McHenry County Natural Hazards Mitigation Plan

Completed for McHenry County and the participating communities within

McHENRY 1837 COUNTY

Draft - October 2016

Stantec

MOLLY O'TOOLE & ASSOCIATES LTD.

The Table of Contents and Appendices will be created after the public review period ends.

EXECUTIVE SUMMARY

Overview

The 2016 *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 storms (including hail, lightning, and wind), winter storms, tornadoes, extreme cold and heat events, and drought. The most recent natural disasters in McHenry County, Illinois, receiving federal disaster declarations were winter storms in 2008 and 2013 and severe storms (flooding, straight-line winds) in 2013. 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 grant 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, which was first developed in 2010, was prepared through the McHenry County Natural Hazards Mitigation Committee, which was 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. Thus, the aforementioned chapters also address community

capabilities. 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 2010, McHenry County had a population of 308,760, 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 2010 Census estimated that there are approximately 116,040 housing units in McHenry County, an increase of 23,132 (20 percent; approximately 2,300 new units per year) from 2000. The 2014 housing unit estimates show continued, but slower, growth at 117,051 housing units (about 200 units per year). The labor force is about 168,000 people.

Figure 0-1 Ten Steps

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 three times from October 2015 to March 2016 to update this Plan. 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. 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 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, the McHenry County website, and a public survey. A public meeting was held on March 3, 2016 at the McHenry County Public Health Building.

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, the local economy, and climate change considerations. The information was based on available technical studies and reports by the participating agencies and communities on their past experiences. Table 0-1 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.

Table 0-1 Summary of Impact on Natural Hazards

Hazard	Value of Vulnerable Property	Appr. Total Historical Damage	Appr. Average Damage per Event	Impact on Health and Safety	Impact on Buildings	Impact on Critical Facilities	Economic Impact
Flood	$210 million	$5.2M (1978-2015)	$150K	High	High	Moderate	Moderate
Severe T-Storm (Wind)	$7.4 billion	$740K (1955-2015)	$4K	Moderate	High	Moderate	High
Severe T-Storm (Lightning)	$7.4 billion	$990K (1996-2015)	$49.5K	Moderate	Moderate	Moderate	Moderate
Severe T-Storm (Hail)	$7.4 billion	$161K (2006-2015)	$1K	Moderate	Moderate	Moderate	Low
Severe Winter Storm & Extreme Cold	$7.4 billion	$4.1M (1960-2012)	$83K	Moderate	Moderate	Moderate	Low
Tornado	$7.4 billion	$273M (1958-2015)	$11.9M	High	High	Moderate	Moderate
Extreme Heat	---	---	---	High	Moderate	Low	Moderate
Drought	---	---	---	Low	Low	Low	Moderate
Earthquake	---	---	---	---	---	---	---
Dam Failure	---	---	---	---	---	---	---

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

During the 2010 development of this plan, the Mitigation Committee put substantial effort into reviewing each strategy to understand the needs of the county. This previous work was then refreshed during the 2016 update of this Plan.

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 Management 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. During the 2010 update of this plan, 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. GIS data improvements during the 2016 update of this plan helped identify potential vulnerabilities.

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 is needed. The Mitigation Committee also recommended each community establish a formal and regular program of drainage system maintenance. These were recommended as actions to consider during the 2010 and 2016 updates of this plan.

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.

During the 2010 update of this Plan, 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. While some efforts have been undertaken, this was a trend for suggested actions during the 2016 update (such as the public survey).

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. The Action Plan is included in Chapter 10 of this *Natural Hazards Mitigation Plan*. It is understood that implementation of the action items included in the Action Plan for each community are 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. For the 2016 update of this Plan, communities were encouraged to define actions specific to their jurisdictions (as a need existed). In addition, the 23 action items developed for the 2010 Plan were reviewed and updated for each jurisdiction for the 2016 Plan.

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 the 2016 *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 will include the continuation of the Mitigation Committee. The municipal resolutions will adopt each action item that is pertinent to the community (see Chapter 10) 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. Resolutions can be found in Appendix A.

Summary

This Plan was developed and updated by the McHenry County Natural Hazards 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. The 2016 update of this Plan will be 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. The Mitigation Committee will continue to meet annually and the public will be invited to participate and provide comments. This Plan will be updated again in five years, as required by FEMA.

CHAPTER 1 - INTRODUCTION

This chapter outlines the purpose of the Plan, McHenry County's planning process to update the Plan (including public involvement), and an overview of the County and the assets within.

McHenry County is subject to natural hazards. Floods, severe 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 April 2013 flood events. Blizzards and snowstorms have impacted the County with the most severe winter storms occurring in 1967, 1979, 1981, 1982, 1999, 2000, 2006, 2014, and 2015. Twenty-three tornadoes have been verified between 1950 and 2015 that have resulted in approximately $275 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 Resources 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).

Figure 1-1 Hazard Mitigation

"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

"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.

1.1 Purpose of This Plan

Natural hazard events threaten every community in the nation. Every community has different resources and needs relating to natural hazards based on the types of hazard that may impact them, the frequency of events, and the potential damages. There are many ways to address potential impacts and a hazard mitigation plan outlines a blue print to reduce the impacts of natural hazards within each community.

Hazard mitigation planning is for the purpose of assessing 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 implementation 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 grant funds are made available by the Federal Emergency Management Agency (FEMA) through the Illinois Emergency Management Agency (IEMA).

Hazard mitigation plans are also recognized as "floodplain management plans" in the National Flood Insurance Program's Community Rating System (CRS) in which McHenry County and several of its jurisdictions participate. CRS is a program that reduces flood insurance premiums in participating communities.

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, townships, and agencies with an action plan for reducing the impacts of these natural hazards on people and property.

1.2 Authority

This updated Plan complies with all requirements set forth by the Illinois Emergency Management Agency and the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Section 104 of the Disaster Mitigation of 2000. In addition, it complies with all of FEMA's Final Rule 44 CFR Part 201, which outlines criteria for approval of hazard mitigation plans.

1.3 Organization of This Plan

This Plan is organized into 10 chapters as outlined in Table 1-1:

Table 1-1 McHenry County Hazard Mitigation Plan Chapters

Chapter 1: Introduction
Purpose of the Plan
Authority
Organization of the Plan
Planning Process Approach
Summary of Meetings
Public Participation Summary
County and Jurisdiction Overview
Chapter 2: Risk Assessment
Hazard Profiles
Vulnerability Assessment
Summary of Risk
Chapter 3: Plan Goals
Plan Goals and Guidelines
Alignment to Other Planning Efforts
Chapter 4: Preventative Measures
Preventative Measures
Recommendations
Chapter 5: Property Protection Measures
Property Protection Measures
Recommendations
Chapter 6: Structural Measures
Structural Measures
Recommendations
Chapter 7: Resources Measures
Resources Measures
Recommendations
Chapter 8 Emergency Management Measures
Emergency Management Measures
Recommendations
Chapter 9: Public Information Measures
Public Information Measures
Recommendations
Chapter 10: Mitigation Action Plan
Mitigation Actions

1.4 Planning Process Approach

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

This planning effort was initiated and coordinated by the McHenry County Emergency Management Agency. The effort was funded by a grant from the IEMA. Stantec Consulting Inc. ("Stantec") led the planning process with assistance from Molly O'Toole & Associates, Ltd. In addition, a planning committee was reconvened from previous planning efforts which included representative from each of the participating jurisdictions. The County followed a general 10-step planning process, based on FEMA guidance and requirements (described below). This was the generalized process used in the previous plan updates as well.

Figure 1-2 Ten Steps

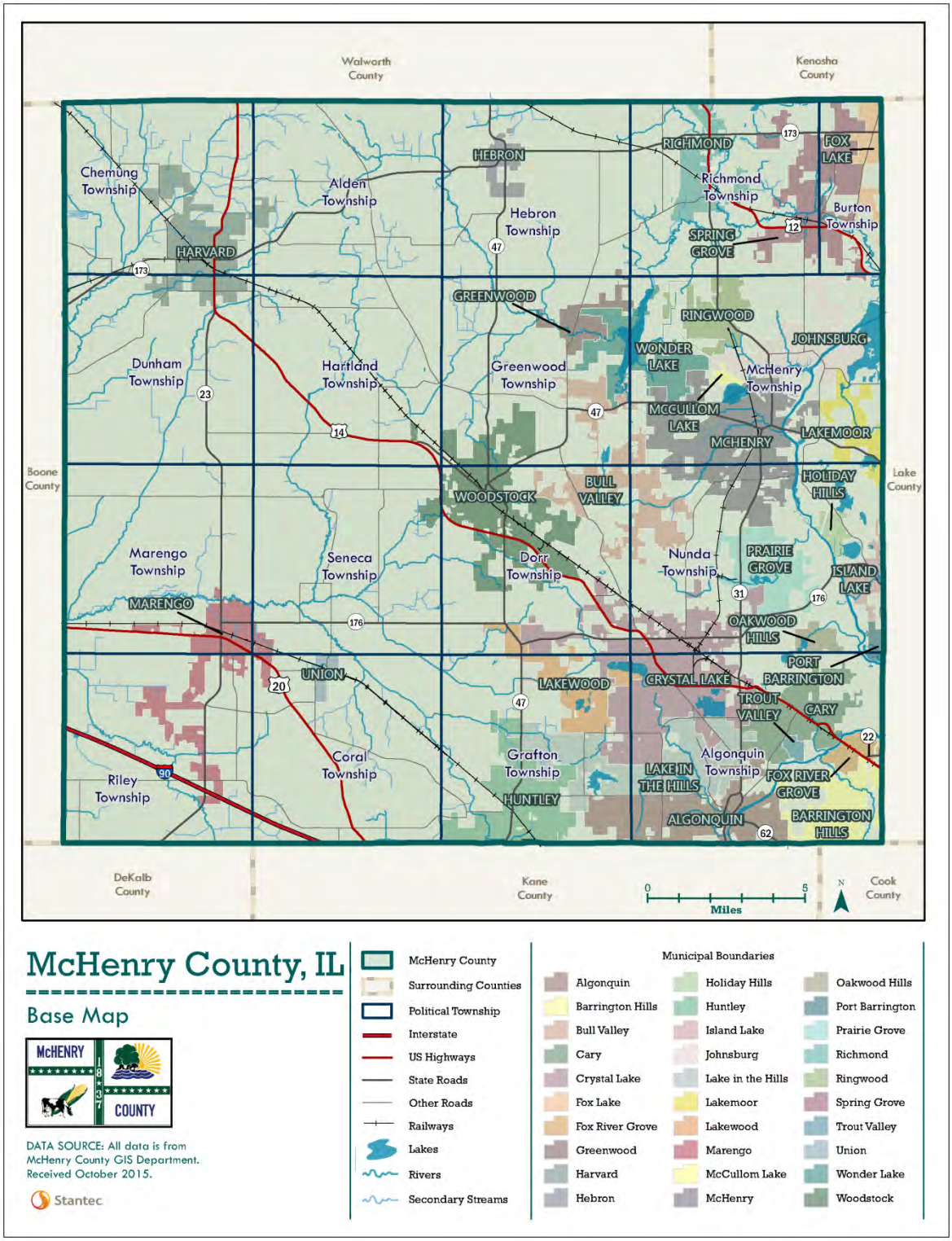
1.4.1 Participating Jurisdictions: Participating jurisdictions were part of the planning committee (described below in Table 1-2). In addition, they were asked to identify mitigation actions for their respective communities and adopt the Plan following FEMA approval.

Two communities in the county are dual plan participants, the Village of Algonquin and Village of Huntley. The Village of Island Lake is new to the 2015-2016 plan. There are no jurisdictions that participated in the 2010 update that are not participating this round. Several jurisdictions in the county are not participating in the 2016 plan update. These communities are Village of Barrington Hills, Village of Lakemoor, and Village of Port Barrington. The Village of Fox Lake is participating in Lake County's Hazard Mitigation Plan only. A list of participating jurisdictions is below. Exhibit 1-1 provides a base map of the county and its jurisdictions for reference.

Table 1-2 McHenry County Participating (and non-participating) Jurisdictions

Jurisdiction	Status	New to 2016 Plan Update	Jurisdiction	Status	New to 2016 Plan Update
Algonquin, Village of	Participating	--	Lakewood, Village of	Participating	--
Barrington Hills, Village of	Not Participating	--	Marengo, City of	Participating	--
Bull Valley, Village of	Participating	--	McCullom Lake, Village of	Participating	--
Cary, Village of	Participating	--	McHenry County	Participating	--
Crystal Lake, City of	Participating	--	McHenry, City of	Participating	--
Fox Lake, Village of	Not Participating	--	Oakwood Hills, Village of	Participating	--
Fox River Grove, Village of	Participating	--	Port Barrington, Village of	Not Participating	--
Greenwood, Village of	Participating	--	Prairie Grove, Village of	Participating	--
Harvard, City of	Participating	--	Richmond, Village of	Participating	--
Hebron, Village of	Participating	--	Ringwood, Village of	Participating	--
Holiday Hills, Village of	Participating	--	Spring Grove, Village of	Participating	--
Huntley, Village of	Participating	--	Trout Valley, Village of	Participating	--
Island Lake, Village of	Participating	X	Union, Village of	Participating	--
Johnsburg, Village of	Participating	--	Wonder Lake, Village of	Participating	--
Lake-In-The-Hills, Village of	Participating	--	Woodstock, City of	Participating	--

Exhibit 1-1 McHenry County Base Map



1.4.2 McHenry County Natural Hazards Mitigation Committee: This Plan was developed under the guidance of a McHenry County Natural Hazards Mitigation Committee (Mitigation

Committee), created by resolution of the McHenry County Board on November 18, 2008. It was reconvened for the 2016 plan update. Responsibilities of the Mitigation Committee included:

- participate in McHenry County Hazard Mitigation Plan meetings and workshops
- provide best available data as required for the risk assessment portion of the Plan
- help complete the local Community Questionnaire to determine capabilities
- provide copies of any mitigation or hazard-related documents for review and incorporation into the Plan
- support the development of the Mitigation Strategy, including the design and adoption of community goal statements
- help design and propose appropriate mitigation actions for their department/agency for incorporation into the Mitigation Action Plan
- review and provide timely comments on all study findings and draft plan deliverables
- support the adoption of the 2016 McHenry County Natural Hazards Mitigation Plan

The municipalities, townships and other agencies who participated in this Plan are presented in Table 1-3, along with the primary representative(s).

Table 1-3 2016 McHenry County Hazard Mitigation Planning Participants

Jurisdiction/ Affiliation	Representative	Department
McHenry County	Mary McCann	County Board
McHenry County	Scott Hartman, Jim Hurley, John Labaj	Administrator's Office
McHenry County	Joe Korpalski (Director), Walley Dittrich, Ed Markison	Division of Transportation
McHenry County	David Christensen (Director), Robert Ellsworth (Assistant Director), Robin Gibbs, Laris Turkic (Planner), Barry Valentine	Emergency Management
McHenry County	Nicole Gattuso (Director), Brittney Venetucci, Edward Amoo, Brian Anderson	GIS
McHenry County	Liz Hackett (MRC), Vanessa Cotton, Keri Zaleski (PIO), Nomm, Eisele, Davidson	Health
McHenry County	Dennis Sandquist (Director)	Planning & Development
McHenry County	Joanna Colletti	Stormwater
McHenry County	Ben O'Dea	Conservation
McHenry County	Duane Cedergren	Sheriff
Village of Algonquin	Ed Urban/Todd Walker (Director)/Craig Arps, Bob Mitchard (Director), Michelle Zimmerman (Assistant Director), Vince Kilcullen	Police/HR/CD/Public Works
Village of Cary	Cris Papierniak/ Chief Patrick Finlon	Public Works/Police
City of Crystal Lake	Jim Moore/Paul DeRaedt/ Victor Ramirez/ Andy Resek (Superintendent)	Fire/Fire/Engineer/ WTR & SWR
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/Al Schlick, Ken Caudle	Police/FIre
Village of Island Lake	Calvin Clay	Emergency Management
Village of Johnsburg	Kenneth Rydberg/Jerry Adams	Police/Building
Village of Lake in the Hills	Fred Mullard/Pat Boulden,	Public Works/Police
Village of Lakewood	Lawrence Howell	Police Department
Village of McCullom Lake	Biddy Boyer	Deputy Clerk
City of McHenry	Doug Martin/Ryan Schwalenberg/Rudy Horist	Admin/Construction/ Fire
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	Township	

Jurisdiction/ Affiliation	Representative	Department
Ringwood		
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/ Shawn Parker (Superintendent)	Police/PW/WTR & SWR
Private Sector	Steve Sowa	
Consultant	Stantec/Molly O'Toole	

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	Joseph Keller
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

Other Invited Participants (Neighboring Communities, Agencies Involved in hazard mitigation activities, and Agencies that Regulate Development) were also invited to participate, including neighboring counties. The County Planning and Development Department served on the planning committee (authority to regulate development). Neighboring counties were notified of the Mitigation Committee's efforts and invited to participate via a letter from McHenry County Emergency Management. A copy of the letter can found in Appendix B.

1.4.3 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 March 3, 2016 at the McHenry County Public Health Building in Crystal Lake, Illinois, to receive comments on the draft Plan.
- Documentation of public engagement efforts are provided in Appendix B and detailed in Section 1.6 below.

1.4.4 Coordination & Review of Plans, Studies, and Resources: 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 (including the McHenry County 2030 Comprehensive Plan and the Watershed Plans). 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, watershed management plans, or local emergency management plans. This Plan is intended to complement those efforts.

1.4.5 Risk Assessment (Hazard Assessment and Problem Evaluation: The Committee undertook steps 4 and 5 of the planning process from October 2015 to February 2016. Throughout the planning process, additional data was collected and incorporated into the risk assessment.

The natural hazards that could potentially impact McHenry County were reviewed by the Mitigation Committee at the October 2015 meeting. No changes were made to the hazard list but climate change was added as an overall consideration on each.

The hazard profiles, including the vulnerability assessment and hazard rankings were presented to the Mitigation Committee at the February 2016 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 –the impact of the hazard on life, health, and property.

1.4.6 Goals: Mitigation planning goals were reviewed and confirmed by the Mitigation Committee during the October 2015 meeting. No changes were made as all goals were found to be in alignment with the County's overall planning goals and needs to reduce the impacts of hazards. These are found in Chapter 3 of this Plan.

1.4.7 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. The mitigation strategies are the subject of Chapters 4 – 9 in this Plan, which were reviewed and updated as part of the 2016 plan update process. A community questionnaire was distributed to all jurisdictions to gather upcoming information. The community questionnaire can be found in Appendix B.

1.4.8 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. During the 2015-2016 plan update process, each action was reviewed to determine the status. A status for each jurisdiction was provided. In addition, each jurisdiction and township provided a status on action to reflect local risk and needs. Mitigation Committee members were encouraged to provide new jurisdiction-specific actions during the 2016 update of this Plan. 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.

1.4.9 Chapter Development and Plan Review: Draft chapters were presented to the Mitigation Committee during the March 2016 meeting (and posted on the County website) following the March 2016 meeting. The full draft was made available between XX and XX to the public. Comments from the public, communities and the Mitigation Committee were collected through this time.

1.5 Summary of Meetings

A total of four in-person meetings were held during the plan update process. Each is described briefly below. All agendas were posted online and open to the public. Complete meeting minutes can be found in Appendix XX.

Meeting 1: County Kickoff Meeting

September 3, 2015

- Plan Update Overview (DMA 2000 and CRS planning requirements)
- Purpose of the Plan
- Plan Schedule
- Next Steps (data collection, public survey publication)

Meeting 2: First Mitigation Committee

October 15, 2015

- Served as official kick-off with planning committee
- Planning Process Overview
- Mitigation Activity Ice Breaker (identify priorities)
- Roles and Responsibilities
- Next Steps

Meeting 3: Second Mitigation Committee Meeting/Mitigation Strategy Meeting

October 15, 2015

- Public Survey Results
- Risk Assessment Results
- Flood Insurance Benefits
- Mitigation Strategy Tasks (review existing actions, develop actions)

Meeting 4: Third Mitigation Committee Meeting/Action Development

March 3, 2016

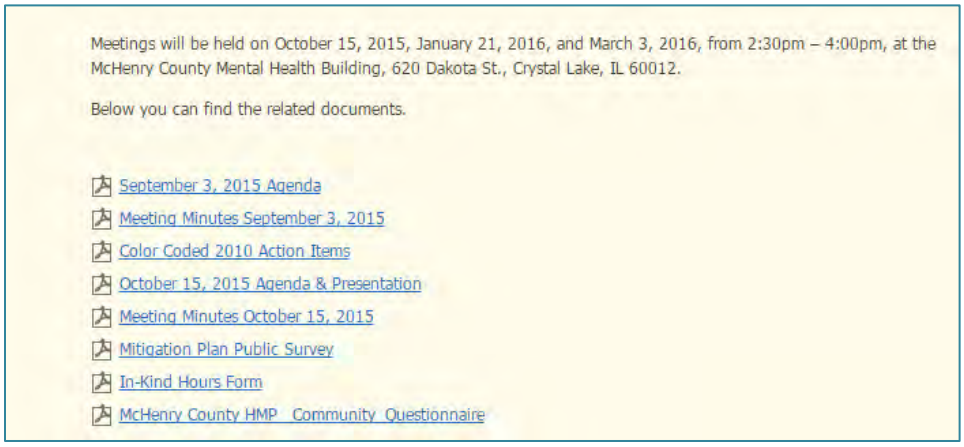
- Public meeting to inform them of the progress and upcoming draft publication
- Committee meeting to focus on review of existing and creation of new actions
- Public Survey Results
- Risk Assessment Results
- Mitigation Strategies, Capability Assessment and Draft Action Plan
- Breakout Groups

1.6 Public Participation Summary

As noted above, the public was kept informed throughout the planning process via the McHenry County website[1] (Figure 1-1), jurisdiction websites, communication through Mitigation Committee members, and press releases. All meetings were open to the public but the final meeting was advertised much more broadly to gain additional public input.

[1] https://www.co.mchenry.il.us/

Figure 1-3 McHenry County Website


Meetings will be held on October 15, 2015, January 21, 2016, and March 3, 2016, from 2:30pm – 4:00pm, at the McHenry County Mental Health Building, 620 Dakota St., Crystal Lake, IL 60012.

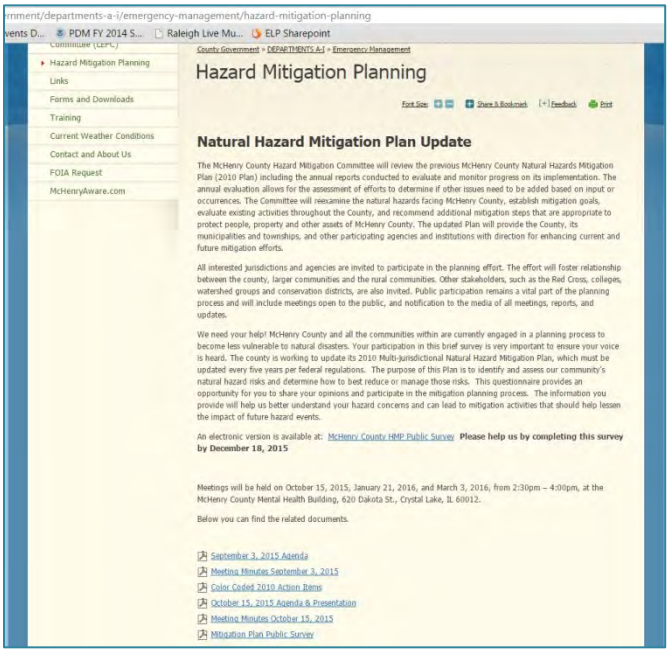
Below you can find the related documents.

- September 3, 2015 Agenda
- Meeting Minutes September 3, 2015
- Color Coded 2010 Action Items
- October 15, 2015 Agenda & Presentation
- Meeting Minutes October 15, 2015
- Mitigation Plan Public Survey
- In-Kind Hours Form
- McHenry County HMP Community Questionnaire

The most successful effort appeared to be the Public Survey which could be accessed online or in paper form at local offices. A summary of the process and results follows:

1.6.1 Public Survey: A survey was made available to try to reach a broad audience. It was active September 1, 2015 to December 18, 2015 and garnered a total of 201 responses. Copies of the Public Survey were distributed to the Mitigation Committee to be made available for residents to complete at local public offices. In addition, a link to an electronic version of the survey was also posted on McHenry County's website (Figure 1-2). Some jurisdictions also publicized the survey on their websites.

Figure 1-4 Publicized Public Survey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Committee (LEPC)

- Hazard Mitigation Planning
- Links
- Forms and Downloads
- Training
- Current Weather Conditions
- Contact and About Us
- FOIA Request
- McHenryAware.com

County Government » DEPARTMENTS A-I » Emergency Management

Hazard Mitigation Planning

Font Size Share & Bookmark [+] Feedback Print

Natural Hazard Mitigation Plan Update

The McHenry County Hazard Mitigation Committee will review the previous McHenry County Natural Hazards Mitigation Plan (2010 Plan) including the annual reports conducted to evaluate and monitor progress on its implementation. The annual evaluation allows for the assessment of efforts to determine if other issues need to be added based on input or occurrences. The Committee will reexamine the natural hazards facing McHenry County, establish mitigation goals, evaluate existing activities throughout the County, and recommend additional mitigation steps that are appropriate to protect people, property and other assets of McHenry County. The updated Plan will provide the County, its municipalities and townships, and other participating agencies and institutions with direction for enhancing current and future mitigation efforts.

All interested jurisdictions and agencies are invited to participate in the planning effort. The effort will foster relationship between the county, larger communities and the rural communities. Other stakeholders, such as the Red Cross, colleges, watershed groups and conservation districts, are also invited. Public participation remains a vital part of the planning process and will include meetings open to the public, and notification to the media of all meetings, reports, and updates.

We need your help! McHenry County and all the communities within are currently engaged in a planning process to become less vulnerable to natural disasters. Your participation in this brief survey is very important to ensure your voice is heard. The county is working to update its 2010 Multi-jurisdictional Natural Hazard Mitigation Plan, which must be updated every five years per federal regulations. The purpose of this Plan is to identify and assess our community's natural hazard risks and determine how to best reduce or manage those risks. This questionnaire provides an opportunity for you to share your opinions and participate in the mitigation planning process. The information you provide will help us better understand your hazard concerns and can lead to mitigation activities that should help lessen the impact of future hazard events.

An electronic version is available at: McHenry County HMP Public Survey **Please help us by completing this survey by December 18, 2015**

Meetings will be held on October 15, 2015, January 21, 2016, and March 3, 2016, from 2:30pm – 4:00pm, at the McHenry County Mental Health Building, 620 Dakota St., Crystal Lake, IL 60012.

Below you can find the related documents.

- September 3, 2015 Agenda
- Meeting Minutes September 3, 2015
- Color Coded 2010 Action Items
- October 15, 2015 Agenda & Presentation
- Meeting Minutes October 15, 2015
- Mitigation Plan Public Survey

The complete survey and survey responses can be found in Appendix B. Key results from the survey are as follows:

- Approximately 52 percent of survey respondents had experienced a disaster.
- Respondents ranked Tornado as the highest threat to their neighborhood (49 percent), followed by Winter Storm (11 percent) and Thunderstorm (11 percent).
- Approximately 50 percent of respondents felt somewhat prepared for natural hazards, but just 9 percent felt well prepared or very well prepared.
- 72 percent of respondents do not know what office to contact regarding learning more about hazard risks in their community.
- Over 50 percent of respondents viewed climate change as a hazard to them now or in the near future.
- A number of suggestions were provided for possible mitigation actions including upgrading the sirens near Hunt Club Hills in Cary, focusing on assisting those with disabilities during a disaster, and training.

- 1.6.2 Public Meeting: A public meeting was held on March 3, 2016 to inform the public and interested stakeholders of the update of this Plan and to collect any input.

1.7 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 DeKalb 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 1-3.

Figure 1-5 McHenry County, IL

1.7.1 Climate: For the period between 1990 and 2015, the average temperature in McHenry County has been about 21 degrees Fahrenheit in

the winter and about 71 degrees Fahrenheit in the summer.[2] The recorded lowest temperature was on January 11, 1979 in Marengo at -29 degrees. However, the winter of 2013-2014 nearly reached the 1979 records for snow and temperature.[3] The highest recorded temperature was on July 14, 1936 in Marengo at 109 degrees.

The total annual precipitation is between 35-36 inches. More than half of the county's annual precipitation usually falls in April through September.[4]

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. The 2016 Plan considers potential future climate change impacts as described further in Chapter 2.

1.7.2 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 contribute to the healthy role that agricultural activities have on 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).

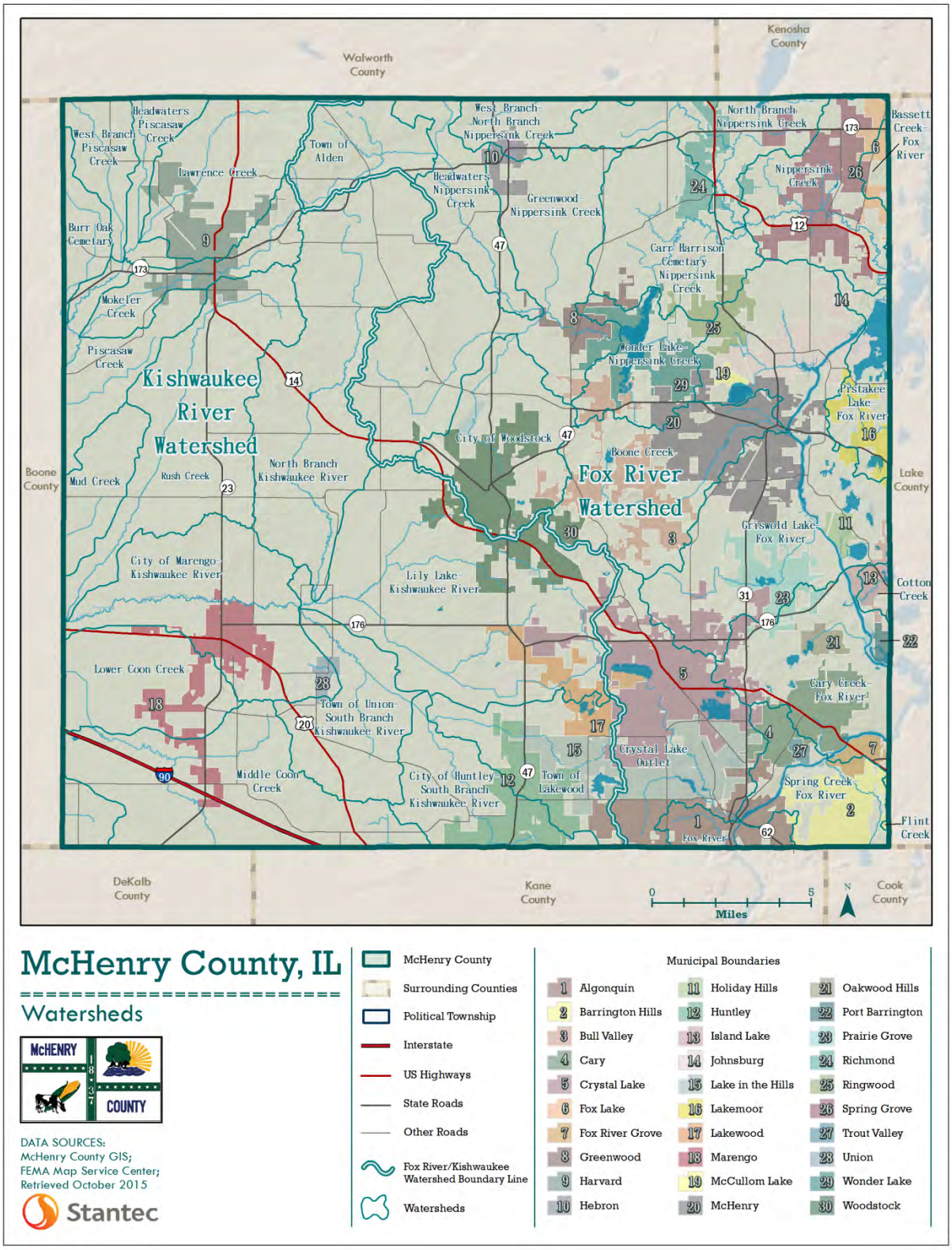
[2] The Weather Warehouse. (2016). *Weather Source API* [NWS Database]. Retrieved from http://weather-warehouse.com/WeatherHistory/PastWeatherData_MchenryStrattonLD_McHenry_IL_January.html

[3] Blais, J. (2014, March 4). "Winter at its worst." *The Marengo-Union Times.* Retrieved from http://marengo-uniontimes.com/news/1429-winter-at-its-worst

[4] McHenry County Weather. (2016). "Historical Weather." USA.com [County Database]. Retrieved from www.usa.com/mchenry-county-il-weather.htm

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 County obtains drinking water from groundwater sources.

Exhibit 1-2 McHenry County Watersheds



1.7.3 Population: In 2000, McHenry County had a population of 260,077, the sixth most populated county in Illinois. The 2010 U.S. Census indicates a population of 308,760 (15 percent increase), and the county remains the sixth most populous in the state. According to the 2010 McHenry County 2030 Comprehensive Plan, the County population is expected to increase to approximately 495,000 by 2030, an increase of nearly 38 percent between 2010 and 2030. The 2010 Census estimated that there are approximately 116,040 housing units in McHenry County, an increase of 23,132 (20 percent; approximately 2,300 new units per year) from 2000. The 2015 housing unit estimates show continued, but slower, growth at 117,351 housing units (about 250 units per year). The 2010 labor force was about 168,000 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 U.S. Census Data, is presented in Table 1-5 (townships) and Table 1-6 (municipalities), and Table 1-7. Also, information on participation in the National Flood Insurance Program (NFIP) is presented in Table 1-7 for McHenry County municipalities. Exhibit 1-3 shows the McHenry County School Districts and Exhibit 1-4 shows the McHenry County Fire Districts.

Table 1-4 2010 McHenry County Township Population Data

Township	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 1-5 McHenry County Municipal Population Data

Community	2000 Population	2010 Population	2014 Population*
Village of Algonquin (Part)	18,254	21,613	30,189
Village of Barrington Hills (Part)	1,336	1,309	3,653
Village of Bull Valley	726	1,077	1,202
Village of Cary	15,531	18,271	18,115
City of Crystal Lake	38,000	40,743	40,598
Village of Fox Lake (Part)	209	497	10,757
Village of Fox River Grove (Part)	4,689	4,367	4,749
Village of Greenwood	611	255	400
City of Harvard	244	9,447	9,829
Village of Hebron	7,996	1,216	1,094
Village of Holiday Hills	1,038	610	654
Village of Huntley (Part)	831	18,496	25,200
Village of Island Lake (Part)	4,623	4,761	8,033
Village of Johnsburg	5,022	6,337	6,322
Village of Lake in the Hills	5,391	28,965	28,926
Village of Lakemoor (Part)	23,152	2,549	6,576
Village of Lakewood	1,802	3,811	4,411
Village of McCullom Lake	2,337	1,049	1,001
City of McHenry	1,038	26,992	26,803
City of Marengo	21,501	7,648	7,451
Village of Oakwood Hills	6,355	2,083	2,079
Village of Port Barrington (Part)	2,194	923	1,503
Village of Prairie Grove	960	1,904	1,812
Village of Richmond	1,091	1,874	2,120
Village of Ringwood	471	836	752
Village of Spring Grove	3,880	5,778	5,390
Village of Trout Valley	599	537	528
Village of Union	576	580	516
Village of Wonder Lake	1,345	4,026	3,769
City of Woodstock	20,151	24,770	25,121
McHenry County Unincorporated	68,124	65,436	--
McHenry County (Total)	260,077	308,760	307,888

Source: U.S. 2010 Census and FEMA

* 2014 ACS populations for entire cities, not available for portion of cities only in McHenry County.

