rain		
1/18/1996	0430	Winter Storm		
1/26/1996	0400	Winter Storm		
11/14/1996	0600	Winter Storm		
12/27/1996	1800	Winter Storm		
1/9/1997	0400	Winter Storm		
1/15/1997	0400	Winter Storm		
1/24/1997	0400	Winter Storm		
2/3/1997	2000	Winter Storm		
12/24/1997	1100	Heavy Snow		
1/8/1998	1000	Winter Storm		
1/20/1998	2100	Winter Storm		
3/8/1998	1200	Heavy Snow		
12/6/1998	1500	Winter Storm		
12/30/1998	1700	Winter Storm		
1/1/1999	0517	Winter Storm		
3/5/1999	1500	Winter Storm		
3/8/1999	1600	Winter Storm		
12/19/1999	1500	Winter Storm		
12/23/1999	1400	Winter Storm		
1/3/2000	1300	Winter Storm		
1/17/2000	0800	Winter Storm		
1/19/2000	1000	Winter Storm		
1/29/2000	1500	Winter Storm		
2/13/2000	0400	Winter Storm		
2/17/2000	1900	Winter Storm		
4/7/2000	1200	Snow		
12/?/2000		Snow		All roads impacted by snowfall
12/1/2000	0200	Snow		
12/7/2000	0400	Snow/freezing Rain		
12/10/2000	2200	Winter Storm		
12/15/2000	1300	Ice Storm		
12/18/2000	0400	Snow/blowing Snow		
12/20/2000	0700	Snow		
12/23/2000	0100	Snow		
12/28/2000	1000	Snow		
1/13/2001	2100	Snow/freezing Rain		
1/26/2001	0200	Snow/blowing Snow		
1/28/2001	1000	Ice Storm		
2/7/2001	1500	Ice Storm		
2/14/2001	0500	Freezing Rain		
2/23/2001	2130	Winter Storm		
1/30/2002	0500	Winter Storm		

3/1/2002	1700	Winter Storm		
1/28/2003	1000	Winter Storm		
3/4/2003	1300	Winter Storm		
1/16/2004	1900	Winter Weather/mix	$15,000	Roads not as treacherous as during ice storm two weeks prior, Ice accumulations of one or two tenths of an inch were reported with the heaviest accumulation along the U.S. 20 corridor
1/5/2005	1800	Heavy Snow	$30,000	Average of 25 mph wind gusts blew drifts 2 feet high
1/22/2005	0500	Heavy Snow	$5,000	Nine inches of snow, U.S. 20 and IL 75 declared potentially hazardous, drifting problems on IL 75
12/8/2005	0300	Winter Weather/mix	0	
12/1/2006		Winter Storm		Heavy snow reported in Loran
1/2/06		Winter Storm		Heavy snow
2/15/2006	2100	Winter Weather	$10,000	
TOTAL			**$60,000**	
Source: National Climatic Data Center: U.S. Storm Event Database				

Table A7: Historical Occurrences of Extreme Temperatures: 1996 – 2007

Date	Time	Type	Reported Deaths	Reported Injuries	Notes
1/30/1996	2000	Extreme Cold	0	0	
2/1/1996	0000	Extreme Cold	0	0	
1/10/1997	0400	Extreme Wind chill	1	0	
1/17/1997	0400	Extreme Wind chill	0	0	
7/25/1997	0400	Excessive Heat	0	0	
7/19-31/1999	0400	Excessive Heat	1	1	Heat advisories and warnings were issued, heat indices of 105 to as high as 125 degrees
12/16/2000	1400	Extreme Wind chill	0	0	
12/21/2000	0400	Extreme Wind chill	0	0	
12/23/2000	2200	Extreme Wind chill	0	0	
TOTAL			**2**	**1**	
Source: National Climatic Data Center: U.S. Storm Event Database					

Table A8: Reported Extreme Temperature Illnesses and Injuries (FHN only) 1998 – 2007

Year	# Extreme Cold Injuries	# Extreme Heat Injuries	# Paid by Medicaid	# Paid by Medicare	# Paid by Other Payment
1998	1	0	1	0	0
1999	0	2	0	1	1
2000	5	0	0	4	1
2001	1	1	0	2	0
2002	1	1	0	1	1
2003	2	0	1	1	0
2004	1	0	0	1	0
2005	3	2	0	2	3
2006	1	0	0	1	0
2007	2	0	0	1	0
TOTAL	**17**	**6**	**2**	**14**	**6**
Source: FHN					

APPENDIX B: MITIGATION STRATEGIES PRIORITIZATION

Armed with a thorough understanding of benefits, drawbacks, and perceptions of each strategy based on input from the Committee, local governments, and the public, Vandewalle & Associates evaluated the benefits and drawbacks/costs of each strategy to develop a preliminary prioritization.

