McHenry County Natural Hazards Mitigation Plan

McHenry County Hazard Mitigation Planning Committee

December 2010

Planning Assistance Provided By:

Molly O'Toole & Associates, Ltd.
engineers + consultants

McHenry County, Illinois
Natural Hazards Mitigation Plan

McHenry County
Village of Algonquin
Village of Bull Valley
Village of Cary
City of Crystal Lake
Village of Fox River Grove
Village of Greenwood
City of Harvard
Village of Hebron
Village of Holiday Hills
Village of Huntley
Village of Johnsburg
Village of Lake in the Hills
Village of Lakewood
Village of McCullom Lake
Village of City of McHenry
City of Marengo
Village of Oakwood Hills
Village of Prairie Grove
Village of Richmond
Village of Ringwood
Village of Spring Grove
Village of Trout Valley
Village of Union
Village of Wonder Lake
City of Woodstock

Alden Township
Algonquin Township
Burton Township
Chemung Township
Coral Township
Dorr Township
Dunham Township
Grafton Township
Greenwood Township
Hartland Township
Hebron Township
Marengo Township
McHenry Township
McHenry Township Road District
McHenry Township Fire Protection District
Nunda Township
Richmond Township
Riley Township
Seneca Township
Woodstock Fire Rescue

McHenry County
Hazard Mitigation Planning Committee

December 2010

This *Natural Hazards Mitigation Plan* was prepared with the plan development and technical support of Molly O'Toole & Associates, Ltd., 450 S. Stewart Avenue, Lombard, IL 60148, www.mollyotoole.com, and technical support of Johnson, Depp & Quisenberry, 6450 S. 6th Street, Suite B, Springfield, IL 62712, www.jdq-engineers.com.

McHenry County
Natural Hazards Mitigation Plan

December 2010

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Executive Summary

Overview

The *McHenry County Natural Hazards Mitigation Plan* (Plan) identifies activities that can be undertaken by both the public and the private sectors to reduce safety hazards, health hazards, and property damage caused by natural hazards. The Plan focuses on the identified major natural hazards facing McHenry County: floods, severe summer and winter storms, tornadoes, extreme cold and heat events, and drought. The most recent natural disasters in McHenry County, Illinois, that received federal disaster declarations were winter storms in 1999 and 2001, and flooding in 1986 and 1993. These disasters impacted people, property owners and businesses in the County.

The development and adoption of a natural hazard mitigation plan allow communities to be eligible for Federal Emergency Management Agency (FEMA) hazard mitigation grants program funds. This Plan fulfills the federal mitigation planning requirements for FEMA's Pre-Disaster Mitigation Program, Hazard Mitigation Grant Program and Flood Mitigation Assistance Program, and is eligible for credit under the FEMA National Flood Insurance Program's Community Rating System. Hazard mitigation grant funds are made available by the FEMA through the Illinois Emergency Management Agency (IEMA).

This Plan was prepared by the McHenry County Natural Hazards Mitigation Committee, created by a resolution of the McHenry County Board on November 18, 2008. The Mitigation Committee's members include representatives of County offices, interested municipalities, townships, and agencies.

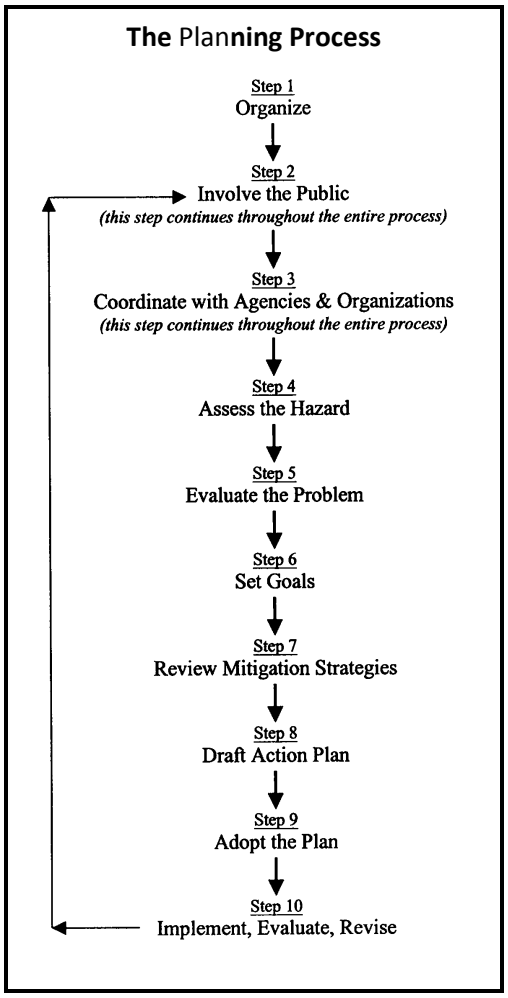
McHenry County and the natural hazards that can impact the County have been assessed in Chapters 1 and 2. Goals and guidelines established by the Mitigation Committee are the focus of Chapter 3. Six mitigation strategies are the subjects of Chapters 4 through 9:

- Preventive
- Property protection
- Structural projects
- Resource Protection
- Emergency services
- Public information

These mitigation strategies were examined to identify current mitigation efforts being implemented throughout the County, to identify additional efforts that can be undertaken, and to make recommendations for future actions. Chapter 10 presents the Action Plan for implementation of this Plan. The Action Plan contains specific action items taken from the Plan's numerous recommendations. The Action Plan also includes items for plan maintenance.

Introduction

McHenry County is located 35 miles northwest of downtown Chicago in northeastern Illinois. The County Seat is Woodstock, Illinois. Political jurisdictions include 17 townships and 30 municipalities. McHenry County has a land area of approximately 611 square miles which makes it the 34th largest county in Illinois. In 2000, McHenry County had a population of 260,077, the sixth most populated county in Illinois. McHenry County has had the highest growth rate of the Chicago metropolitan area counties in northeastern Illinois, or 3.4 percent a year. By 2030, the County population is expected to increase by nearly 73 percent. The 2000 Census estimated that there are approximately 92,908 housing units in McHenry County. The labor force is about 140,203 people.



Over 60 percent of the County is currently in agricultural land use. Though residential, commercial and other development areas are expected to grow, much of the agricultural land conversion is expected to go towards environmentally sensitive areas and open space. As McHenry County grows, more and more people will be vulnerable to natural hazards. Both the consideration of the expected change in land use, as described in the McHenry County 2030 Comprehensive Plan, and population growth were considered throughout the development of this Plan.

The Hazard Mitigation Committee followed a 10-step planning process, based on guidance and requirements of the FEMA. The Mitigation

Committee met six times from November 2009 to May 2010. The Mitigation Committee reviewed the hazards and their effects on people and property, considered a variety of ways to reduce and prevent damage, and recommended the most appropriate and feasible measures for implementation. During the development of this Plan, McHenry County critical facilities were categorized and mapped by the McHenry County GIS department. With the assistance of Mitigation Committee members, over 1,400 critical facilities were identified. Existing plans and programs were reviewed during the planning process. It should be underscored that this Plan does not replace other planning efforts, such as community comprehensive plans, the McHenry County Comprehensive Stormwater Management Plan, or the McHenry County Water Resources Protection Action Plan. This Mitigation Plan complements those efforts.

The public was invited to participate through several concurrent means, including the Mitigation Committee meetings, contact with Mitigation Committee members and their organizations, press releases, newsletter articles, and the McHenry County website. A public meeting was held on May 26, 2010 at the McHenry County Administration Building in Woodstock.

Natural Hazard Risk Assessment

The Mitigation Committee reviewed all potential natural hazards that could impact McHenry County, and evaluated them based on what causes them, their likelihood of occurring, and their impact on people, property, critical facilities, and the local economy. The information was based on available technical studies and reports by the participating agencies and communities on their past experiences. The table below shows the natural hazards that are the focus of this Plan and provides a summary of the hazards' potential impact on McHenry County's health and safety, total assets, and economy from the risk assessment.

Summary of Impact on Natural Hazards

Hazard	Impact on Health and Safety	Impact on Buildings	Impact on Critical Facilities	Economic Impact
Tornado	High	High	Moderate	Moderate
Floods	Moderate	High	Moderate	High
Severe Winter Storms & Extreme Cold	Moderate	Moderate	Moderate	Low
Severe Summer Storms	Moderate	Moderate	Moderate	Low
Extreme Heat	High	Low	Low	Low
Drought/Groundwater	High	Moderate	Low	Moderate

Hazard Mitigation Goals and Guidelines

The Mitigation Committee established the following hazard mitigation goals for the planning process:

Goal 1. Protect the lives, health, and safety of the people of McHenry County from the impact and effects of natural hazards.
Goal 2. Protect public services, utilities and critical facilities from potential damage from natural hazard events.
Goal 3. Protect historic, cultural, and natural resources from the effects of natural hazards.
Goal 4. Ensure that new developments do not create new exposures to damage from natural hazards.
Goal 5. Mitigate to protect against economic and transportation losses due to natural hazards.
Goal 6. Identify specific projects to protect lives and mitigate damage where cost-effective and affordable.

The Mitigation Committee established the following guidelines for accomplishing the mitigation goals:

Guideline 1. Focus natural hazards mitigation efforts on floods, severe summer and winter storms, tornadoes, extreme cold and heat events, and drought.
Guideline 2. Make people aware of the hazards they face and focus mitigation efforts on measures that allow property owners and service providers to help themselves.
Guideline 3. Seek state and federal support for mitigation efforts.
Guideline 4. Use available local funds, when necessary, to protect the public services, critical facilities, lives, health, and safety from natural hazards.
Guideline 5. Examine equitable approaches for the local cost of mitigation, such as user fees.
Guideline 6. Create and foster public-private partnerships to accomplish mitigation activities.
Guideline 7. Strive to improve and expand business, transportation and education opportunities in McHenry County in conjunction with planned mitigation efforts.

Hazard Mitigation Strategies

The Mitigation Committee reviewed current preventive mitigation measures being implemented by the County and municipalities. Preventive measures include activities such as building codes and the enforcement of the McHenry County Stormwater Ordinance. Preventive measures protect new construction, property and natural resources from hazards and see that future development does not increase potential losses. McHenry County is very strong in preventive measures.

Property protection mitigation measures are used to modify buildings or property subject to existing damage. Most measures are implemented by the property owners, so appropriate government activities include public information, technical assistance and financial support. The Mitigation Committee agreed that special attention should be given to floodplain areas and designated repetitively flooded areas. Emphasis has also been placed on critical facilities; understanding their vulnerability to hazards.

The Mitigation Committee concluded that structural mitigation projects, such as the detention basins constructed through the McHenry County stormwater program, are important, but that comprehensive watershed planning in needed. The Mitigation Committee also recommended each community establish a formal and regular program of drainage system maintenance.

The Mitigation Committee called for a better understanding of flood and other hazards to improve emergency management – preparedness, response and recovery. The Mitigation Committee recommended additional stream gaging for flood warning, and critical facility protection for all hazards.

The Mitigation Committee identified numerous subject areas that would benefit from a coordinated public information program, including safety during hazard events, property protection, understanding floods, and protecting our watersheds and water quality. The Mitigation Committee recommended that a common set of public information materials be developed for use throughout McHenry County communities.

Mitigation Action Plan

All mitigation activity recommendations from Chapters 4 through 9 were reviewed and the Mitigation Committee created an “Action Plan” that specifies recommended activities and initiatives to be implemented over the next five years. It is understood that implementation

is contingent on the availability of resources (staff and funding). The Action Plan identifies who is responsible for implementing the action items, and when they are to be done. The Action Plan is included in Chapter 10 of this *Natural Hazards Mitigation Plan*. A table summarizing the action items and the responsible agencies is presented on page ES-8.

There are 23 action items. The first three action items are administrative, but very important for the continued success of hazard mitigation in McHenry County. These items call for the formal adoption of this Plan, the conversion of the Mitigation Committee to a permanent advisory body, and plan maintenance procedures. Formal adoption is a requirement for recognition of the Plan by mitigation funding programs. The Mitigation Committee will provide the mechanism and a vehicle for the Plan to be implemented, monitored, evaluated and updated. The Mitigation Committee will also provide a means for continued public involvement. The Mitigation Committee will report to the County Board and municipal councils and boards, annually, and a five year update to the Plan is required for FEMA's mitigation funding programs.

Twenty of the action items are mitigation program items. Many are ongoing activities of stormwater management and emergency management offices and agencies. The last two action items are public information activities. These items are aimed directly at better helping people be aware of the hazards that they face.

Plan Adoption

This Plan serves to recommend mitigation measures for McHenry County. Adoption of this Plan by the McHenry County Board and the participating communities initiates the implementation of these recommendations. Adoption is also a requirement for recognition of the Plan by mitigation funding programs.

The adoption of this *McHenry County Natural Hazards Mitigation Plan* will be done by resolution of the County Board, the city councils, and boards of trustees of each participating municipality, township and agency. The County's resolution creates the permanent Mitigation Committee. The municipal resolutions will adopt each action item that is pertinent to the community and assigns a person responsible for it. With adoption, the County and each municipality, township or agency are individually eligible to apply for FEMA mitigation grant funding.

Summary

This Plan was developed by the McHenry Natural Hazard Mitigation Committee as a multi-jurisdictional plan to meet federal mitigation planning requirements. The Plan examines natural hazards facing McHenry County, establishes mitigation goals, evaluates existing mitigation activities throughout the County, and recommends additional mitigation steps that are appropriate to protect people, property and other assets of McHenry County. This Plan provides the County, its municipalities and townships, and other participating agencies and institutions with direction for enhancing current mitigation efforts. This Plan will be was adopted by resolution by the County and each participating municipality, township and agency, as appropriate to each jurisdiction. This Plan will be implemented and maintained through both countywide and individual initiatives, as funding and resources become available.

McHenry County Natural Hazard Mitigation Plan Action Items, Responsible Agencies and Deadlines

	Admin. Action Items			Mitigation Program Action Items																			
Responsible Agency	1. Plan Adoption	2. Continuation of Mitigation Committee	3. Plan Monitoring and Maintenance	4. Watershed Studies	5. Stream Gaging Network	6. Stream Maintenance Programs	7. Prohibited Waterway Dumping	8. Mitigation of Public Infrastructure	9. Continued NFIP Compliance	10. Repetitive Loss Areas Study	11. Identification of Floodplain Structures:	12. Investigation of Critical Facilities	13. Critical Facilities Design with Natural Hazards Protection	14. Mitigation of Floodplain Properties	15. Safe Rooms	16. Community Rating System Participation	17. Participation in Tree City USA	18. Participation in StormReady	19. Strengthen Building Codes and Code Enforcement Training	20. Seek Mitigation Grant Funding	21. Implementation of the Water Resources Protection Action Plan	22. Development of a Public Information Strategy	23. Property Protection References
Hazard Mitigation Committee		X	X																			X	X
McHenry County																							
County Board	X	X	X																		X		
Administrator		X	X																	X			
EMA		X	X		X			X				X	X		X	X		X		X			
Planning & Development		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X
Stormwater		X	X	X	X			X	X	X	X	X	X	X							X		
Transportation		X	X			X		X															
GIS		X	X								X	X											
Health		X	X																				
Water Resources		X	X																				
Municipalities																							
City Council/Village Board	X																			X	X		
Emergency Management		X	X					X				X			X					X		X	X
Designated department(s)		X	X			X	X	X	X					X	X	X	X		X	X	X		
Townships																							
Township Office	X	X	X					X				X			X					X		X	X
Road District		X	X			X		X				X								X			
Fire District		X	X					X				X								X			
Other Agencies												X	X	X	X								
Deadline (months)	6	On	On	36	12	36	36	As	On	24	36	24	On	On	36	On	24	24	24	As	On	12	12

On = Ongoing As = As Available or Needed (x) Can be recommended

Chapter 1. Introduction

McHenry County is subject to natural hazards. Floods, storms and tornadoes have threatened life and health, and have caused extensive property damage. Floods have caused flooding of streets, structures, basements and farm fields, including the recent August 2007 and September 2008 flood events. Blizzards and snowstorms have impacted the County with the most severe winter storms occurring in 1967, 1979, 1981, 1982, 1999, 2000 and 2006. Fourteen tornadoes have been verified between 1950 and 2000 that have resulted in over $30 million in property damages.

McHenry County has taken a number of steps to address natural hazards and to protect natural resources. For example, recognizing the impact of flood damage on existing and future development, the County implements a countywide stormwater management program. To protect the groundwater aquifers, the County developed the Water Resource Protection Action Plan. To further address the potential impact of all natural hazards and to identify mitigation opportunities, McHenry County, the participating municipalities, agencies and institutions have developed this *McHenry County Natural Hazards Mitigation Plan* (Plan).

"Hazard mitigation" does not mean that natural hazards are stopped or prevented. It does not suggest complete elimination of the damage or disruption caused by such incidents. Natural forces are powerful and most natural hazards are well beyond our ability to control. Natural hazards can be compounded by manmade hazards and vice versa. Hazard mitigation does not mean quick fixes. Hazard mitigation means a long-term approach to reduce hazard vulnerability. Hazard mitigation also means a comprehensive approach to minimizing the impact of hazards.

> *"Hazard mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event."*
> Source: Federal Emergency Management Agency

This chapter explains that purpose of the Plan, how the Plan was developed, an overview of McHenry County's features and assets, and a summary of critical facilities throughout the County.

1.1 Purpose of This Plan

Every community must address natural hazards. Every community has different resources and interests relating to natural hazards. There are many ways to deal with hazards, there are many agencies that can help, and there are many solutions for managing or mitigating hazards.

Hazard mitigation planning is for the purpose of assesses hazards and resources in order to produce a program of activities that will best mitigate the impact of hazards. Well-prepared hazard mitigation plans ensure that all possible mitigation activities are reviewed and moved towards implemented so that the natural hazard-related problems are managed by the most appropriate and efficient solutions. Mitigation plans should also ensure that mitigation activities are coordinated, compliment other community planning efforts, and foster other community objectives, where possible.

The development and adoption of a natural hazards mitigation plan is a requirement for federal mitigation funds for hazard mitigation projects. Section 104 of the Disaster Mitigation Act of 2000 (42 USC 5165) states that local governments applying for *pre*-disaster mitigation funds must have an approved local mitigation plan. Also, a plan is needed for *post*-disaster mitigation funds under the Hazard Mitigation Grant Program. These requirements are contained in 44 CFR (Code of Federal Regulations) Part 201. Hazard mitigation plans are also recognized as "floodplain management plans" in the National Flood Insurance Program's Community Rating System (CRS). CRS is a program that reduces flood insurance premiums in participating communities.

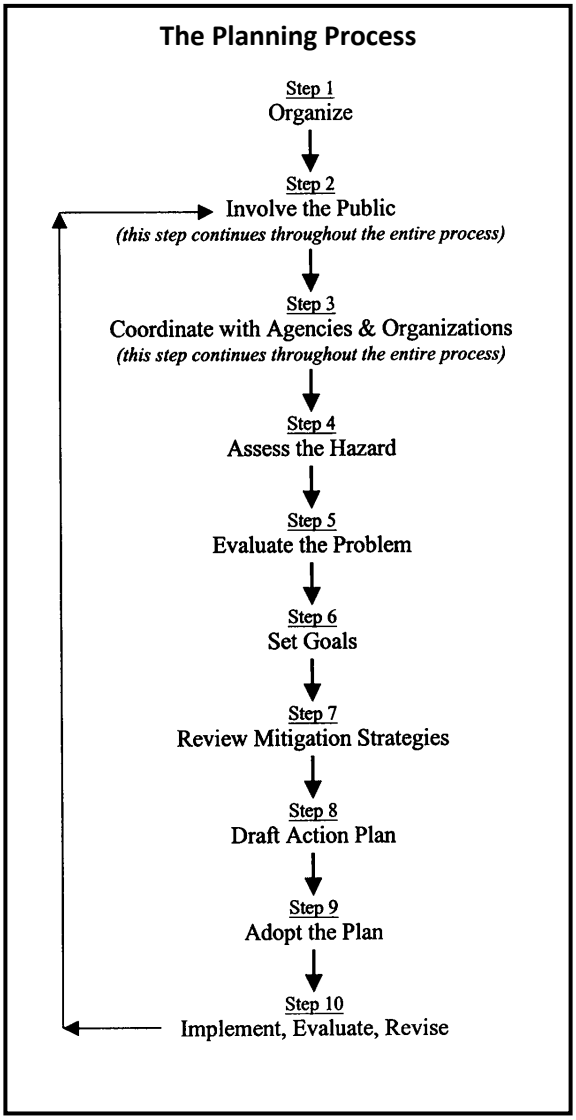
Hazard mitigation grant funds are made available by the Federal Emergency Management Agency (FEMA) through the Illinois Emergency Management Agency (IEMA).

This Plan identifies activities that can be undertaken by both the public and private sectors to reduce safety hazards, health hazards, and property damage caused by natural hazards. The Plan focuses on the major natural hazards facing McHenry County including: floods, severe summer storms, winter storms, tornadoes, extreme heat and cold, and droughts.

This Plan fulfills the federal mitigation planning requirements for mitigation funding, and it provides the County, municipalities, and agencies with a blueprint for reducing the impacts of these natural hazards on people and property.

1.2 Planning Approach

This Plan studies the overall damage potential from natural hazards in McHenry County, and reviews a range of mitigation alternatives. This Plan selects those mitigation alternatives that will work best for McHenry County, and ensures that public funds are well spent. It also considerers the current directions to the County government and the participating municipalities and agencies.



McHenry County Hazard Mitigation Planning Committee: This Plan was developed under the guidance of a McHenry County Hazard Mitigation Planning Committee (Mitigation Committee), created by resolution of the McHenry County Board on November 18, 2008. The municipalities and townships within McHenry County were invited to participate, which allowed this Plan to be a multi-jurisdictional plan. Other regional agencies and organizations were also invited to participate. Neighboring counties were also notified of the Mitigation Committee's efforts and invited to participate.

The municipalities, townships and other agencies who participated in this Plan are presented in Table 1-1, along with the primary representative(s). A list of all participants in the planning effort is provided in Appendix A.

Planning Process: The Mitigation Committee followed a 10-step planning process, based on FEMA guidance and requirements. Step 1 of the planning process was to organize, which the Mitigation Committee did in November 2009.

Public Involvement: Public input was obtained in a variety of ways, including:

- Information presented on the McHenry County website and municipal websites

- Contact with Committee members and their organizations
- Committee meetings open to the public and participation of members of the public at the meetings
- Press releases and mitigation information provided to McHenry County local newspapers and reporters
- A public meeting was held on May 26, 2010 at the McHenry County Administration Building in Woodstock, Illinois, to receive comments on the draft Plan.

Examples of public involvement efforts are provided in Appendix B.

Coordination: During the planning process, contacts were made with regional, state, and federal agencies and organizations to determine the programs, projects or data that could assist or support the County's mitigation efforts, including:

- Illinois Office of Emergency Management
- Illinois Department of Natural Resources, Office of Water Resources
- Illinois Department of Natural Resources, State Water Survey
- Federal Emergency Management Agency
- U.S. Geological Survey
- National Weather Service

All agencies and neighboring counties were invited to comment on the draft Plan.

Existing plans and programs were reviewed during the planning process. It should be underscored that this Plan does not replace other county or municipal planning efforts, such as the County's stormwater management plan, comprehensive plans, or local emergency management plans. This Plan is intended to complements those efforts.

Risk Assessment (Hazard Assessment and Problem Evaluation): The Committee undertook steps 4 and 5 of the planning process from November 2009 to April 2010. Throughout the planning process, additional data was collected and incorporated into the risk assessment.

The potential natural hazards that could potentially impact McHenry County were reviewed by the Mitigation Committee at the November 2009 meeting. Natural hazards were reviewed (and scored on a worksheet by meeting participants) for their likelihood of occurring or frequency, its potential impact or consequences, and the vulnerability of the County to them. The results of this review were used to determine which natural hazards warranted a vulnerability assessment, along with a hazard profile, in the risk assessment.

The hazard profiles were presented to the Mitigation Committee at the January 2010 meeting. Hazard data collection continued throughout the year. The findings of the vulnerability assessment and a summary of the hazards was presented for discussion to the Mitigation Committee at the April 2010 meeting. The hazard data and the Committee's findings and conclusions are covered in Chapter 2 of this Plan. Chapter 2 examines the hazards, including a hazard assessment – what causes the hazard and the likelihood of occurrence, and a vulnerability assessment – and the impact of the hazard on life, health, and property.

Goals: Mitigation planning goals were developed by the Mitigation Committee. A goal-setting exercise was conducted at the January 2010 meeting. The goals were reviewed and revised at the February 2010 meeting. The goals are presented and discussed in Chapter 3 of this Plan. Objectives or guidelines to go with the goals were developed as the Mitigation Committee examined the mitigation strategies.

Mitigation Strategies: The Committee considered a range of hazard mitigation alternatives. The Committee examined current mitigation efforts and then considered a variety of measures that could affect the impact of the hazards. The mitigation strategies have been organized under six categories: preventive measures, property protection, structural alternatives, resource protection, emergency management and public information. All mitigation measures were reviewed in relationship to the developed mitigation goals. These activities were conducted at the February, March and April meetings. The mitigation strategies are the subject of Chapters 4 – 9 in this Plan.

Action Plan: After the review of mitigation alternatives and mitigation recommendations in Chapters 4-9, the Mitigation Committee drafted an "Action Plan" that specifies recommended efforts and projects. The Action Plan describes who is responsible for implementing the mitigation measure, when the measures are to be done, and an estimate of cost and potential funding sources. The Action Plan was developed with the consideration of the goals and guidelines presented in Chapter 3. The Action Plan is presented in Chapter 10 of this Plan.

It should be noted that this Plan serves only to recommend mitigation measures. Implementation of these recommendations depends on adoption of this Plan by the McHenry County Board and the city council or board of trustees of each participating municipality and township. It also depends on the cooperation and support of the offices designated as responsible for each action item.

Chapter Development and Plan Review: Draft chapters were presented to the Mitigation Committee (and posted on the County website) at each meeting as they worked through steps in the planning process. For example, draft Chapter 1 was distributed at the first meeting, a draft Chapter 3 was presented at the February 2010 meeting following the goal exercise at the previous meeting, and a draft Chapter 10 (Action Plan) was provided following the April 2010 meeting. A "public review draft" was distributed and posted on the County website in mid-May for review and discussion at the May 26, 2010 public meeting. Comments from the public, communities and any interested agencies were collected through mid-June 2010.

Table 1-1 McHenry County Hazard Mitigation Planning Participants

McHenry County:	Representative:	
County Board	Mary McCann	
Administrator's Office	John Labaj	
Division of Transportation	Ed Markison	
Emergency Management	Barry Valentine/Bob Ellsworth	
GIS	Nicole Gattuso/Brian Anderson	
Health	Nomm/Eisele/Davidson	
Planning & Development	Dennis Sandquist/Matt Hansel	
Stormwater	Mark Phipps	
Water Resources	Cassandra McKinney	
Municipalities:	**Representative:**	**Department:**
Village of Algonquin	Ed Urban/Todd Walker/Bob Mitchard	Police/HR/PW
Village of Bull Valley	Township	
Village of Cary	Cris Papierniak	Public Works
City of Crystal Lake	Jim Moore/Paul DeRaedt/ Victor Ramirez	Fire/Fire/Engineer
Village of Fox River Grove	Robert Nunamaker	President
Village of Greenwood	Mary McCann	
City of Harvard	David Nelson/Dan Kazy-Garey	Admin./Police
Village of Hebron	Mary McCann	
Village of Holiday Hills	Raymond Dobosz	Building Department
Village of Huntley	Mike Klunk	Police Department
Village of Johnsburg	Kenneth Rydberg/Jerry Adams	Police/Building
Village of Lake in the Hills	Fred Mullard	Public Works
Village of Lakewood	Lawrence Howell	Police Department
Village of McCullom Lake	Biddy Boyer	Deputy Clerk
City of McHenry	Doug Martin/Ryan Schwalenberg	Admin./Construction
City of Marengo	Jayson Shull	Building Department
Village of Oakwood Hills	Township	
Village of Prairie Grove	Tim Carone	Public Works
Village of Richmond	Francis Wilson III/Scott DeSantis/ Tripp Wilson/Tim Savage	Police/ESDA/ESDA/Admin.
Village of Ringwood	McHenry Township	
Village of Spring Grove	Matt Wittum/Tom Sanders	Public Works/Police
Village of Trout Valley	Township	
Village of Union	Mary McCann/Robert Wagner	
Village of Wonder Lake	Dave Mahlke	Police Department
City of Woodstock	Dan Wesolek/John Isbell	Police/PW

Table 1-1 McHenry County Hazard Mitigation Planning Participants - Continued

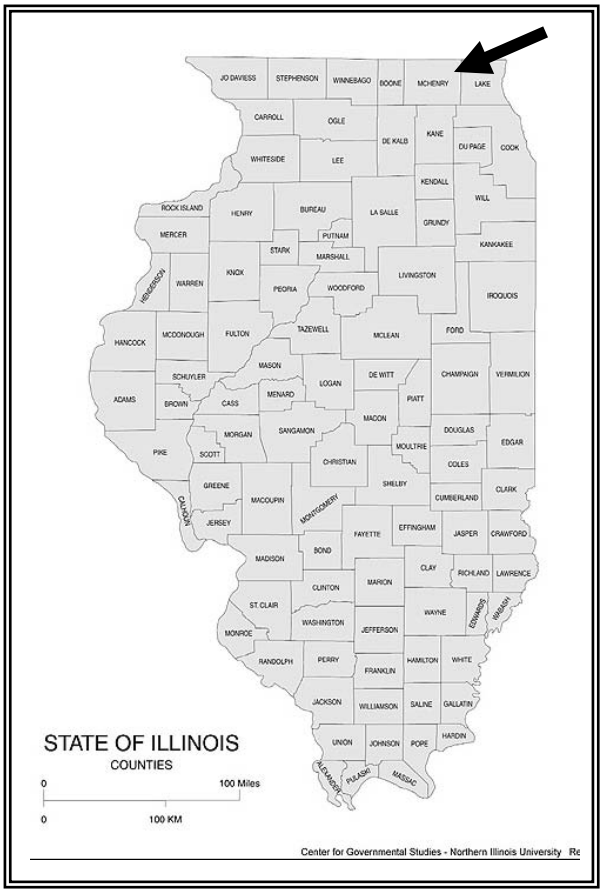
Townships:	Representative:
Alden Township	Mary McCann
Algonquin Township	Bob Miller
Burton Township	--
Chemung Township	Mary McCann
Coral Township	M. Lockwood M. Grismer
Dorr Township	Tom Thurman
Dunham Township	Mary McCann
Grafton Township	--
Greenwood Township	Mary McCann
Hartland Township	Evert Evertsen Michael Murray
Hebron Township	Mary McCann
Marengo Township	Steve Weskerna
McHenry Township	Frank DeVita
McHenry Township Road District	Lynell Limbaugh Dennis McFarlin
McHenry Township Fire Protection District	Mike Majercik
Nunda Township	Don Lopsell Cory Scott
Richmond Township	Dave Bockelmann
Riley Township	Mary Jane Schuring
Seneca Township	Rosemary Bartman
Woodstock Fire Rescue	Scott Ritzert

Other Agencies & Participants:	Representative:
McHenry County Historical Commission	Nancy Fike
Fox Waterway Agency	Ingrid Danler
McHenry County Council of Governments	Anna Moeller
McHenry County Soil and Water Conservation District	Ed Weskerna
Molly O'Toole & Associates, Ltd.	Molly O'Toole
JDQ, Inc.	Greg Michaud

McHenry County Mitigation Project Team: This planning effort was initiated and coordinated by the McHenry County Emergency Management Agency. The effort was funded by a grant from the IEMA. Molly O'Toole & Associates, Ltd. provided technical assistance to the project team and the Mitigation Committee. Johnson, Depp and Quisenberry, Inc. assisted with the risk assessment. The McHenry County GIS Department provided mapping products and the development of datasets for this planning effort.

1.3 McHenry County Overview

McHenry County is located 35 miles northwest of downtown Chicago in northeastern Illinois. The County Seat is Woodstock, Illinois. Political jurisdictions include 17 townships and the County contains 30 municipalities. McHenry County has a land area of approximately 611 square miles which makes it the 34th largest county in Illinois. McHenry County is bordered by Lake County to the east, Cook, Kane and McHenry Counties to the south, Boone County to the west, and Kenosha and Walworth Counties in the State of Wisconsin to the north. McHenry County is approximately 26 miles from east to west, and 23.5 miles from north to south. A base map of McHenry County is provided in Exhibit 1-1.



Climate: For the period between 1961 and 1990, the average temperature in McHenry County has been about 22 degrees Fahrenheit in the winter and about 71 degrees Fahrenheit in the summer. The recorded lowest temperature was on January 11, 1979 in Marengo at -29 degrees. The highest recorded temperature was on July 14, 1936 in Marengo at 109 degrees.

The total annual precipitation is 36.18 inches. Of this, 23.17 inches, or about 66 percent, usually falls in April through September.

The average seasonal snowfall is 35.5 inches. The greatest snow depth at one time recorded between 1961 and 1990 was 38 inches on January 17, 1979. The heaviest one day snowfall was 12 inches on January 1, 1979. The average relative humidity in mid-afternoon is about 60 percent. The sun shines 67 percent of the time possible in summer and 47 percent in winter.

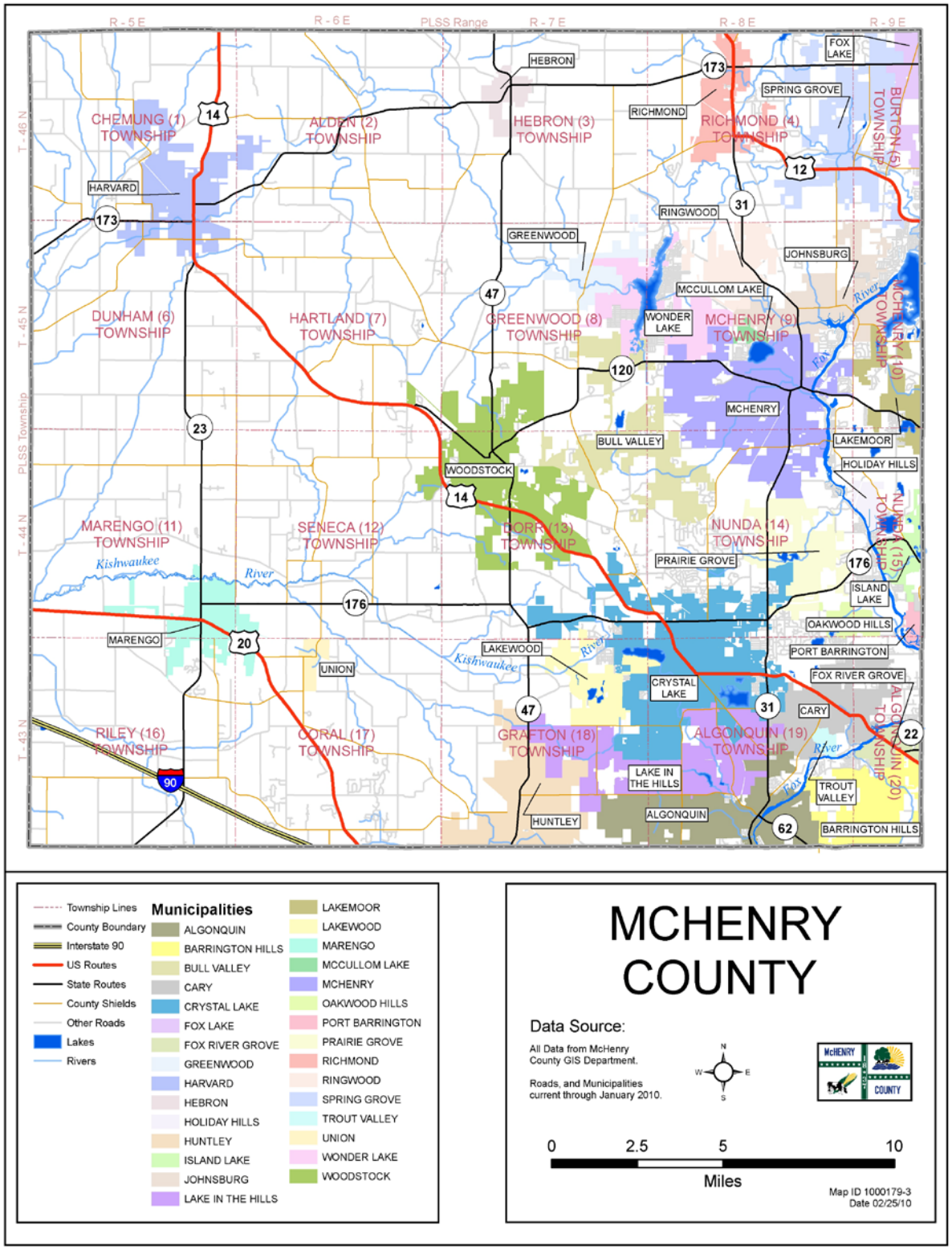


Exhibit 1-1 McHenry County Base Map

Watersheds, Topography and Soils: A watershed is the entire land area that drains into a particular lake or river. McHenry County has two major watershed areas: the Upper Fox River watershed, and the Kishwaukee River watershed. The eastern half of the County is drained by the Fox River, which flows to the south. Boone Creek, Nippersink Creek, and Thunderbird Lake Drain (also known as Sleepy Hollow Creek) are the main tributaries of the Fox River. The western half of the county is drained by the Kishwaukee River, which flows generally towards the west. Piscasaw, Coon, and Rush Creeks are tributaries to the Kishwaukee River. Exhibit 1-2 presents the McHenry County Watersheds.

Glacial activity provided the County's varied terrain of rolling hills, moraines, floodplains, kames, eskers, and bogs. Combined with the many ponds, wetlands, fens and lakes, these features provide diverse recreational opportunities and wildlife habitat. The Marengo Ridge is a prominent moraine in the Harvard and Marengo area. This moraine and the entire county to the east are in the Wheaton Morainal Country of the Great Lakes Section of the Central Lowland Province. The remaining portion of the County west of the Marengo Ridge is in the Rock River Hill Country of the Till Plains Section of the Central Lowland Province. The highest elevation in the County is about 1,190 feet above sea level about five miles northeast of Harvard. The lowest elevation is about 730 feet at the point where the Fox River leaves the County south of Algonquin.

Loams and silt loams are the predominant soils in McHenry County which contributes to the healthy role that agricultural activities have in the economy and quality of life. Prime soils comprise approximately 57percent of the County's landmass. McHenry County is also a major producer of sand and gravel in Illinois. The McHenry County 2030 Comprehensive Plan presents additional information on most production soils (2030 Plan, Figure 1) and primary aggregate areas (sand and gravel) (2030 Plan, Figure 12).

In addition to contributing to the local economy, these resources provide an abundant source of groundwater found in shallow and deep aquifers. All of McHenry obtains drinking water from groundwater sources.

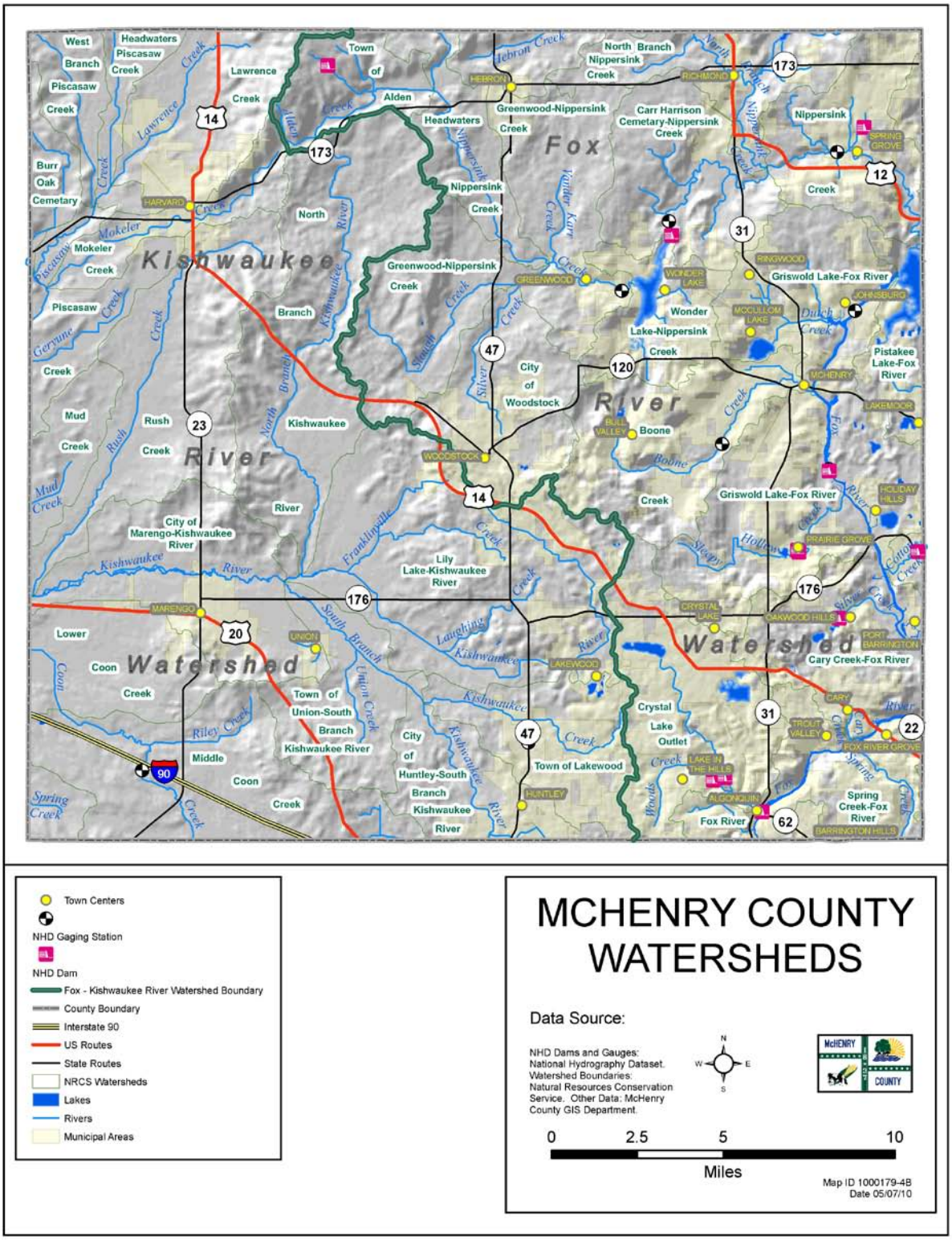


Exhibit 1-2 McHenry County Watersheds

Population: In 2000, McHenry County had a population of 260,077, the sixth most populated county in Illinois. McHenry County has had the highest growth rate of the Chicago metropolitan area counties in northeastern Illinois, or 3.4 percent a year. By 2030, the County population is expected to increase to approximately 540,000, an increase of nearly 73percent. The 2000 Census estimated that there are approximately 92,908 housing units in McHenry County. The labor force is about 140,203 people. This growth and development is largely driven by the County's proximity to Chicago and the nearby northwestern suburbs that cumulatively provide employment opportunities to which residents can easily commute.

Population and relevant socio-economic information for McHenry County, based on the 2000 U.S. Census Data, is presented in Table 1-2 (townships) and Table 1-3 (municipalities). Also, information on participation in the National Flood Insurance Program (NFIP) is presented in Table 1-3 for McHenry County municipalities. Exhibit 1-3 shows the McHenry County School Districts and Exhibit 1-4 shows the McHenry County Fire Districts.

Table 1-2 McHenry County Township Population Data

Community	Population	Housing Units
Alden	1,534	2,499
Algonquin	86,219	617
Burton	3,997	869
Chemung	8,761	2,311
Coral	3,020	1,732
Dorr	18,157	909
Dunham	2,375	754
Grafton	27,547	4,608
Greenwood	10,677	17,872
Hartland	2,063	2,349
Hebron	2,166	1,098
McHenry	41,740	6,507
Marengo	7,239	13,839
Nunda	35,104	1,019
Richmond	4,934	1,329
Riley	1,811	17,442
Seneca	2,733	31,556
Total:	260,077	107,310

Sources: U.S. 2000 Census and McHenry County Assessor

Table 1-3 McHenry County Municipal Data

	2000 U.S. Census					
Community	Population*	Housing Units	Median Household Income	Number of Students in School	NFIP Community Number	NFIP CRS Class
Village of Algonquin	23, 276	7,952	$84,437	7,398	170474	10
Village of Barrington Hills	3,915	1,456	$145,330	1,182	170058	10
Village of Bull Valley	726	281	$92,693	176	170977	**
Village of Cary	15,531	5,037	$82,568	5,280	170475	10
City of Crystal Lake	38,000	13,459	$75,396	12,019	170476	10
Village of Fox Lake	9,178	4,652	$46,548	1,992	170362	10
Village of Fox River Grove	4,862	1,734	$66,469	1,533	170477	10
Village of Greenwood	244	86	$56,250	88	170057	10
City of Harvard	7,996	2,723	$48,087	2,010	170479	10
Village of Hebron	1,038	411	$53,661	286	170086	10
Village of Holiday Hills	831	289	$57,857	252	170936	10
Village of Huntley	5,730	2,501	$65,433	1,133	170480	10
Village of Island Lake	8,153	2,893	$67,500	2,421	170370	10
Village of Johnsburg	5,391	1,875	$69,864	1,849	170486	10
Village of Lake in the Hills	23,152	7,866	$76,921	6,911	170481	7
Village of Lakemoor	2,788	1,161	$60,542	782	170915	10
Village of Lakewood	2,337	877	$11,172	671	170805	10
Village of McCullom Lake	1, 038	418	$54,500	273	170829	10
City of McHenry	21,501	8,127	$66,040	5,991	170483	10
City of Marengo	6,355	2,475	$57,209	1,758	170482	10
Village of Oakwood Hills	2,194	736	$70,875	721	170831	10
Village of Port Barrington	788	320	$83,508	227	170478	10
Village of Prairie Grove	960	308	$93,361	351	170975	10
Village of Richmond	1,091	441	$60,417	320	170484	10
Village of Ringwood	471	174	$71,250	110	170060	**
Village of Spring Grove	3,800	1,205	$80,542	1,308	170485	10
Village of Trout Valley	599	200	$99,297	191	170062	**
Village of Union	576	208	$56,528	160	170487	10
Village of Wonder Lake	1,345	488	$62,404	489	170976	10
City of Woodstock	20,151	7,599	$54,408	5,675	170488	10
McHenry County (Total)	260,077	92,908	$71,553	76,811	170732	10

*** Total population for dual-county communities**

**** Do not participate in the NFIP**

Source: U.S. 2000 Census and FEMA

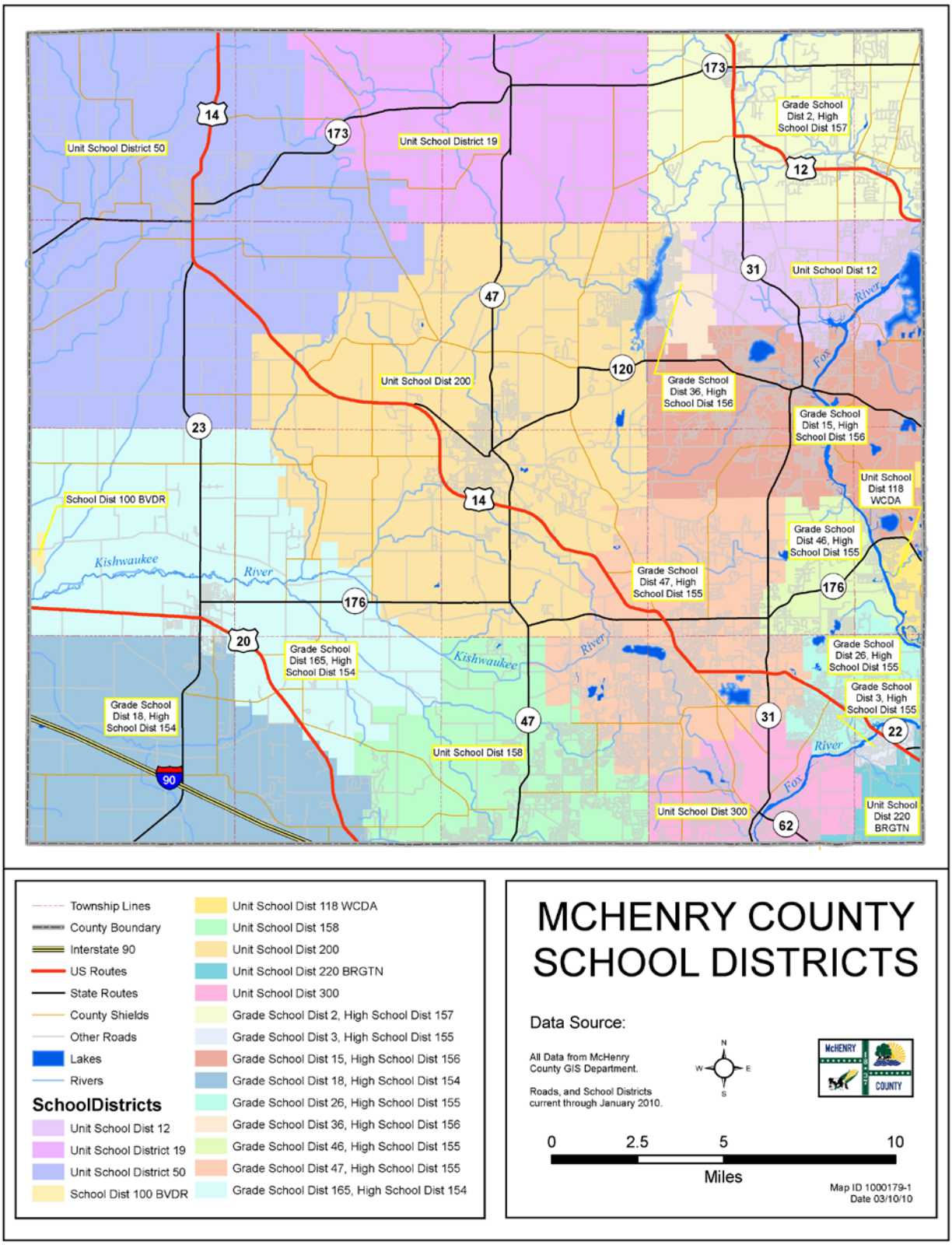


Exhibit 1-3 McHenry County School Districts

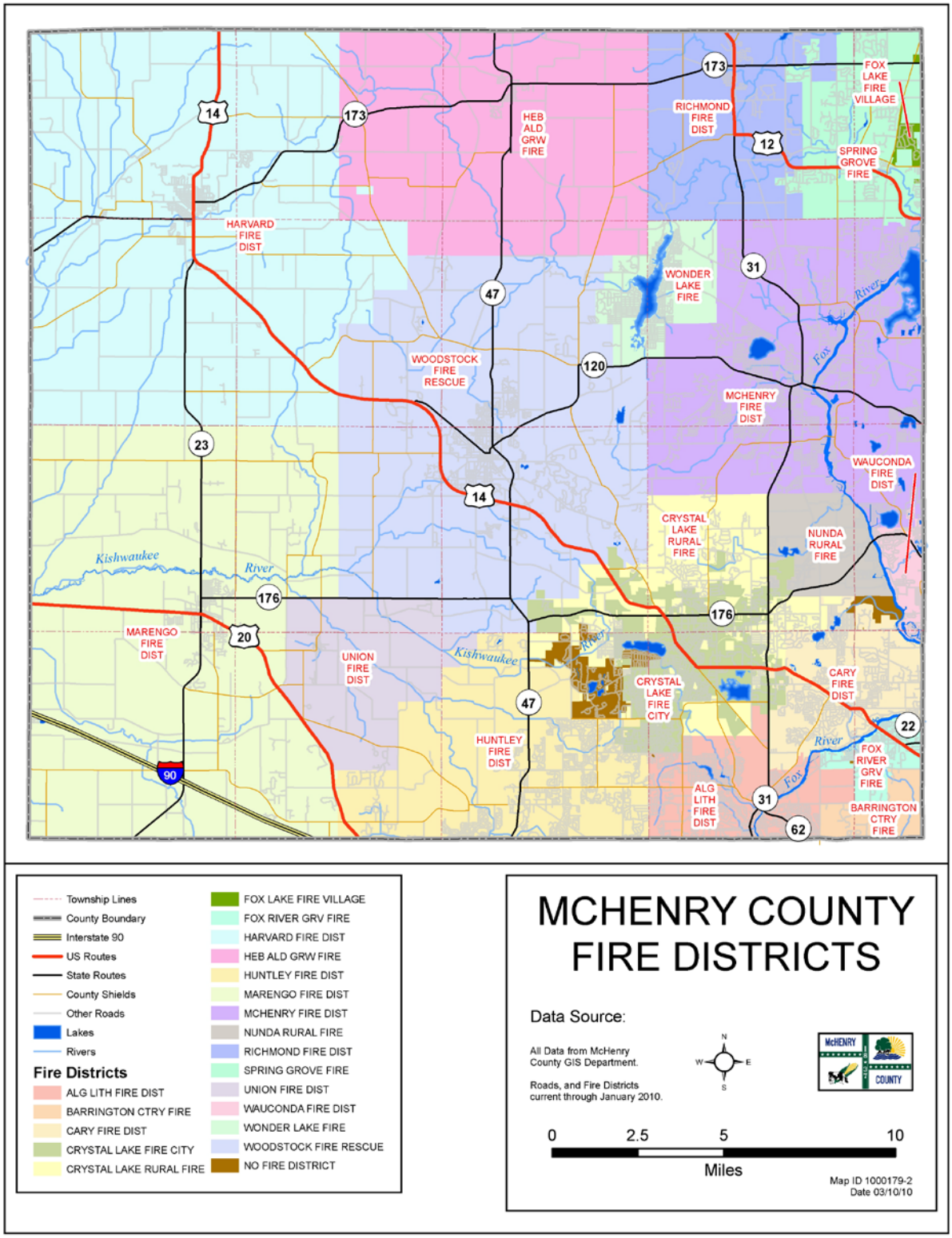
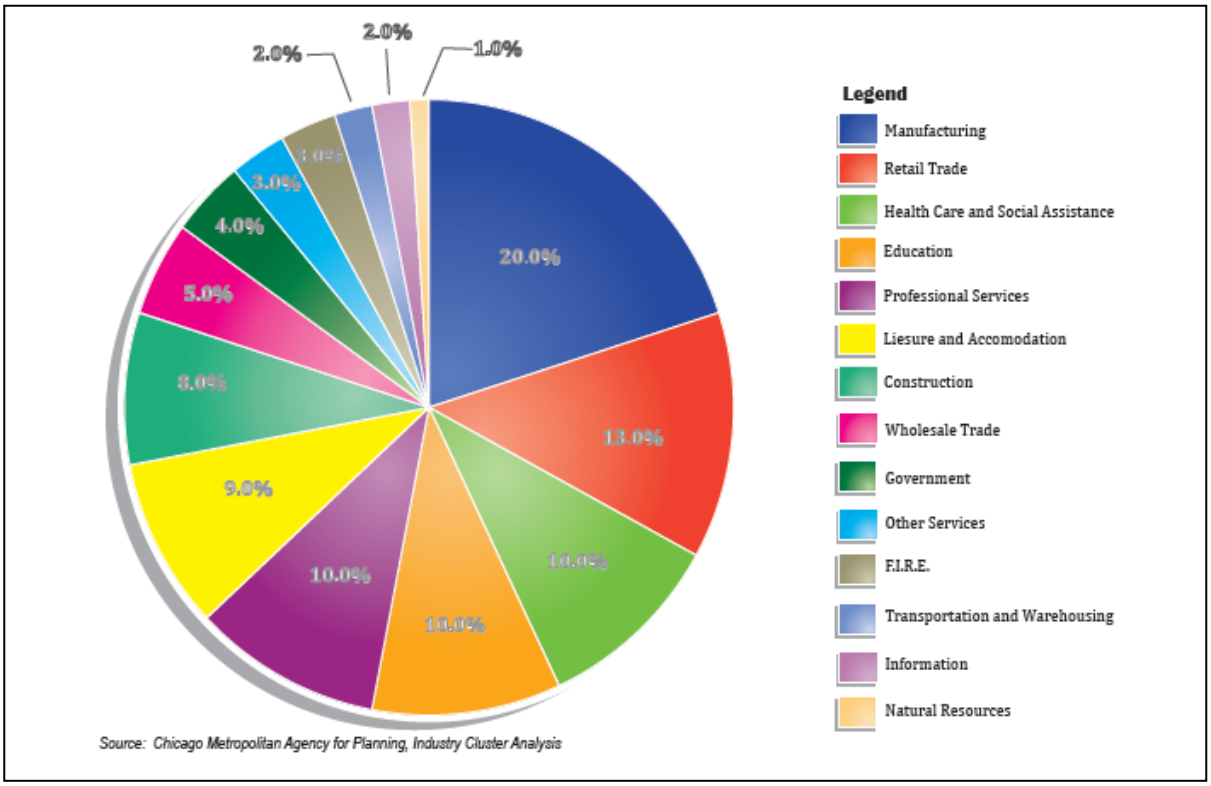


Exhibit 1-4 McHenry County Fire Districts

Employment: The U.S. Census estimated that 2008 workforce to be over 170,000 in McHenry County. The Chicago Metropolitan Agency for Planning (CMAP) estimates that the County's manufacturing base employs an estimated 20percent of the total workforce. Other substantial employment sectors include retail trade (13%), health care and social services (10%), education (10%), professional services (10%), leisure and accommodations (9%), construction (8%), and government (4%), Figure 1-1 shows the current distribution of employment in McHenry County.