Table 1-6 McHenry County Municipal Data

Community	Housing Units	Median Household Income	Number of Students in School	NFIP Community Number	NFIP CRS Class
Village of Algonquin	10,878	100,534	8,954	170474	--
Village of Barrington Hills	1,583	120,192	928	170058	--
Village of Bull Valley*	524	104,417	244	170977	--
Village of Cary	6,200	104,343	5,619	170475	--
City of Crystal Lake	15,408	80,136	11,800	170476	6
Village of Fox Lake	5,468	54,013	1,905	170362	--
Village of Fox River Grove	1,644	86,364	1,448	170477	--
Village of Greenwood	136	65,000	109	170057	--
City of Harvard	3,136	42,386	2,938	170479	--
Village of Hebron	494	44,643	205	170086	--
Village of Holiday Hills	262	63,636	170	170936	--
Village of Huntley	10,883	75,792	6,162	170480	--
Village of Island Lake	3,089	64,583	2,237	170370	--
Village of Johnsburg	2,336	86,797	1,691	170486	--
Village of Lake in the Hills	10,379	83,149	9,035	170481	6
Village of Lakemoor	2,618	71,489	1,877	170915	--
Village of Lakewood	1,425	127,764	1,338	170805	--
Village of McCullom Lake	459	49,444	230	170829	--
City of McHenry	10,912	62,580	7,108	170483	--
City of Marengo	2,700	57,612	1,969	170482	--
Village of Oakwood Hills*	832	82,333	455	170831	--
Village of Port Barrington	580	105,750	436	170478	--
Village of Prairie Grove	665	108,846	600	170975	--
Village of Richmond	1,076	47,396	454	170484	--
Village of Ringwood	288	88,333	226	170060	--
Village of Spring Grove	1,871	103,423	1,670	170485	--
Village of Trout Valley*	197	136,528	144	170062	--
Village of Union	181	73,750	174	170487	--
Village of Wonder Lake	1,552	75,556	1,058	170976	--
City of Woodstock	10,308	57,583	7,208	170488	10
McHenry County	18,758	--	16,278	170732	8
McHenry County (Total)	**116,534**	**$ 76,345**	**87,462**		

*Not an NFIP community
-- Not Participating in CRS

Exhibit 1-3 McHenry County School Districts

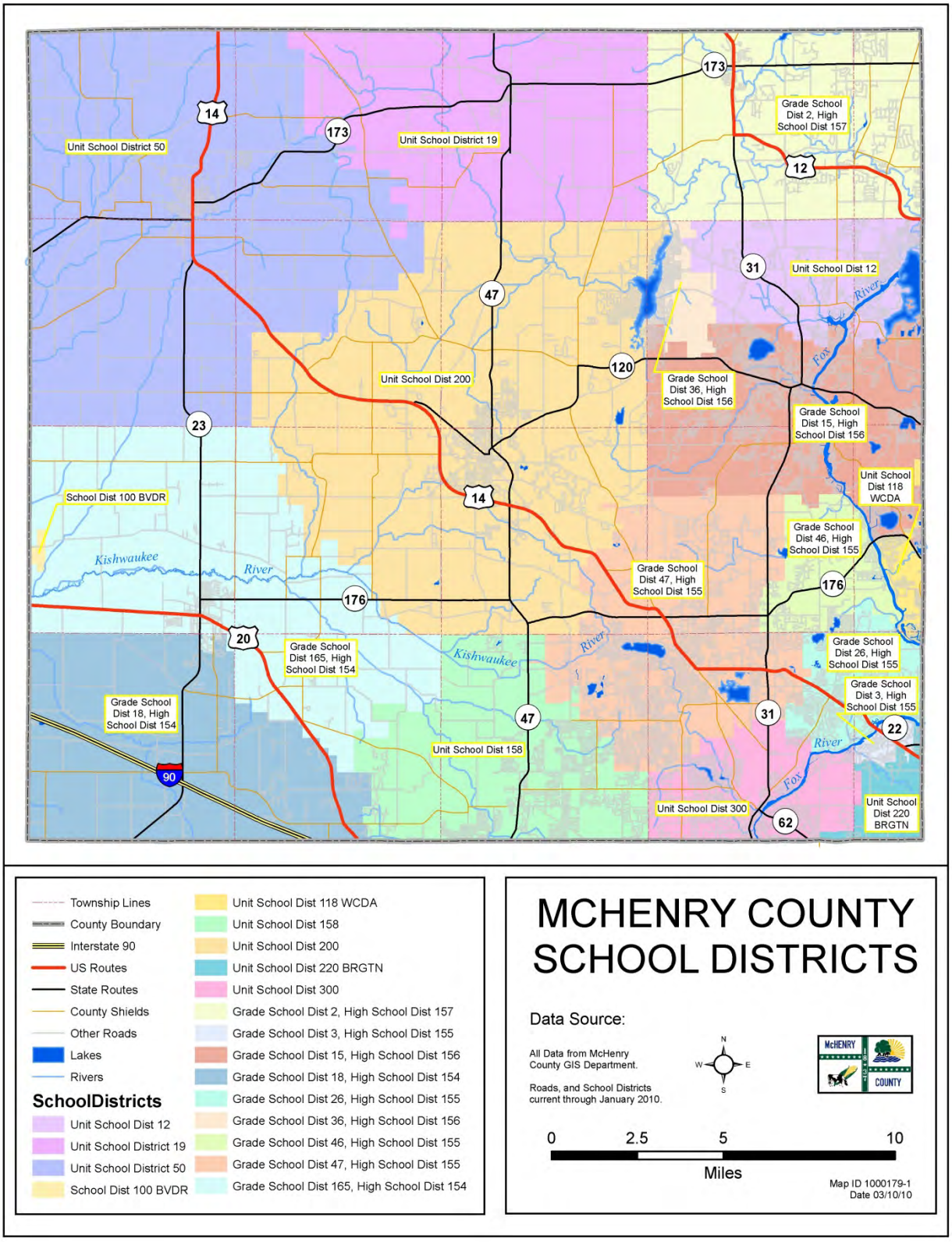
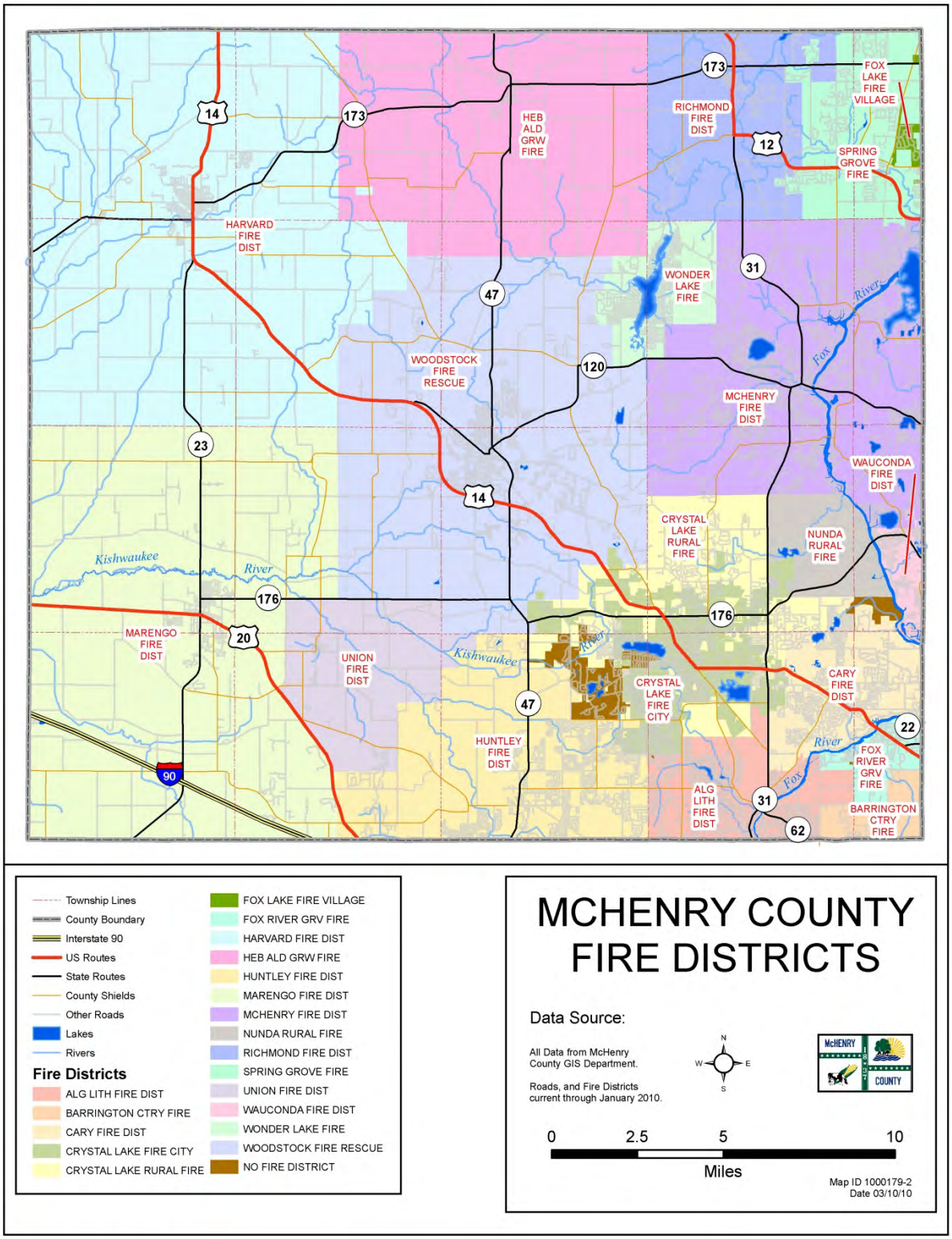


Exhibit 1-4 McHenry County Fire Districts



1.7.4 Employment: The U.S. Census estimated that 2013 workforce to be 171,500 in McHenry County. The Chicago Metropolitan Agency for Planning (CMAP) estimates that the County's manufacturing base employs an estimated 18 percent of the total workforce. Other substantial employment sectors include retail trade (13%), health care and social services (11%), education (11%), professional services (10%), leisure and accommodations (7%), construction (8%), and government (4%).

Of approximately 110 major employers in McHenry County, Centegra Hospital is the largest employer (3,650 employees), followed by the Consolidated School District 158 (1,500 employees), and McHenry County Government (1,400 employees).[5] Table 1-8 presents the major employers, by community, in McHenry County.

Table 1-8 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 Wholesale, Boulder Ridge Country Club, Lowes Home Center, A-LITH Fire Protection District, Moretti's Ristorante, Kurtz Ambulance Service, Ryco Landscaping, Chadwick Contracting, Steak-n-Shake, Woods Creek Tavern, Taco Bell, Walgreens, AMC Theaters, Transport Service Company, Riggsby Companies
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

[5] McHenry County Economic Development Center. (2016). Top 15 largest employers. Retrieved from http://www.mchenrycountyedc.com/county-profile/employers

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

1.8 McHenry County Land Use & Development

McHenry County covers 611 square miles of land area. Table 1-9 shows the estimate of existing land use in McHenry County for both incorporated and unincorporated areas. Table 1-10 shows the projected land use by 2030 (Comprehensive Land Use Plan, 2010). 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 1-9 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%

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.

Table 1-10 McHenry County Future Land Use

Future Land Use (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%

1.9 McHenry County Critical Facilities

Critical facilities are buildings and infrastructure whose exposure or damage can affect the wellbeing 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.

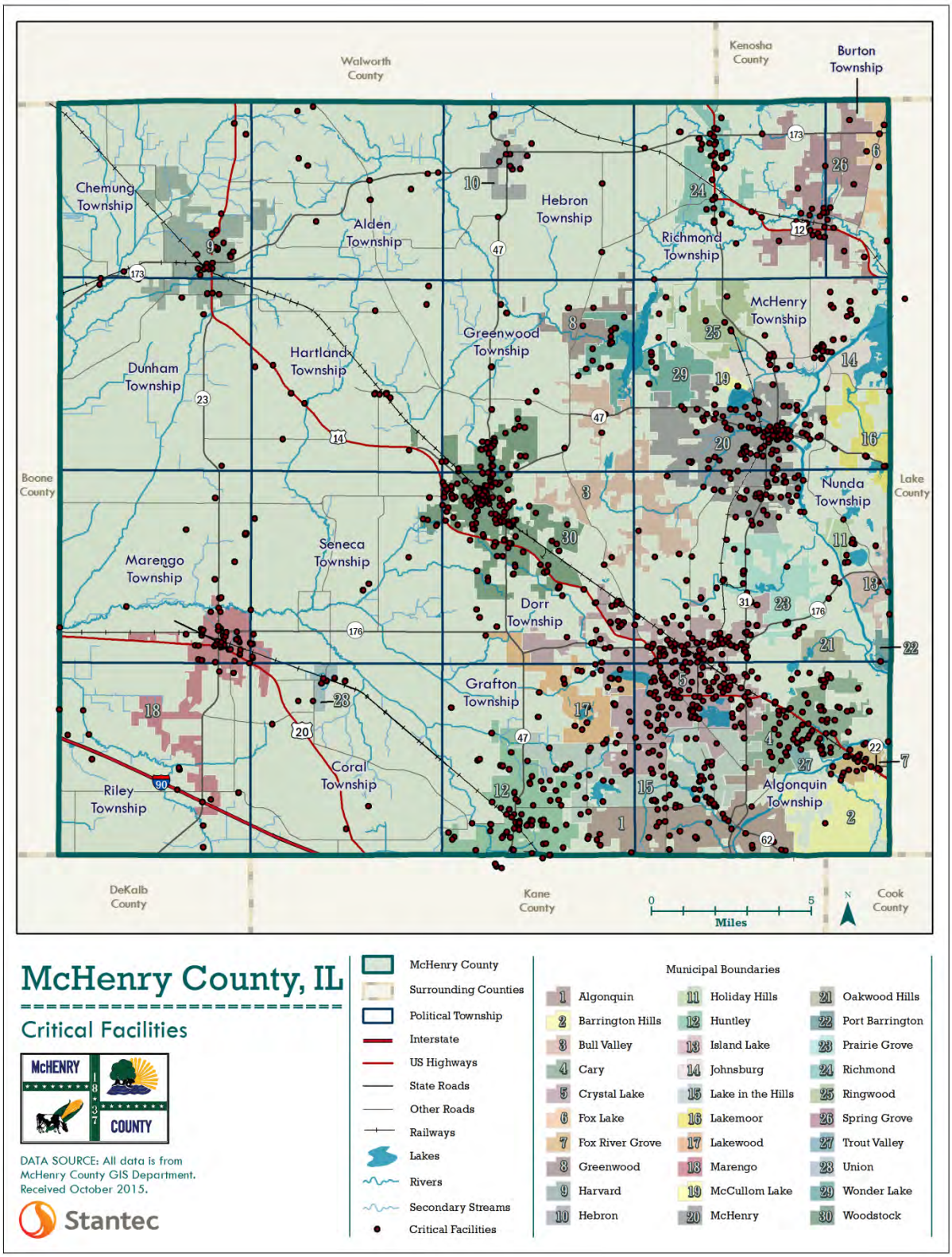
Critical facilities were identified by the County and each municipality and township participating in this Plan. McHenry County Information Management Office (GIS Department) developed a database and GIS layers for critical facilities submitted by communities and with data already available in County GIS layers. Nearly 1,500 facilities are included in the data. The facilities are categorized and tallied for the County, on Table 1-11. 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 1-11, and not all communities reported their numbers or locations. All reported critical facilities locations, as reported by communities, are included in Exhibit 1-5. In addition to this data McHenry County completed a Threat and Hazard Identification and Risk Assessment (THIRA) after the 2010 McHenry County Hazard Mitigation Plan.

Further investigation into critical facility locations, use of critical facility mapping, and protection of critical facilities is discussed in Chapter 2 of this Plan.

Table 1-11 McHenry County Summary of Critical Facilities

Critical Facility Category and Type	Total
Government	**364**
City Hall	36
Emergency Operations Center	14
Evacuation Shelter	26
Fire Station	31
Highway/Road Maintenance Center	36
Jail/Prison & Juvenile Detention Center	7
Library	13
Other	1
Police Station	29
Post Office	14
School	157
Infrastructure	**551**
Airport	3
Ambulance Service	19
Communication Tower	206
Drinking Water Facility	130
Other	5
Power Plant	20
Railway	6
Roadway	36
Wastewater Treatment Facility	126
Medical Facility	**34**
Blood Bank	2
Hospital	3
Medical Clinic	26
Other	3
Other	**200**
Agricultural Chemical Facility	5
Dam	9
Grain Elevator	10
Industrial Hazardous Substance	37
National Guard Armory	1
Petroleum Storage & Distribution	78
Social Service Agency	60
Residential	**94**
Assisted Living/Care Facility	10
Day Care Facility	50
Nursing/Retirement Home	11
Nursing/Retirement Homes & Assisted Living Facility	5
Residential Group Home	18
Gathering Place	**246**
Church	95
Civic Center	8
Other	2
Park	141
Grand Total	**1,489**

Exhibit 1-5 Locations of McHenry County Critical Facilities



1.6 References

1. "Example Plans," FEMA/Community Rating System, 2013.
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, 2015.
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, April 20, 2010.
11. McHenry County Assessor's data, 2015.
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 Natural Hazards Mitigation Committee (Mitigation Committee) and priority hazards were identified at the first Committee Meeting. Understanding that not all natural hazards require a detailed analysis, priority natural hazards were selected for analysis based on potential impacts. The risk assessment for priority hazards, such as severe storms and floods, includes a hazard analysis and vulnerability assessment. Other hazards, such as earthquakes and dam failure, include only a hazard profile in this Plan.

A "hazard profile" was updated for each hazard. The hazard profile includes a description of the nature of the hazard, past occurrences and damages, extent (or magnitude) of the hazard, 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. In addition, the 2016 update of the Plan includes climate change considerations for each hazard. The vulnerability assessment compares the probability of the hazard occurring against the possible impact to County assets (including potential dollar losses).

Following the hazard profiles, a summary of the risk assessment for McHenry County is provided. This includes the critical facilities at risk to each hazard, a table summarizing impacts and events, and hazard ranking based on the Priority Risk Index (PRI). The PRI is a tool used to measure the degree of risk for identified hazards in a particular planning area.

2.1 Natural Hazard Identification

2.1.1 Hazard Review

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. As part of the update process, the hazards from the existing plan were reviewed by the Mitigation Committee, as detailed in *Chapter 1: Introduction*. The Mitigation Committee did not include any additional hazards in the 2016 update but climate change and power outage impacts have been considered across all hazards. In addition, groundwater and water supply issues have been included with the discussion on drought. The hazards to be included in this Plan are as follows in Table 2-1.

The "priority" natural hazards listed in Table 2-1 are discussed in detail in this chapter, and mitigation activities for each hazard are identified in Chapters 4 through 9. Lightning, thunderstorms, and hail storms are combined under the category of severe summer storms; and snow events, ice storms, and extreme cold are combined under the category of severe winter storms. A summary of hazards can be found in Table 2-43 at the end of this chapter.

Table 2-1 McHenry County Identified Natural Hazards

Natural Hazard:

Priority Hazards	Drought/Groundwater
	Extreme Heat
	Floods
	Severe Winter Storms (Including Extreme Cold, Ice and Snow)
	Severe Summer Storms (Including Hail, Lightning and Thunderstorm Wind)
	Tornado
Other	Earthquake
	Dam Failure

2.1.2 Presidential Disaster Declarations

Several hazard events have resulted in damage severe enough to warrant a Presidential (federal) Disaster Declaration within the county over the past 50 years. This included flooding, tornadoes, severe summer and winter storms. Table 2-2 lists all Presidential or federal Disaster Declarations for the County since 1965. This table illustrates that most disasters have occurred in spring or winter.

Table 2-2 Federal Disaster Declarations for McHenry County (1965 – 2015)

Hazard	Description	Incident Begin Date	Declaration Date	Disaster Number
Tornado	Tornadoes, Severe Storms & Flooding	4/25/1965	4/25/1965	194
Tornado	Tornadoes	4/25/1967	4/25/1967	227
Flood	Severe Storms & Flooding	4/26/1973	4/27/1973	373
Flood	Severe Storms & Flooding	6/10/1974	6/10/1974	438
Snow	Blizzards & Snowstorms	1/16/1979	1/16/1979	3068
Flood	Severe Storms & Flooding	9/21/1986	10/7/1986	776
Flood	Severe Storms & Flooding	4/13/1993	7/9/1993	997
Snow	Winter Storm	1/1/1999	1/28/1999	3134
Snow	Illinois Winter Snow Storms	12/11/2000	1/18/2001	3161
Hurricane	Hurricane Katrina Evacuation	8/29/2005	9/7/2005	3230
Snow	Snow	11/30/2006	12/9/2006	3269
Snow	Record Snow And Near Record Snow	2/5/2008	2/5/2008	1960
Snow	Severe Winter Storm And Snowstorm	1/31/2011	3/17/2011	3283
Flood	Severe Storms, Straight-Line Winds, & Flooding	4/16/2013	5/10/2013	4116

2.2 Hazard Profiles Descriptions

As noted above, each hazard is profiled separately to describe the hazard and potential impacts to the county and jurisdictions. Where data exists, specific information on location, such as jurisdiction or unincorporated area, will also be included. The profile for each hazard includes:

- Description: A scientific explanation of the hazard including potential magnitude (or severity) and impacts;

- Location: Geographical extent of the hazard;
- Previous occurrences: The number of previous impacts from the hazard in McHenry County in the past;
- Extent (or magnitude): The severity of the hazard in the past and potential severity in the future. Measures may include wind speed, wave height, or property damage, for example;
- Probability of future events: The likelihood of future events impacting the county. Given that an exact probability is often difficult to quantify, this characteristic is categorized into ranges to be used in hazard profiles (per the PRI criteria):
    - Unlikely: Less than 1% annual probability
    - Possible: Between 1% and 10% annual probability
    - Likely: Between 10+% and 90% annual probability
    - Highly Likely: Greater than 90% annual probability
- Vulnerability Assessment: The vulnerability assessment investigates the potential number of and type of structures at risk, potential dollar loss, and potential impacts resulting from each hazard based on available data and information.
    - Impact on Health and Safety: This category relates to health and safety hazards.
    - 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 described.
    - Economic Impact: Typical impacts on businesses and utilities are described here.
    - Climate Change Considerations: A description of potential future conditions and how they may affect the hazard impacts.

2.2.1 Data Used

The risk assessment relies on a range of data sources to provide accurate hazard impact data for the county and jurisdictions within. Information and data was collected from county, municipal, regional, state, and federal agencies. In addition, anecdotal information was collected from the public via meetings and public surveys. Other data was developed from McHenry County records and the County's GIS. Of note, no building footprints were available.

An important source of information on recorded events was the National Climate Data Center (NCDC) Storm Events Database at the U.S. National Oceanic and Atmospheric Administration (NOAA).[i] The County data, including GIS data and mapping, was used for vulnerability analysis to examine McHenry County's exposure priority natural hazards.

The FEMA digital flood insurance rate map (DFIRM), which provides a (regulatory) floodplain boundary, was obtained from the FEMA Map Service Center.[ii] The McHenry County DFIRMs were effective as of November 16, 2006.

A reference list can also be found in at the end of this chapter in the References subsection.

2.3 McHenry County Assets and Property Value

2.3.1 Assets

McHenry County's assets include people, buildings, infrastructure, businesses and institutions, the land, and natural resources. Assets are summarized in Table 2-3 for purposes of evaluating potential hazards against the possible damage or loss of assets.

Table 2-3 McHenry County Assets

Assets	Numbers
People:	
Total Population*	308,760
Workforce*	167,924
Students (Elem., H.S., University)*	76,811
Buildings:	
Residential Buildings**	108,919
Non-Government, Non-Residential**	7,199
Schools (Pre-K-12)***	115
Government Owned***	201
Transportation:* **	
Bridges	218
Airports	3
Rail Stations	7
Resources:* **	
Conservation Stewardship	412 acres
State Parks	3
Community Parks	284
Golf Courses	20
Agricultural	230 sq. miles

* 2010 Census
** McHenry Township Assessor – 2014 Parcel Data
*** Other County or Municipal or Township Sources

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. While these groups are described below, for purposes of this Plan's vulnerability analysis, calculation will focus on McHenry County residents.

Total Population: According to the 2010 U.S Census, the total McHenry County population was 308,760. A list of populations by municipality is provided in Table 2-4 and by township in Table 2-5.[iii] These tables include populations for McHenry County only. Several municipalities cross county borders, and residents in those communities outside of the County are not included in the tables below.

It is worth noting the average density of people in the State of Illinois is 222 persons per square mile. McHenry County is approximately 611 square miles, making the average density in the County around 505 persons per square mile as of 2010 (an increase from 426 persons per square mile in 2000). This figure was relatively the same as of the 2013 American Community Survey (ACS).

Table 2-4 Total Population by Municipalities (2010 US Census)

Municipality	Total Population	Municipality	Total Population
Algonquin (Part)	21,613	Lakemoor (Part)	2,549
Barrington Hills (Part)	1,309	Lakewood	3,811
Bull Valley	1,077	McCullom Lake	1,049
Cary	18,271	McHenry	26,992
Crystal Lake	40,743	Marengo	7,648
Fox Lake (Part)	497	Oakwood Hills	2,083
Fox River Grove (Part)	4,367	Port Barrington (Part)	923
Greenwood	255	Prairie Grove	1,904

Municipality	Total Population	Municipality	Total Population
Harvard	9,447	Richmond	1,874
Hebron	1,216	Ringwood	836
Holiday Hills	610	Spring Grove	5,778
Huntley (Part)	18,496	Trout Valley	537
Island Lake (Part)	4,761	Union	580
Johnsburg	6,337	Wonder Lake	4,026
Lake In The Hills	28,965	Woodstock	24,770
Unincorporated McHenry County	65,436		
TOTAL			**308,760**

Table 2-5 Total Population by Township (2010 US Census)

Township	Total Population	Township	Total Population
Alden Township	1,402	Hartland Township	2,031
Algonquin Township	88,389	Hebron Township	2,356
Burton Township	5,003	Marengo Township	7,564
Chemung Township	9,134	McHenry Township	47,653
Coral Township	3,552	Nunda Township	38,245
Dorr Township	20,911	Richmond Township	6,683
Dunham Township	2,844	Riley Township	2,922
Grafton Township	53,137	Seneca Township	2,944
Greenwood Township	13,990		
TOTAL			**308,760**

Work Force: Nearly half (46.1 percent) of the McHenry County work force commutes outside the County for employment. According to 2010 Census data, a majority of McHenry County workers travel less than 30 minutes to reach their place of employment. However, it is notable that nearly 50,000 workers have a travel time of more than 45 minutes. Chicago, the northwestern suburbs, and Rockford provide more employment opportunities than those available in McHenry County. The Jane Addams Memorial Tollway (I-90), US Route 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. (Refer to Chapter 1, Exhibit 1-1 Base Map.) Commuter rail and bus service is also available.

Land Parcels and Buildings: The estimate of McHenry County 2014 Tax Parcels is summarized in Table 2-6, Table 2-7, and Table 2-8. The 2014 data is reflective of any new development from the previous plan update. This information is based on data from the McHenry Tax Assessor, and data collected from McHenry County municipalities and townships. Improved parcels were used to estimate the number of buildings, as no building footprints are available for the county. It should be noted that the provided parcel data did not separate land and building value. Thus, values are likely an overestimate of risk as it pertains to building value. To address this, risk is often addressed using additional methods, providing a range of risk. Further, the analysis is sufficient in identifying areas of high risk and vulnerability throughout the county. This information was used throughout the risk assessment (where data permitted analysis) to estimate potential dollar loss and vulnerability.

Using the McHenry County Tax Assessor data, improved parcels were calculated by removing all known vacant lots from the data. However, the value of the improved parcels includes both the assessed building value and land value of those parcels. It should also be noted, some improved parcel tax codes may include parcels that are not necessarily improved. For example, the tax code for 0070-Commercial Improvements could consist of parcels with land use descriptions of either "Office W/Bldg" or "Office Unimproved." Further, parcel improvements were used to estimate the value of property at risk within the county.

Table 2-9 and Table 2-10 provide a breakdown of parcel by type (residential[1], commercial, industrial, and government-owned/tax-exempt) for incorporated, participating municipalities and townships, respectively.

The overall value of land and buildings (improved and unimproved parcels) is approximately $7.6 billion. Of this, $7.4 billion (98%) represents the improved parcels.

Table 2-6 McHenry County Improved Parcel Summary

Parcel Type	Total Improved Parcels	Total Improved Parcel Value (estimated value at risk)	Average Value of Improved Parcels
Residential*	108,403	$ 6,312,718,567	$58,233
Commercial	5,989	$827,824,466	$138,224
Industrial	1,726	$281,122,391	$162,875
Total:	**116,118**	**$7,421,665,424**	**$63,915**

*Improved parcel data includes building and land values; data also includes farm homesite dwellings

Table 2-7 Distribution of Parcels by Jurisdiction

Jurisdictions	Total Parcels	Total Improved Parcels	Total Value of Improved Parcels
Algonquin	8,691	8,073	$615,936,017
Barrington Hills	663	518	$102,523,129
Bull Valley	727	473	$54,176,475
Cary	6,904	6,688	$426,201,183
Crystal Lake	16,262	15,261	$1,028,401,241
Fox Lake	401	178	$14,612,069
Fox River Grove	1,986	1,839	$103,163,986
Greenwood	244	172	$7,101,162
Harvard	3,979	2,964	$108,385,932
Hebron	866	596	$23,099,037
Holiday Hills	650	318	$11,063,131
Huntley	8,370	7,279	$502,200,037
Island Lake	2,322	1,974	$82,446,412
Johnsburg	3,541	2,586	$181,902,959
Lake In The Hills	10,927	10,404	$613,897,616
Lakemoor	2,092	1,174	$50,182,904
Lakewood	2,056	1,467	$157,841,393

[1] Residential counts include farm residences.

Jurisdictions	Total Parcels	Total Improved Parcels	Total Value of Improved Parcels
Marengo	3,265	2,702	$115,466,734
McCullom Lake	647	482	$11,898,749
McHenry	11,940	10,630	$594,842,541
McHenry Unincorporated	42,196	28,563	$1,667,197,635
Oakwood Hills	1,157	846	$50,080,985
Port Barrington	633	438	$24,430,524
Prairie Grove	1,014	831	$80,565,998
Richmond	1,183	960	$47,277,151
Ringwood	637	376	$29,049,848
Spring Grove	2,659	2,076	$162,344,228
Trout Valley	237	194	$19,351,881
Union	399	301	$15,400,309
Wonder Lake	2,596	1,666	$71,759,124
Woodstock	9,923	8,552	$449,799,174
Grand Total	**149,167**	**120,581**	**$7,422,599,564**

Table 2-8 Distribution of Parcels by Township

Township	Total Parcels	Total Improved Parcels	Total Value of Improved Parcels
Alden	1,519	728	$43,629,443
Algonquin	37,364	34,715	$2,277,207,148
Burton	3,211	2,122	$120,688,817
Chemung	4,048	2,962	$105,774,175
Coral	2,678	1,606	$115,321,639
Dorr	9,565	7,725	$465,285,148
Dunham	1,746	1,131	$57,434,985
Grafton	21,627	18,774	$1,367,319,679
Greenwood	6,506	5,035	$237,838,357
Hartland	1,479	953	$65,699,876
Hebron	1,850	1,115	$51,748,532
Marengo	3,619	2,871	$120,473,956
McHenry	25,134	19,522	$1,015,600,059
Nunda	20,985	15,972	$1,029,139,549
Richmond	4,142	3,041	$193,807,248
Riley	1,850	1,099	$69,106,947
Seneca	1,844	1,210	$86,524,006

Table 2-9 Improved Parcel Data by Jurisdiction

Jurisdiction and Parcel Type	Total Parcels	Total Improved Parcels	Assessed Value of Improved Parcels
Algonquin			
Residential	7,992	7,434	$504,495,952
Commercial	405	395	$105,858,107
Industrial	38	38	$5,581,958
Government-Owned/Tax-Exempt	-	12/194	$0

Jurisdiction and Parcel Type	Total Parcels	Total Improved Parcels	Assessed Value of Improved Parcels
Barrington Hills			
Residential	620	501	$99,688,167
Commercial	-	-	$0
Industrial	1	1	$22,369
Government-Owned/Tax-Exempt	-	0/2	-
Bull Valley			
Residential	534	395	$47,576,513
Commercial	8	8	$368,301
Industrial	-	-	$0
Government-Owned/Tax-Exempt	-	1/17	-
Cary			
Residential	6,286	6,092	$363,990,690
Commercial	201	196	$28,575,176
Industrial	178	178	$33,277,815
Government-Owned/Tax-Exempt	-	15/205	-
Crystal Lake			
Residential	14,285	13,434	$754,683,729
Commercial	1,096	1,086	$215,942,985
Industrial	325	318	$56,399,446
Government-Owned/Tax-Exempt	-	30/377	-
Fox Lake			
Residential	218	153	$12,341,251
Commercial	11	11	$1,638,845
Industrial	2	2	$328,438
Government-Owned/Tax-Exempt	-	0/6	-
Fox River Grove			
Residential	1,710	1,571	$88,197,358
Commercial	205	205	$14,571,445
Industrial	7	7	$395,183
Government-Owned/Tax-Exempt	-	6/50	-
Greenwood			
Residential	127	90	$5,233,893
Commercial	5	5	$371,146
Industrial	-	-	$0
Government-Owned/Tax-Exempt	-	1/55	-
Harvard			
Residential	3,264	2,419	$71,761,234
Commercial	367	346	$27,477,533
Industrial	65	65	$8,694,143
Government-Owned/Tax-Exempt	-	12/106	-
Hebron			
Residential	682	448	$16,422,077
Commercial	83	83	$3,835,996
Industrial	34	30	$2,754,084

Jurisdiction and Parcel Type	Total Parcels	Total Improved Parcels	Assessed Value of Improved Parcels
Government-Owned/Tax-Exempt	-	4/28	-
Holiday Hills			
Residential	602	278	$10,935,228
Commercial	3	3	$99,058
Industrial	-	-	$0
Government-Owned/Tax-Exempt	-	1/35	-
Huntley			
Residential	7,793	6,859	$453,513,542
Commercial	190	181	$26,694,564
Industrial	151	134	$20,848,455
Government-Owned/Tax-Exempt	-	9/83	-
Island Lake			
Residential	2,203	1,861	$77,117,235
Commercial	40	40	$5,172,051
Industrial	1	1	$157,126
Government-Owned/Tax-Exempt	-	0/72	-
Johnsburg			
Residential	3,236	2,366	$159,130,177
Commercial	133	127	$21,430,301
Industrial	2	2	$436,869
Government-Owned/Tax-Exempt	-	11/66	$9
Lake In The Hills			
Residential	10,291	9,833	$554,947,907
Commercial	245	236	$43,067,378
Industrial	103	103	$15,653,210
Government-Owned/Tax-Exempt	-	8/222	-
Lakemoor			
Residential	1,832	937	$44,016,493
Commercial	82	82	$2,028,035
Industrial	71	71	$3,697,861
Government-Owned/Tax-Exempt	-	2/80	-
Lakewood			
Residential	1,947	1,392	$152,107,325
Commercial	25	25	$5,010,511
Industrial	2	2	$158,534
Government-Owned/Tax-Exempt	-	2/38	-
Marengo			
Residential	2,748	2,303	$92,034,619
Commercial	231	231	$16,672,954
Industrial	47	36	$4,468,972
Government-Owned/Tax-Exempt	-	8/97	$56,377
McCullom Lake			
Residential	610	446	$10,454,729
Commercial	16	16	$1,364,501

Jurisdiction and Parcel Type	Total Parcels	Total Improved Parcels	Assessed Value of Improved Parcels
Industrial	-	-	$0
Government-Owned/Tax-Exempt	-	1/18	-
McHenry			
Residential	10,264	9,199	$420,683,626
Commercial	993	923	$132,818,594
Industrial	179	169	$40,744,296
Government-Owned/Tax-Exempt	-	22/306	$377
McHenry Unincorporated			
Residential	31,516	23,150	$1,407,660,227
Commercial	707	707	$48,468,422
Industrial	215	208	$24,739,824
Government-Owned/Tax-Exempt	-	30/1702	$266,530
Oakwood Hills			
Residential	1,130	822	$49,285,677
Commercial	7	6	$795,308
Industrial	-	-	-
Government-Owned/Tax-Exempt	-	1/17	-
Port Barrington			
Residential	608	416	$24,211,994
Commercial	2	2	$218,530
Industrial	-	-	-
Government-Owned/Tax-Exempt	-	1/17	-
Prairie Grove			
Residential	802	677	$66,436,238
Commercial	100	100	$7,955,122
Industrial	7	7	$4,784,300
Government-Owned/Tax-Exempt	-	3/20	$601
Richmond			
Residential	848	684	$26,494,880
Commercial	175	175	$13,533,933
Industrial	41	41	$6,912,853
Government-Owned/Tax-Exempt	-	6/48	$24,956
Ringwood			
Residential	400	270	$20,067,218
Commercial	64	52	$4,783,606
Industrial	18	18	$3,516,787
Government-Owned/Tax-Exempt	-	2/20	$1
Spring Grove			
Residential	2,341	1,848	$139,462,956
Commercial	71	71	$8,550,254
Industrial	77	77	$12,730,151
Government-Owned/Tax-Exempt	-	4/53	-
Trout Valley			
Residential	234	191	$19,262,034

Jurisdiction and Parcel Type	Total Parcels	Total Improved Parcels	Assessed Value of Improved Parcels
Commercial	2	2	$89,847
Industrial	-	-	$0
Government-Owned/Tax-Exempt	-	0/1	$0
Union			
Residential	301	222	$8,807,725
Commercial	21	21	$1,489,268
Industrial	31	31	$5,059,475
Government-Owned/Tax-Exempt	-	2/23	$7,337
Wonder Lake			
Residential	2,502	1,628	$70,792,776
Commercial	16	16	$504,717
Industrial	-	-	$0
Government-Owned/Tax-Exempt	-	1/13	$0
Woodstock			
Residential	8,638	7,461	$328,720,139
Commercial	655	638	$88,437,978
Industrial	206	187	$29,760,242
Government-Owned/Tax-Exempt	-	31/227	$230,148

Table 2-10 Improved Parcel Distribution by Township

Jurisdiction and Parcel Type	Total Parcels	Total Improved Parcels	Assessed Value of Improved Parcels
Alden			
Residential	1,090	656	$42,369,676
Commercial	25	25	$1,259,767
Industrial	-	-	$0
Government-Owned/Tax-Exempt	-	2/45	$0
Algonquin			
Residential	33,944	31,533	$1,835,791,959
Commercial	1,641	1,619	$340,322,423
Industrial	592	592	$101,092,132
Government-Owned/Tax-Exempt	-	56/915	$634
Burton			
Residential	2,607	1,750	$114,796,202
Commercial	45	45	$4,017,517
Industrial	10	10	$1,866,760
Government-Owned/Tax-Exempt	-	2/307	$0
Chemung			
Residential	3,066	2,513	$83,337,948
Commercial	268	258	$16,686,786
Industrial	62	62	$5,747,839
Government-Owned/Tax-Exempt	-	11/118	$1,602
Coral			
Residential	1,885	1,362	$101,397,536

Jurisdiction and Parcel Type	Total Parcels	Total Improved Parcels	Assessed Value of Improved Parcels
Commercial	87	76	$7,423,906
Industrial	46	44	$6,460,400
Government-Owned/Tax-Exempt	-	3/121	$39,797
Dorr			
Residential	7,866	6,573	$344,906,030
Commercial	674	663	$88,909,175
Industrial	197	189	$31,238,620
Government-Owned/Tax-Exempt	-	27/273	$231,323
Dunham			
Residential	1,086	933	$40,002,653
Commercial	129	129	$14,396,286
Industrial	8	8	$3,035,627
Government-Owned/Tax-Exempt	-	1/60	$419
Grafton			
Residential	20,484	18,023	$1,295,644,426
Commercial	277	259	$50,336,805
Industrial	167	150	$21,338,448
Government-Owned/Tax-Exempt	-	21/231	$0
Greenwood			
Residential	5,823	4,777	$227,808,991
Commercial	63	63	$8,764,040
Industrial	13	13	$1,133,869
Government-Owned/Tax-Exempt	-	11/171	$131,457
Hartland			
Residential	898	792	$57,857,855
Commercial	21	21	$2,053,504
Industrial	86	68	$5,788,517
Government-Owned/Tax-Exempt	-	3/69	$0
Hebron			
Residential	1,164	894	$44,431,561
Commercial	87	87	$3,866,127
Industrial	38	34	$3,440,071
Government-Owned/Tax-Exempt	-	5/85	$123
Marengo			
Residential	2,705	2,366	$100,027,147
Commercial	257	257	$15,133,976
Industrial	58	55	$5,190,991
Government-Owned/Tax-Exempt	-	9/184	$121,842
McHenry			
Residential	22,758	17,789	$863,721,072
Commercial	1,187	1,156	$142,490,194
Industrial	57	57	$9,388,214
Government-Owned/Tax-Exempt	-	39/480	$540

Jurisdiction and Parcel Type	Total Parcels	Total Improved Parcels	Assessed Value of Improved Parcels
Nunda			
Residential	18,400	13,872	$858,952,115
Commercial	1,094	1,039	$106,926,704
Industrial	334	317	$62,952,762
Government-Owned/Tax-Exempt		21/723	$307,968
Richmond			
Residential	3,164	2,391	$150,588,467
Commercial	253	253	$22,262,515
Industrial	120	120	$20,908,888
Government-Owned/Tax-Exempt	-	10/249	$24,956
Riley			
Residential	1,370	1,047	$67,285,846
Commercial	11	11	$1,150,373
Industrial	1	1	$670,068
Government-Owned/Tax-Exempt	-	2/38	$660
Seneca			
Residential	1,277	1,132	$83,799,083
Commercial	28	28	$1,824,368
Industrial	12	6	$869,185
Government-Owned/Tax-Exempt	-	3/41	$31,370

Residential/Housing Units: The McHenry County Tax Assessor information provided a current count of residential buildings. The current residential building count of 108,403 will be used in the estimation of assets for the vulnerability assessment. In addition, the residential counts above include farm residences.

Housing Density: The average density of housing in McHenry County is approximately 207 housing units per square mile using the 2010 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, but generally decreases from east to west as the western portion of the county is more rural and agricultural in nature. Table 2-11 provides housing density by township.

Table 2-11 McHenry County Housing Density by Township – Ranked

Township	Residential Buildings	Approximate Township Area	Housing Density	Ranking
Algonquin	31,533	48	657	1
Grafton	18,023	36	501	2
McHenry	17,789	48	371	3
Nunda	13,872	48	289	4
Burton	6,573	11	183	5
Dorr	1,750	36	159	6
Greenwood	4,777	36	133	7
Richmond	2,513	33	76	8
Chemung	2,391	33	72	9
Marengo	2,366	36	66	10

Township	Residential Buildings	Approximate Township Area	Housing Density	Ranking
Coral	1,362	36	38	11
Riley	1,132	36	31	12
Hebron	1,047	33	29	13
Seneca	894	36	27	14
Dunham	933	36	26	15
Alden	792	33	22	16
Hartland	656	36	20	17
Totals	**108,403**	**611**	**177**	

Non-residential, or Non-housing Buildings: As shown in Table 2-3 McHenry County Assets are nearly 8,000 non-residential buildings in McHenry County (businesses, hospitals, churches, schools, etc.).

Government-Owned Buildings: Government-owned buildings included in Table 2-3 McHenry County Assets provide an estimate made for the purposes of this Plan for the participating communities. It includes government-owned buildings as a subset of critical facilities (presented below).

Manufactured Housing (Mobile Homes): The total number of manufactured homes/communities in McHenry County was not available. However, there are four manufactured home sites located in the county: Indian Trails in Marengo, Royal Oaks and Oak Brook in Crystal Lake, and Harbor Lites in McHenry. Additionally, communities like Fox River Grove and Huntley have ordinances in place that address manufactured (mobile) home safety and protection. These homes are particularly vulnerable to damage from wind-related hazards. According to the American Community Survey provided by the U.S. Census, there is an estimated 581 manufactured structures with a median value of approximately $45,200 (2013 ACS) within the county. Several jurisdictions in the county, including Algonquin, Bull Valley, Spring Grove, Wonder Lake, and Woodstock have building codes that do not allow manufactured and/or mobile homes.