The following ten elements were considered when identifying the benefits and drawbacks of each strategy. Elements 3 through 10 are a part of a prioritization system developed by FEMA called STAPLEE (based on the first letter of each strategy, as highlighted below). Some communities have used a quantitative process to score each strategy for each of the STAPLEE criteria. In the case of Stephenson County, it was determined that a qualitative, holistic evaluation process would produce the most meaningful prioritization.

11. Ability to achieve one or more of the Stephenson County Hazard Mitigation Goals
12. Community support
13. Ability to be implemented (potential funding available)
14. **S**ocial impacts
15. **T**echnical feasibility
16. **A**dministrative requirements
17. **P**olitical support
18. **L**egality
19. **E**nvironmental impacts
20. **E**conomic impacts / costs of implementing

The following tables summarize the resulting prioritization of mitigation strategies based on benefits and costs/drawbacks. Mitigation strategies are separated into the following tiers:

- *Tier One Priority*: Includes highest priority strategies; begin implementation in Years 1 through 3, following adoption of this Plan.
- *Tier Two Priority*: Includes second-highest priority strategies; begin implementation in Years 1 through 5, generally after Tier One priorities are underway.
- *Tier Three Priority*: Includes strategies that are not currently identified as priorities, but are included for future consideration as the County moves forward with implementation of this Plan.

Table B1: Flood Mitigation Strategies Prioritization Matrix

Mitigation Strategy	Benefits	Drawbacks/Costs
Tier 1 Priority		
Pursue Regular Community Outreach and Education	▪ Can be used to help achieve all mitigation goals, particularly 1) protect human lives, 6) help people protect themselves, and 7) promote partnerships in mitigation ▪ Community-supported strategy ▪ Cost and time required to implement can be minimal ▪ Opportunities to partner with several organizations	▪ Cost of materials, programs, and staff time
Update Official Floodplain Maps	▪ Can be used to help achieve multiple mitigation goals, particularly 3) prevent future development from increasing hazard vulnerability ▪ Better knowledge of areas vulnerable to flooding ▪ Helps communities regulate building in floodplain ▪ Makes floodplain insurance an available option for new properties in floodplain ▪ Potential to remove properties from floodplain (and associated regulations) that are only currently in floodplain due to old maps ▪ ACE "Silver Jackets" program a potential funding source	▪ May meet resistance from property owners who do not want to be subject to floodplain regulations ▪ Cost of updating maps
Improved Planning and Regulatory Practices	▪ Can be used to help achieve multiple mitigation goals, particularly 3) prevent future development from increasing hazard vulnerability and 4) protect open space ▪ Funding sources available for planning activities ▪ Can be used as a tool to prevent future development or activities that increase flood vulnerability	▪ Can sometimes meet resistance to planning and regulation by the public ▪ Costs to develop plans or improve regulations ▪ Time and political commitment to regulation enforcement
Enhance Stormwater Management and Erosion Control	▪ Can be used to help achieve mitigation goals, particularly 1) protect human lives and 2) protect human and environmental health ▪ Improve stream's and storm sewer's capacity to carry water flow when obstructions removed ▪ Reduced threat to roadway damage and incidents from soil erosion ▪ Reduce erosion and threats to water quality from runoff ▪ Potential funding sources: HMGP, NRCS	▪ Cost of any new infrastructure needed ▪ Environmental cost, if any, of new stormwater projects ▪ Cost of maintaining existing infrastructure