Figure 1-1 McHenry County Employment



Of approximately 110 major employers in McHenry County, Centegra Hospital is the largest employer (3,650 employees), followed by McHenry County Government (1,400 employees). Table 1-4 presents most major employer, by community, in McHenry County.

Table 1-4 McHenry County Major Employers

Community	Major Employers
Algonquin	Kenmode Tool & Engineering, Wauconda Tool & Engineering, Duro-Life Corp.,
Cary	Ampac Flexibles, Tru-Cut Manufacturing, Mgi Global LLC, Durex Industries, True Value Mfg. Co., Duraflex Inc., General Assembly & Mfg. Corp., Horizon Steel Treating, Inser Tech Intl., Elecpac Inc., Bartlett Mfg.,Coilcraft Inc., Midwest Woodwork & Venrng Inc., Sage Products Inc.
Crystal Lake	Aptar Group Inc., Induction Heat Treating Corp., Marble Tech Fabrication Inc., Leach Enterprises, Serv All Die & Tool Co., Stephen Fossler Co., Sequoia Automatic, Autotrol Corp., RITA Corp, J A Frate Inc., Mathews Co., Technipaq Inc., Camfil Farr, Corporate Express, Precision Twist Drill Co., Sub Sem Electronics, Woolf Distributing, General Kinematics Corp, Triumph Twist Drill, Covidien, TC Industries, Knaack Manufacturing, Pro Techmation, Eisenmann Corp., Lee Jensen Sales, The Curran Group, Northwest Herald, Millennium Electionics, Catalyst Eshibits, criterion Financial Services.
Harvard	Mercy Harvard Hospital, Dean Foods, Consolidated Container Co., Royal Laundry Systems Inc., Richco Inc.
Hebron	Keystone Display
Huntley	Genesis Medical Imaging Inc., Weber –Stephen Products Inc., H S Crocker Co. Inc., Rohrer Corp., Tek Packaging Group, McGreal Construction
Lake In The Hills	Costco, Boulder Ridge Country Club, Dominick's Finer Foods, Lowes, Morietti's, Applebees, Northwest Home Health Care and Rehabilitation, Evergreen Landscaping, AMC Lake in the Hills Theater, Chadwick Contracting, and Walgreens, School District 158, School District 300
Marengo	Nissan Forklift Corp. of N. America, Engineered Polymer Solutions, Top Die Casting Co., Woodstock Plastics Co.
McHenry	Centegra Health System, Chroma Corp., Plaspros Inc., Water Works Inc., W M Plastics Inc., Meyer Material, Fabrik Industries, Medela, OMNI Products, Engineered Molding Solutions, Precision Metal Stamping, Corporate Disk Co., Ridgeview Electric, Lenco Electronics, RAE Corp., Clariant Corp.
Richmond	Olsun Electrics Corp., Surgipath Medical Industries, John Sterling Corp., Watlow Gordon Corp., Ex-Tech Plastics, Landscape Concepts
Ringwood	Dow Chemical, Modine Manufacturing
Spring Grove	Astro Craft Inc., Intermatic Inc., Scot Forge, Holian Insulation Co. Inc., Sport Decals Inc., Modern Abrasives, Netshape Technologies Inc.
Union	Aubrey Manufacturing,, Techalloy, New Dimensions Precision
Woodstock	Advanced Molding Technologies, Centegra Health System, Guardian Electric Mfg., Memorial Emergency Medical Center, Mercy Hospital, Precision Quincy Corp., Berry Plastics Closure Div., Knight Plastics Inc., Brown Printing Company, Dura-Bar Metal Services, Matrix IV Inc., Plaspros Inc., Wells Manufacturing Company, McHenry County Government

1.4 McHenry County Land Use & Development

McHenry County covers 611 square miles of land area. Table 1-5 shows the estimate of existing land use in McHenry County for both incorporated and unincorporated areas. Table 1-6 shows the projected land use by 2030. Over 60 percent of the County is currently in agricultural land use. That figure is expected to drop to around 42 percent over the next 20 years. Primary crops are corn and soybeans. Though residential, commercial and other development areas are expected to grow (expand), much of the agricultural land conversion is expected to go towards environmentally sensitive areas and open space. The McHenry County 2030 Plan provides maps of existing and future land use (2030 Plan, Figures 17 and 22).

Table 1-5 McHenry County Existing Land Use

Existing Land Use	Incorporated Areas	Unincorp. Areas	Countywide Total
Vacant	12.8%	3.0%	5.5%
Agricultural	26.9%	73.0%	61.2%
Estate	9.6%	9.7%	9.7%
Single-Family Residential	19.1%	1.9%	6.3%
Multi-Family Residential	1.5%	0.0%	0.4%
Mixed Use	0.1%	0.0%	0.0%
Retail	3.6%	0.4%	1.2%
Office/Research/Industrial	3.1%	0.3%	1.0%
Mining	3.9%	0.4%	1.3%
Open Space	13.8%	10.3%	11.3%
Government/Institutions	5.5%	1.0%	2.2%
Total:	100%	100%	100%

Table 1-6 McHenry County Future Land Use

Future Land Use (Draft 2030 Plan)	Countywide Total
Agricultural	42.4%
Environmentally Sensitive	17.2%
Estate	12.2%
Open Space	11.9%
Residential	11.3%
Office/Research/Industrial	2.5%
Retail	1.1%
Government/Institutions	1.0%
Mixed Use	0.4%
Total:	100%

As discussed in the previous section, the McHenry County population is expected to grow 73 percent over the next 20 years. This growth means that more and more people will be vulnerable to natural hazards in McHenry County. Both the consideration of the expected change in land use and population were considered throughout the development of the Plan.

1.5 McHenry County Critical Facilities

Critical facilities are buildings and infrastructure whose exposure or damage can affect the well being of a large group. For example, the impact of a flood or tornado on a hospital is greater than on a home or most businesses.

Critical facilities are generally placed into two categories:

- Buildings or locations vital to public safety and the disaster response and recovery effort, such as police and fire stations and telephone exchanges, and
- Buildings or locations that, if damaged, would create secondary disasters. Examples of such buildings or locations are hazardous materials facilities and nursing homes.

Critical facilities are not strictly defined by any agency. For this mitigation planning effort, a number of categories of critical facilities were used, including County, municipal and township facilities, police and fire stations, public, educational/school facilities, places of assembly, medical and health care, facilities for special needs populations, transportation, and infrastructure.

Critical facilities were identified by the County and each municipality and township participating in this Plan. McHenry County Information Management Office (GIS Department) developed a database and GIS layers for critical facilities submitted by communities and with data already available in County GIS layers. Over 1,500 facilities are included in the data. The facilities are categorized and tallied for the County, on the Table 1-7. Exhibit 1-5 shows that location/distribution of all identified critical facilities. Some facilities, such as parks were left out of the tally in Table 1-7, if not all communities reported their numbers or locations. All reported critical facilities locations, as reported by communities, are included in Exhibit 1-5.

The gold areas on the critical facilities map represent the 100-year or regulatory floodplain for McHenry County. It is estimated that approximate 30 critical facilities are within the 100-year floodplain or within 100 feet of the floodplain limit.

Further investigation into critical facility locations, use of critical facility mapping, and protection of critical facilities is discussed in Chapters 4, 5 and 8 of this Plan.

Table 1-7 McHenry County Summary of Critical Facilities

Critical Facility Category	County Total
County, Municipal and Township Government	47
County, Municipal and Township Maintenance Facilities	38
Dams	10
Fire Stations	38
Gathering Places	127
Grain Elevators	12
Infrastructure	
Drinking Water Facilities	138
Communication Towers	212
Power Plants and Utility Substations	19
Wastewater Treatment Facility	138
Libraries	16
Medical Facilities	
Ambulance Services	20
Clinics and Blood Banks	41
Hospitals	7
National Guard Armory	3
Post Offices	14
Public Safety Facilities	
Emergency Operations Center	14
Evacuation Shelter	27
Jail/Prison & Juvenile Detention Center	7
Police Station	32
Schools (pre-school to 12)	168
Social Service Agencies	70
Special Needs Populations	
Senior and Assisted Living	33
Children's Day Care	54
Group Homes	23
Storage and Distribution	
Industrial Hazardous Substance	40
Petroleum Storage	94
Agricultural Chemical	6
Transportation	
Airport	3
Train Stations	7
Total:	1,458

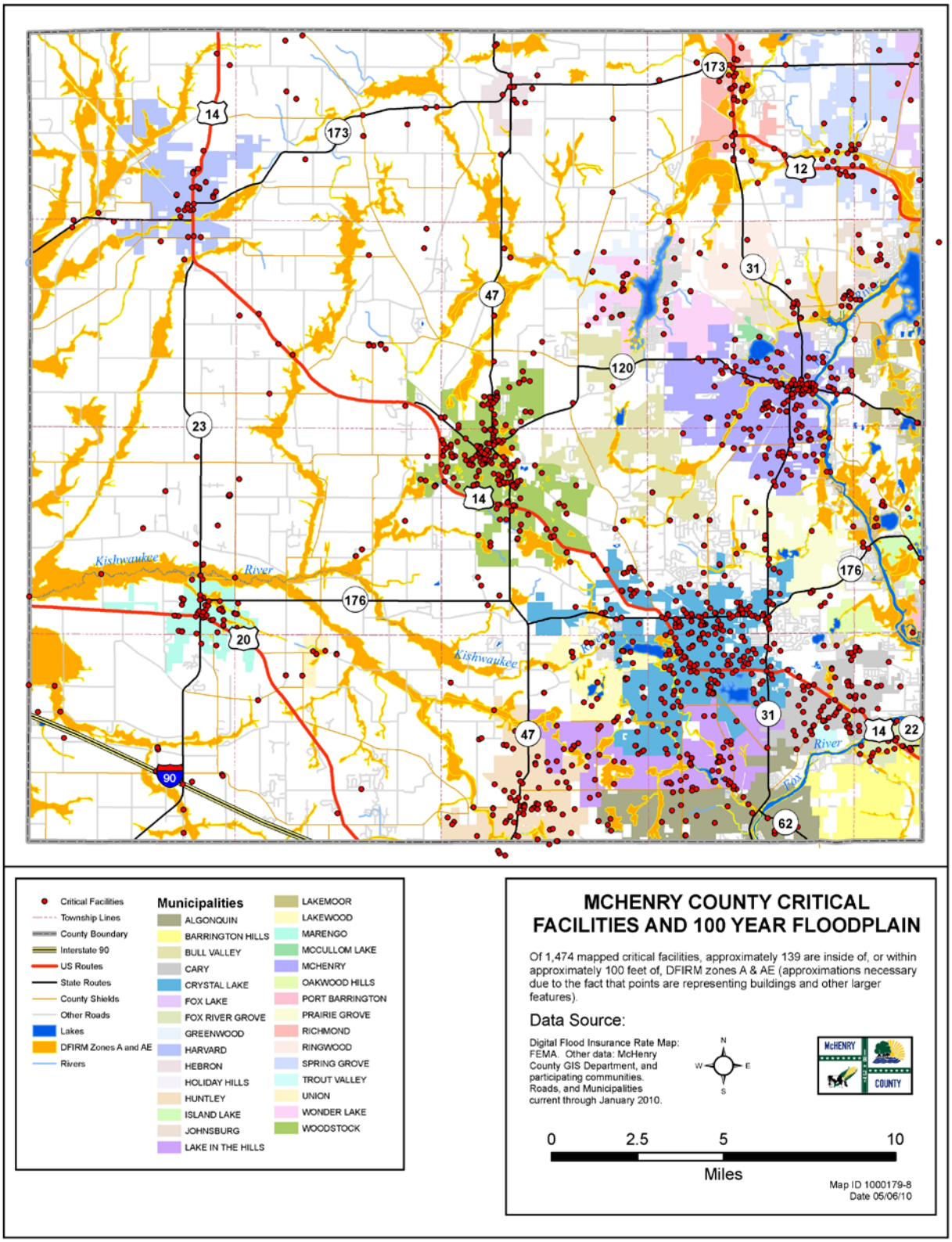


Exhibit 1-5 Locations of McHenry County Critical Facilities

1.6 References

1. "Example Plans," FEMA/Community Rating System, 2002.
2. Getting Started – Building Support for Mitigation Planning, FEMA, FEMA-386-1, 2002.
3. State and Local Plan Interim Criteria Under the Disaster Mitigation Act of 2000, FEMA, 2002.
4. Survey of municipalities, townships and County offices, 2010.
5. Critical facilities data supplied by municipalities, townships and County offices.
6. Illinois Emergency Management Agency.
7. *McHenry County Flood Insurance Study*, Federal Emergency Management Agency, 2006.
8. McHenry County Economic Development Corporation (www.mchenrycountyedc.com/)
9. U.S. Census Bureau website.
10. *2030 Comprehensive Plan*, McHenry County, February 9, 2010 P&D Draft.
11. McHenry County Assessor's data, 2010.
12. Land Cover of Illinois Statistical Summary, Illinois Department of Agriculture, 1999-2000.
13. Industry Cluster Analysis, Chicago Metropolitan Agency for Planning.

Chapter 2. Risk Assessment

This chapter provides a risk assessment of natural hazards that could impact McHenry County. A list of potential hazards was reviewed by the McHenry County Hazard Mitigation Committee (Mitigation Committee), and priority natural hazards were selected for analysis from that review. The risk assessment for priority hazards, such as severe storms and floods, include a hazard analysis and a vulnerability assessment. Other hazards, such as earthquakes and dam failure, include only a hazard profile in this Plan.

The hazard profile includes a description of the nature of the hazard, past occurrences and damages, and likelihood or probability of the hazard occurring in the future. McHenry County assets have been examined to estimate the potential health, safety and property damages attributable to these natural hazards for use in the vulnerability assessment. The vulnerability assessment compares the probability of the hazard occurring against the possible impact to County assets. A summary of the risk assessment for McHenry County is provided at the end of this Chapter.

2.1 Natural Hazards in McHenry County

McHenry County is subject to a variety of natural hazards. While severe summer storms have been the most frequently occurring natural hazard, the County has experienced damage from winter storm events, floods, and tornadoes. Flooding, tornadoes, severe summer and winter storm damage have warranted federal disaster declarations over the past 45 years. Table 2-1 lists the presidential, or federal, disaster declaration for the County since 1965.

Table 2-1 State and Federal Disaster Declarations for McHenry County

Hazard	Fall	Winter	Spring	Summer	Declaration Date	FEMA Disaster Number
Tornado			X		4/25/1965	194
Tornado			X		4/25/1967	227
Flood			X		4/27/1973	373
Flood			X		6/10/1974	438
Winter Storm		X			1/16/1979	3068
Flood	X				10/7/1986	776
Flood				X	7/9/1993	997
Winter Storm		X			1/28/1999	3134
Winter Storm		X			1/18/2001	3161

The Table 2-1 shows that disasters have most frequently occurred in the spring and winter. Table 2-2 shows the natural hazards that McHenry County could potentially experience. Using available data, Table 2-2 shows the past frequency of the listed hazards.

Table 2-2 McHenry County Identified and Potential Hazards

Hazard	Area affected or potentially affected (Location)	Past Frequency Occurrences in the last number of years		
		Last 5 years	Last 10 years	Last 50 years
Dam Failure	Downstream areas	0	0	--
Drought	Countywide	0	1	3+
Earthquake	Countywide	0	0	0
Extreme heat	Countywide	0	2	3+
Extreme cold	Countywide	7	8	12
Flood occurrences	Countywide	12	19	21+
Hail*	Storm location	38	56	73+
Lightning*	Storm location	8	11	12+
Thunderstorm-microburst*	Storm location	54	71	125
Tornado	Storm location	2	2	14
Winter Storm – Ice	Countywide	2	2	3+
Winter Storm – Snow	Countywide	15	20	26+

* Elements of severe summer storms
-- No data available.

At the November 2009 meeting, the Mitigation Committee undertook an exercise to evaluate the listed hazards in order to determine the level of attention that the hazard warranted in this Plan. In the evaluation the Mitigation Committee looked at the expected frequency, impact or consequences of the event and the area of the County that is vulnerable to the hazard. The Mitigation Committee members worked individually, and then the results were totaled and examined. Regardless of weighting of frequency, impact or area, the priority hazards were clearly identified.

A summary of the Mitigation Committee's ranking of hazards is shown in Table 2-3.

Table 2-3
McHenry County Mitigation Committee Ranking of Identified and Potential Hazards

Natural Hazard:		Future Frequency:	Impact:	Area Affected:
Priority	**Severe Winter Storms**	Frequent	Moderate/Serious	Large Area
	Severe Summer Storms	Frequent	Moderate/Serious	Large Area
	Extreme Cold	Likely	Moderate	Large Area
	Extreme Heat	Likely	Moderate	Large Area
	Floods	Occasional/Likely	Moderate/Serious	Community
	Tornado	Seldom	Serious	Community
	Drought	Occasional	Moderate	Large Area
	Groundwater	Occasional	Moderate	Community
Other	Earthquake	Seldom	Low	Community
	Dam Failure	Seldom	Low	Site-Community

The "priority" natural hazards listed in Table 2-3 are discussed in detail in this chapter, and mitigation activities for each hazard are identified in Chapters 4 through 9. Other natural hazards have been recognized, but not addressed in detail in the discussions of mitigation strategies. Lightning, thunderstorms, and hail storms should be combined under the category of severe summer storms, and snow events, ice storms, and extreme cold should be combined under the category of severe winter storms.

Information and data for the risk assessment was collected from the municipalities, regional, state and federal agencies. Other data was developed from McHenry County records and the County's GIS. An important source of information on recorded events was the National Climate Data Center (NCDC) at the U.S. National Oceanic and Atmospheric Administration (NOAA). For the vulnerability analysis, the County data, including GIS data and mapping was used to examine McHenry County's exposure priority natural hazards.

2.2 McHenry County Assets and Property Value

2.2.1 Assets

McHenry County's assets include people, buildings, infrastructure, businesses and institutions, the land and natural resources. Assets are summarized in Table 2-4 for purposes of evaluating potential hazards against the potential damage or loss of assets.

People: There are several population groups in McHenry County: Residents, residents who work in McHenry County, residents who commute to McHenry County to work, and the college student population who commute to McHenry County schools. While these groups are described below, for purposes of this Plan's vulnerability analysis, calculation will focus on McHenry County residents.

Table 2-4 McHenry County Estimate of Assets

People:	Numbers
Residents*	260,077
Workforce*	140,203
Students (Elem., H.S., Unit)*	76,811
Buildings:	
Residential Buildings**	107,310
Non-Government, Non-Residential**	5,636
Churches***	1
Hospitals ***	7
Schools (k-12)***	99
Colleges***	2
Government Owned***	230
Transportation:* **	
Roads (Lanes)	
Bridges	
Airports	3
Rail Stations	7
Resources:* **	
Conservation District	23,000 acres
State Parks	2
Community Parks	150
Golf Courses	20
Agricultural	352 sq. miles

* 2000 Census
** McHenry Township Assessor
*** Other County or Municipal or Township Sources

Residents: According to the 2000 U.S Census, the total McHenry population at the time of the 200 Census was 260,077. A list of populations by township is provided in Table 1-2 in Chapter 1, and by municipality in Table 1-3 in Chapter 1.

It is worth noting that the average density of people in the State of Illinois is 223 persons per square mile. McHenry County is approximately 611 square miles, making the average density in McHenry County was around 426 persons per square mile in 2000. This figure has increased since 2000 as population has grown in the County over the past 10 years.

Work force: Approximately half of McHenry County work force commutes outside the County for employment. The average McHenry County worker commutes over 30 minutes to reach their place of employment. Chicago, the northwestern suburbs, and Rockford provide more nearby employment opportunities than are available within McHenry County. The Northwest Tollway (I-90), US 20, Illinois Route 47, Illinois Route 31, and Randall Road form the basis of a regional roadway system to allow McHenry County residents to reach these employment centers. Commuter rail and bus service is also available.

Students: The majority of the daytime student population is at the elementary, middle and high schools in the County. These students are also residents. Another student population group is those who attend college in the daytime classes in the evening. It is difficult to determine which portions of the college population are also resident and also members of the work force.

Buildings: The estimate of McHenry County buildings shown in Table 2-4 is based in data from the McHenry Township Assessor, and data collected from McHenry County municipalities and townships. Table 2-5 provides the Assessor's data for all parcels in the County will buildings, except farm buildings. Farm homes are included with the residential building.

Table 2-5 McHenry Non-Exempt, Non-Farm Building Values

	Residential - Including Farm Homes		Commercial		Industrial		Township Totals for Non-Exempt, Non-Farm Buildings	
Township	Residential Buildings	Residential Market Value - Buildings Only	Commercial Buildings	Commercial Market Value - Buildings Only	Industrial Buildings	Industrial Market Value - Buildings Only	Total Buildings	Total Market Value of Buildings
Alden	617	$ 142,876,946	21	$3,406,934	0	$ -	638	$146,283,880
Algonquin	31,556	$6,610,785,305	1,311	$951,449,352	436	$327,793,087	33,303	$7,890,027,744
Burton	1,732	$ 442,594,824	26	$10,432,934	9	$6,664,014	1,767	$459,691,772
Chemung	2,499	$ 304,907,396	206	$61,454,698	16	$24,969,691	2,721	$391,331,785
Coral	1,329	$ 355,941,599	48	$18,318,323	31	$23,704,722	1,408	$397,964,644
Dorr	6,507	$ 1,251,757,702	476	$260,116,448	121	$106,960,003	7,104	$1,618,834,153
Dunham	909	$ 145,162,172	69	$42,442,946	5	$9,889,721	983	$197,494,839
Grafton	17,442	$4,086,388,341	187	$135,595,509	100	$52,994,041	17,729	$4,274,977,891
Greenwood	4,608	$883,385,551	45	$30,440,282	9	$3,671,944	4,662	$917,497,777
Hartland	754	$184,063,171	10	$4,405,437	50	$20,638,176	814	$209,106,784
Hebron	869	$ 151,525,524	80	$ 13,798,674	16	$12,985,038	965	$178,309,236
Marengo	2,349	$380,556,400	193	$61,523,654	37	$24,021,737	2,579	$466,101,791
McHenry	17,872	$3,244,762,094	812	$439,800,372	35	$34,310,630	18,719	$3,718,873,096
Nunda	13,839	$2,988,379,916	782	$359,882,343	213	$219,166,019	14,834	$3,567,428,278
Richmond	2,311	$522,186,139	179	$71,719,562	91	$69,838,275	2,581	$663,743,976
Riley	1,019	$228,563,711	5	$3,110,510	1	$2,558,053	1,025	$234,232,274
Seneca	1,098	$272,957,834	14	$ 4,576,001	2	$3,445,377	1,114	$280,979,212
Totals:	107,310	$22,196,794,625	4,464	$2,472,473,979	1,172	$943,610,528	112,946	$25,612,879,132

Residential, or housing, units: The Township Assessor provided a current count of residential buildings. The current residential building count of 107,310 will be used in the estimation of assets and vulnerability (rather than the 2000 Census figure of 92,908). Table 2-6 ranks McHenry County municipalities by population and the estimated number of housing units in each. For this ranking, the 2000 Census figures were used. The ranking of housing units is similar to the ranking by population.

Housing Density: The average density of housing in McHenry County is approximately 175 housing units per square mile using the McHenry County Assessor's data, and 152 housing units per square mile using the 2000 Census data. The average housing unit density for the State of Illinois is 88 housing units per square mile. The McHenry County average housing density varies from the east side of the County to the west side

Table 2-6 McHenry County Municipal Populations - Ranked

Community	Population*	Housing Units
Village of Algonquin	23, 276	7,952
City of Crystal Lake	38,000	13,459
Village of Lake in the Hills	23,152	7,866
Village of City of McHenry	21,501	8,127
City of Woodstock	20,151	7,599
Village of Cary	15,531	5,037
City of Harvard	7,996	2,723
City of Marengo	6,355	2,475
Village of Huntley	5,730	2,501
Village of Johnsburg	5,391	1,875
Village of Fox River Grove	4,862	1,734
Village of Spring Grove	3,800	1,205
Village of Lakewood	2,337	877
Village of Oakwood Hills	2,194	736
Village of Wonder Lake	1,345	488
Village of Richmond	1,091	441
Village of McCullom Lake	1,038	418
Village of Hebron	1,038	411
Village of Prairie Grove	960	308
Village of Holiday Hills	831	289
Village of Bull Valley	726	281
Village of Trout Valley	599	200
Village of Union	576	208
Village of Ringwood	471	174
Village of Greenwood	244	86

Source: 2000 U.S. Census

Summary – housing density:

McHenry County:	611 square miles
Population Density:	426 persons per square mile (2000)
Density of housing units:	175 homes per square mile
Density of housing units in urban areas:	372 homes per square mile
Density of housing units in rural areas:	30 homes per square mile

Non-residential, or non-housing, buildings: As shown in Table 2-5, are over 8,600 non-residential buildings in McHenry County (businesses, hospitals, churches, schools, government facilities, etc.). Estimated market values (assessed value multiplied by three) are also shown in Table 2-5.

Government-Owned Buildings: Government-owned buildings included in Table 2-4 is an estimate made for the purposes of this plan for the participating communities. It includes government owned buildings in critical facilities summary (Table 1-7 in Chapter 1).

Table 2-7 McHenry County Housing Density by Township - Ranked

Township	Residential Buildings	Approximate Township Area (square miles)	Housing Density (houses per square miles)
Algonquin	31,556	48	657
Grafton	17,442	36	485
McHenry	17,872	48	372
Nunda	13,839	48	288
Dorr	6,507	36	181
Burton	1,732	11	157
Greenwood	4,608	36	128
Chemung	2,499	33	76
Richmond	2,311	33	70
Marengo	2,349	36	65
Coral	1,329	36	37
Seneca	1,098	36	31
Riley	1,019	36	28
Hebron	869	33	26
Dunham	909	36	25
Hartland	754	36	21
Alden	617	33	19
Totals	107,310	611	176

Source: McHenry County Assessor and McHenry County GIS

Resources: The resources category in Table 2-4 provides a snapshot of the open space, recreational and other assets in McHenry County.

Infrastructure: Infrastructure, beyond transportation-related infrastructure, includes water mains, sewers, drinking water treatment facilities, utilities, such as electrical distribution, natural gas lines, and communication networks.

2.2.2 Building and Property Value

Building Values: Assessed values of private property in McHenry County are maintained by the County Assessor. For purposes of this Plan, the data in Table2-5 was developed by the County Assessor to understand the value of private property. Market values are based on the assessed value of a property times three. Table 2-5 shows residential, commercial and industrial property value estimates by township for McHenry County. Farm homes are included in the "residential" column, but farm buildings are not. Farm buildings are included in Table 2-6.

Table 2-8 McHenry All Non-Exempt Building Values

Township	Township Total Value of Non-Exempt Buildings – Not Including Farm Buildings	Farm Building Replacement Value	Township Total Value All Non-Exempt Buildings
Alden	$146,283,880	$ 5,194,434	$ 151,478,314
Algonquin	$7,890,027,744	$ 2,859,882	$ 7,892,887,626
Burton	$459,691,772	$ 718,896	$ 460,410,668
Chemung	$391,331,785	$ 2,350,293	$ 393,682,078
Coral	$397,964,644	$ 6,147,312	$ 404,111,956
Dorr	$1,618,834,153	$ 2,801,211	$ 1,621,635,364
Dunham	$197,494,839	$ 3,945,522	$ 201,440,361
Grafton	$4,274,977,891	$ 2,902,623	$ 4,277,880,514
Greenwood	$917,497,777	$ 4,432,749	$ 921,930,526
Hartland	$209,106,784	$ 4,923,279	$ 214,030,063
Hebron	$178,309,236	$ 2,920,857	$ 181,230,093
Marengo	$466,101,791	$ 6,045,630	$ 472,147,421
McHenry	$3,718,873,096	$ 2,783,277	$ 3,721,656,373
Nunda	$3,567,428,278	$ 4,326,204	$ 3,571,754,482
Richmond	$663,743,976	$ 4,496,934	$ 668,240,910
Riley	$234,232,274	$ 2,587,758	$ 236,820,032
Seneca	$280,979,212	$ 4,253,595	$ 285,232,807
Totals:	$25,612,879,132	$63,690,456	$ 25,676,569,588

Note that the values in Table 2-5 are for buildings only; land values are not included. The focus of the vulnerability assessment is on potential damage to buildings. Also, for cost-benefit analyses, FEMA requires the use of replacement values of buildings, which is an examination of each structure's feature(s) and the determination of a per-square-foot replacement cost. For purposes of the vulnerability analysis in the Plan, average replacement costs will be used when available.

Manufactured housing (mobile homes): There are no fewer than six manufactured home communities in McHenry County, located near or in Crystal Lake, Harvard, Marengo, and McHenry. These homes are particularly vulnerable to damage from wind-related hazards. The value of these structures is estimated to be $38,000 (U.S. Census default data).

Building Value Summary: With consideration of the median home price and the U.S. Census Bureau replacement cost of non-residential structures, the following figures were used throughout this chapter for the vulnerability analysis:

Table 2-9 McHenry County Average Building Values

Building Type	Building Numbers	Total Value	Average Building Value
Residential	107,310	$22,196,794,625	$207,000
Commercial	4,464	$2,472,473,979	$554,000
Industrial	1,172	$943,610,528	$805,000
Farm		$63,690,456	--
Total:	112,946	$25,676,569,588	

U.S. Census replacement costs: The U.S. Census for 2000 placed the following replacement costs for buildings in Illinois:

Building Type:	Replacement Cost:
Single family homes	$135,000
Multifamily residential	$720,000
Non-residential	$2,500,000

The replacement cost of $135,000 for a home in McHenry County appears to be low for McHenry County (and the northeastern Illinois regions). It is unknown how many of the 107,310 housing units are multifamily buildings. The replacement value for non-residential structures – as an average – seems appropriate.

Property Value:

Residential Property Value: Average home sale price for all McHenry County municipalities, as reported by the McHenry County Association of Realtors, is currently around $188,000. The average over the past 3 years is around $223,000. This figure is for the building and land. For comparison, using the figures for residential buildings in Table 2-5, the average value of a residential building in McHenry County is about $207,000 (building only). This figure is comparable to the 3 year average, rather than current sales values. For a total asset value (residential building and land), the 3-year average will be used.

Value of Residential Property = 107,310 buildings x $223,000 = $23.93 billion

Value of non-residential property value = 5,636 buildings x $2,500,000 = $1.41 billion

<u>Total market value of all private, taxable and-developed property in McHenry County = $25.3 billion.</u>

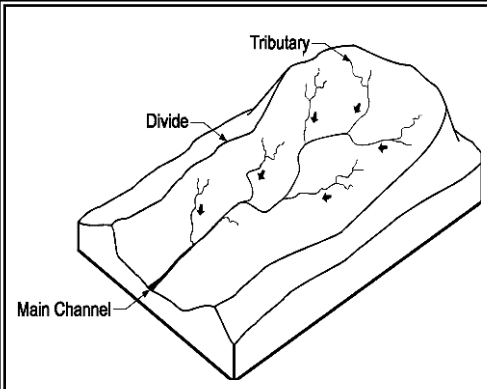
The value of farmland was not estimated.

Government-Owner and Tax-Exempt Property Value: The value of government-owned property in McHenry County is being collected by the County Auditor, as it is submitted by local government agencies. The value of tax-exempt properties, such as churches, is not readily known.

2.3 Flood

2.3.1 Flood Hazard Description

Floods can be classified under two categories: flash floods and riverine floods. Flash floods are generally produced when heavy localized precipitation falls over an area in a short amount of time. Rainfall and runoff exceed the rate at which water can normally soak into the ground and the storm sewers and swales are unable to handle the volume of rainfall and runoff. Flash floods are usually associated with a severe thunderstorm event or events and can occur within and outside floodplain areas. Often flash flooding is called stormwater flooding.



A watershed includes all land that drains to a common channel

Riverine flooding refers to the flood events where capacity of river and stream is exceeded, water levels gradually increase, and floodplain areas are inundated. This type of flooding is most commonly called overbank flooding. Overbank flooding of rivers and streams can be caused by one or more of three factors:

- Too much precipitation in the watershed for the channels to convey,
- Obstructions in a channel, such as an ice jam or beaver dam, and
- Large release of water when a dam or other obstruction fails.

Flooding can occur any time of year. The severity of flooding is determined by a combination of topography and physiography, ground cover, precipitation and weather patterns and recent soil moisture conditions. Flooding is also governed by the size and the nature of the stream's watershed. A watershed is the geographic area of land where all runoff drains to a common point. McHenry County watersheds are shown in Exhibit 1-2 (Chapter 1). McHenry County has two major watersheds: the Fox River watershed and the Kishwaukee River watershed. Table 2-10 shows the major watershed and tributary watersheds of the County, and available drainage areas.

Table 2-10 McHenry County Watersheds

Stream Name:	Tributary Name:	Approximate Drainage Area (In All Counties) square miles
Fox River Watershed		
Fox River at Algonquin Dam		1,402.0
Nippersink Creek		205.0
	Silver Creek/Slough Creek	34.1
	Vander Karr Creek	16.4
	North Branch Nippersink Creek	68.7
	Hebron Creek	---
	Alden Creek	---
Dutch Creek		12.6
Boone Creek		23.2
Thunderbird Lake Drain (Sleepy Hollow Creek)		15.1
Cotton Creek		13.0
Silver Creek		---
Cary Creek		3.3
Spring Creek		26.0
Crystal Creek		26.5
	Woods Creek	9.0
Kishwaukee River Watershed		
Kishwaukee River at Garden Prairie		221.0
Laughing Creek		---
Franklinville Creek		12.0
North Branch Kishwaukee River		40.3
South Branch Kishwaukee River		52.7
	Eakin Creek	
	Kishwaukee Creek	
	Union Creek	
Rush Creek		31.2
Mud Creek		---
Coon Creek near Garden Prairie		129.0
Piscasaw Creek at Chemung		52.9
	Lawrence Creek	21.5
	Mokeler Creek at Piscasaw Creek	9.3
	Geryune Creek near Capron	12.2

Source: USGS

The condition of the land in a watershed affects what happens to the precipitation. For example, more rain will run off the land and into the streams if the terrain is steep, if the ground is already saturated from previous rains, if the watershed is significantly covered with impervious pavement and parking lots, or if depressional storage areas have been filled in.

On average, flooding causes more than $2 billion in property damage each year in the United States. Floods cause utility damage and outages, infrastructure damage (both to transportation

and communication systems), structural damage to buildings, crop loss, decreased land values and impede travel.

Floodplains: A floodplain is generally the land area susceptible to being inundated or flooded by water from any source (i.e., river, stream, lake, estuary, etc.). Floodplains are natural features of any river or stream. Streams that drain more than one square mile have their estimated floodplain areas mapped. The mapped floodplain areas are called the regulatory floodplain. The regulatory floodplain mapping is a result of the hydrologic (rainfall) and hydraulic (runoff) analysis of the watershed and stream.

Flood Watches and Warnings

The National Weather Service Weather Forecast Office in Chicago, Illinois is responsible for issuing flood watches or warnings for McHenry County depending on the weather conditions. The following provides a brief description of each type of alert.

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

The regulatory floodplain is also known as the 100-year floodplain or the Special Flood Hazard Area. The 100-year floodplain is the land area that is subject to a 1% or greater chance of flooding in any given year. The 100-year flood elevation of a stream is also called the Base Flood Elevation. The County and municipalities administer floodplain regulations as part of the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP) and the McHenry County Stormwater Management Ordinance. Activities in floodplains, including grading, construction, and changes to existing structures must meet the floodplain requirements.

The floodway is portion of the floodplain required to convey the flood event. The flood fringe provides flood water storage. The floodway is the high velocity area and structures or obstructions in the floodway can increase flood heights. The 100-year floodway is regulated by the Illinois Department of Natural Resources, Office of Waters Resources (IDNR-OWR). The IDNR-OWR floodway requirements are incorporated into the McHenry County Stormwater Ordinance. Floodplain and floodway regulations will be discussed further in Chapter 4.

The term "100-year flood" is often misinterpreted. The 100-year flood does not mean that it will occur once every 100 years. A 100-year flood has a 1/100 (1%) chance of occurring in any given year. A 100-year flood could occur two times in the same year or two years in a row. It is also possible not to have a 100-year flood event over the course of 100 years.

While the 100-year (or base flood) is the standard most commonly used for floodplain management and regulatory purposes in the United States, the 500-year flood is the national standard for protecting critical facilities, such as hospitals and power plants. A 500-year flood has a 1/500 (0.2%) chance of occurring in any given year. It is generally deeper than a 100-year flood and covers a greater amount of area; however, it is statistically less likely to occur.

Special Flood Hazard Area and Flood Insurance Rate Maps: A Special Flood Hazard Area (SFHA) shown on a Flood Insurance Rate Maps (FIRM) is the regulatory floodplain. FIRMs are produced by FEMA. SFHAs are delineated on the FIRMs and may be designated as Zones A, AO, AH, A1-30, AR, AE or A99. Structures located in the SPHA are highly susceptible to flooding. Structures located in the SFHA A-Zones are required by lenders to purchase flood insurance. Anyone in a community that participates in the NFIP is may voluntarily purchase flood insurance.

2.3.2 Flood Hazard Analysis

Two sources of data were used to assess past flood events in McHenry County: The Storm Events Database and flood insurance claims data provided by FEMA. Table 2-11 summarizes the previous flooding occurrences reported in McHenry County between 1978 and August 31, 2009.

There was only one recorded report of death resulting from a flood event which was provided by the Village of Algonquin. On July 21, 1982 an Algonquin police officer drowned in Crystal Lake Outlet Creek while searching for a man who was reported to have fallen into the creek.

Figures 2-1 and 2-2 chart the reported occurrences of flood and flash flood events by month and hour from the Storm Events Database. Nearly all events took place between May and September. Table 2-1 shows four flood disaster declarations. One disaster occurred in the spring, two in the summer and one in the fall. Approximately 55% of all flood and flash flood events occurred during the a.m. hours, with seven of the 16 events taking place between 6:00 a.m. and 9:00 a.m.

Figure 2-1
McHenry County Flood & Flash Flood Events by Month
1982 through 8/31/2009

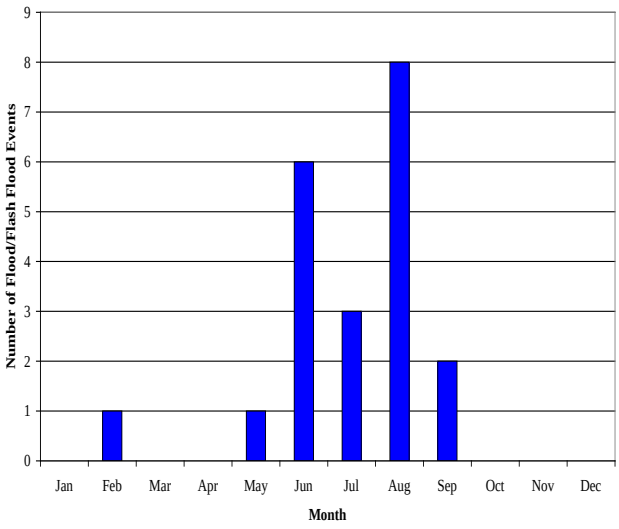
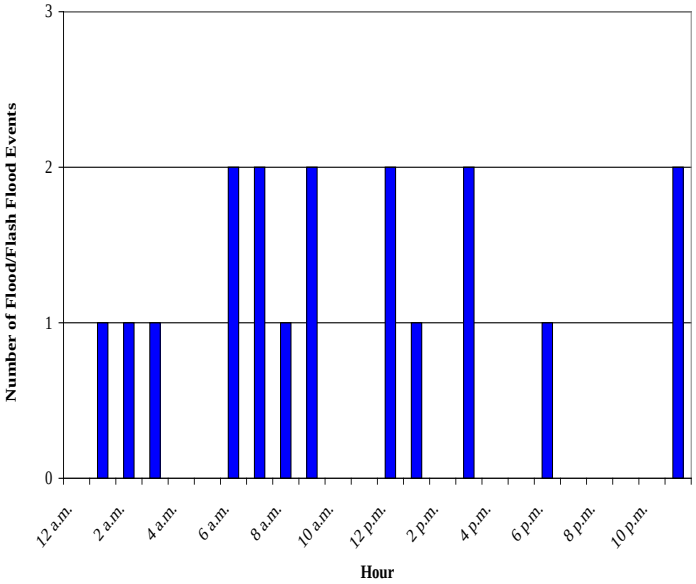


Figure 2-2
McHenry County Flood & Flash Flood Events by Hour
1982 through 8/31/2009



NOAA, National Environmental Satellite, Data & Information Service, National Climatic Data Center, Storm Events Database, Illinois, McHenry County, 2010.

The flood insurance data shows at least 35 flood events from 1978 to 2009. A number of claim dates were aggregated into one flood event. Flood events captured by the flood insurance data range from basement flooding only throughout the County, to long duration overbank flooding on the Fox River. The average insurance claim paid in McHenry County is about $6,100.

Five flood events shown in Table 2-11 (from the NWS), produced zero flood insurance claims. These events include the June 2002, August 2002, September 2002, July 2006 and July 2007. Flood damage was not recorded in the Storm Event Database for these events. Table 2-11 also provides a summary of flood insurance claims paid for each flood event. The table does not show events were only one property owner made a flood insurance claim. However, since 1978, 443 flood insurance claims have been paid in McHenry County for a total of $2.77 million. A summary of flood insurance claims by community is provided in Table 2-12. This table does not include some communities that are partially in McHenry County, but have participated in other county multi-jurisdictional play. For the County and all municipalities that are wholly or partially in McHenry County, there are 1,873 flood insurance policies in place. Of those, 1,409 are in A-Zone floodplains (464 outside the floodplain). The total flood insurance coverage for the County is $357 million.

August 2007 Flood Event: From the Storm Event Database and the flood insurance claims data, the August 2007 flood caused the highest recorded damages. $860,000 was recorded by the NWS and $736,000 was paid in flood insurance claims. A federal disaster declaration was not granted by FEMA in McHenry County for the August 2007 flood.

1993 and 1986 Floods: The two next largest floods in McHenry County were the June 1993 and September 1986 floods. Both floods received disaster declarations. And note that neither flood was shown in the NOAA's Storm Events Database.

Reported Sources of Flood Problems - 1997: In 1997, the McHenry County Department of Planning and Development collected flood problem reports from around the County, and produced a map showing the problem area locations. Problems included overbank flooding, local drainage-related flooding, basement flooding, erosion and sedimentation problem areas, and surface water quality problems. From a review of the County mapping, almost 40 areas of overbank flooding occurred in both the Fox River and Kishwaukee River watersheds. Overbank flooding was prevalent along the Fox River, but along Nippersink Creek. Notable flooding occurred in headwater areas in Lakewood, Huntley, and Woodstock.

Table 2-11 Reported Flood Events in McHenry County

Flood Event:	Area Impacted	Rainfall Estimate	Reported Damage	Flood Insurance Claims Paid:	Claims Amount Paid:	Notes:
June-September 1978				18	$20,808	
August 1981				1	$1,667	
Jan-Mar 1982				3	$8,302	
July 21,1982	Algonquin, Lake in the Hills	approx. 7”	$64,000	5	$11,300	1 Death
December 1982				3	$94,447	
April 1983				6	$8,394	
March 1986				2	$2,917	
Aug-Oct 1986				69	$350,495	Disaster Declaration
April-July 1993				61	$484,003	Disaster Declaration
February 1994				14	$104,913	
April-July 1996				7	$23,859	
February 20-22, 1997	countywide	3” – 4”	$0	2	$15,933	
May-June 1997				2	$3,217	
June 13-17, 1999	countywide	4” – 6”	$0	26	$230,225	
June 12-17, 2000	Harvard, Richmond, and countywide	3”to 5” in addition to runoff from earlier in the day	$0	15	$101,611	
February-March 2001				2	$8,869	
June 4, 2002	countywide	3.5”	$0	0	-	
August 22, 2002	countywide	5”	$0	0	-	
September 19, 2002	Harvard	2.4”	$0	0	-	
July 2003				2	$4,349	
May-Jun 2004	Crystal Lake	1.5”	$0	11	$120,927	
July 20, 2006	Huntley	unavailable	$0	0	-	
July 9, 2007	Crystal Lake	unavailable	$0	0	-	
August-September 2007	Woodstock, Marengo, Union, Algonquin, Huntley, Lakewood	4.4” – 5.1”	$860,000	70	$735,866	
April 2008				4	$9,873	
June 13-25, 2008	Spring Grove	6.6”	$250,000	10	$64,081	
September 13, 2008	Crystal Lake, Lake in the Hills, Algonquin	unavailable	$0	2	$5,670	
December 1, 2008				2	$9,453	
February-March 2009				2	$10,098	
June 2009				5	$37,199	
		Totals:	1,174,000	443	$2,765,773	

Source: NOAA

Table 2-12 Summary of McHenry County Community Flood Insurance Claims Information

Community	Number of Claims Paid	Total Paid	Average Paid	Number of Active Policies
Village of Algonquin	0			
Village of Bull Valley	0			
Village of Cary	10	$35,764	$3,576	108
City of Crystal Lake	18	$212,498	$11,805	40
Village of Fox River Grove	13	$54,272	$4,175	98
Village of Greenwood	0			35
City of Harvard	5	$14,022	$2,804	1
Village of Hebron	0			19
Village of Holiday Hills	17	$103,599	$6,094	64
Village of Huntley	0			20
Village of Johnsburg	3	$62,412	$20,804	50
Village of Lake in the Hills	27	$163,378	$6,051	51
Village of Lakewood	1	$535	$535	8
Village of McCullom Lake	0			--
City of McHenry	44	$167,191	$3,800	90
City of Marengo	8	$16,160	$2,020	123
Village of Oakwood Hills	0			--
(Village of Port Barrington)	36	$193,484	$5,375	42
Village of Prairie Grove	0			--
Village of Richmond	1	$5,755	$5,755	4
Village of Ringwood	0			--
Village of Spring Grove	26	$178,623	$6,870	29
Village of Trout Valley	0			--
Village of Union	8	$31,481	$3,935	16
Village of Wonder Lake	1	$3,791	$3,791	9
City of Woodstock	7	$140,009	$20,001	32
McHenry County (Unincorporated)	226	$1,398,404	$6,188	635

Repetitive Flood Loss Structures: FEMA defines a "repetitive loss structure" as a flood-insured structure that has received two or more flood insurance claim payments of more than 25% of the market value within any 10-year period. McHenry County has 52 repetitive loss structures located in eight communities as presented in Table 2-13.

Table 2-13 McHenry County Repetitive Loss Structures

Community	FEMA Repetitive Flood Loss Properties
Crystal Lake	1
Fox River Grove	1
Harvard	1
Holiday Hills	4
Lake in the Hills	3
Port Barrington	3
Spring Grove	6
McHenry County	33
Total:	52

Source: FEMA

The repetitive flood loss structures are concentrated in the Fox River Watershed. They are nearly all single family residences. Mitigation of repetitive flood loss structures are discussed further in Chapter 5. "Repetitive Flood Loss Problem Areas" were developed and are presented in Exhibit 5-1. Also, from the review of flood insurance data, over 90 properties in McHenry County have made multiple insurance claims.

Roadway Flooding: Flash flooding and overbank flooding can cause flood problems on roads. As part of this Plan development, communities were asked to report bridges or culverts that impede flood flow (shown in Chapter 6). As part of this effort, the McHenry County Division of Transportation, at a meeting of all staff members, identified any roadway that has had a flood problem (that could be recalled over the last 30 years). Over 60 problem locations were identified throughout the County. Again, the problems could be a result of flash flooding or overbank flooding. The map of these locations in provided in Chapter 6 (Exhibit 6-1).

Extent of Hazard and Probability of Future Occurrence: Much of McHenry County is subject to property damage due to flooding. In the past, flooding appeared to be significant in the Fox River watershed only, but as the County has developed over the last decades, the Kishwaukee River watershed has a number of growing flood problems. The odds of flooding in any year are 100% as rivers and streams are meant to make use of their floodplains. The odds of flood damage in any year are more difficult to estimate. In some years the damage is limited or isolated. In other years, the flooding can be regional.

2.3.3 Flood Vulnerability Assessment

With a growing population and increasing development, McHenry County is susceptible to increased flooding. Being aware of this fact, McHenry County has taken steps through the McHenry County Stormwater Management Ordinance and comprehensive planning to protect against new flood damages. These efforts will be discussed in Chapter 4.

Despite these steps, McHenry County is still vulnerable to significant flooding due to existing development. McHenry County GIS has estimated that the FEMA mapped floodplain (FIRM A and AE Zones) covers 72 square miles of the County. An examination of land parcel data and the digital FIRM (100-year floodplain map), shows 16,205 parcels of land that are either within or touch the FEMA mapped floodplain. The 16,205 parcels cover over 186 square miles of the County.

In the Fox River watershed, the operation of the Stratton Dam by IDNR protects both upstream and downstream properties (depending on the nature of the flood event), but for very large events, flooding damage along the Fox River occurs.