Critical Facilities: Critical facilities are buildings and infrastructure whose exposure or damage can affect the wellbeing 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:

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

Critical facilities are not strictly defined by any agency. For this mitigation planning effort, the critical facilities were provided by the county and include several categories including County, municipal and township facilities, police and fire stations, public, educational/school facilities,

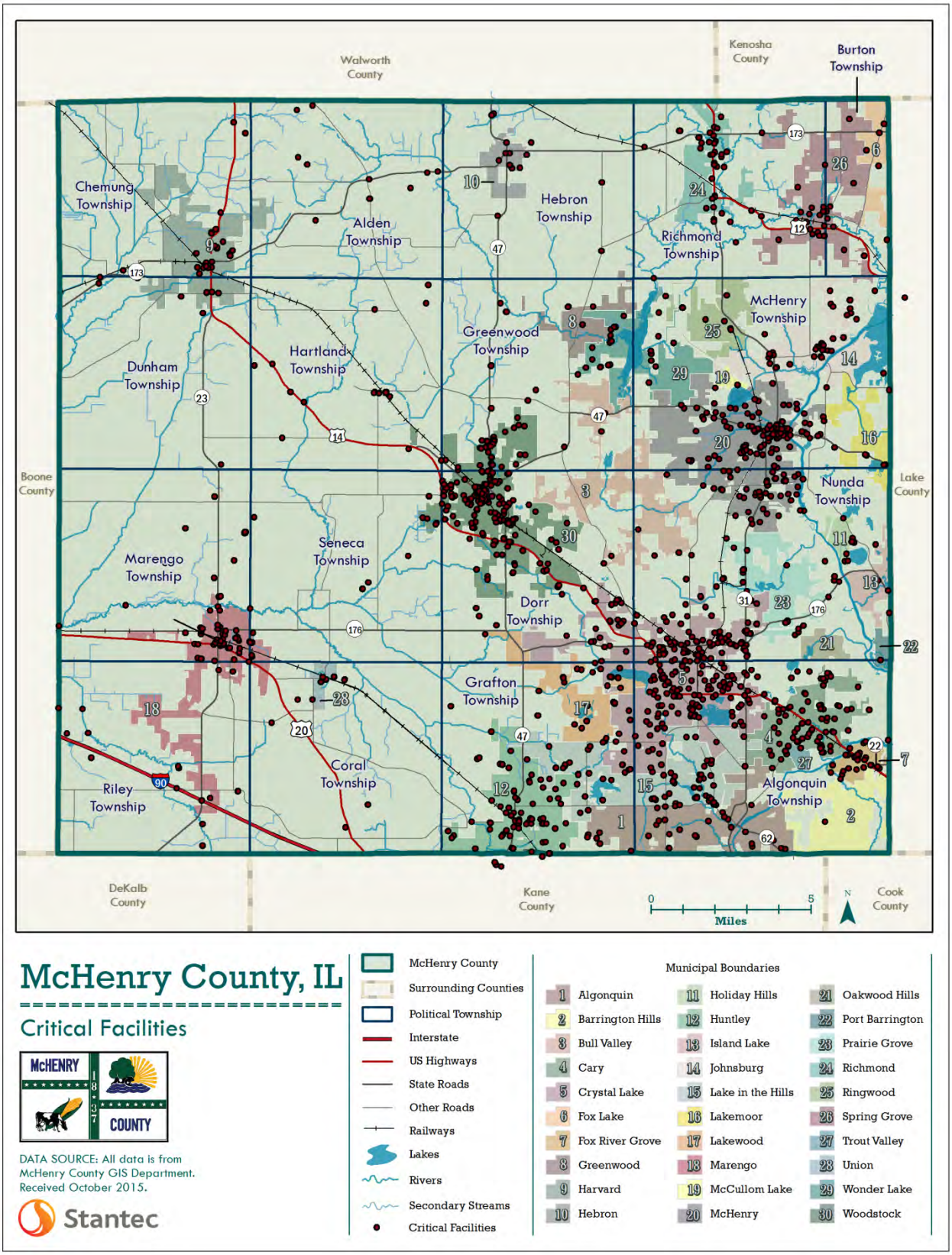
places of assembly, medical and health care, facilities for special needs populations, transportation, and infrastructure.

During the 2010 planning effort, critical facility information was provided by each participating municipality and township. However, for the 2016 plan update, 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. Nearly 1,500 facilities are included in the data. The facilities are categorized and tallied for the County, in Table 2-12. Exhibit 2-1 shows the location/distribution of all identified critical facilities reported by communities.

Table 2-12 McHenry County Summary of Critical Facilities

Critical Facility Category and Type	Total
Government	**364**
City Hall	36
Emergency Operations Center	14
Evacuation Shelter	26
Fire Station	31
Highway/Road Maintenance Center	36
Jail/Prison & Juvenile Detention Center	7
Library	13
Other	1
Police Station	29
Post Office	14
School	157
Infrastructure	**551**
Airport	3
Ambulance Service	19
Communication Tower	206
Drinking Water Facility	130
Other	5
Power Plant	20
Railway	6
Roadway	36
Wastewater Treatment Facility	126
Medical Facility	**34**
Blood Bank	2
Hospital	3
Medical Clinic	26
Other	3
Other	**200**
Agricultural Chemical Facility	5
Dam	9
Grain Elevator	10
Industrial Hazardous Substance	37
National Guard Armory	1
Petroleum Storage & Distribution	78
Social Service Agency	60
Residential	**94**
Assisted Living/Care Facility	10
Day Care Facility	50
Nursing/Retirement Home	11
Nursing/Retirement Homes & Assisted Living Facility	5
Residential Group Home	18
Gathering Place	**246**
Church	95
Civic Center	8
Other	2
Park	141
Grand Total	**1,489**

Exhibit 2-1 McHenry County Critical Facilities Locations



2.4 Flood

2.4.1 Flood Hazard Description

Flooding is a very frequent, dangerous and costly hazard. Globally, it accounts for 40 percent of all natural disasters and results in an average of over 6,500 deaths annually. In the U.S., flooding results in an average of 89 deaths annually. Nearly 90 percent of all presidential disaster declarations result from natural events where flooding was a major component. There are several types of flooding, which are presented below.

Figure 2-1 Flood Warnings

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 fllowing 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.

Flash Flooding: Flash floods occur within a few minutes or hours of heavy amounts of rainfall and can destroy buildings, uproot trees, and scour out new drainage channels. Heavy rains that produce flash floods can also trigger mudslides and landslides. Most flash flooding is caused by slow-moving thunderstorms or repeated thunderstorms in a local area, or by heavy rains from hurricanes and tropical storms (not applicable in McHenry County). Although flash flooding often occurs in mountainous areas, it is also common in urban centers where much of the ground is covered by impervious surfaces.

Sheet Flooding: Sheet flooding is a condition where storm water runoff forms a sheet of water to a depth of six inches or more. Sheet flooding and ponding are often found in areas where there are no clearly defined channels and the path of flooding is unpredictable. It is also more common in flat areas. Most floodplains are adjacent to streams or oceans; although, almost any area can flood under the right conditions where water may accumulate.

Urban Flooding: Urban flooding is usually caused by heavy rain over a short period of time. As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Since sidewalks and roads are non-absorbent, rivers of water flow down streets and into sewers. Roads and buildings generate more runoff than forestland. Fixed drainage channels in urban areas may be unable to contain the runoff that is generated by relatively small, but intense, rainfall events. Urbanization increases runoff two to six times over what would occur on natural terrain. This high volume of water can turn parking lots into lakes, flood basements and businesses, and cause lakes to form in roads where drainage is poor or overwhelmed.

Urban flooding, which can include flash flooding and sheet flooding, can also occur where there has been development within stream floodplains. This is partly a result of the use of waterways for transportation purposes in earlier times. Sites adjacent to rivers and coastal inlets provided convenient places to ship and receive commodities. The price of this accessibility has increased flooding in the ensuing urban areas. Urbanization intensifies the magnitude and frequency of

floods by increasing impermeable surfaces, amplifying the speed of drainage collection, reducing the carrying capacity of the land and, occasionally, overwhelming sewer systems.

Riverine Flooding: Periodic flooding of lands adjacent to non-tidal rivers and streams (known as the floodplain) is a natural and inevitable occurrence. When stream flow exceeds the capacity of the normal watercourse, some of the above-normal stream flows onto adjacent lands within the floodplain. Riverine flooding is a function of precipitation levels and water runoff volumes within the watershed of a stream or river. According to USGS, the recurrence interval of a flood is defined as probability of an event in any given year (e.g. 1 percent annual chance). Flood magnitude increases with increasing recurrence interval.

In addition, there are several types of floodplains. These are identified areas of flood occurrence. However, not all flooding occurs in such areas. Localized urban flooding and flash flooding often occur outside of designated floodplain areas.

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 in most areas. 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.

The regulatory floodplain is also known as the 100-year floodplain, base flood elevation, 1.0-percent annual chance 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 County and municipalities (all but three jurisdictions participate in the NFIP – nonparticipants are Bull Valley, Oakwood Hills, and Trout Valley) administer floodplain regulations as part of the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP) and through 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 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 Management Ordinance. Floodplain and floodway regulations will be discussed further in Chapter 4.[iv]

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.

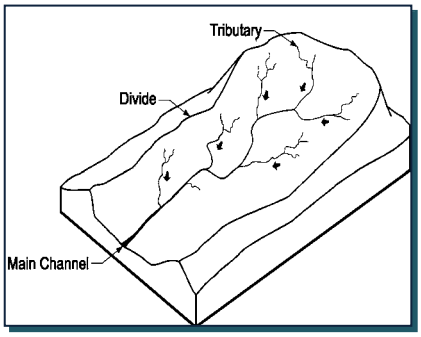
While the 100-year (or base flood) is the standard most commonly used for floodplain management and regulatory purposes in the United States, the 500-year flood is the national standard for protecting critical facilities, such as hospitals and power plants. A 500-year flood

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 Map (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 SFHA 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 may voluntarily purchase flood insurance.

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 2-13 and Table 2-14 show the major watersheds and tributary watersheds of the County, and available drainage areas.

Figure 2-2 Watershed Model



A watershed includes all land that drains to a common channel

Table 2-13 McHenry County Fox River Watershed Streams and Tributaries

Stream Name and Tributaries	Approximate Drainage Area In All Counties (Sq Miles):
Fox River at Algonquin Dam	1,402.0
Nippersink Creek	205.0
Silver Creek/Slough Creek – (Trib. of Nippersink Creek)	34.1
Vander Karr Creek – (Trib. of Nippersink Creek)	16.4
North Branch Nippersink Creek – (Trib. of Nippersink Creek)	68.7
Hebron Creek – (Trib. of Nippersink Creek)	---
Alden Creek – (Trib. of Nippersink 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 – (Trib. of Crystal Creek)	9.0

Table 2-14 McHenry County Kishwaukee River Watershed Streams and Tributaries

Stream Name and Tributaries	Approximate Drainage Area In All Counties (Square Miles):
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 – (Trib. of South Branch Kishwaukee River)	34.1
Kishwaukee Creek – (Trib. of South Branch Kishwaukee River)	16.4
Union Creek – (Trib. of South Branch Kishwaukee River)	68.7
Rush Creek	31.2
Mud Creek	---
Coon Creek near Garden Prairie	15.1
Piscasaw Creek at Chemung	52.9
Lawrence Creek– (Trib. of Picasaw Creek)	21.5
Mokeler Creek at Piscasaw Creek– (Trib. of Piscasaw Creek)	9.3
Geryune Creek near Capron – (Trib. of Piscasaw Creek)	12.2

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.[v]

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.

2.4.2 Flood Hazard Location

The county DFIRM hazard maps indicate both the 1.0-percent annual chance (100-year) floodplain and 0.2-percent annual chance (500-year) floodplain areas in the county as shown in Exhibit 2-2 These DFIRMs became effective on November 16, 2006.[vi] In addition, Table 2-15, shows the amount of floodplain (in acres) in each participating jurisdiction, indicating varying risk throughout the county. However, it should be noted that flooding outside of the FEMA designated flood areas is possible. A more severe event could easily exceed the 0.2-percent annual chance (500-year) floodplain boundaries shown. In addition, urban flooding and sheet flooding are possible throughout the planning area. Basement flooding caused through water rising from a high groundwater table (i.e., seepage or groundwater flooding) is common in McHenry County. The public and the Mitigation Committee were asked to identify areas that are subject to flooding, which is also reported below.

Notably, 95.4 percent of all 1.0-percent annual chance (100-year) floodplains are located in the eastern half of the county due to the location of the Fox River, portions of the Kishwaukee River, and Nippersink Creek. This is of particular concern because 27 of the 30 municipalities, as well as most of the population are located in the eastern half of the county as well.

Exhibit 2-2 McHenry County Special Flood Hazard Areas

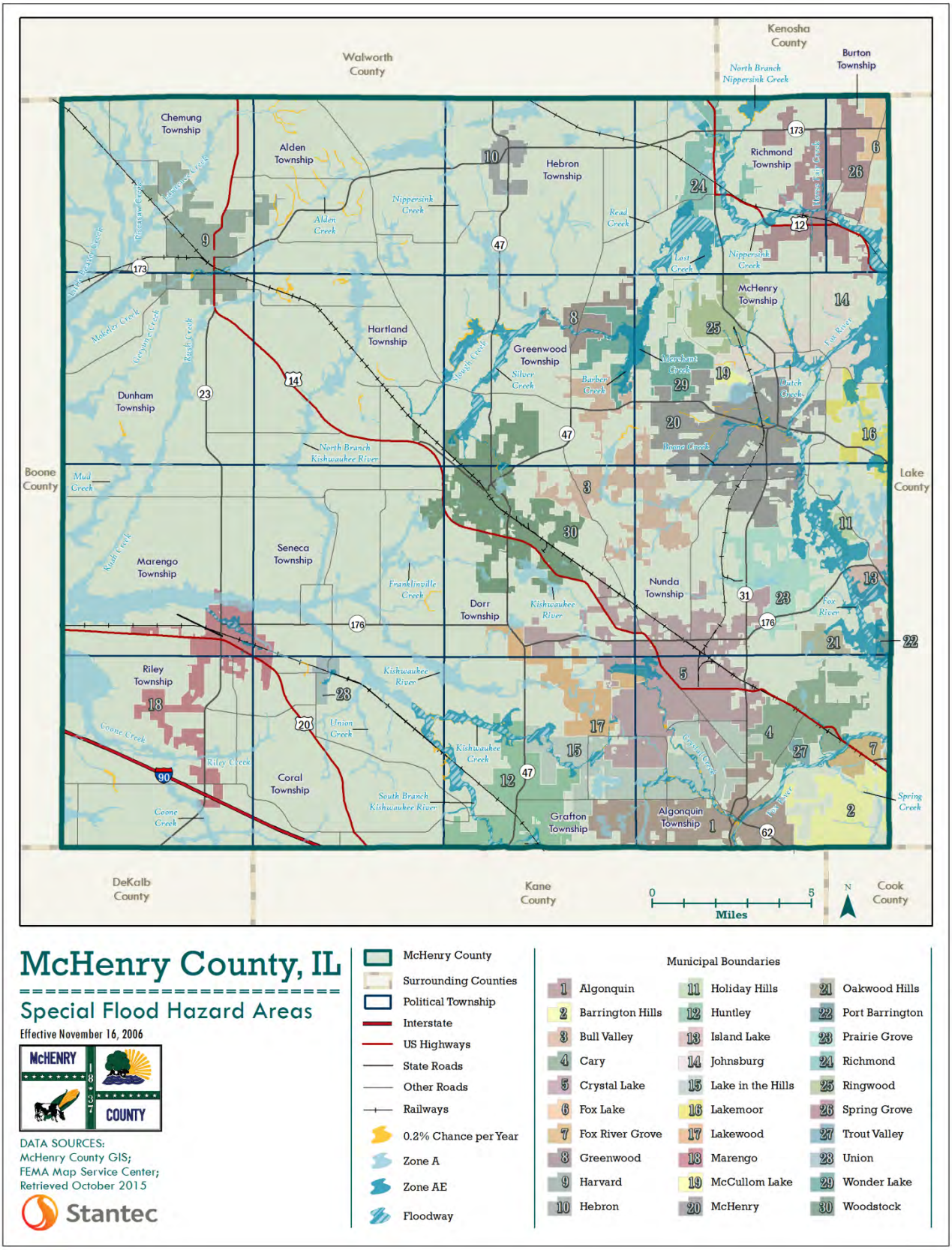


Table 2-15 Total Floodplain Area by Jurisdiction (in Acres)

Municipality	Acres of 1.0-percent annual chance floodplain (100-year)	Acres of 0.2-percent annual chance floodplain (500-year)	Total Floodplain Acres	% of Total Acres
Algonquin	79.3	29.1	108.4	1.8%
Barrington Hills	35.8	0	35.8	1.1%
Bull Valley	45.4	0	45.4	0.8%
Cary	32.6	1.0	33.6	0.8%
Crystal Lake	67.3	14.9	82.2	0.7%
Fox Lake	0.1	0	0.1	0.0%
Fox River Grove	37.9	6.8	44.7	4.6%
Greenwood	56.4	18.4	74.7	4.4%
Harvard	82.3	30.4	112.7	2.1%
Hebron	1.9		1.9	0.2%
Holiday Hills	25.8	11.1	36.8	6.0%
Huntley	109.7	55.5	165.2	3.1%
Island Lake	40.9	7.9	48.8	3.9%
Johnsburg	154.0	81.1	235.0	4.9%
Lake In The Hills	160.2	71.2	231.3	3.5%
Lakemoor	49.6		49.6	2.5%
Lakewood	74.6	6.1	80.7	2.6%
McCullom Lake	87.6	0	87.6	1.7%
McHenry	1.2	0	1.2	0.5%
Marengo	65.3	75.5	140.8	1.5%
Oakwood Hills	12.1		12.1	1.6%
Port Barrington	15.0	3.7	18.7	4.9%
Prairie Grove	20.6	17.6	38.2	1.1%
Richmond	81.0	15.7	96.7	3.6%
Ringwood	18.1		18.1	0.7%
Spring Grove	80.8	14.5	95.2	1.6%
Trout Valley	2.7		2.7	1.0%
Union	12.2	1.5	13.7	2.5%
Wonder Lake	16.3		16.3	0.4%
Woodstock	141.9	21.9	163.8	2.0%
Unincorporated McHenry County	216.8	307.7	524.5	0.2%
McHenry County Total	**1,825.1**	**791.5**	**2,616.6**	**1.8%**

Additional Areas of Known Flood Occurrence: In addition to the FEMA designated flood areas, several areas were noted by the planning team and the public as likely to flood or prone to flood impacts. These include:

- 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.

- *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 also occurred along Nippersink Creek. Notable flooding occurred in headwater areas in Lakewood, Huntley, and Woodstock.
- *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). Details reported by the communities are described below.
- *Algonquin* – Woods Creek Lane
- *Bull Valley* – The "S-curve" on Queen Anne Road, north of Bull Valley Road has flooded a couple times in the past several years. It is a marshy area, and the road is level with the low lying ground. In addition Ladd Court, located south of Crystal Springs Road and west of Cherry Valley Road, has flooded from large amounts of rain. The road shoulder, consisting of gravel and vegetation, has washed down and blocked the drainage/wash out areas.
- *Hebron Township* – The township identified multiple roads with structural issues during flood events; these roads include State Line Road, Hebron Road, Johnson Road, Thayer Road, Kemman Road, and Oksen Road. These roads can overtop with just two inches of rain during the spring. Many culverts along these roads are half full of sediment build-up, and the township stated the need for barriers. In addition, IL State Highway 173 floods west of the Village of Hebron.
- *Johnsburg* – The village stated that there are several roadways in the village located in the floodway that flood entirely during heavy flood events. They also identified sediment accumulation in the Dutch Creek Bay and its adjacent channels that contributes to flooding issues.
- *McHenry City* – The city noted during flood events, the intersection of Ramble Road and Home Avenue floods frequently and limits access. In addition, Meadow Lane Bridge obstructs the flow of water over Lakeland Park Drainage Ditch. They also indicated several locations of sediment accumulation that causes channel capacity reduction and/or potential flooding, including Lakeland Park Drainage Ditch from Illinois Route 120 (Elm Street) to the Fox River, Boone Lagoon ponds

along Watersedge Drive, and Boone Creek starting west of Oakwood Drive Bridge to the Fox River.

- *Oakwood Hills* – The village identified erosion and sediment issues along the channel inflow at the south end of Silver Lake from Lake Killarney. In addition, an overflow culvert under North Shore Drive obstructs water flow and increases flooding issues in the area.
- *Prairie Grove* – The village indicated that Wright Road overtops with approximately six inches of water during the spring thaw.
- *Spring Grove* – There are several properties along Nippersink Creek with previous flood impacts. A dozen of these properties are eligible for buyout and the McHenry County was in the process of finalizing the terms of a $10.1 million funding arrangement with the state in March 2016. However, the state budget has been in a stalemate, leaving several homeowners (in Spring Grove and several other nearby jurisdiction outside of McHenry County: Des Plaines and South Elgin) in limbo.[vii]

2.4.3 Flood Hazard Previous Occurrences

Two sources of data were used to assess past flood events in McHenry County: The NOAA National Climatic Data Center (NCDC) Storm Events Database and flood insurance claims data provided by FEMA. Table 2-16 summarizes the previous flooding occurrences reported in McHenry County between 1978 and November 2015. No injuries were reported as a result of flooding though one fatality did occur.

Nearly all events took place between May and September. Table 2-2 shows four Presidential Disaster Declarations as a result of flooding.

The National Flood Insurance Program (NFIP) data shows at least 35 flood events from 1978 to 2015. 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.

Events in June 2002, August 2002, September 2002, July 2006 and July 2007 did not result in any flood insurance claims. Flood damage was not recorded in the Storm Event Database for these events. Table 2-15 also provides a summary of flood insurance claims paid for each flood event. The table does not show events where only one property owner made a flood insurance claim.

Since 1978, 680 flood insurance claims have been paid in McHenry County for a total of $5.7 million (2015 dollars), resulting in average claim of $8,300. Total claims nearly doubled since the previous version of this Plan in 2010 ($3.1 million in 2015 dollars), and the average claim amount increased by $2,200 as a result of the 2013 floods claims. A summary of flood insurance claims by community is provided in Table 2-17. This table does not include some communities that are partially in McHenry County, but have participated in other county multi-jurisdictional plans. For the County and all municipalities that are wholly or partially in McHenry County, there are 1,657 flood insurance policies in place (1,610 in participating areas of this Plan). Of those,

1,409 are in A-Zone floodplains (464 outside the floodplain). The total flood insurance coverage for the County is $357 million based on a review of NFIP claims data. Additionally, Tables 2-18 and 2-19 summarize NFIP claims data across the county since the beginning of the NFIP in 1978.

Table 2-16 Reported Flood Events in McHenry County

Flood Event:	Flood Type	Area Impacted	Rainfall Estimate	Damage* (2015 dollars)	NFIP Claims Paid:	Claims Amount Paid:	Deaths/ Injuries*
June-Sept 1978	-		-	$0	18	$20,808	0/0
August 1981	-		-	$0	1	$1,667	0/0
Jan-Mar 1982	-		-	$0	3	$8,302	0/0
July 21,1982	-	Algonquin, Lake In The Hills	approx. 7"	$74,200	5	$11,300	1/0
December 1982	-		-	$0	3	$94,447	0/0
April 1983	-		-	$0	6	$8,394	0/0
March 1986	-		-	$0	2	$2,917	0/0
Aug-Oct 1986**	-		-	$0	69	$350,495	0/0
April-July 1993**	-		-	$0	61	$484,003	0/0
February 1994	-		-	$0	14	$104,913	0/0
April-July 1996	Flash Flood		-	$0	7	$23,859	0/0
Feb 20-22, 1997	Riverine Flood	countywide	3" - 4"	$0	2	$15,933	0/0
May-June 1997	Riverine Flood			$0	2	$3,217	0/0
June 13-17, 1999	Riverine Flood	countywide	4" - 6"	$0	26	$230,225	0/0
June 12-17, 2000	Flash Flood & Riverine	Harvard, Richmond, and countywide	3"to 5" plus earlier runoff	$0	15	$101,611	0/0
Feb-March 2001	-		-	$0	2	$8,869	0/0
June 4, 2002	Riverine Flooding	countywide	3.5"	$0	0	0	0/0
Aug 22, 2002	Flash Flood & Riverine	countywide	5"	$0	0	0	0/0
Sept 19, 2002	Riverine Flooding	Harvard	2.4"	$0	0	0	0/0
July 2003	-		-		2	$4,349	0/0
May-June 2004	Flash Flood & Riverine	Crystal Lake	1.5"	$0	11	$120,927	0/0
May 19, 2005	Riverine Flood	countywide	-	-	-	0	0/0
July 20, 2006	Riverine Flood	Huntley	-	$0	0	0	0/0
July 9, 2007	Riverine Flood	Crystal Lake	-	$0	0	$897,511	0/0
Aug-Sept 2007	3 Flash Floods & 1 Riverine	Woodstock, Marengo, Union, Algonquin, Huntley, Lakewood	4.4" – 5.1"	$996,980	70	$735,866	0/0
April 2008	-				4	$9,873	0/0
June 13-25, 2008	Riverine Flood	Spring Grove	6.6"	$289,820	10	$64,081	0/0
Sept 13, 2008	Flash Flood	Crystal Lake, Lake In The Hills, Algonquin	-	$0	2	$5,670	0/0
Dec 1, 2008	-		-	$0	2	$9,453	0/0

Flood Event:	Flood Type	Area Impacted	Rainfall Estimate	Damage* (2015 dollars)	NFIP Claims Paid:	Claims Amount Paid:	Deaths/ Injuries*
Feb-March 2009	-		-	$0	2	$10,098	0/0
June 2009	-		-	$0	5	$37,199	0/0
May 2011	Riverine	Crystal Lake and Richmond	8" to 12"	$0		No data	0/0
March 2012	Riverine	Bull Valley, Woodstock, McCullom Lake & Hartland (Uninc. Place)	-	$0		No data	0/0
April 2013**	Riverine				145	$2,519,900	
June 2013	2 Flash Floods	Cary, McHenry, & Terre Cotta (Uninc. Place)	3" to 4"	$0		No data	0/0
County Totals	40			$1,361,000	489	$5,885,887	1/0

* NCDC Reported Data
**Federal Disaster Declaration
Source: NOAA; FEMA

Notable Flood Events: There have been several significant flood events in the county. Details related to the more recent events are presented below.

- **July 1982:** There was only one recorded report of death associated with 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 reported to have fallen into the creek.
- **1986 and 1993 Floods:** The two next largest floods in McHenry County were the September 1986 and the June 1993 floods. Both floods received disaster declarations. Neither flood event is shown in the NOAA's Storm Events Database for McHenry County, nor are details of the floods available. Both floods were the results of extended periods of rainfall across Wisconsin and Illinois. Flood insurance claims totaled $521,000 for the 1986 flood and $754,000 for the 1993 event.
- **June 1999 Flood:** Flooding occurred along the Upper Fox River and Nippersink Creek in June 1999. It was the worst flooding in 6 years. At Four Colonies Park near Crystal Lake, water was knee-deep. Homes and streets suffered severe flooding along Nippersink Creek. About $279,000 in flood insurance claims was paid for this event.
- **June 2000 Riverine and Flash Flood:** In McHenry County there was flooding of streets and basements in Harvard and Richmond. It was the worst flooding in 20 years in Richmond. Nine residents had to be rescued. The Fox River and Chain of Lakes was closed to all motorized boat traffic. Some communities affected along the Fox River included Holiday Hills, and Spring Grove.
    - Some residents in Holiday Hills sandbagged to protect their homes from flooding. Floodwaters from Nippersink Creek forced the evacuation of 3 homes in Spring Grove.

$118,000 in flood insurance claims was paid for this event.

- **August 2007 Flood Event:** From the Storm Event Database and the flood insurance claims data, the August 2007 flood caused the second highest recorded damages, $996,980 (2015 dollars) 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.
    - In Woodstock, the intersection of Route 47 and 120 closed due to two feet of standing water. Willow and Clay Streets closed due to waist deep water. Police conducted rescues from stranded vehicles. Basement flooding was reported throughout Woodstock, and as many as 10 properties were flooded.
    - In Union, Boot Creek overflowed at Hemmingson Road. Water flowed over the railway station platform and many Union streets were closed. On August 19, flash flooding caused an evacuation of the Railway Museum, a mobile home park, and local campground.
- **June 2008 Floods:** The McHenry Lock and Dam crested at 6.8 feet, and downstream from the dam, about 100 homes were affected by flood water in the Orchard Heights and Colby Point areas, with 50 sustaining some damage. $254,000 in flood insurance claims was paid for this event.
- **April 2013:** On April 17 & 18, 2013, storms cut across the Chicago area of Illinois, resulting in heavy rains of 5 to 10 inches[viii] on top of another two inches of rain received earlier in the week. This event was considered record river flooding for the Illinois River Valley. A federal disaster declaration was made in 35 counties across the state. Over 58,000 homes and contents were damaged or destroyed through the impacted area; as a result, over $190 million in federal grants and loans were made available. Over $3.7 million in flood insurance claims were paid for this event.
    - McHenry County received five to six inches of rain, and stormwater flowed into McHenry County from Lake County and Wisconsin where watersheds were already full.[ix] Multiple roads were closed throughout the county, and many communities were calling for volunteers to contribute to sandbagging efforts. The Fox River continued to rise, reaching a record level of 7.44 feet at McHenry Dam on April 22 ("major" flood level). NFIP claims (damages) were over $2.5 million (2015 dollars), though this does not include damage to public infrastructure. It was declared a State and Federal Disaster in the county. This was a major flood event for the county with 185 NFIP claims made (145 paid totaling $2.5 million). Farmers also qualified for federal assistance through the USDA.

Table 2-17 Summary of McHenry County Flood Insurance Claims Data for Communities Participating in the NFIP

Community	Number of Claims Paid	Total Paid	Average Paid	Number of Active Policies	CRS Class
Village of Algonquin	41	$293,800	$7,165	114	--
Village of Barrington Hills	4	$53,648	$13,412	15	--
Village of Bull Valley*	--	--	--	0	--
Village of Cary	12	$59,200	$4,930	33	--
City of Crystal Lake	27	$331,950	$12,290	56	6
Village of Fox Lake	41	73350	1790	258	--
Village of Fox River Grove	18	$157,180	$8,730	34	--
Village of Greenwood	--	--	--	0	--
City of Harvard	8	$24,570	$3,070	28	--
Village of Hebron	--	--	--	0	--
Village of Holiday Hills	27	$428,700	$15,880	59	--
Village of Huntley	2	$710	$355	22	--
Village of Island Lake	1	$740	$740	27	--
Village of Johnsburg	10	92700	9270	80	--
Village of Lake In The Hills	30	$170,400	$5,680	51	6
Village of Lakemoor	3	$6,750	$2,250	21	--
Village of Lakewood	2	$1,300	$650	9	--
City of Marengo	--	--	--	100	--
Village of McCullom Lake	50	$422,190	$8,440	0	--
City of McHenry	11	$25,670	$2,330	63	--
Village of Oakwood Hills*	--	--	--	0	--
Village of Port Barrington	13	$196,030	$15,080	30	--
Village of Prairie Grove	--	--	--	0	--
Village of Richmond		--		5	--
Village of Ringwood	--	--	--	0	--
Village of Spring Grove	32	$ 306,490	$9,580	19	
Village of Trout Valley*	--	--	--	0	--
Village of Union	8	$31,480	$3,935	16	--
Village of Wonder Lake	1	$ 3,790	$3,790	11	--
City of Woodstock	14	$182,320	$13,020	21	--
McHenry County	291	$2,626,450	$9,025	583	8
Totals	**646**	**$5,489,418**	**$8,498**	**1,65**	

Source: CIS and FEMA Region V
*Not an NFIP Community.

Table 2-18 McHenry County Flood Insurance Claims Summary

Years	Total Claims Made*	Total Claims Paid	Claims Paid Over $1,000	Claims Paid Less than $1,000	Total Claims Not Paid
1978-1979	180	130	70	60	50
1980- 1989	155	105	75	30	50
1990-1999	215	135	110	25	80
2000-2009	220	150	135	15	70
2010-2015	210	160	150	10	50
2013**	185	145	137	8	40
All Years (1978-2015)	980	680	540	140	300

Source: FEMA NFIP Data, February 2016
*187 claims were removed from the data provided by FEMA. These claims were for properties not located in McHenry County due to incorrect community ID numbers or dual-county municipalities.
**Most recent flood in April 2013.

Table 2-19 McHenry County Flood Insurance Claims Summary

Years	Total Claims Paid ($)	Claims Paid Over $1,000 ($)	Claims Paid Less Than $1,000 ($)	Average Claim ($)
1978-1979	$262,500	$229,000	$33,500	$2,019
1980- 1989	$532,000	$517,600	$14,400	$5,067
1990-1999	$1,019,700	$1,006,200	$13,500	$7,553
2000-2009	$1,318,750	$1,310,100	$8,650	$8,792
2010-2015	$2,567,650	$2,562,400	$5,250	$16,048
2013**	$2,519,900	$2,515,600	$4,300	$17,379
All Years (1978-2015)	$8,220,500	$8,140,900	$79,600	$8,388.27

Source: FEMA NFIP Data, February 2016
**Most recent flood in April 2013

NFIP 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. FEMA Region V provided repetitive loss data in December 2015. The FEMA data showed 76 repetitive loss structures throughout McHenry County. Most properties were identified on the list for unincorporated McHenry County, but the review of the data showed repetitive loss structures in twelve communities as presented in Table 2-20. The previous version of this plan listed 52 properties. Notably, ten of these properties were added due to flooding in April 2013.

Table 2-20 McHenry County Repetitive Loss Structures

Community	Repetitive Flood Loss Properties	Type	Total Repetitive Losses Paid
Algonquin	4	All Residential	$143,687
Crystal Lake	2	All Residential	$26,739
Fox River Grove	2	All Residential	$60,025
Harvard	1	All Residential	$12,577
Holiday Hills	5	All Residential	$135,737
Johnsburg	1	All Residential	$6,535
Lake In The Hills	4	All Residential	$57,548

Community	Repetitive Flood Loss Properties	Type	Total Repetitive Losses Paid
Lakemoor	1	All Residential	$3,540
Marengo	1	All Residential	$4,754
McHenry	1	All Residential	$115,894
Port Barrington	5	All Residential	$138,922
Woodstock	2	All Residential	$44,282
McHenry County Unincorporated	49	All Residential	$1,413,121
Total:	**76**		**$3,430,687**

Source: FEMA Region V
Not included above are 28 repetitive loss properties identified for Fox Lake due to the community's participation in the Lake County HMP.

A review of NFIP flood insurance claims data shows over 300 properties in McHenry County have had flood insurance claims paid since 1978. In addition to the 76 FEMA-identified repetitive flood loss properties, there are 38 other properties that have been paid two or more flood insurance claims that have been under $1,000. This means there are at least 93 properties within the County that have experienced repeated flooding issues.

The repetitive flood loss structures are concentrated in the Fox River Watershed. They are all single family residences. Mitigation of repetitive flood loss structures is discussed further in Chapter 5. "Repetitive Flood Loss Problem Areas" were developed and are presented in Exhibit 5-1.

2.4.4 Flood Hazard Extent

Flood extent, or magnitude, can be defined in several ways including flow or discharge rate (cubic feet per second), height of flood waters, and damages. The USGS drainage areas, discharge rates, and available flood stage data for McHenry County are shown in Table 2-21. Maximum discharge and maximum mean gage height are used to indicate extent.

Table 2-21 USGS Stream Gage Data for Locations in McHenry County

Water Feature	Gage Location	Median Discharge (cubic feet/second)	Max Discharge (cubic feet/second) (year)	Drainage Area (sq miles)	Max Mean Gage Height (feet/year)
Nippersink Creek	Near Spring Grove	196	667 (1983)	192	Unavailable
Kishwaukee River	At Marengo	196	264 (2015)	170	12.03 (2013) - mean
Fox River	At Algonquin	2,020	6,080 (1980)	1,430	4.01 (2013)
Fox River	Near McHenry	Unavailable	Unavailable	1,250	5.4 (2013)

In addition, injuries and loss of life can be associated with the flood hazard.

2.4.5 Flood Hazard Probability of Future Occurrences

In the last 20 years there have been 35 total flood occurrences (Riverine and Flash Flood) according to NCDC records and the NFIP (likely under-reported). This indicates a 100 percent chance of flooding annually, resulting in a probability of "highly likely" (greater than 90% chance) on the PRI index. While it is clear that flooding is a frequently occurring hazard within McHenry County, it is possible to have years with no flood events and years with multiple flood events.

2.4.6 Flood Hazard 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. GIS analysis was used to determine that the FEMA mapped floodplain (FIRM A and AE Zones) covers approximately 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 River watershed are increasing as additional runoff is discharged by new development. Though discharges rates in new development are controlled by the Stormwater Management Ordinance, the quantity of runoff still increases. As previously noted, flooding from water rising from a high water table is also a concern in many areas of the County.

Health and Safety: Safety during a flood, whether from overbank flooding or flooding caused by a high water table (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 exact number of buildings within the 1-percent annual chance floodplain (100-year) and the 0.2-percent annual chance floodplain (500-year) has not been determined. Further, building footprints are not available to analyze as potentially in the floodplain. However, an "improved parcel" dataset was available and was used to represent potentially developed properties since the properties are noted as improved, and for this analysis assumed to have buildings. A GIS interaction analysis was used to determine the number of improved parcels. Table 2-22 details the improved parcels with 51 percent or more of their total area in the 1.0-percent or 0.2-percent annual chance floodplain. However, this is an approximate analysis for planning purposes and should be noted that flooding occurs outside the 1.0-percent annual chance floodplain.

Table 2-22 Improved Parcels in Floodplain by Jurisdiction ***(parcels with 51% or more of total area in floodplain)***

	1% chance floodplain (100-year)		0.2% chance floodplain (500-year)	
Jurisdiction and Parcel Type	Total Improved Parcels	Assessed Value of Parcels	Total Improved Parcels	Assessed Value of Parcels
Algonquin				
Residential	164	$11,679,904	18	$882,524
Commercial	19	$1,190,158	14	$1,308,896
Industrial	3	$323,360	0	-
Government-Owned/Tax-Exempt	0/31	Not Available	0/10	Not Available
Barrington Hills				
Residential	7	$1,768,668	0	-
Commercial	0	-	0	
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0/1	Not Available	0	-
Bull Valley				
Residential	8	$782,944	0	-
Commercial	3	$220,905	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0/0	-	0	-
Cary				
Residential	70	$1,302,954	0	-
Commercial	6	$354,861	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0/2	Not Available	0	-
Crystal Lake				
Residential	170	$12,889,352	1	$64,554
Commercial	2	$39,449	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	1/34	Not Available	0	-
Fox Lake				
Residential	0	-	0	-
Commercial	0	-	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0	-	0	-
Fox River Grove				
Residential	62	$3,445,114	0	-
Commercial	3	$203,438	0	-
Industrial	2	$9,782	0	-
Government-Owned/Tax-Exempt	0/6	Not Available	0	-
Greenwood				
Residential	1	$60,970	1	$82,622
Commercial	0	-	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0/4	Not Available	0	-

	1% chance floodplain (100-year)		0.2% chance floodplain (500-year)	
Jurisdiction and Parcel Type	Total Improved Parcels	Assessed Value of Parcels	Total Improved Parcels	Assessed Value of Parcels
Harvard				
Residential	61	$1,826,392	0	-
Commercial	7	$399,427	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0/4	Not Available	0/1	Not Available
Hebron				
Residential	0	-	0	-
Commercial	0	-	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0	-	0	-
Holiday Hills				
Residential	159	$6,081,814	0	-
Commercial	1	$19,589	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0/35	Not Available	0	-
Huntley				
Residential	64	$3,542,808	11	$578,257
Commercial	3	$1,634,569	15	$2,830,887
Industrial	15	$1,164,890	2	$88,347
Government-Owned/Tax-Exempt	0/2	Not Available	0	-
Island Lake				
Residential	227	$9,889,007	112	$4,213,932
Commercial	3	$266,264	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0/21	Not Available	0	-
Johnsburg				
Residential	258	$19,631,681	24	$1,157,212
Commercial	4	$489,112	3	$470,367
Industrial	0	-	-	
Government-Owned/Tax-Exempt	0/28	Not Available	0/1	Not Available
Lake In The Hills				
Residential	58	$3,382,286	23	$1,258,793
Commercial	9	$7,214	0	-
Industrial	1	$713,032	1	$310
Government-Owned/Tax-Exempt	0/36	Not Available	0/2	Not Available
Lakemoor				
Residential	52	$1,444,866	0	-
Commercial	0	-	0	-
Industrial	3	$16,369	0	-
Government-Owned/Tax-Exempt	1/25	Not Available	0	-

	1% chance floodplain (100-year)		0.2% chance floodplain (500-year)	
Jurisdiction and Parcel Type	Total Improved Parcels	Assessed Value of Parcels	Total Improved Parcels	Assessed Value of Parcels
Lakewood				
Residential	35	$4,293,448	1	$66,543
Commercial	1	$14,828	0	-
Industrial	1	$72,266	0	-
Government-Owned/Tax-Exempt	0/5	Not Available	0	-
Marengo				
Residential	261	$9,038,982	0	-
Commercial	9	$799,571	0	-
Industrial	1	$74,136	0	-
Government-Owned/Tax-Exempt	0/21	$14,696	0	-
McCullom Lake				
Residential	0	-	0	-
Commercial	0	-	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0	-	0	-
McHenry				
Residential	102	$4,630,457	65	$2,607,866
Commercial	16	$1,361,991	7	$790,771
Industrial	0	-	3	$405,113
Government-Owned/Tax-Exempt	0/28	Not Available	0/6	Not Available
McHenry Unincorporated				
Residential	1,154	$62,430,603	60	$3,549,732
Commercial	36	$1,395,313	1	$615
Industrial	-	-	-	-
Government-Owned/Tax-Exempt	0/565	0/$7,565	0/3	Not Available
Oakwood Hills				
Residential	6	$289,027	0	-
Commercial	1	$9,806	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0/1	Not Available	0	-
Port Barrington				
Residential	92	$4,624,299	42	$1,971,295
Commercial	0	-	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0/9	Not Available	0/1	Not Available
Prairie Grove				
Residential	1	$125,843	0	-
Commercial	1	$11,467	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0/3	Not Available	0	-

	1% chance floodplain (100-year)		0.2% chance floodplain (500-year)	
Jurisdiction and Parcel Type	Total Improved Parcels	Assessed Value of Parcels	Total Improved Parcels	Assessed Value of Parcels
Richmond				
Residential	8	$383,949	0	-
Commercial	3	$130,560	0	-
Industrial	1	$305,770	0	-
Government-Owned/Tax-Exempt	0/3	Not Available	0	-
Ringwood				
Residential	5	$392,540	0	-
Commercial	0	-	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0	-	0	-
Spring Grove				
Residential	8	$255,985	2	$259,761
Commercial	3	$615,369	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0/3	Not Available	0	-
Trout Valley				
Residential	0	-	0	-
Commercial	0	-	0	-
Industrial	0	-	0	-
Government-Owned/Tax-Exempt	0	-	0	-
Union				
Residential	23	$790,709	0	-
Commercial	4	$273,270	0	-
Industrial	2	$308,352	0	-
Government-Owned/Tax-Exempt	0/5	Not Available	0	-
Wonder Lake				
Residential	52	$3,509,137	0	-
Commercial	0		0	-
Industrial	0		0	-
Government-Owned/Tax-Exempt	0		0	-
Woodstock				
Residential	42	$2,021,039	54	$1,812,414
Commercial	3	$88,618	6	$1,765,293
Industrial	1	$13,029	2	$130,304
Government-Owned/Tax-Exempt	0/6	Not Available	0/4	Not Available
County Totals	**2,254**	**$183,063,804**	**432**	**$26,296,408**

The data in Table 2-21 indicates that there are approximately 2,700 parcels with 51 percent or more of their area located in the floodplain. The value of these parcels is just over $200 million. A secondary way of measuring this is to compare with NFIP claims. Assuming approximately 2,700 parcels have buildings in the floodplain and average claims of $8,300, building damages would be about $22.4 million. All of these methodologies to assess potential flood damage

present some level of uncertainty. In the case of the parcel value analysis, building footprints were not available so flooding on the parcel was equated to damage. Further, building values were not separated from land values, thus representing a worst case scenario.