Mitigation Strategy	Benefits	Drawbacks/Costs
	Agricultural Lands ▪ Improved ag land erosion control can be implemented through SWCD incentive program	
Advance an Initiative of Voluntary Acquisition of Structures and Relocation of People	▪ Can be used to help achieve multiple mitigation goals, particularly 1) protect human lives ▪ Gets residents permanently out of harm's way ▪ Eliminates risk to emergency responders who would otherwise evacuate people ▪ Opens the door to new housing alternatives ▪ Creates an opportunity to create open space amenities in the floodplain ▪ HMGP a potential funding source	▪ Potential to involve several implementation hurdles: overcoming public misperceptions of intent of the program; getting political and public buy-in ▪ Cost of acquisitions (minimal in the case of Freeport Pecatonica) Freeport Pecatonica ▪ Challenge in identifying new housing that residents can afford ▪ Challenge in identifying area for relocation that can help maintain cohesive community
Maintain River Gages	▪ Can be used to help achieve multiple mitigation goals, particularly 6) help people to protect themselves, and 7) promote partnerships in mitigation ▪ Provides critical information for emergency responders ▪ Provides information for tracking historic floods to project future flooding vulnerability	▪ Cost of agency's time to maintain gage
Promote Floodproofing of Buildings Where Appropriate and Cost-effective	▪ Can be used to help achieve mitigation goals 1) protect human lives, 4) protect open space, and 5) protect critical facilities ▪ Protects property from damage ▪ HMGP a potential funding source if cost feasible	▪ Still requires evacuation of people during major floods ▪ Cost of floodproofing can be high, depending on the technique (e.g. elevation)
Tier 2 Priority		
Protect Critical Facilities and Infrastruct-ure	▪ Can be used to help achieve multiple mitigation goals, particularly 5) protect critical facilities ▪ Can reduce/eliminate loss of productivity at businesses that lose access to the highway when roadways/bridges are flooded ▪ Protect community's ability to respond to disasters by protecting critical facilities used in disasters ▪ Reduce economic impacts from damages to critical facilities	▪ Cost of floodproofing or relocating facilities / infrastructure
Protect Water Quality (e.g. brownfield cleanup,	▪ Can be used to help achieve multiple mitigation goals, particularly 2) protect human and environmental health	▪ Cost of relocating facilities that contain hazardous materials out of flood hazard area, or cost of floodproofing hazardous

Mitigation Strategy	Benefits	Drawbacks/Costs
hazardous spill prevention, & erosion control)	▪ EPA a potential funding source for brownfield cleanup	material storage areas, or cost of cleaning up contaminated sites ▪ Cost of maintaining sanitary sewer infrastructure ▪ Cost of protecting potable water infrastructure, wells
Increase Access to Flood Insurance	▪ Reduce amount property owners have to spend personally to recover from flood damages ▪ Identify repetitive loss properties once a property has been enrolled and experiences 2+ losses within 10 years ▪ Can reduce cost of insurance through community's participation in FEMA's Community Rating System	▪ Does not directly achieve any priority mitigation goals ▪ Personal costs of insurance ▪ Staff time to report on activities to FEMA's Community Rating System program to reduce insurance rates ▪ Staff time to educate residents about benefit of flood insurance, host open houses with insurance providers
Promote and Implement Modern Hazard Warning Systems	▪ Can be used to help achieve multiple mitigation goals, particularly 6) help people to protect themselves ▪ Reduces resources to be expended by emergency responders if people get out of harm's way themselves ▪ Grant programs available for NOAA radios (but not HMGP)	▪ Cost of warning equipment, programs ▪ Staff time to educate people about use of hazard warning systems
Tier 3 Priority		
Improve Coordination and Communication Among Emergency Responders	▪ Can be used to help achieve multiple mitigation goals, particularly 7) promote partnerships in mitigation ▪ Maximize use of limited resources by working together and improving efficiency ▪ Potential funding sources available (but not HMGP)	▪ Cost of improving/updating communication systems ▪ Time investment to improve coordination
Develop Emergency Water and Power Sources	▪ Can be used to help achieve mitigation goal 2) protect human and environmental health	▪ Cost of providing emergency water and power ▪ Has not been a critical need to date ▪ Less of a long-term solution than protecting existing water and power infrastructure from flooding damages
Monitor Vulnerable Populations	▪ Can be used to help achieve mitigation goal 2) protect human and environmental health ▪ Helps to prioritize emergency response actions	▪ Staff time to maintain and update list
Construct Structural Flood Control Projects	▪ Can be used to help achieve mitigation goal 5) protect critical facilities ▪ Reduces threats to people and property from flooding	▪ Not likely to be grant funded ▪ Can exacerbate flooding in other areas ▪ Not a long-term solution ▪ Cost of maintenance, repair ▪ Environmental costs; risks to habitat