Flooding concerns in the Kishwaukee watershed are increasing as additional runoff is discharged by new development. Through discharges rates are controlled by the Stormwater Ordinance, the quantity of runoff still increases. Groundwater flooding is also a concern in many areas of the County.

Health and safety: Safety during a flood, whether from overbank flooding or groundwater flooding (basements), is a concern. If clean-up after a flood is not properly done, then health problems can develop due to mold. Flooding roads and viaducts are dangerous. People continue to be at risk when driving through floodwaters; fast moving waters are a hazard to people in and out of cars. The highest flood depths are at the Fox River, but stormwater flooding away from the floodplain in McHenry County can also threaten lives, as emphasized in the death during the 1982 flood event.

Impact to health and safety due to flooding is considered **moderate**.

Damage to Buildings:

The number of buildings within the 100-year floodplain has not been determined (16,205 parcel either touch or are within the floodplain). It is known that flooding occurs outside the 100-year floodplain. So in half of the parcels within or touching the floodplain (about 8,000), say for the Fox River watershed area of the County, received an average of $6,100 of damage to the structure and contents in a flood, then total building damage would be about $48.8 million.

There are 52 FEMA repetitive flood properties that particularly vulnerable. As important for FEMA and McHenry County is the fact that over 300 properties have had flood insurance claims paid on them and over 90 properties have been paid two or more flood insurance claims. This means that 38 additional properties have a repeated flood losses.

Estimates range of who should have flood insurance verses those who carry flood insurance. Currently, the FEMA FloodSmart program estimates that "nearly 80 percent of Midwesterners lack financial protection in case of a flood (Source: RAND Corporation)." Assuming that 300 properties represents 20 percent of those who should have flood insurance, then total policies would be 1,500. Then is half the policy holders were flooded times the average claim amount of $6,100, then the exposure would be $4.6 million.

The range of flood damage to building can range from $4.6 to $48.8 million. Impact to buildings due to flooding is considered **high**.

Critical Facilities: Current mapping of critical facilities show that approximately 30 critical facilities are within or within 100 feet of the floodplain. As the County's GIS is expanded, a more accurate count of critical facilities in the floodplain will be developed.

Impact to critical facilities due to flooding is considered **moderate**.

Economic Impact: Flood damage to businesses is difficult to estimate. Businesses that are disrupted by floods often have to be closed. They lose their inventories, customers cannot reach them, and employees are often busy protecting or cleaning up their flooded homes. Business can be disrupted regardless of the business being located in the floodplain when customers and clients cannot reach their location. As with flooded roads, public expenditures on flood fighting, sandbags, fire department calls, clean-up and repairs to damaged public property affect all residents of the County, not just those in the floodplain.

Therefore, overall economic impact to businesses is **high**.

2.4 Severe Summer Storms

2.4.1 Severe Summer Storms Hazard Description

The National Weather Service (NWS) classifies any thunderstorm as severe if it produces one or more of the following elements:

- Winds with gust of 50 knots (58 mph) or greater;

- Hail that is at least ¾ inch in diameter (penny size) or larger; and/or
- Tornado

These severe storms can occur any time of the year, but in the Midwest they are commonly referred to as severe *summer* storms, in part to make a distinction from severe winter storms. Severe summer storms are capable of producing deadly lightning and excessive rainfall that may lead to flash flooding. For the purposes of this Plan, tornadoes and flooding are discussed as separate hazards

Thunderstorms affect relatively small areas when compared to winter storms. The typical thunderstorm is approximately 15 miles in diameter and lasts an average of 30 minutes at a single location. They may occur singly, in clusters or in lines. Despite their size, all thunderstorms are dangerous and capable of threatening life and property. Thunderstorms can bring heavy rain, damaging winds, hail, lightning and tornadoes. Of the estimated 100,000 thunderstorms that occur each year in the United States, roughly 10% are classified as severe.

Building damaged by a microburst, July 7, 1994 storm in Aurora

Source: Aurora Emergency Management

Wind: Aside from tornadoes, thunderstorms can produce straight-line winds. A straight-line wind is a term used to define any wind produced by a thunderstorm that is not associated with rotation. Straight-line winds are responsible for most thunderstorm wind damage. There are several types of straight-line winds including downdrafts, downbursts and microbursts. Straight-line wind speeds can exceed 100 miles per hour (MPH) and can cause damage equivalent to a strong tornado. These winds can also be extremely dangerous for aircraft.

Hail: Hail is precipitation in the form of spherical or irregular-shaped pellets of ice. It forms within a thunderstorm when strong rising currents of air (updrafts) carry raindrops into extremely cold areas of the atmosphere where freezing occurs. As the hail grows in size they become heavier and begin to fall. Depending on the strength of the updraft, the hail may be caught up and re-circulated through the storm clouds growing larger in size. Eventually the hail becomes too heavy to be supported by the thunderstorm's updrafts and falls to the ground. The size of an individual hailstone depends on how many times it was drawn back up into the upper levels of the storm cloud before it finally fell to the ground.

Most thunderstorms do not produce hail, and the ones that do normally produce only small hailstones not much more than half inch in diameter. Hail may be as small as a pea, or under

extreme conditions, as large as a grapefruit or softball. Its size is estimated by comparing it to known objects. Table 2-14 provides descriptions for various hail sizes. Typically hail that is three-quarters of inch in diameter (penny size) or larger is considered severe.

Table 2-14 Hail Size Descriptions

Hail Diameter	Description	Hail Diameter	Description
0.25	Pea	1.75	Golf Ball
0.50	Marble	2.50	Tennis Ball
0.75	Penny	2.75	Baseball
0.88	Nickel	3.00	Tea Cup
1.00	Quarter	4.00	Grapefruit
1.50	Ping Pong Ball	4.50	Softball

Source: NOAA, Storm Prediction Center

Hail annually causes more than $1 billion in damage to property and crops. It damages buildings and homes by perforating holes in roofs and shingles, breaking windows and denting siding and damages automobiles by denting panels and breaking windows. Hail rarely causes any deaths; however, several dozen people are injured each year in the United States.

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

Lightning on average causes 80 fatalities and 300 injuries annually in the United States. Most fatalities and injuries occur when people are caught outdoors in the summer months. In addition, lightning can cause structure and forest fires. Many of the wildfires in the western United States and Alaska are started by lightning. While it is difficult to quantify lightning-related losses, NOAA's National Severe Storms Laboratory estimates that lightning causes $4 to $5 billion in damages each year.

The National Weather Service Weather Forecast Office in Chicago, Illinois is responsible for issuing severe thunderstorm watches or warnings for McHenry County depending on the weather conditions. The following provides a brief description of each type of alert.

Severe Thunderstorm Watch. A severe thunderstorm watch is issued when conditions are favorable for a storm to develop. The watch will tell individuals when and where a severe thunderstorm is likely to occur.

Severe Thunderstorm Warning. A severe thunderstorm warning is issued when severe weather has been reported by spotters or indicated by radar. Warnings indicate imminent danger to life and property for those who are in the path of the storm.

2.4.2 Severe Summer Storms Hazard Analysis

Thunderstorms: The NOAA Storm Events Database and community records show 143 recorded occurrences of thunderstorms and high winds in McHenry County between 1960 and August

31, 2009. Of the 143 recorded occurrences, 113 had wind speeds of 50 knots or greater. Twenty-eight of recorded occurrences of thunderstorms and high winds where the wind speed was not recorded. The location of recorded wind events are presented in Exhibit 2-1. Figures 2-3 and 2-4 chart the recorded occurrences of thunderstorm and high wind events by month and hour. One hundred and sixteen of the 143 events took place between April and August. Eighty-eight of the 143 events took place between 12:00 p.m. and 8:00 p.m.

The data provided by the Storm Events Database indicates that between 1960 and August 31, 2009, 20 thunderstorm & high wind events caused approximately $737,000 in property damage. It should be noted, however, that the property damage total includes $275,000 for two high wind events that represent losses sustained by multiple counties (including McHenry County). A breakdown by county of this total was not available. Damage information was either unavailable or none was recorded for 123 of the recorded occurrences.

Figure 2-3
McHenry County Thunderstorm & High Wind Events by Month – 1960 through 8/31/2009

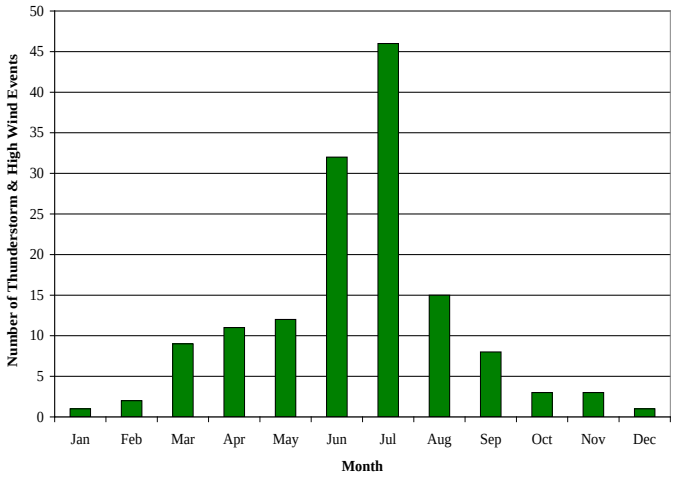
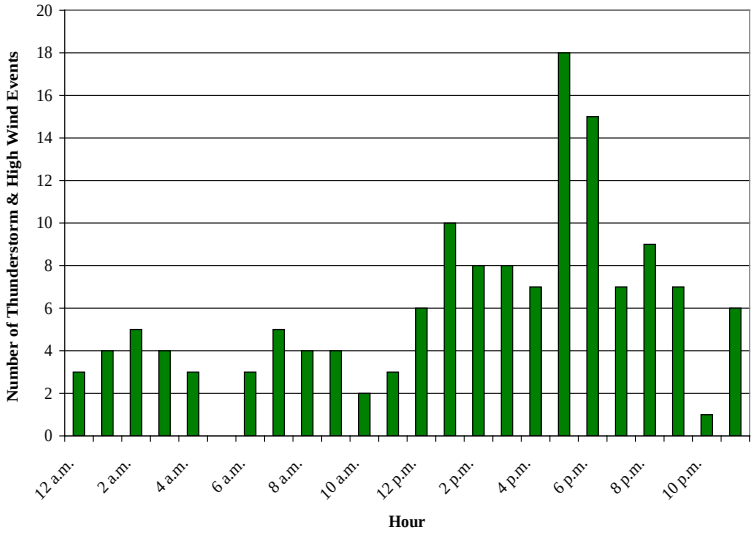


Figure 2-4
McHenry County Thunderstorm & High Wind Events by Hour – 1960 through 8/31/2009



NOAA, National Environmental Satellite, Data & Information Service, National Climatic Data Center, Storm Events Database, Illinois, McHenry County, 2010.

The Storm Events Database has three recorded reports of injury and one recorded report of death from two separate thunderstorm and high wind events. On July 13, 1992 two injuries were recorded in Marengo due to a severe thunderstorm event. On April 7, 2001 a high wind event killed a woman in Algonquin when a 10-inch diameter tree limb fell on her car as she was driving and a little girl was injured when the trampoline she was jumping on was blown 25 feet across the yard.

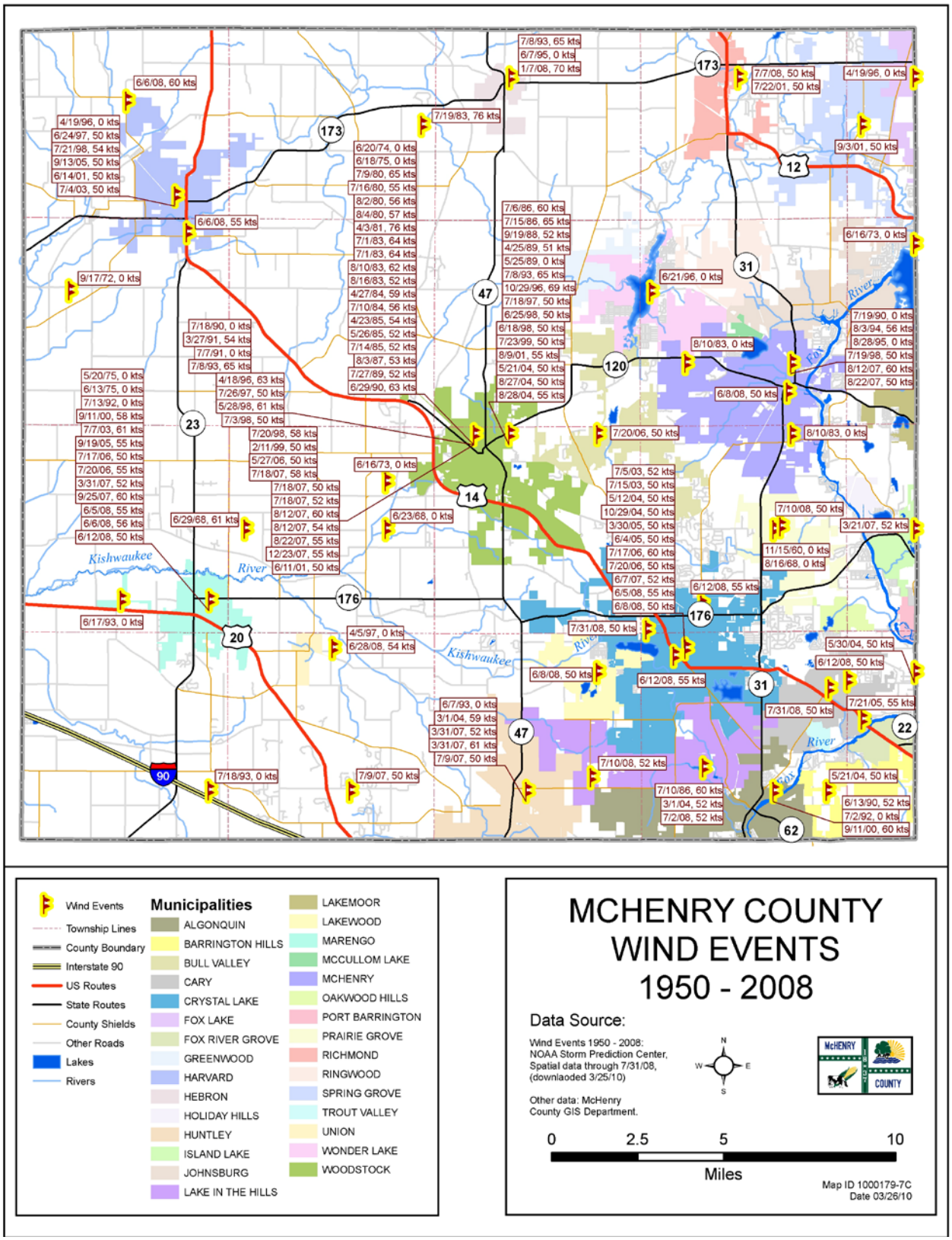


Exhibit 2-1 Recorded McHenry County Wind Events

Hail: The Storm Events Database records show 73 recorded occurrences of hail in McHenry County between 1973 and August 31, 2009. Of the 73 recorded occurrences, 33 produced hailstones one inch or larger in diameter. Figures 2-5 and 2-6 chart the recorded occurrences of hail by month and hour. Fifty-one of the 73 events took place between May and July. Approximately 90% of all hail events occurred during the p.m. hours, with 41 events taking place between 12:00 p.m. and 4:00 p.m. The location and size of the hail event are presented in Exhibit 2-2.

Figure 2-5
McHenry County Hail Events by Month
1973 through 8/31/2009

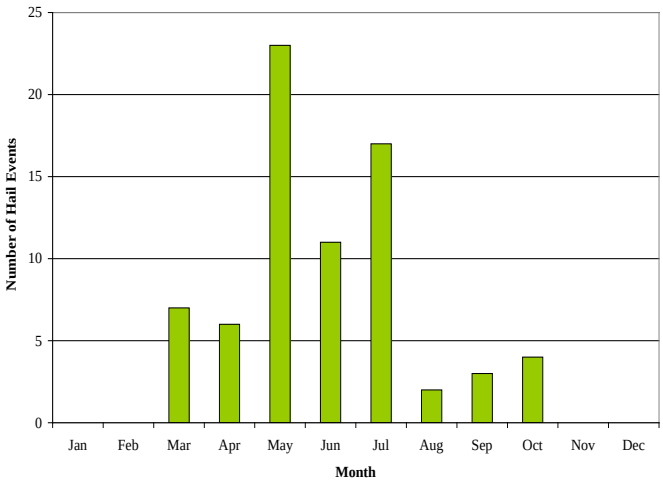
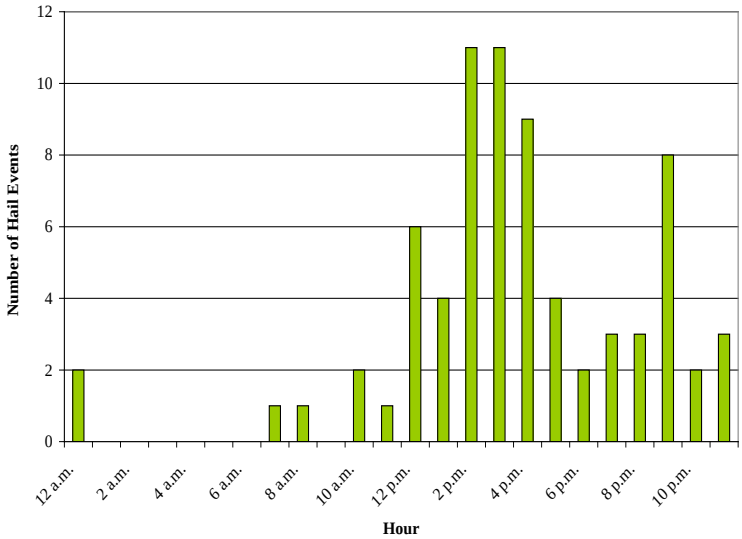


Figure 2-6
McHenry County Hail Events by Hour
1973 through 8/31/2009



NOAA, National Environmental Satellite, Data & Information Service, National Climatic Data Center, Storm Events Database, Illinois, McHenry County, 2010.

The data provided by the Storm Events Database indicates that hail caused approximately $130,000 in property damage between 1973 and August 31, 2009. Of the 73 recorded occurrences, damages were only recorded for three events. On April 13, 2006, hail measuring 1.00 inch in diameter (quarter size) dented a vehicle and siding on a house in Marengo causing $5,000 in property damage. On October 2, 2006, hail measuring 1.5 inches in diameter (ping pong ball size) dented cars and homes in Marengo causing $75,000 in property damage.

On July 2, 2008, hail measuring 1.00 inch in diameter damaged siding on homes in Algonquin causing an estimated $50,000 in property damage. No injuries or deaths were recorded as the result of any of the hail events.

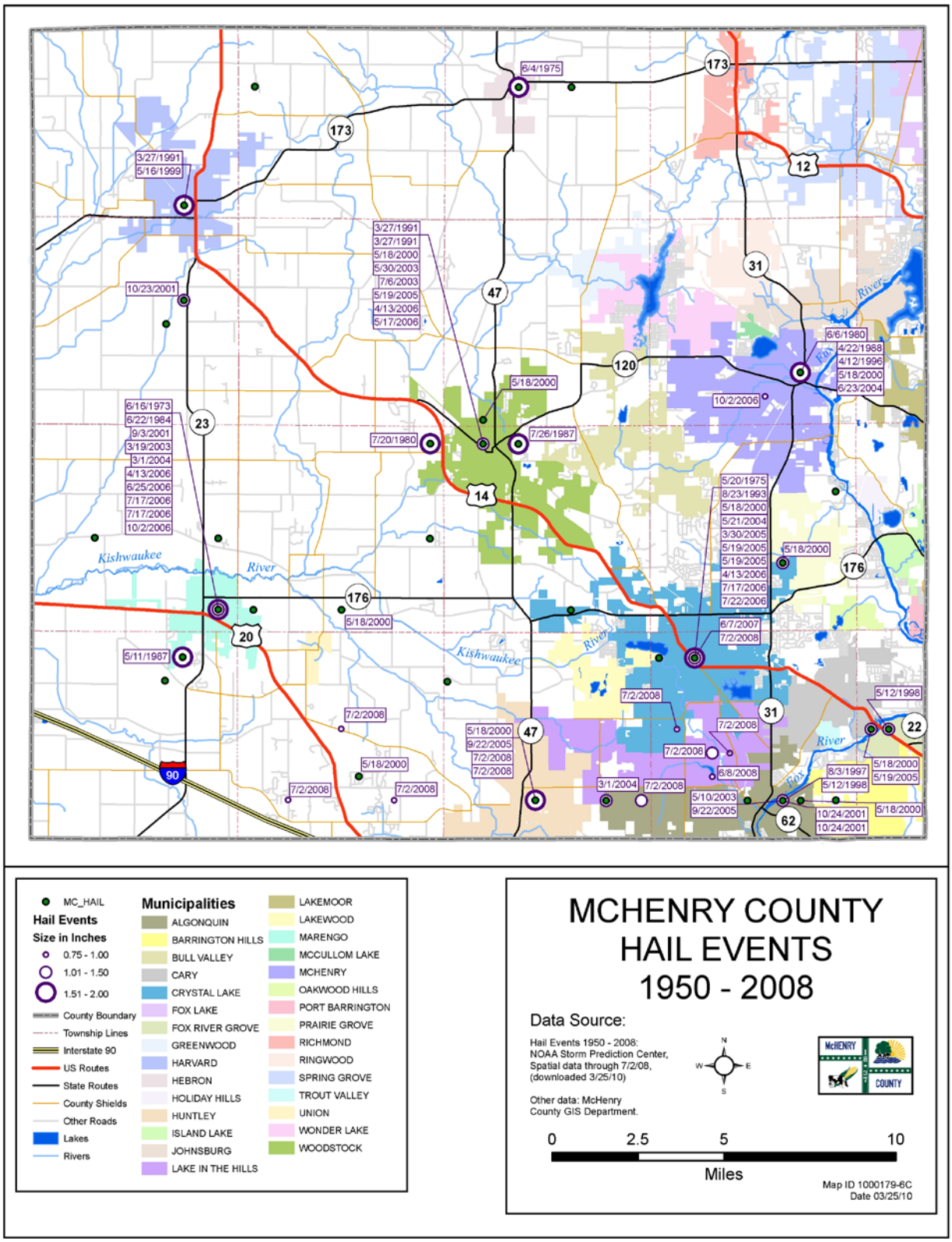


Exhibit 2-2 Recorded McHenry County Hail Events

Lightning: The Storm Events Database records show 12 recorded occurrences of lightning strikes in McHenry County between 1996 and August 31, 2009 (Table 2-15). These 12 recorded occurrences were produced by 11 weather events. There was one weather event that produced two recorded lightning strikes. All 12 events took place between May and October, with three events taking place in July. Approximately 60% of all recorded lightning strikes occurred during the p.m. hours.

The data provided by the Storm Events Database indicates that lightning strikes caused approximately $557,600 in property damage between 1996 and August 31, 2009. Property damages for three of the occurrences totaled $100,000 or more. There was only one occurrence where the amount of the property damage was unknown. No injuries or deaths were reported for any of the occurrences.

Table 2-15 Lightning Events Reported in McHenry County 1996 through August 31, 2009

Date	Time	Location	Injuries	Death	Property Damage	Crop Damage
8/5/1996	11:30 p.m.	Woodstock	0	0	$200,000	$0
5/10/2001	2:45 a.m.	Woodstock	0	0	$1,000	$0
9/3/2001	6:17 p.m.	Marengo	0	0	$10,000	$0
9/7/2001	8:00 a.m.	Harvard	0	0	$0	$0
10/2/2005	NA	Lakewood	0	0	$10,600	$0
5/20/2006	7:04 p.m.	Woodstock	0	0	$1,000	$0
7/17/2006	9:00 p.m.	Crystal Lake	0	0	$20,000	$0
7/9/2007	3:00 p.m.	Marengo	0	0	$100,000	$0
7/9/2007	3:15 p.m.	Lake in the Hills	0	0	$50,000	$0
6/8/2008	10:15 a.m.	Lake in the Hills	0	0	$5,000	$0
8/8/2008	7:30 a.m.	McCullom Lake	0	0	$110,000	$0
6/19/2009	8:14 a.m.	Crystal Lake	0	0	$50,000	$0
Totals:			**0**	**0**	**$557,600**	**$0**

Extent of Hazard and Probability of Future Occurrence: As supported by the recorded storm data, severe summer storms impact all of McHenry County. On average, five severe thunderstorms have occurred each year in the past 20 years. Using the estimation that the average severe storm affects 100 square miles, the odds of any community in McHenry County being impacted by a severe thunderstorm in a given year are nearly 100 percent.

2.4.3 Severe Summer Storms Vulnerability Assessment

In this Plan, severe summer storms are considered to include thunderstorms, hail storms, lightning events, and micro-bursts or high wind events. Though called severe summer storms, they can occur anytime of the year. Severe summer storms are the most frequently occurring natural hazard in McHenry County.

All of McHenry County is vulnerable to severe storms due to the topography and movement of weather fronts through the area. The presence of hail, high winds, rain, and lightning poses the threat of property damage, injury and death. Injuries, crop damage, and building damage have been reported in McHenry County.

Health and Safety: Three injuries and one death have been attributed to severe storms in McHenry County. The threat to life and safety is present with severe summer storms. The National Weather Service reported that between 1995 and 2000, 20 people in Illinois were killed by flash floods, wind and lightning brought by thunderstorms. Before 1990, and average of 89 people were killed in the United States by lightning. Hail rarely causes loss of life.

No special health problems are attributable to thunderstorms, other than the potential for tetanus and other diseases that arise from injuries and damaged property.

Impact to health and safety for severe summer storms is considered **moderate**.

Damage to Buildings and Critical Infrastructure: Damage to roofs is frequently reported as a result of hail events. Depending on the hail size and wind severity, damage to awnings, glass, and siding can also occur. Critical facilities tend to be as vulnerable to severe storm damage as residences.

The critical infrastructure typically of most concern during a severe storm is the electrical supply. Winds, lightning, falling branches and trees can damage substations, transformers, poles, and power lines.

Impact to buildings and critical facilities for severe summer storms is considered **moderate**.

Economic Impact: Communications can be disrupted by lightning. Signal disruptions due to lightning are common. In addition, communication lines, antennas, and towers can suffer damage from lightning and downed branches/trees. However, with the common occurrence of severe summer storms, recovery is relatively quick by utility companies.

Economic impact to low for severe summer storms is considered **low**.

2.5 Severe Winter Storms and Extreme Cold

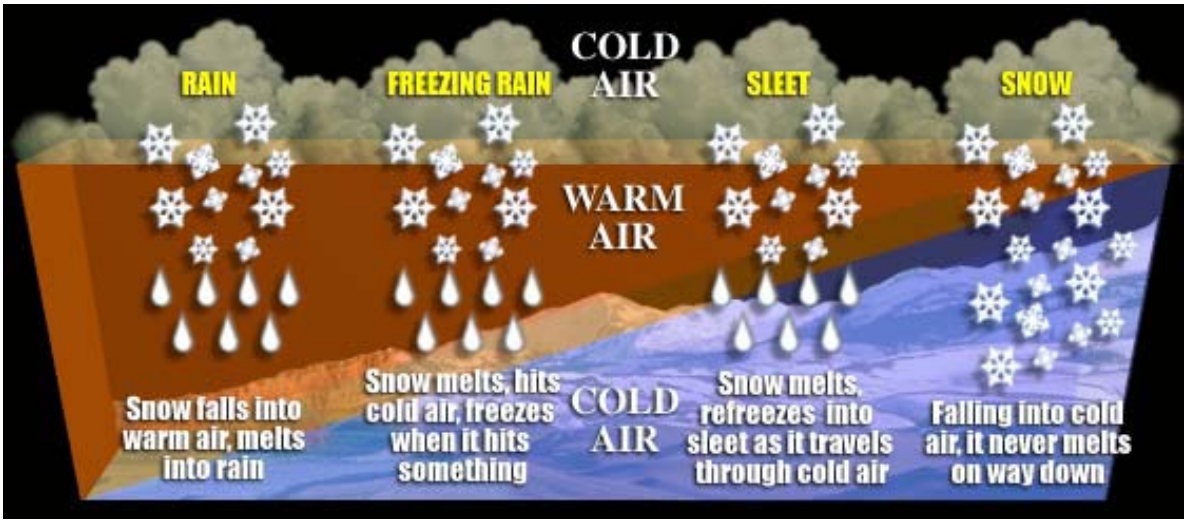
2.5.1 Severe Winter Storms and Extreme Cold Hazard Description

A severe winter storm can range from moderate snow over a few hours to blizzard conditions with blinding wind-driven snow, sleet and/or ice and extreme cold that lasts several days. The amount and extent of snow or ice, air temperature, wind speed and event duration all influence the severity and type of severe winter storm that results. In general there are three types of severe winter storms:

Blizzards: Blizzards are characterized by low temperatures and strong winds of at least 35 miles per hour. In addition to extreme temperatures and life-threatening wind chills, a blizzard is also characterized by falling or blowing snow that reduces visibility to ¼ mile or less for at least three hours. Blizzards are by far the most dangerous of all winter storms.

Heavy Snow Storms: A heavy snow storm is any winter storm that produces six inches or more of snow within a 48 hour period or less.

Ice Storms: Ice storms occur when precipitation (i.e., freezing rain, sleet, etc.) falls to the ground and freezes immediately on impact. Generally in Illinois an ice storm is considered severe if there is an accumulation of ¼ inch or more of freezing rain or ½ inch or more of sleet.



Source: University of Nebraska website, http://hpccsun.unl.edu/nebraska/icestorms.html

Winter Storm Watches, Advisories and Warnings

The National Weather Service Weather Forecast Office in Chicago, Illinois is responsible for issuing winter storm watches and warnings for McHenry County depending on the weather conditions. The following provides a brief description of each type of alert.

Winter Storm Watch. A winter storm watch is issued when severe winter conditions, such as heavy snow, blizzard conditions or significant accumulations of ice, may affect an area within the next 12 to 36 hours.

Advisories. Winter advisories are issued for lesser winter weather events that while presenting an inconvenience, do not pose an immediate threat of death, injury or significant property damage. The following advisories will be issued when an event is occurring, is imminent or has a high probability of occurring.

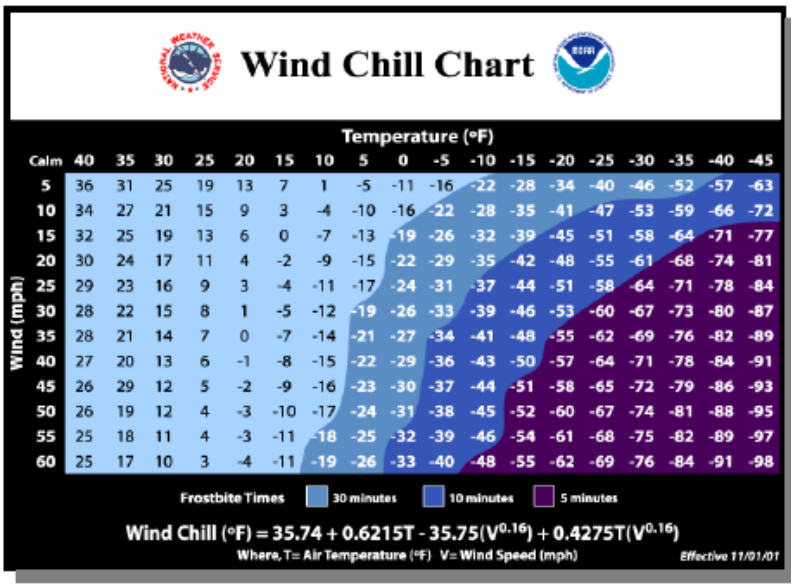
- **Snow Advisory.** A snow advisory is issued for an average snow fall of 3 to 5 inches.
- **Freezing Rain Advisory.** A freezing rain advisory is issued when light freezing rain or freezing drizzle will produce less than ¼ inch of ice accumulation.
- **Sleet Advisory.** A sleet advisory is issued when sleet accumulation are expected to be less than ½ inch.
- **Blowing Snow Advisory.** A blowing snow advisory is issued when sustained winds or frequent gust of 25 to 35 mph are accompanied by falling and blowing snow, occasionally reducing visibility to ¼ mile or less.
- **Winter Weather Advisory.** A winter weather advisory is issued when a combination of two or more of the following events are occurring, imminent or likely: snow, freezing rain or drizzle, sleet or blowing snow.
- **Wind Chill Advisory.** A wind chill advisory is issued when the wind chill values are expected to be between -20°F and -30°F.

Warnings. Winter weather warnings are issued for events that pose a threat to life and/or property. The following warnings will be issued when an event is occurring, is imminent, or has a high probability of occurring.

- **Blizzard Warning.** A blizzard warning is issued when sustained winds or frequent gusts greater than or equal to 35 mph are accompanied by considerable falling and/or blowing snow that frequently reduces visibility to less than ¼ mile for three hours or more. There are no temperature criterion, however, freezing temperatures and 35 mph winds will create sub-zero wind chills.
- **Heavy Snow Warning.** A heavy snow warning is issued when six inches or more of snow is expected to fall within 12 hours or less or when eight inches or more is expected to fall within 24 hours or less.
- **Ice Storm Warning.** An ice storm warning is issued when freezing rain is expected to produce ¼ inch or more of ice accumulation.
- **Heavy Sleet Warning.** A heavy sleet warning is issued when sleet accumulations are expected to be ½ inches or more.
- **Winter Storm Warning.** A winter storm warning is issued when a combination of two or more of the following events are occurring, imminent or likely: heavy snow, freezing rain, sleet and/or strong winds.
- **Wind Chill Warning.** A wind chill warning is issued when wind chill values are expected to be -30°F or below.

If an event is expected to produce only one type of precipitation, say snow, then the warning or advisory will be specific: Heavy Snow Warning or Snow Advisory. If a mixture of precipitation types is expected, say snow and sleet, then the generic Winter Storm Warning or Winter Storm Advisory will be used.

Extreme Cold: The term "extreme cold" can have varying definitions in hazard identification. Generally, extreme cold events refer to a prolonged period of time (days) with extremely cold temperatures. An extreme cold event to the National Weather Service can refer to a single day of extreme or record-breaking day of sub-zero temperatures. Extended or single day extreme cold events can be hazardous to people and animals, and cause problems with buildings and transportation.



Wind Chill Chart

Wind (mph) \ Temperature (°F)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
Calm																		
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	29	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill } (^\circ F) = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Source: NOAA

Wind Chill Index: The Wind Chill Index is a measure of the rate of heat loss from exposed skin caused by the combined effects of wind and cold. As the wind increases, heat is carried away from the body at a faster rate, driving down both the skin temperature and eventually the internal body temperature. Exposures to extreme wind chills can be life threatening. The NOAA's chart above shows the Wind Chill Index as it corresponds to various temperatures and wind speeds. As an example, if the air temperature is 5°F and the wind speed is 10 miles per hour, then the wind chill would be -10°F. As wind chills edge toward -19°F and below, there is an increased likelihood that continued exposure will lead to individuals developing cold-related illnesses.

Frostbite and hypothermia are both extreme cold-related illnesses that result when individuals are exposed to extreme temperatures and wind chills, in many cases, as a result of severe winter storms. The following describes the symptoms associated with each.

- **Frostbite.** During exposure to extremely cold weather the body reduces circulation to the extremities (i.e., feet, hands, nose, cheeks, ears, etc.) in order to maintain its core temperature. If the extremities are exposed, then this reduction in circulation coupled with the cold temperatures can cause the tissue to freeze. Frostbite is characterized by a loss of feeling and a white or pale appearance. At a wind chill of -19°F, exposed skin can freeze in as little as 30 minutes. See medical attention immediately if frostbite is suspected. It can permanently damage tissue and in severe cases can lead to amputation.

- **Hypothermia.** Hypothermia occurs when the body begins to lose heat faster than it can produce it. As a result, the body's temperature begins to fall. If an individual's body temperature falls below 95°F, then hypothermia has set in and immediate medical attention should be sought. Hypothermia is characterized by uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness and exhaustion. Left untreated, hypothermia will lead to death. Hypothermia occurs most commonly at very cold temperatures, but can occur at cool temperatures (above 40°F) if an individual isn't properly clothed or becomes chilled.

2.5.2 Severe Winter Storms Hazard Analysis

The Storm Events Database records show 37 recorded occurrences of severe winter storm and extreme cold events in McHenry County between 1994 and August 31, 2009 (Table 2-16). Of the 37 recorded occurrences, there were 24 snow events, ten extreme cold events, two ice and sleet events and one event that was a combination of ice, sleet and snow. At least one severe winter storm has every year since 1994, except for 2001. Despite such a short record of severe winter storms in the Storms Event Database, it is known that numerous other severe winter storm events occurred in McHenry County, and most likely to the same frequency as indicated by the available record.

There were no property damage estimates available for any of the 37 events. Two deaths were reported as a result of two separate extreme cold events. On January 20, 1997 a man died while clearing snow and on January 24, 2009 a young man died from hypothermia after walking away from his car which had gotten stuck in a snow drift. Certainly, numerous injuries for McHenry County residents can be associated with severe winter storms and extreme cold events, but nearly all go unreported.

Figures 2-7 and 2-8 chart the recorded occurrences of severe winter storm and extreme cold events by month and hour. Twenty-five of the 37 events took place in December and January. Also, the three State winter storm disaster declarations for McHenry County, shown in Table 2-1, were declared in the month of January. Approximately 57% of all severe winter storm and extreme cold events began during the p.m. hours.

Severe winter storms have immobilized portions of the County, blocking roads, and downing power lines, trees, and branches. Severe winter storms lead to school and business closures.

Extent of Hazard and Probability of Future Occurrence: Severe winter storms affect the entire County. The probability of future occurrence is 100 percent.

Table 2-16 Severe Winter Storm & Extreme Cold Events Reported in McHenry County 1994 through August 31, 2009

Beginning Date	Event	Description
January 26, 1994	Ice Storm	ice accumulations ranged from ¼" to ½" then followed by heavy rain
December 6, 1994	Winter Storm	6" – 10" snow
January 18, 1995	Heavy Snow	≤ 6" heavy, wet snow; blowing & drifting snow
December 8, 1995	Winter Storm	2" – 4" snow; strong winds; blowing & drifting snow; low temperatures & very low wind chills
February 2, 1996	Extreme Cold	record low temperatures (-2°F to -24°F)
January 10, 1997	Extreme Cold	
January 15, 1997	Winter Storm	4" – 6" snow; low temperatures & very low wind chills; blowing & drifting snow
January 8, 1998	Heavy Snow	4" – 8" snow
January 1, 1999	Heavy Snow	9" – 15" snow; blowing snow
February 18, 2000	Heavy Snow	5" – 12" snow; blowing & drifting snow
January 30, 2002	Winter Storm	6" – 10" snow
March 2, 2002	Winter Storm	6" – 11" snow
January 23, 2003	Extreme Cold/Wind Chill	low temperatures (0°F to -5°F) & very low wind chills (-20°F to -25°F)
March 4, 2003	Winter Storm	5" – 7" snow
January 29, 2004	Extreme Cold/Wind Chill	low temperatures (-5°F to -10°F) & very low wind chills (-20°F to -34°F)
January 4, 2005	Heavy Snow	6" – 12" snow
		10" – 11" snow
January 21, 2005	Heavy Snow	
January 20, 2006	Winter Storm	6" – 9" snow
February 18, 2006	Extreme Cold/Wind Chill	low temperatures (3°F to -11°F) & very low wind chills (-30°F to -35°F)
November 30, 2006	Winter Storm	10" – 15" snow
February 3, 2007	Extreme Cold/Wind Chill	low temperatures (5°F to -10°F) & very low wind chills (-20°F to -30°F)
February 25, 2007	Winter Storm	3" – 5" snow; ½" sleet & ice accumulation; strong wind creating blizzard conditions
December 1, 2007	Ice Storm	¼" ice accumulation; mix of snow & sleet changed to freezing rain
December 4, 2007	Winter Storm	approx. 6" snow
December 15, 2007	Heavy Snow	6" – 8" snow
January 31, 2008	Winter Storm	6" – 10" snow
February 5, 2008	Winter Storm	12" – 14" snow
February 10, 2008	Extreme Cold/Wind Chill	low temperatures (-5°F to -10°F) & very low wind chills (-25°F to -35°F)
February 25, 2008	Winter Storm	6" – 7" snow
March 21, 2008	Winter Storm	6" – 7" snow
December 19, 2008	Winter Storm	6" – 9" snow
December 21, 2008	Extreme Cold/Wind Chill	low temperatures (-5°F to -10°F) & very low wind chills (-35°F)
January 9, 2009	Winter Storm	8" – 9" snow
January 15, 2009	Extreme Cold/Wind Chill	low temperatures (-15°F to -20°F) & very low wind chills (-30°F to -45°F)
January 24, 2009	Extreme Cold/Wind Chill	low temperatures (0°F to -5°F)
March 28, 2009	Winter Storm	approx. 7" heavy wet snow

Figure 2-7
McHenry County Severe Winter Storm & Extreme Cold Events by Month
1994 through 8/31/2009

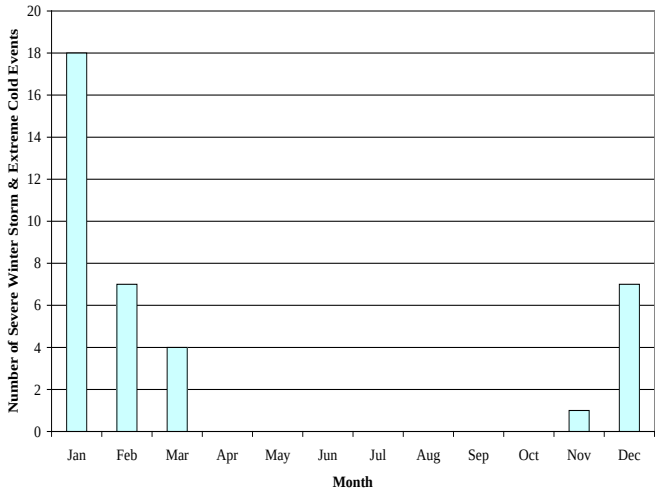
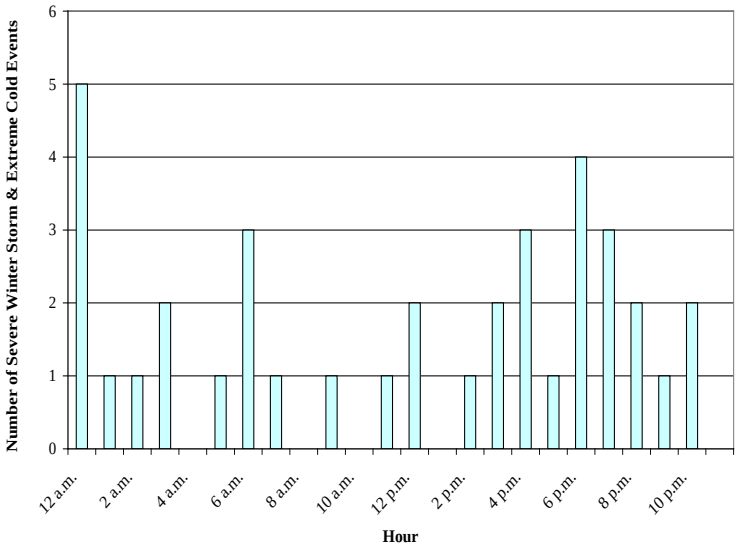


Figure 2-8
McHenry County Severe Winter Storm & Extreme Cold Events by Hour
1994 through 8/31/2009



NOAA, National Environmental Satellite, Data & Information Service, National Climatic Data Center, Storm Events Database, Illinois, McHenry County, 2010.

2.5.3 Severe Winter Storms Vulnerability Assessment

All of McHenry County is vulnerable to severe winter storms. Severe winter storms can lead to power outages, downed trees and branches, hypothermia, injuries and loss of life. Climate data maintained by the Illinois State Water Survey indicates that between 1900 and 2000, Illinois can expect to receive a six inch or more snowfall within a 48 hour period at least twice a year. In Illinois, severe winter storm losses since 1950 average an estimated $102 million, annually. Severe weather storms can immobilize large areas with rural areas being particularly impacted by impassable roads.

Health and Safety: Health hazards related to walking and snow removal are frequent and life-threatening. Falls, particularly to the elderly, can result in serious injury including fractures, broken bones, and shattered hips. Middle-aged and older adults are susceptible to heart attacks from shoveling snow. An average of six deaths per year are attributable to winter storms in Illinois.

While vehicular accidents are often caused by the driver's lapse in judgment, the weather and its impact on roads are also a major factor. Blowing snow, ice and slush create slippery

pavement making vehicle travel less safe during and immediately following winter storms. The injuries and deaths that occur when winter storm are present could be reduced through mitigation. While road surfaces can become unsafe as a result of winter road conditions anywhere in McHenry County, crash statistics from the Illinois Department of Transportation for the five year period from 2004 through 2008 were evaluated to determine the number of accidents that occur. The results in Table 2-17 suggest that winter driving conditions should be taken seriously in McHenry County.

Table 2-17 Vehicle Crashes During Winter

	Road Conditions			
Year	**Ice**	**Snow/Slush**	**Injuries**	**Deaths**
2008	371	1,124	307	4
2007	259	915	288	6
2006	93	292	76	3
2005	177	611	141	1
2004	171	486	152	2
Total	1,071	4,392	964	16

Source: IDOT

While most injuries caused by snow and ice storms result from vehicle accidents, about 25 percent of all winter storm injuries occur to people caught outside in a storm. The effect of cold on people is magnified by wind. As the wind increases, heat is carried away from the body at an accelerated rate, driving down body temperature. Frostbite (damage to tissue) to hands, feet, ears, and nose, and hypothermia (lowering of body temperature below 95 F) are common winter storm injuries.

Impact to health and safety for severe winter storms is considered **moderate**.

Damage to Buildings and Critical Infrastructure: Information gathered from residents of McHenry County indicates snow and ice accumulations on communication, power lines, and key roads pose the most frequent infrastructure problems. Accumulations on above-ground electrical lines often create power outages. These power outages vary from several hours to several days.

Dangerous driving conditions frequently occur during and shortly after severe winter storms. State and county roads in McHenry County that experience repeated drifting result in road closures and greater susceptibility to accidents. When transportation is disrupted, schools close, emergency services are delayed, some businesses close, and some government services are delayed.

There is a financial cost to road departments. An average snow storm is defined as requiring 12 hours of work each day for two days, consuming approximately 40 tons of road salts, and 600 gallons of fuel to maintain County roads in McHenry County. Highway departments and road district budget for snow removal, but budgets can easily be exceeded.

Impact to buildings and critical facilities for severe winter storms is considered **moderate**.

Economic Impact: Loss of power means businesses and manufacturing concerns must close down. Loss of access due to snow or ice covered roads has a similar effect. There are also impacts when people cannot get to work, to school, or to the store.

Economic impact to low for severe winter storms is considered **low**.

2.6 Tornado

2.6.1 Tornado Hazard Description

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

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

Tornado Alerts

The National Weather Service Weather Forecast Office in Chicago, Illinois is responsible for issuing tornado watches or warnings for McHenry County depending on the weather conditions. The following provides a brief description of each type of alert.

- **Tornado Watch.** A tornado watch is issued when conditions are favorable for a tornado and other kinds of severe weather to develop in the next several hours. It does not mean that a tornado is imminent, just that individuals need to be alert and prepared.
- **Tornado Warning.** A tornado warning is issued when a tornado has been spotted or indicated by radar. Warnings indicate imminent danger to life and property for those who are in the path of the tornado. Individuals should see shelter immediately.

Tornadoes are rated using the Enhanced Fujita Scale, which measures the intensity of a tornado based on its wind speed and the damage sustained by structures and vegetation. The Enhanced Fujita Scale, shown below, identifies six different categories of tornadoes, EF0 through EF5. Prior to 2007, the NWS used the Fujita Scale. Most of the historical data available on McHenry County tornadoes is based on the original Fujita Scale.

Enhanced Fujita Scale

Enhanced Fujita Scale*			Original Fujita Scale	
	Derived EF Scale	Operational EF Scale		
Enhanced Fujita Scale	3 Second Gust (mph)	**3 Second Gust (mph)**	Fujita Scale	3 Second Gust (mph)
EF0	65 - 85	**65 - 85**	F0	45 - 78
EF1	86 - 109	**86 - 110**	F1	79 - 117
EF2	110 - 137	**111 - 135**	F2	118 - 161
EF3	138 - 167	**136 - 165**	F3	162 - 209
EF4	168 - 199	**166 - 200**	F4	210 - 261
EF5	200 - 234	**>200**	F5	262 - 317

* Effective February 1, 2007

Fujita Tornado Scale (Magnitude)

F0 Gale tornado 40-72 mph, chimney damage, tree branches broken

F1 Moderate tornado 73-112 mph, mobile homes pushed off foundations or overturned

F2 Significant tornado 113-157 mph, considerable damage, mobile homes demolished, trees uprooted

F3 Severe tornado 158-206 mph, roofs and walls torn down, trains overturned, cars thrown around

F4 Devastating tornado 207-260 mph, well-constructed walls leveled

F5 Incredible tornado 261-318 mph, homes lifted off foundation and carried considerable distances, autos carried as far as 100 meters

Tornadoes are classified as F0 through F5, based on wind speed and damage.

Source: NOAA, Storm Prediction Center

The destruction caused by a tornado may range from light to catastrophic depending on the intensity, size and duration of the storm. Tornado damage may include crop and property damage, power outages, environmental degradation, injury and death. Tornadoes are known to blow off roofs, move cars and tractor trailers and demolish homes. Typically tornadoes cause the greatest damage to structures of light construction, such as residential homes.

In 1999, FEMA conducted an extensive damage survey of residential and non-residential buildings in Oklahoma and Kansas following an outbreak of tornadoes on May 3, 1999, which killed 49 people. The assessment found:

- The failure for many residential structures occurred where the framing wasn't secured to the foundation, or when nails were used as the primary connectors between the roof structure and the walls. A home in Kansas, for example, was lifted from its foundation. The addition of nuts to the foundation anchor bolts (connected to the wood framing) may have been all that was needed to prevent this.
- Roof geometry also played a significant role in a building's performance.
- Failure of garage doors, commercial overhead doors, residential entry doors or large windows caused a significant number of catastrophic building failures.
- Manufactured homes on permanent foundations were found to perform better than those that were not on solid foundation walls.

2.6.2 Tornado Hazard Analysis

Illinois is located in the northwest portion of "tornado alley," the area of the United States most prone to tornado activity. Since 1950, Illinois has averaged 36 tornadoes annually. Over 60% of the tornadoes in Illinois occur between April-June, with occasional spikes occurring in late September and late December, but this natural hazard can occur at any time during the year. Illinois averages four tornado fatalities annually, but this number varies widely from year to year.

Table 2-18 summarizes the previous occurrences as well as the extent or magnitude of tornado events recorded in McHenry County. The Storm Events Database records show 14 recorded occurrences of tornadoes in McHenry County between 1958 and August 31, 2009. Of the 14 recorded occurrences, three were classified as F4 tornadoes, four were classified as F2 tornadoes, one was classified as an F1 tornado, four were classified as F0 tornadoes, one was classified as an EF2 tornado and one was classified as an EF1 tornado. These 14 recorded tornadoes were produced by 13 weather events. There was one weather event where two tornadoes were produced. The paths of the recorded tornadoes are shown in Exhibit 2-3.