Impact to buildings due to flooding is considered high.

Critical Facilities: The previous version of this plan only identified 30 facilities in/near the floodplain and no mapping analysis was conducted. By using GIS technology analysis in this Plan Update, the resulting number of critical facilities significantly increased from the previous version, and there are approximately 112 critical facilities located in or within 100 feet of the floodplain. Table 2-23 lists the facilities in the 1.0-percent annual chance (100-year) floodplain, 0.2-percent annual chance (500-year) floodplain, and those facilities within 100 feet of the floodplain.

Previously, the impact to critical facilities due to flooding is considered moderate; however, due to the increased number of critical facilities in the floodplain shown in this Plan, impact has been updated to high. Exhibit 2-3 illustrates the locations of these facilities.

Table 2-23 Critical Facilities Located in or within 100 Feet of the Floodplain

1.0-PERCENT ANNUAL CHANCE (100 Year) FLOODPLAIN				
Critical Facility Name	**Facility Type**	**Category**	**Community or Township**	**Floodway**
Wallace Road Bridge	Infrastructure	Roadway/Bridge	Algonquin Township	-
Braeburn & Plum Tree Road Bridge	Infrastructure	Roadway/Bridge	Algonquin Township	-
St. Elizabeth Ann Seton Catholic Church	Gathering Place	Church	Crystal Lake	-
West Park	Gathering Place	Park	Crystal Lake	-
Lift Station #8	Infrastructure	Wastewater Treatment Facility/Lift Station	Crystal Lake	-
Lift Station #16	Infrastructure	Wastewater Treatment Facility/Lift Station	Crystal Lake	-
Cress Creek Property	Gathering Place	Park	Crystal Lake	X
Lake Park/Main Beach	Gathering Place	Park	Crystal Lake	-
Naoki Kamijima Park	Gathering Place	Park	Crystal Lake	-
Crystal Lake Park District	Other	Industrial Hazardous Substance	Crystal Lake	-
Lift Station #23	Infrastructure	Wastewater Treatment Facility/Lift Station	Crystal Lake	-
Winding Creek Park & Bike Path	Gathering Place	Park	Crystal Lake	-
Doty Road over Kishwaukee headwaters	Infrastructure	Roadway/Bridge	Dorr Township	-
N/A (located on Marengo Road)	Infrastructure	Communication Tower	Dunham Township	-
Lions Park	Gathering Place	Park	Fox River Grove	-
N/A (located on Bay View Drive)	Infrastructure	Wastewater Treatment Facility/Lift Station	Fox River Grove	-
N/A (located on Tower Drive)	Infrastructure	Drinking Water Facility	Holiday Hills	-
Playground (near Lake Griswold)	Gathering Place	Park	Holiday Hills	-

1.0-PERCENT ANNUAL CHANCE (100 Year) FLOODPLAIN				
Critical Facility Name	Facility Type	Category	Community or Township	Floodway
Lake Griswold	Other	Dam	Holiday Hills	-
Talamore Park	Gathering Place	Park	Huntley	-
Main Street / Coyne Station	Infrastructure	Roadway/Bridge	Huntley	X
Union Road	Infrastructure	Roadway/Bridge	Huntley	X
N/A (located at Bedford Drive)	Infrastructure	Drinking Water Facility/Water Tower	Huntley	-
Kishwaukee	Infrastructure	Wastewater Treatment Facility/Lift Station	Huntley	-
Smith Drive	Infrastructure	Wastewater Treatment Facility/Lift Station	Huntley	-
Mobil	Other	Petroleum Storage & Distribution	Lake In The Hills	X
Carpenter Park	Gathering Place	Park	Lake In The Hills	X
Woods Creek Lake (Class 1)	Other	Dam	Lake In The Hills	X
Willow Lake (Class 3)	Other	Dam	Lake In The Hills	X
Lake Scott (Class 3)	Other	Dam	Lake In The Hills	X
Crystal Lake Road Bridge	Infrastructure	Roadway/Bridge	Lake In The Hills	-
Lakemoor Police Department	Government	Police Station	Lakemoor	-
Village of Lakewood City Hall	Government	City Hall	Lakewood	-
Lakewood Police Department	Government	Police Station	Lakewood	-
West Beach Lift Station	Infrastructure	Wastewater Treatment Facility/Lift Station	Lakewood	-
Redtail Golf Course Dam (near Hole #2)	Other	Dam	Lakewood	-
Child Assessment Service Family Care	Medical Facility	Medical Clinic	Marengo	X
Well # 6	Infrastructure	Drinking Water Facility/Well	Marengo	-
Victory Rock Fellowship	Gathering Place	Church	Marengo	-
Stevenson Street Lift Station	Infrastructure	Wastewater Treatment Facility/Lift Station	Marengo	X
North State Lift Station	Infrastructure	Wastewater Treatment Facility/Lift Station	Marengo	X
Bridge over Kishwaukee River	Infrastructure	Roadway/Bridge	Marengo	-
Well # 8	Infrastructure	Drinking Water Facility/Well	Marengo	-
Waste Water Treatment Plant	Infrastructure	Wastewater Treatment Facility/Wastewater Treatment Plant	Marengo	-
MCMS	Other	Petroleum Storage & Distribution	Marengo Township	-
Thorne Road	Infrastructure	Roadway/Bridge	Marengo Township	-
Deerpass Road	Infrastructure	Roadway/Bridge	Marengo Township	-
Miller Riverfront Park	Gathering Place	Park	McHenry	-
Elm Street (IL-120) Bridge	Infrastructure	Roadway/Bridge	McHenry	-
Pearl Street Bridge	Infrastructure	Roadway/Bridge	McHenry	X
Charles J Miller Road Bridge	Infrastructure	Roadway/Bridge	McHenry	X
Central Plant	Infrastructure	Wastewater Treatment Facility/Wastewater Treatment Plant	McHenry	X
N/A (near Pearl Street)	Infrastructure	Drinking Water Facility/Water Tower	McHenry	-

1.0-PERCENT ANNUAL CHANCE (100 Year) FLOODPLAIN				
Critical Facility Name	Facility Type	Category	Community or Township	Floodway
Brookside Trail	Gathering Place	Park	McHenry	-
Pheasant Valley Park	Gathering Place	Park	McHenry	-
Walsh Park	Gathering Place	Park	McHenry	X
Millstream Subdivision Beaches	Gathering Place	Park	McHenry	-
West Bull Valley Road Bridge	Infrastructure	Roadway/Bridge	McHenry	-
Barnard Mill Road Bridge	Infrastructure	Roadway/Bridge	McHenry Township	X
Bay View Lane Bridge	Infrastructure	Roadway/Bridge	McHenry Township	-
McHenry Wellhouse #2	Infrastructure	Drinking Water Facility/Well	McHenry Township	-
Stratton Lock & Dam Business Office	Other	Dam	McHenry Township	-
McHenry Lock & Dam	Other	Dam	Nunda Township	X
Hill Road Bridge	Infrastructure	Roadway/Bridge	Richmond Township	X
West Solon Road Bridge	Infrastructure	Roadway/Bridge	Richmond Township	X
Pioneer Road Bridge	Infrastructure	Roadway/Bridge	Richmond Township	X
Village of Richmond	Gathering Place	Park	Richmond Township	-
Jackson Road Bridge	Infrastructure	Roadway/Bridge	Riley Township	-
Grange Road Bridge	Infrastructure	Roadway/Bridge	Riley Township	-
Coon Creek Bridge	Infrastructure	Roadway/Bridge	Riley Township	-
Winn Road	Infrastructure	Roadway/Bridge	Spring Grove	X
Lyle C. Thomas Park and Nippersink Canoe Base	Gathering Place	Park	Spring Grove	X
Oak Valley Park	Gathering Place	Park	Spring Grove	-
Public Works Department	Government	Highway/Road Maintenance Center	Wonder Lake	-
Thompson Road at Wondermere Road	Infrastructure	Roadway/Bridge	Wonder Lake	X
Jacobson Park	Gathering Place	Park	Wonder Lake	-
Silver Creek (Conservation)	Gathering Place	Park	Woodstock	-
N/A (located on Dorham Lane)	Infrastructure	Wastewater Treatment Facility/Lift Station	Woodstock	-
N/A (located on Waterleaf Lane)	Infrastructure	Wastewater Treatment Facility/Lift Station	Woodstock	-

0.2-PERCENT ANNUAL CHANCE (500 Year) FLOODPLAIN			
Critical Facility Name	Critical Facility Name	Category	Community or Township
N/A (located on Haligus Road)	Infrastructure	Power Plant/Utility Substation	Grafton Township
East Plant	Infrastructure	Wastewater Treatment Facility/Wastewater Treatment Plant	Huntley
Lake In The Hills Public Works	Government	Highway/Road Maintenance Center	Lake In The Hills
N/A (located on Hilltop Drive)	Infrastructure	Wastewater Treatment Facility/Lift Station	Lake In The Hills
Hilltop Drive Bridge	Infrastructure	Roadway/Bridge	Lake In The Hills
East Oak Street Bridge	Infrastructure	Roadway/Bridge	Lake In The Hills

0.2-PERCENT ANNUAL CHANCE (500 Year) FLOODPLAIN			
N/A (located on North Riverside Drive)	Infrastructure	Wastewater Treatment Facility/Lift Station	McHenry
N/A (located on West Grove Avenue)	Infrastructure	Wastewater Treatment Facility/Lift Station	McHenry
Fort McHenry	Gathering Place	Park	McHenry
SBC McHenry Garage	Infrastructure	Other	McHenry Township
Pioneer Center Group Home	Residential	Residential Group Home	McHenry Township

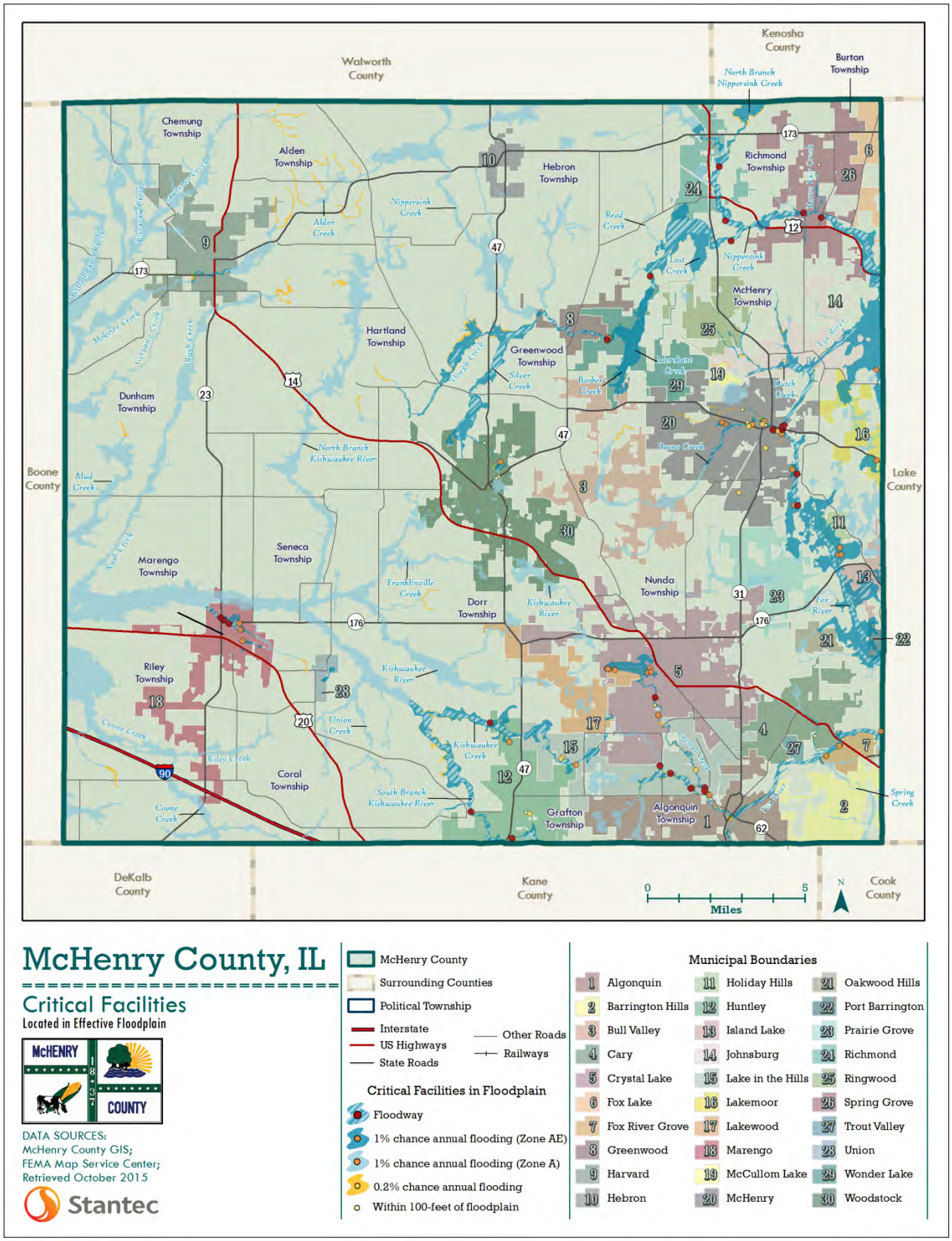
WITHIN 100 FEET OF FLOODPLAIN			
Critical Facility Name	**Critical Facility Name**	**Category**	**Community or Township**
Well # 8	Infrastructure	Drinking Water Facility/Well	Cary
Well # 9	Infrastructure	Drinking Water Facility/Well	Cary
Lift Station #1	Infrastructure	Wastewater Treatment Facility/Lift Station	Crystal Lake
Facility at Lions Park	Infrastructure	Drinking Water Facility	Fox River Grove
N/A (located on North River Road)	Infrastructure	Wastewater Treatment Facility/Lift Station	Fox River Grove
Village of Huntley Maintenance Garage	Government	Highway/Road Maintenance Center	Huntley
Well # 8	Infrastructure	Drinking Water Facility/Well	Huntley
N/A (located on Decatur Avenue)	Infrastructure	Wastewater Treatment Facility/Lift Station	Lake In The Hills
McHenry Villa	Residential	Assisted Living/Care Facility	McHenry
N/A (located on Millstream Drive)	Infrastructure	Wastewater Treatment Facility/Lift Station	McHenry
N/A (located on West Willow Lane)	Infrastructure	Wastewater Treatment Facility/Lift Station	McHenry
Freund Field	Gathering Place	Park	McHenry
Salvation Army	Other	Social Service Agency	McHenry
The McHenry Villa	Residential	Nursing/Retirement Homes & Assisted Living Facility	McHenry Township
Radio Dynamics Corporation	Infrastructure	Communication Tower	Nunda Township
Springdale Trails Park	Gathering Place	Park	Spring Grove
Community Montessori	Government	School/Preschool	Woodstock
Melody Lane (Vehicle Bridge)	Infrastructure	Roadway/Bridge	Woodstock
Community Montessori	Residential	Day Care Facility	Woodstock
N/A (located on Irving Avenue)	Infrastructure	Wastewater Treatment Facility/Lift Station	Woodstock

Additionally, Lake In The Hills identified several other critical facilities vulnerable to flooding. GIS data was not provided for these critical facilities; Therefore GIS analysis was not conducted, and their exact proximity to the floodplain is unknown. It is possible they may be mapped at a later date. These additional at-risk critical facilities in Lake In The Hills include the following:

- Goose Lake Dam (Class 2) – Infrastructure
- Hilltop Drive Bridge – Infrastructure

- Jessie Road Bridge – Infrastructure
- Algonquin Road Bridge over Woods Creek – Infrastructure
- Lakewood Road culvert north of Miller Road Intersection – Infrastructure
- Miller Road culvert between Heron Drive and Greenfield Lane – Infrastructure
- Randall Road between Acorn Lane and Miller Road – Infrastructure
- La Buy Park – Gathering Place
- Indian Trail Beach – Gathering Place

Exhibit 2-3 McHenry County Critical Facilities Located within the Floodplain



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. Business interruption is also forgone sales tax for the county. 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.

Climate Change Impact: Climate change could affect future flood impacts in McHenry County as data shows increasing precipitation trends in Northeast Illinois. Illinois precipitation has increased by 10 percent in the last century. The Illinois average number of storm events exceeding 4 inches of rain per city (Chicago, Rockford, Moline, Peoria, Springfield, Bloomington-Normal, Champaign-Urbana, Edwardsville, and Carbondale) has increased steadily over the last century with 2005-2014 being the busiest with an average of 1.8 events per city. As a result, a 2- to 3-inch storm at the end of a wet week or month may do more damage than the same storm falling during a dry week or month.[x] Precipitation since 2005 has been much above normal every year through 2011. Overall, precipitation in Illinois has increased by about 5 inches over the period of record.[xi]

El Niño and La Niña cycles are also climatic events that can affect the amount of precipitation an area receives. These refer to periods when sea-surface temperatures along the equator in the Pacific Ocean are either unusually cold for La Niña or unusually warm for El Niño affecting the weather patterns for the entire world. Currently, it is El Niño in the Midwest bringing above-normal temperatures with drier conditions to eastern portions of the Midwest. This usually means decreased precipitation in the Pacific Northwest and in the Ohio and Tennessee Valleys. Years where La Nina is happening expect the opposite effect in the Region.

Without the proper planning, increasing impervious surfaces and extreme precipitation can impact communities through increased stormwater management costs, flooding, and business interruptions.[xii]

2.5 Severe Summer Storms Hazard (Wind, Lightning, Hail)

2.5.1 Severe Summer Storms Hazard Description

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 storms may be associated with a range of hazards such as flooding, tornadoes and hail, for example. For the purposes of this Plan, wind, hail, and lighting are included in this hazard, while tornadoes and flooding are discussed as separate hazards.

Thunderstorms are very dangerous because of their ability to generate tornadoes, hailstorms, strong winds, flash flooding, and damaging lightning. While thunderstorms can occur in all regions of the United States, they are most common in the central and southern states because atmospheric conditions in those regions are most ideal for generating these powerful storms.

Figure 2-3 Thunderstorm Warnings

THUNDERSTORM WATCHES AND WARNINGS

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.

Three conditions need to occur for a thunderstorm to form. First, it needs moisture to form clouds and rain. Second, it needs unstable air, such as warm air that can rise rapidly (this often referred to as the "engine" of the storm). Third, thunderstorms need lift, which comes in the form of cold or warm fronts, sea breezes, mountains, or the sun's heat. When these conditions occur simultaneously, air masses of varying temperatures meet, and a thunderstorm is formed. These storm events can occur singularly, in lines, or in clusters. Further, they can move through an area very quickly or linger for several hours.

According to the National Weather Service, more than 100,000 thunderstorms occur each year, though only about 10 percent of these storms are classified as "severe." A severe thunderstorm occurs when the storm produces one of three elements: 1) Hail of three-quarters of an inch; 2) Tornado; 3) Winds of at least 58 miles per hour.

Thunderstorm (Wind): Aside from tornadoes, thunderstorms can produce high or 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 to aviation.

Hail: Hailstorms are a potentially damaging outgrowth of severe thunderstorms. Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until they develop to a sufficient weight and fall as precipitation. Hail typically takes the form of spheres or irregularly-shaped masses greater than 0.75 inch in diameter. The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth's surface. Higher temperature gradients relative to elevation above the surface result in increased suspension time and hailstone size.

Hailstone size can range a great deal in size from 5 millimeters (mm) (approximately pea-sized) to greater than 100 mm (approximately melon-sized). Hailstones are categorized using the TORRO Hailstorm Intensity Scale (Table 2-24). Hailstone size descriptions are located in Table 2-25.

Table 2-24 TORRO Hailstorm Intensity Scale (in millimeters)

	Intensity Category	Typical Hail Diameter	Probable Kinetic Energy, J-m²	Typical Damage Impacts	Size Code
H0	Hard Hail	5	0-20	No damage	1
H1	Potentially Damaging	5-15	>20	Slight general damage to plants, crops	1-3
H2	Significant	10-20	>100	Significant damage to fruit, crops, vegetation	1-4
H3	Severe	20-30	>300	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored	2-5
H4	Severe	25-40	>500	Widespread glass damage, vehicle bodywork damage	3-6
H5	Destructive	30-50	>800	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries	4-7
H6	Destructive	40-60		Bodywork of grounded aircraft dented, brick walls pitted	5-8
H7	Destructive	50-75		Severe roof damage, risk of serious injuries	6-9
H8	Destructive	60-90		Severe damage to multiple roof types (including sheet and metal); damage aircraft bodywork	7-10
H9	Super Hailstorms	75-100		Extensive structural damage (including concrete and wooden walls). Risk of severe or even fatal injuries to persons caught in the open	8-10
H10	Super Hailstorms	>100		Extensive structural damage (including destruction of wooden houses and damage to brick-built homes). Risk of severe or even fatal injuries to persons caught in the open	9-10

Table 2-25 TORRO Hailstorm Size Code Descriptions

Size Codes	Diameter	Relational Size
0	5-9	Pea
1	9-15	Mothball
2	16-20	Marble, grape
3	21-30	Walnut
4	31-40	Pigeon's egg > squash ball
5	41-50	Golf ball > Pullet's egg
6	51-60	Hen's egg
7	61-75	Tennis ball > cricket ball
8	76-90	Large orange > Soft ball
9	91-100	Grapefruit
10	>100	Melon

Hail annually causes more than $1 billion in damage to property and crops.[xiii] 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 is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a "bolt" when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes the thunder which often accompanies lightning strikes. While most often affiliated with severe thunderstorms, lightning may also strike outside of heavy rain and might occur as far as 10 miles away from any rainfall.

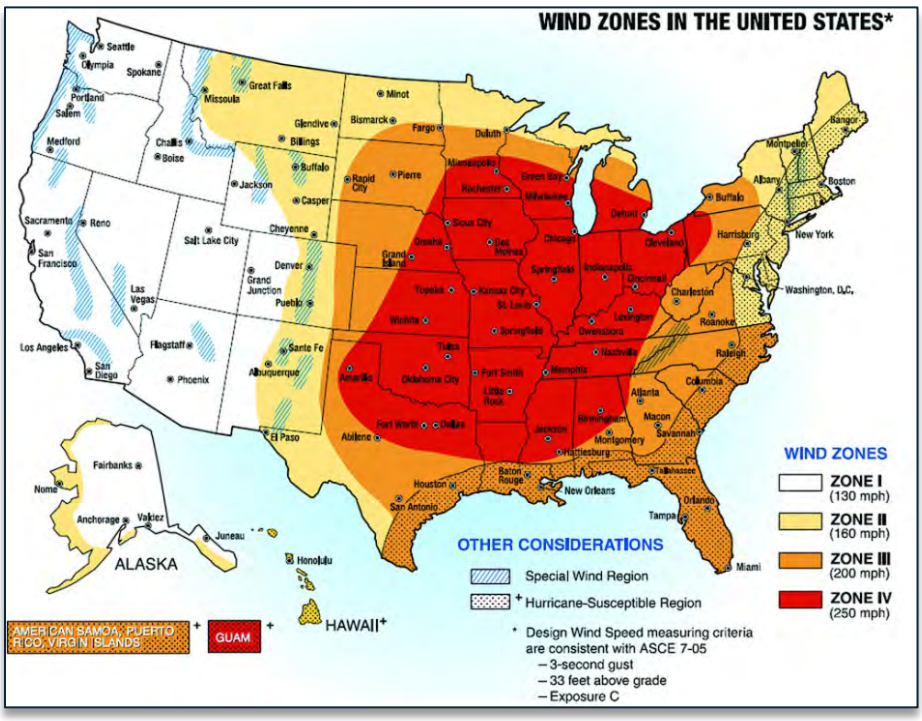
According to FEMA, lightning injures an average of 300 people and kills 80 people each year in the United States. NOAA's National Weather Service reported 42 deaths and 58 injuries from lightning for the ten year average between 2000 and 2009. Direct lightning strikes also have the ability to cause significant damage to buildings, critical facilities, infrastructure, and inventory largely by igniting a fire. Lightning is also responsible for igniting wildfires that can result in widespread damages to property.

2.5.2 Severe Summer Storms Hazard Location

Thunderstorms, including the associated hazards of wind, lightning and hail, are atmospheric hazards; thus, have the potential to occur anywhere in McHenry County.

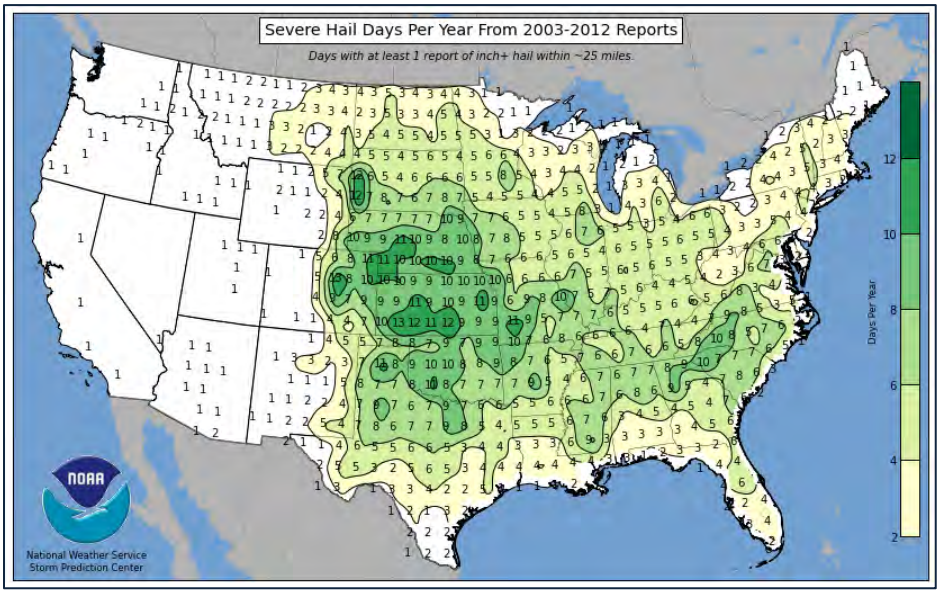
Thunderstorm (Wind): Wind can tear roofs from buildings; rip siding from walls; and throw debris through windows. They can happen anywhere in the county, and occur during multiple types of storms. The following map in Figure 2-4 from the Federal Emergency Management Agency illustrates wind zones in the United States. McHenry County is located in Wind Zone IV, where velocities can reach up to 250 mph.[xiv]

Figure 2-4 United States Wind Zone Map



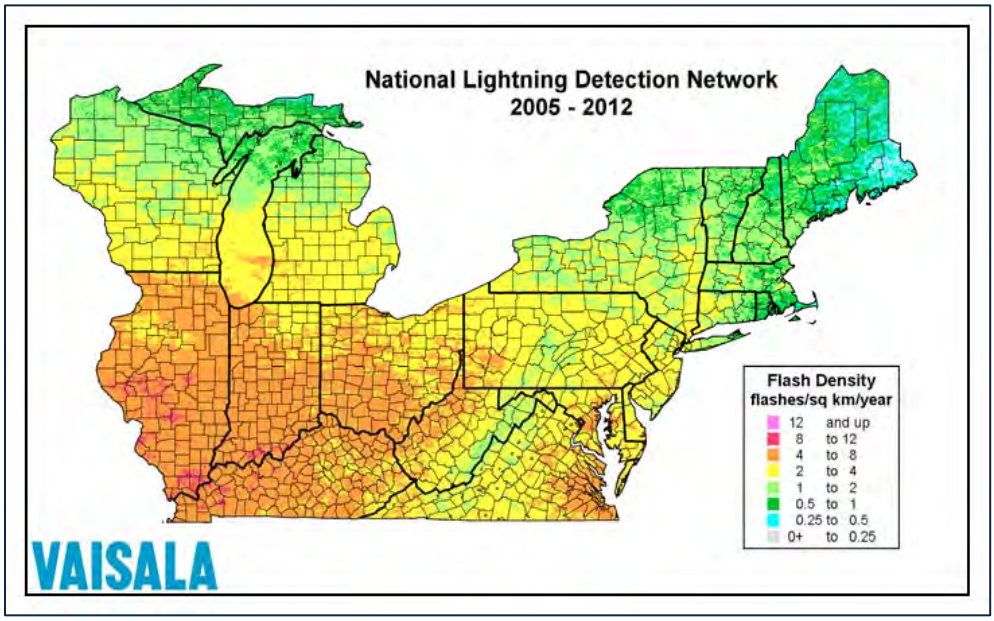
Hail: McHenry County is located in an area of the United States that receives an average of 6-8 days per year with hail events. This information is provided by the National Weather Service displayed in Figure 2-5.[xv]

Figure 2-5 United States Average Number of Days per Year with Severe Hail Events



Lightning: Lightning flash data compiled by Vaisala, Inc. with data from 2005 through 2012 shows the frequency of lightning flashes per square kilometer per year; see Figure 2-6. Most areas in McHenry County have an average of 4 - 8 flashes per square kilometer per year (about average compared to national levels).[xvi]

Figure 2-6 Average Lightning Flash per Square Kilometer per Year (2005-2012)



2.5.3 Severe Summer Storms Hazard Previous Occurrences

Thunderstorm (Wind): The NOAA's National Climatic Data Center (NCDC) Storm Events Database lists 183 recorded occurrences of thunderstorm wind events in McHenry County between 1960 and November 30, 2015. [Note: "Thunderstorm Wind" events have been recorded since 1960]. Of the 183 recorded occurrences, 157 had wind speeds of 50 knots or greater. The highest wind speed recorded in the data was 76 knots (1981 and 1983). For 28 of the recorded occurrences of thunderstorms (wind) events, the wind speed was unavailable. Of the 183 events recorded, 161of them occurred between April and August. Eighty-eight of the 143 events took place between 12:00 p.m. and 8:00 p.m., reflecting the favorable thunderstorm development environment (cooling of the atmosphere) during the afternoon and evening hours.

The data provided by the NCDC Storm Events Database indicates that between 1960 and November 30, 2015, 20 thunderstorm and high wind events caused approximately $737,000 (2015 dollars) in property damage. It should be noted, however, the property damage total includes $275,000 (2015 dollars) for two high wind events representing 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 throughout the county. See list of occurrences in Appendix XX.

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.

Hail: The Storm Events Database records show 148 recorded occurrences of hail in McHenry County between 1973 and November 21, 2015. Since the previous plan there have been 75

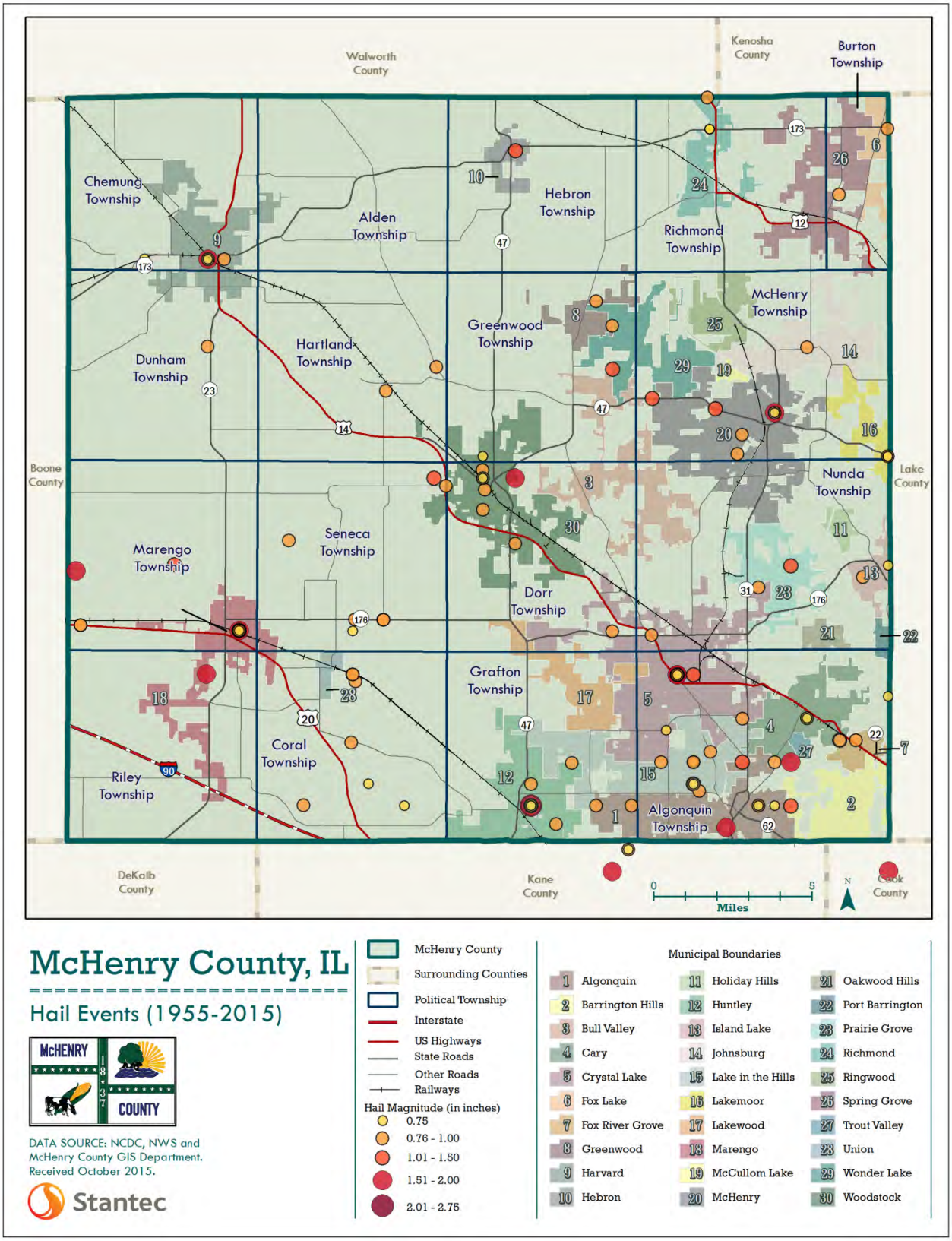
recorded occurrences by the NCDC, and all produced hailstones three quarters of an inch or larger. Ninety-three of the 148 events took place between May and July. The location and size of the hail events that cause are presented in Exhibit 2-4. These events did not result in any reported deaths or injuries.

The data provided by the Storm Events Database indicates that hail caused approximately $161,000 in property damage between 1973 and November 21, 2015. Of the 148 recorded occurrences, damages were only recorded for four events; details shown in Table 2-26. See Appendix XX for all hail occurrences.

Table 2-26 Hail Events with Recorded Damages

Event Date	Area Impacted	Hail Size	Reported Damage (2015 dollars)	Event Details
April 13, 2006	Marengo	1.00 inch	$5,970	Quarter size hail dented siding on a house and a vehicle.
October 2, 2006	Marengo	1.5 inch	$89,550	Walnut size hail dented houses and cars in Marengo.
July 2, 2008	Algonquin	1.00 inch	$59,700	Extensive siding damage to homes was reported from wind blown hail.
May 11, 2011	Crystal Lake	1.5 inch	$5,630	Walnut size hail was reported at the intersection of Main Street and Route 14 causing damage to cars.
Total			**$160,850**	

Exhibit 2-4 Hail Events in McHenry County (1955-2015)



Lightning: The Storm Events Database records show 20 recorded occurrences of lightning strikes in McHenry County between 1996 and November 21, 2015 (Table 2-27). These 20 recorded occurrences were produced by 16 weather events. There was one weather event that produced two recorded lightning strikes.

The data provided by the Storm Events Database indicates that lightning strikes caused nearly $1,000,000 (2015 dollars) in property damage between 1996 and November 21, 2015. Four of the occurrences totaled $100,000 or more in property damages. 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 2-27 Lightning Events Reported in McHenry County 1996 through 2015

Date	Location	Deaths/ Injuries	Property Damage (2015 dollars)	Crop Damage	Event Details
8/5/1996	Woodstock	0/0	$200,000	$0	Lightning strikes knocked out power at the Woodstock swimming pool and struck power lines and equipment in 25 different places throughout McHenry County. The roof of an apartment building caught fire after being struck by lightning, with damages estimated at $200,000.00.
5/10/2001	Woodstock	0/0	$1,000	$0	Lightning ignited the wooden roof of an historic old home causing one thousand dollars' damage. The house was built in 1852.
9/3/2001	Marengo	0/0	$10,000	$0	A line of thunderstorms moved into extreme northern Illinois during the late afternoon and early evening of Sept. 3, 2001. Trees were blown down in Fox Lake in Lake County and trees and power lines were blown down in Spring Grove and Crystal Lake in McHenry County. Dime size hail fell in Marengo in McHenry County. A house was struck by lightning and the roof caught fire in Marengo.
9/7/2001	Harvard	0/0	$0	$0	Lightning struck a radio tower knocking out a transmitter which had to be replaced.
10/2/2005	Lakewood	0/0	$10,600	$0	--
5/30/2006	Woodstock	0/0	$1,000	$0	Lightning strike at IL 47 and Donovan Road brought down power lines
7/17/2006	Crystal Lake	0/0	$20,000	$0	A home on Saddle Ridge Road was struck by lightning, which started a fire in the attic.
7/9/2007	Marengo	0/0	$100,000	$0	Lightning struck a two-story house starting a fire which caused significant damage.
7/9/2007	Lake In The Hills	0/0	$50,000	$0	Lightning struck a house causing a fire in the attic, which sustained extensive damage. The rest of the house was uninhabitable.
6/8/2008	Lake In The Hills	0/0	$5,000	$0	A house was struck by lightning on Heaven's Gate Street.
8/8/2008	McCullom Lake	0/0	$110,000	$0	--
6/19/2009	Crystal Lake	0/0	$50,000	$0	Lightning struck a house along Canterbury Drive and started a fire in the bathroom. The house was declared uninhabitable.
6/21/2011	Wonder Lake	0/0	$11,255	$0	Lightning struck a house in the 5300 block of East Wonder Lake Road and started a fire in the attic.