Table B2: Severe Storm, Tornado, and Winter Storm Mitigation Strategies Prioritization Matrix

Mitigation Strategy	Benefits	Drawbacks/Costs
Tier 1 Priority		
Pursue Regular Community Outreach and Education	▪ Can be used to help achieve all mitigation goals, particularly 1) protect human lives, 6) help people protect themselves, and 7) promote partnerships in mitigation ▪ Community-supported strategy ▪ Cost and time required to implement can be minimal ▪ Opportunities to partner with several organizations	▪ Cost of materials, programs, and staff time
Promote and Implement Modern Hazard Warning Systems	▪ Can be used to help achieve multiple mitigation goals, particularly 6) help people to protect themselves ▪ Reduces resources to be expended by emergency responders if people get out of harm's way themselves ▪ Grant programs available for NOAA radios (but not HMGP)	▪ Cost of warning equipment, programs ▪ Staff time to educate people about use of hazard warning systems
Promote Active Tree Management	▪ Can be used to help achieve multiple mitigation goals, particularly 1) protect human lives, 5) protect critical facilities, and 6) help people to protect themselves ▪ Community and politically-supportable strategy ▪ Technically and financially feasible ▪ Potentially fundable through HMGP if protecting utilities	▪ Personnel time to implement ▪ Cost of materials and personnel time to educate property owners on tree management techniques and benefits
Identify Or Construct Saferooms	▪ Can be used to help achieve multiple mitigation goals, particularly 1) protect human lives and 6) help people to protect themselves ▪ Greatly reduces risk of injury/death of people in structures that are not hazard-resistant; in the case of mobile homes, reduces risk to lower income groups. ▪ Community and politically-supportable strategy ▪ Technically and financially feasible ▪ Construction fundable through HMGP	▪ Cost of constructing saferooms ▪ Cost of materials and personnel time to educate property owners on saferoom identification/construction techniques and benefits
Protect Critical Facilities and Infrastructure	▪ Can be used to help achieve multiple mitigation goals, particularly 5) protect critical facilities ▪ Can reduce/eliminate loss of productivity at businesses that lose access to the highway when roadways/bridges are blocked with storm debris ▪ Protect community's ability to respond	▪ Cost of structural retrofitting materials/labor ▪ Cost of materials and personnel time to educate critical facilities operators of structural retrofitting techniques and benefits ▪ Cost of bracing/undergrounding utilities

Mitigation Strategy	Benefits	Drawbacks/Costs
	to disasters by protecting critical facilities used in disasters ▪ Reduce economic impacts from damages to critical facilities and infrastructure ▪ Reduce risk to safety and property of damaged aboveground utility lines/poles	
Tier 2 Priority		
Improve Planning and Regulatory Practices	▪ Can be used to help achieve multiple mitigation goals, particularly 3) prevent future development from increasing hazard vulnerability ▪ Funding sources available for planning activities ▪ Can be used as a tool to improve hazard-resistance of new development	▪ Can sometimes meet resistance to planning and regulation by the public ▪ Costs to develop plans or improve regulations ▪ Time and political commitment to regulation enforcement
Improve Coordination and Communication Among Emergency Responders	▪ Can be used to help achieve multiple mitigation goals, particularly 7) promote partnerships in mitigation ▪ Maximize use of limited resources by working together and improving efficiency ▪ Potential funding sources available (but not HMGP)	▪ Cost of improving/updating communication systems ▪ Time investment to improve coordination
Tier 3 Priority		
Conduct Structural Retrofitting of Non-Critical Facilities	▪ Can be used to help achieve multiple mitigation goals, particularly 1) protect human lives and 6) help people to protect themselves ▪ Can be implemented as part of routine building maintenance ▪ Reduces likelihood of damages to structures and personal property ▪ Community and politically-supportable strategy ▪ Technically and financially feasible ▪ Fundable through HMGP	▪ Cost of retrofitting materials/labor ▪ Reduces, but does not eliminate risk to certain structures including mobile homes and industrial buildings ▪ Cost of materials and personnel time to educate property owners on structural retrofitting techniques and benefits
Improve Hazard Threat Recognition (e.g. recruit additional storm spotters)	▪ Can be used to help achieve multiple mitigation goals, particularly 6) help people to protect themselves, and 7) promote partnerships in mitigation ▪ Provides critical information for emergency responders	▪ Cost personnel time and materials for storm spotter training/recruitment ▪ Need for additional storm spotters not currently imminent
Monitor Vulnerable Populations	▪ Can be used to help achieve mitigation goal 2) protect human and environmental health ▪ Helps to prioritize emergency response actions	▪ Staff time to maintain and update list
Increase Use of Crop Insurance	▪ Can be used to help achieve mitigation goal 6) help people to protect themselves	▪ Personal costs of insurance ▪ Personnel time to educate farm owners