Table 2-18 Tornadoes Reported in McHenry County
1958 through August 31, 2009

Date	Time	Location	Magnitude	Injuries	Deaths	Property Damage
10/9/1958	12:26 a.m.	Pistakee Highlands*	F2	0	1	$2,500,000
10/8/1959	3:30 p.m.	Lakemoor*	F2	1	0	$250,000
4/19/1963	5:45 p.m.	Prairie Grove*	F2	0	0	$250,000
4/11/1965	3:20 p.m.	Lakewood / Crystal Lake	F4	75	6	$1,500,000
4/21/1967	4:05 p.m.	Woodstock*	F4	40	0	$25,000,000
4/21/1967	5:00 p.m.	Algonquin / Fox River Grove	F4	100	1	$2,500,000
6/15/1973	5:00 p.m.	Marengo	F0	0	0	$0
6/16/1973	2:25 p.m.	Harvard	F0	0	0	$0
8/15/1978	7:45 p.m.	Lake in the Hills	F2	0	0	$250,000
7/6/1986	6:20 p.m.	Crystal Lake / Lakemoor	F0	0	0	$0
4/29/1991	7:30 p.m.	Marengo*	F0	0	0	$0
5/19/1996	11:00 p.m.	Union	F1	0	0	$0
1/7/2008	3:39 p.m.	Harvard*	EF2	1	0	$2,000,000
6/19/2009	6:10 p.m.	Woodstock*	EF1	0	0	$75,000
			Totals:	**217**	**8**	**$34,325,000**

*

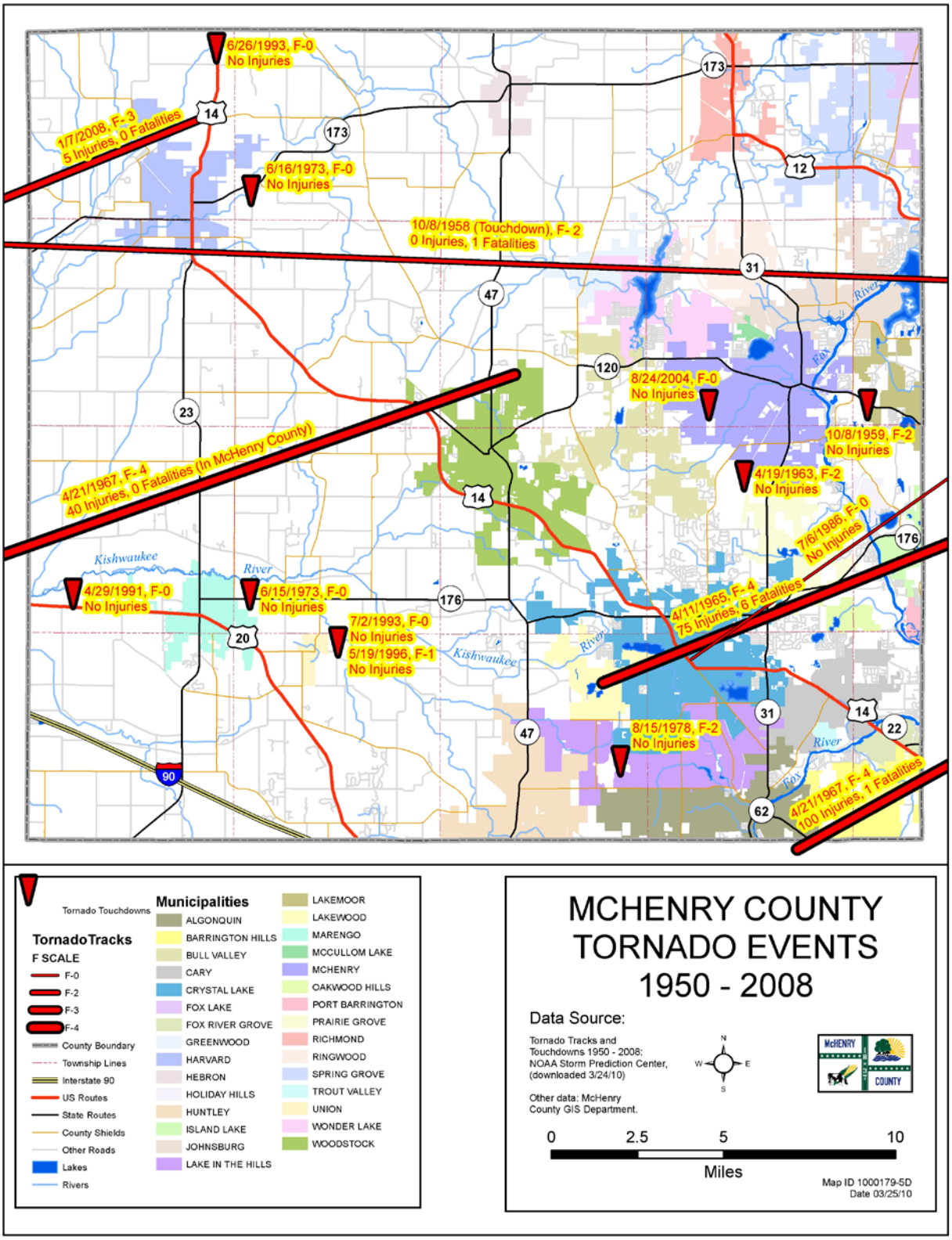


Exhibit 2-3 Recorded McHenry County Tornado Events

Figures 2-9 and 2-10 chart the recorded occurrences of tornado events by month and hour. Eleven of the 14 events took place between April and September, with five of the events taking place in April. Approximately 93% of all tornadoes occurred during the p.m. hours, with 12 of the 14 events taking place between 2:00 p.m. and 7:00 p.m.

Figure 2-9
McHenry County Tornadoes by Month
1958 through 8/31/2009

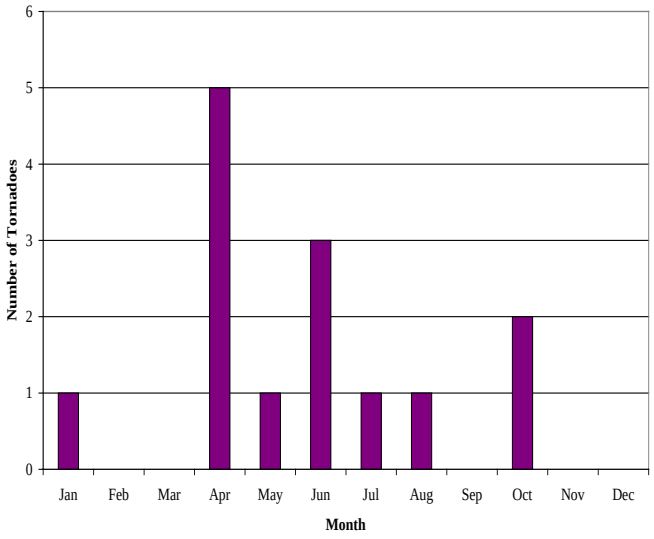
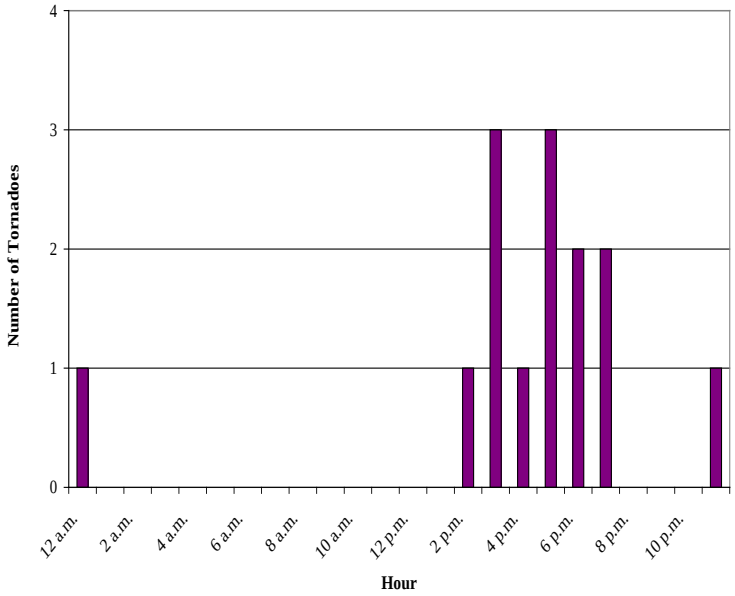


Figure 2-10
McHenry County Tornadoes by Hour
1958 through 8/31/2009



NOAA, National Environmental Satellite, Data & Information Service, National Climatic Data Center, Storm Events Database, Illinois, McHenry County, 2010.

The data provided by the Storm Events Database indicates that tornadoes caused approximately $34,325,000 in property damage between 1958 and August 31, 2009. Property damages for five of the occurrences totaled $1,500,000 or more. There were, however, five occurrences where the amount of the property damage was unknown.

Two hundred and seventeen injuries and eight deaths were reported as a result of six separate incidents. Detailed information is only available for two of the incidents. On April 11, 1965 an F4 tornado formed approximately three miles from the center of Crystal Lake. The tornado moved northeast destroying a shopping mall and the large subdivision of Coventry. Six deaths and 75 injuries were reported as a result of this tornado, and a federal disaster declaration was declared.

The April 1967 tornado also led to a federal disaster declaration for McHenry County. Forty injuries and $25 million in damages were reported.

On January 7, 2008 an EF2 tornado formed in Boone County and crossed into McHenry County approximately four miles west of Harvard. The tornado moved northeast flipping over a semi-trailer at a truck stop weigh station on Highway 14 and injuring the driver. The tornado also derailed cars on a freight train travelling east through the County near Harvard. The derailment created a hazardous materials incident.

Extent of Hazard and Probability of Future Occurrence: Tornadoes affect the entire County. With only 14 tornadoes recorded in the last 50 years, it could be assumed that a tornado is only likely every about once every three years. However, other tornados could have gone unrecorded, and any future tornado is McHenry County's largest concern for injury and loss of life. All communities in McHenry County are subject to the dangers presented by tornadoes. Odds of a tornado occurring each year are 100 percent; the odds of a tornado causing damage are less that 100 percent, but still very high.

2.6.3 Tornado Vulnerability Assessment

All of McHenry County is vulnerable to tornadoes. Past tornadoes have been deadly and have led to disaster declarations in McHenry County. The potential for loss of life and significant property damage in growing in McHenry County as the population and number of buildings increases.

Health and Safety: Vulnerability to residents and buildings is as the county grows in population and building counts. Eight deaths and 217 injuries have been attributed to tornadoes in McHenry County. On average, Illinois experiences 4 tornado–related deaths each year. Based on tornado history in Illinois, advanced warning and taking appropriate shelter appears to be the best mitigation method for preventing death and injury.

Residents living in mobile homes are more vulnerable than people in permanent homes. People can inadvertently put their lives in danger during a tornado, or have little or no warning.

Impact to health and safety for severe winter storms is considered **high**.

Damage to Buildings: Buildings and infrastructure located above-ground in the path of a tornado usually suffers extensive damage if not complete destruction. Although some buildings adjacent to a tornado's path can stand with little or no damage, debris hurled by the wind makes all buildings vulnerable to damage. Although tornadoes strike at random, making all buildings vulnerable, three types of structures are more likely to suffer damage:

- Mobile homes,
- Homes on crawlspaces (more susceptible to lift), and
- Buildings with large spans, such as airplane hangars, gymnasiums and factories.

To assess this potential for building damage, several tornado scenarios have been developed and presented below. The assessment uses the population and asset information presented in Section 2.2 of the Chapter. The scenarios assume a tornado damage area of 5 square miles.

1. Countywide average building density:

   5 mi^2 x 175 houses/mi^2 = 875 homes damaged
   875 homes x $207,000 per home x 50% of value damaged = $90.6 million

For a 10 square mile area the County's average exposure to tornado damage would be $181 million.

2. Rural area average building density:

   5 mi^2 x 30 houses/mi^2 = 150 homes damaged
   150 homes x $207,000 per home x 50% of value damaged = $15.5 million

For a 10 square mile area the County's average exposure to tornado damage would be $30 million.

3. Urban average building density:

   5 mi^2 x 372 houses/mi^2 = 1,860 homes damaged
   1,860 homes x $207,000 per home x 50% of value damaged = $192.5 million

For a 10 square mile area the County's average exposure to tornado damage would be $385 million.

4. Algonquin Township:

   5 mi^2 x 657 houses/mi^2 = 3,285 homes damaged
   3,285 homes x $207,000 per home x 50% of value damaged = $340 million

For a 10 square mile area the County's average exposure to tornado damage would be $680 million.

Impact to buildings due to tornadoes is considered **high**.

Damage to Critical Facilities: Because a tornado can hit anywhere in the County, all categories of critical facilities are susceptible to being hit. Schools are a particular concern for two reasons:

- They have large numbers of people present, either during school or as a storm shelter, and
- They have large span areas, such as gyms and theaters.

The 1990 Plainfield tornado was an unfortunate example of this. It struck the Plainfield High School, Grand Prairie Elementary School, St. Mary Immaculate Church and the gymnasium to the Church's elementary school. Cost to repair the two public schools was estimated at up to $35 million. The cost for the church and its school was $5 million.

Large span buildings were also affected in 1990. In addition to the schools and their gyms, hangers at the Aurora airport and Joliet's Essington Road Fire Station were damaged. At this time, it is unknown which critical facilities in McHenry County may have large span structures.

Impact to critical facilities for tornadoes is **moderate.**

Economic Impact: The major impact of a tornado on the local economy is damage to businesses and infrastructure. A heavily damaged business, especially one that was barely making a profit, often has to be closed. The post-disaster damage report stated that at least 50 businesses were destroyed by the 1990 tornado.

Infrastructure damage is usually limited to above ground utilities, such as power lines.

Damage to roads and railroads is also localized. If it can't be repaired promptly, alternate transportation routes are usually available. Public expenditures include search and rescue, shelters, and emergency protection measures. The large expenses are for repairs to public facilities and clean-up and disposal of debris. Most public facilities are insured, so the economic impact on the local treasury may be small.

Clean-up and disposal can be a larger problem, especially with limited landfill capacity near the damage site.

Economic impact due to tornadoes is considered **moderate.**

2.7 Extreme Heat

2.7.1 Extreme Heat Hazard Description

Extreme heat is characterized by temperatures that hover 10 degrees or more above the average high temperature of a region for several days to several weeks. In comparison, a heat wave is generally defined as a period of at least three consecutive days above 90°F.

Extreme heat events are usually a result of both high temperatures and high relative humidity. (Relative humidity refers to the amount of moisture in the air.) The higher the relative humidity or the more moisture in the air, the less likely that evaporation will take place. This becomes significant when high relative humidity is coupled with soaring temperatures. On hot days the human body relies on the evaporation of perspiration or sweat to cool and regulate the body's internal temperature. Sweating does nothing to cool the body unless the water is removed by evaporation. When the relative humidity is high, then the evaporation process is hindered, robbing the body of its ability to cool itself.

On average, more than 1,500 people die in the United States each year from extreme heat. This number is greater than the 30-year mean annual number of deaths due to tornadoes, hurricanes, floods and lightning combined. In an effort to raise the public's awareness of the hazards of extreme heat, the National Weather Service has devised the "Heat Index".

Heat Index: The Heat Index, sometimes referred to as the "apparent temperature", is a measure of how hot it feels when relative humidity is added to the actual air temperature. Table 2-12 shows the Heat Index as it corresponds to various air temperatures and relative humidity. As an example, if the air temperature is 96°F and the relative humidity is 65%, then the Heat Index would be 121°F. It should be noted that the Heat Index values were devised for shady, light wind conditions.

Heat Alerts

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

- **Excessive Heat Outlook.** An excessive heat outlook is issued when the potential exists for an excessive heat event to occur within the next three to seven days.
- **Excessive Heat Watch.** An excessive heat watch is issued when conditions are favorable for an excessive heat event to occur within the next 12 to 48 hours.
- **Excessive Heat Advisory (northern Illinois).** An excessive heat advisory is issued when the heat index is expected to be between 105°F and 110°F, with a minimum temperature of 75°F or higher for two or more consecutive days.
- **Excessive Heat Warning (northern Illinois).** An excessive heat warning is issued when the heat index is expected to equal or exceed 110°F and the minimum temperature is 75°F for two or more consecutive days.

Exposure to full sunshine can increase Heat Index values by up to 15°F. Also strong winds, particularly with very hot, very dry air, can be extremely hazardous. When the Heat Index reaches 105°F or greater, there is an increased likelihood that continued exposure and/or physical activity will lead to individuals developing severe heat disorders, particularly those in higher risk groups. Generally, when the heat index is expected to exceed 105°F, the National Weather Service will initiate extreme or excessive heat alert procedures.

Heat Disorders: Heat disorders are a group of illnesses caused by prolonged exposure to hot temperatures and are characterized by the body's inability to shed excess heat. These disorders develop when the heat gain exceeds the level the body can remove or if the body cannot compensate for fluids and salt lost through perspiration. In either case the body loses its ability to regulate its internal temperature. All heat disorders share one common feature: the individual has been overexposed to heat, or over exercised for their age and physical condition on a hot day. The following describes the symptoms associated with the different heat disorders.

- **Sunburn.** Sunburn is characterized by redness and pain of skin exposed too long to the sun without proper protection. In severe cases it can cause swelling, blisters, fever and headaches. It can significantly retard the skin's ability to shed excess heat.

Heat Index Chart

Relative Humidity (%) \ Temperature (°F)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Source: National Weather Service

- **Heat Cramps.** Heat cramps are characterized by heavy sweating and painful spasms, usually in the muscles of the legs and possibly the abdomen. The loss of fluid through perspiration leaves the body dehydrated resulting in muscle cramps. This is usually the first sign that the body is experiencing trouble dealing with heat.

- **Heat Exhaustion.** Heat exhaustion is characterized by heavy sweating, weakness, nausea, exhaustion, dizziness and faintness. Breathing may become rapid and shallow and the pulse weak. The skin may appear cool, moist and pale. Blood flow to the skin increases, causing blood flow to decrease to the vital organs. This results in a mild form of shock. If not treated, the victim's condition will worsen.

- **Heat Stroke (Sunstroke).** Heat stroke is life-threatening condition characterized by a high body temperature (106°F or higher). The skin appears to be dry and flushed with very little perspiration present. The individual may become mentally confused and aggressive. The pulse is rapid and strong. There is a possibility that the individual will faint or slip into unconsciousness. If the body is not cooled quickly, then brain damage and death may result.

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

Relationship between Heat Index and Heat Disorders

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

Source: NOAA

2.7.2 Extreme Heat Hazard Analysis

Table 2-19 summarizes the previous extreme heat occurrences as well as the extent or severity of extreme heat events in McHenry County. The Storm Events Database records show three recorded extreme heat events in McHenry County between 1995 and August 31, 2009. All of the extreme heat events recorded occurred in July and lasted between four and five days.

Heat-related deaths were reported for all three extreme heat events. However, in two of the three events, the heat-related deaths reported did not occur in McHenry County. The deaths reported took place in Lake, Grundy, Kane, Winnebago, Will and Cook Counties. In the case of

the third event which covered seven counties, information on the location(s) of the heat-related deaths was not available.

Table 2-19 Extreme Heat Events Reported in McHenry County 1995 through August 31, 2009

Date	Temperature (°F)	Heat Index (°F)	Regional Impact*
July 12-16, 1995	Middle to upper 90s	High of 125°F	583 heat-related deaths; roads buckling and power outages
July 21-25, 1999	Lower to middle 90s	103°F – 111°F	13 heat-related deaths
July 28-31, 1999	Upper 90s to 100°F	105°F – 120°F	99 heat-related deaths

*Deaths occurred in other counties; no reported deaths in McHenry County
Source: NOAA

Extent of Hazard and Probability of Future Occurrence: Extreme heat events affect the entire County. All communities in McHenry County are vulnerable to the dangers presented during an extreme heat event. Three extreme heat events occurred in the course of two years, then no events for ten years. The odds of an extreme event happening in any year are about 50%.

2.7.3 Extreme Heat Vulnerability Assessment

In Illinois, vulnerability to extreme heat has primarily impacted the elderly and persons with pre-existing health problems who live in high-rise buildings or other housing with inadequate ventilation or cooling systems. Since these housing conditions are not prevalent in McHenry County, extreme heat is considered a lower priority hazard. If land-use changes elevate the risk from extreme heat, a vulnerability analysis can be conducted when this Plan is updated.

Health and Safety: McHenry County, like most areas of the Midwest, is very vulnerable to extreme heat. Urban areas are exposed more acutely to the dangers of extreme heat due to heat being retained in asphalt and concrete and being released at night. This effect brings little relief to the area even in the nighttime. People are at risk for heat stroke or sun stroke, heat exhaustion, and dehydration. Children and the elderly are most at risk. Loss of life is common with extreme heat events.

Impact on people due to extreme heat is **high**.

Damage to Buildings: Heat and drought have little or no impact on structures. Impact on buildings is **low**.

Damage to Critical Facilities: Extreme heat can have an impact on the demand on electric utilities, otherwise the impact to critical facilities due to extreme heat is **low**.

Economic Impact: Economic impact of extreme heat is **low**.

2.8 Drought

2.8.1 Drought Hazard Description

While there is no universally accepted definition of drought, it can generally be defined as a period of unusually persistent dry weather that continues long enough to cause serious problems such as crop damage and/or water supply shortages. A drought may also be defined as the cumulative deficit of precipitation relative to what is normal for a region over an extended period of time, usually a season or more. There are effectively four types of drought, differentiated based on the use and need for water.

Meteorological Drought: Meteorological drought is a period of well-below-average precipitation that spans a few months to a few years.

Agricultural Drought: An agricultural drought is a period when soil moisture no longer meets the needs of a particular crop to germinate and grow.

Hydrological Drought: Hydrological drought is a period when surface and subsurface water supplies (i.e., streams, lakes, aquifers, etc.) drop below normal levels.

Socioeconomic Drought: Socioeconomic drought is a period when water shortages begin to affect people when there is not enough water to meet human and environmental needs.

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. It is generally difficult to pinpoint the beginning and the end of a drought. Because the impacts of a drought accumulate slowly at first, a drought may not be recognized until it has become well established. Even during a drought there may be one or two months with above average precipitation totals. These wet months do not necessarily signal the end of a drought and generally do not have a major impact on moisture deficits. Droughts can be short, lasting just a few months, or they can persist for several years before regional climate conditions return to normal. While drought conditions can occur at any time throughout the year, the most apparent time is during the summer months. Nationally, drought impacts often exceed $1 billion due in part to the sheer size of the areas affected.

Measuring Droughts: There are several quantitative measures (indices) that have been developed to measure drought in the United States. How these indices measure drought depends on the discipline affected (i.e., agriculture, hydrology, meteorology, etc.) and the region being considered. The Palmer Drought Severity Index (PDSI) and the U.S. Drought Monitor will be highlighted in the Plan. The PDSI was the first comprehensive drought index developed in the United States. The U.S. Drought Monitor is a relatively new index that combines quantitative measures with input from experts in the field. NOAA has begun including the U.S. Drought Monitor's drought intensity ratings along with the weather information provided for drought events recorded with the National Climate Data Center.

Palmer Classification System

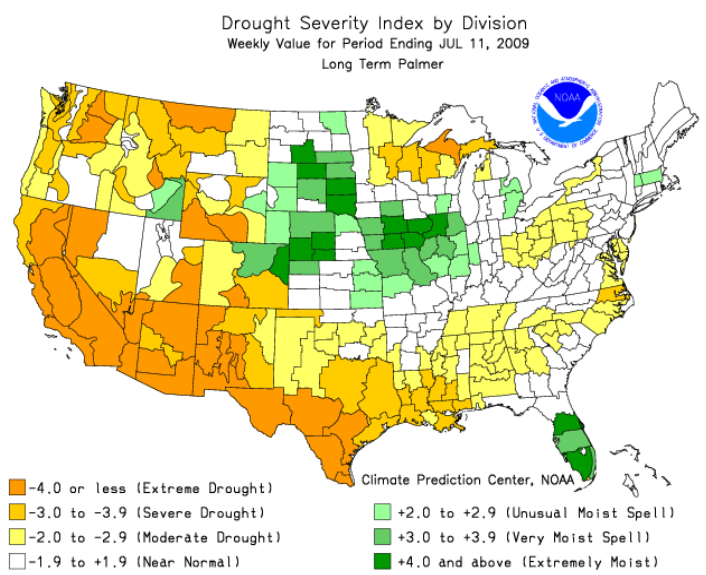
Index Value	Description
4.0 or more	extremely wet
3.0 to3.99	very wet
2.0 to 2.99	moderately wet
1.0 to 1.99	slightly wet
0.5 to 0.99	incipient wet spell
0.49 to -0.49	near normal
-0.5 to -0.99	incipient dry spell
-1.0 to -1.99	mild drought
-2.0 to -2.99	moderate drought
-3.0 to -3.99	severe drought
-4.0 or less	extreme drought

Source: National Drought Mitigation Center, University of Nebraska – Lincoln

Palmer Drought Severity Index (PDSI): The PDSI, or Palmer Index, was developed in 1965 and is a long-term meteorological index that indicates when weather conditions have been abnormally dry or abnormally wet. It is most effective at measuring impacts that are sensitive to soil moisture conditions, such as agriculture. Many federal and state agencies rely on PDSI to trigger drought relief programs. It provides a standardized method to measure moisture conditions so that comparisons can be made between various locations and times. The PDSI is most useful when working with large areas of uniform topography.

The PDSI is calculated based on precipitation and temperature data, as well as the local available water content of the soil and the cumulative patterns of previous months. The index ranges from +4 (extremely moist) to -4 (extreme drought). NOAA's Climate Prediction Center produces a weekly map that shows the climate divisions and their PDSI value by color. Figure 2-11 shows an example of this map.

Figure 2-11



Source: National Oceanic and Atmospheric Administration, Climate Prediction Center, Drought Monitoring.

U.S. Drought Monitor: A relatively new tool used for assessing drought conditions is the U.S. Drought Monitor. It is designed to provide the general public, media, government officials and others with an easily understandable "big picture" overview of drought conditions across the United States.

The U.S. Drought Monitor is unique in that it blends multiple numeric measures of drought, including the PDSI and three other indices, and the best judgments of experts to create a weekly map that depicts drought conditions across the United States. There are five drought intensity categories, D0 through D4, to identify areas of drought.

U.S. Drought Monitor – Drought Severity Classifications

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

Source: National Integrated Drought Information System, U.S. Drought Portal, "Drought Monitor: State-of-the-Art Blend of Science and Subjectivity", U.S. Drought Monitor, January 2008.

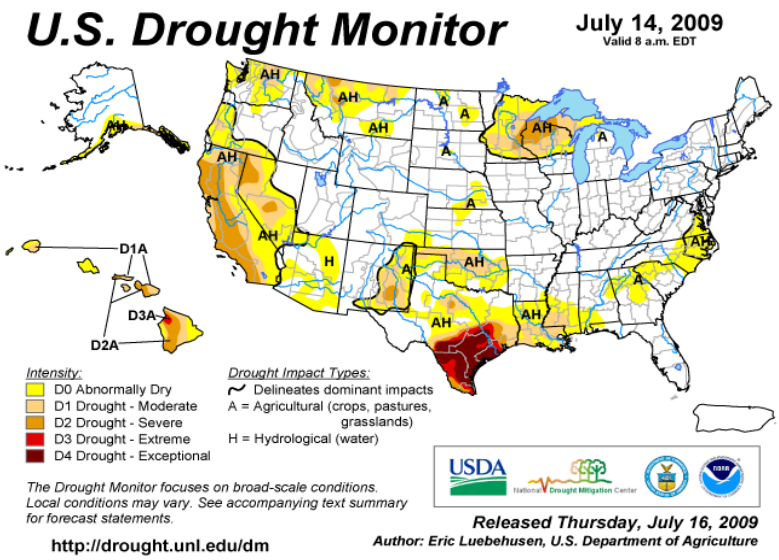
The U.S. Drought Monitor is designed to provide a general and up-to-date overview of current drought conditions across the county. It is not designed, however to depict local conditions. As a result, there could be water shortages or crop failures within areas not designated as drought, just as there could locations with adequate water supplies in an area designated as D3 or D4. Figure 2-12 shows an example of the U.S. Drought Monitor weekly map.

2.8.2 Drought Hazard Analysis

The following summarizes the previous occurrences as well as the extent or severity of the drought events in McHenry County. Information obtained from the Storm Events Database and the Illinois Emergency Management Agency show three reported drought events in McHenry County between 1983 and August 31, 2009. Comprehensive damage information was either unavailable or none was recorded for any of the events. Also, no drought-related injuries or deaths were reported.

- In 1983, all 102 Illinois counties were proclaimed state disaster areas because of high temperatures and insufficient precipitation beginning in mid-June.

Figure 2-12 U.S. Drought Monitor Map



Source: National Integrated Drought Information System, U.S. Drought Portal, U.S. Drought Monitor.

- In 1988, approximately half of the counties in Illinois (including McHenry County) were impacted by drought conditions, although none of the counties were proclaimed state disaster areas. Disaster relief payments exceeding $382 million were paid to landowners and farmers as a result of this drought.

- In 2005, drought conditions impacted much of the state, including McHenry County. Dry conditions reached a historic level of severity in some parts of Illinois and ranked as one of the three most severe droughts in Illinois based on 112 years of data.

Extent of Hazard and Probability of Future Occurrence: Drought events affect the entire County in any one of the four drought categories discussed above. The County and municipalities rely on groundwater for their source of drinking water. With the anticipated growth in the total County population, this will be a growing concern. The agricultural community will continue to be affected by droughts. All communities in McHenry County are subject to drought-related impacts. The odds of a drought in any year are most likely less than 10 percent, but it is recognized that droughts can extend over multiple years.

2.8.3 Drought Vulnerability Assessment

McHenry County can be significantly impacted by a drought. Surface water levels in lakes, impoundments, and reservoirs can drop dramatically during drought. Groundwater supply can also be impacted. Agricultural activities are impacted. Recreational activities can be impacted. A vulnerability assessment was not conducted for this Plan. Information on drought impact and other issues related to ground water are included in the County's Water Resources Protection Action Plan.

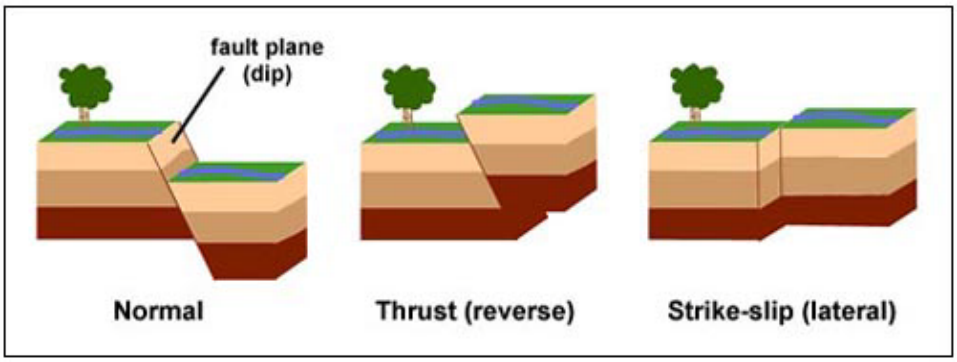
2.9 Earthquake

2.9.1 Earthquake Hazard Description

An earthquake is a sudden shaking of the ground caused when rocks forming the earth's crust slip or move past each other along a fault (a fracture in the rocks). Most earthquakes occur along the boundaries of the earth's tectonic plates. These slow-moving plates are being pulled and dragged in different directions, sliding over, under and past each other. An abrupt shift releases the energy, producing vibrations or seismic waves that travel outward from the earthquake's point of origin. The location below the earth's surface where the earthquake starts is known as the hypocenter or focus. The point on the earth's surface directly above the focus is the epicenter.

A fault is a fracture or zone of fractures in the earth's crust between two blocks of rock. Faults are classified based on the direction of slip or movement along the fault. There are three main groups of faults: normal, thrust (reverse) and strike-slip (lateral).

Earthquake Faults



Source: U. S. Geological Survey, Earthquake Hazards Program, "Visual Glossary – fault".

The severity of an earthquake is measured in terms of its magnitude and intensity. The magnitude describes the size of the earthquake and the intensity depicts the associated damage.

Magnitude: Magnitude refers to the amount of seismic energy released at the hypocenter of an earthquake. The magnitude of an earthquake is determined from measurements of ground vibrations recorded by seismographs. As a result, magnitude is represented as a single, instrumentally determined value. There are several scales that measure the magnitude of an earthquake. The most well known is the Richter Scale. This logarithmic scale provides a numeric representation of the magnitude of an earthquake through the use of whole numbers and decimal fractions. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in ground vibrations measured. In addition, each whole number increase corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number.

Earthquake Magnitude Classes

Class	Magnitude (Richter Scale)
Micro	smaller than 3.0
Minor	3.0 – 3.9
Light	4.0 – 4.9
Moderate	5.0 – 5.9
Strong	6.0 – 6.9
Major	7.0 – 7.9
Great	8.0 or larger

Source: U.S. Geological Survey

The earthquake magnitude categorizes is based on event's Richter Scale value. Earthquakes with a magnitude of 2.0 or less are not commonly felt by individuals. The largest earthquake to occur in the United States since 1900 took place off the coast of Alaska on March 28, 1964 and registered a 9.2 on the Richter Scale.

Intensity: Intensity refers to the effect an earthquake has on a particular location. The intensity of an earthquake is determined from observations made of the damage inflicted on individuals, structures and the environment. As a result, intensity does not have a mathematical basis; instead it is an arbitrary ranking of observed effects, and intensity generally diminishes with distance.

In the United States is the Modified Mercalli Intensity Scale is used to measure earthquake intensity. This scale, shown in Table 2-27, is designated by Roman numerals. The lower numbers of the intensity scale are based on human observations (i.e., felt only by a few people at rest, felt quite noticeably by persons indoors, etc). The higher numbers of the scale are based on observed structural damage (i.e., broken windows, general damage to foundations etc.).

Earthquakes occur every day. Worldwide, small earthquakes, such as magnitude 2 earthquakes, occur several hundred times a day. Major earthquakes, such as magnitude 7 earthquakes, generally occur more than one a month. Table 2-28 illustrates the approximate number of earthquakes that occur worldwide per year based on magnitude. This figure also

identifies manmade and natural events that release approximately the same amount of energy for comparison.

Magnitude	Mercalli Intensity	Abbreviated Modified Mercalli Intensity Scale
1.0 to 2.9	I	Not felt except by a very few under especially favorable conditions.
3.0 to 3.9	II	Felt only by a few persons at rest, especially on upper floors of buildings.
	III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
4.0 to 4.9	IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
	V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
5.0 to 5.9	VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
	VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
6.0 to 6.9	VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
	IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
7.0 and higher	X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
	XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
	XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

*Typical Maximum Modified Mercalli Intensity – at epicenter

Earthquake intensity is directly related to the area and regional geology. Earthquakes in California, for example are felt in relatively localize locations. Earthquakes in the Midwest can be felt a number of states away. Figure 2-13 shows the intensity for a 5.3 earthquake with an epicenter near the Illinois-Kentucky boarder.

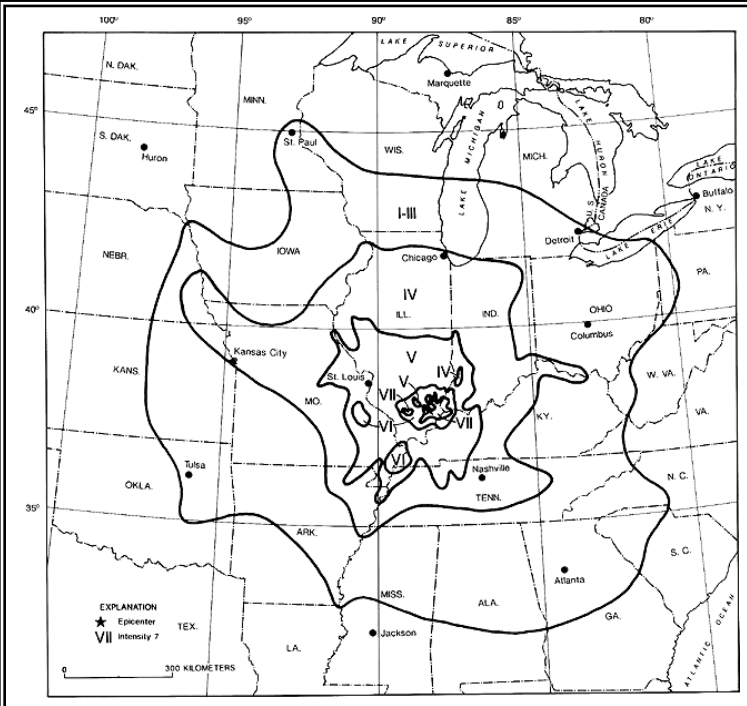


Figure 2-13

November 9, 1968 Earthquake of magnitude 5.3 and an intensity of VII. Intensity felt in McHenry County estimated to be IV.

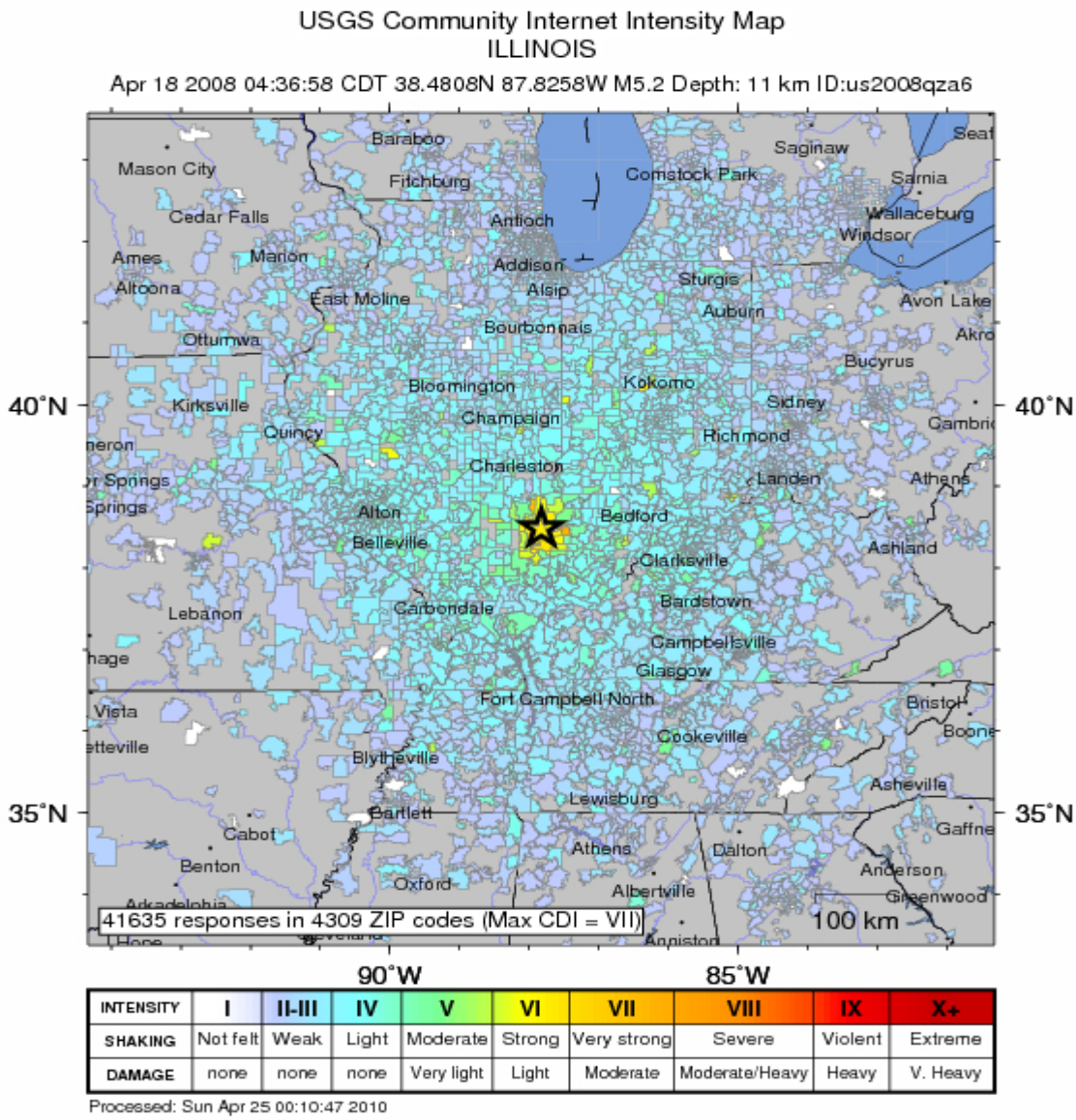
Source: USGS

2.9.2 Earthquake Hazard Analysis

According to the Illinois State Geological Survey's Northern Illinois Earthquakes fact sheet and the Earthquakes of Illinois: 1795 – 2008 map, no earthquakes have originated in McHenry County during the last 200 years. However, there have been at least a dozen earthquakes that have occurred in northern Illinois in the last century, though none of them were greater than a magnitude 5.1. These earthquakes generally caused minor damage within 10 to 20 miles of the epicenter and were felt over several counties. Earthquakes greater than a magnitude 5 are generally not expected in this region.

The most recent earthquake to take place in northern Illinois occurred on February 10, 2010 at around 4:00 a.m. USGS recorded the earthquake as 3.8 in magnitude with the epicenter at Pingree Grove in Kane County. Prior to that, a 5.2 earthquake on April 18, 2008 was felt in McHenry County. The epicenter of this earthquake was in Wabash County, Illinois. As shown in Figure 2-14, people in McHenry County reported feeling the earthquake. People can report to USGS through their "Did You Feel It" website. USGS classified the McHenry reports from the April 2008 earthquake as "II" or weak and "III" or light.

Figure 2-14
"Did You Feel It" Reports for April 18, 2008 Earthquake in Wabash County, Illinois



The earthquake was located along the Wabash Valley seismic zone. Minor structural damage was reported in several towns in Illinois and Kentucky. Ground shaking was felt over all or parts of 18 states in the central United States and southern Ontario, Canada. No damages were reported in McHenry County.

Other recent, notable earthquake include the June 28, 2004, magnitude 4.2,

USGS "Did You Feel It" Program
http://earthquake.usgs.gov/earthquakes/dyfi/

earthquake located approximately eight miles northwest of Ottawa in La Salle County and was felt over six states. There were no reports of significant damage and no damages were reported in McHenry County. Numerous other earthquakes occurred in Illinois with similar intensity (3.0 to 4.8) and no reports of damage.

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

The strongest earthquake in the central United States during the 20th century occurred along the Wabash Valley seismic zone in southeastern Illinois near Dale in Hamilton County. This magnitude 5.3 earthquake occurred on November 9, 1968 (see Figure 2-13) with an intensity estimated VII in the area of the epicenter and an intensity of III to IV in McHenry County. Moderate structural damage was reported in several towns in south-central Illinois, southwest Indiana and northwest Kentucky. Ground shaking was felt over all or parts of 23 states in the central and eastern United States and southern Ontario, Canada. As with the previous earthquakes, no damages were reported in McHenry County.

Two of the three largest earthquakes ever recorded within the continental United States took place along the New Madrid seismic zone in 1811 and 1812 with magnitudes of 8.1 and 8.0 respectively. These great earthquakes, centered near the town of New Madrid, Missouri, devastated the surrounding region and rang church bells 1,000 miles away in Boston. The quakes locally changed the course of the Mississippi River and created Reelfoot Lake, which covers an area of more than 10 square miles in northwestern Tennessee. If another earthquake the magnitude of those recorded 1811 and 1812 occurs again along the New Madrid seismic zone, the damage that will be experienced in northern Illinois and McHenry County is not expected to be substantial.

Table 2-20 Probability of Earthquake Events in The New Madrid Seismic Zone

Richter	Year 2000	Year 2035
6.3	40% - 63%	86% - 97%
7.6	5.4% - 8.7%	19% - 29%
8.3	0.3% - 1.0%	2.7% - 4.0%

Source: Illinois State Geological Survey

Extent of Hazard and Probability of Future Occurrence: Earthquakes events can affect the entire County. Impact is expected to be relatively uniform throughout the County. Table 2-20 shows earthquake probability for the New Madrid Seismic Zone from 2000 and into 2035. Earthquakes happen every year in Illinois. Earthquakes have been felt in McHenry County the

last two years. The odds of feeling an earthquake in a year are about 50 percent, but the odds of incurring damage from the earthquake are less than one percent.

2.9.3 Earthquake Vulnerability Assessment

Since earthquake is currently considered a lower priority hazard for McHenry County, a vulnerability analysis was not conducted. Earthquake vulnerability may be limited to historic structures in McHenry County. Other earthquake concerns relate to the interruption of natural gas for heating in the winter. If deemed appropriate, earthquake vulnerability will be examined in the 5-year update of this Plan.

2.10 Dam Failure

2.10.1 Dam Failure Hazard Description

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

A dam failure is the partial or total collapse, breach or other failure of a dam that causes flooding downstream. Dam failures can result from natural events such as a flood event, earthquakes or landslides, human-induced events such as improper maintenance, or a combination of both. In the event of a dam failure, the people, property and infrastructure downstream could be subject to devastating damage.

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

- Prolonged periods of rainfall and flooding (the cause of most failures);
- Inadequate spillway capacity resulting in excess flow overtopping the dam;
- Internal erosion caused by embankment or foundation leakage ;
- Improper maintenance (including failure to remove trees, repair internal seepage problems, maintain gates, valves and other operational components, etc.);
- Improper design (including use of improper construction materials and practices);
- Negligent operation (including failure to remove or open gates or valves during high flow periods);
- Failure of an upstream dam on the same waterway;
- Landslides into reservoirs which cause surges that result in overtopping of the dam;

- High winds which can cause significant wave action and result in substantial erosion; and
- Earthquakes which can cause longitudinal cracks at the tops of embankments that can weaken entire structures.

Dam Regulation and Classifications in Illinois: IDNR-OWR regulates dam construction and modification, and maintains an inventory of dams. Dams that either have been subject to an IDNR-OWR permit, or that have a height of 25 feet or more and have more than a 50 acre-foot impounding area, are included in the inventory. Three classifications are used in Illinois for regulatory proposes (Class I, II and III). Table 2-31 provides a brief description of each hazard classification. The hazard classifications used in Illinois are similar to those used by the U.S. Army Corps of Engineers and are based on the degree of threat to life and property in the event of a dam failure.

Illinois Dam Hazard Classification System

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

Source: Illinois Administrative Code.

2.10.1 Dam Failure Hazard Analysis

Algonquin, Lake in the Hills, Island Lake, Cary and Crystal Lake own classified dams. Table 2-21 provides a brief description of each dam. In addition to the classified dams owned by the participating jurisdictions, there are two state-owned dams, the Stratton Lock & Dam and the Black Tern Marsh Dam. The Algonquin Dam in not included in the Table 2-17, but it is owned

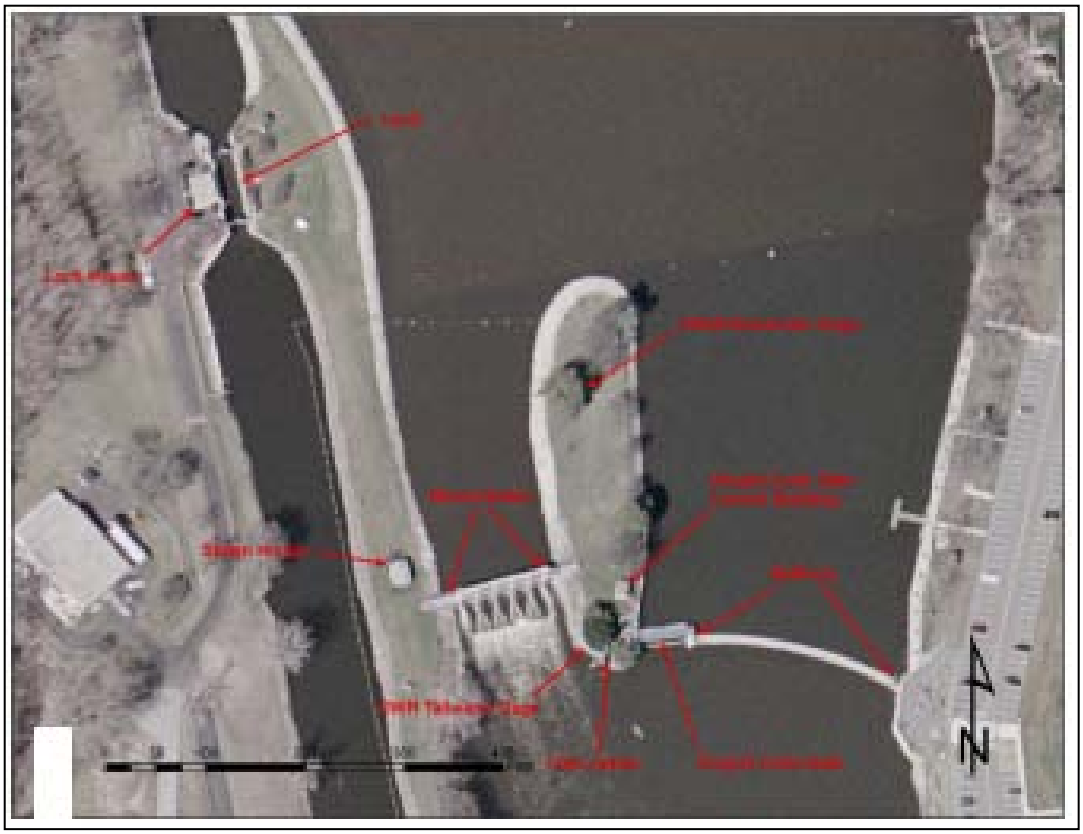
and operated by IDNR. The R-15 Dam, owned by the Fox Waterway Agency, a special unit of local government created by the State of Illinois. The Wonder Lake Dam is privately owned.

Table 2-21 Classified Dams with McHenry County

Name	Owner	Purpose	Classification
High Hill Farms Dam	Algonquin	Flood Control & Storm Water Management	Class I
Lake in the Hills 1 Dam	Lake in the Hills	Recreation	Class I
Stratton Lock & Dam (McHenry Lock & Dam)	IDNR	Flood Control & Storm Water Management, Recreation	Class I
R-15 Dam (Fox River Dredge Disposal Facility)	Fox Waterway Agency	Other	Class I
Wonder Lake Dam	Master Property Owners Assoc., Inc.	Recreation	Class I
Island Lake Dam	Island Lake	Recreation	Class II
Lake in the Hills 2 Dam	Lake in the Hills	Recreation, Other	Class II
Black Tern Marsh Dam (Moraine Hills Mitigation Dam)	IDNR	Recreation	Class III
Cary Pond Dam	Cary	---	Class III
Lake in the Hills 3 Dam	Lake in the Hills	Recreation	Class III
Lake in the Hills 4 Dam	Lake in the Hills	---	Class III
Woodscreek Detention Dam	Crystal Lake	Flood Control & Storm Water Management	Class III

Fox River Dams: IDNR owns and operated the Stratton Dam, which is located at river mile 97.7 on the Fox River and where the Fox River drainage area is 1,250 square miles. The Stratton Dam has a boat lock, five vertical lift gates, one hinged-crest gate and a fish ladder. A photo of the facilities is shown on the following page. IDNR operates to gate to control the pool elevation during normal weather conditions and to manage upstream and downstream flooding during all seasons of the year.

The Algonquin Dam is located at river mile 81.6 on the Fox River (near U.S. Route 14). In 2002, IDNR took over the operation of the Algonquin Dam. The Dam is nine feet in height and has an impoundment area of 849 acres. The crest length or spillway length is 242 feet, which includes a hinged-crest gate at the northern end of the Dam. The hinged-crest gate is operated to control flows and ice development, as needed.

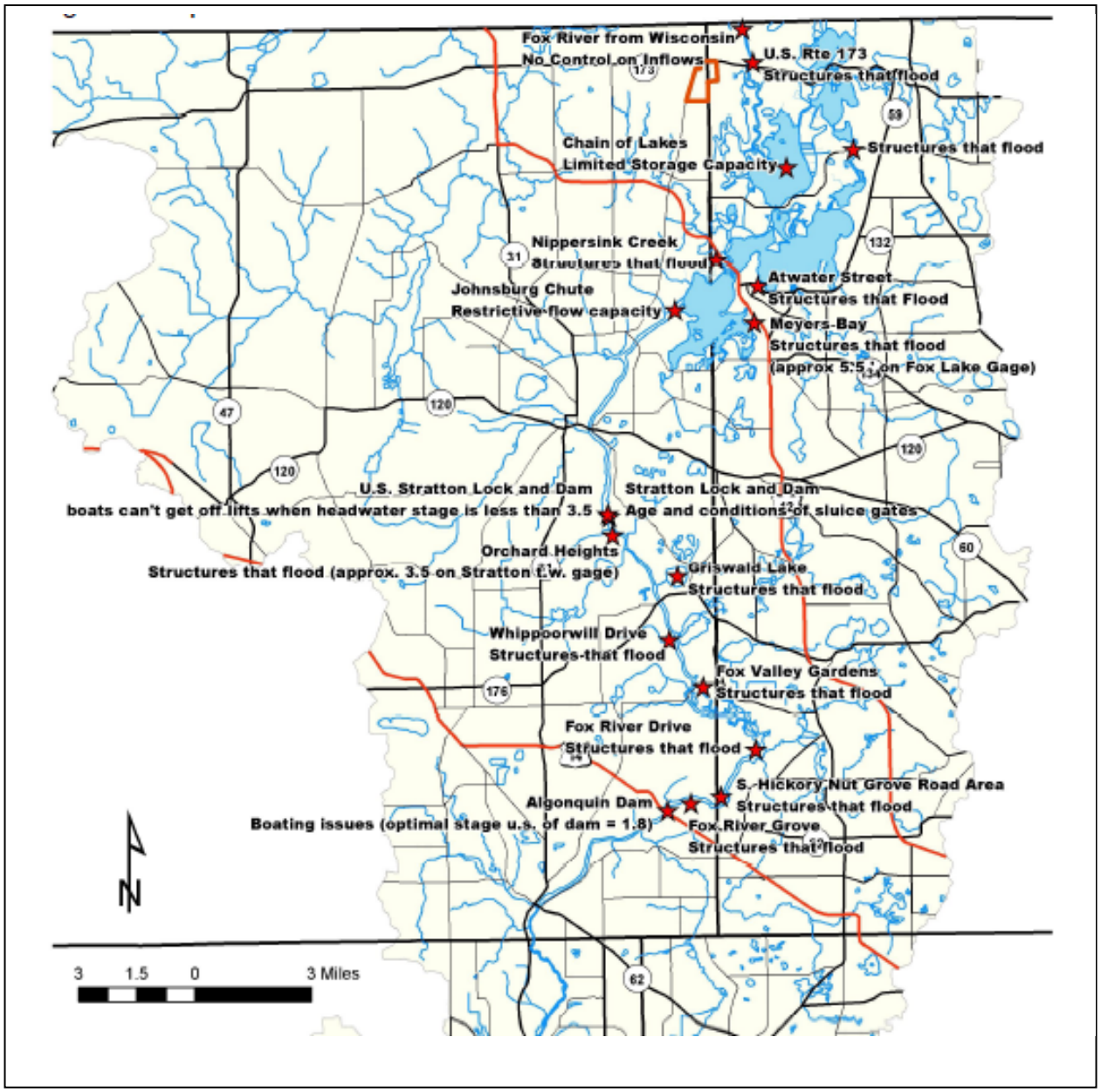


Source: IDNR

The above photo and Figure 2-15 are from the January 2010 "Operation of the Stratton and Algonquin Dams" report prepared by IDNR. The report is available online at: http://www.dnr.state.il.us/owr/includes/StrattonOperations/content_StrattonOperations3.htm. Figure 2-15 presents the operational constraints that IDNR has for opening and closing the Stratton Dam gates.