Date	Location	Deaths/ Injuries	Property Damage (2015 dollars)	Crop Damage	Event Details
7/11/2011	Richmond and Ringwood	0/0	$11,255	$0	Lightning struck a 40-foot oak tree which then fell onto a car, blowing out the rear window and heavily damaging the trunk and vinyl roof of the convertible. The tree also caused some damage to the roof and gutter of a garage.
7/11/2011	Richmond and Ringwood	0/0	$11,255	$0	A lightning strike ignited a fire in the steeple of a former church on Hill Road. There was slight damage to the roof and some water damage.
7/11/2011	Richmond and Ringwood	0/0	$11,255	$0	Lightning struck a village pump house on Valley Drive melting wiring and destroying the water pump.
7/27/2011	Fox River Grove	0/0	$196,964	$0	Lightning started a fire which destroyed the roof of a 2200 square foot home on Glenhurst Court.
7/27/2011	Woodstock	0/0	$11,255	$0	Lightning knocked ornamental stonework from the bell tower of the Woodstock Opera House.
3/17/2012	Woodstock	0/0	$5,464	$0	Lightning struck a satellite dish on the roof of a building of condos, which started a fire in the attic. Only minor damage was reported and the condo remained habitable.
6/30/2014	Silver Lakes (Unincorporated)	0/0	$66,950	$0	Lightning struck a house and caused a fire in the attic on Ned Drive.
Totals		**0/0**	**$991,457**	**$0**	

2.5.4 Severe Summer Storms Hazard Extent

Thunderstorm (Wind): Thunderstorm wind extent is measured in terms of wind speed. Over 85 percent of wind events had gusts exceeding 50 mph. The greatest sustained wind reported in McHenry County was 76 miles per hour. However, stronger gusts are possible. Extent can also be measured in terms of damage. The greatest amount of damage reported from a single thunderstorm wind event was $100,000. However, costlier events are possible.

Hail: According to the TORRO scale, hailstones can exceed 100 mm (3.9 inches) in diameter, known as super hail. The largest hailstone recorded in McHenry County since 1955 was 2 inches. Hailstones of this size are considered destructive and can damage vehicle bodywork, dent aircrafts, and pit holes in bricks. Extent can also be measured in terms of damage and human impacts (including loss of life and injuries). The greatest amount of damage reported from a single hail event was almost $90,000 (2015 dollars). However, costlier events are possible.

Lightning: According to Figure 2-6, most of McHenry County receives 4 – 8 flashes of lightning per square mile per year. Not all of these flashes result in lightning strikes, however. Lightning can also be measured in terms of damage caused. All events but one had recorded damage loss; the greatest amount of damage reported from a single lightning event was $200,000. However, costlier events, as well as deaths and injuries are possible.

2.5.5 Severe Summer Storms Hazard Probability of Future Occurrences

Overall, the thunderstorm hazard has a highly likely (greater than 90 percent annual chance) estimated annual chance of occurrence. These events are most common in the summer months.

Thunderstorm (Wind): A total of 183 events were reported over 55 years (1960-2015), with events recorded in each year. This is well over 100 percent annual probability of occurrence. Therefore, a probability of "highly likely" (greater than 90 percent annual chance) was assigned.

Hail: A total of 148 events were reported over 42 years (1973-2015), with events recorded in each year, and 75 events in the last five years alone. This is well over 100 percent annual probability of occurrence. Therefore, a probability of "highly likely" (greater than 90 percent annual chance) was assigned.

Lightning: A total of 21 events were reported over 20 years. This results in approximate annual probability 100 percent. It is also likely the data is not inclusive of all events in the area. Lightning flashes and strikes are an annual occurrence, though all events may not result in damage. Therefore, a probability of highly likely (greater than 90 percent annual chance) was assigned.

2.5.6 Severe Summer Storms Hazard Vulnerability Assessment

All of McHenry County, including current and future buildings, populations, infrastructure, and other assets, is vulnerable to severe storms due to the topography and movement of weather fronts through the area. During a thunderstorm, the presence of hail, high wind, rain, and lightning poses the threat of property damage, injury and death. Injuries, crop damage, and building damage have been reported in McHenry County for each thunderstorm event type.

Health and Safety: Three injuries and one death have been attributed to severe storms in McHenry County, but there have not been any associated injuries or deaths since the previous version of this Plan (between 2010 and November 21, 2015). However, there is always a threat to life and safety present with the occurrence of severe summer storms. The National Weather Service reported that between 2000 and 2014, 61 people in Illinois were killed by flash floods, wind, and lightning brought by thunderstorms. Since 1940, there has been an average of 27 deaths per year in the United States caused by lightning. Hail rarely causes loss of life, but it is possible; hail more commonly results in injuries and property damage.

No special health problems are attributable to thunderstorms, other than the potential for tetanus and other diseases that could arise from injuries and damaged property. Impact to health and safety for severe summer storms is considered moderate.

Damage to Buildings and Critical Facilities: Damage to roofs and cars is frequently reported as a result of hail and wind events. Depending on the hail size and wind severity, damage to awnings, glass, and siding can also occur. In addition, lightning may results in structural fires and loss of electrical equipment.

The critical infrastructure of most concern during a severe storm is infrastructure supplying electricity. Severe winds, lightning, and falling branches/trees can damage substations, transformers, poles, and power lines, resulting in power outages.

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 wind, lightning, and downed branches/trees. Businesses can also be affected by power outages. However, with the common occurrence and generally limited extent of damages associated with severe summer storms, recovery is relatively quick by utility companies. Economic impact for severe summer storms is considered low.

Climate Change Impact: The influence on changing climatic conditions on the severe storms is still ongoing. Many scientists have concluded that extreme rain events are happening more frequently, and that a warmer atmosphere with more water vapor in it is making such events more likely. The warmer the air, the greater the ability to hold more water vapor. This ability increases by almost 4% with each Fahrenheit degree increase. This means that on average storms have slightly more water available for precipitation increasing the storm energy. Warmer air temperatures have been linked to increased lightning strikes by about 12 percent per degree Celsius of warming (give or take 5 percent). However, there is data suggesting that the disproportionate warming in the Arctic will lead to less wind shear in mid-latitude areas causing severe thunderstorms to be less frequent. In general, a trend in rising temperatures may result in more severe and more frequent storm events.

2.6 Severe Winter Storms and Extreme Cold Hazard

2.6.1 Severe Winter Storms and Extreme Cold Hazard Description

A winter storm is an event in which varieties of precipitation are formed that only occur at low temperatures, such as snow, sleet, freezing rain or ice. Snow storms generally occur with the clash of different types of air masses, with differences in temperature, moisture, and pressure; specifically when warm moist air interacts with cold dry air. Snow storms that produce a lot of snow require an outside source of moisture, such as the Gulf of Mexico or the Atlantic Ocean.

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

Blizzard: A blizzard is a severe snow storm with winds in excess of 35 mph and visibility of less than a 1/4 mile for more than 3 hours.

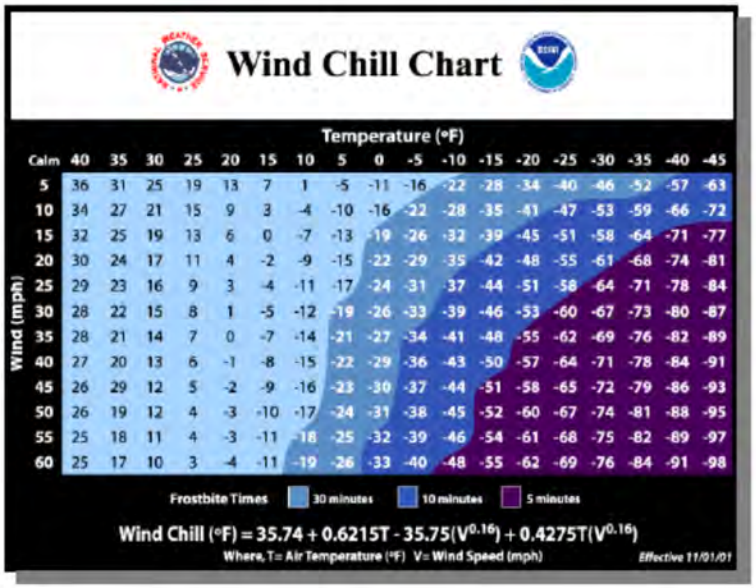
Ice Storm, Sleet, and Freezing Rain: An ice storm is defined as a storm with significant amounts of freezing rain and is a result of warm air in between two layers of cold air. With warmer air above, falling precipitation in the form of snow melts, then becomes either super-cooled (liquid below the melting point of water) or re-freezes.

In the former case, super-cooled droplets can freeze on impact (freezing rain), while in the latter case, the re-frozen water particles are ice pellets (or sleet). Sleet is defined as partially frozen raindrops or refrozen snowflakes that form into small ice pellets before reaching the ground. They typically bounce when they hit the ground and do not stick to the surface. However, it does accumulate like snow, posing similar problems and has the potential to accumulate into a layer of ice on surfaces. Freezing rain, conversely, usually sticks to the ground, creating a sheet of ice on the roadways and other surfaces. 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.

Winter storms are defined differently in various parts of the country relevant to their standard weather. Two inches of snow may create serious disruptions to traffic in areas where snowfall is not expected; however, this may be considered a light dusting in regions where snowfall is typical. Therefore, there are multiple ways in which to measure a winter storm, based on snowfall, temperatures, wind speeds, societal impact, etc.

Extreme Cold: The term "extreme cold" can have varying definitions in hazard identification. It may or may not be associated with a winter storm. 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.

Figure 2-7 NOAA Wind Chill Index



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
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

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

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

Effective 11/01/01

The Wind Chill Index (see Figure 2-1)[xvii] 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. Exposure 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 health impacts.

Frostbite and hypothermia are both extreme cold-related impacts 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.

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

Hypothermia 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.

Figure 2-8 Winter Storm Warnings

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, and then the generic Winter Storm Warning or Winter Storm

2.6.2 Severe Winter Storms and Extreme Cold Hazard Location

All of McHenry County is susceptible to the winter storm hazard.

2.6.3 Severe Winter Storms and Extreme Cold Hazard Previous Occurrences

Various sources were used to understand the previous occurrences for the Severe Winter Storms and Extreme Cold Hazard. Together these sources show approximately 20 deaths, 1,500 injuries, and over $4 million in damages.

The Storm Events Database records lists 56 recorded occurrences of severe winter storm and extreme cold events in McHenry County between 1996 and November 21, 2015 (Table 2-29). Previous occurrences are totaled by type in the table as well. At least one severe winter storm has occurred every year since 1996, except for 2001. The years with the most severe winter storm occurrences were 2007 (6 events), 2008 (9 events), and 2009 (7 events). Although there are only 20 years of NCDC recorded severe winter storm events, there have been numerous other historical severe winter storms in McHenry County. These events resulted in three deaths and two injuries.

There have been reported 34 deaths for McHenry County (Zone) events, although, not all of those events occurred in McHenry County. Details regarding winter storm-related deaths and injuries are listed in Table 2-28. Certainly, numerous other injuries for McHenry County residents can be associated with severe winter storms and extreme cold events, but nearly all go unreported.

Table 2-28 Winter Storm Previous Occurrences (1996 - 2015)

Jurisdiction	Type of Winter Storm Event	Date	Damages (2015 Dollars)	Injuries/ Deaths*	Event Details
McHenry County	Extreme Cold/Cold/Wind Chill	2/2/1996	$0	0/0	Temperatures remained below zero for almost 70 hours. Lowest temperature recorded was -33°F. Three deaths associated with event, but not in McHenry County.
McHenry County	Winter Storm	1/9/1997	$0	0/0	Between 7" and 9" of snow was reported.
McHenry County	Extreme Cold/Cold/Wind Chill	1/10/1997	$0	0/1	A man died while clearing snow at a local high school.
McHenry County	Winter Storm	1/15/1997	$0	0/0	Winds were recorded near 40 knots, temperatures reached -42°F in Chicago, and 5 deaths were recorded in Cook County. (Cook County borders McHenry to the southeast).
McHenry County; Barrington	Heavy Snow	1/8/1998	$0	0/0	Heavy snows were recorded in and around Barrington. Max snowfall recorded was 7.5 inches.
McHenry County; Harvard	Heavy Snow	1/1/1999	$0	0/0	Around 22 inches of snow was recorded in Chicago. In Harvard, 9 inches was recorded. In the region, $12 million was spent on snow removal efforts, and 300 flights were cancelled at nearby airports.
McHenry County; Barrington	Heavy Snow	2/18/2000	$0	0/0	The City of Barrington recorded a max of 10 inches; an estimated 600 flights were cancelled in the area. There were also numerous accidents in the region due to poor visibility and slick road conditions.

Jurisdiction	Type of Winter Storm Event	Date	Damages (2015 Dollars)	Injuries/ Deaths*	Event Details
McHenry County	Blizzard	12/11/2000	$0	0/0	While there is no specific data related to McHenry County for this event, the event was declared both a federal and state disaster for the county. Winds reached 40 mph, wind chill averaged 35-40 below zero, and nearly 14 inches of snow was recorded in some areas. Some homeless shelters could not open due to inaccessibility for staff, essentially all air travel was canceled, and one Boeing 727 slid off the runway during landing. There were 19 deaths due to heart failure and/or hypothermia. It is uncertain how many, if any, deaths occurred in McHenry County.
McHenry County	Winter Storm	1/31/2002	$0	0/0	Areas received one quarter inch of ice from freezing rain during the early morning hours of January 31st. Many utility poles, power lines, trees and tree limbs were knocked down by the ice causing several power outages.
McHenry County	Winter Storm	3/2/2002	$0	0/0	Snowfall was measured at 10 inches near O'Hare airport.
McHenry County	Extreme Cold/Cold/Wind Chill	1/23/2003	$0	0/0	One death resulted from cold exposure (not in McHenry County).
McHenry County; Cary	Winter Storm	3/4/2003	$0	0/0	Snowfall was reported at 7.3 inches in Cary.
McHenry County	Extreme Cold/Cold/Wind Chill	1/29/2004	$0	0/0	Wind chills between -20°F and 34°F
McHenry County	Frost/Freeze	5/3/2004	$0	0/0	Temperatures were below freezing.
McHenry County, Harvard, Spring Grove, and Woodstock	Heavy Snow	1/4/2005	$0	0/0	Snowfall was recorded as follows: 8.3 inches in Spring Grove; 8.1 inches in Woodstock; 6.0 inches in Harvard.
McHenry County	Heavy Snow	1/21/2005	$0	0/0	McHenry reported 11.5 inches of snow accumulation.
McHenry County, Barrington, and Spring Grove	Winter Storm	1/20/2006	$0	0/0	In Barrington, 11 inches of snow was reported, and in Spring Grove 6.7 inches was reported.
McHenry County	Extreme Cold/Cold/Wind Chill	2/18/2006	$0	0/0	One man died due to exposure (north of Chicago).
McHenry County, Harvard, and Woodstock	Winter Storm	11/30/2006 – 12/1/2006	$0	0/0	Snowfall was recorded as follows: 14.8 inches in Harvard; 12.1 inches in Woodstock
McHenry County; Crystal Lake	Extreme Cold/Cold/Wind Chill	2/3/2007	$0	0/0	Temperatures ranged from -9°F to -14°F from the 4th-6th.
McHenry County, Island Lake, and Spring Grove	Blizzard	2/13/2007	$0	0/0	Snowfall was recorded as follows: 7.0 inches in Island Lake and 6.3 inches in Spring Grove.

Jurisdiction	Type of Winter Storm Event	Date	Damages (2015 Dollars)	Injuries/ Deaths*	Event Details
McHenry County	Blizzard	2/25/2007	$0	0/0	Snowfall of 5 inches was recorded in both Harvard and Woodstock. There were numerous vehicle accidents and downed powerlines throughout the region.
McHenry County	Ice Storm	12/1/2007	$0	0/0	South of the City of McHenry, one-quarter inch of ice accumulation was reported.
McHenry County; City of McHenry	Winter Storm	12/4/2007	$0	0/0	Snowfall was measured at 6.5 inches in McHenry.
McHenry County	Heavy Snow	12/15/2007	$0	0/0	Snowfall ranged from 6 to 8 inches throughout the region.
McHenry County	Winter Storm	1/31/2008 – 2/1/2008	$0	0/0	Snowfall ranged from 6 to 10 inches throughout the region.
McHenry County' Cary and Woodstock	Winter Storm	2/5/2008	$0	0/0	Snowfall was recorded as follows: ranges of 9-14 inches in Woodstock and 12.5 inches in Cary.
McHenry County	Extreme Cold/Cold/Wind Chill	2/10/2008	$0	0/0	Temperatures ranged from -5°F to -10°F with wind chills of -25°F to -35°F.
McHenry County; Woodstock	Winter Storm	2/25/2008	$0	0/0	Snowfall was measured at 6.6 inches in Woodstock.
McHenry County; Spring Grove	Winter Storm	3/21/2008	$0	0/0	Snowfall was measured at 7 inches in Spring Grove.
McHenry County	Winter Storm	12/19/2008	$0	0/0	Heavy snow fell across the region measuring between 6-9 inches in McHenry County. Snow, ice, and sleet cause multiple car accidents.
McHenry County	Blizzard	12/21/2008	$0	0/0	One to two inches of snow fell atop the layer of snow from 12/19. Blizzard conditions resulted in wind gusts of 40 mph and visibility dropped to zero in some locations.
McHenry County	Extreme Cold/Cold/Wind Chill	12/21/2008	$0	0/0	A combination of temperatures between -5°F to -10°F and wind speeds of 20- 30 mph caused wind chill to drop to -35°F.
McHenry County; Fox Lake	Winter Storm	1/9/2009	$0	0/0	Snowfall was measured at 8.7 inches in Fox Lake.
McHenry County	Extreme Cold/Cold/Wind Chill	1/15/2009	$0	0/0	Temperatures fell between -15°F to -20°F and wind chill to dropped between -30°F and -45°F.
McHenry County	Extreme Cold/Cold/Wind Chill	1/24/2009	$0	0/1	Temperatures ranged between -5°F and 0°F. In Chicago a 74 year-old man died due to cold exposure, and in Johnsburg, McHenry County, a 17 year-old passed from hypothermia.
McHenry County, Algonquin, and Bull Valley	Winter Storm	3/28/2009	$0	0/0	Snowfall was recorded as follows: 6.5 inches in Algonquin and 7.0 inches near Bull Valley.
McHenry County, Bull Valley, Hebron, and Wonder Lake	Winter Storm	12/8/2009	$0	0/0	Snowfall was recorded as follows: 7.8 inches near Bull Valley, 8.6 inches near Hebron, and 6.7 inches near Wonder Lake.

Jurisdiction	Type of Winter Storm Event	Date	Damages (2015 Dollars)	Injuries/ Deaths*	Event Details
McHenry County	Ice Storm	12/23/2009	$0	0/0	A mixture of sleet and freezing rain fell across the area. Some areas received a quarter to a half inch of ice accumulation. Trees, tree limbs, and powerlines fell throughout the region due to the weight of the ice.
McHenry County, Barrington, Island Lake, and Woodstock	Winter Storm	12/26/2009	$0	0/0	Snowfall was recorded as follows: 9.2 inches near Barrington, 7.5 inches in Island Lake, and 10 inches in Woodstock.
McHenry County, Barrington, and Spring Grove	Winter Storm	1/7/2010	0	0/0	Snowfall was recorded as follows: 8.0 inches near Barrington and 8.3 inches near Spring Grove.
McHenry County and McHenry	Winter Storm	2/8/2010	0	0/0	Snowfall ranged from 7-14 inches across the region, with 8.3 inches recorded in McHenry.
McHenry County	Winter Storm	12/11/2010	0	3/0	Snowfall ranged between 1 and 3 inches, with wind gusts between 45 and 55 mph creating near whiteouts/blizzard-like conditions. A 19 year-old was killed in Ogle County, a 14 car pile-up sent injured 5 people, and a flipped car in Woodstock injured 3 people.
McHenry County, McHenry, Barrington, and Hebron	Blizzard	2/1/2011	$0	0/0	Highest snowfall totaled 21.1 inches near McHenry, 17.0 inches in Barrington, and 15.3 inches in Hebron. Blizzard conditions reduced visibility, and thousands of motorists were left stranded throughout the region.
McHenry County	Winter Storm	1/12/2012	$0	0/0	Snowfall was recorded as follows: 6.0 inches near Algonquin and 6.0 inches in Harvard. A 77 year-old woman died shoveling snow in Des Plaines.
McHenry County	Winter Storm	1/20/2012	$0	0/0	Snowfall ranged between 1 and 8 inches.
McHenry County, Bull Valley, Cary, and Woodstock	Winter Storm	2/23/2012	$0	0/0	Snowfall was recorded as follows: 9.3 inches near Bull Valley, and 8.5 inches near Cary, and 7.8 inches near Woodstock. An 80 year-old man died clearing snow in Buffalo Grove (about 20 miles east of McHenry County's southeastern border).
McHenry County, Fox Lake, Hebron, Lakemoor, Spring Grove, Wonder Lake, and Woodstock	Heavy Snow	2/7/2013	$0	0/0	Snowfall ranged between 6-8 inches across McHenry County, including 8.2 inches near Fox Lake, 6.7 inches in Hebron, 6.2 inches near Lakemoor, 8.1 inches near Spring Grove, 6.7 inches near Wonder Lake, and 8.0 inches near Woodstock.
McHenry County, Fox Lake, Lakemoor, McHenry, Richmond, Wonder Lake	Heavy Snow	2/26/2013	$0	0/0	Snowfall was recorded as follows: 9.1 inches near Fox Lake, 8.0 inches near Lakemoor, 8.2 inches in McHenry, 10.1 inches in Richmond, and 9.8 inches near Wonder Lake.

Jurisdiction	Type of Winter Storm Event	Date	Damages (2015 Dollars)	Injuries/ Deaths*	Event Details
McHenry County; Woodstock	Winter Storm	3/5/2013	$0	0/0	Snowfall ranged between 6-10 inches across the region, including 7.5 inches in Woodstock.
McHenry County; Harvard	Heavy Snow	12/21/2013	$0	0/0	Snowfall ranged between 6-8 inches across the region, including 7.0 inches in Harvard.
McHenry County	Extreme Cold/Cold/Wind Chill	1/6/2014	$0	0/0	Wind chills in the region fell between -40°F and -50°F. There were 4 deaths reported in Cook County due to hypothermia/cold exposure.
McHenry County; Harvard	Heavy Snow	2/1/2015	$0	0/0	Event produced blizzard conditions with wind gusts >35 mph and low visibilities. One of the highest snowfall reports was in Harvard at 18 inches. Whiteout conditions stranded some vehicles in McHenry County.
McHenry County	Heavy Snow	3/23/2015	$0	0/0	Snowfall ranged between 5-7 inches across the region, including 6.3 inches in Bull Valley.

Summary of Event Types						
Blizzard	Extreme Cold/Cold/Wind Chill	Frost/Freeze	Heavy Snow	Ice Storm	Winter Storm	Total Events
5	11	1	11	2	24	56

*NCDC Totals 3 injuries and 2 deaths in McHenry County due to winter weather; it is possible more have occurred but were unreported.

2.6.4 Severe Winter Storms and Extreme Cold Hazard Previous Extent

The severity of the winter storm or blizzard can be measured in terms of amount of snow or ice accumulation, loss of human life and animal life, or by economic costs imposed by property and infrastructure loss.

There were no specific property damage estimates available for any of the 56 events; however, the 2013 Illinois Hazard Mitigation Plan does list some information regarding generalized loss due to severe winter storms (see Table 2-29).[xviii]

Table 2-29 McHenry County Winter Storm Loss Estimates

2013 Loss Estimates from Illinois State HMP		
Total Recorded Loss	Average Loss in Property Damage Per Event	Estimated Annual Loss
$4,070,477	$83,070.96	$78,278.40

2.6.5 Severe Winter Storms and Extreme Cold Hazard Probability of Future Occurrence

There is an average of 3 severe winter storm events per year based on the Storm Events Database records since 1996, and there was only one year without a recorded event. Events prior to those in the NCDC Storm Events Database are assumed to have a similar frequency as to those recorded occurrences, and winter storm events are considered an annual occurrence in the county. The Illinois State Hazard Mitigation Plan states that there have only been 5 years since 1900 where temperatures did not reach below zero, and there is an average of five severe

winter storms in the state each year. Therefore, the probability of severe winter storms is considered "highly likely" (greater than 90 percent annual chance of occurrence).

2.6.6 Severe Winter Storms and Extreme Cold Hazard Vulnerability Assessment

All of McHenry County, including current and future buildings, populations, infrastructure, and other assets, is vulnerable to severe winter storms hazards. Severe winter storms can lead to power outages, closed highways/travel difficulties, increased automobile accidents, closed schools and businesses, downed trees and branches, hypothermia, frostbite, injuries (including falling), and loss of life. Blizzard and whiteout conditions can inhibit emergency response as well as limit access to medical care or emergency shelters.

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. According to the National Weather Service's Weather Fatality Statistics, an average of nine deaths per year are attributable to winter storms and extreme cold in Illinois (based on data from 1996-2014).[xix]

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 storms 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 from 2004 through 2014 were evaluated to determine the number of accidents that occur.[xx] The results in Table 2-30 suggest that winter driving conditions should be taken seriously in McHenry County.

Table 2-30 Vehicle Crashes during Winter Conditions

Year	Icy Conditions	Snow/Slushy Conditions	Injuries	Deaths
2004	171	486	152	2
2005	177	611	141	1
2006	93	292	76	3
2007	259	915	288	6
2008	371	1,124	307	4
2009	291	548	157	0
2010	84	328	86	1
2011	194	289	92	1
2012	80	308	73	0
2013	257	480	130	1
2014	38	85	19	0
Total	2,015	5,466	1,521	19

Source: IDOT/*Deaths are not all accounted for in Previous Occurrence Data Above

While the majority of injuries during severe winter storms are automobile related, about 25 percent of winter storm injuries occur to people who are stranded 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 bodily tissue – examples: hands, feet, ears, and nose), and hypothermia (lowering of body temperature below 95^{0}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 can vary from several hours to several days.

Dangerous driving conditions frequently occur during and shortly after severe winter storms. 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 as well. Impact to buildings and critical facilities for severe winter storms is considered moderate.

Economic Impact: Loss of power during a severe winter storm means businesses and/or public facilities 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.

An average snow storm requires 12 hours of work each day for two days, consuming approximately 40 tons of road salt, 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.

Economic impact for severe winter storms is considered low.

Climate Change Impact: Climate change impact could have mixed impacts on winter weather in the county. According to the National Climatic Assessment, waves of extreme cold

temperatures have reached their lowest levels on record since 1895. Increasing temperatures in the winter pose a threat to the glacial ice coverage on the Great Lakes, which has the potential to increase the impacts of other hazards.

La Niña effects would cause a more northern storm track that often brings higher than average snowfall to the northern third of the U.S. and less snow to southern areas, so winters are typically warmer and wetter than average.

2.7 Tornado

2.7.1 Tornado Hazard Description

Figure 2-9 Tornado Alerts

TORNADO ALERTS

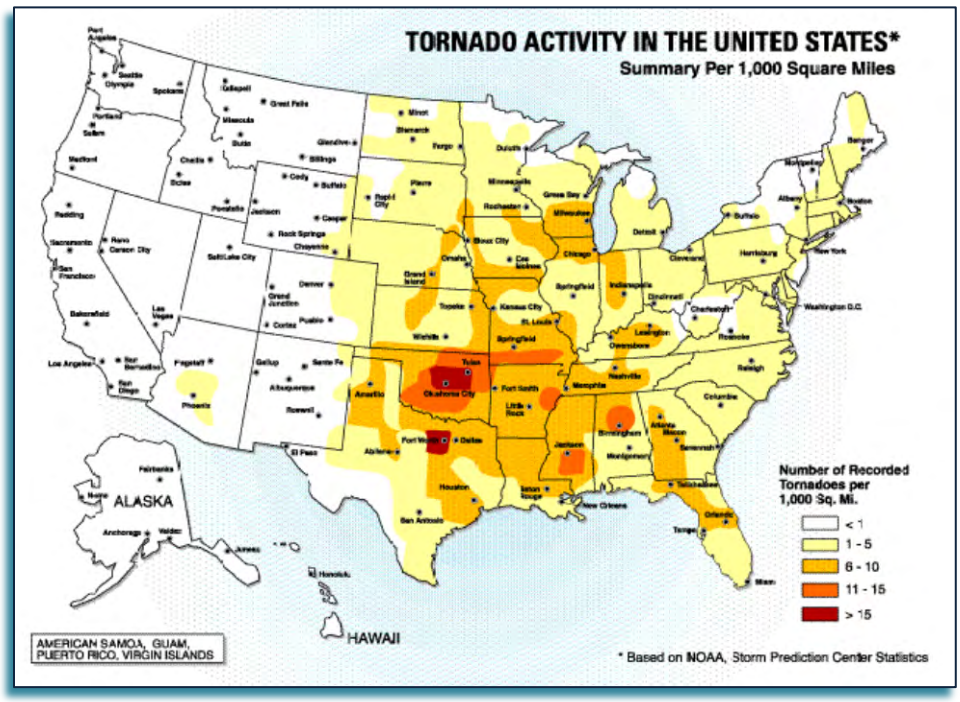
The National Weather Service Weather Forecast Office in Chicago, Illinois is responsible for issuing tornado watches or warnings for McHenry County depending on the weather conditions. The following provides a brief description of each type of alert.

- **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 seek shelter immediately.

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. Tornadoes are most often generated by thunderstorm activity (but sometimes result from hurricanes and other tropical storms) when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The damage caused by a tornado is a result of the high wind velocity and wind-blown debris, also accompanied by lightning or large hail. According to the National Weather Service, tornado wind speeds normally range from 40 miles per hour to more than 300 miles per hour. The most violent tornadoes have rotating winds of 250 miles per hour or more, are capable of causing extreme destruction, and can turning normally harmless objects into deadly missiles.

Each year, an average over 800 tornadoes are reported nationwide, resulting in an average of 80 deaths and 1,500 injuries. According to the NOAA Storm Prediction Center (SPC), the highest concentration of tornadoes in the United States has been in Oklahoma, Texas, Kansas and Florida, respectively. Although the Great Plains region of the Central United States does favor the development of the largest and most dangerous tornadoes (earning the designation of "Tornado Alley"), Florida experiences the greatest number of tornadoes per square mile of all U.S. states (SPC, 2002). Figure 2-10 shows tornado activity in the United States based on the number of recorded tornadoes per 1,000 square miles.[xiv]

Figure 2-10 United States Tornado Activity



Tornadoes are most likely to form in the late afternoon and early evening. Most tornadoes are a few dozen yards wide and touchdown briefly, but even small short-lived tornadoes can inflict tremendous damage. Highly destructive tornadoes may carve out a path over a mile wide and several miles long.

The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction, including residential dwellings (particularly mobile homes). Tornadic magnitude is reported according to the Fujita and Enhanced Fujita Scales. The Enhanced Fujita Scale, see Table 2-32, identifies six different categories of tornadoes, EF0 through EF5. Prior to 2005, the NWS used the Fujita Scale. Tornado magnitudes prior to 2005 were determined using the traditional version of the Fujita Scale, Table 2-31. Tornado magnitudes that were determined in 2005 and later were determined using the Enhanced Fujita Scale, Table 2-32. Most of the historical data available on McHenry County tornadoes is based on the original Fujita Scale.

Table 2-31 The Fujita Scale (Effective Prior to 2005)

F-SCALE NUMBER	INTENSITY	WIND SPEED	TYPE OF DAMAGE DONE
F0	GALE TORNADO	40–72 MPH	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
F1	MODERATE TORNADO	73–112 MPH	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	SIGNIFICANT TORNADO	113–157 MPH	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	SEVERE TORNADO	158–206 MPH	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
F4	DEVASTATING TORNADO	207–260 MPH	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	INCREDIBLE TORNADO	261–318 MPH	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.
F6	INCONCEIVABLE TORNADO	319–379 MPH	These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 wind that would surround the F6 winds. Missiles, such as cars and refrigerators would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies.

Table 2-32 The Enhanced Fujita Scale (Effective 2005 and Later)

EF-SCALE NUMBER	INTENSITY PHRASE	3 SECOND GUST	TYPE OF DAMAGE DONE
EF0	GALE	65–85 MPH	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
EF1	MODERATE	86–110 MPH	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
EF2	SIGNIFICANT	111–135 MPH	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	SEVERE	136–165 MPH	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF4	DEVASTATING	166–200 MPH	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
EF5	INCREDIBLE	Over 200 MPH	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.

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.

Illinois has averaged 64 tornadoes annually. Over 60% of the tornadoes in Illinois occur between March and May, but this natural hazard can occur at any time during the year. According to the National Weather Service Weather Fatalities Database, Illinois has averaged two tornado fatalities per year since 1996, but this number varies widely from year to year.[xix]

2.7.2 Tornado Hazard Location

It cannot be predicted where a tornado will strike, so all of McHenry County is subject to a tornado event. Illinois is located in the northwest portion of "Tornado Alley," the area of the United States most prone to tornado activity.

2.7.3 Tornado Hazard Previous Occurrences

Table 2-33 summarizes the previous occurrences as well as the extent or magnitude of tornado events recorded in McHenry County. The NCDC Storm Events Database records show 18 recorded occurrences of tornadoes in McHenry County between 1958 and November 2015, and the NOAA Storm Prediction Center data indicates an additional five.

These 23 recorded tornadoes were produced by 20 weather events. There were three different weather events where two tornadoes were produced. The paths of the recorded tornadoes are shown in Exhibit 2-5.

The data provided by the Storm Events Database and Storm Prediction Center indicates tornadoes caused approximately $275 million (2015 dollars) in property damage between 1958 and November 2015. Those events showing no property damage may have resulted in losses; however, such data is unavailable (not reported).

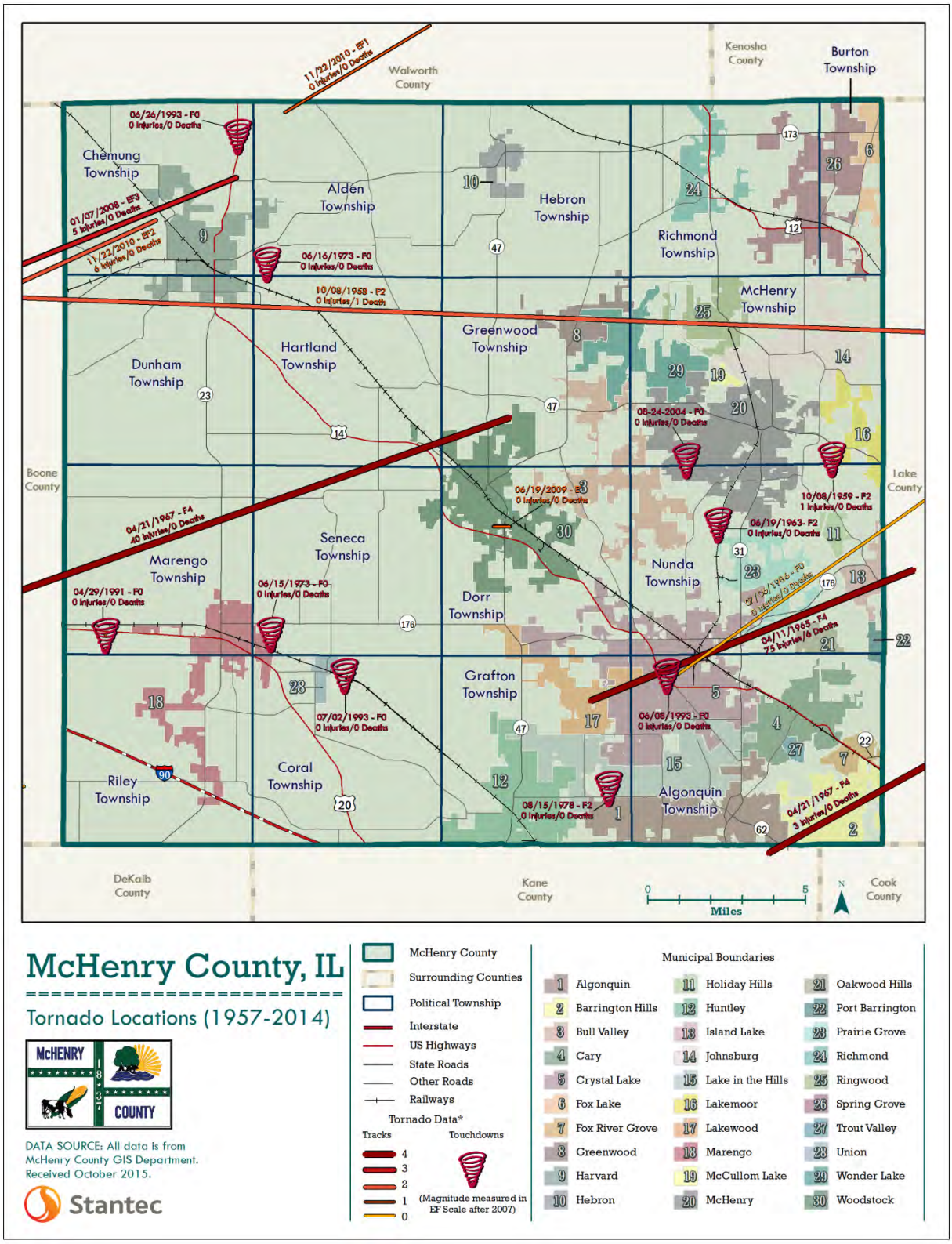
One hundred twenty-six injuries and seven deaths were reported as a result of seven separate incidents.

Table 2-33 Historically Reported Tornadoes in McHenry County (1958-2015)

Date	Location	Magnitude	Injuries	Deaths	Property Damage (2015 Dollars)
10/9/1958	Pistakee Highlands	F2	0	1	$23,194,360
10/8/1959	Lakemoor	F2	1	0	$2,306,899
4/19/1963	Prairie Grove	F2	0	0	$2,188,596
4/11/1965	Lakewood/Crystal Lake	F4	75	6	$12,739,589
4/21/1967	Woodstock	F4	40	0	$200,364,427
4/21/1967	Algonquin/Fox River Grove	F4	3	0	$20,036,443
6/15/1973	Marengo	F0	0	0	$0
6/16/1973	Harvard	F0	0	0	$0
8/15/1978	Lake In The Hills	F2	0	0	$1,028,376
7/6/1986	Crystal Lake/Lakemoor	F0	0	0	$0
4/29/1991	Marengo	F0	0	0	$0
6/8/1993	Crystal Lake	F0	0	0	-
6/26/1993	McHenry County	F0	0	0	$9,278-$92,777*
7/2/1993	McHenry County	F0	0	0	
5/19/1996	Union/ Marengo	F1	0	0	$0
8/24/2004	Near City of McHenry	F0	0	0	$415,270*
1/7/2008	Chemung (CDP), Harvard, and Lawrence (Unincorporated Place)	EF3	1	0	$2,459,748
6/19/2009	Woodstock	EF1	0	0	$89,554
11/22/2010	Big Foot Prairie (Unincorporated Place)	EF2	6	0	$6,921,169*
11/22/2010	McHenry County	EF1	0	0	$1,384,234*
4/9/2015	Hartland	EF1	0	0	$0
7/18/2015	Lawrence (Unincorporated Place)	EF0	0	0	$0
7/18/2015	Alden (Unincorporated Place)	EF0	0	0	$0
Totals: 23 Previous Occurrences			**126**	**7**	**$273,128,665**

*These tornado event damages are estimates from NOAA's Storm Prediction Center. Prior to 1996, this data was recorded in ranges, therefore the June 26, 1993 event damages are not included in the total.

Exhibit 2-11 McHenry County Tornado Tracks



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.

On January 7, 2008 an EF3 tornado formed in Boone County and crossed into McHenry County approximately four miles west of Harvard and caused significant damage in the unincorporated town of Lawrence. 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 twelve cars on a freight train travelling east through the County near Harvard. The derailment created a hazardous materials incident.

On June 16, 2009, an EF1 tornado touched down near Highway 14 and Davis Road. The tornado traveled three-quarters of a mile northeast toward Lake Avenue, damaging and uprooting trees along the way. Upon crossing Highway 14, the tornado entered a neighborhood where it lifted a garage off of its foundation. The garage was fairly new and securely bolted to its concrete foundation. The tornado made its way into the Woodstock's commercial district where it damaged the roof of one building and caused a wall to collapse in another building. The tornado's max wind speed reached 100 mph. There were no injuries or fatalities.

2.7.4 Tornado Hazard Extent

The two most severe tornadoes on record are an F4 in 1967 (wind speeds between 207–260 mph) and an EF3 (wind speeds between 136–165 mph) in 2008. However, it is possible for stronger events to occur in the planning area, specifically due to its location in "Tornado Alley."

2.7.5 Tornado Hazard Probability of Future Occurrence

Based on 23 tornadoes recorded in the last 57 years, there is an annual probability of 40 percent; therefore, tornado events are "likely" (between 10% and 90% annual probability) to occur. In addition, the possibility of other, unrecorded tornadoes may have occurred and should be taken into consideration. It may also be important to note five tornados have occurred since the previous version of this Plan, with three in the year 2015 alone.