Mitigation Strategy	Benefits	Drawbacks/Costs
	▪ Reduce amount farm owners have to spend personally to recover from storm damages	about benefit of crop insurance ▪ Local efforts may not greatly improve upon state and federal efforts to increase use of crop insurance
Develop Emergency Water and Power sources	▪ Can be used to help achieve mitigation goal 2) protect human and environmental health	▪ Cost of providing emergency water and power ▪ Has not been a critical need to date ▪ Less of a long-term solution than protecting existing water and power infrastructure from storm damages
Advance an Initiative of Voluntary Acquisition of Structures and Relocation of People	▪ Can be used to help achieve mitigation goal 1) protect human lives	▪ Potential to involve several implementation hurdles: overcoming public misperceptions of intent of the program; getting political and public buy-in ▪ Cost of acquisitions ▪ Not likely to be funded by outside sources ▪ Impractical to implement as risk of storm damage is a county-wide threat

Table B3: Drought Mitigation Strategies Prioritization Matrix

Mitigation Strategy	Benefits	Drawbacks/Costs
Tier 1 Priority		
Pursue Regular Community Outreach and Education	▪ Can be used to help achieve all mitigation goals, particularly 6) help people protect themselves ▪ Community-supported strategy ▪ Cost and time required to implement can be minimal ▪ Opportunities to partner with several organizations	▪ Cost of materials, programs, and staff time
Promote Use of Best Management Practices for Yards and Agriculture	▪ Can be used to help achieve mitigation goal 4) Preserve open space including agriculturally productive areas and 6) help people to protect themselves ▪ Offers a more sustainable approach to drought mitigation	▪ Personnel time to educate and encourage farmers and property owners to adopt BMPs.
Tier 2 Priority		
Improve Planning and Regulatory Practices	▪ Can be used to help achieve multiple mitigation goals, particularly 2) protect human and environmental health ▪ Funding sources available for planning activities ▪ Offers a more sustainable approach to drought mitigation	▪ Can sometimes meet resistance to planning and regulation by the public ▪ Costs to develop plans or improve regulations ▪ Time and political commitment to regulation enforcement
Tier 3 Priority		
Increase Use of Crop Insurance	▪ Can be used to help achieve mitigation goal 4) Preserve open space including agriculturally productive areas and 6) help people to protect themselves ▪ Reduce amount farm owners have to spend personally to recover from drought	▪ Personal costs of insurance ▪ Personnel time to educate farm owners about benefit of crop insurance ▪ Local efforts may not greatly improve upon state and federal efforts to increase use of crop insurance
Promote and Implement Modern Hazard Warning Systems	▪ Can be used to help achieve multiple mitigation goals, particularly 6) help people to protect themselves ▪ Grant programs available for NOAA radios (but not HMGP)	▪ Cost of warning equipment, programs ▪ Staff time to educate people about use of hazard warning systems
Improve Hazard Threat Recognition	▪ Can be used to help achieve multiple mitigation goals, particularly 6) help people to protect themselves ▪ Improves ability to implement mitigation actions in a timely manner, such as water conservation	▪ Personnel time to improve monitoring of drought forecasts and monitor local groundwater resources
Develop Emergency Water Sources	▪ Can be used to help achieve mitigation goal 2) protect human and environmental health	▪ Cost of providing emergency water sources ▪ Has not been a critical need to date ▪ Less of a long-term solution than water conservation methods