Extent of Hazard and Probability of Future Occurrence: The extent of dam failure hazard is of course limited to dams within McHenry County. Ideally, McHenry County dams are well maintained and have emergency operation plans developed for use when a dam failure is probable or imminent.

Figure 2-15 IDNR Stratton Dam Operational Constraints



2.10.1 Dam Failure Vulnerability Assessment

Since dam failure is currently considered a lower priority hazard for McHenry County, a vulnerability analysis was not conducted. Also, a dam-breach analysis and mapping of potential dam breach inundation areas is most appropriate for examining vulnerability. If deemed appropriate, dam failure vulnerability will be examined in the 5-year update of this Plan.

2.11 Summary of Natural Hazards

This risk assessment examines natural hazards that could impact McHenry County. This section summarized the impact of the hazards on McHenry County and presents conclusions that can be drawn from the assessment.

2.11.1 Impact of the Hazards

The impacts of the hazards are summarized according to the four major concerns:

- Health and safety,
- Damage to buildings,
- Damage to critical facilities, and
- Economic impact.

After the conclusion of the hazard assessments and vulnerability assessments of the priority hazards, the Mitigation Committee discussed the findings in order to determine the overall impact the hazard has on the County and the communities. The hazards and their impact are shown in Table 2-22, "Summary of the Hazards," and they are in order of the overall impact to McHenry County. The different columns on the table represent the following:

Annual Chance or Frequency: The annual chance column in the table shows the likelihood of occurrence in any given year. These numbers are discussed in the "Frequency" section of each hazard.

Impact Location: The location and area affected by a single occurrence is shown.

Square Miles Impacted: The portion of the County that is vulnerable to the hazard.

Value of vulnerable property: The property damage exposure computed in Section 2.2 of this Chapter.

Potential Damage: The range of potential damage that could occur for the square miles impacted and the value of exposed property.

Impact on Health and Safety: This category relates to health and safety hazards. Ratings of high, medium, or low are shown.

Impact on Buildings: The vulnerability of structural damage to buildings or other property damage.

Critical Facilities: The types of critical facilities and infrastructure that are affected are listed.

Economic Impact: Typical impacts on businesses and utilities are listed in this column.

The County, all municipalities, other agencies and institutions involved in this Plan are exposed to all identified hazards. This is due to the relatively flat topography of the County. While much of the County is still in agricultural use, the residents and business are equally impacted by the identified natural hazards as the urban areas. Flooding in the floodplain has been considered, for example, but it is understood that flooding is not limited to floodplain areas. Community impact does vary by degree between larger and smaller communities based on population and number of buildings.

Table 2-22 Summary of McHenry County Natural Hazards

Hazard	Annual Chance	Impact Location	Square miles Affected	Value of Vulnerable Property*	Potential Damage	Impact on Health and Safety	Impact on Buildings	Impact on Critical Facilities	Economic Impact
Tornado	0.00%	Countywide	10	$25.3 billion	---	High	High	Moderate	Moderate
	0.01%	Community	5	$414 million	$15.5-$90.6 million	High	High	Moderate	Moderate
Floods	1%	Floodplains	72	$3.0 billion	$4.6-$48.8 million	Moderate	High	Moderate	High
	10%	(Local Drainage)	611	---	---	Moderate	Moderate	Moderate	Moderate
Severe Winter Storms & Extreme Cold	100%	Countywide	611	$25.3 billion	---	Moderate	Moderate	Moderate	Low
Severe Summer Storms	100%	Communities	611	$25.3 billion	---	Moderate	Moderate	Moderate	Low
Extreme Heat	5%	Countywide	611	$25.3 billion	---	High	Low	Low	Low
Drought/ Groundwater	1%	Countywide	611	$25.3 billion	---	High	Moderate	Low	Moderate

*** Equals total estimated value of all privately owned, taxable buildings, $25.3 billion, times the percent of county affected.**

Table 2-23 shows the McHenry County hazard identification by community and township for the natural hazards evaluated in Table 2-18. The findings of the hazard analysis and profile of Chapter 2 and the vulnerability assessment were used as the foundation of goals and guidelines and mitigation activities developed in Chapter 4 though 9.

Table 2-23 McHenry County Hazard Identification by Community and Township for Natural Hazards

Communities	Tornado	Flood	Severe Winter Storm & Extreme Cold	Severe Summer Storms	Extreme Heat	Drought/Groundwater
Village of Algonquin	X	X	X	X	X	X
Village of Bull Valley	X	X	X	X	X	X
Village of Cary	X	X	X	X	X	X
City of Crystal Lake	X	X	X	X	X	X
Village of Fox River Grove	X	X	X	X	X	X
Village of Greenwood	X	X	X	X	X	X
City of Harvard	X	X	X	X	X	X
Village of Hebron	X		X	X	X	X
Village of Holiday Hills	X	X	X	X	X	X
Village of Huntley	X	X	X	X	X	X
Village of Johnsburg	X	X	X	X	X	X
Village of Lake in the Hills	X	X	X	X	X	X
Village of Lakewood	X	X	X	X	X	X
Village of McCullom Lake	X	X	X	X	X	X
City of McHenry	X	X	X	X	X	X
City of Marengo	X	X	X	X	X	X
Village of Oakwood Hills	X	X	X	X	X	X
Village of Prairie Grove	X	X	X	X	X	X
Village of Richmond	X	X	X	X	X	X
Village of Ringwood	X	X	X	X	X	X
Village of Spring Grove	X	X	X	X	X	X
Village of Trout Valley	X	X	X	X	X	X
Village of Union	X	X	X	X	X	X
Village of Wonder Lake	X	X	X	X	X	X
City of Woodstock	X	X	X	X	X	X

Townships	Tornado	Flood	Severe Winter Storm & Extreme Cold	Severe Summer Storms	Extreme Heat	Drought/Groundwater
Alden	X	X	X	X	X	X
Algonquin	X	X	X	X	X	X
Burton	X	X	X	X	X	X
Chemung	X	X	X	X	X	X
Coral	X	X	X	X	X	X
Dorr	X	X	X	X	X	X
Dunham	X	X	X	X	X	X
Grafton	X	X	X	X	X	X
Greenwood	X	X	X	X	X	X
Hartland	X	X	X	X	X	X
Hebron	X	X	X	X	X	X
Marengo	X	X	X	X	X	X
McHenry	X	X	X	X	X	X
McHenry Twnshp RD Dist.	X	X	X	X	X	X
McHenry Twnshp FPD	X	X	X	X	X	X
Nunda	X	X	X	X	X	X
Richmond	X	X	X	X	X	X
Riley	X	X	X	X	X	X
Seneca	X	X	X	X	X	X
Woodstock Fire Rescue	X	X	X	X	X	X

2.11.2 Comparison to State of Illinois 2007 Natural Hazard Mitigation Plan

The 2007 Illinois Natural Hazard Mitigation Plan prepared by the Illinois Emergency Management Agency (IEMA) hazard rating system has five levels: low, guarded, elevated, high and severe. McHenry County's hazard ratings for identified natural hazards are in the 2007 Plan are shown in Table 2-24.

Table 2-24 IEMA Hazard Ratings for McHenry County

Hazard:	IEMA Rating
Tornado	High
Floods	Guarded
Severe Winter Storms	Severe
Severe Summer Storms	Severe
Extreme Heat	Elevated
Drought	Guarded
Earthquake	Guarded

Note that the State's plan is currently being updated.

2.12 References

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Chapter 3. Goals

The goals for this *McHenry County Natural Hazards Mitigation Plan* were developed to reflect current community priorities, to be appropriate with the natural hazards that impact McHenry County, and to be consistent with other planning efforts. At the January 2010 meeting, the Mitigation Committee, working in small groups and then as a large group, conducted three exercises to outline the goals for this Plan. At the February 2010 meeting, the Mitigation Committee reviewed the goals and developed guidelines for their implementation. The goals and guidelines presented in this chapter are the foundation of the Action Plan, presented in Chapter 10.

3.1 Consideration of Community Priorities

Mitigation Committee members were given a handout listing various community priorities listed in alphabetical order. The handout asked: "What are the top five priorities for your community and McHenry County? What do your community leaders hold as most important?" Mitigation Committee members were asked not to answer these questions from their personal views, but to reflect the position of their city council, village board, township board or County Board.

The purpose of this exercise was to consider the direction or future of the County, municipalities and townships before focusing on hazard mitigation goals or objectives. Priorities selected from the list varying from the larger municipalities on the east side of the County to the rural townships on the west side of the County. However, common priorities were identified through the exercise. Common countywide (County, municipal and township) priorities include:

- Improve water quality
- Improve roads and highways
- Provide a safe place to live and work
- Improve/get more businesses
- Preserve historic and cultural resources

The County gave additional priorities to:

- Improve/get more public transportation opportunities
- Improve employment opportunities
- Improve schools and educational programs

The municipalities gave additional priority to:

- Improve/get more recreation facilities
- Improve/get more housing
- Improve employment opportunities

The townships gave additional priority to:

- Control/hold up the rate of growth
- Preserve farmlands
- Improve/get more open space

From the exercise, it can be concluded that the Mitigation Committee sees community priorities as those activities that improve the quality of life of the people who live and work in McHenry County. The priorities are focused on serving and protecting people.

3.2 Plan Focus

The Mitigation Committee conducted two more exercises to examine what the Plan should focus on, and how mitigation projects should be funded and implemented. Mitigation Committee members were given a list of possible responses to each of these questions. After a process of discussing individual responses in the small groups and writing out each small group's top five responses, an overall vote was conducted to assess the mitigation priorities.

For the questions of *"What to focus on?"* the priorities were:

- Protecting people's lives
- Protecting public services, street and utilities
- Protecting public health
- Protecting critical facilities

Additionally, the Mitigation Committee gave importance to:

- Protecting future development
- Protecting special needs populations

For the question of *"How should mitigation projects be funded and implemented?"* the responses were as follows:

- Help people protect themselves
- Make people aware of the hazards they face

- Make people aware of how they can protect themselves
- Develop public-private partnerships
- New development should pay the full cost of protection measures
- Protect life/safety*
- Only fund projects where it's proven that the benefits exceed the costs.

Also:

- Seek user fees to fund measures
- Protect critical facilities*
- Use county/municipal agencies to implement mitigation activities.

The items marked with a "*" above are statements that had "regardless of the cost" included with the exercise. The small group summaries and the Committee discussion leaned away from the "regardless of the cost" but the importance was left on a community commitment to protect life and safety and critical facilities.
Help people protect themselves was selected by the majority of the Committee. Educating people and developing public-private partnerships were selected by more than half the Committee.

3.3 Goals and Guidelines

The Mitigation Committee established the goals for this *McHenry County Natural Hazards Mitigation Plan* as:

Goal 1. Protect the lives, health, and safety of the people of McHenry County from the impact and effects of natural hazards.
Goal 2. Protect public services, utilities and critical facilities from potential damage from natural hazard events.
Goal 3. Protect historic, cultural, and natural resources from the effects of natural hazards.
Goal 4. Ensure that new developments do not create new exposures to damage from natural hazards.
Goal 5. Mitigate to protect against economic and transportation losses due to natural hazards.
Goal 6. Identify specific projects to protect lives and mitigate damage where cost-effective and affordable.

The following guidelines were developed by the Mitigation Committee for purpose of achieving the goals and to facilitate the development of hazard mitigation action items in Chapter 10:

Guideline 1. Focus natural hazards mitigation efforts on floods, severe summer and winter storms, tornadoes, extreme cold and heat events, and drought.

Guideline 2. Make people aware of the hazards they face and focus mitigation efforts on measures that allow property owners and service providers to help themselves.

Guideline 3. Seek state and federal support for mitigation efforts.

Guideline 4. Use available local funds, when necessary, to protect the public services, critical facilities, lives, health, and safety from natural hazards.

Guideline 5. Examine equitable approaches for the local cost of mitigation, such as user fees.

Guideline 6. Create and foster public-private partnerships to accomplish mitigation activities.

Guideline 7. Strive to improve and expand business, transportation and education opportunities in McHenry County in conjunction with planned mitigation efforts.

In summary, the goals and guidelines of this Plan focus on the life, health, and safety issues associated with natural hazards, and on the importance of people being able to protect themselves and their property from damage.

3.4 Consistency with Other County and Municipal Planning Goals

A review of the goals and guidelines of this Plan were compared to the goals of other County and municipal p*l*ans. The review showed that this Plan's focus is consistent and complementary to current County and municipal initiatives included in their comprehensive and other plans.

During the development of this Plan, the draft of the McHenry County 2030 Comprehensive Plan was adopted by the McHenry County. There are numerous policy statements in the 2030 Plan, plus a vision statement on pages 10 and 11, that support this Plan. This Plan will also foster the goals of the 2030 Comprehensive Plan. Shown on the following page is an excerpt from the vision statement.

McHenry County 2030 Comprehensive Plan
"Our Vision"
(Excerpt from February 9, 2010 Draft)

"Over the next 20 years McHenry County will…

…continue to recognize the importance of natural resources and provide beautiful and clean natural areas throughout McHenry County for residents and visitors to enjoy. The County will accomplish this by…

- Making land use choices that preserve environmentally sensitive areas.

… continue to recognize that water is to be treasured as a resource and not treated as a waste product. The County will accomplish this by…

- Minimizing damages incurred from flooding by limiting new development in flood hazard areas.

In 1996, McHenry County adopted the McHenry County Comprehensive Stormwater Management Plan.

Goals of the *McHenry County*
Comprehensive Stormwater Management Plan, 1996

Goal 1: The general goal of the Storm water Plan is to protect, preserve and restore the quality and environmental values of water resources by controlling storm water runoff. Means of implementation of the Stormwater Plan shall be established requiring effective storm water management methods for both existing and new systems and thereby enhance the beneficial use of surface water.

Goal 2: It shall be the goal of the Stormwater Plan to provide for watershed management systems developed as coordinated parts of district-wide stormwater management and based upon watershed principles that allow for diversities of terrain and land use.

Goal 3: It shall be a goal to maintain to the maximum extent practical, during and after construction and development activities, the desirable pre-development storm water discharge characteristics of a site; reducing stream channel erosion, siltation, sedimentation and flooding; reducing storm water pollutant loadings discharged into surface waters and enhancing groundwater recharge by allowing infiltration of stormwater in those areas of appropriate geologic and physiographic land features.

Goal 4: It shall be a goal to eliminate nuisance discharges of inadequately and improperly managed storm water onto land and into surface water; minimizing flooding and other adverse impacts on private and public property and protecting public health, safety and welfare affected by improperly managed storm water runoff.

As with the 2030 Comprehensive Plan, the McHenry County Water Resources Protection Action Plan was also under consideration by the County and municipalities during the development of this Plan. The Water Resources Protection Action Plan has twelve major areas of concerns, and the overreaching goal of the entire plan is shown below.

McHenry County Water Resources Protection Action Plan
(Formerly the Groundwater Protection Action Plan)
Executive Summary
October 2009

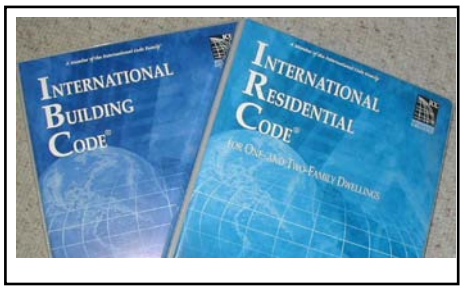
"The goal of the [Water Resources Protection Action Plan] is to find solutions that reach across political boundaries to protect and preserve the quantity and quality of water for current and future generations, including the built and natural environments.

It strives to create a culture of conservation and awareness and to guide residents and businesses to-ward more efficient use and quality protection of our County's finite water resources.

The [Water Resources Protection Action Plan] serves as a toolkit that links water resource management goals with other community goals such as economic prosperity, public safety, and quality of life. It may assist with prioritizing water conservation, maximizing water efficiency and protecting the quantity and quality of all water resources.

In McHenry County, the ultimate goal is not to prevent water use, but to maximize the benefit of each gallon through sound resource planning and quality protection.

Chapter 4. Preventive Measures



Preventive mitigation measures are aimed at protecting new construction from hazards and to help ensure that future development does not increase potential losses to existing development or to community assets. Building, planning, zoning, and/or code enforcement offices administer preventive measures. Preventive measures include but are not limited to the following:

- Building Codes
- Standards for Manufactured Homes
- Planning and Zoning
- Subdivision Regulations
- Comprehensive Stormwater Management

Comprehensive stormwater management incorporates the management of stormwater runoff, floodplain management, wetland protection, water quality protection, and soil erosion and sediment control.

4.1 Building Codes

The administration and enforcement of building codes is one of the most effective approaches for addressing natural hazard mitigation. Building codes protect new structures from damage by earthquakes, tornadoes, high winds, and snow storms. When properly designed and constructed according to code, the average building can withstand the impacts of most of these natural events.

Hazards Addressed	
✓	Floods
✓	Summer Storms
✓	Winter Storms
	Extreme Cold
	Extreme Heat
✓	Tornadoes
	Drought
	Groundwater

Additional hazard protection standards for all new, improved or repaired buildings can be incorporated into the local building code. Provisions that should be included are:

- Making sure roofing systems will handle high winds and expected snow loads,
- Providing special standards for tying the roof, walls and foundation together to resist the effects of wind,
- Requiring new buildings to have tornado “safe rooms,”
- Including insulation standards that ensure protection from extreme heat and cold as well as energy efficiency,
- Regulating overhanging masonry elements that can fall during an earthquake,

- Ensuring that foundations are strong enough for earth movement and that all structural elements are properly connected to the foundation, and
- Mandating overhead sewers for all new basements to prevent sewer backup.

Model codes: The predominate model building codes being adopted by communities are the International Code series (I-Codes), including the International Residential Code (IRC) and the International Building Code (IBC). The most recent version of these codes is 2009.

Flood Standards: The I-Codes have a section on flood protection that communities must adopt separately. These standards are in addition to requirements of the National Flood Insurance Program that are adopted in a community's floodplain ordinance.

Protected Homes: The Institute for Business and Home Safety (IBHS) has a set of recommendations to strengthen a building to better resist the impacts of natural hazards. The specific requirements for a protected or a "Fortified" home are available through the IBHS website at www.disastersafety.org (see next page). On the web site, a postal code (zip code) can be entered and regional recommendations are made for maintenance, new construction and businesses.

New construction should also include the construction of an underground shelter or "safe room" at the first floor level to protect the lives of the occupants. A building code could require them in new construction. Tornado safe rooms are discussed further in Section 5.2.2.

Code Administration: Enforcement of code standards is very important. Adequate inspections are needed during the course of construction to ensure that the builder understands and implements the requirements. The Building Code Effectiveness Grading Schedule (BCEGS) is a national program used by the insurance industry to determine how well new construction is protected from wind, earthquake and other non-flood hazards. The

BCEGS is similar to the National Flood Insurance Program (NFIP) Community Rating System and the century-old fire insurance rating scheme. With BCEGS, building permit programs are reviewed and scored, a class 1 community is the best, and a class 10 communities has little or no program.

Code Official Training: Training of code officials is also very important for code enforcement. Training of code officials and inspectors is a large part of the BCEGS rating for a community. Courses are offered through the building code associations to help local officials understand standards that apply to seismic, wind and flood hazards.

Local Implementation: Table 4-1 below lists the building codes in use in McHenry County.

Table 4-1 Building Codes Used in McHenry County and BCEGS Ratings

Municipalities	Building Code Residential	BCEGS Residential	Building Code Commercial	BCEGS Commercial
Algonquin	2006 IRC		2006 IBC	3
Cary	2003 IRC	4	2003 IBC	4
Crystal Lake	2006 IRC	5	2006 IBC	4
Fox River Grove	BOCA		BOCA	
Harvard	2006 IRC	4	2006 IBC	4
Holiday Hills	2006 IRC		2006 IBC	
Huntley	2003 IRC		2003 IBC	
Johnsburg	2006 IRC		2006 IBC	
Lake in the Hills	2006 IRC	5	2006 IBC	5
Lakewood	2006 IRC		2006 IBC	
Marengo	2006 IRC	4	2006 IBC	4
McCullom Lake	2003 IRC		2003 IBC	
McHenry	2000 ICS	*	2000 ICS	*
Prairie Grove	2006 IRC	4	2006 IBC	4
Spring Grove	2003 IRC		2003 IBC	
Wonder Lake	2003 IRC		2003 IBC	
Woodstock	2006 IRC	5	2006 IBC	5
McHenry County	2006 IRC		2006 IBC	

* Not in the program or no longer in the program

CRS Credit: The Community Rating System provides flood insurance discounts to those communities that implement various floodplain management activities that meet certain criteria. Comparing local activities to those national criteria helps determine if local activities should be improved.

The Community Rating System encourages strong building codes. It provides credit in two ways: points are awarded based on the community's BCEGS classification and points are awarded for adopting the International Code series. Up to 120 points are possible.

The CRS also has a prerequisite for a community to attain a CRS Class 8 or better: the community must have a BCEGS class of 6 or better. To attain a CRS Class 4 or better, the community must have a BCEGS class of 5 or better. In other words, a strong building code program is a must to do well in the Community Rating System.

4.2 Manufactured Home Installation

Manufactured or "mobile" homes are usually not regulated by local building codes. They are built in a factory in another state and are shipped to a site. They do have to meet construction standards set by the US Department of Housing and Urban Development's National Manufactured Home Construction and Safety Standards. These standards apply uniformly across the country and it is illegal for a local unit of government to require additional construction requirements. Local jurisdictions may regulate the location to these structures and their on-site installation.

Hazards Addressed	
✓	Floods
✓	Summer Storms
	Winter Storms
	Extreme Cold
	Extreme Heat
✓	Tornadoes
	Drought
	Groundwater

The greatest mitigation concern with manufactured housing is protection from damage by wind. The key to local mitigation of wind damage to mobile homes is proper installation. The Illinois Mobile Home Act and Manufactured Home Tiedown Code are enforced by the Illinois Department of Public Health (IDPH). The State code includes equipment and installation standards. Installation must be done in accordance with manufacturers' specifications. There is a voluntary program for installers to be trained and certified.

Following the installation of a manufactured home, installers must send the state a certification that they have complied with the State's tiedown code. Inspections are only done if complaints are made regarding an installation.

In addition to code standards to protect the mobile home from high winds is the need to protect the occupants. There are no state or federal requirements for shelters in mobile home parks.

Local Implementation: As discussed in Chapter 2, there are at least six manufactured home communities in McHenry County, located near or in Crystal Lake, Harvard, Marengo and McHenry. Also in McHenry County, manufactured structures are sometimes used for temporary classroom or sales offices at development sites. The floodplain ordinance portion of the County Stormwater Management Ordinance applies to mobile homes and manufactured buildings. Also, zoning ordinances have mobile home standards incorporated into them.

Mobile school classrooms are regulated by the IDPH, and school districts must provide the State with an architect's seal of compliance. Each year, there must be an inspection of the anchoring and a renewed evacuation plan signed by the superintendent of the school district. These provisions provide a higher level of protection than current procedures do for residential mobile homes.

CRS Credit: Up to 50 points are provided for enforcing the floodplain management requirements in mobile home parks. Because the McHenry County Stormwater Ordinance has these provisions, communities with mobile home parks could receive this credit. Additional points are possible for other special regulations, such as prohibiting manufactured housing in the floodway. There are no CRS credits for manufactured housing standards for hazards other than flooding.

4.3 Critical Facility Construction

Critical facilities, defined in Chapter 2 for purposes of this Plan, are generally constructed with public funds. The exception is usually health care facilities. The source of public funds can be federal, state or local. State of Illinois and federal government executive orders require higher flood protection standards for critical facilities when funded with state or federal dollars. Both orders require compliance when state or federal funds are used for the construction or permitting of any critical facility. Both the state and federal orders have consistent interpretations of "critical facilities".

Hazards Addressed	
✓	Floods
✓	Summer Storms
	Winter Storms
	Extreme Cold
	Extreme Heat
✓	Tornadoes
	Drought
	Groundwater

Illinois Executive Order 2006-05 requires that State agencies which plan, promote, regulate, or permit activities, as well as those which administer grants or loans in the State's floodplain areas, must ensure that all projects meet the standards of the State floodplain regulations or the NFIP, whichever is more stringent. The State Executive Order also guarantees the State's eligibility for certain types of federal disaster assistance. Critical facilities must be protected to the 500-year level (see box on following page).

The Illinois Department of Natural Resources-Office of Water Resources is required by the Order to assist state agencies with flood hazard information and assistance to carry out the Executive Order. Unfortunately, no agency has the authority to enforce the Executive Order.

The Federal Executive Order 11988 has similar floodplain standards for federal agencies. Compliance with Federal Executive Order 11988 must be met for all "pass through" federal funding. These standards ensure that federal and state resources and funds are not being used for inappropriate and dangerous floodplain development. The 500-year flood protection level is also used for critical facilities in Executive Order 11988.

Excerpt from Illinois Executive Order 2006-05:

"2. All State Agencies engaged in any development within a Special Flood Hazard Area shall undertake such development in accordance with the following:

A. All development shall comply with all requirements of the National Flood Insurance Program (44 C.F.R. 59-79) and with all requirements of 92 Illinois Administrative Code Part 700 or 92 Illinois Administrative Code Part 708, whichever is applicable.

B. In addition to the requirements set forth in preceding Section A, the following additional requirements shall apply where applicable:

1. All new Critical Facilities shall be located outside of the floodplain. Where this is not practicable, Critical Facilities shall be developed with the lowest floor elevation equal to or greater than the 500-year frequency flood elevation or structurally dry floodproofed to at least the 500-year frequency flood elevation.

2. All new buildings shall be developed with the lowest floor elevation equal to or greater than the Flood Protection Elevation or structurally dry floodproofed to at least the Flood Protection Elevation.

3. Modifications, additions, repairs or replacement of existing structures may be allowed so long as the new development does not increase the floor area of the existing structure by more than twenty (20) percent or increase the market value of the structure by fifty (50) percent, and does not obstruct flood flows. Floodproofing activities are permitted and encouraged, but must comply with the requirements noted above.

3. State Agencies which administer grants or loans for financing development within Special Flood Hazard Areas shall take all steps within their authority to ensure that such development meets the requirements of this Order.

4. State Agencies responsible for regulating or permitting development within Special Flood Hazard Areas shall take all steps within their authority to ensure that such development meets the requirements of this Order."

Local Implementation:

Federal and/or state owned or funded critical facilities: Federal and State agency consideration and adherence to the Executive Order 2006-05 and Executive Order 11988 for the placement of critical facilities in the floodplain is lacking. Although they are required to follow state building codes, federal agencies, State agencies and school districts are *not* required to obtain local permits for construction. Local agencies are mostly unaware of the executive orders. Local government understanding of the executive orders is important, along with an understanding of the potential impact on a community when the floodplain management standards are not followed.

County, municipal or township funded critical facilities: The McHenry County Stormwater Management Ordinance includes a definition of critical facilities, however it does not specify a level of protection beyond the 100-year event. The McHenry Ordinance does require that all buildings and additions to buildings in the 100-year floodplain (Special Flood Hazard Area) be constructed to the flood protection elevation (FPE). The McHenry County FPE is the

placement of the lowest floor of a building 2 feet above the base flood elevation (100-year flood elevation).

4.4 Planning and Zoning

Planning and zoning activities direct development away from hazardous areas, especially floodplains and wetlands. They do this by designating land uses that are more compatible to the natural conditions of the land, such as open space or recreation. They can also benefit by simply allowing developers more flexibility in arranging improvements on a parcel of land through the planned development approach.

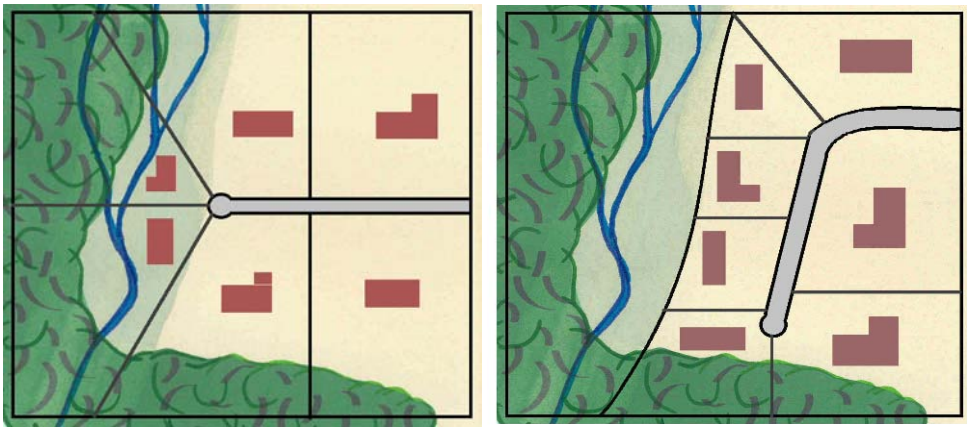
Hazards Addressed	
✓	Floods
	Summer Storms
	Winter Storms
	Extreme Cold
	Extreme Heat
	Tornadoes
✓	Drought
✓	Groundwater

Comprehensive Plans: These plans are the primary tools used by communities to address future development. They can reduce future flood-related damages by indicating open space or low density development within floodplains and other hazardous areas. Natural hazards should be emphasized in specific land use recommendations.

A zoning ordinance should designate floodprone lands for agricultural, conservation, or other uses that suffer minimal damage from a flood.

Zoning Regulations: Zoning codes are the primary tool used to implement comprehensive plan guidelines for how land should be developed. Zoning ordinances usually set minimum lot sizes for each zoning district, however a community can allow flexibility in lot sizes and location so developers can avoid hazardous areas.

Communities can also consider cluster developments or conservation designs to allow the developer to incorporate flood hazard mitigation, and resource protection, measures into the project. Open space and/or floodplain preservation can be facilitated and site design standards and land use densities can be adjusted, as in the example below.



In the standard zoning approach (left), the developer considers six equally-sized lots without regard for the flood hazard. Two properties are subject to flooding and the natural stream is disrupted. An alternative, flexible, approach is shown on the right. The floodplain is dedicated as public open space. There are seven smaller lots, but those abutting the floodplain have the advantage of a larger open area. Four lots have riverfront views instead of two. These amenities compensate for the smaller lot sizes, so the parcels are valued the same.

Capital Improvement Plans: Capital improvement plans guide a community's major public expenditures for the next 5 to 20 years. Capital expenditures may include acquisition of open space within the hazardous areas, extension of public services into hazardous areas, or retrofitting existing public structures to withstand a hazard.

Local Implementation: Table 4-2 summarizes the findings of a review of comprehensive and land use plans adopted by the County and the municipalities.

Table 4-2 McHenry County Planning and Land Use Ordinances

Municipalities	Comprehensive Plan	Flooding or other hazards included in Comprehensive Plan	Zoning Ordinance	Flood hazards or drainage provisions in Subdivision Ordinance	Requirement to bury utilities in Subdivision Ordinance
Algonquin	X	X	X	X	X
Bull Valley			X		
Cary	X		X	X	X
Crystal Lake	X	X	X	X	X
Fox River Grove	X		X		
Greenwood			X		
Harvard			X		
Hebron			X		
Holiday Hills			X	X	
Huntley	X		X		
Johnsburg	X		X	X	X
Lake in the Hills	X	X	X	X	X
Lakewood	X	X	X	X	X
Marengo	X	X	X	X	X
McCullom Lake	X		X	X	X
McHenry	X		X	X	X
Oakwood Hills					
Prairie Grove	X	X	X	X	X
Richmond					
Ringwood					
Spring Grove	X	X	X	X	X
Trout Valley					
Union					
Wonder Lake	X	X	X	X	X
Woodstock	X	X	X	X	X
McHenry County	X	X	X	X	

NFIP/CRS

CRS Credit: Up to 100 points are provided for regulations that encourage developers to preserve floodplains or other hazardous areas from development. There is no credit for a plan, only for the enforceable regulations that are adopted pursuant to a plan.

4.5 Subdivision Regulations

Hazards Addressed	
✓	Floods
✓	Summer Storms
	Winter Storms
	Extreme Cold
	Extreme Heat
✓	Tornadoes
✓	Drought
✓	Groundwater

Subdivision regulations govern how land will be subdivided and sets construction standards. These standards generally address roads, sidewalks, utilities, storm sewers and drainageways. They can include the following hazard protection standards:

- Requiring that the final plat show all hazardous areas.
- Road standards that allow passage of firefighting equipment and snow plows
- Requiring power or phone lines to be buried
- Minimum water pressures adequate for fire fighting
- Requiring that each lot be provided with a building site above the flood level
- Requiring that all roadways be no more than one foot below the flood elevation.

Local Implementation: Table 4-2, on the previous page, shows the communities in McHenry County that have adopted subdivision regulations.

NFIP/CRS

CRS Credit: Up to 25 points are provided for requiring that new streets in a floodplain be elevated to no more than one foot below the flood elevation. There are no CRS credits for requirements for hazards other than flooding.

4.6 Comprehensive Stormwater Management

Hazards Addressed	
✓	Floods
✓	Summer Storms
	Winter Storms
	Extreme Cold
	Extreme Heat
	Tornadoes
✓	Drought
✓	Groundwater

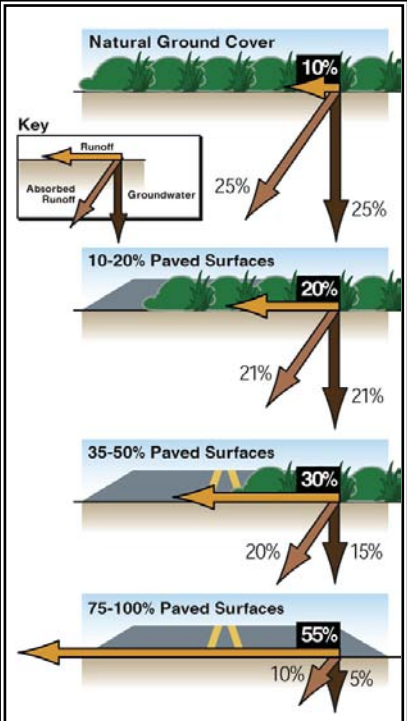
Development alters watersheds. Stormwater runoff is increased when natural ground cover is replaced by urban development (see graphic on the next page). Comprehensive stormwater management, or watershed management, ordinances are adopted for the purpose of minimizing development impacts. Comprehensive stormwater management ordinances typically include:

- Site stormwater runoff requirements
- Floodplain management
- Soil erosion and sediment control
- Wetland avoidance and mitigation requirements
- Riparian environment protection
- Water quality protection

4.6.1 Site Stormwater Runoff

Site stormwater runoff management requirements involve regulating all development to ensure that the flood problems will not be created or increased. Different site requirements are developed based on the size of the development or area of disturbance. Smaller development typically must include site features to ensure that site runoff is properly collected and discharged from the site. Larger development typically must provide site runoff storage and other requirement to protect adjacent and downstream properties from the impact of the development

Local Implementation: The McHenry County Stormwater Management Ordinance established site stormwater management for development that creates 5,000 square feet of impervious area and detention requirements for development that creates over 20,000 square feet of impervious area.



Increases in impervious surfaces increase watershed runoff. *Source: ASFPM*

4.6.2 Floodplain Management

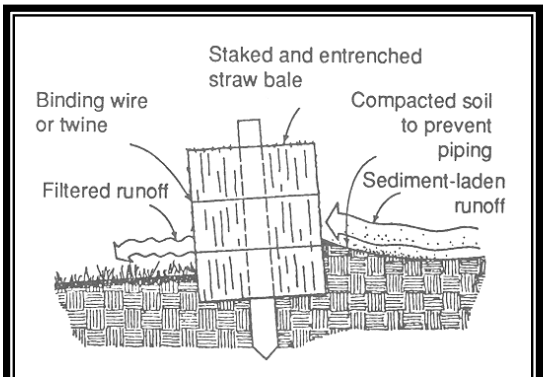
Development in floodplains is development in harm's way. New construction in the floodplain increases the amount of development exposed to damage and can aggravate flooding on neighboring properties. Floodplain management involves regulating development in the floodplain to ensure that it will be protected from flooding and that it won't divert floodwaters onto other properties The NFIP and the Illinois Department of Natural Resources (IDNR) set minimum requirements for regulating development in the floodplain and in the floodway. All new buildings must be protected from the base or 100-year flood and no development can cause an increase in flood heights or velocities.

Local Implementation: All but three McHenry County communities participate in the National Flood Insurance Program (NFIP) (see Table 1-3 in Chapter 1). The McHenry County Stormwater Management Ordinance meets or exceeds all of the state and NFIP floodplain regulatory requirements. These standards are enforced in all communities. Also the McHenry County definition for "development" in the Stormwater Management Ordinance is the same as the definition required by the NFIP. This helps ensure that all activities in the floodplain are being properly regulated. Also, compensatory storage is required at a ratio of 1.5 to 1.0 in McHenry County, plus a 2 foot flood protection elevation.

Municipalities that participate in the NFIP are each responsible for maintaining their "good standing" with FEMA and the NFIP. In April 2010, McHenry County received a "Community Assistance Visit" (CAV) from IDNR and FEMA. The CAV allows the community to demonstrate to FEMA that the floodplain regulations are being properly administered and enforced.

4.6.3 Soil Erosion and Sedimentation Control

Erosion can occur when any soils are exposed to the wind or rain, but it also occurs along streambanks and shorelines as the volume and velocity of flow or wave action destabilize and wash away the soil. Sediment suspended will settle out where flowing water slows down. It can clog storm sewers, drain tiles, culverts and ditches, and reduce the water transport and storage capacity of river and stream channels, lakes and wetlands.



Straw bales catch sediment

Additionally, the sediment often brings chemicals, heavy metals and other pollutants, and light and oxygen are reduced in the stream which impairs water quality. Sediment has been identified by the US EPA as the nation's number one nonpoint source pollutant for aquatic life.

Techniques to minimize erosion include phased construction, minimal land clearing, and stabilizing bare ground as soon as possible with vegetation and other soil stabilizing practices. If erosion occurs, other measures are used to capture sediment before it leaves the site. Silt fences, sediment traps and vegetated filter strips are commonly used to control sediment transport. Runoff from the site can be slowed down by terraces, contour strip farming, no-till farm practices, hay or straw bales, constructed wetlands, and impoundments (e.g., sediment basins and farm ponds). Slowing surface water runoff on the way to a drainage channel increases infiltration into the soil and reduces the volume of topsoil eroded from the site. These practices or approaches are commonly referred to as "best management practices" or BMPs.

BMPs

Best Management Practices or BMPs is a broad term used in several aspects of stormwater or watershed management, including site runoff management, soil erosion and sediment control and water quality protection. BMP represents a list of land management practices that a site engineer may select from.

Since BMP is such a broad term, the use of it is waning. More and more, specific approaches are being required with particular performance standards.

Local Implementation: Standards for soil erosion and sediment control during and following project construction are components of the McHenry County Stormwater Management Ordinance and are consistent with the Illinois Environmental Protection Agency's (IEPA) ILR-10 permit, as issued. IEPA recently revised the ILR-10 permit in August 2008, shortly after McHenry County adopted the revised McHenry County Stormwater Management Ordinance.

4.6.4 Wetland Protection

Wetlands are often found in floodplains and depressional areas of a watershed. Many wetlands receive and store floodwaters, thus slowing and reducing downstream flows. They also serve as a natural filter, which helps to improve water quality, and provide habitat for many species of fish, wildlife, and plants.

Wetlands that are determined to be part of the Waters of the United States (WOTUS) are regulated by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency (USEPA) under Section 404 of the Clean Water Act. Before a "404" permit is issued, the plans are reviewed by several agencies, including the Corps and the U.S. Fish and Wildlife Service. Each of these agencies must sign off on individual permits. Not regulated under Section 404 are other wetlands that are not within the WOTUS and they are referred to as "isolated wetlands."

Chicago area wetland

There are also nationwide permits that allow small projects that meet certain criteria to proceed without individual permits. If a permit is issued by the Corps (and/or by McHenry County), the impact of the development is typically required to be mitigated. Wetland mitigation can include creation, restoration, enhancement or preservation of wetlands elsewhere. Wetland mitigation is often accomplished within the development site, however, mitigation is allowed off-site and sometimes in another watershed. The appropriate type of mitigation is addressed in each permit. Some developers and government agencies have accomplished the required mitigation by buying into a wetland bank. Wetland banks are large wetlands created for the purpose of mitigation. The banks accept money to reimburse the owner for setting the land aside from development.

Additional education about the importance of wetlands is needed. An example of an education approach used in Wisconsin is shown on the following page.

West Nile Virus and Wetlands
Wetland predators lower mosquito populations, WNV risk

West Nile is a mosquito-borne virus first detected in the United States in 1999 and in Illinois in 2001. Female mosquitoes transmit the virus mainly to birds, but also to other animals and occasionally to people. The threat to human health raises concerns about mosquito populations and the sites that breed them. **Some citizens are concerned that wetlands are part of the problem, but in fact, wetlands can be part of the cure.**

Healthy wetlands are home to fish, insects and birds that eat mosquitoes and keep their populations low. Furthermore, the species of mosquitoes responsible for transmitting West Nile Virus don't prefer wetlands but breed prolifically in stagnant water in discarded tires, birdbaths, and roof gutters. Such artificial containers lack the predators found in wetlands, and are located in or near urban areas, providing infected mosquitoes with easy access to human or animal hosts.

The presence of West Nile Virus in Illinois makes it more important than ever to protect and restore wetlands. Healthy wetlands can control mosquito numbers in addition to providing wildlife habitat, preventing flooding and purifying water.

Read on to learn more about mosquitoes and wetlands and what you can do around your home and community to decrease the risk of WNV.

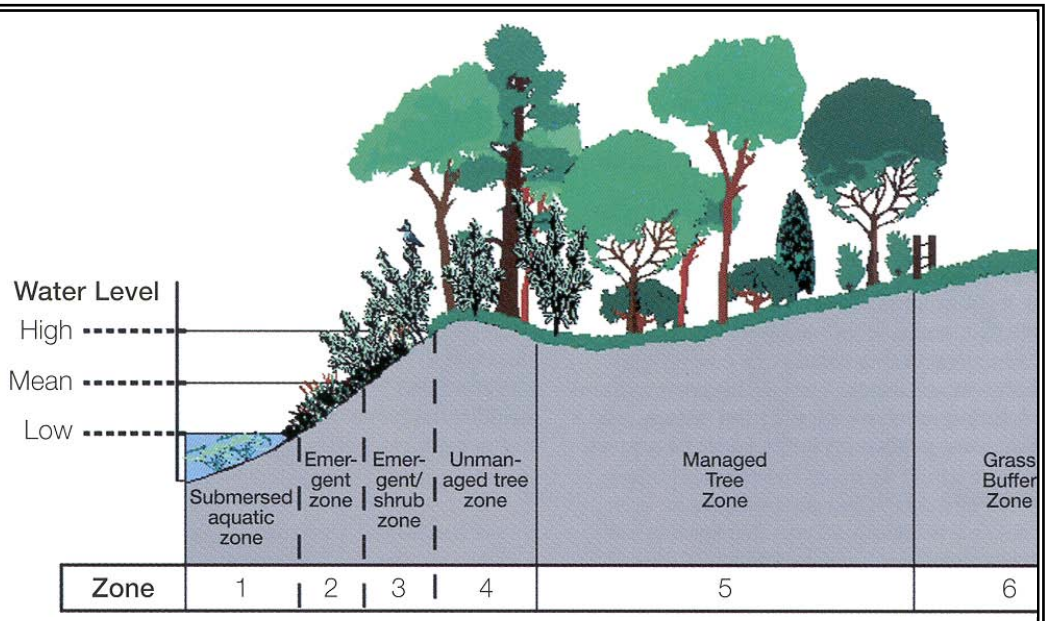
Source: Fox River Ecosystem Partnership, Wisconsin DNR

Local Implementation: Both Corps WOTUS (jurisdictional wetlands) and isolated wetlands are regulated in the McHenry County Stormwater Management Ordinance. Wetlands must be properly identified and delineated according to the standards in the Stormwater Management Ordinance, which are consistent with the Corps. Disturbance of wetlands located within the WOTUS require a permit from the Corps before a permit is issued under the McHenry County Stormwater Management Ordinance.

4.6.5 Riparian Environment Protection

Riparian environments are the areas surrounding or adjacent to open bodies of water, including streams, lake and wetlands. Riparian environments provide a range of functions. For example, they filter runoff, enhance streambank stability, and provide a habitat for flora and fauna. Riparian areas are generally established as a buffer area, and the size depends on the nature or the quality of the water body.

Implementation: Buffer areas are required in the McHenry County Stormwater Ordinance for areas meeting the definition of WOTUS or isolated waters of McHenry County. The Stormwater Management Ordinance requires that all buffer areas be maintained free from development including disturbance of the soil, dumping or filling, erection of structures and placement of impervious surfaces, with some exceptions.



Aquatic and Riparian Buffer Plant Zones

Aquatic and Riparian Buffer Plant Zones

Different types of plants are used in different buffer zones along a channel. Zone 1 plants are normally submerged while zone 2 plants are inundated during much of the growing season. Zone 3 plants are water tolerant, but are flooded only during high water. By using the proper plants in each zone, they stabilize streambanks, filter polluted runoff, and provide habitat. *Source: Banks and Buffers – A Guide to Selecting Native Plants for Streambanks and* Shorelines, Tennessee Valley Authority

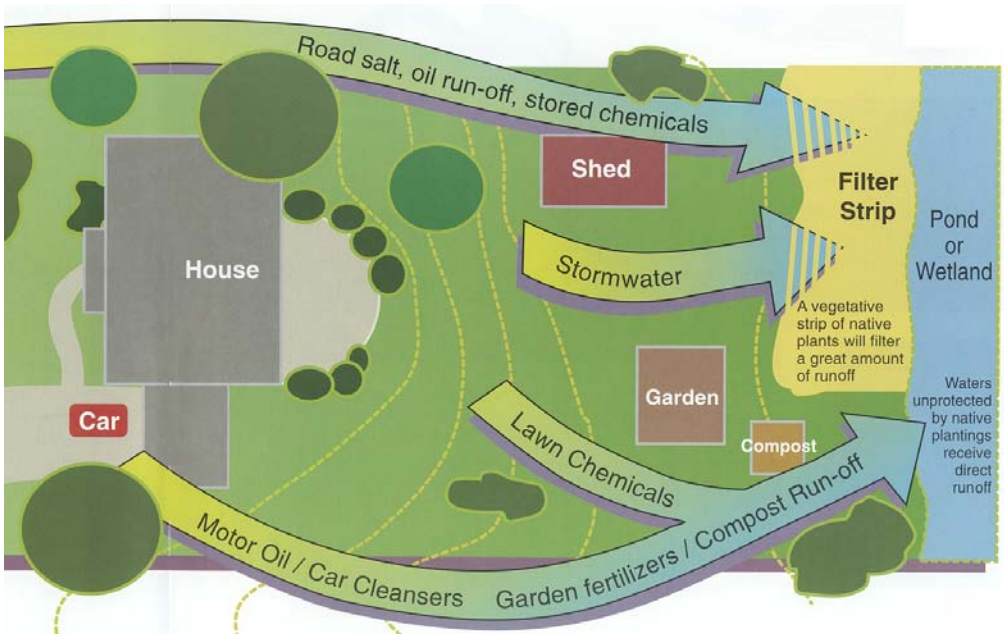
4.6.6 Water Quality Requirements

Point source pollutants come from pipes such as the outfall of a municipal wastewater treatment plant. They are regulated by the U.S. and Illinois Environmental Protection Agencies. *Nonpoint source* pollutants come from non-specific locations and are harder to regulate.

Examples of nonpoint source pollutants are lawn fertilizers, pesticides, and other farm chemicals, animal wastes, oils from street surfaces and industrial areas and sediment from agriculture, construction, mining and forestry. These pollutants are washed off the ground's surface by stormwater and flushed into receiving storm sewers, ditches and streams.

BMPs can be employed to minimize water quality degradation, preserve beneficial natural features onsite, maintain natural base flows, minimize habitat loss, and provide multiple use of drainage and storage facilities.

Local Implementation: Water quality protection practices are included in the McHenry County Stormwater Ordinance, and also have been incorporated throughout the Ordinance. The Stormwater Management Ordinance requires, in general, that runoff from impervious area be directed toward pervious areas before leaving the site.



BMPs slow stormwater runoff and improve water quality.

Source: Living With Wetlands, A Handbook for Homeowners in Northeastern Illinois

4.6.7 Implementation of the McHenry County Stormwater Management Ordinance

The McHenry County Department of Planning and Development is responsible for administering and enforcing the Stormwater Management Ordinance. Communities, based on their regulatory resources, are granted "certified" status by the County for the review of permit application and permit issuance. Table 4-3 shows the status of McHenry County municipalities for the implementation of the Stormwater Management Ordinance.

The Stormwater Technical Advisory Committee (TAC) meets regularly to discuss Ordinance implementation to ensure consistent interpretation and enforcement of ordinance provisions.

Table 4-3 McHenry Countywide Stormwater Ordinance – Certified Community Status

Municipality:		Status:
Village of	Algonquin	Kane
Village of	Barrington Hills	Non-Certified
Village of	Bull Valley	Non-Certified
Village of	Cary	Non-Certified
City of	Crystal Lake	Certified
Village of	Fox Lake	Lake-part
Village of	Fox River Grove	Non-Certified
Village of	Greenwood	Non-Certified
City of	Harvard	Non-Certified
Village of	Hebron	Certified
Village of	Holiday Hills	Non-Certified
Village of	Huntley	Kane
Village of	Island Lake	Lake-full
Village of	Johnsburg	Certified
Village of	Lake in the Hills	Certified
Village of	Lakemoor	Non-Certified
Village of	Lakewood	Certified
City of	Marengo	Certified
Village of	McCullom Lake	Certified
City of	McHenry	Certified
Village of	Oakwood Hills	Non-Certified
Village of	Port Barrington	Lake-part
Village of	Prairie Grove	Certified
Village of	Richmond	Certified
Village of	Ringwood	Certified
Village of	Spring Grove	Certified
Village of	Trout Valley	Non-Certified
Village of	Union	Certified
Village of	Wonder Lake	Certified
City of	Woodstock	Certified

CRS Credit: CRS credit is provided for both higher regulatory standards in the floodplain and runoff management standards for new developments. Credit is based on how those standards exceed the minimum NFIP requirements.

The County's Stormwater Ordinance has the following provisions that would be recognized by the CRS (in addition to the provisions discussed in other sections):

- Buildings must be elevated to a level two feet above the base (100-year) flood elevation (although attached garages can be lower, reducing the CRS score),
- Fill must meet certain standards to protect it from erosion and scour,
- Flood storage lost due to filling and construction must be compensated for by removal of an equal volume of storage,
- Only appropriate uses are allowed in the floodway. Buildings are not appropriate uses,
- Standards for retention and detention basins,
- Requirements for erosion and sedimentation control,
- Requirements that protect channel banks and lakeshores from development through setbacks or buffer zones, and
- The requirement to incorporate best management practices into all plans.

The County and all municipalities should receive at least 300 points for these provisions of the McHenry County Stormwater Ordinance. They certainly exceed minimum State and Federal requirements. To attain a Class 4 or better in the CRS program, communities must have an adopted stormwater management plan that examines the impact of the 100-year event with future development conditions. Watershed plans being developed by the McHenry County Stormwater Division should fulfill this requirement.

The Community Rating System focuses on activities that directly affect flood damage to insurable buildings. While there is no credit for relying on the Corps of Engineers' 404 regulations, there is credit for preserving open space in its natural condition or restored to a state approximating its natural condition. The credit is based on the percentage of the floodplain that can be documented as wetlands protected from development by ownership or local regulations.

4.7 Conclusions

1. Building codes are the prime preventive measure for tornadoes, high winds, snow storms, and earthquakes. Rigorous enforcement of the latest available building codes, with an adequately trained staff provides a more sustainable community.
2. The County and nearly all communities have adopted the International Code series, which provides better protection from natural hazards. However, according to the Institute for Building and Home Safety, the International Residential and Building Codes do not adequately protect new construction from damage by tornadoes (wind) and hail.
3. Based on the national Building Code Effectiveness Grading Schedule (BCEGS), administration of building codes in McHenry County is generally good. BCEGS Class 5 is recognized by CRS as a minimum requirement for better CRS classes. Most communities have residential and commercial ratings of 5 and better.
4. State administration of the installation of mobile or manufactured homes does not guarantee that they will be adequately tied down or protected from flooding and other hazards.
5. Limited attention is given to the construction of critical facilities in the floodplains.
6. The majority of the comprehensive and land use plans address floodplains and the need to preserve these hazardous areas from intensive development. However, many zoning ordinances do not designate floodprone areas for any special type of land use.
7. It is unknown what percent of the county's floodplains are open space and/or in public ownership.
8. The McHenry County Stormwater Management Ordinance's provisions for stormwater management, floodplain development, soil erosion and sediment control, and wetland, riparian and water quality protection, meet and exceed minimum national and State standards.