2.7.6 Tornado Vulnerability Assessment

All of McHenry County, including current and future buildings, populations, infrastructure, and other assets, is vulnerable to tornadoes. The potential for loss of life and significant property damage increases as McHenry County's population grows and the number of buildings increase.

Health and Safety: Vulnerability to residents and buildings escalates as the county grows in population and building counts. Tornadoes have resulted in seven deaths and 120 injuries in McHenry County. On average, Illinois experiences two tornado–related deaths each year (NCDC Data 1996-2015). Based on tornado history in Illinois, advanced warning and taking appropriate shelter is a significant 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.

Other health and safety issues from tornadoes include water contamination and driving hazards, as well as the potential for fire and gas leaks.

Impact to health and safety for tornadoes is considered high.

Damage to Buildings and Critical Facilities: Buildings (including critical facilities) and infrastructure located above-ground in the path of a tornado can suffer extensive damage and/or 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 all buildings are vulnerable to tornadoes, 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.

Schools are a particular concern for two reasons:

1. They have large numbers of people present, either during school or as a storm shelter.
2. They have large span areas (open areas with high ceilings), such as gyms and theaters.

The 1990 Plainfield tornado, about 45 miles south of McHenry County, was an unfortunate example of tornado damage to educational facilities. 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 $42 million (annualized). 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 buildings (including critical facilities) due to tornadoes is considered high.

Economic Impact: When businesses and infrastructure are damaged by a tornado, the County may suffer economic loss. Heavily damaged businesses often have to close, impacting business owners. Loss of business can alter the local economy depending on the duration of closures. The post-disaster damage report stated that at least 50 businesses were destroyed by the 1990 Plainfield tornado. (As previously noted, this tornado did not impact McHenry County, but serves a realistic scenario of potential damage.)

In addition, the cost of repairs can severely affect businesses, and it is possible that small business owners may not be able to reopen at all.

Infrastructure damage is usually limited to above ground utilities, such as power lines. Along with the cost of repairing electrical infrastructure, power outages can affect a business, even if a business' structure is not damaged.

Damage to roads and railroads is also localized to the tornado's path. When roads close, there are usually other transportation routes 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. Many public facilities are insured, so the economic impact on the local treasury may be small.

Clean-up and disposal can be a larger problem (both structural and vegetative debris), especially if there is limited landfill capacity near the damage site.

Economic impact due to tornadoes is considered moderate.

Climate Change Impact: There is still some uncertainty as to the specific link between tornadoes and changing climatic conditions, and more research is needed to understand the full impact of climate change on tornadic activity. Due to the small scale of tornado events, observation and modeling can be challenging.[xii] However, a warmer atmosphere can hold more water vapor, a crucial component to storm formation. In general, when events occur, they have the potential to be more severe.

El Niño reduces tornado activity in the High Plains and Midwest and increases it in the South. While La Niña tends to have the opposite effect regarding tornadoes. Research finds that although tornadoes are occurring fewer days per year than they used to, they are forming at greater density and strength. This means that on days when tornadoes do form, there tend to be more of them and are more powerful.[xxi]

2.8 Extreme Heat

2.8.1 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

Figure 2-12 Heat Alerts

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.

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.

The National Weather Service Weather Fatalities Database has records of heat-related fatalities beginning in 1986. Since 1986, there has been an approximate average of 140 heat-related deaths annually. In an effort to raise the public's awareness of the hazards of extreme heat, the National Weather Service has devised the "Heat Index."

Figure 2-13 NOAA's Heat Index Chart

Temperature (°F)

Relative Humidity (%)	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										

Heat Index (Apparent Temperature)

- Extreme Danger: Heat stroke or sunstroke highly likely
- Danger: Sunstroke, muscle cramps, and/or heat exhaustion likely
- Extreme Caution: Sunstroke, muscle cramps, and/or heat exhaustion possible
- Caution: Fatigue possible

Heat Index: NOAA's National Weather Service (NWS) devised the Heat Index as a mechanism to better inform the public of heat dangers. The Heat Index Chart, shown in Figure 2-2, uses air temperature and humidity to determine the heat index or apparent temperature.[xxii] In addition, information regarding the health dangers by temperature range is presented. As noted above, some populations, such as the elderly and young, are more susceptible to heat danger than other segments of the population.

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

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

2.8.2 Extreme Heat Hazard Location

Extreme heat events affect the entire County.

2.8.3 Extreme Heat Hazard Previous Occurrences

Table 2-34 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 four extreme heat events in McHenry County between 1995 and November 2015. All of the extreme heat events recorded occurred in July and lasted between three to five days.

Deaths were reported for all three extreme heat events. However, in three of the four 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. For the most recent event, fatalities occurred as a result of another heat-related accident.

Table 2-34 Extreme Heat Events Reported in McHenry County (1995 – 2015)

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
July 4-7, 2012	Upper 90s to 105°F	105°F – 115°F	23 heat- related deaths; 2 deaths – heat caused railroad lines on a bridge to expand, derailing a train. The incident caused a 28 car pile-up and collapsed a bridge. Two people died in a car under the bridge.

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

2.8.4 Extreme Heat Hazard Extent

Extreme heat events affect the entire County. Extent can be defined with record highs and the NWS Heat Index. Record highs throughout multiple communities in the County have reached upwards of 110 degrees during spring and summer months, although average temperatures generally remain in the low to mid 80s. All communities in McHenry County are vulnerable to the dangers presented during an extreme heat event.

2.8.5 Extreme Heat Hazard Probability of Future Occurrence

Four extreme heat events occurred in the last twenty years, resulting in an estimated 20 percent chance of an event. Therefore, an extreme heat event is considered "likely" (between 10% and 90% annual probability) on the PRI Index.

2.8.6 Extreme Heat Hazard Vulnerability Assessment

All of McHenry County, including current and future buildings, populations, infrastructure, and other assets, is vulnerable to extreme heat hazards. There are no associated dollar losses with the extreme heat hazard in the planning area or surrounding area. Future damages are expected to be negligible but are possible through power outages, for example. Despite limited potential for damages, there are serious health risks to the population.

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.

Vulnerable populations, such as the elderly, young children, mentally ill, disabled, or homeless persons are at greatest risk to the impacts of extreme heat. People are at risk for heat stroke or sun stroke, heat exhaustion, fatigue, and dehydration. Preparedness reduces the risks associated with this hazard. In cases of extreme heat:

- Stay indoors as much as possible to limit exposure (consider public buildings such as libraries, schools, movie theaters, or cooling centers if you do not have air conditioning);
- Limit alcoholic intake;
- Drink plenty of water, even if you do not feel thirsty;
- Do not leave children or pets in vehicles;
- Check on vulnerable populations;
- Arrange your day to avoid strenuous work during the warmest part of the day, if possible;
- Use an electric fan to vent hot air out or bring cool air in; and
- Wear loose-fitting clothing.

Impact on people due to extreme heat is high.

Damage to Buildings: Extreme heat events generally have little or no impact on structures. However, in some rare cases extreme heat can cause structures to collapse or buckle. Power consumption for air-conditioned environments could increase and thus stress infrastructure. For the previous event listed by the NCDC in July 2012, heat caused the railroad lines on a bridge in Cook County (bordering McHenry County to the southeast) to expand. This is referred to as a heat kink in the rail line. A train derailed at the location of the heat kink, causing a 28 car pile-up, and led to the collapse of the bridge.

There are no known losses associated with heat events and buildings in McHenry County; therefore, impact on buildings is considered low.

Damage to Critical Facilities: Extreme heat events can potentially impact the demand on electric utilities, possibly causing power outages. Otherwise the impact to critical facilities due to extreme heat is low.

Economic Impact: It is possible that indirect losses due to business interruption in the case of a power outage during an extreme heat event; however, losses would most likely be minimal. Therefore, the economic impact of extreme heat is considered low.

Climate Change Impact: Climate change could affect extreme heat conditions in McHenry County because of the increased rate of warming in the Midwest over the past few decades. Between 1900 and 2010, the average Midwest air temperature increased by more than 1.5°F. The warming has been more rapid at night and during winter months.[xii] Extreme heat can have impacts not only to people but livestock creating a decline in meat, milk, and egg production.[xxiii]

Heat waves are projected to be more frequent, more intense, and last longer with climate models projecting that the entire contiguous U.S. will likely experience a significant increase in the number of extreme heat events in the coming decades. This could increase the number of heat-related deaths and illnesses.[xxiv]

2.9 Drought/Groundwater

2.9.1 Drought/Groundwater Hazard Description

Drought is conceptually defined by the National Drought Mitigation Center as "a protracted period of deficient precipitation resulting in extensive damage to crops, resulting in loss of yield." Although sometimes considered a rare and random event, drought is a normal, recurrent feature of climate. Climatic factors such as high temperatures, high wind, and low relative humidity are often associated with drought. Drought occurs in virtually all climatic zones, varying significantly from one region to another, and can be defined according to meteorological, hydrological, agricultural, or socioeconomic criteria. Drought is typically categorized in four types as shown in Table 2-35. Drought is differentiated based on the use and need for water.

Table 2-35 Drought Types and their Descriptions

Drought Type	Description
Meteorological Drought	Meteorological drought is usually based on long-term precipitation departures from normal, but there is no consensus regarding the threshold of the deficit or the minimum duration of the lack of precipitation that makes a dry spell an official drought.
Hydrological Drought	Hydrological drought refers to deficiencies in surface and subsurface water supplies. It is measured as stream flow, and as lake, reservoir, and groundwater levels.
Agricultural Drought	Agricultural drought occurs when there is insufficient soil moisture to meet the needs of a particular crop at a particular time. A deficit of rainfall over cropped areas during critical periods of the growth cycle can result in destroyed or underdeveloped crops with greatly depleted yields. Agricultural drought is typically evident after meteorological drought but before a hydrological drought.
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. Conversely, 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.

Human activities often exacerbate the impact of drought. For example, excessive water use can deplete groundwater supply. Groundwater depletion is also a concern given aquifers in the county and drinking and agricultural water supply needs. Of note, the county recognizes this as a concern and maintains a Water Resources Action Plan. Crystal Lake also has an ordinance to manage water in drought conditions. Information on these plans can be found in Chapter 4.

Measuring Droughts: There are several quantitative methods for measuring drought in the United States. How these indices measure drought depends on the discipline affected (e.g.,

agriculture, hydrology, meteorology, etc.) and the region being considered. Two main methods are the Palmer Drought Severity Index (PDSI) and the U.S. Drought Monitor. The PDSI was the first comprehensive drought index developed in the United States. The U.S. Drought Monitor is a relatively new index that combines quantitative measures with input from experts in the field and is used in this Plan to assess drought in McHenry County.

U.S. Drought Monitor: The U.S. Drought Monitor is designed to provide the general public, media, government officials, and others with an easily understandable overview of weekly drought conditions across a county throughout the United States. The U.S. Drought Monitor is unique because it assesses multiple numeric measures of drought, including the PDSI and three other indices, as well as the interpretations of experts to create a weekly map depicting drought conditions across the United States. There are five drought intensity categories, D0 through D4, to identify areas of drought; they are shown in Table 2-36.

Table 2-36 U.S. Drought Monitor - Drought Severity Classifications

Category	Category Name	Category Description
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

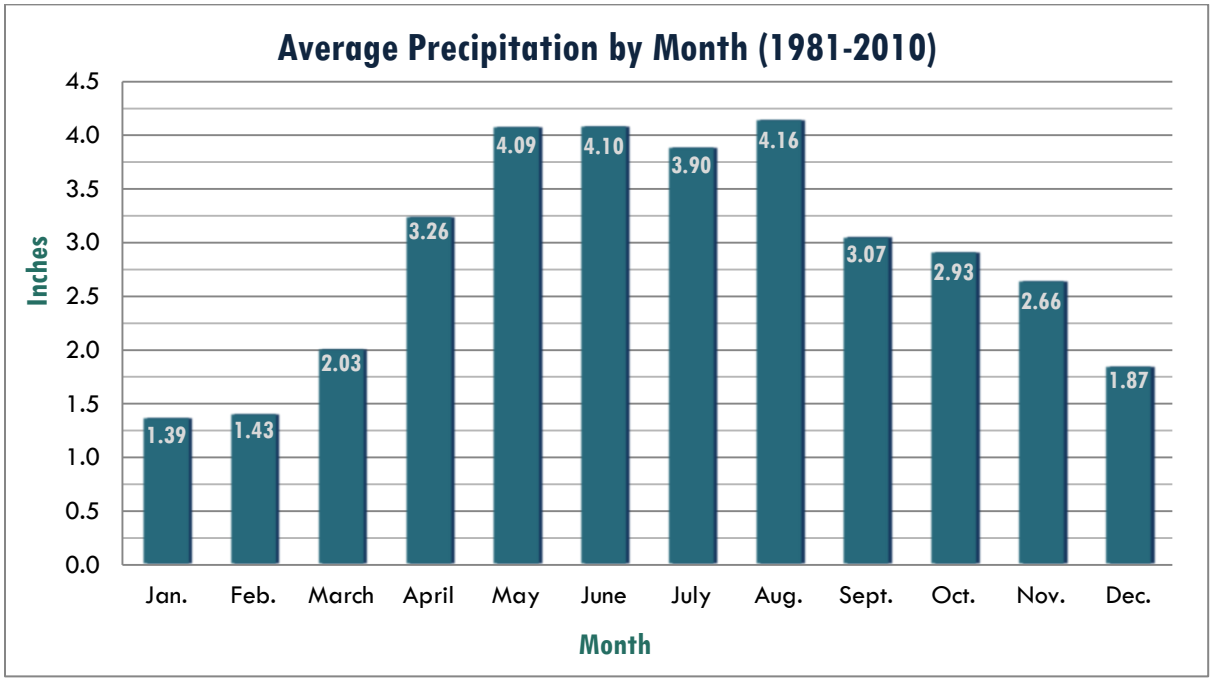
2.9.2 Drought/Groundwater Hazard Location

A drought is a regional event that is not confined to geographic or political boundaries; it can affect several areas at once. It can also range in severity across those areas. All of McHenry County is at risk to drought occurrence and impacts.

2.9.3 Drought/Groundwater Hazard Previous Occurrences

In order to understand the conditions of past droughts, it can be helpful to understand the normal precipitation received each year. Official precipitation normals from the Illinois State Water Survey at the McHenry-WG Stratton monitoring station are shown in Figure 2-14.[xxv]

Figure 2-14 Average Precipitation by Month



The following summarizes the previous occurrences as well as the extent or severity of the drought events in McHenry County. Information obtained from the NCDC Storm Events Database, U.S. Drought Monitor, Illinois State Hazard Mitigation Plan 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.

- **1983:** All 102 Illinois counties were proclaimed state disaster areas because of high temperatures and insufficient precipitation beginning in mid-June.
- **1988:** During this event, 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.
- **2003:** There were eight weeks of "Severe Drought" from February 2003 through April 2003.
- **2005-2006:** 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. Thirty-one weeks from July 2005 through January 2006 were categorized as "Extreme Drought," except for two weeks at the end of August 2005 which were "Severe Drought." There were eight weeks of "Severe Drought" from February 2006 through the end of March, totaling to a 39 week stretch of drought.
- **2012-2013:** There was a 27 week stretch of drought. Beginning at the end of July 2012 through mid-October 2012 there were 12 weeks of "Extreme Drought." From the third week of October 2012 through January 2013, there were 15 weeks of "Severe Drought."

During this event, hay for hooved animals became very expensive. McHenry County has the largest horse population of all counties in Illinois. Due to the increase price of hay, a food bank for hooved animals was set up in the county. The food bank was not funded by the county.[xxvi]

U.S. Drought Monitor Data was used to assess past drought conditions. The reporting period is January 2000 to November 2015 (830 Weeks). The number of weeks recorded were noted based on the highest level of drought recorded that week. It should be noted that categories are reported as a percentage so the highest drought condition reported in each week may not have been experienced by the entire county or the majority of the county. The information is compiled and presented in Table 2-37. [xxvii]

Table 2-37 Drought Monitor Data in McHenry County

Category	Category Name	Weeks at Drought Level
None	None	596
D0	Abnormally Dry	99
D1	Moderate Drought	53
D2	Severe Drought	41
D3	Extreme Drought	41
D4	Exceptional Drought	0

2.9.4 Drought/Groundwater Hazard Extent

Drought events can affect the entire County in any one of the four drought categories discussed above. The most severe category is D4 (Exceptional Drought); however, the U.S. Drought Monitor does not list any weeks for McHenry County at D4. Nonetheless, it is still possible for a D4 event to occur in the County or surrounding region. There have been 41 weeks of drought at the second-most severe drought level of D3 (Extreme Drought), although longer and more severe events are possible.

The County and municipalities rely on groundwater for their source of drinking water. With the anticipated growth in the total County population as well as climate change impacts, this will be a growing concern. Specifically, the agricultural community will continue to be affected by droughts. All communities in McHenry County are subject to drought-related impacts.

2.9.5 Drought/Groundwater Hazard Probability of Future Occurrence

Of 830 weeks recorded by the U.S. Drought Monitor, 82 weeks of "Severe" and/or "Extreme Drought;" this is slightly less than ten percent, resulting in a PRI category of "possible" (between 1% and 10% annually). Additionally, drought is measured in weeks, and therefore it is understood drought events can span across years.

2.9.6 Drought Hazard/Groundwater Vulnerability Assessment

McHenry County can be significantly impacted by a drought, and it is assumed that all current and future buildings, populations, and critical facilities in the County are at risk to drought. The atmospheric nature of drought and lack of specific boundaries make it difficult to quantify drought conditions. The majority of drought impacts, however, are not structural but societal in nature. A

drought's impacts on society result from the interplay between a natural event and the demand people place on water supply.

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 qualitative vulnerability assessment was conducted for the 2016 version of this Plan. However, more detailed information on drought impacts and other issues related to groundwater are included in the County's Water Resources Action Plan.

Health and Safety: Water availability is imperative to health ranging from daily life to medical operations. While drought has never been severe enough of fully deprive the county of water, it is possible. In general, even a severe drought is unlikely to impact the health and safety of a community.

Impact on people due to drought is low.

There have been some concerns in recent years regarding limitations on the groundwater supply in McHenry County, specifically in the Marengo-Union area. One study conducted by the Illinois State Water Survey (ISWS) in 2014, stated the County's groundwater resources may be strained within 30 – 40 years. Such a strain could cause local water shortages and severe effects on the ecology of streams in the area.[xxviii]

The Marengo-Union area is located in a critical portion of the Kishwaukee River Watershed. In this region, the river and its tributaries are at risk because construction regulations and agricultural activities are not designed for resource protection. According to the Greater Marengo-Union Watershed Planning Guide, the underlying groundwater supplies are not being conserved. Population has increased in this area in the last 10 years, and this trend is projected to continue. Without proper management, this could cause a serious issue for the residents living in this area.[xxix]

Additionally, large portions of McHenry County are highly susceptible to groundwater contamination due to the County's geology and land uses.[xxx]

Damage to Buildings and Critical Facilities: As noted above, drought has minimal impacts on structures although it could have impacts on the functionality of the building if water supply is disrupted. There are no known losses associated with drought and buildings in McHenry County; therefore, impact on buildings is considered low.

In terms of the county's critical facilities, drought events can potentially impact the water supply, possibly causing operation disruptions. Further, depleted water supply could impede the capability to effectively fight structure fires. The impact to critical facilities due to drought is considered low.

Economic Impact: Drought could have (and has had) a number of economic impacts on McHenry County including agricultural, recreation and business. One of the most pronounced economic impacts is that on agricultural holdings. Given the agricultural nature of the county, water supply is imperative for crops, livestock and equestrian businesses. Drought can also

destroy crops. Drought resulting in water shortage can also impact businesses (ranging from restaurants to manufacturing) which cannot operate without water. Lastly, in the case of a water shortage, the cost of water may increase (or the county may be forced to buy water from a water-rich area), which would have ripple effects in terms of a reduction in the local economic multiplier as money leaves the county.

The economic impact due to drought is considered moderate.

Climate Change Impact: Changing trends in climatic conditions may also impact the drought conditions in the future.

The Midwest has been getter warmer - Between 1900 and 2010, the average Midwest air temperature increased by more than 1.5°F,[xii] though it is also receiving more rainfall (NOAA). This indicates that droughts experienced to date could have been much worse if not for additional precipitation. According to the National Climatic Assessment, while there is no apparent change in drought duration in the Midwest, the number of days without precipitation is projected to increase in the future. This indicates that even in the absent of a warmer climate, droughts could be longer and more pronounced. In addition, this could lead to agricultural drought and suppressed crop yields.[xii]

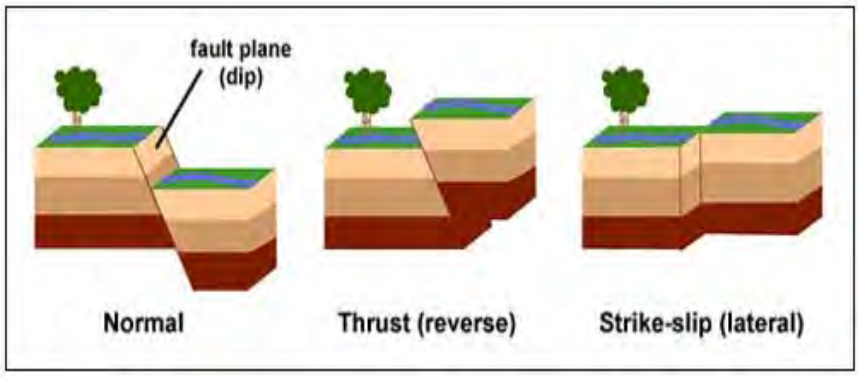
2.10 Earthquake

2.10.1 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) as shown in Figure 2-15.[xxxi]

Figure 2-15 Earthquake Faults



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.

The earthquake magnitude categorization is based on an event's Richter Scale value. Earthquakes with a magnitude of 3.5 or less are not commonly felt by individuals as shown in Table 2-38. 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.

Table 2-38 Richter Scale

Richter Magnitudes	Earthquake Effects
< 3.5	Generally not felt, but recorded.
3.5 - 5.4	Often felt, but rarely causes damage.
5.4 - 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 - 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 - 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or >	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Source: FEMA

Beginning in 2002, the USGS began using Moment Magnitude as the preferred measure of magnitude for all USGS earthquakes greater than magnitude 3.5. This was primarily due to the fact the Richter Scale has an upper bound, so large earthquakes were difficult to measure. Moment Magnitude also has a scale, but no instrument is used to measure it. Instead, factors such as the distance the earthquake travels, the area of the fault, and land that was displaced (also known as "slip") are used to measure Moment Magnitude. Table 2-39 shows the Moment Magnitude scale.

Table 2-39 Moment Magnitude Scale (appears that this scale is the same as the Richter Scale)

Scale Value	Effect
Less than 3.5	Very weak; unlikely to be felt
3.5 – 5.4	Generally felt; rarely causes damage
5.4-6.0	Minor property damage
6.1-6.9	Will not cause damage to well-designed buildings; will damage poorly designed ones
7.0-7.9	Considered a "major earthquake" that causes a lot of damage
8 or greater	Large and destructive earthquake that can destroy large cities

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 2-16 shows the intensity for a 5.3 earthquake with an epicenter near the Illinois-Kentucky boarder.

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.

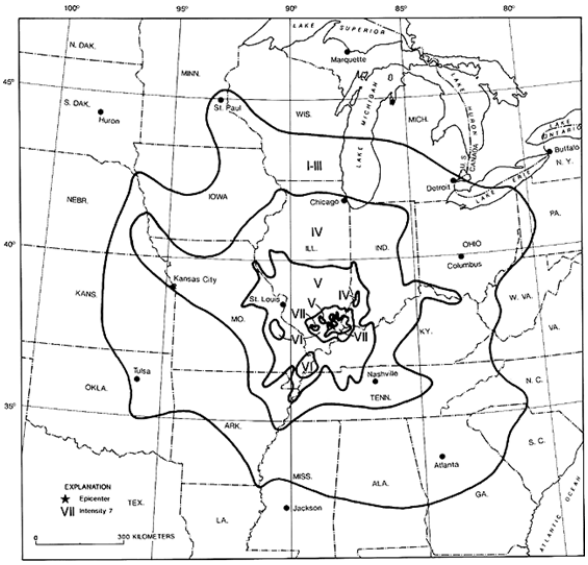
In the United States, the Modified Mercalli Intensity Scale is used to measure earthquake intensity. This scale, shown in Table 2-40, is designated by Roman numerals. The lower numbers of the intensity scale are based on human observations (e.g., felt only by a few people at rest, felt quite noticeably by persons indoors, etc.) The higher numbers of the scale are based on observed structural damage (e.g., broken windows, general damage to foundations, etc.). Figure 2-3 shows the intensity and magnitude of an earthquake in 1978 felt in McHenry County.

Table 2-40 Modified Mercalli Intensity Scale

Scale	Intensity	Description Of Effects	Corresponding Richter Scale Magnitude
I	INSTRUMENTAL	Detected only on seismographs.	
II	FEEBLE	Some people feel it.	< 4.2
III	SLIGHT	Felt by people resting; like a truck rumbling by.	
IV	MODERATE	Felt by people walking.	
V	SLIGHTLY STRONG	Sleepers awake; church bells ring.	< 4.8
VI	STRONG	Trees sway; suspended objects swing, objects fall off shelves.	< 5.4
VII	VERY STRONG	Mild alarm; walls crack; plaster falls.	< 6.1
VIII	DESTRUCTIVE	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged.	
IX	RUINOUS	Some houses collapse; ground cracks; pipes break open.	< 6.9
X	DISASTROUS	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread.	< 7.3

Scale	Intensity	Description Of Effects	Corresponding Richter Scale Magnitude
XI	VERY DISASTROUS	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards.	< 8.1
XII	CATASTROPHIC	Total destruction; trees fall; ground rises and falls in waves.	> 8.1

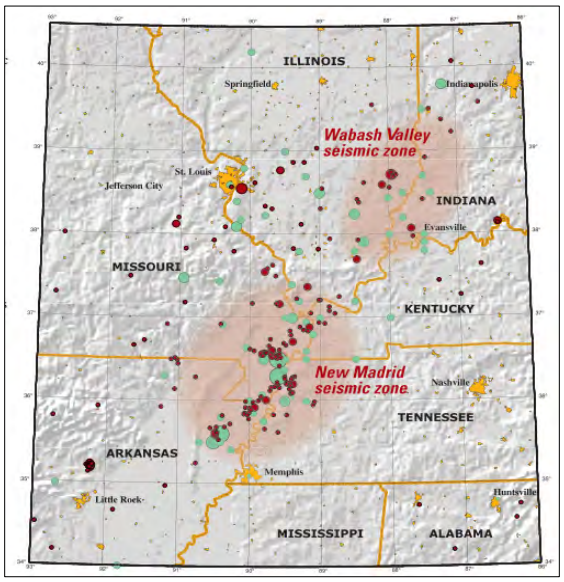
Figure 2-16 November 9, 1968 Earthquake of magnitude 5.3 and an intensity of VII. Intensity felt in McHenry County estimated to be IV. (USGS)



2.10.2 Earthquake Hazard Location

An earthquake event would impact the entire planning area. There are earthquake faults and earthquake risk areas that help define locations. There are no known active faults in McHenry County. Figure 2-4 is a USGS map of the New Madrid and Wabash Valley seismic zones and shows earthquakes as circles.[xxxii] While McHenry County is not shown here, these are the nearest seismic zones to the county. Red circles indicate earthquakes that occurred from 1974 to 2002 with magnitudes larger than 2.5 located using modern instruments (University of Memphis). Green circles denote earthquakes that occurred prior to 1974 (USGS Professional Paper 1527). Larger earthquakes are represented by larger circles.

Figure 2-17 USGS Earthquake potential for ground shaking indicating McHenry County as low hazard.

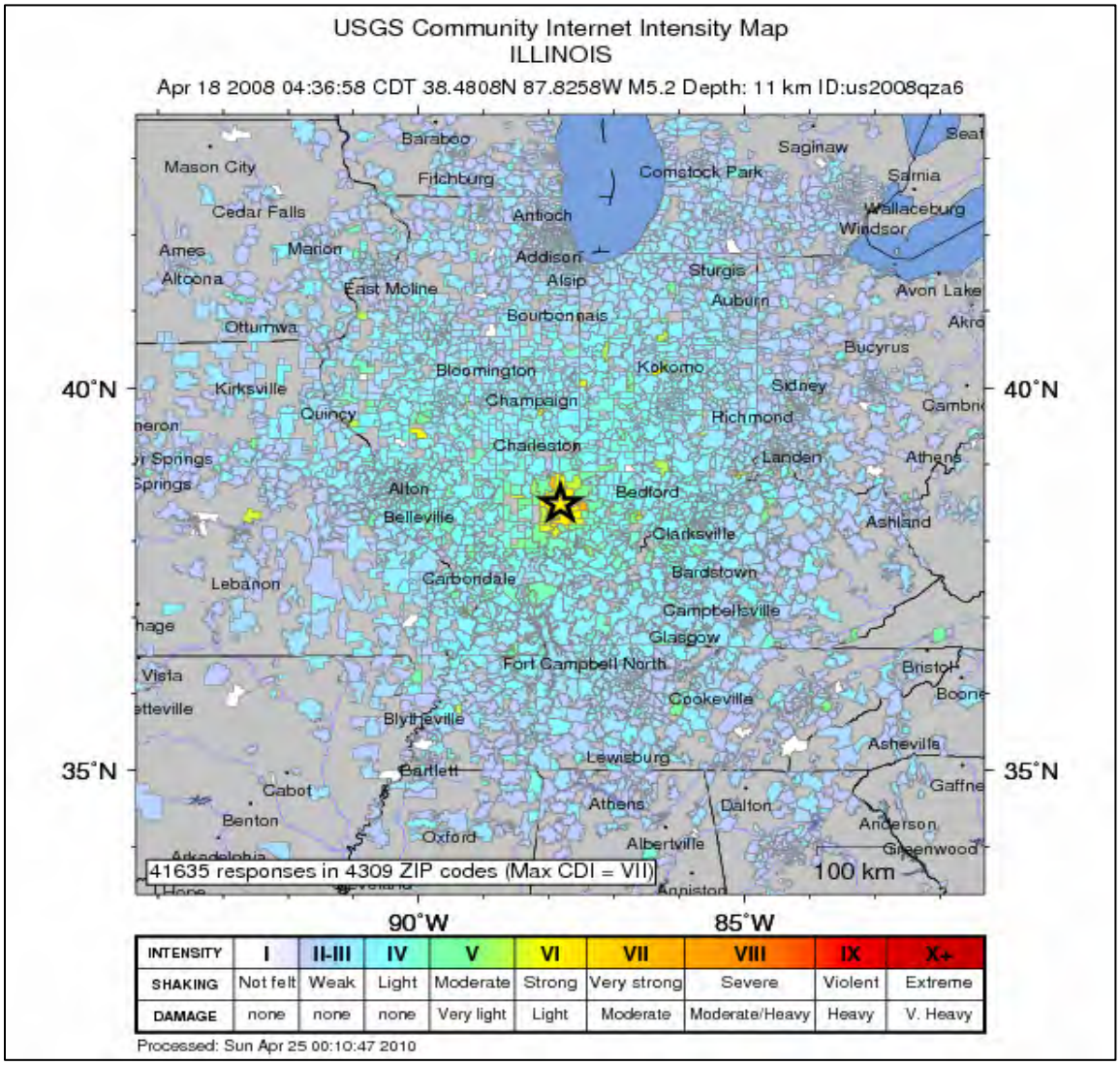


2.10.3 Earthquake Hazard Previous Occurrences

Until recently, no earthquakes had been reported in McHenry Henry County for the last 200 years. However, since the last plan update, four events have been reported in the county:

- **April 18, 2008:** A 5.2 magnitude earthquake was felt in McHenry County. The epicenter of this earthquake was in Wabash County, Illinois. As shown in Figure 2-5, 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.[xxxiii] 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.
- **February 10, 2010:** An earthquake occurred in northern Illinois at around 4:00 a.m. USGS recorded the earthquake as 3.8 in magnitude with the epicenter at Pingree Grove in Kane County (just south of McHenry County).
- **January 31, 2012:** The City of McHenry was the epicenter of a 2.4 magnitude earthquake, but there were no damages or injuries recorded.
- **March 25, 2015:** A 2.9 magnitude earthquake was reported in Lake In The Hills. The impact was felt in Algonquin, Crystal Lake, Huntley, Lake In The Hills, and other jurisdictions. The event was very minor with weak to light shaking. There was no recorded damage associated with the event but it did disrupt communication (Verizon).

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



A number of other earthquakes have occurred outside of the McHenry County as described below. Only one event in 1909 caused damage in the county and remains the strongest earthquake on record in the area, according to the Illinois State Geological Survey's Northern Illinois Earthquakes fact sheet, Earthquakes of Illinois: 1795 – 2008 Map, and the USGS. In addition, 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.[xxxiv]

A June 28, 2004, a magnitude 4.2 earthquake was 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 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, Illinois. This

magnitude 5.3 earthquake occurred on November 9, 1968 (see Figure 2-18) with an intensity estimated at 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.

May 26, 1909 marked the largest earthquake to take place in northern Illinois in the past several hundred years. 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.

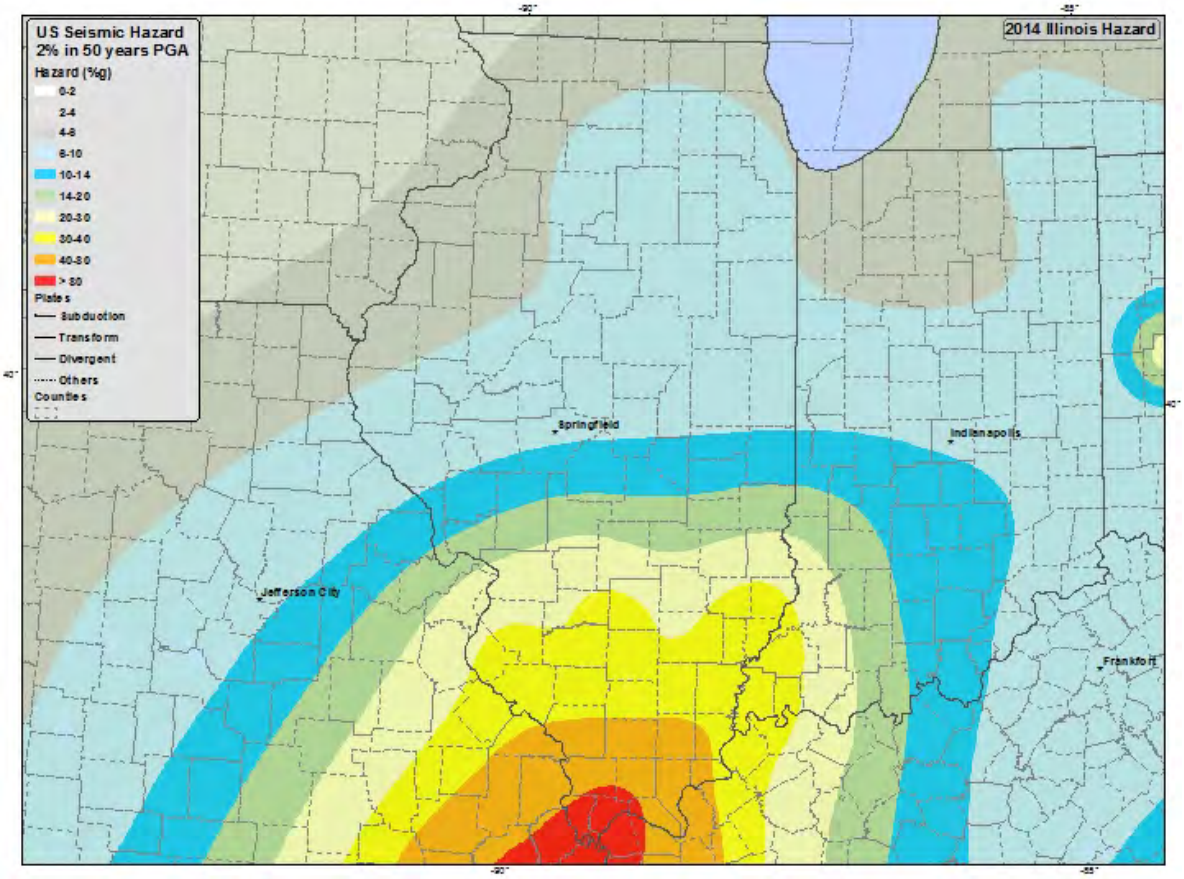
New Madrid Earthquakes of 1811 and 1812 - Two of the three largest earthquakes ever recorded within the continental United States took place along the New Madrid seismic zone in 1811 and 1812 with magnitudes of 8.1 and 8.0, respectively. These great earthquakes, centered near the town of New Madrid, 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.

2.10.4 Earthquake Hazard Extent

There are several ways to measure the extent of an earthquake including magnitude and intensity experienced. The greatest earthquake recorded in McHenry County was a magnitude 2.9 event in March 2015. The strongest earthquake to impact the county was a 4.2 magnitude event in 1909. However, stronger events are possible in the county and beyond. In general, earthquakes greater than 5.0, which typically result in damage, are not common (or likely) in the area.

Another way to measure extent is by using percent-g, which is used as a way of estimating locational risk. Figure 2-6 illustrates this risk for McHenry County, displaying a 4-8%-g.[xxxv]

Figure 2-19 USGS Seismic Map for Illinois (Measured in Percent-G)



2.10.5 Earthquake Hazard Probability of Future Occurrences

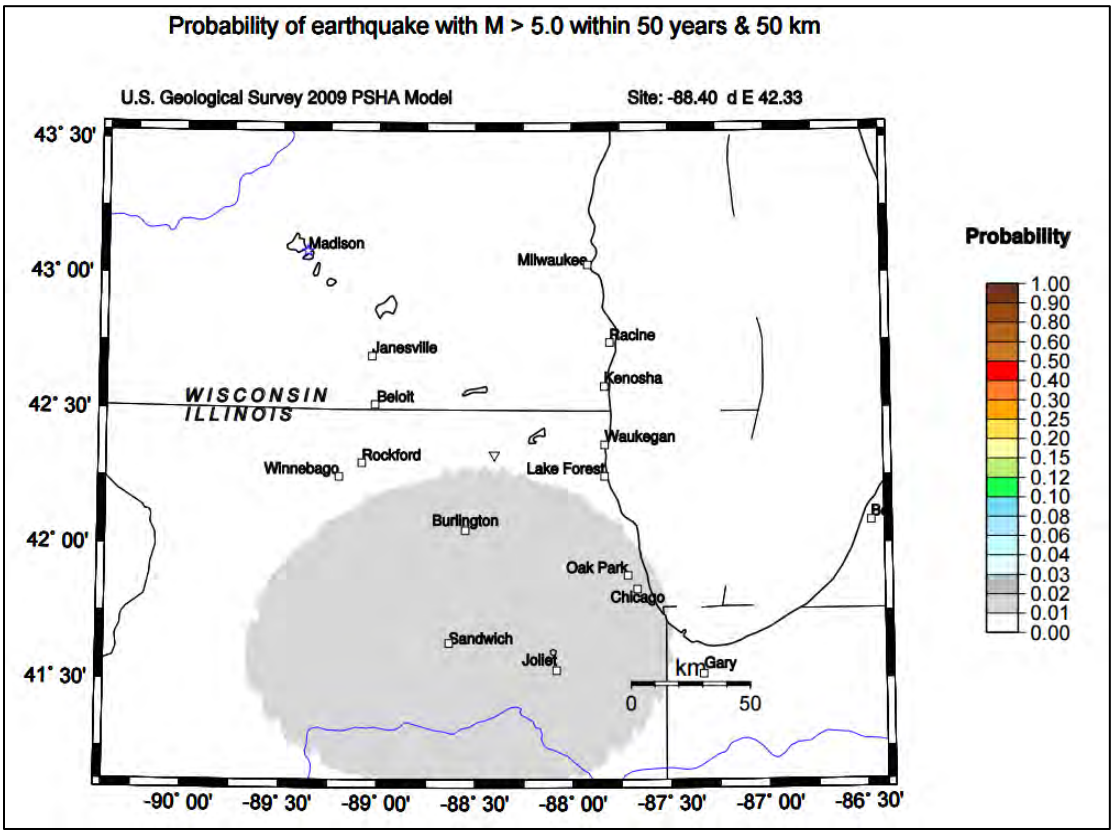
The probability of the earthquake hazard can be difficult to estimate given the unpredictable nature of earthquakes. Table 2-41[xxix] shows earthquake probability for the New Madrid Seismic Zone from 2000 and into 2035 as reported by the Illinois State Geological Survey. (As previously noted, such an event is not expected to cause widespread damage in the county due to building codes and distance from the epicenter.) It is known that earthquakes happen every year in Illinois and are occasionally felt in McHenry County. Further, two events have occurred in county the last two years. USGS estimates an approximate 1.0 percent probability of a magnitude 5.0 earthquake occurring in the next 50 years in the planning area (see Figure 2-7).[xxxvi] As a result, a probability of possible (1% and 10% on the PRI scale) was assigned, though recent increase in activity is notable.