Table B4: Extreme Temperatures Mitigation Strategies Prioritization Matrix

Mitigation Strategy	Benefits	Drawbacks/Costs
Tier 1 Priority		
Pursue Regular Community Outreach and Education	▪ Can be used to help achieve all mitigation goals, particularly 1) protect human lives, 6) help people protect themselves, and 7) promote partnerships in mitigation ▪ Community-supported strategy ▪ Cost and time required to implement can be minimal ▪ Opportunities to partner with several organizations	▪ Cost of materials, programs, and staff time
Promote And Improve Use Of Cooling Centers (Possibly Similar Spaces As Saferooms)	▪ Can be used to help achieve multiple mitigation goals, particularly 1) protect human lives and 6) help people to protect themselves ▪ Greatly reduces risk of illness/death of vulnerable populations. ▪ Community and politically-supportable strategy ▪ Technically and financially feasible	▪ Cost of materials and personnel time to educate property owners on locations and hours of cooling centers
Tier 2 Priority		
Monitor Locations of Vulnerable Populations and Improve Access to Adequate Heating/Cooling	▪ Can be used to help achieve mitigation goal 2) protect human and environmental health ▪ Helps to prioritize emergency response actions ▪ Extreme temperatures are one of the greatest risks particularly to low-income and elderly and therefore monitoring those populations' access to adequate heating and cooling can have significant impact	▪ Staff time to monitor and educate vulnerable populations ▪ Cost to subsidize heating/cooling for vulnerable populations
Promote Home Weatherization	▪ Can be used to help achieve mitigation goal 2) protect human and environmental health and 6) help people protect themselves ▪ Community and politically-supportable strategy ▪ Technically and financially feasible	▪ Existing, effective NICAA program in place—may not need to be greatly improved upon in near-term ▪ Staff time/materials needed to strengthen home weatherization program
Tier 3 Priority		
Promote and Implement Modern Hazard Warning Systems	▪ Can be used to help achieve multiple mitigation goals, particularly 6) help people to protect themselves ▪ Reduces resources to be expended by emergency responders if people get out of harm's way themselves ▪ Grant programs available for NOAA radios (but not HMGP)	▪ Cost of warning equipment, programs ▪ Staff time to educate people about use of hazard warning systems

Mitigation Strategy	Benefits	Drawbacks/Costs
Improve Coordination and Communication Among Emergency Responders	▪ Can be used to help achieve multiple mitigation goals, particularly 7) promote partnerships in mitigation ▪ Maximize use of limited resources by working together and improving efficiency ▪ Potential funding sources available (but not HMGP)	▪ Cost of improving/updating communication systems ▪ Time investment to improve coordination
Increase Use of Crop Insurance	▪ Can be used to help achieve mitigation goal 6) help people to protect themselves ▪ Reduce amount farm owners have to spend personally to recover from damages from extreme temperatures	▪ Personal costs of insurance ▪ Personnel time to educate farm owners about benefit of crop insurance ▪ Local efforts may not greatly improve upon state and federal efforts to increase use of crop insurance

Table B5: Earthquake Mitigation Strategies Prioritization Matrix

Mitigation Strategy	Benefits	Drawbacks/Costs
Tier 1 Priority		
Promote and Implement Modern Hazard Warning Systems	▪ Can be used to help achieve multiple mitigation goals, particularly 6) help people to protect themselves ▪ Reduces resources to be expended by emergency responders if people get out of harm's way themselves ▪ Grant programs available for NOAA radios (but not HMGP)	▪ Cost of warning equipment, programs ▪ Staff time to educate people about use of hazard warning systems
Tier 2 Priority		
Pursue Regular Community Outreach and Education	▪ Can be used to help achieve all mitigation goals, particularly 1) protect human lives, 6) help people protect themselves, and 7) promote partnerships in mitigation ▪ Community-supported strategy ▪ Cost and time required to implement can be minimal ▪ Opportunities to partner with several organizations	▪ Cost of materials, programs, and staff time
Protect Critical Facilities And Infrastructure	▪ Can be used to help achieve multiple mitigation goals, particularly 5) protect critical facilities ▪ Can reduce/eliminate loss of productivity at businesses that lose access to the highway when roadways/bridges are blocked with storm debris ▪ Protect community's ability to respond to disasters by protecting critical facilities used in disasters ▪ Reduce economic impacts from damages to critical facilities and infrastructure ▪ Reduce risk to safety and property of damaged aboveground utility lines/poles	▪ Cost of structural retrofitting materials/labor ▪ Cost of materials and personnel time to educate critical facilities operators of structural retrofitting techniques and benefits ▪ Cost of bracing/undergrounding utilities
Tier 3 Priority		
Promote Structural Retrofitting and Property Protection of Non-Critical Facilities	▪ Can be used to help achieve multiple mitigation goals, particularly 1) protect human lives, 5) protect critical facilities, and 6) help people to protect themselves ▪ Can be implemented as part of routine building maintenance ▪ Reduces likelihood of damages to structures and personal property ▪ Community and politically-supportable strategy ▪ Technically and financially feasible ▪ HMGP fundable	▪ Cost of retrofitting materials/labor ▪ Reduces, but does not eliminate risk to certain structures including mobile homes and industrial buildings ▪ Cost of materials and personnel time to educate property owners on structural retrofitting techniques and benefits