4.8 Recommendations

The following preventive measure recommendations were identified by the Mitigation Committee:

1. The public, developers, builders, and decision makers should be informed about the hazard mitigation benefits of building codes and the McHenry County Stormwater Management Ordinance.
2. Communities that have not adopted the International series of codes should do so, and on a regional basis, municipal and County code enforcement staffs should work together to develop building code language to strengthen new buildings against damage by high winds, tornadoes and hail,
3. All communities should work to improve code administration and enforcement, and should also be trained on implementing the codes that are applicable to hazard mitigation.
4. The County and municipalities that participation in the NFIP should ensure that they fully and properly administer and enforce the requirements of the NFIP, and fully enforce all provisions of the Countywide Stormwater Management Ordinance.
5. The adequacy or current requirements for manufactured home and recreational vehicle parks for protection from natural hazards should be examined, especially concerns pertaining to placement in flood prone areas, tie downs and sheltering.
6. On a regional basis, municipal and County planning and engineering staff should develop example subdivision ordinance language that requires new infrastructure to have hazard mitigation provisions, such as secondary access to subdivisions.
7. Municipal comprehensive plans, land use plans and zoning ordinances should incorporate open space provisions that will protect properties from flooding and preserve wetlands, groundwater quality and recharge, and farmland.
8. The McHenry County should continue to enforce all aspects of the Stormwater Management Ordinance. The County should also maintain the TAC.
9. Offices responsible for design, construction or permitting critical facilities should ensure that the design accounts for natural hazards and adjacent land uses.
10. Communities (certified and non-certified) need to understand and consistently enforce the McHenry County Stormwater Management Ordinance provisions. The McHenry County Technical Advisory Committee should continue their efforts in these areas.
11. McHenry County and municipalities should consider joining the NFIP's CRS program. For the municipalities already involved in CRS, they should work to improve their CRS class.

4.9 References

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18. Survey of McHenry County municipalities and townships, and review of ordinances, 2010.

Chapter 5. Property Protection

Source: F. Wetmore

Property protection mitigation measures are used to modify a building or a property that is subject to a hazard in order to reduce potential damage. Property protection measures fall under the following approaches:

- Modify the site to keep the hazard from reaching the building
- Modify the building (retrofit the building) so it can withstand the impacts of the hazard
- Insure the property to provide financial relief after the damage occurs

The word "building" can refer to residential, commercial or industrial structures, or it can mean infrastructure facilities (treatment plants, electrical substations, roads) or other public structures. Property protection measures are normally implemented by the property owner (public or private), although in many cases technical and financial assistance can be provided by a government agency. These are discussed later in this chapter.

5.1 Barriers, Elevation, Relocation, and Acquisition

Hazards Addressed	
✓	Floods
✓	Summer Storms
	Winter Storms
	Extreme Cold
	Extreme Heat
	Tornadoes
	Drought
✓	Groundwater

For the hazards considered in this plan, flooding is the one hazard that can be kept away from a building. There are four common methods to do this:

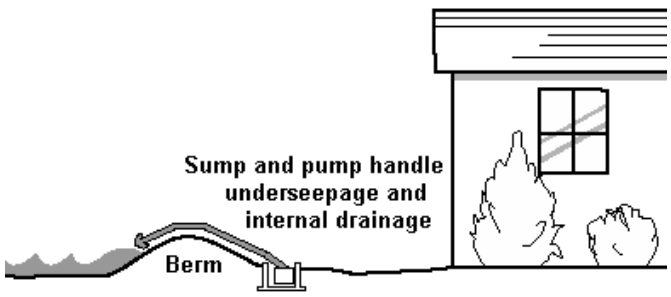
- Erect a barrier between the building and the source of flooding
- Move the building out of the flood prone area
- Elevate the building above the flood level
- Demolish the building

The advantages and disadvantages to these four methods will be discussed below. Generally, floods do not damage vacant areas. The major impact of hazards is to people and improved property. In some cases, properties can be modified so the hazard does not reach the damage-prone improvements. A fire break is an example of this approach – brush and other fuel are cleared away from the building so a fire may not reach it.

Table 5-1 Reported Types of Existing Flood Problems in McHenry County

Municipality	Stormwater Flooding	Stream Overbank Flooding	Foundation Seepage	Groundwater
Algonquin	X	X		
Bull Valley				
Cary				
Crystal Lake	X			X
Fox River Grove		X		
Greenwood	X		X	
Harvard	X		X	X
Hebron	X			
Holiday Hills				X
Huntley	X		X	
Johnsburg		X		
Lake in the Hills	X	X	X	X
Lakewood	X		X	X
Marengo	X		X	X
McCullom Lake	X		X	X
McHenry	X		X	X
Oakwood Hills				
Prairie Grove				
Richmond	X			
Ringwood	X			
Spring Grove	X			
Trout Valley				
Union	X	X		
Wonder Lake	X		X	
Woodstock	X		X	X
McHenry County	X	X		X
Township				
Alden				
Algonquin	X	X	X	X
Burton				
Chemung				
Coral				
Dorr	X		X	X
Dunham				
Grafton				
Greenwood	X			
Hartland				
Hebron	X			
Marengo				
McHenry Road District	X	X		
McHenry				
Nunda		X		
Richmond				
Riley	X		X	
Seneca	X	X		X

Barriers: A flood protection barrier can be built of dirt or soil ("berm") or concrete or steel ("floodwall"). Berms take up more space than floodwalls, but floodwalls are more expensive than berms.



Small barriers can be effective against shallow flooding.

Careful design is needed so as not to create flooding or drainage problems on neighboring properties. If the ground is porous and if floodwaters will stay up for more than an hour or two, the design needs to account for leaks, seepage of water underneath, and rainwater that falls inside the perimeter.

Barriers can only be built so high. They can be overtopped by a flood higher than expected. Barriers made of earth are susceptible to erosion from rain and floodwaters if not properly sloped, covered with grass, and maintained. A berm can settle over time, lowering its protection level. A floodwall can crack, weaken, and lose its watertight seal. Therefore, barriers need careful design and maintenance (and insurance on the building, in case of failure).

Relocation: Moving a building to higher ground is the surest and safest way to protect it from flooding. Relocation of a building can be to a new property outside of the floodplain, or, for large lots, to a higher location (outside of the floodplain) on the existing property. Any building can be moved, however the cost goes up for heavier structures, such as those with exterior brick and stone walls, and for large or irregularly shaped buildings.

Building Elevation: Raising a building above the flood level can be almost as effective as moving it out of the floodplain. Water flows under the building, causing little or no damage to the structure or its contents.

Raising a building above the flood level is cheaper than moving it and can be less disruptive to a neighborhood. Elevation has proven to be an acceptable and reasonable means of complying with floodplain regulations that require new, substantially improved, and substantially damaged buildings to be elevated above the base flood elevation.

Elevating a building will change its appearance. If the required amount of elevation is low, the result is similar to putting a building on a 2- or 3-foot-high crawlspace (see example

below). If the building needs to be raised more than four feet, owners are concerned that it will stick out like a sore thumb, and they may decline to implement an elevation project. Yet, many owners have successfully and attractively (with stairs and landscaping) elevated their homes more than eight feet.

Another problem with this approach is with basements. Only the first floor and higher are elevated. The basement remains as the foundation. All utilities are elevated and the basement is filled in to protect the walls from water pressure. The owner loses the use of the basement, which may deter him or her from trying this approach.

A third problem with elevation is that it may expose the structure to greater impacts from other hazards. If not braced and anchored properly, an elevated building may have less resistance to the shaking of an earthquake and the pressures of high winds. Careful design and construction, however, should prevent these secondary problems.

Demolition: If a home has been heavily damaged and susceptible to future damage, it is safest for owners to relocate. Acquisition, followed by demolition, is most appropriate for buildings that are dilapidated and are not worth protecting, but acquisition and demolition should also be considered for structures that would be difficult to move—such as larger, slab foundation, or masonry structures. Generally, demolition projects are undertaken by a government agency, so the cost is not borne by the property owner, and the land is converted to public use, such as a park.

One problem that sometimes results from an acquisition and demolition project is a "checkerboard" pattern in which nonadjacent properties are acquired. Creating such an acquisition pattern in a community adds to the maintenance costs that taxpayers must support.

Home elevated two foot above the base flood elevation.

Local Implementation: The Village of Algonquin and City of Woodstock have acquired and demolished buildings.

McHenry County and the Villages of Holiday Hills and Johnsburg have buildings that have been elevated according to requirements of the NFIP and the McHenry County Stormwater Management Ordinance. The countywide flood protection elevation (for the first floor of all buildings) is 2 feet above the FEMA established base flood elevation.

CRS Credit: The Community Rating System provides the most credit points for acquisition and relocation because this measure permanently removes insurable buildings from the floodplain. The score is based on the number of buildings removed compared to the number remaining in the floodplain (Activity 520 – Acquisition and Relocation).

The CRS also credits barriers and elevating existing buildings (Activity 530 – Flood Protection). Elevating a building above the flood level will also reduce the flood insurance premiums on that individual building. Because barriers are less secure than elevation, not as many points are provided.

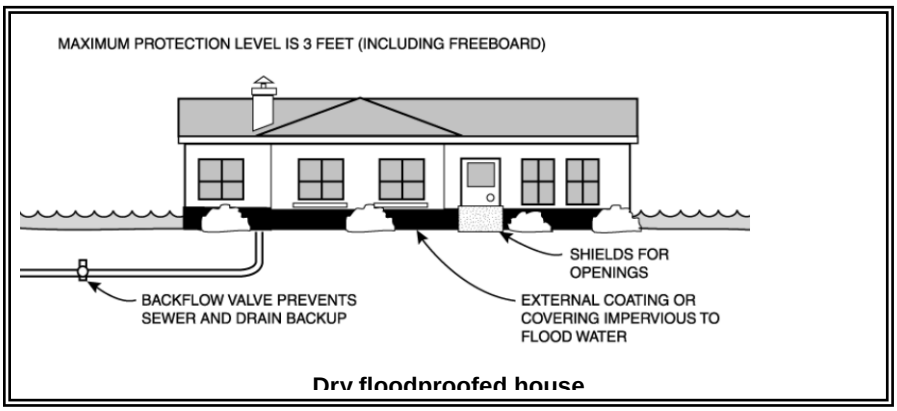
5.2 Retrofitting – Modify the Building

Hazards Addressed	
✓	Floods
✓	Summer Storms
✓	Winter Storms
✓	Extreme Cold
	Extreme Heat
✓	Tornadoes
	Drought
✓	Groundwater

Section 5.1 focused on keeping the hazard from reaching a building or damage-prone part of a property. An alternative is to modify or "retrofit" the site or building to minimize or even prevent damage. There are a variety of techniques to do this. This section looks at the measures that can be implemented to protect existing buildings from damage by floods, sewer backup, earthquakes, tornadoes, summer and winter storms.

5.2.1 Flood Retrofitting - Buildings

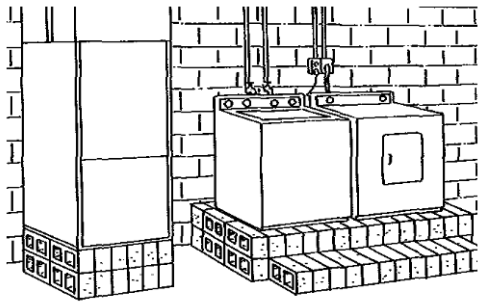
Flood retrofitting measures include **dry floodproofing** where all areas below the flood protection level are made watertight. Walls are coated with waterproofing compounds or



plastic sheeting. Openings (doors, windows, and vents) are closed, either permanently, with removable shields, or with sandbags.

Dry floodproofing of new and existing nonresidential buildings in the regulatory floodplain is permitted under State, FEMA and County regulations. Dry floodproofing of existing residential buildings in the floodplain is also permitted as long as the building is not

substantially damaged or being substantially improved. Owners of buildings located outside the regulatory floodplain can always use dry floodproofing techniques.



Wet floodproofed basement

The alternative to dry floodproofing is **wet floodproofing:** water is let in and everything that could be damaged by a flood is removed or elevated above the flood level. Structural components below the flood level are replaced with materials that are not subject to water damage. For example, concrete block walls are used instead of wooden studs and gypsum wallboard. The furnace, water heater, and laundry facilities are permanently relocated to a higher floor. Where the flooding is not deep, these appliances can be raised on blocks or platforms.

Wet floodproofing has one advantage over the other approaches: no matter how little is done, flood damage is reduced. Thousands of dollars in damage can be prevented by simply moving furniture and electrical appliances out of a basement.

A third flood protection modification addresses flooding caused by overloaded sanitary or combined sewers. Four approaches may be used to protect a structure against **sewer backup**: floor drain plugs, floor drain stand-pipes, overhead sewers, and backflow protection valves.

The first two devices keep water from flowing out of the lowest opening in the building, the floor drain. They cost less than $25. However, if water becomes deep enough in the sewer system, it can flow out of the next lowest opening, such as a toilet or tub, or it can overwhelm a drain plug by hydrostatic pressure and flow into the building through the floor drain. The other two measures, overhead sewers and backflow protection valves keep water in the sewer line during a backup. These are more secure, but more expensive ($3,000-$4,000).

For dry floodproofing, wet floodproofing, and sewer backup prevention, it is important to consider what contents of a building are suitable for keeping in basements or crawl spaces. Valuable and invaluable items, such as, photographs, should be kept elsewhere in the event that the seepage or flooding occurs even with the retrofitting measures in place.

Local Implementation: Most floodproofing activity in the County has been the installation of overhead sewers, such as in the Village of Lakewood and the Cities of McHenry and Woodstock. Woodstock also offers financial assistance for an overhead sewer retrofit.

CRS Credit: Credit for dry and wet floodproofing and sewer backup protection is provided under Activity 530 (Retrofitting). Because these property protection measures are less secure than barriers and elevation, not as many points are provided.

Tornado shelter

5.2.2 Tornado Retrofitting

Tornado retrofitting measures include constructing an underground shelter or "safe room" at the first floor level to protect the lives of the occupants. Their worth has been proven by recent tornadoes in Oklahoma, as shown in the photo to the below. They can be installed for approximately $3,000.

Safe rooms are built by connecting all parts of the shelter together (walls, roof and foundation) using adequate fasteners or tie downs. These help hold the safe room together when the combination of high wind and pressure differences work to pull the walls and ceiling apart. The walls of the safe room are constructed out of plywood and metal sheeting to protect people from windborne missiles (flying debris) with the strong winds of a tornado. More information on safe rooms can be found in FEMA Publication 320.

Interior rooms can be reinforced and retrofitted to be tornado "safe rooms"

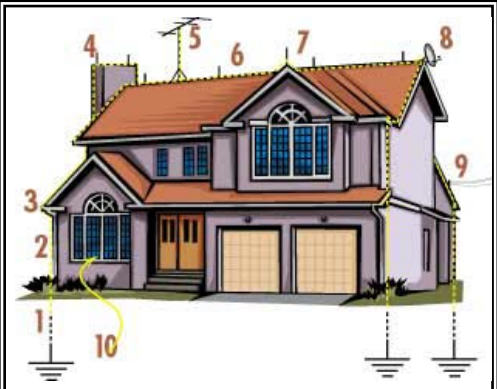
Another retrofitting approach for tornadoes and high winds is to secure the roof, walls and foundation with adequate fasteners or tie downs. These help hold the building together when the combination of high wind and pressure differences work to pull the building apart. This measure also applies to manufactured homes.

A third tornado and high wind protection modification is to strengthen garage doors, windows and other large openings. If winds break the building's "envelope," the pressures on the structure are greatly increased. Impact-resistant glass is also recommended for high wind or tornado protection.

5.2.3 Summer Storm Retrofitting

Retrofitting approaches to protect private or public buildings from the effects of **thunderstorms** include:

- storm shutters
- lightning rods (illustrated on the previous page)
- strengthening connections and tie-downs (similar to tornado retrofitting)
- impact-resistant glass in window panes
- surge protectors at electrical outlets



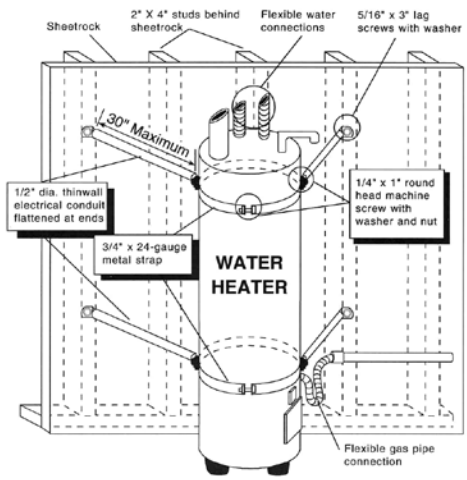
Lightning protection measures

Source: State Farm Insurance

Also, roofs can be replaced with materials less susceptible to damage by **hail**, such as modified asphalt or formed steel shingles.

5.2.4 Winter Storm Retrofitting

Winter storm retrofitting measures include improving insulation on older buildings and relocating water lines from outside walls to interior spaces. Windows can be sealed or covered with an extra layer of glass (storm windows) or plastic sheeting. Roofs can be retrofitted to shed heavy loads of snow and prevent ice dams that form when snow melts.



Source: The Homeowners Guide to Earthquake Safety

5.2.5 Earthquake Retrofitting - Buildings

Earthquakes, or seismic events, present two hazards for buildings and people – a hazard for the structure itself and a hazard for the building's contents (non-structural hazard). Earthquake retrofitting measures for the **structure** include:

- removing masonry overhangs that will fall onto the street during shaking
- bracing the walls of the building provides structural stability
- bolting sill plates to the foundation

These measures can be very expensive and should be considered for buildings on a case by case basis.

Measures that protect against non-structural seismic hazards typically involve small modifications. Retrofitting activities for non-structural hazards include:

- tying down appliances, water heaters, bookcases, and fragile furniture so they won't fall over during a quake
- installing latches on drawers and cabinet doors
- mounting picture frames and mirrors securely
- installing flexible utility connections for water and gas lines
- anchoring and bracing propane tanks and gas cylinders

These approaches can be very cost effective and have little or no impact on the appearance of a building, yet they are important measures for keeping buildings safer and protecting lives during earthquake events.

While these simple and inexpensive measures may be cost effective for a home or business, they may not be sufficient for protection of **critical facilities**. Fire stations need to be sure that they can open their doors and hospitals must be strong enough to continue operating during the shocks and aftershocks. Again, critical facilities should be evaluated on a case by case basis.

5.2.6 Earthquake Retrofitting – Infrastructure and Lifelines

Infrastructure hardening, attention to lifelines and bridge strengthening are important elements of earthquake mitigation. From FEMA Publication Number 271, *Seismic Design Guidelines and Standards for Lifelines* (1996):

> Lifelines are the public works and utility systems that support most human activities: individual, family, economic, political, and cultural. The various lifelines can be classified under the following five systems: electric power, gas and liquid fuels, telecommunications, transportation, and water supply and sewers.

The first step in protecting lifeline systems is the prioritization of critical facilities, utility systems, and other infrastructure. The involvement of state agencies, such as the Illinois Department of Transportation, is important. The involvement of private owners of utility systems is also important. FEMA, through the National Earthquake Hazard Reduction Program (NEHRP) and the Central United States Earthquake Consortium offer technical guidance on retrofitting approaches.

CRS Credit: Retrofitting to protect a building for hazards other than flooding is not credited under the CRS.

5.3 Insurance

Hazards Addressed	
✓	Floods
✓	Summer Storms
✓	Winter Storms
✓	Extreme Cold
	Extreme Heat
✓	Tornadoes
	Drought
✓	Groundwater

Technically speaking, insurance does not mitigate damage caused by a natural hazard. However, it does help the owner repair, rebuild and (hopefully) afford to incorporate some of the other mitigation measures in the process.

Insurance has the advantage that, as long as the policy is in force, the property is protected and no human intervention is needed for the measure to work. A standard **homeowner's insurance** policy will cover a property for the hazards of tornado, wind, hail, and winter storms. Separate endorsements are usually needed for earth movement (e.g., earthquake) coverage.

Although most homeowner's insurance policies do not cover a property for flood damage, an owner can insure a building for damage by surface flooding through the National Flood Insurance Program. **Flood insurance** coverage is provided for buildings and their contents damaged by a "general condition of surface flooding" in the area.
Some people have purchased flood insurance because it was required by the bank when they got a mortgage or home improvement loan. Usually these policies just cover the building's structure and not the contents. Renters can buy contents coverage, even if the owner does not buy structural coverage on the building. There is limited coverage for basements and the below grade floors of bi-levels and tri-levels.

Several insurance companies have **sump pump failure** or **sewer backup coverage** that can be added to a homeowner's insurance policy. Each company has different amounts of coverage, exclusions, deductibles, and arrangements. Most are riders that cost extra. Most exclude damage from surface flooding that would be covered by a National Flood Insurance policy.

Larger local governments can self-insure and absorb the cost of damage to one facility, but if many properties are exposed to damage, self-insurance can be a major drain on the treasury. Communities cannot expect Federal disaster assistance to make up the difference. Under Section 406(d) of the Stafford Act.

> If an eligible insurable facility damaged by flooding is located in a [mapped floodplain] … and the facility is not covered (or is underinsured) by flood insurance on the date of such flooding, FEMA is required to reduce Federal disaster assistance by the *maximum* amount of insurance proceeds

that would have been received had the buildings and contents been fully covered under a National Flood Insurance Program (NFIP) standard flood insurance policy. [Generally, the maximum amount of proceeds for a non-residential property is $500,000.]

– [Communities] need to:

- Identify all insurable facilities, and the type and amount of coverage (including deductibles and policy limits) for each. The anticipated insurance proceeds will be deducted from the total eligible damages to the facilities.
- Identify all facilities that have previously received Federal disaster assistance for which insurance was required. Determine if insurance has been maintained. *A failure to maintain the required insurance for the hazard that caused the disaster will render the facility ineligible for Public Assistance funding….*
- [Communities] *must* obtain and maintain insurance to cover [their] facility - buildings, equipment, contents, and vehicles - for the hazard that caused the damage in order to receive Public Assistance funding. Such coverage must, at a minimum, be in the amount of the eligible project costs. FEMA will not provide assistance for that facility in future disasters if the requirement to purchase insurance is not met. – FEMA Response and Recovery Directorate Policy No. 9580.3, August 23, 2000

In other words, the law expects public agencies to be fully insured as a condition of receiving Federal disaster assistance.

Earthquake Insurance: Earthquakes are not covered under standard homeowners or business insurance policies, but coverage is usually available for earthquake damage in the form of an endorsement to a home or business insurance policy. Cars and other vehicles are covered for earthquake damage under the comprehensive part of the auto insurance policy. In McHenry County, property owners can obtain earthquake insurance.

- Earthquake insurance provides coverage for your dwelling, for your personal property, and for any additional living expense (ALE). ALE coverage can include costs for the following:
- Temporary rental home, apartment, or hotel room
- Restaurant meals
- Telephone or utility installation in a temporary residence
- Relocation and storage
- Furniture Rental
- Laundry

Premiums for earthquake insurance are very low, but deductibles are often very high.

Local Implementation: Flood insurance has been available in McHenry County communities since the 1970's. Current flood insurance coverage is over 1,800 policies

Most communities in McHenry County are enrolled in either the Illinois Municipal League Risk Management Association (IML). IML provides risk management advice and coverage for

all of the hazards covered in this Plan, including flood and earthquake. McHenry County has an insurance policy through the ICI.

CRS Credit: There is no credit for purchasing flood or basement insurance, but the Community Rating System does provide credit for local public information programs that explain flood insurance to property owners. The CRS also reduces the premiums for those people who do buy NFIP coverage.

5.4 The Government's Role

Property protection measures are usually considered the responsibility of the property owner. However, local governments should be involved in all strategies that can reduce flood losses, especially acquisition and conversion of a site to public open space. There are various roles the County or a municipality can play in encouraging and supporting implementation of these measures.

Government Facilities: One of the first duties of a local government is to protect its own facilities. Fire stations, water treatment plants and other critical facilities should be a high priority for retrofitting projects and insurance coverage.

Often public agencies discover after the disaster that their "all-hazard" insurance policies do not cover the property for the type of damage incurred. Flood insurance is even more important as a mitigation measure because of the Stafford Act provisions discussed above.

Public Information: Providing basic information to property owners is the first step in supporting property protection measures. Owners need general information on what can be done. They need to see examples, preferably from nearby. Public information activities that can promote and support property protection are covered in Chapter 9.

Financial Assistance: Communities can help owners by helping to pay for a retrofitting project. Financial assistance can range from full funding of a project to helping residents find money from other programs. Some communities assume responsibility for sewer backups, street flooding, and other problems that arise from an inadequate public sewer or public drainage system.

Less expensive community programs include low interest loans, forgivable low interest loans and rebates. A forgivable loan is one that does not need to be repaid if the owner does not sell the house for a specified period, such as five years. These approaches don't fully fund the project but they cost the community treasury less and they increase the

owner's commitment to the flood protection project. Often, small amounts of money act as a catalyst to pique the owner's interest to get a self-protection project moving.

The City of Guthrie, Oklahoma has a rebate program for installation of tornado shelters and safe rooms. The City provides up to $1,500 per house, which can cover the majority of the cost.

The more common outside funding sources are listed below. Funding under item 3 is only available after a disaster, not before, when damage could be prevented. Following past disaster declarations, FEMA, the Illinois Emergency Management Agency (IEMA) and the Illinois Department of Natural Resources have provided advice on how to qualify and apply for these funds.

1. Pre-disaster funding sources
   - FEMA's Pre-Disaster Mitigation (PDM) grants (administered by IEMA)
   - FEMA's Flood Mitigation Assistance (FMA) grants (administered by IEMA)
   - Community Development Block Grant (administered by the Department of Commerce and Economic Opportunity
   - Illinois Department of Natural Resources
   - Conservation organizations, such as the Conservation Foundation and CorLands, although generally these organizations prefer to purchase vacant land in natural areas, not properties with buildings on them.

2. Post-disaster funding sources
   - Insurance claims
   - The National Flood Insurance Program's Increased Cost of Compliance provision (which increases the claim payment to cover a flood protection project required by code as a condition to rebuild the flooded building)

3. Post-disaster funding sources, Federal disaster declaration needed
   - FEMA's disaster assistance (for public properties, however, after a flood, the amount of assistance will be reduced by the amount of flood insurance that the public agency should be carrying on the property) (administered by IEMA)
   - Small Business Administration disaster loans (for non-governmental properties)
   - FEMA's Hazard Mitigation Grant Program (administered by IEMA)

Acquisition Agent: The community can be the focal point in an acquisition project. Most funding programs require a local public agency to sponsor the project. The County or a

municipality could process the funding application, work with the owners, and provide some, or all, of the local share.

Mandates: Mandates are considered a last resort if information and incentives aren't enough to convince a property owner to take protective actions. An example of a retrofitting mandate is the requirement that many communities have that downspouts be disconnected from the sanitary sewer line.

There is a mandate for improvements or repairs made to a building in the mapped floodplain. If the project equals or exceeds 50 percent of the value of the original building it is considered a "substantial improvement." The building must then be elevated or otherwise brought up to current flood protection codes.

Another possible mandate is to require less expensive hazard protection steps as a condition of a building permit. For example, many communities require upgraded electrical service as a condition of a home improvement project. If a person were to apply for a permit for electrical work, the community could require that the service box be moved above the base flood elevation or the installation of separate ground fault interrupter circuits in the basement.

CRS Credit: Except for public information programs, the Community Rating System does not provide credit for efforts to fund, provide incentives or mandate property protection measures. The CRS credits are provided for the actual projects, after they are completed (regardless of how they were funded or who instigated them).
On the other hand, in order to participate in the CRS, a community must certify that it has adequate flood insurance on all properties that have been *required* to be insured. The minimum requirement is to insure those properties in the mapped floodplain that have received Federal aid, as specified by the Flood Disaster Protection Act of 1973.

5.5 Repetitive Flood Loss Properties

Chapter 2 explains the criteria for designation of the County's repetitive loss properties –two federal flood insurance claims of at least $1,000 in any ten year period. These properties deserve special attention because they are more prone to damage by natural hazards than any other properties in the County. Further, protecting repetitive loss buildings is a priority with FEMA and IEMA mitigation funding programs.

National Flood Insurance Reform Act of 2003 Definition of Repetitive Flood Loss
". . . a building covered by a contract for flood insurance that has incurred flood-related damages on two occasions during a 10-year period ending on the date of the event for which a second claim is made, in which the cost of repairing the flood damage, on the average, equaled or exceeded 25 percent of the market value of the building at the time of each such flood event.

When repetitive loss properties are reviewed, the key factors listed below should be used to determine appropriate property protection measures. The criteria used are based on

several studies that have identified appropriate measures based on flood and building conditions. While a cost/benefit study was not conducted on each property, these guidelines show which measures are cost-effective.

- "High hazard areas" are areas in the floodway or where the 100-year flood is two or more feet over the first floor.
- Buildings in high hazard areas or in less than good condition should be acquired and demolished.
- Buildings with basements and split-level foundations in high hazard areas should be acquired and demolished. They are too difficult to elevate and the hydrostatic pressures on the walls from deeper flooding make them too risky to protect in place.
- Buildings subject to shallow flooding from local drainage should be protected through area-wide flood control or sewer improvement projects.
- Buildings in good condition on crawlspaces should be elevated or relocated.
- Buildings in good condition on slab, basement or split-level foundations subject to shallow flooding (less than 2 feet) can be protected by barriers and dry floodproofing.
- Recent flood claims. Some properties have not had a flood insurance claim for 20 years, indicating that some measure has probably been put in place to protect the property from repetitive flooding.

These criteria are general, and recommendations for individual structures should be made only after a site inspection. Other extenuating circumstances may also alter the recommendations.

Local Implementation: FEMA flood insurance data shows 52 repetitive loss structures located in 12 communities. As discussed in Chapter 2, a full review of flood insurance claims data reveals that over 90 properties in McHenry County have been mail multiple insurance claims.

The communities with repetitive loss structures include Crystal Lake, Fox River Grove, Harvard, Holiday Hills, and Lake in the Hills, Port Barrington, Spring Grove, and McHenry County. For purposes of investigating property protection measures for the 52 repetitive flood loss properties, and to investigate other at-risk structures in the vicinity of the repetitive flood loss property, the 52 properties have been grouped into areas – repetitive flood loss areas.

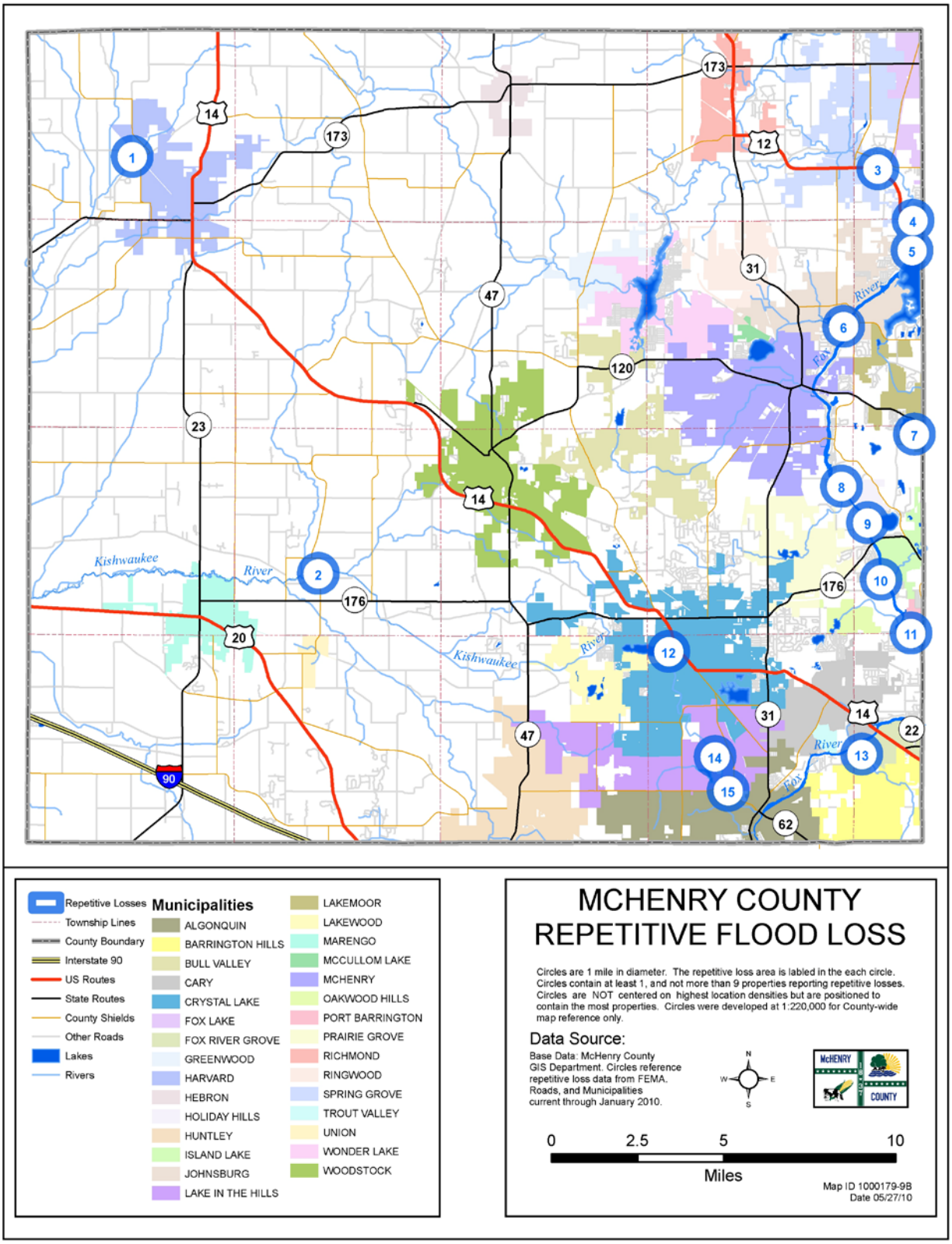


Exhibit 5-1 McHenry County Repetitive Flood Loss Areas

Exhibit 5-1 shows the general location of the repetitive flood loss areas. Table 5-2 shows the number of repetitive flood loss properties in each area shown on Exhibit 5-1. Note that addresses of repetitive flood loss are not provided in this plan. That information is confidential.

Table 5-2 Identified McHenry County Repetitive Flood Loss Areas

Repetitive Flood Loss Area	Community	FEMA Repetitive Flood Loss Properties
1	City of Harvard	1
2	McHenry County	1
3	Spring Grove	4
4	Spring Grove and McHenry County	11
5	McHenry County	5
6	McHenry County	2
7	McHenry County	1
8	McHenry County	5
9	Holiday Hills and McHenry County	7
10	McHenry County	4
11	McHenry County and Port Barrington	4
12	Crystal Lake	1
13	Fox River Grove and McHenry County	2
14	Lake in the Hills	1
15	Lake in the Hills and McHenry County	3
	Total:	52

5.6 Conclusions

1. Property protection measures for natural hazards are important for McHenry County given the number of hazards and the number of buildings for which the County is at risk.
2. There are several ways to protect individual properties from damage by natural hazards. The advantages and disadvantages of each should be examined on a building by building basis.
3. Property owners can implement some property protection measures at little cost, especially for sites in areas of low hazards (e.g., shallow flooding, seepage, sewer backup, summer, and winter storms).

4. For other measures, such as relocation, elevation and safe rooms, the owners may need financial assistance.
5. Most property protection projects should be voluntary, but in some circumstances, projects should be requires (per ordinances).
6. Government agencies can promote and support property protection measures through activities ranging from financial incentives to public information.
7. The County is unable to determine if government properties, including critical facilities, have measures to protect them from flooding, tornadoes, and other natural hazards.
8. About 1,800 of the buildings in the County's floodplains are covered by flood insurance.
9. The availability of tornado shelters or safe rooms in McHenry County manufactured home communities is unknown.
10. Addressing the repetitive flood loss problem can lead to assisting a number of other families on protection themselves from future floods.

5.7 Recommendations

1. Available property protection public education materials should be consolidated and tailored for McHenry County. Materials should address measures that can help owners reduce their exposure to damage by natural hazards and the various types of insurance coverage that are available.
2. Repetitive flood loss areas should be further investigated and mitigated.
3. All property owners should be encouraged to determine if they are adequately insured for natural hazards.
4. All buildings and critical facilities in the floodplain, with priority given to buildings or facilities in the floodway, should be mitigated, to the extent that the measures are cost effective and feasible.
5. A standard checklist should be developed to evaluate a property's exposure to damage from the hazards most prevalent in McHenry County. The checklist should be provided to each agency participating in this planning process and made available to the general public.
6. Each public entity should evaluate its own properties using the standard checklist. A priority should be placed on determining critical facilities' vulnerability to damage and whether public properties are adequately insured.

7. Each public entity should protect its own publicly-owned facilities with appropriate mitigation measure(s), except where efficiencies allow for joint funding and joint projects.
8. The County and municipalities should consider the feasibility of providing information and technical advice to floodplain property owners for protecting their property.
9. Structural elevation or acquisition alternatives should be investigated for flood prone properties when a regional project is not feasible.
10. Feasible structural elevation or acquisitions should be funded through grants or through capital funding.
11. Positive incentives should be maintained and created by the County and municipalities to encourage property protection by property owners. Communities should consider cost-sharing programs, such as rebates, to encourage low cost property protection.
12. McHenry County should seek property protection financial assistance for flood and tornado mitigation projects for properties at risk.
13. The availability of tornado shelters or safe rooms in McHenry County should be investigated
14. Safe rooms should be constructed wherever needed in McHenry County with priority given to schools and critical faculties.

5.8 References

1. *Disaster Mitigation Guide for Business and Industry*, Federal Emergency Management Agency, FEMA-190, 1990.
2. Engineering Principles and Practices for Retrofitting Flood Prone Residential Buildings, Federal Emergency Management Agency, FEMA-259, 1995.
3. Flood Insurance Agent's Manual, FEMA, 2000.
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5. Mitigation Ideas: Possible Mitigation Measures by Hazard Type, FEMA Region 5, 2002.
6. Floodproofed Sites in Illinois, French & Associates, 1992.
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8. *The Homeowners Guide to Earthquake Safety*, California Seismic Safety Commission, 2000.
9. Homeowner's Guide to Retrofitting: Six Ways to Protect Your House from Flooding. Federal Emergency Management Agency, FEMA-312, 1998.
10. *Ice Storm Mitigation*, FEMA –860-DR-Illinois, Illinois Emergency Management Agency, 1990.
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13. State Farm Insurance website, www.statefarm.com.
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12. Windstorm Mitigation Manual for Light Frame Construction, Illinois Emergency Management Agency, 1997.
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15. Survey of municipalities, townships and County offices, 2010.

Chapter 6. Structural Projects

Hazards Addressed	
✓	Floods
✓	Summer Storms
	Winter Storms
	Extreme Cold
	Extreme Heat
	Tornadoes
	Drought
	Groundwater

Structural projects are projects that are constructed to protect people, buildings and infrastructure from damage due to natural hazards. Structural projects are the third of six overall mitigation strategies examined in this Plan. Preventing damage due to flooding is the primary focus of structural projects. Structural projects are usually funded by public agencies. Structural projects keep flood waters away from buildings or an area by constructing barriers, by storing floodwater elsewhere, or by redirecting flood flows. Large structural flood control projects are most often planned, funded and implemented at a regional level by agencies, such as the Illinois Department of Natural Resources, Office of Water Resources (IDNR-OWR), the U.S. Army Corps of Engineers, the USDA Natural Resources Conservation Service. Many projects are jointly planned and funded between these agencies in cooperation with counties and/or municipalities.

> The McHenry County Stormwater Management Plan was adopted in 1996. In consolidated the existing stormwater effort throughout the county into a "unified, countywide structure." The Plan was adopted in accordance with Illinois Public Act 85-905 which gives McHenry County to authority to conduct planning, adopt regulations and implement projects, including structural projects, relating to stormwater management.

Six approaches are reviewed in this chapter:

- Reservoirs and detention
- Levees and barriers
- Channel improvements and diversions
- Crossings and roadways
- Drainage and storm sewer improvements
- Drainage system maintenance

Structural projects offer advantages not provided by other measures, as shown in the table below, but they also have shortcomings. The appropriateness of using structural flood control depends on individual project area circumstances.

Pros and Cons of Structural Flood Control Projects

Advantages	Shortcomings
May provide the greatest amount of protection for land area used.	They disturb the land and disrupt natural water flows, often destroying wildlife habitat.
Because of land limitations, may be the only practical solution in some circumstances.	They require regular maintenance, which if neglected, can have disastrous consequences.
Can incorporate other benefits into structural project design such as water supply and recreational uses.	They are built to a certain flood protection level that can be exceeded by larger floods, causing extensive damage.
Regional detention may be more cost-efficient and effective than requiring numerous small detention basins.	They can create a false sense of security as people protected by a project often believe that no flood can ever reach them.
	Although it may be unintended, in many circumstances they promote more intensive land use and development in the floodplain.

The planning of structural flood control projects usually involves an alternative assessment, and that assessment is typically part of, or a product of, a watershed plan.

CRS Credit: CRS provides flood insurance discounts to those communities that implement various floodplain management activities that meet certain criteria. Comparing local activities to those national criteria helps determine if local activities should be improved. Structural flood control projects that provide 100-year flood protection and result in revisions to the FIRM are not credited by the CRS in order to not duplicate the larger premium reduction provided by removing properties from the mapped floodplain. However, in 2002, the CRS began crediting structural flood control projects that meet the following criteria:

- They must provide protection to at least the 25-year flood
- The design and construction must be certified by a licensed professional engineer
- They must meet certain environmental protection criteria
- They must meet Federal, State and local regulations, such as Corps of Engineers' 404 permit and State dam safety rules requirements
- They must meet certain maintenance requirements

These criteria ensure that credited projects are well-planned and permitted. Any of the first five measures reviewed in this chapter would be recognized under Section 531 of the *CRS Coordinator's Manual*. Credit points are based on the type of project, how many buildings are protected, and to what flood protection level.

6.1 Reservoirs and Detention

Reservoirs reduce flooding by temporarily storing flood waters behind dams or in storage or detention basins. Reservoirs lower the flood height by holding back, or detaining, runoff before it can flow downstream. Flood waters are detained until the flooding has subsided, then the water in the reservoir or detention basin is released or pumped out slowly at a rate that the river can accommodate downstream. Reservoirs can be dry and remain idle until a large rain event occurs. Or they may be designed so that a lake or pond is created.

Reservoirs are most commonly built for one of two purposes. Large reservoirs are constructed to protect property from existing flood problems. Smaller reservoirs or detention basins are built to protect property from the impacts of new development (i.e., more runoff).

Regardless of size, reservoirs protect the development that is downstream from the reservoir site. Unlike levees and channel modifications, they do not have be built close to or disrupt the area to be protected.

There are several considerations when evaluating use of reservoirs and detention:

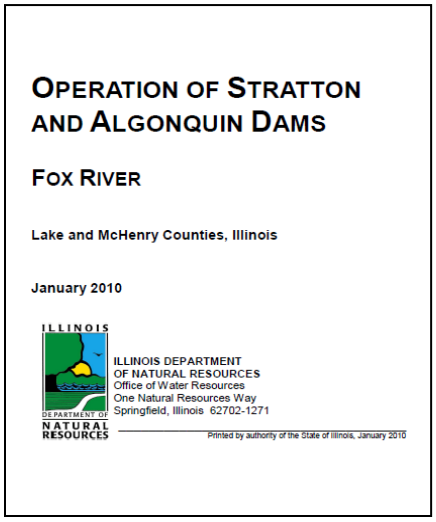
- The expense for management and maintenance of the facility.
- Flooding can still occur if their design level is exceeded.
- Sediment deposition may occur and reduce the storage capacity over time.
- They can impact water quality as they are known to affect temperature, dissolved oxygen and nitrogen, and nutrients.

Local Implementation: Examination of detention opportunities should be a part of watershed planning for McHenry County. Also, the McHenry County Stormwater Management Ordinance requires stormwater detention with most new developments.

Stratton and Algonquin Dams create flood storage reservoirs. As discussed in Section 2-xx (Chapter 2), both dams are operated by IDNR. Stratton Dam has 5 vertical lift gates and one hinged crest gate. The gate operation is based forecasted peak flows from National Weather Service, lake stages as measured at Channel Lake, Nippersink Lake, and Fox Lake, river flows as computed for the Fox River at New Munster, Wisconsin and Nippersink Creek at Spring Grove, and river stages at Johnsburg, Algonquin and Elgin.

River flows are primarily controlled at the Stratton Dam, especially when the Fox River is approaching or at flood state. Operational objectives include keeping summer normal flows for recreational pools, utilizing the sluice gates at Stratton Lock and Dam to pass flood waters downstream without creating downstream flood damages, and utilizing the sluice gates during winter ice jam events to restrict flows downstream to 1100 cfs, if possible, when there has been an accumulation of 60 degree-freezing days or very cold temperatures (daily high temperature less than 20 degrees Fahrenheit). Additional information about

operation of the Stratton Lock and Dam and the Algonquin Dam can be found in the January 2010 IDNR report (see page 2-60 for IDNR web site link).


OPERATION OF STRATTON AND ALGONQUIN DAMS

FOX RIVER

Lake and McHenry Counties, Illinois

January 2010

ILLINOIS DEPARTMENT OF NATURAL RESOURCES
Office of Water Resources
One Natural Resources Way
Springfield, Illinois 62702-1271

Printed by authority of the State of Illinois, January 2010

6.2 Levees and Barriers

This flood control measure is a barrier of earth (levee) or concrete (floodwall) erected between the watercourse and the property to be protected. Levees and floodwalls confine water to the stream channel by raising its banks. They must be well designed to account for large floods, underground seepage, pumping of internal drainage, and erosion and scour.
Key considerations when evaluating use of a levee include:

- Removal of fill to compensate for the floodwater storage that will be displaced by the levee
- Internal drainage of surface flow from the area inside the levee.
- Cost of construction and maintenance
- Design limitations (while levees may reduce flood damage for smaller more frequent rain events, they may also overtop or breach in extreme flood events and subsequently create more flood damage than would have occurred without the levee).

Levees can push floodwater onto other properties upstream or downstream and need to be designed with this in mind. To reduce environmental impacts and provide multiple use benefits, a setback levee (set back from the floodway) is the best project design. The area inside a setback levee can provide open space for recreational purposes and provide access sites to the river or stream.

Floodwalls perform like levees except they are vertical-sided structures that require less surface area for construction. Floodwalls are constructed of reinforced concrete, which makes the expense of installation cost prohibitive in many circumstances. Floodwalls also degrade adjacent habitat and can displace erosive energy to unprotected areas of shoreline downstream.

Levees and floodwalls are appropriate when the cost of relocating structures out of the flood prone area exceeds that cost of the levee or floodwall construction and maintenance, and when upstream and downstream impacts can be mitigated.

6.3 Channel Improvements and Diversions

By improving channel's conveyance, more water is carried away at a faster rate. Three types of channel improvements are reviewed here: projects that make the channel wider, straighter or smoother; dredging the channel bottom; and diversion of high flows to another channel or body of water.

Straightening, deepening and/or widening a stream or river channel, commonly referred to as "**channelization,**" which is commonly used for local drainage or flooding problems. Considerations for channel improvement are:

- Channelized streams can create or worsen flooding problems downstream as larger volumes of water are transported at a faster rate.
- Channelized streams rise and fall faster. During dry periods the water level in the channel is lower than it should be, which creates water quality problems and degrades habitat.
- Channelized waterways tend to be unstable and experience more streambank erosion. The need for periodic reconstruction and silt removal becomes cyclic, making channel maintenance very expensive.

However, properly designed, properly sloped and planted channel banks are more aesthetically and environmentally appealing, and can prove to be cost-effective approaches. In McHenry County, detention projects are usually considered with channel improvements.

Dredging for the purpose of floodwater management is often viewed as a form of conveyance improvement. However, it has the following limitations:

- Dredging is often cost prohibitive because the dredged material must be disposed of somewhere else (out of the floodplain).
- Unless instream and/or tributary erosion are corrected upstream, the dredged areas usually fill back in within a few years.
- If the channel has not been disturbed for many years, dredging will destroy the habitat that has developed.
- To protect the natural values of the stream, federal law requires a Corps of Engineers permit before dredging can proceed. This can be a lengthy process that requires much advance planning and many safeguards to protect habitat.

A **diversion** is a new channel that sends floodwaters to a different location, thereby reducing flooding along an existing watercourse. Diversions can be surface channels, overflow weirs, or tunnels. During normal flows, the water stays in the old channel. During flood flows, the floodwaters spill over to the diversion channel or tunnel, which carries the excess water to a receiving lake or river. Diversions are limited by topography; they will not work in some areas. Unless the receiving water body is relatively close to the floodprone stream and the land in between is low and vacant, the cost of creating a diversion can be prohibitive.

Local Implementation: McHenry County channel improvement projects North Shore Culvert and Channel Enhancement in Crystal Lake, and a Weir and diversion channel just upstream of the Marengo city limits.

6.4 Crossings and Roadways

In some cases buildings may be elevated above floodwaters but access to the building is lost when floodwaters overtop local roadways, driveways, and culverts or ditches. Depending on the recurrence interval between floods, the availability of alternative access, and the level of need for access, it may be economically justifiable to elevate some roadways and improve crossing points.

For example, if there is sufficient downstream channel capacity, a small culvert that constricts flow and causes localized backwater flooding may be replaced with a larger culvert to eliminate flooding at the waterway crossing point. The potential for worsening adjacent or downstream flooding needs to be considered before implementing any crossing or roadway drainage improvements.

Local Implementation: The bridges shown in Table 6-1 are those that have been identified, to date, by McHenry County communities as those which impede or obstruct flow. The roadways included in the table could be considered for elevation to provide continued access during flooding.

Table 6-1
McHenry County Bridges and Roadways That Potentially Impede Flood Flows

Community	Bridge or Roadway
Village of Algonquin	Woods Creek Lane
Village of Algonquin	Gaslight Drive
Village of Cary	Spring Street
Village of Cary	Route 14
City of Crystal Lake	North Shore Drive
City of Marengo	Greenlee Street
City of Marengo	Prospect Street
City of Marengo	U.S. 176
City of Marengo	Page Street
City of Marengo	Taylor Street
City of Marengo	Hale Street
City of Marengo	U.S. 23
City of McCullom Lake	Various culverts
Village of Prairie Grove	Wright Road
City of Woodstock	Edgewood Drive
Greenwood Township	Thayer Road
Marengo Township	County Line Road
Nunda Township	Whipporwill Drive
Riley Township	Numerous

The McHenry County Division of Transportation developed the map in Exhibit 6-1, which shows roadway that Division staff could recall has having flooded during a flood event for a severe storm over the past 30 years.

6.5 Drainage and Storm Sewer Improvements

Manmade ditches and storm sewers help drain areas where the surface drainage system is inadequate, or where underground drainageways may be safer or more practical. Storm sewer improvements include installing new sewers, enlarging small pipes, and preventing back flows. Particularly appropriate for depressions and low spots that will not drain naturally, drainage and storm sewer improvements usually are designed to carry the runoff from smaller, more frequent storms.

Because drainage ditches and storm sewers convey water faster to other locations, improvements are only recommended for small local problems where the receiving stream or river has sufficient capacity to handle the additional volume and flow of water. To reduce the cumulative downstream flood impacts of numerous small drainage projects, additional detention or run-off reduction practices should be provided in conjunction with the drainage system improvements.