Table 2-41 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

Figure 2-20 USGS Earthquake Probability Model (2009)



2.10.6 Earthquake Hazard 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 and communication systems. If deemed appropriate, earthquake vulnerability will be examined in the 5-year update of this Plan.

2.11 Dam Failure

2.11.1 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 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 2-42 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.

Table 2-42 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.

2.11.2 Dam Failure Hazard Location

Areas downstream of the dams are considered at risk. Specific dam breach analysis was not performed as part of this Plan and can be found in dam-specific emergency action plans.

2.11.3 Dam Failure Hazard Analysis

Algonquin, Lake In The Hills, Island Lake, Cary and Crystal Lake own classified dams. Table 2-433 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 2-44, 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 2-43 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

Name	Owner	Purpose	Classification
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 operates 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 in Figure 2-8. The IDNR is currently reconstructing the boat lock and sluice gate structures. Construction is on hold as of June 30, 2015 pending a state budget. IDNR operates gate to control the pool elevation during normal weather conditions and to manage upstream and downstream flooding during all seasons of the year.

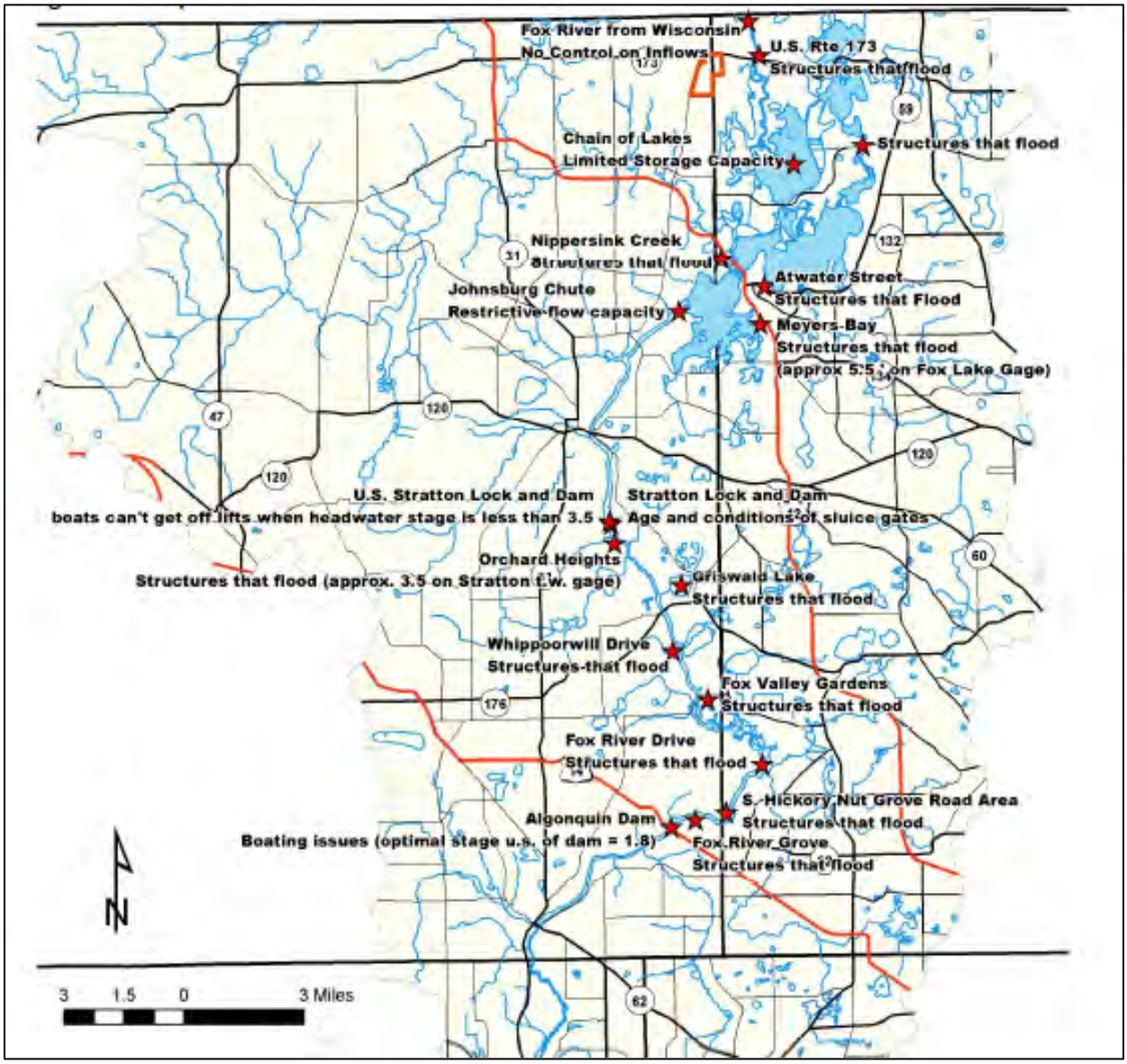
Figure 2-21 Plan View of Stratton Lock and Dam

The Algonquin Dam is located at river mile 81.6 on the Fox River (near Illinois Route 62). 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. The Algonquin Dam is shown in Figure 2-9.

Figure 2-22 Plan View of Stratton Lock and Dam

The above photos are from the February 2012 "Operation of the Stratton and Algonquin Dams" report prepared by IDNR. [xxxvii] Figure 2-10 presents the operational constraints that IDNR has for opening and closing the Stratton Dam gates.

Figure 2-23 Operational Constraints to be considered during the Operation of Stratton and Algonquin Dams



2.11.4 Dam Failure Previous Occurrences

There have been no previous occurrences of dam failure in McHenry County. However, in June 2008, McHenry County officials were concerned about water breaching the dam at Lower Phantom Lake in Mukwonago, Wisconsin. The Mukwonago Dam, which holds back 470 acres of water, did not breach during the heavy rain event, but the impacts could have been devastating to the already flooding areas, specifically near Fox Lake.[xxxviii]

During the April 2013 flood event, the McHenry Stratton and Lock Dam failed to hold back flood waters. The flood stage at this dam is 4 feet, and during this event, waters reached the record level of 7.44 feet. Damages from this flood are discussed in the Section 2.4.3 above.

2.11.5 Dam Failure Hazard Extent

The extent of dam failure hazard is of course limited to dams (including their spillways) within McHenry County. The greatest magnitude possible is loss of life and property damage due to dam failure.

2.11.6 Dam Failure Hazard Probability of Future Occurrences

Ideally, McHenry County dams are well maintained and have emergency operation plans developed for use when a dam failure is probable or imminent. Given the limited previous occurrences, a probability of unlikely (less than 1% annual probability) was assigned.

2.11.7 Dam Failure Hazard 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. These are typically completed as a separate document for individual dams.

2.12 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 including the PRI index results.

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 businesses 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.

Of note, all municipalities and agencies participating (including current and future buildings, populations, and critical facilities) in McHenry County are at risk to the natural hazards contained in this Plan. All critical facilities are assumed to be at risk to tornado, severe winter storm hazards, severe summer storm hazards, extreme heat and drought.

The findings of the hazard analysis of Chapter 2 and the vulnerability assessment are summarized in Table 2-44, and were used as the foundation of goals and guidelines and mitigation activities developed in Chapter 4 through 9. The PRI index results are shown in Table 2-45.

Table 2-44 Summary of Hazard Profiles and Analysis

Hazard	Value of Vulnerable Property	Appr. Total Historical Damage	Appr. Average Damage per Event	Impact on Health and Safety	Impact on Buildings	Impact on Critical Facilities	Economic Impact
Flood	$210 million	$5.2M (1978-2015)	$150K	High	High	Moderate	Moderate

Hazard	Value of Vulnerable Property	Appr. Total Historical Damage	Appr. Average Damage per Event	Impact on Health and Safety	Impact on Buildings	Impact on Critical Facilities	Economic Impact
Severe T-Storm (Wind)	$7.4 billion	$740K (1955-2015)	$4K	Moderate	High	Moderate	High
Severe T-Storm (Lightning)	$7.4 billion	$990K (1996-2015)	$49.5K	Moderate	Moderate	Moderate	Moderate
Severe T-Storm (Hail)	$7.4 billion	$161K (2006-2015)	$1K	Moderate	Moderate	Moderate	Low
Severe Winter Storm & Extreme Cold	$7.4 billion	$4.1M (1960-2012)	$83K	Moderate	Moderate	Moderate	Low
Tornado	$7.4 billion	$273M (1958-2015)	$11.9M	High	High	Moderate	Moderate
Extreme Heat	---	---	---	High	Moderate	Low	Moderate
Drought/Groundwater	---	---	---	Low	Low	Low	Moderate
Earthquake	---	---	---	---	---	---	---
Dam Failure	---	---	---	---	---	---	---

Table 2-45 Summary of McHenry County Natural Hazards Based on PRI Index

Hazard	Category/Degree of Risk					
	Probability	Impacts	Spatial Extent	Warning Time	Duration	PRI Score
Flood	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 1 week	**3.2**
Severe T-Storm (Wind)	Highly Likely	Limited	Large	More than 24 hours	Less than 24 hours	**2.9**
Severe T-Storm (Lightning)	Highly Likely	Limited	Large	More than 24 hours	Less than 24 hours	**2.9**
Severe T-Storm (Hail)	Highly Likely	Limited	Large	More than 24 hours	Less than 24 hours	**2.9**
Severe Winter Storm	Highly Likely	Critical	Large	More than 24 hours	Less than 1 week	**3.3**
Tornado	Likely	Catastrophic	Small	Less than 6 hours	Less than 6 hours	**3**
Extreme Heat	Likely	Minor	Large	More than 24 hours	Less than one week	**2.4**
Drought/ Groundwater	Possible	Minor	Large	More than 24 hours	More than one week	**2.2**
Earthquake	Possible	Minor	Small	Less than 6 hours	Less than 6 hours	**2.1**
Dam Failure	Unlikely	Limited	Small	More than 24 hours	Less than 24 hours	**1.5**

Based on the PRI index and a review of the risk assessment results, the McHenry County Mitigation Committee ranked hazards in the county as shown in Table 2-46. However, all hazards in the county may results in impacts. It should also be noted that some jurisdictional variations occur as noted in the profile sections above.

Table 2-46 Hazard Priority Ranking

Ranking	Hazard
High	Severe Winter Storm Flood Tornado Severe Thunderstorm (wind, hail, lightning)
Moderate	Extreme Heat Drought/Groundwater
Low	Earthquake Dam Failure

2.12.1 Comparison to State of Illinois 2013 Natural Hazard Mitigation Plan

The 2013 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 2013 Plan are shown in Table 2-47.

Table 2-47 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/Groundwater	Guarded
Earthquake	Guarded

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CHAPTER 3 – GOALS

The goals for this McHenry County Natural Hazards Mitigation Plan (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. The 2010 hazard mitigation plan development process underwent a robust process to define goals for this Plan. During the 2016 plan update process, these goals were reviewed and confirmed by the Mitigation Committee. No changes were made to the goals or guidelines. The goals and guidelines presented in this chapter are the foundation of the Action Plan, presented in Chapter 10.

3.1 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.

3.2 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 plans. 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.

There are numerous policy statements in the McHenry County 2030 Comprehensive 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 below is an excerpt from the vision statement.

Figure 3-1 Comprehensive Plan

MCHENRY COUNTY 2030 COMPREHENSIVE PLAN
"OUR VISION"
(Excerpt from Plan approved April 20, 2010)

"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. The following text indicates the goals from the 1996 plan.

Figure 3-2 Comprehensive Stormwater

MCHENRY COUNTY COMPREHENSIVE STORMWATER MANAGEMENT PLAN, 1996
"GOALS"

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.

The McHenry County Water Resources Action Plan (WRAP) was adopted by the County Board in October 2011. Some municipalities have adopted excerpts from the WRAP during the time between the development and update of this Plan. The Water Resources Action Plan has twelve major areas of concerns, and the overreaching goal of the entire plan is shown below.

Figure 3-3 Water Resources Action Plan

MCHENRY COUNTY WATER RESOURCES ACTION PLAN
OCTOBER 2011

(Formerly the Groundwater Protection Action Plan)

The goal of the Water Resources 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.

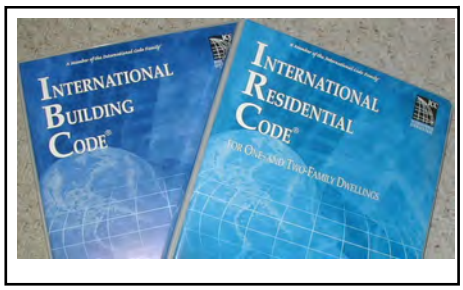
It strives to create a culture of conservation and awareness and to guide residents and businesses toward more efficient use and quality protection of our County's finite water resources.

The Water Resources 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

Figure 4-1 Building Codes



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
✓	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) – shown in Figure 4-1. The most recent version of these codes is 2015.

Figure 4-2 Institute for Business and Home Safety

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 (Figure 4-2).

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 (indicating exemplary commitment to building code enforcement), and a class 10 community 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 (not all communities are listed)

Municipalities	Building Code Residential	BCEGS Residential	Building Code Commercial	BCEGS Commercial
Algonquin	2006 IRC	3	2006 IBC	3
Bull Valley	**McHenry County's Building Code		**McHenry County's Building Code	
Cary	**2003 IRC	**4	2003 IBC	**4
Crystal Lake	2006 IRC	5	ICC 2006	4
Fox River Grove	**BOCA		2006 IBC	
Harvard	2006 IRC	4	2012 ICC	4
Holiday Hills	**2006 IRC		**2006 IBC	
Huntley	2003 IRC	5	2012 ICC	
Johnsburg	**2006 IRC		2004 IBC	
Lake in the Hills	2012 IRC	5	2012 IBC	5
Lakewood	**2006 IRC		**2006 IBC	
Marengo	2006 IRC	4	2006 IBC	4
McCullom Lake	**2003 IRC		**2003 IBC	
McHenry	2000 ICS	*	2009 ICC	*
Oakwood Hills	**Yes	*	**Yes	*
Prairie Grove	2006 IRC	4	2006 IBC	5
Spring Grove	2015 IRC	5	2015 IRC	5
Wonder Lake	2003 IRC	*	2003 IBC	*
Woodstock	2006 IRC		**2006 IBC	
McHenry County	2015 IRC		2015 IBC	

* Not in the program or no longer in the program
**Results from 2010 plan

The Community Rating System (CRS) 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. Communities can earn up to 120 points.

The CRS also has a prerequisite for a community to attain a CRS Class 6 or better: the community must have a BCEGS Class of 5/5 or better. To attain a CRS Class 4 or better, the community must have a BCEGS Class of 4/4 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

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

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-

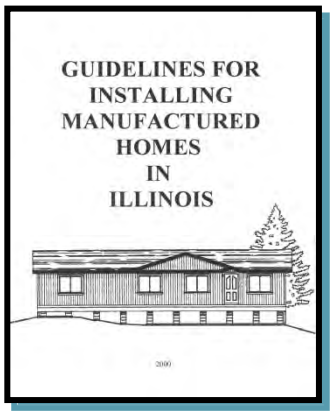
site installation.

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 (Figure 4-3) 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.

Figure 4-3 Manufactured Homes

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. However, there are no state or federal requirements for shelters in mobile home parks.



Local Implementation: As discussed in Chapter 2, there are four manufactured home sites located in the county: Indian Trails in Marengo, Royal Oaks and Oak Brook in Crystal Lake, and Harbor Lites in McHenry. Additionally, communities like Fox River Grove and Huntley have ordinances in place that address manufactured (mobile) home safety and protection. Also in McHenry County, manufactured structures are sometimes used for temporary classroom or sales offices at development sites. The floodplain ordinance portion of the McHenry 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.

4.3 Critical Facility Construction

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

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 construction or permitting of any critical facility. Both state and federal orders have consistent interpretations of "critical

facilities".

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 Illinois Floodplain Management's 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 Figure 4-4 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 federal and state resources and funds are not used for inappropriate and/or dangerous floodplain development. The 500-year flood protection level is also used for critical facilities in Executive Order 11988.

Figure 4-4 Executive Order 2006-05

EXCERPT FROM ILLINOIS EXECUTIVE ORDER 2006-05:

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

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 these agencies are required to follow state building codes, federal agencies and state agencies 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 Stormwater Management 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 two feet above the base flood elevation (100-year flood elevation).

4.4 Planning and Zoning

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

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.

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.

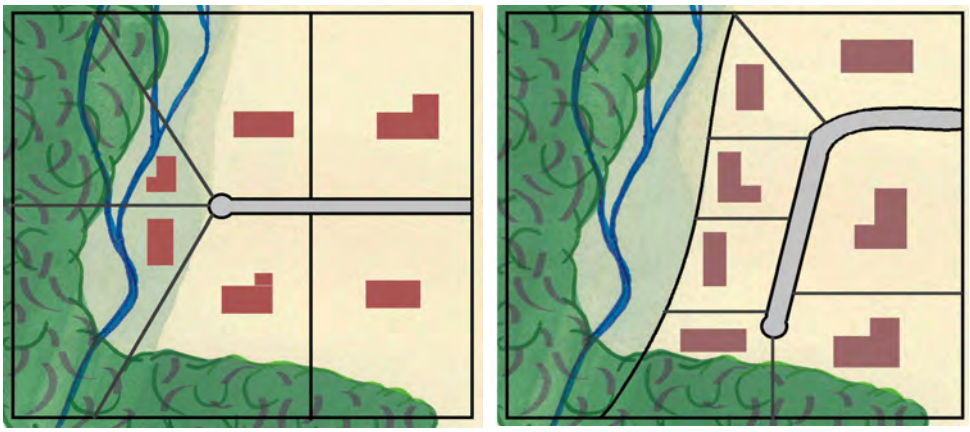
Zoning Regulations: Zoning codes are the primary tool used to implement comprehensive plan guidelines for how land should be developed. Zoning ordinances usually set minimum lot sizes for each zoning district (Figure 4-5); however, a community can allow flexibility in lot sizes and location so developers can avoid hazardous areas.

Figure 4-5 Zoning

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

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. Additionally, site design standards and land use densities can be adjusted, as in the example below (Figure 4-6).

Figure 4-6 Smart Zoning



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	Yes	No	Yes	Yes	Yes
Bull Valley	Yes	Yes	Yes	Yes	Yes
Cary	Yes	Yes	Yes	Yes	Yes
Crystal Lake	Yes	No	Yes	Yes	Yes
Fox River Grove	Yes	Yes	Yes	Yes	Yes (temp. drops)
*Greenwood	No	No	Yes	No	No
Harvard	Yes	No	Yes	Yes	Yes
*Hebron	No	No	Yes	No	No
*Holiday Hills	No	No	Yes	Yes	No
Huntley	Yes	Yes	Yes	Yes	Yes
Johnsburg	Yes	No	Yes	Yes	Yes
Lake in the Hills	Yes	No	Yes	Yes	Yes
*Lakewood	Yes	Yes	Yes	Yes	Yes
*Marengo	Yes	Yes	Yes	Yes	Yes
*McCullom Lake	Yes	No	Yes	Yes	Yes
McHenry	Yes	Yes	Yes	Yes	No
Oakwood Hills	Yes	No	Yes	Yes	Yes
Prairie Grove	Yes	No	Yes	Yes	No
*Richmond	No	No	No	No	No
*Ringwood	No	No	No	No	No
Spring Grove	Yes	No	Yes	Yes	Yes
*Trout Valley	No	No	No	No	No
*Union	No	No	No	No	No
Wonder Lake	Yes	Yes	Yes	Yes	Yes
Woodstock	Yes	Yes	Yes	Yes	Yes
McHenry County	Yes	Yes	Yes	Yes	No

*Results from 2010 plan

4.5 Subdivision Regulations

Subdivision regulations govern how land will be subdivided and set construction standards. These standards generally address roads, sidewalks, utilities, storm sewers, and drainage ways. 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

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

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

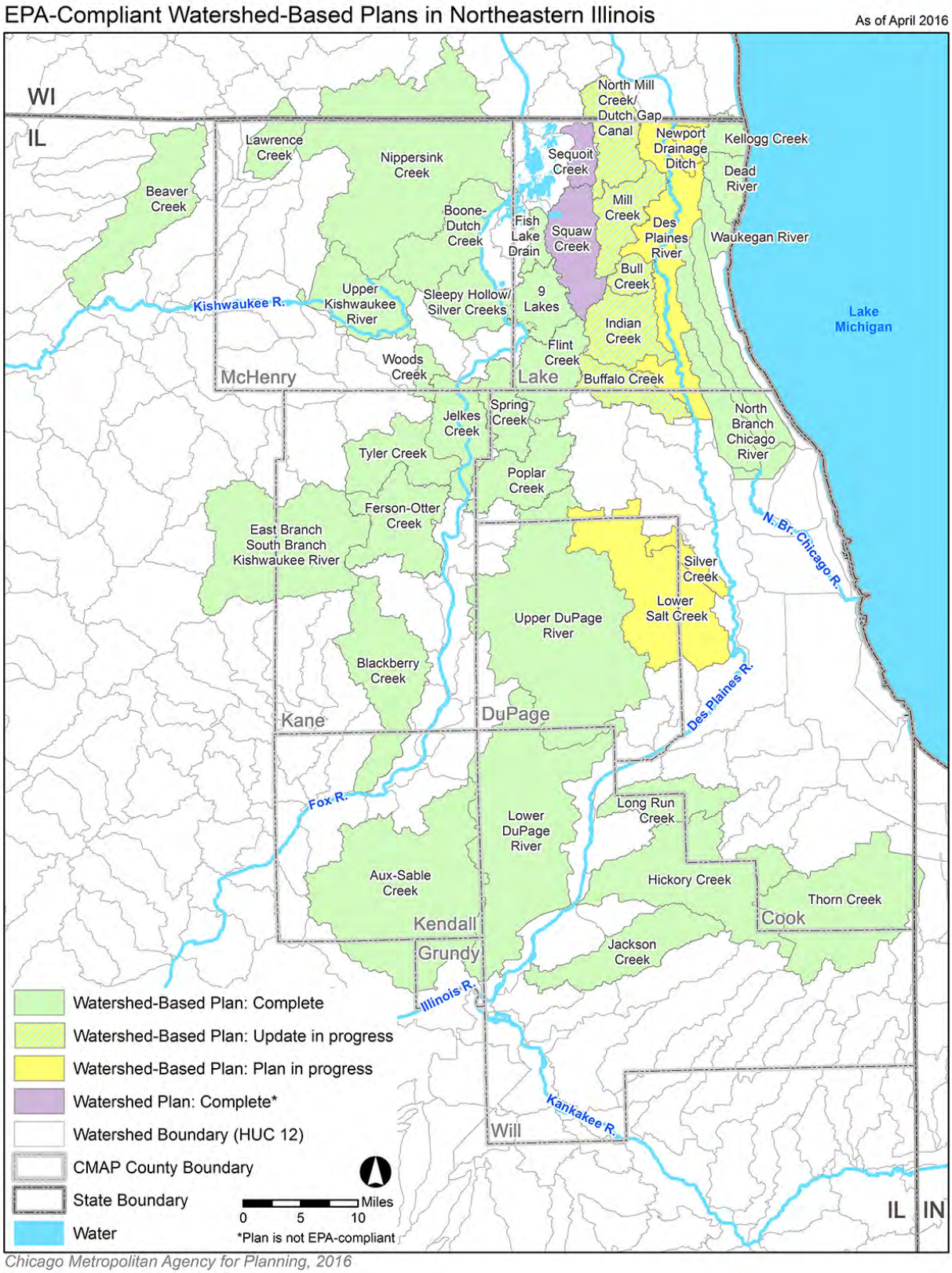
4.6 Watersheds and Their Role in Natural Hazard Mitigation Planning

A watershed is the land area from which rainwater and snowmelt drain into a body of water such as a stream or lake. Watershed boundaries are defined by nature and are largely determined by the surrounding topography or "lay of the land". Protecting our watersheds is important because what we do on the land directly affects the quality of our surface waters, drinking water supply, local economy, wildlife habitat, and recreational resources. They also play an important role in preventing flooding, mitigating the effects of droughts, and protecting our natural resources.

Watershed planning is a voluntary approach to protecting and improving watershed health. The written plans that result from such planning contain recommended projects that may be implemented by local governments. Such projects are aimed at protecting open space, providing floodplain protection, creating riparian buffers, controlling erosion, preventing sediment build-up, preserving and restoring wetlands, preserving habitat, retrofitting detention/retention basins, and educating the public about the importance of watershed management. Many of these projects that are part of IEPA-approved plans are eligible for grants under Section 319 of the Clean Water Act, which might aid communities as they work to implement actions to mitigate natural hazards in McHenry County. Thus local governments are urged to include projects contained in IEPA-approved watershed plans that encompass their area in their Natural Hazard Mitigation Plans.

Exhibit 4-1, from the Chicago Metropolitan Agency for Planning (CMAP), illustrates completed watershed plans and plans underway in northeast Illinois. For a list of completed plans with links to plan documents and partner organizations, please visit http://www.cmap.illinois.gov/documents/10180/12330/watershedplans.pdf.

Exhibit 4-1 Watershed Based Plans



Chicago Metropolitan Agency for Planning, 2016

McHenry County watersheds with IEPA-approved plans and the municipalities that they encompass include:

1. Silver and Sleepy Hollow Creeks Watershed: Prairie Grove; Oakwood Hills; portions of Cary, Crystal Lake, and McHenry; and portions of Nunda and Algonquin Townships and unincorporated McHenry County
2. Boone-Dutch Creek Watershed: Bull Valley; McHenry; McCullom Lake; portions of Woodstock, Greenwood, Wonder Lake, Ringwood and Johnsburg; and portions of McHenry, Greenwood, Dorr, Nunda, and Richmond Townships and unincorporated McHenry County
3. Nippersink Creek Watershed: Richmond; Spring Grove; Wonder Lake; Hebron; Greenwood; Ringwood; much of Woodstock; portions of Fox Lake, Bull Valley and McHenry; and portions of Richmond, Hebron, Alden, Burton, McHenry, and Dorr Townships and unincorporated McHenry County
4. Upper Kishwaukee Creek Watershed: Woodstock; Lakewood; Crystal Lake; and portions of Dorr, Grafton, Hartland and Seneca Townships and unincorporated McHenry County
5. Lawrence Creek Watershed: Harvard; portions of Chemung, Dunham and Alden Townships and unincorporated McHenry County
6. Woods Creek Watershed: Algonquin; a portion of Algonquin Township and unincorporated McHenry County
7. Jelkes Creek Watershed: Algonquin; a portion of Algonquin Township and unincorporated McHenry County
8. Flint Creek Watershed: Barrington Hills; a portion of Algonquin Township and unincorporated McHenry County
9. Spring Creek Watershed: Fox River Grove; Algonquin; a portion of Algonquin Township and unincorporated McHenry County
10. Nine Lakes Watershed: Island Lake; Port Barrington; portions of Nunda and Algonquin Townships and unincorporated McHenry County

4.7 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 Figure 4-7). 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

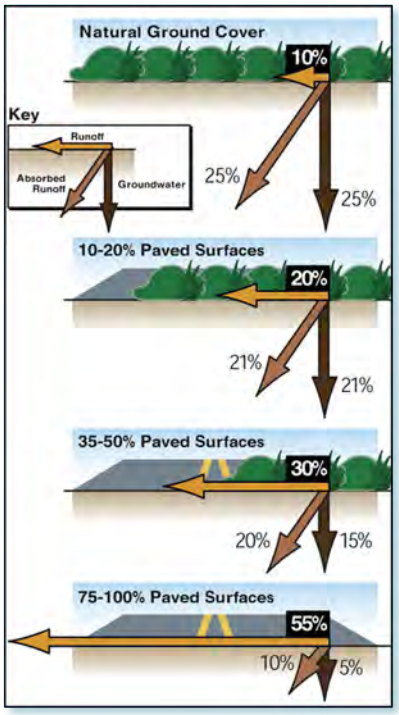
4.7.1 Site Stormwater Runoff

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.

Figure 4-7 Runoff

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

4.7.2 Floodplain Management



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

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 (Bull Valley, Oakwood Hills, and Trout Valley) participate in the National Flood Insurance Program (NFIP) (see Table 1-2 in Chapter 1). The McHenry County Stormwater Management Ordinance meets or exceeds all of 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 ensures all activities in the floodplain are being properly regulated. Also, compensatory

storage is required at a ratio of a minimum of 1.0 to 1.0 and up to 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.

4.7.3 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. Suspended sediment 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.

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 U.S. EPA as the nation's number one nonpoint source pollutant for aquatic life.

Figure 4-8 Best Management Practices

1. 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

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, 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 (Figure 4-8).

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) ILR10 Permit, as issued. The most recent version of the ILR10 Permit is August 2013.

4.7.4 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 (Corps) 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."

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 in Figure 4-9.

Figure 4-9 West Nile

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

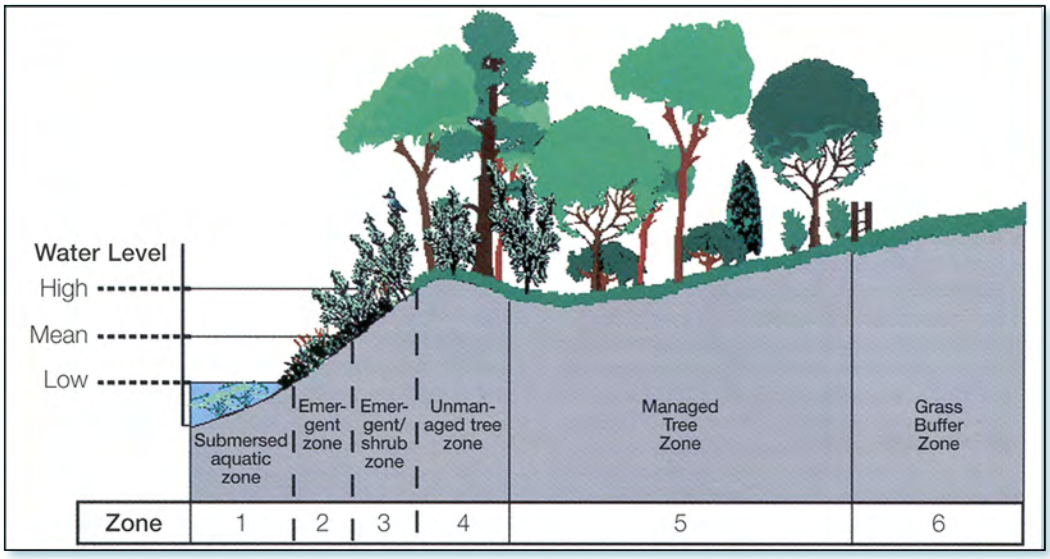
Local Implementation: Both Corps WOTUS (jurisdictional wetlands) and isolated wetlands are regulated in the McHenry County Stormwater Management Ordinance. Wetlands must be properly identified and delineated according to the standards in the Stormwater Management Ordinance, which are consistent with the Corps' standards. 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.

4.7.5 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. Figure 4-10 illustrates an example of environment protection using a riparian buffer, and Figure 4-11 provides descriptions of the zones shown in Figure 4-10.

Implementation: Buffer areas are required in the McHenry County Stormwater Management 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.

Figure 4-10 Riparian Environment Protection



Aquatic and Riparian Buffer Plant Zones ***(Source: USDA, NRCS)***

Figure 4-11 Aquatic and Riparian Buffer Plant Zones

2. 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 highwater. By using the proper plants in each zone, they stabilize streambanks, filter polluted runoff, and provide habitat.

4.7.6 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.

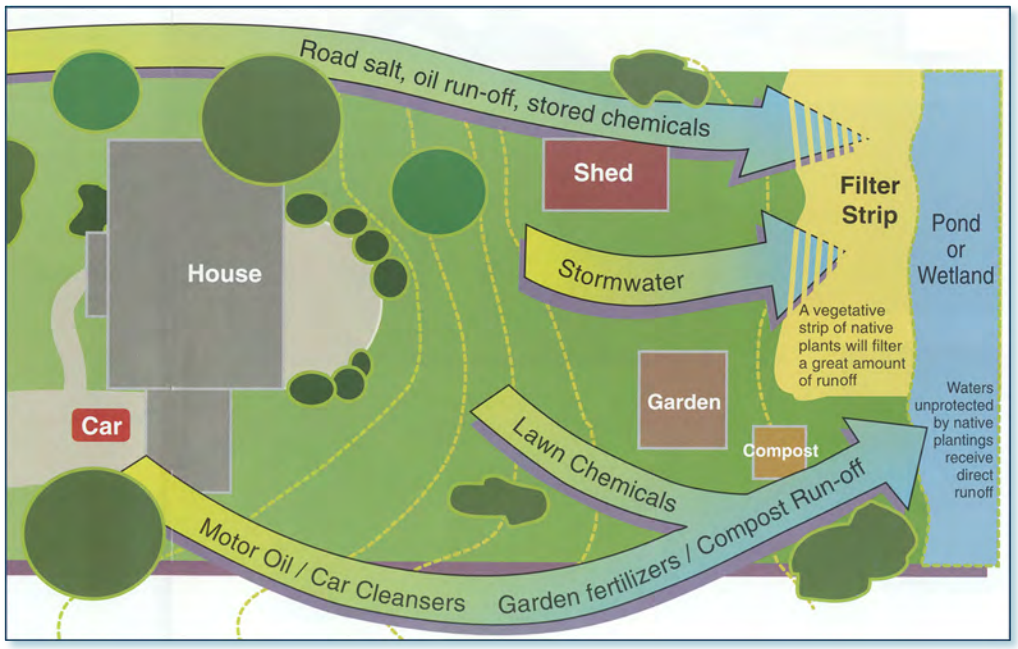
Examples of nonpoint source pollutants are lawn fertilizers, pesticides, and other farm chemicals, animal wastes, oils from street surfaces and industrial areas and sediment from agriculture, construction, mining and forestry. These pollutants are washed off the ground's surface by stormwater and flushed 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 uses of drainage and storage facilities.

Local Implementation: Water quality protection practices are included in the McHenry County Stormwater Management 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.

4.7.7 Implementation of the McHenry County Stormwater Management Ordinance

Figure 4-12 Stormwater Management



BMPs slow stormwater runoff and improve water quality.
Source: Living With Wetlands, A Handbook for Homeowners in Northeastern Illinois

Figure 4-12 above shows the benefits of using BMPs in stormwater management. 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 applications 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 County Stormwater Management Ordinance Certified Community Status

Municipality:	Status:
Village of Algonquin	Kane County
Village of Barrington Hills	Lake-part
Village of Bull Valley	Non-Certified
Village of Cary	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	Certified
Village of Hebron	Certified
Village of Holiday Hills	Non-Certified
Village of Huntley	Kane County
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	Non-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

4.8 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. Some 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. Critical facilities constructed in floodplains are held to the same standards as other structures built in 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. 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.

4.9 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 participate 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 for 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. 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.

4.10 References

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CHAPTER 5 - PROPERTY PROTECTION

Figure 5-1 Property Protection

Source: Lake County Stormwater Management

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 (Figure 5-1)

The advantages and disadvantages to these four methods are discussed below. Generally, floods do not damage vacant areas. Table 5-1 lists various types of flood problems reported in McHenry County. Most major impacts of hazards are 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 (Barrington Hills, Fox Lake, Island Lake, Lakemoor, Port Barrington are missing)

Municipality	Stormwater Flooding	Stream Overbank Flooding	Foundation Seepage	Groundwater
Algonquin	Yes	Yes	No	No
Bull Valley	No	No	No	No
Cary	Yes	No	No	No
Crystal Lake	Yes	No	Yes	Yes
Fox River Grove	No	Yes	No	No
*Greenwood	Yes	No	Yes	No

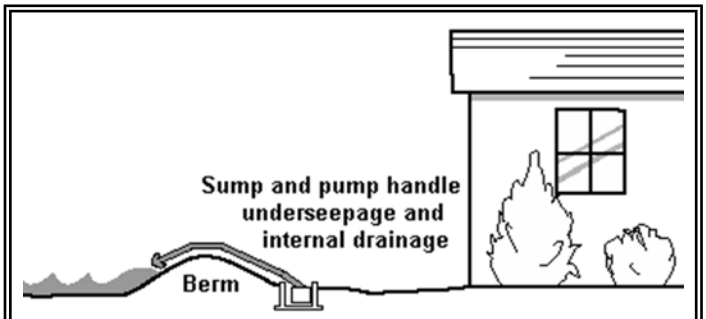
Municipality	Stormwater Flooding	Stream Overbank Flooding	Foundation Seepage	Groundwater
Harvard	No	No	No	No
*Hebron	Yes	No	No	No
*Holiday Hills	No	No	No	No
Huntley	No	No	No	No
Johnsburg	Yes	Yes	Yes	Yes
Lake in the Hills	No	Yes	No	No
*Lakewood	Yes	No	Yes	Yes
*Marengo	No	No	No	No
*McCullom Lake	Yes	No	No	No
McHenry	Yes	No	No	No
Oakwood Hills	Yes	No	No	No
Prairie Grove	No	No	Yes	Yes
*Richmond	Yes	No	No	No
*Ringwood	Yes	No	No	No
Spring Grove	No	Yes	No	No
*Trout Valley	No	No	No	No
*Union	Yes	Yes	No	No
Wonder Lake	Yes	No	Yes	Yes
Woodstock	No	No	No	No
McHenry County	Yes	Yes	Yes	Yes
Township	**Stormwater Flooding**	**Stream Overbank Flooding**	**Foundation Seepage**	**Groundwater**
*Alden	No	No	No	No
Algonquin	Yes	Yes	Yes	Yes
*Burton	No	No	No	No
Chemung	No	No	No	No
Coral	Yes	Yes	Yes	Yes
Dorr	Yes	No	Yes	Yes
Dunham	No	No	No	No
Grafton	No	No	No	No
*Greenwood	Yes	No	No	No
Hartland	No	No	No	No
*Hebron	Yes	No	No	No
Marengo	Yes	No	Yes	Yes
*McHenry	No	No	No	No
Nunda	No	Yes	No	No
*Richmond	No	No	No	No
Riley	Yes	No	Yes	No
*Seneca	Yes	Yes	No	Yes

*Results from 2010 plan

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 (Figure 5-2).

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,

Figure 5-2 Barriers



Small barriers can be effective against shallow flooding.

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 (see Figure 5-3). 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.

Figure 5-3 Home Elevation

Home elevated two foot above the base flood elevation

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.

Local Implementation: McHenry County, the Village of Algonquin and the 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.

5.2 Retrofitting – Modify the Building

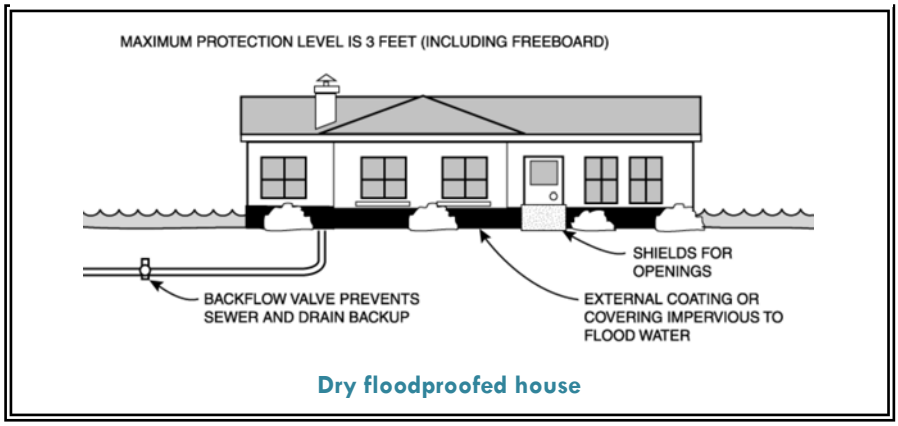
Hazards Addressed	
✓	Floods
✓	Summer
✓	Winter Storms
✓	Extreme Cold
	Extreme Heat
✓	Tornadoes
	Drought
✓	Groundwater

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

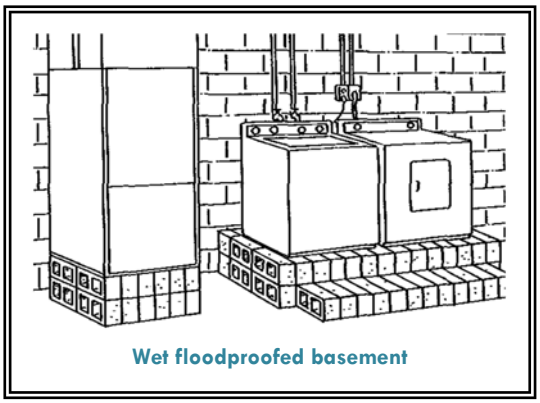
Dry Floodproofing: Flood retrofitting measures include dry floodproofing where all areas below the flood protection level are made watertight. Walls are coated with waterproofing compounds or plastic sheeting. Openings (doors, windows, and vents) are closed, either permanently, with removable shields, or with sandbags (Figure 5-4).