Mitigation Strategy	Benefits	Drawbacks/Costs
Improve Planning and Regulatory Practices	▪ Can be used to help achieve multiple mitigation goals, particularly 3) prevent future development from increasing hazard vulnerability ▪ Funding sources available for planning activities ▪ Can be used as a tool to improve hazard-resistance of new development	▪ Can sometimes meet resistance to planning and regulation by the public ▪ Costs to develop plans or improve regulations ▪ Time and political commitment to regulation enforcement
Improve Coordination and Communication among Emergency Responders	▪ Can be used to help achieve multiple mitigation goals, particularly 7) promote partnerships in mitigation ▪ Maximize use of limited resources by working together and improving efficiency ▪ Potential funding sources available (but not HMGP)	▪ Cost of improving/updating communication systems ▪ Time investment to improve coordination
Improve Hazard Threat Recognition	▪ Can be used to help achieve multiple mitigation goals, particularly 6) help people to protect themselves, and 7) promote partnerships in mitigation ▪ Provides critical information for emergency responders	▪ Cost personnel time and materials for storm spotter training/recruitment ▪ May not have as great an impact as other strategies as the County currently has good connection with state emergency management communication
Monitor Vulnerable Populations	▪ Can be used to help achieve mitigation goal 2) protect human and environmental health ▪ Helps to prioritize emergency response actions	▪ Staff time to maintain and update list
Develop Emergency Water and Power Sources	▪ Can be used to help achieve mitigation goal 2) protect human and environmental health	▪ Cost of providing emergency water and power ▪ Has not been a critical need to date ▪ Less of a long-term solution than protecting existing water and power infrastructure from storm damages

Table B6: Human-Caused and Disease Outbreak Mitigation Strategies Prioritization Matrix

Mitigation Strategy	Benefits	Drawbacks/Costs
Tier 1 Priority		
Improve Coordination and Communication Among Emergency Responders	▪ Can be used to help achieve multiple mitigation goals, particularly 7) promote partnerships in mitigation ▪ Maximize use of limited resources by working together and improving efficiency ▪ Potential funding sources available (but not HMGP)	▪ Cost of improving/updating communication systems ▪ Time investment to improve coordination
Pursue Regular Community Outreach and Education	▪ Can be used to help achieve all mitigation goals, particularly 1) protect human lives, 6) help people protect themselves, and 7) promote partnerships in mitigation ▪ Community-supported strategy ▪ Cost and time required to implement can be minimal ▪ Opportunities to partner with several organizations	▪ Cost of materials, programs, and staff time
Promote and Implement Modern Hazard Warning Systems	▪ Can be used to help achieve multiple mitigation goals, particularly 6) help people to protect themselves ▪ Reduces resources to be expended by emergency responders if people get out of harm's way themselves ▪ Grant programs available for NOAA radios (but not HMGP)	▪ Cost of warning equipment, programs ▪ Staff time to educate people about use of hazard warning systems
Tier 2 Priority		
Identify and Address Infrastructure Hazard Vulnerability	▪ Can be used to help achieve multiple mitigation goals, particularly 5) protect critical facilities ▪ Protect community's ability to respond to disasters by protecting critical facilities used in disasters ▪ Reduce economic impacts from damages to critical facilities and infrastructure ▪ Reduce risk to safety and property of damaged aboveground utility lines/poles	▪ Cost of structural retrofitting materials/labor ▪ Cost of materials and personnel time to educate critical facilities operators of structural retrofitting techniques and benefits