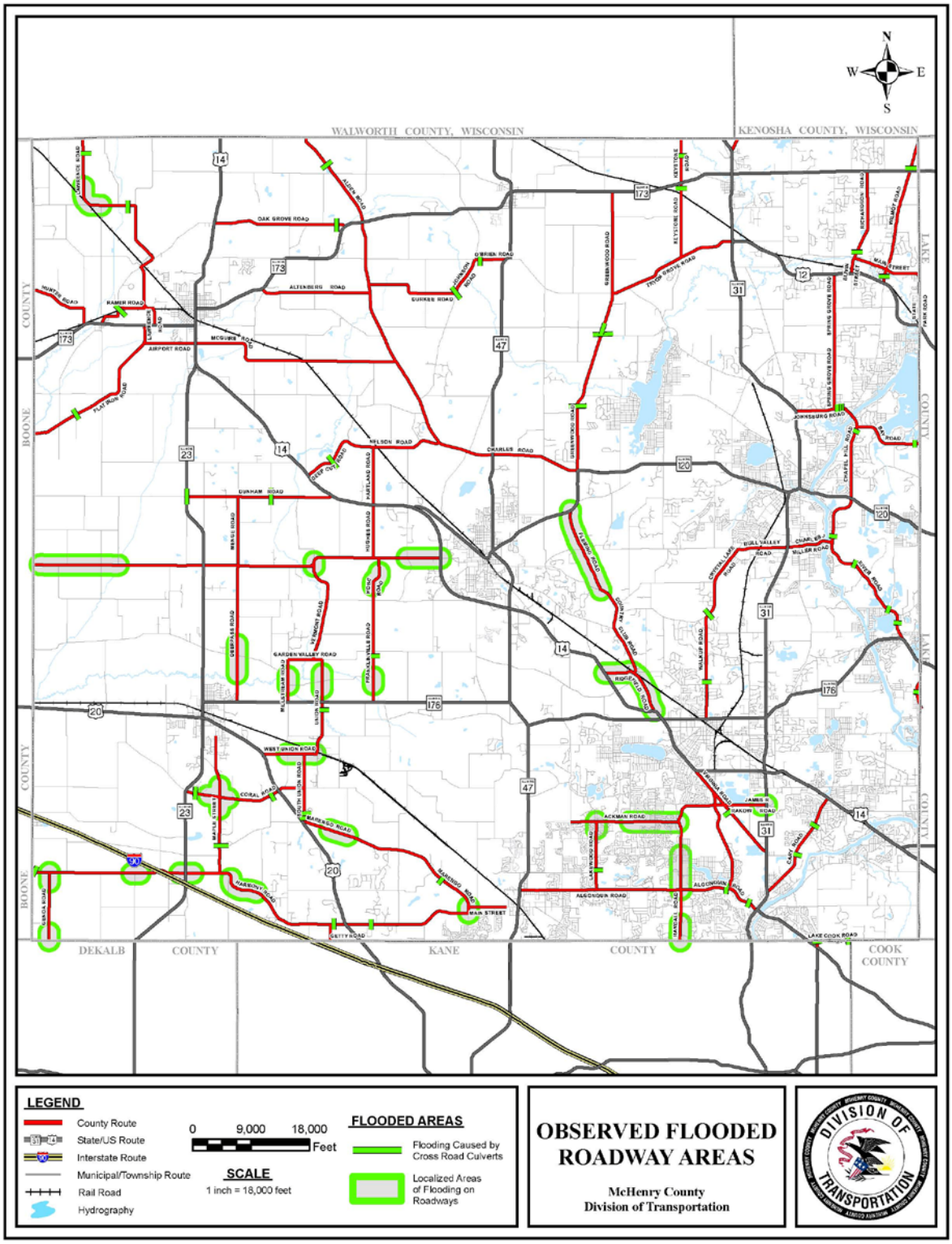


Exhibit 6-1 Past Flooding Locations on McHenry County Highways (1980 to 2010)

A combination of restored wetland detention, vegetated swales, infiltration trenches and other best management practices that increase infiltration (reducing runoff), and improve water quality can be implemented in conjunction with stormwater system improvements.

Local Implementation: Most all McHenry County communities include storm sewer and drainage improvements annually in their capital budgets. Many communities also had implemented projects to address areas with combined sewers.

NFIP/CRS

CRS Credit: The Community Rating System credits capital improvement plans that fund drainage improvements that reduce the need for maintenance or that eliminate bottlenecks, logjams and other maintenance problems. Up to 50 points are provided.

6.6 Drainage System Maintenance

The drainage system may include detention ponds, stream channels, swales, ditches and culverts. Drainage system maintenance is an ongoing program to clean out blockages caused by an accumulation of sediment or overgrowth of weedy, non-native vegetation or debris, and remediation of streambank erosion sites.

"Debris" refers to a wide range of blockage materials that may include tree limbs and branches that accumulate naturally, or large items of trash or lawn waste accidentally or intentionally dumped into channels, drainage swales or detention basins. Maintenance of detention ponds may also require revegetation or repairs of the restrictor pipe, berm or overflow structure.

Maintenance activities normally do not alter the shape of the channel or pond, but they do affect how well the drainage system can do its job. Sometimes it is a very fine line that separates debris that should be removed from natural material that helps form habitat. Therefore, written procedures that are consistent with state laws and environmental concerns are usually needed.

Government agencies usually accept responsibility for maintaining facilities on public property. However, in Illinois, the responsibility for drainage way maintenance on private property, when no easements have been granted, is with the individual private property owner. This often results in very little maintenance being accomplished.

Implementation: Tables 6-2 and 6-3 shows drainage system maintenance activity in McHenry County municipalities and townships, respectively.

Table 6-2
McHenry County Municipal Drainage System Maintenance

Municipality	Sediment Accumulation	Drain System Maintenance	Written Procedures
Algonquin	X	X	
Bull Valley			
Cary		X	X
Crystal Lake		X	In development
Fox River Grove			
Greenwood			
Harvard		X	
Hebron			
Holiday Hills	X	X	
Huntley		X	
Johnsburg		X	X
Lake in the Hills	X	X	
Lakewood		X	
Marengo		X	
McCullom Lake	X	X	X
McHenry	X	X	
Oakwood Hills			
Prairie Grove	X	X	
Richmond			
Ringwood			
Spring Grove		X	
Trout Valley			
Union			
Wonder Lake	X	X	
Woodstock	X		

Table 6-3
McHenry County Township Drainage System Maintenance

Township	Sediment Accumulation	Drain System Maintenance	Written Procedures
Alden			
Algonquin	X	X	
Burton			
Chemung			
Coral			
Dorr			
Dunham			
Grafton			
Greenwood			
Hartland			
Hebron			
Marengo		X	
McHenry		X	
Nunda	X	X	
Richmond			
Riley	X		
Seneca	X		

CRS Credit: Community Rating System credit is provided for a formal drainage system inspection and maintenance program with published procedures that clearly identify what can be removed and what "debris" should be allowed to stay in natural channels. Up to 250 points are possible, but communities (like the County) that do not have formal written procedures and/or only respond on an as needed basis will not receive the credit.

6.7 Conclusions

1. The McHenry County Stormwater Management Program is important to McHenry County and its municipalities.
2. Structural projects, including reservoirs, channel improvements and levees, can be effective in reducing flood damage in McHenry County, to the extent that they have been tested, though it is understood that structural projects can have adverse impacts on downstream properties and on the environment.
3. Structural projects can be effective in protecting critical facilities from natural hazards.
4. There are a number of locations throughout McHenry County where bridge openings or culverts are impeding flood flows, and roadways that have flooded in the past.

5. Local drainage and stormwater flooding (both in and outside the floodplain) could be reduced through drainage system improvements.
6. Stream maintenance, in most areas of the County is lacking. Both channel erosion and additional flooding may be a result of inadequate maintenance.
7. Drainage maintenance programs in communities are important throughout the County.

6.8 Recommendations

1. Watershed studies should be developed for McHenry County as part of the countywide stormwater management program.
2. Structural flood control projects, including drainage and bridge and culvert improvements, should be pursued for McHenry County, but incorporate protecting the natural functions of the stream and floodplain, in addition to flood protection. Priority areas include:
    - Coon Creek
    - Boone Creek
    - Nippersink Creek
    - Areas in Algonquin, Union, Spring Grove and Nunda Township
3. Opportunities for stream or natural area restoration should be sought with structural projects.
4. The McHenry County Stormwater Management program should continue to be funded through appropriate funding mechanisms.
5. Each municipality and the County should implement a formal and regular drainage system maintenance program.
6. Funding for municipal or regional structural measures in McHenry County should be sought as it is made available through FEMA hazard mitigation programs.
7. Flood problem areas in McHenry County that should be considered for structural mitigation are not limited to those identified in this Plan. Flood problems should be addressed as they are identified.

6.9 References

1. McHenry County Stormwater Management Program information and studies listed on page 6-2 of this chapter.
2. Our Community and Flooding, 1998, Resource Coordination Policy Committee.
3. CRS Coordinator's Manual, Community Rating System, FEMA, 2007.
4. CRS Credit for Drainage System Maintenance, FEMA, 2002.
5. Survey of municipalities, townships and County offices, 2010.
6. *Operation of Stratton and Algonquin Dams*, Illinois Department of Natural Resources, Office of Water Resources, January 2010

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Chapter 7. Resource Protection

Hazards Addressed	
✓	Floods
✓	Summer Storms
✓	Winter Storms
	Extreme Cold
	Extreme Heat
	Tornadoes
✓	Drought
✓	Groundwater

Resource protection activities are generally aimed at preserving, or in some cases restoring, natural areas. Resource protection activities enable the naturally beneficial functions of the land and water areas to be better realized. Natural and beneficial functions of watersheds, floodplains and wetlands include the following:

- Reduction in runoff from rainwater and snow melt in pervious areas
- Infiltration that absorbs overland flood flow
- Removal and filtering of excess nutrients, pollutants, and sediments
- Storage of floodwaters
- Absorption of flood energy and reduction in flood scour
- Water quality improvement
- Groundwater recharge
- Habitat for flora and fauna
- Recreational and aesthetic opportunities

As development occurs, many of the above benefits can be achieved though regulatory steps for protecting natural areas or natural functions. The regulatory programs are discussed in Chapter 4. Preventive Measures.

Old McHenry County Courthouse

Source: waymarking.com

This chapter covers the resource protection programs and standards that can help mitigate the impact of natural hazards, while they improve the overall environment and quality of the County. Areas reviewed:

- Wetlands
- Groundwater
- Streambank restoration
- Dumping regulations
- Urban forestry
- Open space preservation
- Farmland protection
- Historic and natural area protection

7.1 Wetlands

The regulation of wetlands is discussed in Chapter 4, but the Mitigation Committee placed emphasis on the need to highlight their function and their importance in McHenry County. Wetlands are often found in floodplains and depressional areas of a watershed. Many wetlands receive and store floodwaters, thus slowing and reducing downstream flows. They also serve as a natural filter, which hel ps to improve water quality, and provide habitat for many species of fish, wildlife, and plants. Approximate wetland locations in McHenry County are available on the McHenry County web site.

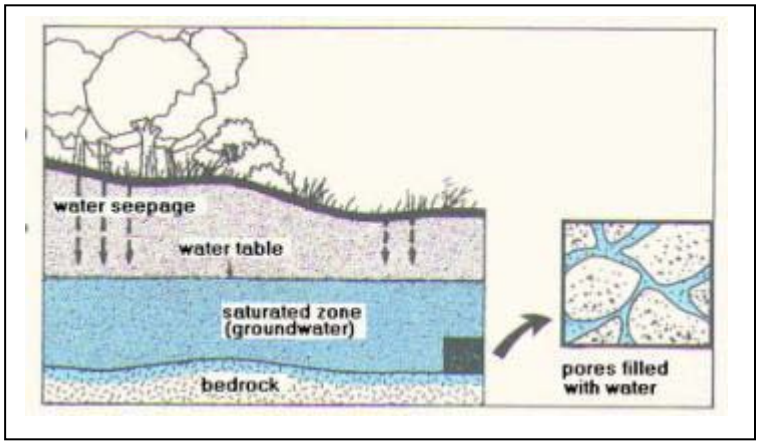
> "Wetlands are parts of our landscape that are either permanently or seasonally wet. As a consequence, a specific community of plants has adapted to wetland soils that are either inundated or saturated for at least part of the year. Many types of wetlands exist, each with a community of plants adapted to specific conditions that are determined by the hydrology (the source, periodicity, and quality of the water supply), and the underlying soil chemistry. Some wetlands, such as fens or sedge meadows, may be fed by subsurface or surfacing groundwater. Others, such as a floodplain forest, are periodically flooded by overflowing rivers or streams. Still others, such as bogs or vernal pools, capture rainwater in depressions or basins on the land. Marshes are areas with plants that normally grow in relatively shallow water, while a swamp is much like a marsh that is forested.
>
> "Wetlands provide all of us with critical services. They remove pollutants and toxic substances, reduce flood and storm damages, provide important habitat for wildlife, recharge groundwater supplies, and provide valuable open space and recreational opportunities, such as fishing, hunting and bird watching. The value of wetlands is becoming ever more evident as they continue to be lost."
>
> Taken from: *Living with Wetlands: A Handbook for Homeowners in Northeastern Illinois*, The Wetlands Initiative, Inc.

Wetlands are of varying types and varying quality. Wetlands such as fens or sedge meadows hold much more environmental value that a wetland created by roadside ditches. According to IDNR, McHenry County contains the largest area in the State for shallow marsh or wet meadow wetlands (11,406 acres or 8 percent of the State's total). McHenry also holds 6 percents of the State's deep marsh wetlands (second highest in the State).

Local implementation: Wetland protection is included in the McHenry County Stormwater Ordinance (also see Chapter 4 of this Plan, section 4.6.4). Wetland protection is also an area of focus in the McHenry County 2030 Comprehensive Plan and the McHenry County Water Resources Action Plan.

7.2 Groundwater Protection

The term "groundwater protection" refers to both the protection of groundwater quantity (or groundwater availability) and groundwater quality. All groundwater was at one time surface water. Rain and snow melt seeps or infiltrates into the ground. Water that infuriates through the soil can eventually reach aquifers where groundwater is stored. Aquifers can be shallow, perched, deep, confined, unconfined, etc. Aquifer types and estimates of sizes can be mapped. Often the mapping of aquifer recharge areas is similar in shape and size as surface watershed boundary maps.



The quantity of groundwater and groundwater recharge, depends on the ability of runoff to reach a pervious surface where it can become seepage. Urban runoff reaching a storm sewer, for example, which discharges into a stream is effectively lost from the groundwater system.

The quantity and the rate that water that seeps into the ground, and becomes stored groundwater, varies based on land use, soils, season, temperature, and more. The quality of the groundwater is influenced by a number of factors. Different types of ground cover, soils and aggregate layers have differing abilities to filter the infiltrating waters. Because of human activity, much of the rain or snow melt runoff that becomes seepage has many opportunities to collect pollutants. Pollutants need to be filtered back out either while the water is still above ground, or when it is seeping through the ground. Because soils and aggregate layers may not have the ability to fully "treat" the seepage before it becomes groundwater, it is essential to reduce the human-caused pollutants

Local implementation: McHenry County's source for drinking water is groundwater. As discussed in Chapter 1, the pollution of McHenry County is expected to grow by 73 percent in 2030. The demand for groundwater will be significantly higher. The "McHenry County Water Resources Action Plan" addresses the groundwater quantity and quality issues, while stressing the enhancement of surface water quality, as well. The Water Resources Action Plan's goal is to ensure that the County's water resources are protected and available in the years to come.

The Water Resources Action Plan has ten areas of focus:

- Land Use and Zoning
- Stormwater Management
- Open Space
- Facility Regulation
- Winter Snow and Ice
- Wastewater
- Pollution Prevention
- Planning for the Future
- Conservation
- Education

Each section includes a model policy for the consideration of McHenry County municipalities with supporting materials. As shown Chapter 3 of this Mitigation Plan, the Mitigation Committee places a high priority on water quality and natural resource protection.

Numerous products have been developed for the plan, including Exhibit 7-1, (next page) which shows the sensitive aquifers recharge areas for McHenry County. The darkest green areas on the map represent areas with a high potential for aquifer contamination, lighter green represents areas with moderate potential for aquifer contamination.

7.3 Stream Restoration

Our understanding of the need for stream, streambank and riparian environment protection has grown significantly in past decades. Eroding streambanks negatively impact our infrastructure (bridges and culvert blockages), impact property, and degrade the water quality. Terminology for “stream restoration” can differ, but the objective is to return streams, streambanks and adjacent land to a more natural condition, including the natural meanders. Term such as ecological restoration encourage the restoration of native indigenous plants and animals to an area.

A key component of these efforts is to use appropriate native plantings along the banks that resist erosion. This may involve retrofitting the shoreline with willow cuttings, wetland plants, and/or rolls of landscape material covered with a natural fabric that decomposes after the banks are stabilized with plant roots.

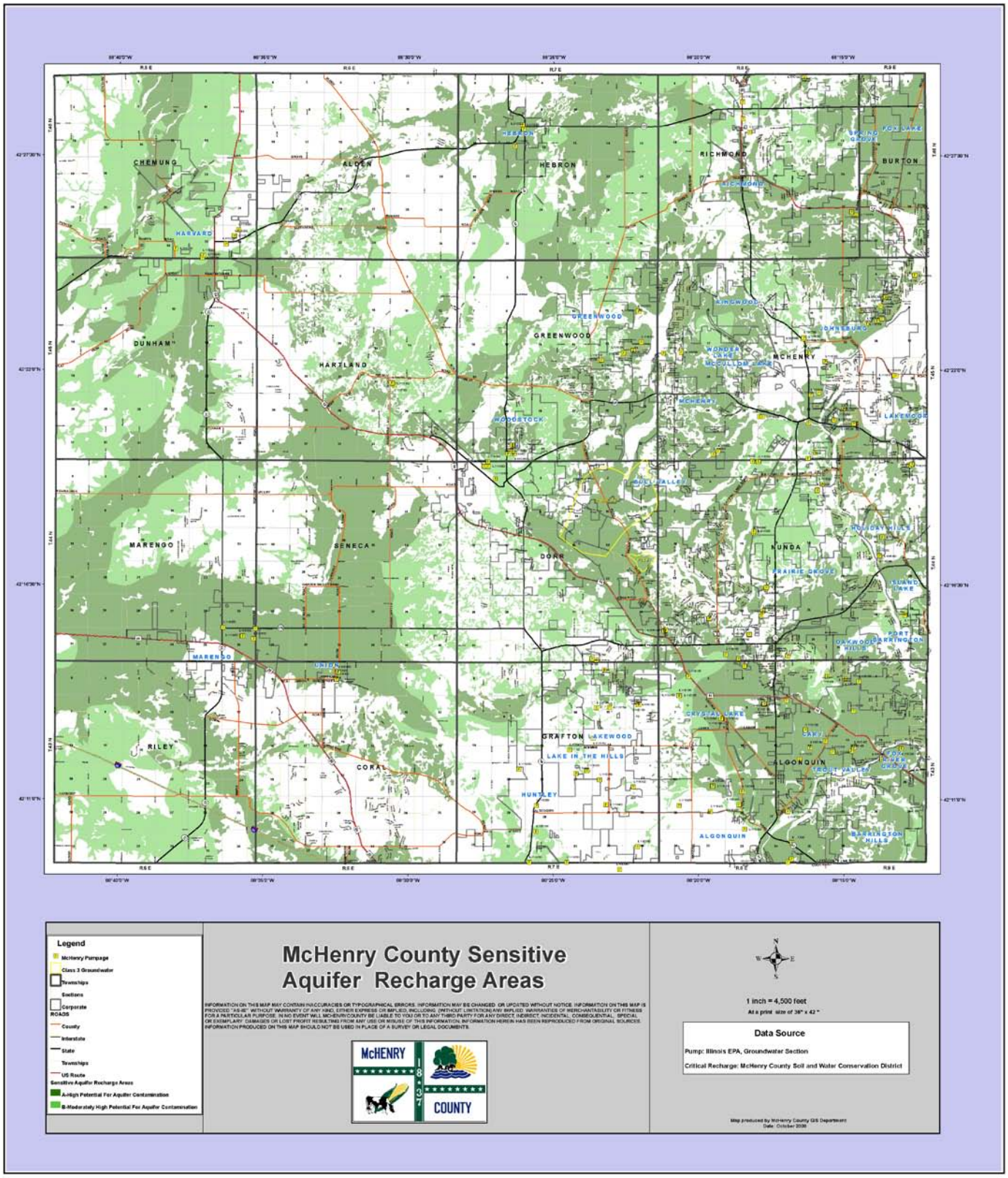


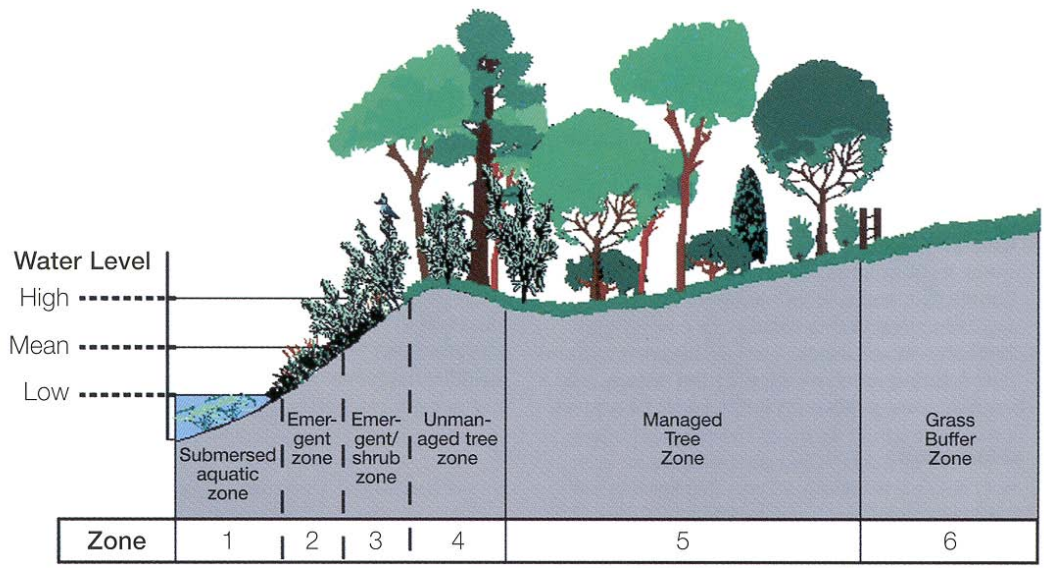
Exhibit 7-1 McHenry County Sensitive Aquifer Recharge Areas

In all, restoring the right vegetation to a stream has the following advantages:

- Reduces the amount of sediment and pollutants entering the water
- Enhances aquatic habitat by cooling water temperature
- Provides food and shelter for both aquatic and terrestrial wildlife
- Can reduce flood damage by slowing the velocity of water
- Increases the beauty of the land and property value
- Prevents property loss due to erosion
- Provides recreational opportunities, such as hunting, fishing, and bird watching
- Reduces long term maintenance costs

The last bullet deserves special attention. Studies have shown that after establishing the right vegetation, long term maintenance costs are lower than if the banks were concrete. The Natural Resources Conservation Service estimates that over a ten year period, the combined costs of installation and maintenance of a natural landscape may be one-fifth of the cost for conventional landscape maintenance, e.g., mowing turf grass.

It is worth noting that rivers will take the most efficient or shortest path as the waters flows downstream. Because of debris, scour and other factors, a stream might meander through



Aquatic and riparian buffer plant zones

Different types of plants are used in different buffer zones along a channel. Zone 1 plants are normally submerged while zone 2 plants are inundated during much of the growing season. Zone 3 plants are water tolerant, but are flooded only during high water. By using the proper plants in each zone, they stabilize streambanks, filter polluted runoff, and provide habitat. *Source: Banks and Buffers – A Guide to Selecting Native Plants for Streambanks and Shorelines*, Tennessee Valley Authority

an area. During a flood, though, the stream will attempt to straighten itself or adjust its course. This is a natural occurrence, but manmade influences on this cycle should be minimized.

7.4 Dumping Regulations

BMPs usually address pollutants that are liquids or suspended in water that are washed into a lake or stream. Dumping regulations address solid matter, such as shopping carts, appliances and landscape waste that can be accidentally or intentionally thrown into channels or wetlands. Such materials may not pollute the water, but they can obstruct even low flows and reduce the channels' and wetlands' ability to convey or clean stormwater.
Many cities have nuisance ordinances that prohibit dumping garbage or other "objectionable waste" on public or private property. Waterway dumping regulations need to also apply to "nonobjectionable" materials, such as grass clippings or tree branches which can kill ground cover or cause obstructions in channels. Regular inspections to catch violations should be scheduled.

Many people do not realize the consequences of their actions. They may, for example, fill in the ditch in their front yard not realizing that it is needed to drain street runoff. They may not understand how regrading their yard, filling a wetland, or discarding leaves or branches in a watercourse can cause a problem to themselves and others. Therefore, a dumping enforcement program should include public information materials that explain the reasons for the rules as well as the penalties.

Local Implementation: The McHenry County Stormwater Ordinance prohibits dumping in regulatory floodplains, in flood prone areas, and in wetlands in McHenry County. The temporary or permanent storage of landscape waste in floodplains is also prohibited in the Ordinance. Most communities have ordinances that prohibit dumping regardless of the proximity to the floodplain (dumping is not allowed anywhere), as shown in Table 4-5. In other areas of the County, dumping outside of floodplains is prohibited in associated with a development that exceeds 5,000 square feet, involves 100 cubic yards of material, or changes the direction of stormwater runoff (transfer between watersheds).

NFIP/CRS

CRS Credit: The CRS provides up to 30 points for enforcing and publicizing a regulation that prohibits dumping in the drainage system. As currently written, the McHenry County Stormwater Ordinance would not receive this credit.

Table 7-1 McHenry County Communities that Prohibit Dumping in Streams

Municipality	Dumping Ordinance	Township	Dumping Ordinance
Algonquin	X	Alden	
Bull Valley		Algonquin	
Cary	X	Burton	
Crystal Lake	X	Chemung	
Fox River Grove		Coral	
Greenwood		Dorr	
Harvard	X	Dunham	
Hebron		Grafton	
Holiday Hills	X	Greenwood	
Huntley		Hartland	
Johnsburg	X	Hebron	
Lake in the Hills	X	Marengo	X
Lakewood	X	McHenry	
Marengo	X	McHenry Township Road	County
McCullom Lake		McHenry Township FPD	
McHenry	X	Nunda	X
Oakwood Hills		Richmond	
Prairie Grove	X	Riley	
Richmond		Seneca	
Ringwood		Woodstock FPD	X
Spring Grove	X		
Trout Valley			
Union			
Wonder Lake	X		
Woodstock	X		
McHenry County	X		

7.5 Urban Forestry

The majority damage caused by wind, ice and snow storms is to trees. Downed trees and branches break utility lines and damage buildings, parked vehicles and anything else that was under them. A forestry program (urban or rural) can reduce the damage potential of trees. The cities in central Illinois are most prone to ice storms and have initiated programs that select species that are resistant to ice and storm damage.

Urban foresters or arborists can select hardier trees which can better withstand high wind and ice accumulation. Only trees that attain a height less than the utility lines should be allowed along the power and telephone line rights-of-way. Just as important as planting the right trees is correct pruning after a storm. If not done right, the damaged tree will not heal properly, decay over the next few years, and cause a hazard in the future. A trained person should review every damaged tree to determine if it should be pruned or removed.

By having stronger trees, programs of proper pruning, and on-going evaluation of the trees, communities can prevent serious damage to their tree population. A properly written and enforced urban forestry plan can reduce liability, alleviate the extent of fallen trees and limbs caused by wind and ice build-up, and provide guidance on repairs and pruning after a storm. Such a plan helps a community qualify to be a Tree City USA.

Trees are the first victims of ice storms.

Local Implementation: McHenry County Division of Transportation has 2 certified arborists on staff. Table 7-2 shows the McHenry County municipalities that participate in Tree City USA..

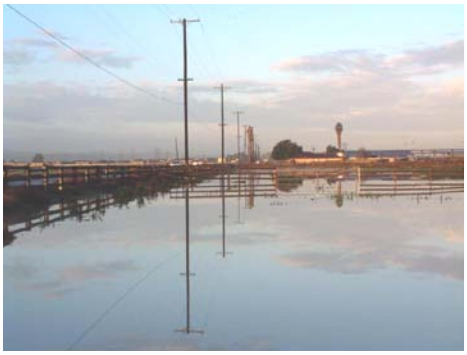
Table 7-2 McHenry County Tree City USA Communities

Municipality	Tree City
Algonquin	13 years
Cary	12 years
Lake-in-the-Hills	5 years
Lakewood	8 years
McHenry	15 years

7.6 Open Space Preservation

Keeping the floodplain and other hazardous areas open and free from development is the best approach to preventing damage to new developments. In urban areas, open space can serve as parks, greenway corridors and golf courses. Capital improvement plans and comprehensive land use plans can identify areas to be preserved through any or all of the following means:

- Acquisition,
- Dedication by developers,
- Dedicating or purchasing an easement to keep the land open,
- Specifying setbacks or buffer zones where development is not allowed, and
- Subdivision regulations need to ensure that streets and other public facilities can handle emergency vehicles during an emergency.



Preserving floodplain farmland prevents damage to buildings.

Local Implementation: There are two kinds of open space land in McHenry County: lands that are currently open, such as vacant parcels or remaining farmland; and lands that are preserved as open space, such as parks and fish and wildlife areas. Community interest in maintaining and creating open space is growing throughout the County.

Park Districts and the McHenry County Conservation District are working to maintain existing open land. The Conservation District currently has over 23,000 acres of woodlands, prairies, wetlands, ponds and creeks. They maintain 27 sites for public use. There are also 17 State Nature Preserves in McHenry County.

NFIP/CRS

CRS Credit: Preserving floodprone areas as open space is one of the highest priorities of the Community Rating System. Up to 700 points can be given, based on how much of the floodplain is in parks, forest preserves, golf courses, undeveloped floodway or other uses that can be depended on to stay open. Additional credit is provided if there are deed restrictions on the parcels.

7.7 Farmland Protection

Farmland protection is quickly becoming an important piece of comprehensive planning and zoning throughout the United States. The purpose of farmland protection is to provide

mechanisms for prime, unique, or important agricultural land to remain as such, and to be protected from conversion to nonagricultural uses.

Frequently, farm owners sell their land to residential or commercial developers and the property is converted to non-agricultural land uses. With development comes more buildings, roads and other infrastructure. Urban sprawl occurs, which can create additional stormwater runoff and emergency management difficulties.

Farms on the edge of cities are often appraised based on the price they could be sold for to urban developers. This may drive farmers to sell to developers because their marginal farm operations cannot afford to be taxed as urban land.

The Farmland Protection Program in the United States Department of Agriculture's 2002 Farm Bill (Part 519) allows for funds to go to state, tribal, local governments and to nonprofit organizations to help purchase easements on agricultural land to protect against the development of the land. Eligible land includes cropland, rangeland, grassland, pastureland, and forest land that are part of an agricultural operation. Certain lands with historical or archaeological resources are also included.

- The hazard mitigation benefits of farmland protection are similar to those of open space preservation, discussed in Chapter 4. Preventive Measures:
- Farmland is preserved for future generations,
- Farmland in the floodplain keeps damageable structures out of harm's way,
- Farmland keeps more stormwater on site and lets less runoff downstream,
- Rural economic stability and development is sustained,
- Ecosystems are maintained, restored and/or enhanced, and
- The rural character and scenic beauty of the area is kept.

Local implementation: The Mitigation Committee agreed that the protection of farmland is important and should be of continued concern in McHenry County along with other land use issues. Agricultural resources are discussed in Section 3 of the McHenry County 2030 Comprehensive Plan.

7.8 Historic and Natural Area Protection

McHenry County is rich in historic resources and natural resources. Table 7-3 provides a list of McHenry County's sites on the National Register of Historic Places. The McHenry County

Historical Society Commission also maintains lists of almost 200 other historic buildings and locations within the County.

The historic sites are vulnerable to hazards. It is difficult to protect the structures from hazards due to their historic nature, but it is important to consider should any mitigation opportunities be presented.

Table 7-3 National Register of Historic Places in McHenry County

Property Name:	Location:
Memorial Hall	Richmond
Lucien Boneparte Covell House	Richmond
Colonel Gustavius A. Palmer House	Crystal Lake
The County's House	McHenry
Charles H. Hibbard House	Marengo
Orson Rogers House	Marengo
Old McHenry Courthouse	Woodstock
Woodstock Opera House	Woodstock
Woodstock Square Historic District	Woodstock
George Stickney House	Bull Valley
Terrwilliger House	Bull Valley

There are five historic bridges in McHenry County that are listed in the "Historic Bridges of the U.S." list including, Allendale Road Bridge over Nippersink Creek, County Line Road bridge of the Kishwaukee River, Deep Cut Road bridge over the C&NW Railroad, Graf Road bridge over Piscasaw Creek, and Streit Road bridge over the North Branch of the Kishwaukee River.

7.9 Conclusions

1. A hazard mitigation program can utilize resource protection programs to support protecting areas and natural features that can mitigate the impacts of natural hazards.

2. Preserving farmland in the floodplain and other hazardous areas will prevent damage to homes, businesses and other development.

3. Preventive measures can have a great impact on the future flood damages, especially if the county's floodplains remain undeveloped and preserved as open space.

4. A number of communities have an ordinance that prohibits dumping in wetlands or other parts of the drainage system. The degree of enforcement of these ordinances is unknown.

5. Groundwater protection is a high priority in McHenry County.

6. Community forestry programs can be effective against damage and power losses from wind and ice storms. Communities should have urban forestry programs in place that can be effective against damage and power losses from wind and ice storms.

7. McHenry County is rich in historic and natural areas, which should be protected from natural hazards..

7.10 Recommendations

1. Each community should ensure that it has enforceable stream and wetland dumping regulations.
2. Municipal comprehensive plans, land use plans and zoning ordinances should incorporate open space provisions that will protect properties from flooding and preserve wetlands and farmland.
3. The public and decision makers should be informed about the hazard mitigation benefits of restoring rivers, wetlands and other natural areas.
4. The public should be informed about the need to protect streams and wetlands from dumping and inappropriate development and the relevant codes and regulations.
5. When opportunities become available, resources should be directed towards stream restoration, to protect and enhance the riparian environment, to protect against unnatural erosion, and to increase recreation benefits.
6. The County and municipalities should implement the water quality and groundwater protection measures recommended by the McHenry County Groundwater Protection Action Plan.
7. McHenry County should continue to encourage conservation design approaches such as cluster development and other "low impact" approaches.
8. Communities should implement an urban forestry program that qualifies them to become a Tree City, USA.
9. Myths about mosquitoes and wetlands (and open water) should be dispelled.

7.11 References

1. *Best Management Practices Guidebook for Urban Development*, Northeastern Illinois Planning Commission, 1992.
2. *Environmental Consideration in Comprehensive Planning,* Northeastern Illinois Planning Commission, 1994.
3. *Illinois Hazard Mitigation Plan,* Illinois Emergency Management Agency, 2000.
4. *Banks and Buffers – A Guide to Selecting Native Plants for Streambanks and Shorelines*, Tennessee Valley Authority, 1997
5. *Living With Wetlands, A Handbook for Homeowners in Northeastern Illinois*, The Wetlands Initiative, 1998
6. *Making our Urban Forests Safer,* Alabama Cooperative Extension Service, 2001.
7. *Protecting Nature in Your Community*, Chicago Wilderness and Northeastern Illinois Planning Commission, 2000.
8. *Reducing the Impacts of Urban Runoff – The Advantages of Alternative Site Design Approaches,* Northeastern Illinois Planning Commission, 1997.
9. *Stormwater management – The Benefits of Alternative Approaches*, South Suburban Mayors and Managers Association, 2000.
10. *Stream and Wetland Protection: A Natural Resource Management Priority in Northeastern Illinois,* Northeastern Illinois Planning Commission, 1991.
11. *Stream Corridor Restoration Principles, Processes and Practices*, Federal Interagency Stream Restoration Working Group, 1998. Copies available through the USDA Natural Resource Conservation Service.
12. McHenry County Conservation District web site.
13. McHenry County Historical Society Commission web site.
14. http://bridgehunter.com/il/mchenry web site
15. Survey of McHenry County municipalities and townships, 2010.
16. Tree City USA website: www.arborday.org.
17. *Protecting Nature in Your Community*, Chicago Wilderness and Northeastern Illinois Planning Commission, 2000.
18. IDNR Office of Real Estate and Property, Critical Trends Assessment Program website.

Chapter 8. Emergency Services

Hazards Addressed	
✓	Floods
✓	Summer Storms
✓	Winter Storms
✓	Extreme Cold
✓	Extreme Heat
✓	Tornadoes
	Drought
	Groundwater

Emergency service measures protect lives and property. Emergency service functions can be included in the broad categories of preparedness, warning, response, and recovery. Attention to these facets of emergency services prior to a hazard event or disaster is another mitigation strategy.

A good emergency management program addresses natural hazards, and it involves all municipal and/or county departments. This chapter reviews emergency services measures, following their chronological order of identifying an oncoming problem (threat recognition), responding to an emergency, through post-disaster activities.

The Illinois Emergency Management Agency (IEMA) coordinates the state response to emergencies. The McHenry County Emergency Management Agency (EMA) coordinates emergency management services in McHenry County within incorporated and unincorporated areas. Municipalities can implement their own emergency management programs. Most municipalities have staff that serve as the emergency management director along with other municipal duties and responsibilities.

8.1 Preparedness and Planning

An emergency operations plan (EOP) ensures that all response needs are addressed and that all response activities are appropriate for the expected threat. EOPs should be reviewed annually to keep contact names and telephone numbers current and to make sure that supplies and equipment that will be needed are still available. Keeping up with changing contacts and phone numbers can be challenging. EOPs should be critiqued and revised after disasters and exercises to take advantage of the lessons learned and changing conditions. The end result is a coordinated effort implemented by people who have experience working together so that available resources will be used in the most efficient manner.

Local Implementation: The County has an adopted Emergency Operations Plan (EOP). McHenry EMA is responsible for the EOP for the County and for the review of EOPs developed by the municipalities. McHenry County is in the process of updating County Plan. McHenry EMA also facilities emergency manage exercises with the municipalities. McHenry

County has a Local Emergency Planning Committee (LEPC) that meets quarterly. The LEPC has a number of County departments represented, several municipalities, the American Red Cross, heath care, area employers, and other members.

All McHenry County municipalities have emergency management personnel, and the majority of municipalities have either developed and adopted EOPs or are developing EOPs. All communities are working towards National Integrated Management System (NIMS) compliance. Nine communities reported having completed NIMSCAST. The County has a dedicated EOC. Most communities have rooms that are converted into EOCs.

Mutual aid agreements are in place throughout the county for fire, police, emergency management, public health, and public works. These agreements (MABAS, ILEAS, ILWARN, IEMMAS, PHMAS) can be utilized in any phase of an emergency or disaster.

8.2 Preparedness - Threat Recognition

Planning, resources and personnel are all important elements of preparedness. Threat recognition is also important. The first step in responding to a flood, tornado, storm or other natural hazard is to know when weather conditions are such that an event could occur. With a proper and timely threat recognition system, adequate warnings can be disseminated.

8.2.1 Floods

A flood threat recognition system predicts the time and height of the flood crest. This can be done by measuring rainfall, soil moisture, and stream flows upstream of the community and calculating the subsequent flood levels.

On rivers and streams, including the Fox River and the Kishwaukee River, the measuring and calculating of flood events is done by the National Weather Service (NWS) which is in the U.S. Department of Commerce's National Oceanic and Atmospheric Administration (NOAA). Support of NOAA's efforts is provided by the United States Geological Service (USGS), the Illinois Department of Natural Resources (IDNR), and McHenry County.

Forecasts of expected river stages are made through the Advanced Hydrologic Prediction Service (AHPS) of the National Weather Service (NWS). Flood threat predictions are disseminated on the NOAA Weather Wire or NOAA Weather Radio. NOAA Weather Radio is considered by the federal government to be the official source for weather information.

When weather conditions are right for potential flooding, the NWS is able to issue a specific *prediction* of when and how high the major streams in McHenry County will peak. NWS can also issue more general flood statements on smaller streams throughout the County. The National Weather Service may issue a "flash flood watch." This means the amount of rain expected will cause standing water and flooding on small streams and depressional area. However, these events are can be very localized and rapid that a "flash flood warning" may not be issued.

One of the best tools for understanding flood predictions is a flood stage forecast map. Staff can identify the number of properties flooded, which roads will be under water, which critical facilities will be affected, etc. for a given prediction. With this information, an advance plan can be prepared that shows problem sites and determines what resources will be needed to respond to the predicted flood level.

Local Implementation: Real-time stream gage readings for sites on the Fox River and the Kishwaukee River can be accessed on the internet at websites shown in Table 8-1. McHenry County cooperates with the USGS and IDNR to maintain a network of rainfall and river gages are needed for flood threat recognition. Gage locations and identification are shown in Exhibit 8-1 and Table 8-2. The McHenry County web site offers a link to the NWS's website, which provides rainfall data, stream levels and flood forecasts. The IDNR web site provides links to numerous sites including the NWS, USGS and the Corps of Engineers.

Table 8-1
Flood Forecast and Rain and Stream Gage Links

Illinois Department of Natural Resources (IDNR)
http://dnr.state.il.us/owr/surveilance.htm

National Weather Service (NWS)
http://www.crh.noaa.gov/crh/

United States Geological Service (USGS)
http://waterdata.usgs.gov/il/nwis/rt

Table 8-2
McHenry County Rain and Stream Gages

Station	Datum (Elevation in feet)	Flood Stage (feet)
Fox River		
New Munster	735.72	10
Fox Lake	733	5
Nippersink Creek	746	8.3
Johnsburg	733	6.5
McHenry Pool	733	5.5
McHenry TW	730.15	4
Algonquin	729.48	3
Algonquin TW	719.48	??
South Elgin Pool	687.95	16.1
South Elgin TW	687.95	10
Dayton	462.3	12
Kishwaukee River		
Belvidere	738.34	9.0
Perryville	692.13	12.0

Source: IDNR-OWR and USGS websites

8.2.2 Tornadoes and Thunderstorms

The NWS is the prime agency for detecting meteorological threats, such as tornadoes and thunderstorms. Severe weather warnings are transmitted through the Illinois State Police's Law Enforcement Agencies Data System (LEADS) and through the NOAA Weather Radio System. As with floods, the NWS can only look at the large scale weather picture (whether conditions are appropriate for formation of a tornado).

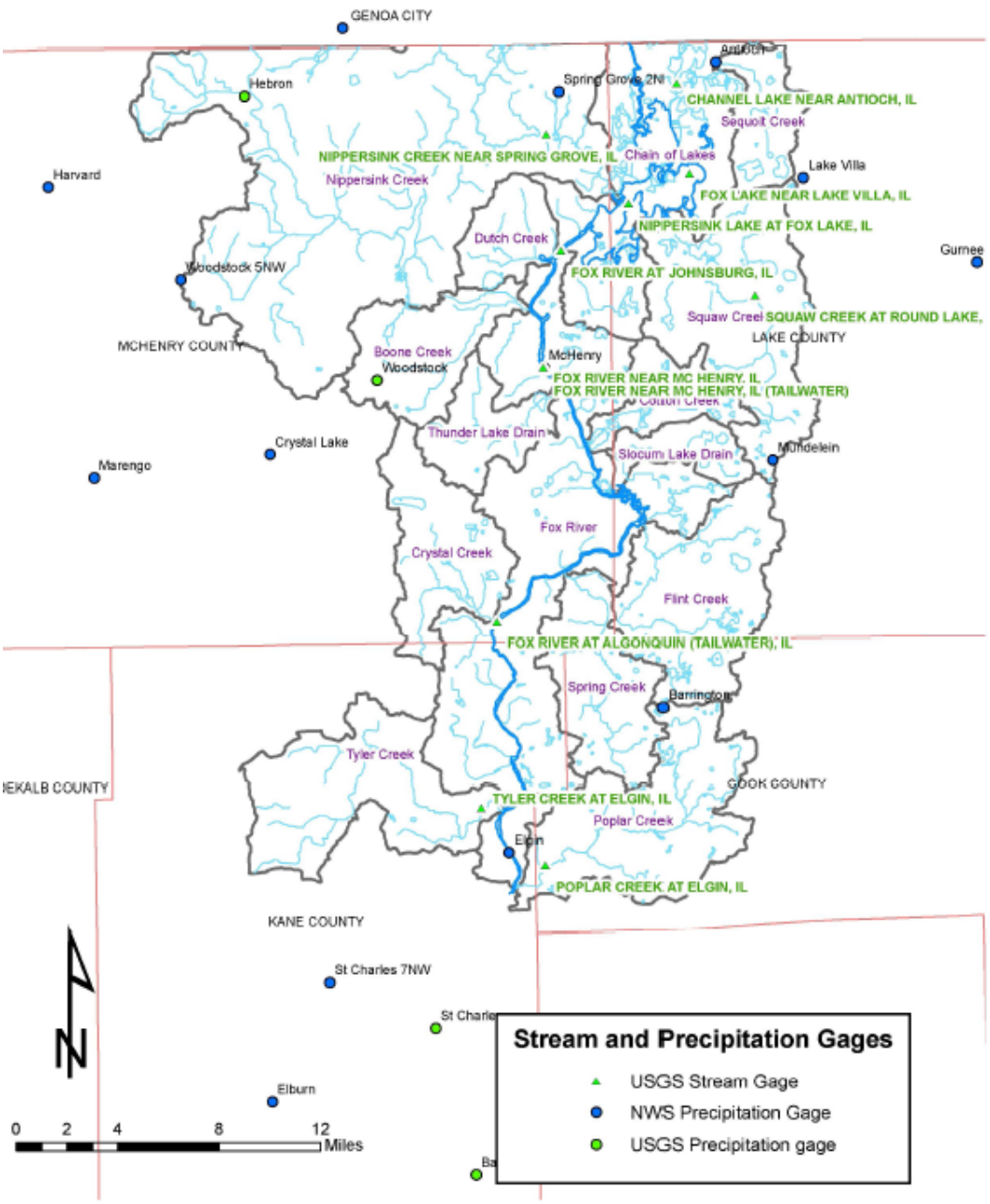
For tornadoes and thunderstorms, local emergency managers can provide more site-specific and timely recognition by sending out NWS trained spotters to watch the skies when the NWS issues a watch or warning.

8.2.3 Winter Storms

The NWS is again the prime agency for predicting winter storms. Severe snow storms can often be forecasted days in advance of the expected event, which allows time for warning and preparation. Though more difficult, the National Weather Service can also forecast ice storms.

Exhibit 8-1

McHenry County Rain and Stream Gage Locations



Source: "Operation of Stratton and Agonquin Dams, Fox River, Lake and McHenry Counties, Illinois," January 2010, IDNR-OWR

8.2.4 Other Weather Hazards

McHenry County dispatch centers receive other severe weather alerts from the LEADS system. These alerts are issued by the Illinois State Police who monitor the NOAA Weather Wire, or through their monitoring of NOAA weather radios. Police and fire stations, schools, county and municipal buildings, and some private facilities have been issued Weather Radios, or they are notified over the EAS from McHenry County EMA.

NFIP/CRS

CRS Credit: Credit can be received for utilizing the gages listed in Table 8-2. The actual points are based on how much of the community's floodplain is subject to flooding by the gauged stream.

8.3 Warning

After the threat recognition system tells the County and municipalities that a flood, tornado, thunderstorm, winter storm or other hazard is coming, the next step is to notify the public and staff of other agencies and critical facilities. The earlier and the more specific the warning, the greater the number of people who can implement protection measures.
The NWS issues notices to the public using two levels of notification:

Watch: conditions are right for flooding, thunderstorms, tornadoes or winter storms.

Warning: a flood, tornado, etc. has started or has been observed.

A more specific warning may be disseminated by the community in a variety of ways. The following are the more common methods:

- Outdoor warning sirens
- Sirens on public safety vehicles
- Commercial or public radio or TV stations
- The Weather Channel
- Cable TV emergency news inserts
- Reverse 911
- Telephone trees/mass telephone notification
- NOAA Weather Radio
- Tone-activated receivers in key facilities
- Door-to-door contact
- Mobile public address systems
- Cellular phone text messages
- E-mail notifications

Multiple or redundant systems are most effective – if people do not hear one warning, they may still get the message from another part of the system. Each has advantages and disadvantages:

- Radio and television provide a lot of information, but people have to know when to turn them on.
- NOAA Weather Radio can provide short messages of any impending weather hazard or emergency and advise people to turn on their radios or televisions. While nearly all critical facilities (including schools) have Weather Radios, many or most property owners do not.
- Outdoor warning sirens can reach many people quickly as long as they are outdoors. They do not reach people in tightly-insulated buildings or those around loud noise, such as in a factory, during a thunderstorm, or in air-conditioned homes. They do not explain what hazard is coming, but people should know to turn on a radio or television.
- Automated telephone notification services are also fast, but can be expensive and do not work when phone lines are down. Nor do they work for unlisted numbers and calling screener services, although individuals can sign up for notifications.
- Where a threat has a longer lead time, going door-to-door and manual telephone trees can be effective.

Just as important as issuing a warning is telling people what to do. A warning program should have a public information aspect. People need to know the difference between a tornado warning (when they should seek shelter in a basement) and a flood warning (when they should stay out of basements).

StormReady: The National Weather Service established the StormReady program to help local governments improve the timeliness and effectiveness of hazardous weather-related warnings for the public. To be officially StormReady, a community must:

- Establish a 24-hour warning point and emergency operations center (EOC)
- Have more than one way to receive severe weather warnings and forecasts and to alert the public
- Create a system that monitors weather conditions locally
- Promote the importance of public readiness through community seminars
- Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.

Being designated as a StormReady community by the Weather Service is a good measure of a community's emergency warning program for weather hazards.

Local Implementation: Currently, no McHenry County communities are part of the StormReady program.

McHenry County and municipal emergency services, including fire protection districts are responsible for disseminating warning information to the public and notifying response personnel during an emergency. Once a threat is perceived, the County's 911 dispatch center then transmits the warnings to all first responders, and, in conjunction with the McHenry County emergency management, the warnings are transmitted to schools, hospitals, government offices, business, and the general public through the following systems:

- The Emergency Alert Radio System (EARS) is a tone alert system designed to provide weather watch and warning information to schools, hospitals, government offices, businesses, and the general public.
- The Illinois Emergency Alert System (ILEAS) is a national warning system that utilizes broadcast radio, television stations, and local cable television systems.
- The Emergency Alert System Emergency Management Network (EM*net*) is a satellite based digital state-wide messaging system that allows users to send secure messages to all municipalities.

Communities are responsible for notification to their citizens and activation of their warning systems. Fire chiefs, police chiefs, and mayors may be authorized to activate the warning system according to their emergency plans. The hospitals, nursing homes, special needs homes in the county have weather radios to monitor weather conditions.

In 2009 McHenry EMA and municipal EMAs expand communications through radio and radio frequency interoperability.

NFIP/CRS

CRS Credit: Community Rating System points are based on the number and types of warning media that can reach the community's floodprone population. Up to 60 points can be provided for disseminating flood warnings to the general public, up to 40 points for a flood threat recognition system, and being designated as a StormReady community can provide 25 more points.

8.4 Response

The protection of life and property is the foremost important task of emergency responders. Concurrent with threat recognition and issuing warnings, a community should respond with actions that can prevent or reduce damage and injuries. Typical actions and responding parties include the following:

- Activating the emergency operations center (emergency management)
- Closing streets or bridges (police or public works)
- Shutting off power to threatened areas (utility company)
- Passing out sand and sandbags (public works)
- Ordering an evacuation (chief elected official)
- Holding children at school/releasing children from school (school district)
- Opening evacuation shelters (Red Cross)
- Monitoring water levels (engineering)
- Security and other protection measures (police)

Local Implementation: Municipalities are responsible for warnings in their incorporated areas, and fire protection districts for their areas of service, until all of their resources are exhausted. If the severity or extent of an emergency were to exceed any municipality's capability, the County emergency management will be able to provide additional resources and assistance. Table 8-3 shows which communities have EOPs with specific flood response procedures.

Algonquin utilized their GIS system of identify critical facilities and other properties that will be impacted by a flood. Maps are delivered to owners/occupants with an evacuation notice. As discussed in Section 8.1, mutual aid agreements have been developed and will be utilized to the extent needed.

NFIP/CRS

CRS Credit: CRS credits are added for the effective use of GIS mapping in the development of response plans. Given the County's GIS capabilities, CRS credit should be available.

8.5 Critical Facilities Protection

Critical facilities are discussed in Chapter 1. Protecting critical facilities during a disaster is the responsibility of the facility owner or operator. However, if they are not prepared for an emergency, the rest of the community could be impacted. If a critical facility is damaged, workers and resources may be unnecessarily drawn away from other disaster response efforts. If such a facility is adequately prepared by the owner or operator, it will be better able to support the community's emergency response efforts.

Many critical facilities have full-time professional managers or staff who are responsible for the facility during a disaster. Some have their own emergency response plans. Illinois state law requires hospitals, nursing homes, and other public health facilities to develop such

plans. Many facilities would benefit from early warning, response planning, and coordination with community response efforts.

Local Implementation: This Plan identifies all local government-owned buildings, schools, hospitals, nursing homes, and other public and private health facilities. The County is working on the development of mapping to determine if critical facilities are located in flood prone areas. Table 8-3 shows communities that have procedures in their EOPs for critical facilities. Chapter 5 discusses the importance of protecting critical facilities from damage.

CRS Credit: The Community Rating System gives the same weight to critical facility protection as it does to the rest of the community's flood response plan (up to 50 points). CRS credit focuses on coordinating the community's efforts with the facilities' managers and helping them develop their own flood-specific emergency plans.

8.6 Recovery and Mitigation

After a disaster, communities should undertake activities to protect public health and safety, facilitate recovery, and help prepare people and property for the next disaster. Throughout the recovery phase, everyone wants to get "back to normal." The problem is, "normal" means the way they were before the disaster, exposed to repeated damage from future disasters.

Appropriate measures include the following:

- Recovery actions
  - Patrolling evacuated areas to prevent looting
  - Providing safe drinking water
  - Monitoring for diseases
  - Vaccinating residents for tetanus
  - Clearing streets
  - Cleaning up debris and garbage
  - Regulating reconstruction to ensure that it meets all code requirements

- Mitigation actions
  - Conducting a public information effort to advise residents about mitigation measures they can incorporate into their reconstruction work
  - Evaluating damaged public facilities to identify mitigation measures that can be included during repairs

- Acquiring substantially or repeatedly damaged properties from willing sellers
- Planning for long-term mitigation activities
- Applying for post-disaster mitigation funds

Table 8-3 Community Emergency Flood Procedures

Municipality	Flood Response Procedures	Critical Facilities Protection Procedures	Personnel Trained for Damage Assessment
Algonquin	X	X	X
Bull Valley			
Cary	X	X	X
Crystal Lake	X		X
Fox River Grove			
Greenwood			
Harvard			
Hebron			
Holiday Hills		X	
Huntley	X	X	X
Johnsburg	X		X
Lake in the Hills	X	X	X
Lakewood	X	X	X
Marengo	X		
McCullom Lake			
McHenry	X		
Oakwood Hills			
Prairie Grove			
Richmond			
Ringwood			
Spring Grove			X
Trout Valley			
Union			
Wonder Lake			X
Woodstock		X	X
McHenry County			X

Local Implementation: Special requirements apply to buildings in the floodplain and the floodway, regardless of the type of disaster or cause of damage. The National Flood Insurance Program (and the McHenry County Stormwater Management Ordinance) requires that local officials enforce the substantial damage regulations. These rules require that if the cost to repair a building in the mapped floodplain equals or exceeds 50% of the building's market value, the building must be retrofitted to meet the standards of a new building in the floodplain. In most cases, this means that a substantially damaged building in the floodplain must be elevated above the base flood elevation. State law prohibits the re-building of substantially damaged buildings in the floodway. Floodway rules established by IDNR are included in the County's Stormwater Management Ordinance.

These requirements can be very difficult for understaffed and overworked offices after a disaster. If these activities are not carried out properly, the community can miss an opportunity to address a hazardous area, but it may be violating its obligations under the NFIP.

McHenry County Stormwater Management Division is responsible for the implementation of the floodplain regulations in the countywide Stormwater Management Ordinance. Municipalities that participate in the NFIP are responsible for floodplain regulations as a condition of their good standing in the NFIP.

Also, forms for conducting damage assessments, following a hazard event are posted on the McHenry County EMA website.

8.7 Conclusions

1. Emergency management planning in the County is ongoing and a number of municipalities are in the process of developing their own EOPs.
2. Numerous mutual aid agreements are in place throughout the County.
3. The flood threat recognition system should be improved. The rain and stream gage network is generally good but additional gaging is needed in tributary watersheds to the Fox River and Kishwaukee River.
4. The threat recognition system for severe weather hazards (tornadoes, thunderstorms, and winter storms) for the County is relatively good.
5. The procedures and media that the County and municipalities use to disseminate warnings are generally comprehensive.
6. Schools, hospitals, nursing homes, and government buildings have NOAA weather radios.
7. Outdoor warning systems in a number of areas of the County may be inadequate.
8. Mobile home parks (discussed in Chapter 5) are without warning systems.] The availability to tornado shelters or safe rooms at McHenry County manufactured home communities is unknown.
9. Some emergency response plans do not cover critical facilities that will be affected by various types of hazards.

8.8 Recommendations

1. Continue to update emergency operations plans for the County, and continue to develop municipal emergency operations plans with a NIMS compliant template.
2. All identified critical facilities in the County should be mapped using the County's GIS mapping for planning, warning and response purposes. The County should continue their efforts to determine critical facilities located in flood prone areas.
3. Continue work for NIMS compliance for the County and all municipalities, and provide training on NIMS and ICS for all first responders and other identified personnel for compliance.
4. Emergency operations centers at the County and in municipalities should be evaluated for effectiveness and functionality, and modified appropriately. The County and all municipalities should have a fully operational emergency operations center and a secondary location.
5. Conduct annual emergency response training exercises. Look for multi-jurisdiction training opportunities.
6. Develop a disaster recovery strategy for the County and municipalities that includes the identification of mitigation efforts.
7. All parcels in the floodplain should be identified using the County's GIS mapping for planning, warning and response purposes.
8. Investigate adequacy and research funding opportunities for emergency warning and response equipment, including outdoor weather warning sirens, generators for critical facilities, and other warning systems.
9. Response procedures for floods and other hazards should be incorporated in all emergency operations planning and response where appropriate. For example, public works department pre-identify sandbag staging locations for residents.
10. All communities should strive to obtain a StormReady designation.
11. Develop flood stage maps for the County's major streams to make use of gaging networks, warning systems and GIS mapping capabilities.
12. Research funding for additional rainfall and river gages. Also the County and community should look to expand the National Weather Service observer's network.
13. Continue use and funding of the County's Reverse-911 system and utilize other applications of that system for natural hazard warning and response.

14. Develop emergency transportation plans that allow for emergency coordination and evacuation (routing).

8.9 References

1. McHenry County website.
2. IDNR-OWR website: http://dnr.state.il.us/owr/
3. IDNR and USGS websites: : http://il.water.usgs.gov/nwis-w/IL/datasum.components/owrtable.cgi?table=norm
4. Survey of McHenry County, municipalities and townships, 2010.
5. Illinois Emergency Management Agency
6. FEMA website
7. *Flood Fighting*, Illinois Department of Transportation, Division of Water Resources, 1985.
8. Guidelines on Community Local Flood Warning and Response Systems, Federal Interagency Advisory Workgroup on Water Data, 1985.
9. Information on StormReady communities can be found on the National Weather Service website, www.nws.noaa.gov/stormready/.
10. Reverse 911 website www.reverse911.com.
11. *CRS Coordinator's Manual*, Community Rating System, FEMA, 2007.
12. CRS Credit for Flood Warning Programs, FEMA, 1999.

Hazards Addressed	
✓	Floods
✓	Summer Storms
✓	Winter Storms
✓	Extreme Cold
✓	Extreme Heat
✓	Tornadoes
✓	Drought
✓	Groundwater

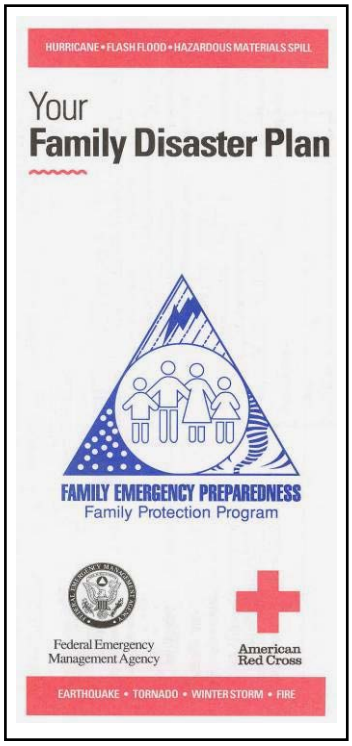
Chapter 9. Public Information

Mitigation of all natural hazards can be accomplished through effective public information activities. This is also true for addressing health issues and pandemics. Public information activities advise property owners, renters, businesses, and local officials about hazards and ways to protect people and property. These activities can motivate people to take the steps necessary to protect themselves and others. A successful hazard mitigation program involves a public information strategy and involves both the public and private sectors.

9.1 Outreach Projects

Outreach projects provide property owners with information to assist them in taking appropriate steps or designing and implementing a project. Outreach projects should encourage people to seek out more information in order to take the most appropriate steps to protect themselves and their properties. Sending notices to property owners can help introduce the idea of property protection and identify sources of assistance.

Numerous government agencies and non-profit organizations publish public information regarding hazards and hazard mitigation. These can be used for outreach purposes. Providing technical assistance and library resources are other forms of outreach. The challenge is to have these efforts effectively reach their intended audience.



Community newsletters/direct mailings: One of the most effective types of outreach projects are materials mailed or distributed to everyone in the community or, in the case of floods, to floodplain property owners.

Research has proven that outreach projects work. However, awareness of the hazard is not enough; people need to be told what they can do about the hazard, so projects should include information on safety, health and property protection measures. Research has also shown that a properly run local information program is more effective than national advertising or publicity campaigns. Therefore, outreach projects should be locally designed and tailored to meet local conditions.

News media: Local newspapers can be strong allies in efforts to inform the public. Press releases and story ideas may be all that is needed to garner the interest of a local reporter. And, for example, after a tornado in another community, people and the media become interested in their own tornado vulnerability and how to protect themselves and their property. Local radio stations and cable TV channels can also help. These media offer interview formats and cable may be willing to broadcast videos on the hazards.

Other approaches: Examples of other outreach project approaches include:

- School programs
- Presentations at meetings of neighborhood, civic or business groups
- Displays in public buildings or shopping malls
- Signs in parks, along trails and on waterfronts that explain the natural features (such as the river) and their relation to hazards (such as floods)
- Brochures available in municipal buildings and libraries
- Special meetings such as floodproofing open houses

Local implementation: McHenry County and all municipalities provide community newsletters and/or community news on their web sites. Algonquin and McHenry Townships and Woodstock Fire Rescue District also prepare community newsletters.

National publications: The American Red Cross has a variety of brochures and publications on safety measures to take for fires, floods, winter storms, heat, etc. Their publications are tailored for different age groups. The American Red Cross also conducts specialized programs on topics such as "home alone safety," first aid and CPR, and what to do during a disaster. American Red Cross publications can be obtained at www.redcross.org/pubs/ or www.chicagoredcross.org.

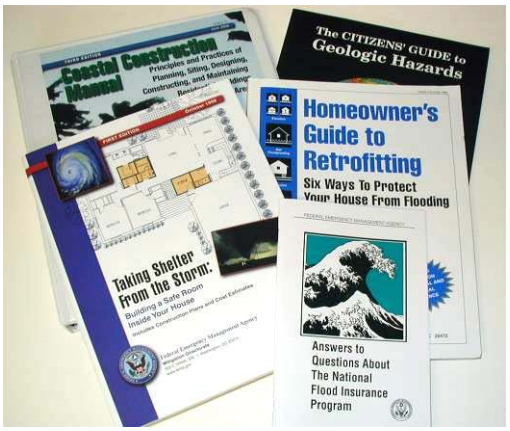
FEMA and IEMA provide numerous publications that can be obtained via their web sites: www.fema.gov/help/publications.shtm, and www.state.il.us/iema/. A number of the FEMA preparedness guides are also available on the McHenry County web site.

NFIP/CRS

CRS credit: The Community Rating System provides up to 290 points for outreach projects on flood topics. 100 of those points are for having a public information program strategy. This Plan qualifies for the strategy credit (see Section 9.5).

9.2 Library and Web Sites

The community library and local web sites are obvious places for residents to seek information on hazards, hazard protection, and protecting natural resources. Books and pamphlets on hazard mitigation can be given to libraries, many of them obtained free from state and federal agencies. Libraries also have their own public information campaigns with displays, lectures, and other projects, which can augment the activities of the local government.



Today, web sites are becoming more popular as research tools. They provide quick access to a wealth of public and private sites and sources of information. Through links to other web sites, there is almost no limit to the amount of up-to-date information that can be accessed by the user.

In addition to on-line floodplain maps, web sites can link to information for homeowners on how to retrofit for tornadoes, earthquakes and floods and a "FEMA for Kids" site. This web site (http://www.fema.gov/kids/) teaches children how to protect their home and what to have in a family disaster kit.

Local implementation: Community libraries in the Village of Algonquin, the Village of Cary, the City of Marengo, and the City of McHenry provides information on hazards and hazard mitigation. The Village of Algonquin, the Village of Lakewood, and the City of McHenry provide web site links to hazard information and hazard mitigation.

The State of Illinois has created a web site called "Ready Illinois" that provide information for before, during and after an emergency. Numerous other agency web site links are provided at this site.

CRS credit: The Community Rating System provides up to 30 points for having a variety of flood references in the local public library and up to 36 more for similar material on municipal web sites.

9.3 Technical Assistance

Hazard information: Providing map information to inquirers is an important public information activity. More and more mapping becomes available each year, both on paper and via the internet. While a map may be readily available, understanding what the map shows and measures may still, in many circumstances, require technical assistance.

Communities can easily provide map information from FEMA's Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies. They may also assist residents in submitting requests for map amendments and revisions when they are needed to show that a building is outside the mapped floodplain.

Communities often supplement what is shown on the FIRM with maps that complement the FIRM and provide information on additional hazards, flooding outside mapped areas and zoning. When the map information is provided, community staff can explain insurance, property protection measures and mitigation options that are available to property owners. Communities should also remind inquirers that being outside the mapped floodplain is no guarantee that a property will never get wet, and that flood insurance is available.

Property protection assistance: While general information provided by outreach projects or the library helps, most property owners do not feel ready to retrofit their buildings without more specific guidance. Local building department staffs are typically experts in construction. They can provide free advice, not necessarily to design a protection measure, but to steer the owner onto the right track.

Building or public works department staff can provide the following types of assistance:

- Visit properties and offer protection suggestions
- Recommend or identify qualified or licensed contractors
- Inspect homes for anchoring of roofing and the home to the foundation
- Provide advice on protecting windows and garage doors from high winds
- Explain when building permits are needed for home improvements

Local implementation: Table 9-1 shows communities that provide technical assistance in reading FIRMs and technical assistance hazard protection.

CRS credit: The Community Rating System provides 140 points for providing map information to inquirers. The community must keep the maps up to date. Up to 71 points are available for providing one-on-one flood protection assistance to residents and businesses and making site visits. Both services must be publicized.

Table 9-1 McHenry County Communities Providing Technical Assistance to Property Owners

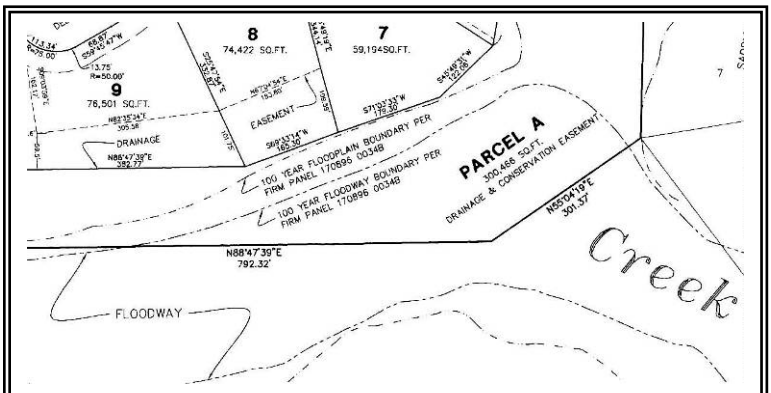
Community	Read FIRMs for Property Owners?	Property Visits for Hazard Protection Advice?
Municipality:		
Algonquin	X	
Cary	X	X
Crystal Lake	X	
Holiday Hills	X	X
Huntley	X	
Johnsburg	X	X
Lake in the Hills	X	
Lakewood		X
Marengo	X	X
McHenry	X	X
Prairie Grove	X	X
Wonder Lake	X	
Woodstock	X	
McHenry County	X	
Township:		
Algonquin		X

9.4 Real Estate Disclosure

Many times after a flood or other natural disaster, people say they would have taken steps to protect themselves if only they had known they had purchased a property exposed to a hazard. Three regulations, one federal and two state, require that a potential buyer of a parcel be told of their exposure to a hazard.

Federal law: Federally regulated lending institutions must advise applicants for a mortgage, or other loan that is to be secured by an insurable building, that the property is in a floodplain as shown on the FIRM.

Flood insurance is required for buildings located within the special flood hazard area if the mortgage or loan is federally insured. However, because this requirement has to be met only 10 days before closing, often the applicant is already committed to purchasing the property when he or she first learns of the flood hazard.



Subdivision plat with flood hazard disclosure

Illinois Residential Real Property Disclosure Act: This law requires a seller to tell a potential buyer:

- If the seller is aware of any flooding or basement leakage problem
- If the property is located in a floodplain or if the seller has flood insurance
- If the seller is aware of a radon problem
- If the seller is aware of any mine subsidence or earth stability defects on the premises
- If the seller is aware of any structural defects

This State law is not wholly reliable because the seller must be aware of a problem and willing to state it on the disclosure form. Due to the sporadic occurrence of flood events, a property owner may legitimately not be aware of potential flooding problems with a property being sold or purchased. Practices by local real estate boards can overcome the deficiencies of these laws and advise newcomers about the hazard earlier. They may also encourage disclosure of past flooding or sewer problems, regardless of whether the property is in a mapped floodplain.

The shortcoming of this approach is that it is dependent on the seller, not on an independent check of the flood map. Multiple Listing Service (MLS) entries read “Flood insurance may be required.” This does not provide any help in disclosing the flood hazard.

Illinois Compiled Statutes: Chapter 55, Section 5/3-5029 requires that all subdivision plats must show whether any part of the subdivision is located in the 100-year floodplain (see example).

NFIP/CRS

CRS credit: Communities would receive 10 points for the two state laws. Up to 46 more points are available if real estate agents implemented a program that checked the FIRMs before a property was listed and provided the flood hazard information to house hunters. Ten points would be provided if local real estate agents gave out brochures that advised people to check out a property’s hazards before they commit to a purchase.

9.5 Public Information Program Strategy

The development of a public information program strategy is an approach to improve the effectiveness of the community's public information efforts. A public information program strategy involves the review of local conditions, local public information needs, and a recommended action plan of activities. A strategy should consist of the following parts, which are incorporated into this plan.

- The local hazards – discussed in Chapter 2 of the Plan.
- The property protection measures appropriate for a specific hazard – discussed in Chapter 5.
- Hazard safety measures appropriate for the local situation. Examples are shown on pages 9-11 and 9-12.
- The public information activities currently being implemented within the communities, including those by non-government agencies – discussed in sections 9.1 through 9.4.
- Goals for the community public information programs are covered in Chapter 3.
- The outreach projects that will be done in each year to reach the goals of Chapter 10's Action Plan, and the recommendations make in this Chapter.
- The process that will be followed to monitor and evaluate the projects is in Chapter 10's Action Plan.

Much of the above items are taken from FEMA's Community Rating System for the National Flood Insurance Program, but the strategy is useful and applicable for any hazard or mitigation outreach effort.

Public information topics and ways to disseminate public information: The Mitigation Committee worked through a list of potential public information topics at their March 2010 meeting and selected topics to focus initial efforts on. The Mitigation Committee also evaluated ways or methods of distributing the public information messages and materials. The selected topics and methods are shown in the conclusions and recommendations in the sections below.

NFIP/CRS

CRS credit: The Community Rating System provides 100 points for a public information program strategy. Although not discussed before the exercises, the CRS provides the most credit for direct mailings to floodplain residents. Credit also favors newsletters, web site and libraries. Fewer points are given for other media, such as presentations at meetings and booths at shopping malls because they reach fewer people.

9.6 Conclusions

1. Public information programs are important so that people and businesses are more aware of the hazards they face and how they can protect themselves. Some public information efforts are currently being implemented by McHenry County, McHenry County municipalities and townships, FEMA, IEMA, and the American Red Cross.
2. Community outreach projects, libraries and web sites can reach a lot of people, but only a moderate amount of information is being provided on natural hazards.
3. Mitigation efforts are being implemented made by communities (e.g., building codes and the countywide stormwater ordinance), but little information is being provided to property owners to describe these current mitigation activities and actions.
4. The Mitigation Committee assessed a variety of topics and determined that for McHenry County the most important topics to cover in public information activities are:
   a. Emergency protection measures
   b. Safety precautions during storms and tornadoes
   c. Safety hazards during and after floods
   d. Protecting property against flood damage
   e. Water quality issues
5. The most appropriate ways to get the messages out are:
   a. Community newsletters
   b. Newspaper articles
   c. Web sites and links to other sources
   d. Handouts at public places
6. All communities in McHenry County implement public information activities. By making a few changes and formalizing the activities, a community can earn nearly 500 points under the Community Rating System.

9.7 Recommendations

1. The following topics should be covered in public information activities.
   a. Safety and emergency protection measures
      - During thunderstorms and lightning
      - During tornadoes
      - During floods
      - During winter storms

b. Protecting your property
   - From flood damage
   - Floodproofing
   - Local drainage issues
   - Sources of assistance

c. Understanding floods
   - Why there are floods
   - Why we regulate the floodplain
   - Flood insurance

d. Other:
   - Protecting our watersheds
   - Protecting water quality
   - Water conservation

2. Each County office, municipality and township should review their current public information activities and incorporate the above messages in them, where appropriate.
3. Public information for hazard mitigation should be coordinated with the McHenry County Health Department in order to combine resources and messages for natural hazards and health concerns related to pandemic or disasters.
4. Publications developed by other agencies should be reviewed, consolidated, and tailored for distribution to McHenry County property owners. A set of countywide publications should be developed that can be used by communities as is, but developed in a format that allows communities to customize the material.
5. Sample articles, with illustrations, on these topics should be prepared and distributed to all interested parties, such as public information offices, webmasters, permit offices, reception desks, and neighborhood organizations.
6. Community newsletters, newspapers, web sites, handouts, and mailings should be used to convey these messages. They are listed in priority order as recommended by the Mitigation Committee.
7. The County should provide an order form for local libraries to order free state and federal hazard mitigation publications.
8. Community web sites should include information and links to other sites to cover as many topics as possible.
9. Communities in the National Flood Insurance Program should provide floodplain information for property owners.

9.8 References

1. *Are You Ready? A Guide to Citizen Preparedness*, FEMA 2002.
2. CRS Credit for Outreach Projects, FEMA, 2002.
3. *CRS Coordinator's Manual*, FEMA 2007.
4. Floodproof Retrofitting: Homeowner Self-Protection Behavior, Shirley Bradway Laska, University of Colorado, 1991.
5. Stormwater Management Public Information Resource Guide, South Suburban Mayors and Managers Association, 1999.
6. Illinois Emergency Management Agency web site.
7. McHenry County community survey, 2010.
8. Municipal web sites.

Duck, Cover and Hold

Whether you are in your home, a school classroom, a high-rise or other type of building, it is important to know how to protect yourself during an earthquake. Practice what to do during an earthquake with your family members so you can react automatically when the shaking starts. If you are outdoors when the shaking starts, get into an open area away from trees, buildings, walls and power lines. If you are indoors follow these steps.

Duck

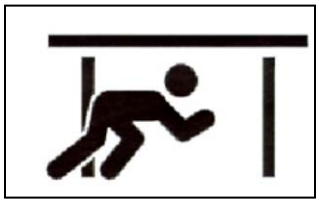
Duck or drop down to the floor.

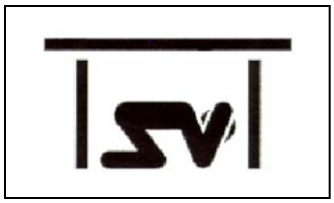
Cover

Take cover under a sturdy desk, table or other furniture. If that is not possible, seek cover against an interior wall and protect your head and neck with your arms. Avoid danger spots near windows, hanging objects, mirrors or tall furniture.

Hold

If you take cover under a sturdy piece of furniture, hold on to it and be prepared to move with it. HOLD the position until the ground stops shaking and it is safe to move.





Flood Safety

- Do not walk through flowing water. Drowning is the number one cause of flood deaths. Currents can be deceptive; six inches of moving water can knock you off your feet. Use a pole or stick to ensure that the ground is still there before you go through an area where the water is not flowing.
- Do not drive through a flooded area. More people drown in their cars than anywhere else. Don't drive around road barriers; the road or bridge may be washed out.
- Stay away from power lines and electrical wires. The number two flood killer after drowning is electrocution. Electrical current can travel through water. Report downed power lines to the Police or Sheriff by calling 911.
- Look out for animals that have been flooded out of their homes and who may seek shelter in yours. Use a pole or stick to poke and turn things over and scare away small animals.
- Look before you step. After a flood, the ground and floors are covered with debris including broken bottles and nails. Floors and stairs that have been covered with mud can be very slippery.
- Be alert for gas leaks. Use a flashlight to inspect for damage. Don't smoke or use candles, lanterns, or open flames unless you know the gas has been turned off and the area has been ventilated.
- Carbon monoxide exhaust kills. Use a generator or other gasoline powered machine outdoors. The same goes for camping stoves. Charcoal fumes are especially deadly -- cook with charcoal outdoors.
- Clean everything that got wet. Flood waters have picked up sewage and chemicals from roads, farms, factories, and storage buildings. Spoiled food, flooded cosmetics, and medicine can be health hazards. When in doubt, throw them out.
- Take good care of yourself. Recovering from a flood is a big job. It is tough on both the body and the spirit and the effects a disaster has on you and your family may last a long time.

Chapter 10. Action Plan

10.1 Action Plan Overview

The findings, conclusions and recommendations presented in Chapters 1 through 9 of the *McHenry County Natural Hazards Mitigation Plan* have been used as the basis of this Action Plan. This Action Plan establishes the priority direction of the McHenry County natural hazards mitigation program. Specific mitigation activities of the Action Plan are presented in detail in Section 10.2. Tables summarizing the action items assigned to each agency, and related to the Plan's goal and guidelines, are provided in Section 10.3. Section 10.4 addresses plan maintenance.

Plan Recommendations: Recommendations for this *McHenry County Natural Hazards Mitigation Plan* are provided at the end of Chapters 4 through 9 for each of the six mitigation strategies (preventive, property protections, structural measures, resource protection, emergency services, and public information). Recommendations presented in the Plan may be selected for implementation as resources become available (e.g., federal, state and/or local funding). Some recommendations act as "building blocks" to other recommendations, but most recommendations call for mitigation actions and the mitigation projects. This chapter presents selected recommendations for implementation as priority action items. *Recommendations not included in this Action Plan are no less important.* Again, as resources become available, any and all recommendations may be implemented.

Selection of Action Items: Recommendations selected as priority action items were deemed as being both necessary and feasible over the course of the next years by the Mitigation Committee. Feasibility was based on current County and municipal resources and currently available grant funding from state and federal agencies. The Mitigation Committee initially selected action items at their April 2010 meeting, then reviewed the Action Plan in its entirety at their May 2010 meeting.

The action items included in this Action Plan support the goals and guidelines for this *McHenry County Natural Hazards Mitigation Plan* (Chapter 3). The action items call for both the continuation of current mitigation efforts throughout the County, and the initiation of new mitigation activities. Continued compliance with the NFIP is called for in Action Item 9,

and improved understanding of the County's floodplain and flood problem areas is also incorporated into a number of other action items.

Organization, Prioritization and Assignment of Action Items: The action items in Section 10.2 are grouped into administrative items that include maintenance activities, mitigation program activities. Action items assign recommended projects and deadlines to the appropriate agencies. Each action item contains a short description and a section for the responsible agency, the deadline for accomplishing the action item, the costs, and the benefits. Action items are prioritized within this Chapter in the order that they are presented. The action items are summarized in Table 10-1 and show the agency assignments. Appendix E provides action items assigned to each participating jurisdiction and example adoption resolutions. While this Chapter and Appendix E provides the action items in a priority order, any and all action items should be implemented if staff time and/or funding becomes available ahead of other action times. The relationship between the goals and guidelines and chapter recommendations are shown in Tables 10-2 and 10-3, respectively.

10.2 Mitigation Action Items

10.2.1 Administrative Action Items

Action Item 1: Plan Adoption

Adopt this *McHenry County Natural Hazards Mitigation Plan* by resolution of the County Board, City Councils, Boards of Trustees, and other governing boards, as appropriate. Each agency resolutions should adopt the action items pertinent to the community and assign a person responsible.

Responsible Agency: County Board, City Councils, Village Boards, Boards of Trustees, and other agencies.

Deadline: 6 months.

Cost: Staff time.

Benefits: Adoption of the Plan ensures that County, municipalities, townships and other agencies are authorized to implement the action items with available resources. Adoption is also a requirement for recognition of the Plan by mitigation funding programs, including the Disaster Mitigation Act of 2000, the FEMA Flood Mitigation Assistance Program and the National Flood Insurance Program's Community Rating System.

Plan Reference: Chapters 1 and 10.

Action Item 2: Continuation of Mitigation Committee

The County's resolution to adopt this Plan should convert the McHenry County Hazards Mitigation Committee to a permanent advisory body. It should:

- Act as a forum for hazard mitigation issues,
- Disseminate hazard mitigation ideas and activities to all participants,
- Allow for continued public participation in the implementation and future revisions,
- Ensure incorporation of this Plan's goals and guidelines into other planning documents,
- Monitor implementation of this Action Plan, and
- Report on progress and recommended changes to the County Board and each municipality and township.

Responsible Agency: The McHenry County Board.

Deadline: Ongoing.

Cost: Staff time.

Benefits: The benefit is better implementation of this Plan, plus a more comprehensive mitigation program in McHenry County. This approach also provides a mechanism for continued public involvement (e.g., Mitigation Committee activities posted on the County web site).

Plan Reference: Chapters 1 and 10.

Action Item 3: Plan Monitoring and Maintenance

A McHenry County Hazard Mitigation Committee meeting will be held at least once a year to evaluate and monitor progress on implementation. This meeting will be publicized in print and on the County and community web sites (the public will be welcome to attend and/or comment). An annual evaluation report should be submitted to the County Board by the chair of the Mitigation Committee.

At the annual meeting, along with an assessment of the implementation efforts, the Mitigation Committee will determine if other mitigation issues or efforts, based on any natural hazard occurrences or input from communities or the public, should be added to the Plan.

The Plan is required by FEMA to be updated every five years. Every five years, or if any substantial revisions to the Plan are recommended to the Action Plan in any year, the Plan must be adopted by the County Board and the participating communities.

Responsible Agency: McHenry County Hazard Mitigation Committee and McHenry County EMA.

Deadline: Mitigation Committee meetings are to occur annually. Evaluation reports are to be prepared annually. A five-year update is required for FEMA's mitigation funding programs.

Cost: Staff time.

Benefits: A monitoring system helps ensure that responsible agencies continue to be aware of their assignments. The Plan should be evaluated in light of progress, changed conditions, and new opportunities.

Plan Reference: Chapters 1 and 10.

10.2.2 Mitigation Program Action Items

Action Item 4: Watershed Studies

McHenry County should pursue comprehensive watershed studies. This effort will foster the understanding of impact of development on existing flood problems and identify ways to reduce future flood problems. Watershed studies should also evaluate wetlands and water quality impacts of development and other activities in McHenry County.

Responsible agency: McHenry County.

Deadline: 36 months.

Cost: $500,000 estimate.

Benefits: All residents will benefit from the understanding of the County's watersheds, and this effort will allow for a cost-effective approach to addressing existing and future flood problems. Efforts will provide for the protection of property, reduced transportation disruption, and improved health and safety during minor and major flood events.

Plan Reference: Chapter 6 discussion and recommendation 1 in Section 6.8.

Action Item 5: Expand Stream Gaging Network

McHenry County should pursue the installation and maintenance of additional stream gages throughout the county. Additional assistance should be sought from the Illinois Department of Natural Resources and the U.S. Geological Survey for funding and technical assistance.

Responsible agency: McHenry County.

Deadline: 12 months.

Cost: $50,000 estimate.

Benefits: The availability of more extensive river stage data will benefit the County in a number of ways. These benefits include, better calibration data for the development of watershed models (studies), improved flood forecasting, and additional data for operation of Stratton Dam.

Plan Reference: Chapter 6 discussion, Chapter 8 discussion and recommendation 12 in Section 8.8.

Action Item 6: Stream Maintenance Programs

The County, municipalities, and townships should develop and implement formal and regular drainage system maintenance programs. This effort should include the inspection of privately maintained drainage facilities. It is understood that each municipality and township will make these considerations based on available staffing and financial resources. Both urban and rural streams are in need of maintenance Also, bridges and culverts (active or abandoned) that restrict flood flows should be evaluated. The removal or enlargement of stream crossings, in cases were a modification will not cause an increase in downstream flooding, should be considered and funded.

Responsible Agency: McHenry County, municipalities and townships. This can include public works departments, township road districts, or other appropriate departments or offices.

Deadline: 36 months.

Cost: Staff time and equipment.

Benefits: Development and agriculture have lead to a reduction of stream capacity, and upstream flooding as a result may be increasing. A restoration of stream capacity may mitigate upstream damage, and enhance stream and water quality. Regular maintenance can protect both structures and property. Regular maintenance can also be more cost effective than major maintenance efforts that are done on an as-needed basis.

Plan Reference: Chapter 6 discussion and recommendation 5 in Section 6.8.

Action Item 7: Prohibited Waterway Dumping Ordinances

Each community should ensure that they have enforceable stream and wetland dumping ordinances. Regulations should apply to both "objectionable waste" and "non-objectionable" materials such as grass clippings and tree branches. Communities they do not have stream and wetland dumping ordinances should adopt appropriate regulations.

Responsible agency: McHenry County and municipalities.

Deadline: 36 months.

Cost: Community specific.

Benefits: Keeping streams, including drainage ditches, free of debris and dumped material benefits the stream's ability to convey water, reduced erosion and sedimentation, protects the riparian environment, protects water quality, and can reduce flood damage.

Plan Reference: Chapter 7 discussion and recommendation 1 in Section 7.10.

Action Item 8: Mitigation of Public Infrastructure

Mitigation of public infrastructure, including roadways, bridges and culverts, and treatment facilities, for protection from natural hazards should be investigated as the facility or asset is being considered for repair, replacement or expansion. When possible, improvements should incorporate protecting the natural functions of the streams and floodplains, if located in a floodplain.

Responsible agency: McHenry County, municipalities and townships.

Deadline: As funding available.

Cost: Project specific.

Benefits: Regional solutions to flood problems are often more cost beneficial that the mitigation of individual buildings. Also, when flooding on streets and the overtopping of bridges is reduced, then the entire community benefits. Transportation damages are reduces and safety is improved.

Plan Reference: Chapter 6 discussion (including Table 6-1) and recommendation 2 under Section 6.8.

Action Item 9: Continued NFIP Compliance

Municipalities that participate in the National Flood Insurance Program (NFIP) should ensure that they are in full compliance with the NFIP administration and enforcement requirements. While the McHenry County Planning and Development Department administers the McHenry County Comprehensive Stormwater Ordinance for non-certified municipalities, all NFIP municipalities are still ultimately responsible for ensuring that development within the regulatory floodplain meets the NFIP minimum standards.

Responsible Agency: McHenry County Planning and Development Department and municipal NFIP Administrators.

Deadline: Ongoing.

Cost: Staff time.

Benefits: Community compliance with the NFIP is essential

Plan Reference: Chapter 4, discussion and recommendation 4 in Section 4.8.

Action Item 10: Repetitive Loss Areas Study

Repetitive flood loss areas (identified as part of this Plan) should be studied and mitigation alternatives, such as acquisition, elevation or floodproofing, identified and investigated for the structures. The County or municipalities should seek a mitigation planning grant as needed for preparing the repetitive loss areas studies.

Responsible agency: McHenry County Planning and Development Department with the cooperation of municipalities with properties included in the repetitive loss areas.

Deadline: 24 months.

Cost: $100,000.

Benefits: Property owners subject to repetitive flood losses will directly benefit from this action as they learn of ways that they can protect themselves from future flood damage. This effort will also lead to the request for FEMA funding for mitigation measures within the repetitive flood loss areas, and the removal or protection of repetitive flood loss structures will benefit all levels of government and the National Flood Insurance Fund.

Plan Reference: Chapter 2, Section 2.5.2; and Chapter 5 discussion and recommendations 2 and 4 in Section 5.7.

Action Item 11: Identification of Floodplain Structures:

In addition to examining repetitively flood loss areas, a comprehensive list of structures located in the County's floodplains should be developed. Through GIS and examining building footprints, the numbers and types of structures in the floodplain can be determined. The list should include critical facilities that potentially need flood protection.

Responsible Agency: McHenry County Planning and Development and GIS Division.

Deadline: 36 months.

Cost: $100,000.

Benefits: The countywide stormwater management program and hazard mitigation effort would benefit from a full picture of the number of McHenry County floodplain properties. Appropriate property protection measures could be better identified through this information. Also, having this information would allow municipalities to provide public information materials directly to these property owners.

Plan Reference: Chapters 4, 5 and 8 discussions, and recommendation 7 in Section 8.8.

Action Item 12: Investigation of Critical Facilities

An investigation/analysis of the critical facilities mapped in the County's GIS as part of this Plan should be conducted to determine if buildings or facilities are located in hazardous locations (floodplains or otherwise). Additional critical facility data should be collected and added to the GIS layers. Emergency managers should provide input on mapping and data formats that would enhance emergency preparedness, response and recovery in the county. The investigation should also identify critical facilities that should be protected from identified natural hazards.

Responsible Agency: McHenry County.

Deadline: 24 months.

Cost: $100,000.

Benefits: This review of critical facilities and any mitigation efforts will benefit McHenry County through preparedness, response and recovery.

Plan Reference: Chapter 8 and recommendation 2 in Section 8.8.

Action Item 13: Critical Facilities Design with Natural Hazards Protection

Offices responsible for design, construction or permitting critical facilities, including federal, state, county and municipal agencies, and institutions should ensure that the design or modification of critical facilities accounts for all natural hazards and adjacent land uses. Critical facilities in the floodplain should be protected to the 500-year flood event.

Responsible agency: County, municipal, townships, and federal and state agencies responsible for critical facilities.

Deadline: Ongoing.

Cost: Staff time.

Benefits: This Plan expanded the list of critical facilities to include school, places of assembly, and other assets that are significant in the county during times of natural disasters. These may be shelters, or places of concentrated populations. If these facilities are better protected, then the risk for life, health and safety is reduced.

Plan Reference: Chapter 5 discussion and recommendation 4 in Section 5.7, and Chapter 8 discussion and recommendation 2 in Section 8.8.

Action Item 14: Mitigation of Floodplain Properties - Property Protection Projects

Properties that are exposed to flood damage throughout McHenry County should be protected through property protection measures where regional structural projects are not feasible. Property protection measures should include, but not be limited to, acquisition, elevation, or floodproofing. Priority should be given to repetitive loss properties, but all floodplain properties including critical facilities should be included.

Responsible Agency: McHenry County Stormwater Management Division, municipal stormwater administrators and NFIP coordinators.

Deadline: Ongoing.

Cost: Identified per project.

Benefits: Properties will be protected from future flooding. Also the exposure of the National Flood Insurance Fund will be reduced. There will also be a reduction in emergency response as structures are protected or removed from flood prone areas.

Plan Reference: Chapter 5 discussion and recommendations 4 and in Section 5.7.

Action Item 15: Safe Rooms

The need for additional safe rooms throughout the county should be considered, including safe rooms and sheltering in residences, businesses, critical facilities, health care facilities, and schools. As needs are identified, grant funding should be pursued for the construction of safe rooms.

Responsible agency: McHenry County, municipalities, townships and institutions.

Deadline: 36 months.

Cost: Staff time (plus grant cost share).

Benefits: McHenry County is vulnerable to tornado events. With the construction of safe rooms, life and safety can be protected.

Plan Reference: Chapter 5 discussion and recommendations 13 and 14 Section 5.7.

Action Item 16: Community Rating System Participation

McHenry County and the municipalities that participate in the NFIP should consider participating in the Community Rating System (CRS). The Village of Lake in the Hills already participates in CRS, and they should also continue their participation.

Responsible Agency: McHenry County Planning and Development and municipal NFIP administrators.

Deadline: Ongoing.

Cost: Staff time.

Benefits: The CRS program saves property owners money on flood insurance premiums and it has been shown to be effective for the implementation of stormwater and floodplain management. McHenry County and the municipalities enforce higher regulatory standards than FEMA and participate in many creditable CRS activities.

Plan Reference: Chapter 1, and throughout the Plan (see CRS icons and comments). Also see recommendation 11 in Section 4.8.

Action Item 17: Urban Forestry - Participation in Tree City USA

McHenry County municipalities that are Tree City USA communities will maintain their status in the nationwide program, and communities that are not in the program will consider joining the program. It is understood that each municipality will make these considerations based on available staffing and financial resources.

Responsible Agency: Public works department or other appropriate municipal department.

Deadline: 24 months.

Cost: $2 per capita, staff time.

Benefits: Urban forestry programs provide mitigation against severe winter and summer storms, and high wind events. The loss of trees is prevented along with the protection of power, telephone and cable services. Damage to vehicles and buildings from falling limbs is also prevented.

Plan Reference: Chapter 7 discussion and recommendations 8 in Section 7.10.

Action Item 18: Participation in StormReady

McHenry County, communities and other agencies should consider joining the National Weather Service's StormReady program. The StormReady program has been developed to provide communities guidelines to improve the timeliness and effectiveness of hazardous weather-related warnings for the public.

Responsible Agency: County, municipal, other agency, and institutional emergency managers.

Deadline: 24 months.

Cost: $2 per capita, staff time.

Benefits: By meeting StormReady requirements, the County, communities and institutions will be better able to detect impending weather hazards and disseminate warnings as quickly as possible. All efforts to prevent injury, save lives, and protect property are of high value.

Plan Reference: Chapter 8 discussion and recommendation 10 in Section 8.8.

Action Item 19: Strengthen Building Codes and Code Enforcement Training

Communities that have not adopted the International Code series of building codes should do so, and for all communities, future code revisions should be pursued to strengthen new buildings against damage by high winds, tornadoes, hail, and earthquakes. Requiring tornado "safe rooms" in certain structures should be considered. Any code revisions should be consistent with the efforts undertaken by multi-community organizations of building department staff.

Training should be developed and conducted for building department staff on building code administration, enforcement, the natural hazards aspects of the International Codes, regulation of mobile home installation, floodplain ordinances, and provisions applicable to hazard mitigation.

Responsible agency: McHenry County and building departments.

Deadline: 24 months.

Cost: Staff time.

Benefits: Building codes cannot be effective unless they are administered and enforced properly. Training will ensure that county and municipal staffs understand the codes and procedures. This is a benefit that property owners will also benefit from as they understand the importance of the building standards for new construction. It also allows them to protect their investment in the property. Implementation of this Action Item will improve the hazard protection standards for new construction and will ensure a consistent set of building standards across the County.

Plan Reference: Chapter 4 discussion and recommendations 2 and 3 in Section 4.8.

Action Item 20: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects

The County, municipalities, townships, other agencies and institutions should apply for mitigation grant funding through available IEMA and FEMA programs for mitigation planning and mitigation projects. As required by IEMA and FEMA programs, projects must be cost beneficial. FEMA hazard mitigation funding including PDM, HMGP, FMA and Section 406 of the Stafford Act (for facilities and infrastructure damaged due to a presidentially declared disaster) should be considered.

Responsible Agency: McHenry County, municipalities, other agencies, and institutions.

Deadline: As needed.

Cost: 25 percent of plan or project cost (non-federal share).

Benefits: The County, municipalities, townships, other agencies and institutions, along with residents and property owners, would benefit from the available grant funding. The request for grant funding also allows the Mitigation Committee to benefit from the mitigation planning effort.

Plan Reference: Chapters 1 and 4 through 9.

Action Item 21: Implementation of the Water Resources Protection Action Plan

The County, municipalities and townships should implement the water quality and groundwater protection measures recommended by the "McHenry County Water Resources Protection Action Plan."

Responsible agency: McHenry County, municipalities and townships.

Deadline: Ongoing.

Cost: Staff time.

Benefits: McHenry County will benefit in the years to come by the protection of surface water and groundwater quality, and groundwater quantity for drinking water supply purposes.

Plan Reference: Chapter 7 discussion and recommendation 6 in Section 7.10.

Action Item 22: Development of a Public Information Strategy

A countywide natural hazards public information strategy should be developed for the use of the County, municipalities, townships and institutions. The strategy should be consistent with the recommended approach for the CRS program. The most important topics to cover are:

Safety and emergency protection measures

- During thunderstorms and lightning
- During tornadoes
- During floods
- During winter storms

Protecting your property

- From flood damage
- Floodproofing
- Local drainage issues

- Sources of assistance

Understanding floods

- Why there are floods
- Why we regulate the floodplain
- Flood insurance

Other:

- Protecting our watersheds
- Protecting water quality
- Water conservation

The most appropriate ways to provide information are:

- Community newsletters
- Newspaper articles
- Web sites and links to other sources
- Handouts at public places

Publications developed by other agencies should be reviewed, consolidated, and tailored for distribution to McHenry County property owners. A set of countywide publications should be developed that can be used by communities as is, but developed in a format that allows communities to customize the materials.

Responsible Agency: McHenry County Hazard Mitigation Committee, municipalities, institutions.

Deadline: 12 months.

Cost: Staff time, publication costs.

Benefits: There are many benefits to having a well-informed public. For example, deaths from lightning have steadily decreased over the years because people are more aware of what they should and should not do. More self-help and self-protection measures will be implemented if people know about them and are motivated to pursue them.

By preparing a public information strategy and a master set of locally pertinent articles and materials, each interested office only has to select the most appropriate media and distribute the messages. By simply inserting an article in a newsletter or putting it on the website, the local level of effort is greatly reduced, which increases the likelihood that the messages will get out. The messages will also be technically correct and consistent throughout the County.

Plan Reference: Chapter 9 discussion, and conclusion 5 in Section 9.6 and recommendation 1 in Section 9.7.

Action Item 23: Property Protection References

Provide municipal departments, libraries and other interested offices with a list of references on property protection that can be ordered for free from state and federal offices. Include a request that they make the references available for public use. A special effort should be made to identify references on insurance, emergency preparedness and property protection.

Also, identify web sites that provide property protection information and provide their addresses to the County and municipal webmasters.

Responsible Agency: McHenry County Hazard Mitigation Committee, then municipal offices to place in libraries and offices. The American Red Cross should provide technical advice.

Deadline: 12 months.

Cost: Staff time.

Benefits: As with the other public information activities, this action item helps inform the public. It provides the greatest assistance to those people who want to learn more about property protection and take the right steps to reduce their exposure to damage by natural hazards.

Plan Reference: Chapter 9.

10.3 Summary of Action Plan Items

Table 10-1 summarizes the 23 action items, the responsible agencies and the deadlines for implementing them. The action items are categorized as administrative items and mitigation program items. Administrative items include tasks needed to administer and support plan implementation. The relationship between the goals and guidelines (from Chapter 3) are shown in Table 10-2.

Appendix C provides a list of specific action items assigned to the Mitigation Committee, the County and communities. Appendix C also includes a copy of sample adoption resolutions for the County and the communities.

10.4 Plan Implementation and Maintenance

The continuation of the McHenry County Hazard Mitigation Committee is necessary for implementation of the Action Plan. The establishment of the Mitigation Committee as a permanent group is proposed to monitor the implementation of the Plan, report to the County Board, municipalities, townships and other agencies on its progress, and recommend revisions to this Plan as needed (see Action Item 2).

Maintenance and monitoring of the *McHenry County Natural Hazards Mitigation Plan* are addressed in Action Item 3. This Action Item explains how and when this Plan will be reviewed, revised, and updated. While Action Item 3 calls for the Mitigation Committee to meet at least once a year, it is anticipated that they will meet more frequently through the Stormwater Technical Advisory Committee meetings and the Local Emergency Managers Coordinators group. The purpose of the Mitigation Committee meetings will be for the development and review of countywide mitigation activities.

Table 10-1 Action Items, Responsible Agencies and Deadlines

	Administrative Action Items			Mitigation Program Action Items																			
Responsible Agency	1. Plan Adoption	2. Continuation of Mitigation Committee	3. Plan Monitoring and Maintenance	4. Watershed Studies	5. Expand Stream Gaging Network	6. Stream Maintenance Programs	7. Prohibited Waterway Dumping Ordinances	8. Mitigation of Public Infrastructure	9. Continued NFIP Compliance	10. Repetitive Loss Areas Study	11. Identification of Floodplain Structures:	12. Investigation of Critical Facilities	13. Critical Facilities Design with Natural Hazards Protection	14. Mitigation of Floodplain Properties - Property Protection Projects	15. Safe Rooms	16. Consider Community Rating System Participation	17. Urban Forestry – Consider Participation in Tree City USA	18. Consider Participation in StormReady	19. Strengthen Building Codes and Code Enforcement Training	20. Seek Mitigation Grant Funding	21. Implementation of the Water Resources Protection Action Plan	22. Development of a Public Information Strategy	23. Property Protection References
Hazard Mitigation Committee		X	X																			X	X
McHenry County																							
County Board	X	X	X																		X		
Administrator		X	X																	X			
EMA		X	X		X			X				X	X		X	X		X		X			
Planning & Development		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X
Stormwater		X	X	X	X			X	X	X	X	X	X	X							X		
Transportation		X	X			X		X															
GIS		X	X								X	X											
Health		X	X																				
Water Resources		X	X																				
Municipalities																							
City Council/Village Board	X																			X	X		
Emergency Management		X	X					X				X			X					X		X	X
Designated department(s)		X	X			X	X	X	X					X	X	X	X		X	X	X		
Townships																							
Township Office	X	X	X					X				X			X					X		X	X
Road District		X	X			X		X				X								X			
Fire District		X	X					X				X								X			
Other Agencies												X	X	X	X								
Deadline for first product (months)	6	On	On	36	12	36	36	As	On	24	36	24	On	On	36	On	24	24	24	As	On	12	12

On = Ongoing

As = As Available or Needed

(x) Can be recommended

Table 10-2 Action Items, Goals and Guidelines

	Administrative Action Items			Mitigation Program Action Items																			
Responsible Agency	1. Plan Adoption	2. Continuation of Mitigation Committee	3. Plan Monitoring and Maintenance	4. Watershed Studies	5. Expand Stream Gaging Network	6. Stream Maintenance Programs	7. Prohibited Waterway Dumping Ordinances	8. Mitigation of Public Infrastructure	9. Continued NFIP Compliance	10. Repetitive Loss Areas Study	11. Identification of Floodplain Structures:	12. Investigation of Critical Facilities	13. Critical Facilities Design with Natural Hazards Protection	14. Mitigation of Floodplain Properties - Property Protection Projects	15. Safe Rooms	16. Consider Community Rating System Participation	17. Urban Forestry – Consider Participation in Tree City USA	18. Consider Participation in StormReady	19. Strengthen Building Codes and Code Enforcement Training	20. Seek Mitigation Grant Funding	21. Implementation of the Water Resources Protection Action Plan	22. Development of a Public Information Strategy	23. Property Protection References
Goals																							
Goal 1. Protect the lives, health, and safety of the people of McHenry County from the impact and effects of natural hazards.	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Goal 2. Protect public services, utilities and critical facilities from potential damage from natural hazard events.	X	X	X	X	X	X	X	X	X		X	X	X		X		X	X			X	X	X
Goal 3. Protect historic, cultural, and natural resources from the effects of natural hazards.	X	X	X			X	X				X			X			X			X	X	X	X
Goal 4. Ensure that new developments do not create new exposures to damage from natural hazards.	X	X	X	X									X						X		X	X	X
Goal 5. Mitigate to protect against economic and transportation losses due to natural hazards.	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X
Goal 6. Identify specific projects to protect lives and mitigate damage where cost-effective and affordable.	X	X	X					X		X			X	X	X					X			

Responsible Agency	1. Plan Adoption	2. Continuation of Mitigation Committee	3. Plan Monitoring and Maintenance	4. Watershed Studies	5. Expand Stream Gaging Network	6. Stream Maintenance Programs	7. Prohibited Waterway Dumping Ordinances	8. Mitigation of Public Infrastructure	9. Continued NFIP Compliance	10. Repetitive Loss Areas Study	11. Identification of Floodplain Structures:	12. Investigation of Critical Facilities	13. Critical Facilities Design with Natural Hazards Protection	14. Mitigation of Floodplain Properties - Property Protection Projects	15. Safe Rooms	16. Consider Community Rating System Participation	17. Urban Forestry – Consider Participation in Tree City USA	18. Consider Participation in StormReady	19. Strengthen Building Codes and Code Enforcement Training	20. Seek Mitigation Grant Funding	21. Implementation of the Water Resources Protection Action Plan	22. Development of a Public Information Strategy	23. Property Protection References
Guidelines																							
Guideline 1. Focus natural hazards mitigation efforts on floods, severe summer and winter storms, tornadoes, extreme cold and heat events, and drought.				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Guideline 2. Make people aware of the hazards they face and focus mitigation efforts on measures that allow property owners and service providers to help themselves.	X	X																				X	X
Guideline 3. Seek state and federal support for mitigation efforts.				X	X					X	X	X		X	X					X			
Guideline 4. Use available local funds, when necessary, to protect the public services, critical facilities, lives, health, and safety from natural hazards.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Guideline 5. Examine equitable approaches for the local cost of mitigation, such as user fees.																			X		X		
Guideline 6. Create and foster public-private partnerships to accomplish mitigation activities.														X	X					X	X	X	X
Guideline 7. Strive to improve and expand business, transportation and education opportunities in McHenry County in conjunction with planned mitigation efforts.								X					X							X	X		

Table 10-3
Action Items and Recommendations

	Administrative Action Items			Mitigation Program Action Items																			
Responsible Agency	1. Plan Adoption	2. Continuation of Mitigation Committee	3. Plan Monitoring and Maintenance	4. Watershed Studies	5. Expand Stream Gaging Network	6. Stream Maintenance Programs	7. Prohibited Waterway Dumping Ordinances	8. Mitigation of Public Infrastructure	9. Continued NFIP Compliance	10. Repetitive Loss Areas Study	11. Identification of Floodplain Structures:	12. Investigation of Critical Facilities	13. Critical Facilities Design with Natural Hazards Protection	14. Mitigation of Floodplain Properties - Property Protection Projects	15. Safe Rooms	16. Consider Community Rating System Participation	17. Urban Forestry – Consider Participation in Tree City USA	18. Consider Participation in StormReady	19. Strengthen Building Codes and Code Enforcement Training	20. Seek Mitigation Grant Funding	21. Implementation of the Water Resources Protection Action Plan	22. Development of a Public Information Strategy	23. Property Protection References
Recommendations																							
Ch. 4. Preventive Measures				X	X				X		X		X			X			X	X	X	X	X
Ch. 5. Property Protection						X	X	X	X	X	X	X		X	X	X	X	X		X		X	X
Ch. 6. Structural Projects				X	X	X														X			
Ch. 7. Resource Protection						X	X				X						X	X			X	X	X
Ch. 8. Emergency Services					X			X			X	X	X		X					X		X	X
Ch. 9. Public Information	X	X	X																			X	X