Figure 5-4 Floodproofing Home



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.

Figure 5-5 Floodproofing Basement



Wet floodproofing: 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. An example of a wet floodproofed basement is shown is Figure 5-5.

Wet floodproofing has one advantage over the other approaches that 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.

Sewer Backup: 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 to include floor drain plugs, floor drain stand-pipes, overhead sewers, and backflow protection valves.

The first two approaches keep water from flowing out of the lowest opening in the building, the floor drain and 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.

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. Aboveground shelters are often a better choice and can function as a storage shed if outside or closet/bathroom if built into the home. Aboveground shelters are also less likely to trap people after a storm if debris is blocking the exit.

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. Figure 5-6 shows a safe room still standing in the aftermath of a tornado. More information on safe rooms can be found in FEMA Publication 320.

Figure 5-6 Safe Rooms

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.

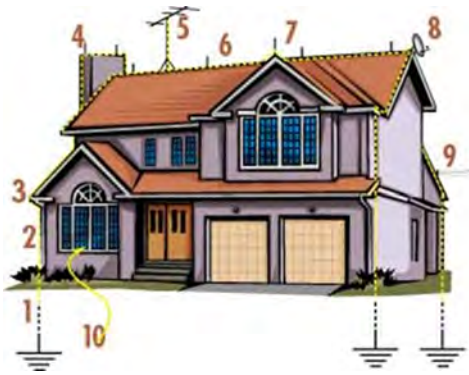
A third tornado and high wind protection modification is to strengthen garage doors, windows and other large openings. If winds break the building's "envelope," the pressures on the structure are greatly increased. Impact-resistant glass is also recommended for high wind or tornado protection.

5.2.3 Severe Summer Storms Hazard (Wind, Lightning, Hail)

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

- Storm shutters
- Lightning rods (see Figure 5-7)
- Strengthening connections and tie-downs (similar to tornado retrofitting)
- Impact-resistant glass in window panes
- Surge protectors at electrical outlets

Figure 5-7 Lightning Protection



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 Severe Winter Storms and Extreme Cold Hazard

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.

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:

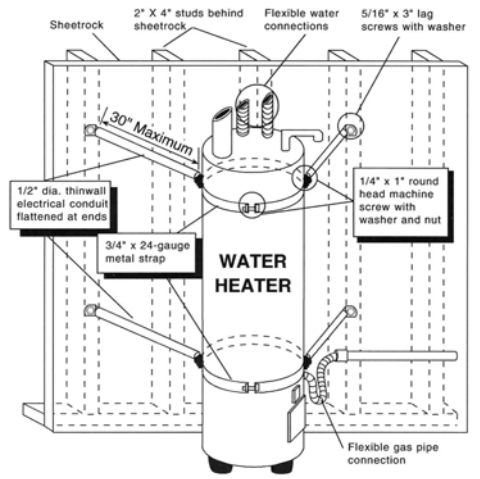
- Removing masonry overhangs that will fall onto the street during shaking
- Bracing the walls of the building provides structural stability
- Bolting sill plates to the foundation

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 (Figure 5-8)
- 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

Figure 5-8 Earthquake Retrofitting



Source: The Homeowners Guide to Earthquake Safety

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.

5.3 Insurance

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.

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

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.

Flood insurance: 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. For the County and all municipalities that are wholly or partially in McHenry County, there are 1,657 flood insurance policies in place.

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.

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.

For example, 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)
- U.S. Housing and Urban Development (HUD) - Community Development Block Grant-Disaster Recovery (CDBG-DR)

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.

5.5 Repetitive Flood Loss Properties

Chapter 2 explains the criteria for designation of the County's repetitive loss properties (Figure 5-9). 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.

Figure 5-9 Repetitive Loss Property Definition

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.

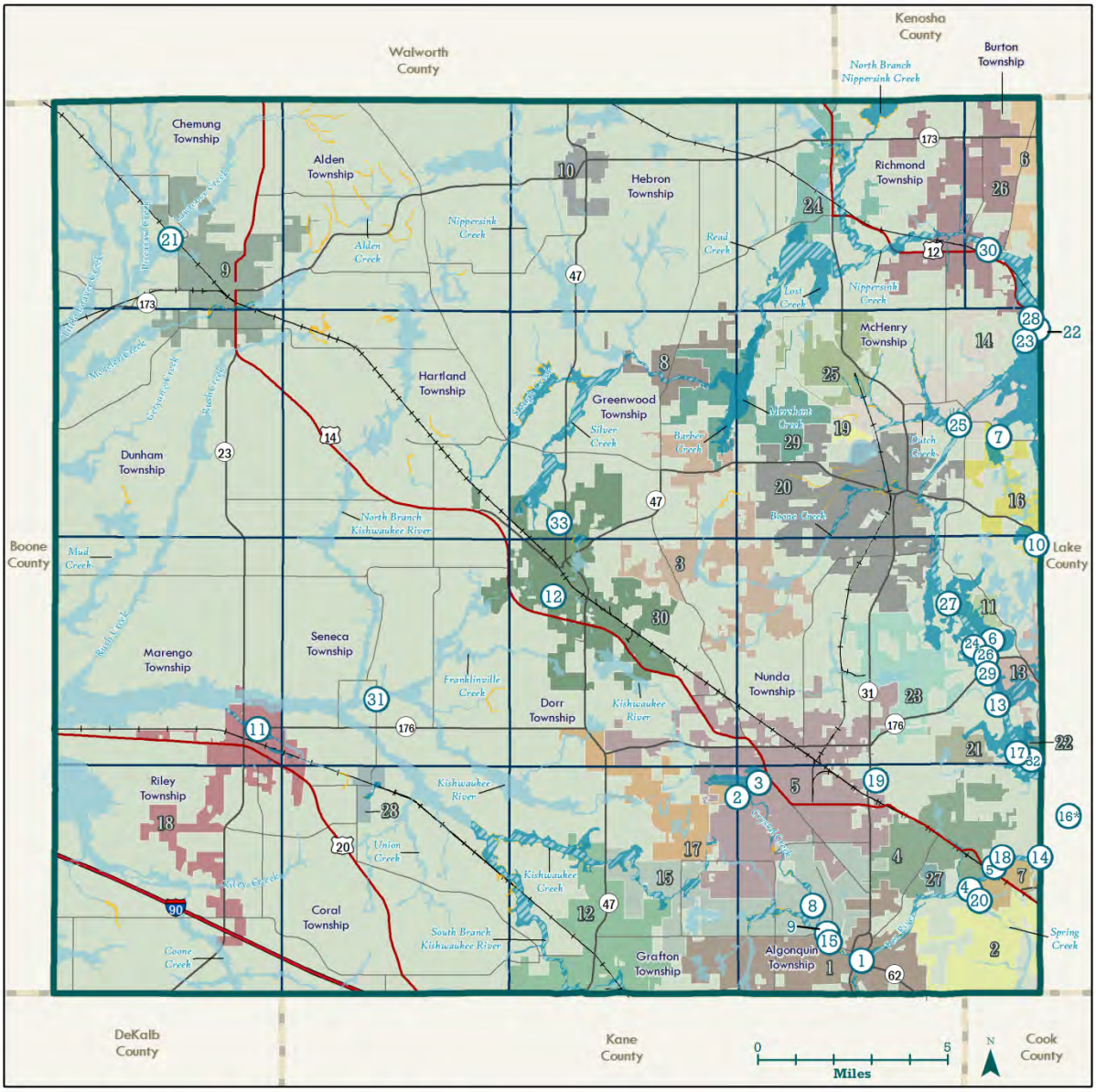
- "High hazard areas" are areas in the floodway or where the 100-year flood is two or more feet over the first floor.
- Buildings in high hazard areas or in less than good condition should be acquired and demolished.
- Buildings with basements and split-level foundations in high hazard areas should be 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 76 repetitive loss structures located in the county. As discussed in Chapter 2, a full review of flood insurance claims data reveals that over 90 properties in McHenry County have experienced repeated flooding issues.

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 76 repetitive flood loss properties, and to investigate other at-risk structures in the vicinity of the repetitive flood loss property, the 76 properties have been grouped into areas – repetitive flood loss areas.

Exhibit 5-1 McHenry County Repetitive Flood Loss Areas



McHenry County, IL

Repetitive Loss Areas

DATA SOURCES:
McHenry County GIS;
FEMA Map Service Center;
Retrieved October 2015

Stantec

Circles are 1 mile in diameter. The numbers for each repetitive loss area corresponds to the number in Table 5-2. Circles are not centered on highest location densities, but are positioned to contain the most properties. Circles were developed at 1:220,000 for Countywide map reference only.

*Note: Area #16 is located outside of the County boundary.

- McHenry County
- Surrounding Counties
- Political Township
- Interstate
- US Highways
- State Roads
- Other Roads
- Railways
- 0.2% Chance per Year
- Zone A
- Zone AE
- Floodway
- Repetitive Loss Areas

Municipal Boundaries

1 Algonquin	11 Holiday Hills	21 Oakwood Hills
2 Barrington Hills	12 Huntley	22 Port Barrington
3 Bull Valley	13 Island Lake	23 Prairie Grove
4 Cary	14 Johnsburg	24 Richmond
5 Crystal Lake	15 Lake in the Hills	25 Ringwood
6 Fox Lake	16 Lakemoor	26 Spring Grove
7 Fox River Grove	17 Lakewood	27 Trout Valley
8 Greenwood	18 Marengo	28 Union
9 Harvard	19 McCullom Lake	29 Wonder Lake
10 Hebron	20 McHenry	30 Woodstock

Exhibit 5-1 shows the general location of the repetitive flood loss areas. Table 5-2 shows the number of properties included in each repetitive loss area shown on Exhibit 5-1. Table 5-3 summarizes the number of repetitive loss properties throughout McHenry County. Note that addresses of repetitive flood loss are not provided in this Plan, that information is confidential.

Flood insurance claim information was reviewed and summarized for each community in Chapter 2 of this Plan. Insurance claims data was also reviewed as part of the repetitive loss consideration. The highest flood insurance claim paid was about $180,000. Ninety-three properties had claims over $1,000, and 36 properties with three or more claims. All of these properties appear to be within the identified repetitive loss areas. Twenty-six claims were over $40,000 and were mostly from the 2007 and 2013 floods.

A more detailed description of the repetitive loss areas and maps of each repetitive loss area are provided in Appendix XX to this Plan.

Table 5-2 Identified McHenry County Repetitive Flood Loss Areas

Repetitive Flood Loss Area	Community	FEMA Repetitive Flood Loss Properties
1	Algonquin	4
2	Crystal Lake	1
3	Crystal Lake	1
4	Fox River Grove	1
5	Fox River Grove	1
6	Holiday Hills	5
7	Johnsburg	1
8	Lake In The Hills	1
9	Lake In The Hills	3
10	Lakemoor	1
11	Marengo	1
12	McHenry County (Unincorporated Area)	1
13	McHenry County (Unincorporated Area)	6
14	McHenry County (Unincorporated Area)	2
15	McHenry County (Unincorporated Area)	1
16	McHenry County (Unincorporated Area)	1
17	McHenry County (Unincorporated Area)	1
18	McHenry County (Unincorporated Area)	1
19	McHenry County (Unincorporated Area)	1
20	McHenry County (Unincorporated Area)	1
21	McHenry County (Unincorporated Area)	1
22	McHenry County (Unincorporated Area)	3
23	McHenry County (Unincorporated Area)	2
24	McHenry County (Unincorporated Area)	2
25	McHenry County (Unincorporated Area)	2

Repetitive Flood Loss Area	Community	FEMA Repetitive Flood Loss Properties
26	McHenry County (Unincorporated Area)	4
27	McHenry County (Unincorporated Area)	4
28	McHenry County (Unincorporated Area)	10
29	McHenry County (Unincorporated Area)	1
30	McHenry County (Unincorporated Area)	2
31	McHenry County (Unincorporated Area)	1
32	Port Barrington	5
33	Woodstock	1
	Total	**73**

Table 5-3 Identified McHenry County Repetitive Flood Loss Summary

Community	Repetitive Loss Properties for FEMA Identified CID	Repetitive Loss Properties with Correct CID
McHenry County	64	49
Algonquin	4	4
Crystal Lake	0	2
Fox River Grove	2	2
Holiday Hills	0	5
Johnsburg	0	1
Lake in the Hills	0	4
Lakemoor	1	1
Marengo	0	1
Port Barrington	5	5
Woodstock	0	2
Total	76	76

- Included above are 3 RLs not found (no such address)
- Not included above are 28 repetitive loss properties identified for Fox Lake. Fox Lake is participating in the Lake County All Natural Hazards Mitigation Plan
- In 2010 there were 52 RL within McHenry County
- At least 10 homes added to RL list due to April 2013 flooding

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 required (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 facilities.

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.
4. *Flood Proofing Techniques, Programs and References*, U.S. Army Corps of Engineers National Flood Proofing Workgroup, 1991.
5. *Mitigation Ideas: Possible Mitigation Measures by Hazard Type*, FEMA Region 5, 2002.
6. *Floodproofed Sites in Illinois*, French & Associates, 1992.
7. *Guide to Flood Protection in Northeastern Illinois*, Illinois Association for Floodplain and Stormwater Management, 1997.
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.

11. *Local Flood Proofing Programs*, U.S. Army Corps of Engineers, 1994.

12. Materials supplied by County offices and municipalities, 2015 and 2016.

13. State Farm Insurance website, www.statefarm.com.

14. *Taking Shelter from the Storm: Building a Safe Room Inside Your House*, Federal Emergency Management Agency, FEMA-320, 1998.

15. *Windstorm Mitigation Manual for Light Frame Construction*, Illinois Emergency Management Agency, 1997.

16. Insurance Information Institute website: www.iii.org.

17. *CRS Coordinator's Manual*, Community Rating System, FEMA, 2013.

18. Survey of municipalities, townships and County offices, 2015.

CHAPTER 6 - STRUCTURAL PROJECTS

Hazards Addressed
✓ Floods
✓ Summer
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, and the USDA Natural Resources Conservation Service. Many projects are jointly planned and funded between these agencies in cooperation with counties and/or municipalities. Figure 6-1 provides a short description of McHenry County's Stormwater Management Plan.

Figure 6-1 Stormwater Management Plan

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 Figure 6.2, but they also have shortcomings. The appropriateness of using structural flood control measures depends on individual project area circumstances.

Figure 6-2 Flood Control Projects

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 alternatives assessment, and that assessment is typically part of, or a product of, a watershed plan.

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 (e.g., 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 to be built close to or disrupt the area to be protected.

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

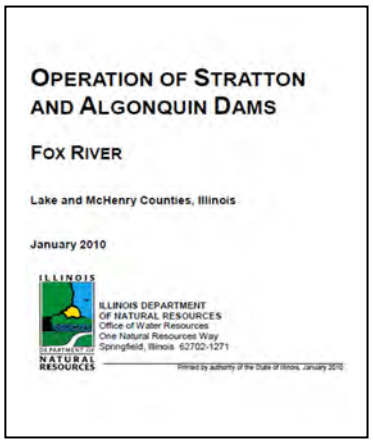
- The expense for management and maintenance of the facility.
- Flooding can still occur if their design level is exceeded.
- Sediment deposition may occur and reduce the storage capacity over time.
- They can impact water quality as they are known to affect temperature, dissolved oxygen and nitrogen, 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 Chapter 2, Section 2.11.3, 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. Both dams have operational guidance; the cover of the dam operations document is shown in Figure 6-3.

River flows are primarily controlled at the Stratton Dam, especially when the Fox River is approaching or at flood stage. 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).

Figure 6-3Algonquin Dams


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

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 the 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 downstream shorelines.

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 a 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," 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, when 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 an U.S. Army 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 of increasing adjacent or downstream flooding should 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.

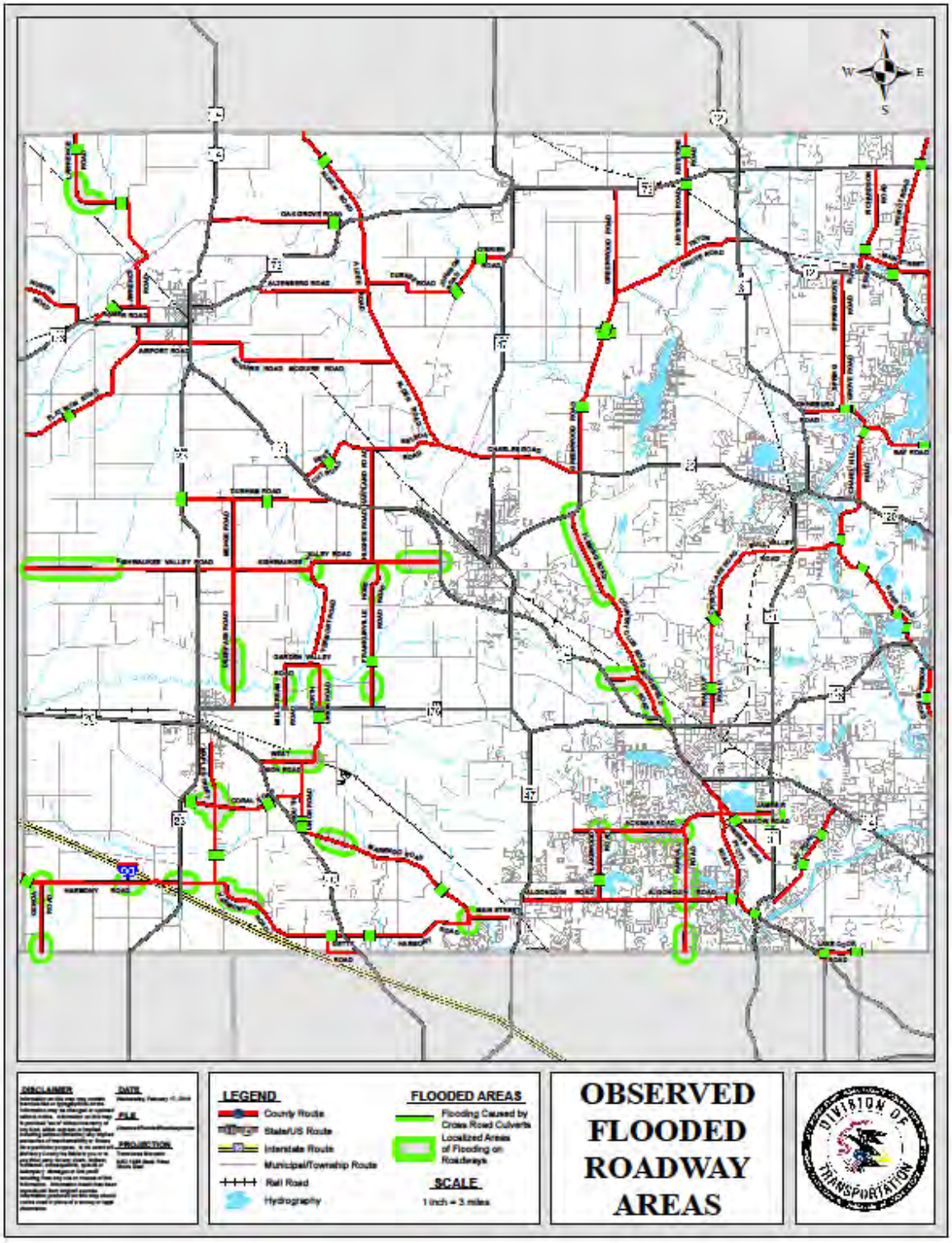
Table 6-1 McHenry County Bridges and Roadways That Potentially Impede Flood Flows

Community	Bridge or Roadway
Village of Algonquin	Woods Creek Drive
Village of Bull Valley	
Village of Cary	TBD in 2016 Mitigation Study
Village of Fox River Grove	Private Property
Village of Johnsburg	Local roads culverts with 10 yr. frequency
City of McHenry	Meadow Lane Bridge
Village of Oakwood Hills	Overflow culvert under 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	Justen Road Bridge
Village of Prairie Grove	Culverts under Ames Road
*City of Woodstock	Edgewood Drive
*Greenwood Township	Thayer Road
*Marengo Township	County Line Road
*Nunda Township	Whipporwill Drive
*Riley Township	Numerous

*Results from 2010 plan

The McHenry County Division of Transportation developed the map in Exhibit 6-1, which shows roadways that Division staff could recall has having flooded during a flood event for a severe storm over the past 30 years. This was updated for the 2016 update, though no major changes were reported.

Exhibit 6-1 Past Flooding Locations on McHenry County Highways (1980 to 2016)



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 drainage ways 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.

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.

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.

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

Table 6-2 McHenry County Municipal Drainage System Maintenance (not all communities are included in the table)

Municipality	Channel Sediment Accumulation	Drain System Maintenance	Written Procedures
Algonquin	No	Yes	No
Bull Valley	No	Yes	No
Cary	No	Yes	Yes
Crystal Lake	No	Yes	No
Fox River Grove	No	Yes	No
*Greenwood	No	No	No
Harvard	No	Yes	No
*Hebron	No	No	No
*Holiday Hills	Yes	Yes	No
Huntley	No	Yes	No
Johnsburg	Yes	Yes	Yes
Lake in the Hills	No	Yes	Yes
*Lakewood	No	Yes	No
*Marengo	No	Yes	No
*McCullom Lake	Yes	Yes	Yes
McHenry	Yes	Yes	No
Oakwood Hills	Yes	Yes	No
Prairie Grove	Yes	Yes	No
*Richmond	No	No	No
*Ringwood	No	No	No
Spring Grove	No	Yes	No
*Trout Valley	No	No	No
*Union	No	No	No
Wonder Lake	Yes	Yes	No
Woodstock	No	Yes	No

*Results from 2010 plan

Table 6-3 McHenry County Township Drainage System Maintenance

Township	Sediment Accumulation	Drain System Maintenance	Written Procedures
*Alden	No	No	No
*Algonquin	Yes	Yes	No
*Burton	No	No	No
*Chemung	No	No	No
Coral	No	Yes	No
*Dorr	No	No	No
Dunham	No	Yes	No
*Grafton	No	No	No
*Greenwood	No	No	No
*Hartland	No	No	No
*Hebron	No	No	No
Marengo	Yes	No	No
*McHenry	No	Yes	No
*Nunda	Yes	Yes	No
*Richmond	No	No	No
*Riley	Yes	No	No
*Seneca	Yes	No	No

*Results from 2010 plan

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 upstream and 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 where roadways 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 plans 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.

6.8 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, 2013.
4. *CRS Credit for Drainage System Maintenance*, FEMA, 2002.
5. Survey of municipalities, townships and County offices, 2015.
6. *Operation of Stratton and Algonquin Dams*, Illinois Department of Natural Resources, Office of Water Resources, January 2010

CHAPTER 7- RESOURCE PROTECTION

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 through regulatory steps for protecting natural areas or natural functions. The regulatory programs are discussed in Chapter 4.

Figure 7-1 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 helps to improve water quality, and provide habitat for many species of fish, wildlife, and plants. Figure 7-2 provides a further description of wetlands. Approximate wetland locations in McHenry County are available on the McHenry County website.

Figure 7-2 Wetlands

"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.

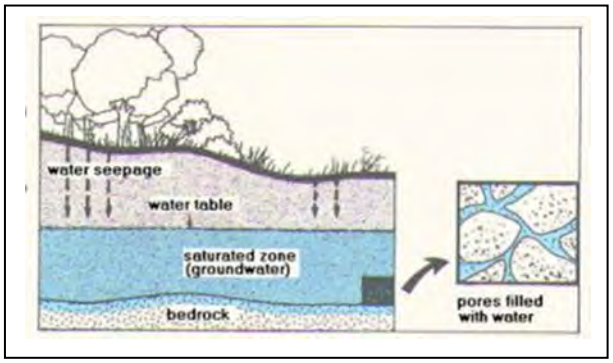
Wetlands are of varying types and varying quality. Wetlands such as fens or sedge meadows hold much more environmental value that a wetland created by roadside ditches. According to the IDNR, McHenry County contains the largest area in the State for shallow marsh or wet meadow wetlands (11,406 acres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

Local implementation: Wetland protection is included in the McHenry County Stormwater Management 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 (Figure 7-3). All groundwater was at one time surface water. Rain and snow melt seeps or infiltrates into the ground. Water that infiltrates 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.

Figure 7-3 Groundwater Protection



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 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.

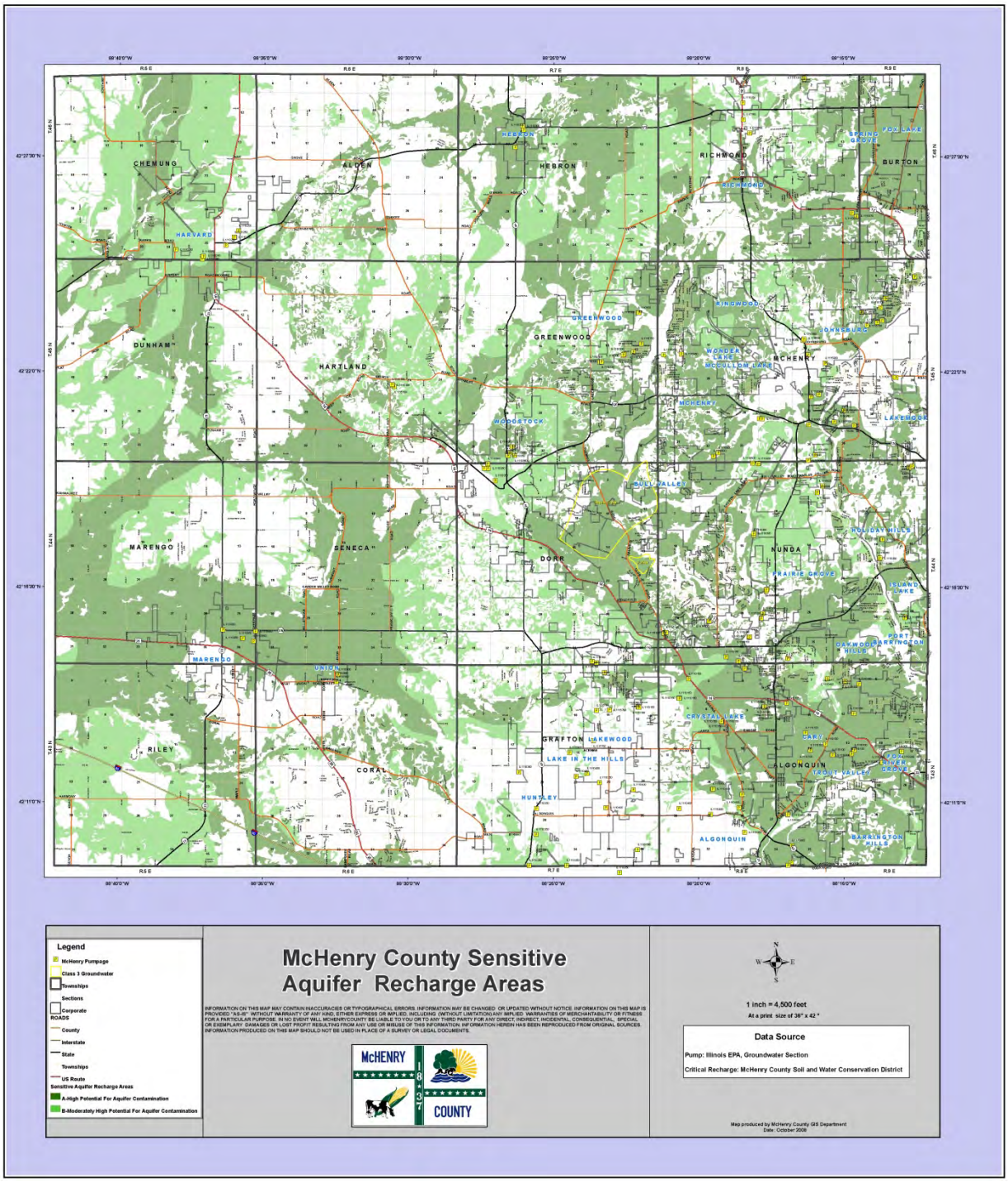
The Water Resources Action Plan has ten areas of focus:

- 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 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.

Exhibit 7-1 McHenry County Sensitive Aquifer Recharge Areas



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. Terms 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 (see Figure 7-4).

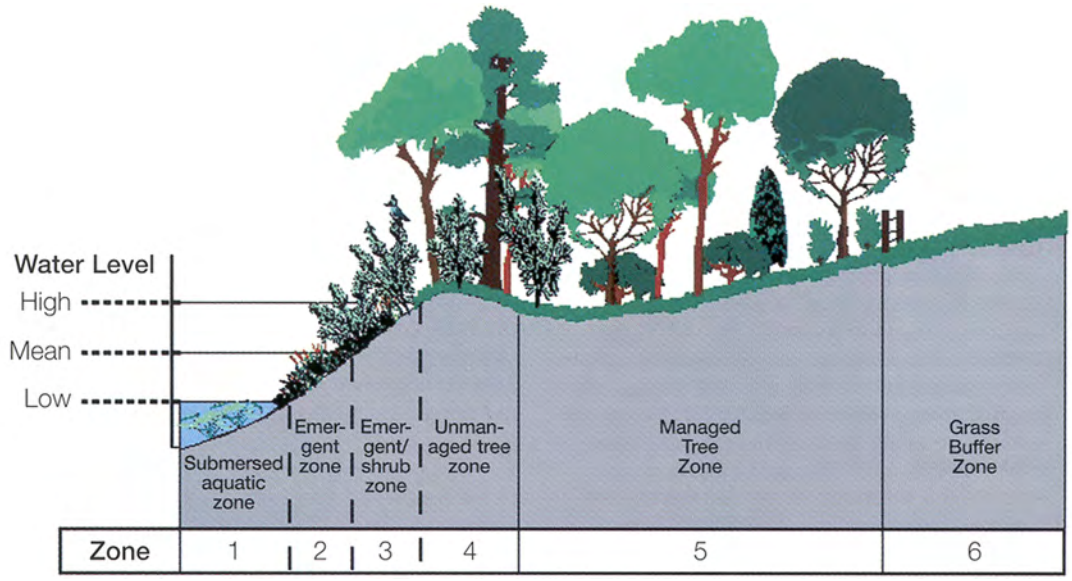
In all, restoring the right vegetation to a stream has the following advantages:

- 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 water flows downstream. Because of debris, scour and other factors, a stream might meander through 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.

Figure 7-4 Buffer 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

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 be 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 Management 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 7-1. In other areas of the County, dumping outside of floodplains is prohibited in associated with a development that exceeds 5,000 square feet.

Table 7-1 McHenry County Communities that Prohibit Dumping in Streams

Municipality	Dumping Ordinance	Township	Dumping Ordinance
Algonquin	Yes	*Alden	No
Bull Valley	No	*Algonquin	No
Cary	Yes	*Burton	No
Crystal Lake	Yes	*Chemung	No
Fox River Grove	Yes	*Coral	No
*Greenwood	No	*Dorr	No
Harvard	Yes	*Dunham	No
*Hebron	No	*Grafton	No
*Holiday Hills	Yes	*Greenwood	No
Huntley	Yes	*Hartland	No
Johnsburg	Yes	*Hebron	No
Lake in the Hills	Yes	*Marengo	Yes
*Lakewood	Yes	*McHenry	No
*Marengo	Yes	McHenry Township Road	No
*McCullom Lake	No	*McHenry Township FPD	No
McHenry	Yes	*Nunda	Yes
Oakwood Hills	Yes	*Richmond	No
Prairie Grove	No	*Riley	No
*Richmond	No	*Seneca	No
*Ringwood	No	*Woodstock FPD	Yes
Spring Grove	Yes		
*Trout Valley	No		
*Union	No		
Wonder Lake	Yes		
Woodstock	Yes		
McHenry County	No		

*Results from 2010 plan

7.5 Urban Forestry

The majority of damage caused by wind, ice and snow storms is to trees (Figure 7-5). 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.

Figure 7-5 Trees are the first victims of ice storms.

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."

Local Implementation: The 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.

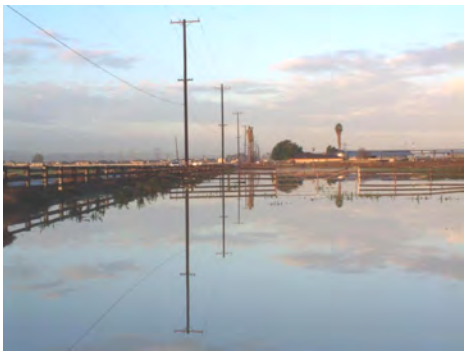
Table 7-2 McHenry County Tree City USA Communities

Municipality	Tree City
Algonquin	Yes
Cary	Yes
Lake-in-the-Hills	Yes
*Lakewood	Yes

*Results from 2010 plan

7.6 Open Space Preservation

Figure 7-6 Preserving floodplain farmland prevents damage to buildings.



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
- Subdivision regulations need to ensure that streets and other public facilities can handle emergency vehicles during an emergency

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.

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 non-agricultural 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 than developed land;
- 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:
Charles H. Hibbard House	Marengo
Christian Geister House	Algonquin
Col. Gustavus A. Palmer House	Crystal Lake
Count's House	McHenry
George Stickney House	Nunda Township
Lucein Boneparte Covell House	Richmond
Memorial Hall	Richmond
Old McHenry County Courthouse	Woodstock
Orson Rogers House	Marengo
Terwilliger House	Dorr Township
Woodstock Opera House	Woodstock
Woodstock Square Historic District	Woodstock

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 over the Kishwaukee River, Deep Cut Road bridge over the C&NW Railroad, Graf Road bridge over the 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 help 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 Water Resources 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, 2015.

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 services measures protect lives and property. Emergency services 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). The McHenry County 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 the County's EOP. The McHenry County EMA also facilitates emergency management 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 most 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 Emergency Operations Center (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 rivers and 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 areas. However, these events can be very localized and rapid such 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 Table 8-2 and Exhibit 8-1. The McHenry County website offers a link to the NWS's website, which

provides rainfall data, stream levels and flood forecasts. The IDNR website provides links to numerous sites including the NWS, USGS and the U.S. Army Corps of Engineers.

Table 8-1 Flood Forecast and Rain and Stream Gage Links

Illinois Department of Natural Resources (IDNR)
National Weather Service (NWS)
United States Geological Service (USGS)

Table 8-2 McHenry County Rain and Stream Gages

USGS Station ID	USGS Station Name	NWS Flood Stage (ft)	Historical Peak (cfs)
05438030	Franklinville Creek at Franklinville, IL		239
05438170	Kishwaukee River at Marengo, IL		7,350
05548105	Nippersink Creek above Wonder Lake, IL		3,690
05548280	Nippersink Creek near Spring Grove, IL		2,910
05548500	Fox River at Johnsburg, IL		
05549000	Boone Creek near Mc Henry, IL		345
05549500	Fox River near McHenry, IL		
05549501	Fox River (Tailwater) near McHenry, IL	4	
05550000	Fox River at Algonquin, IL	3	6,720
05550001	Fox River (Tailwater) at Algonquin, IL	9.5	7,590

8.2.2 Tornadoes and Thunderstorms

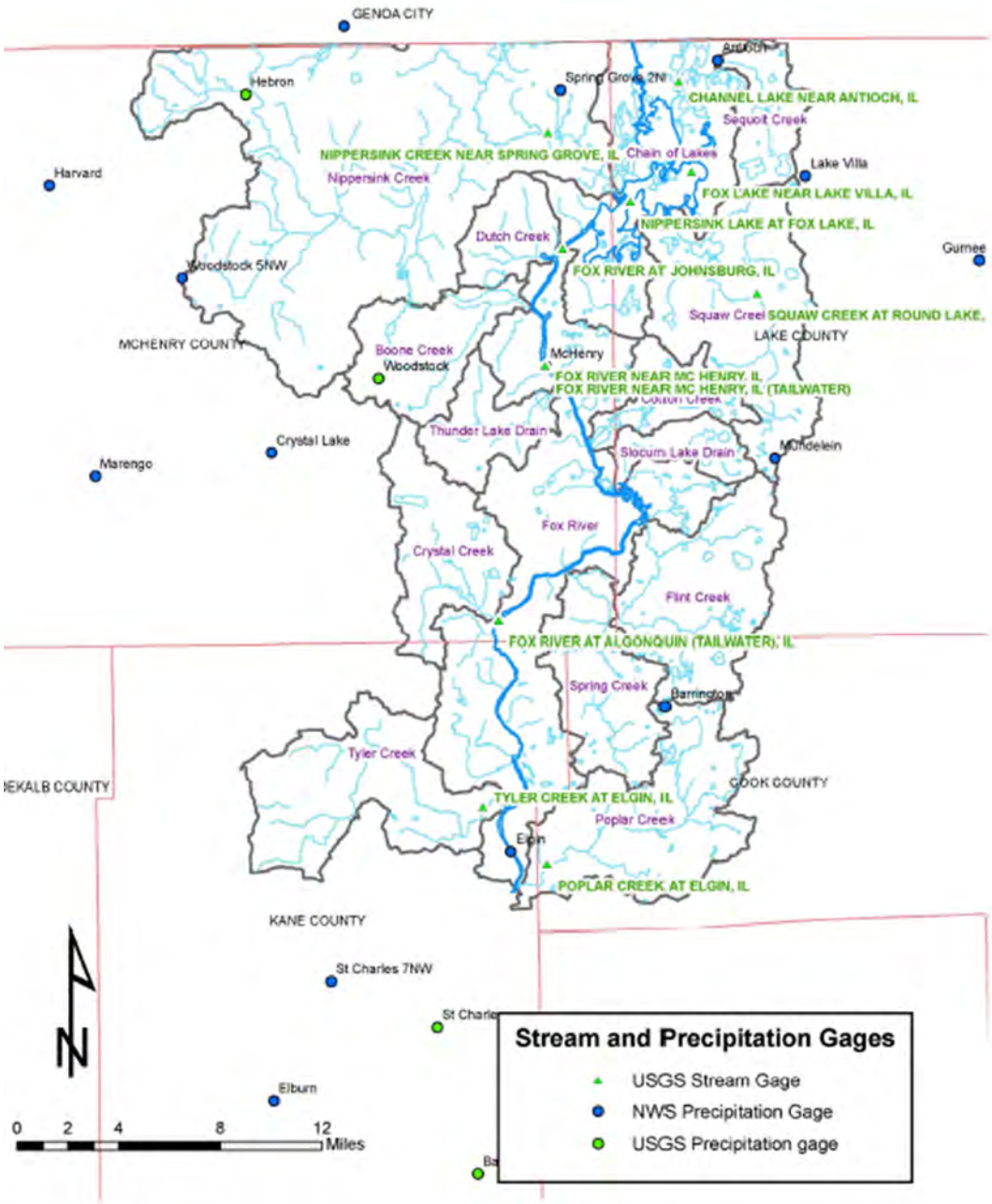
The NWS is the prime agency for detecting meteorological threats, such as tornadoes and thunderstorms. Severe weather warnings are transmitted through the Illinois State Police's Law Enforcement Agencies Data System (LEADS) and through the NOAA Weather Radio System. As with floods, the NWS can only look at the large scale weather picture (whether conditions are appropriate for the 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 monitors the NOAA Weather Wire, or through their monitoring of NOAA weather radios. Police and fire stations, schools, county and municipal buildings, townships, libraries, and some private facilities have been issued Weather Radios, or they are notified over the EAS from the McHenry County EMA.

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-timed warnings or warnings with specific details can increase 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
- 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: McHenry County is 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.
- Nixle is a system that provides real-time communication between public safety, municipalities, businesses, and their communities through text, email, voicemail, social media, and the Nixle Mobile App.

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, the McHenry EMA and municipal EMAs expanded communications through radio and radio frequency interoperability.

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, Sheriff, MCDOT, township or public works)
- Shutting off power to threatened areas (utility company)
- Passing out sand and sandbags (MCDOT, township or public works)
- Ordering an evacuation (chief elected official)
- Holding children at school/releasing children from school (school district)
- Opening evacuation shelters (EMA)
- Monitoring water levels (engineering)
- Security and other protection measures (police or Sheriff)

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 to 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.

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.

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
  - Providing toilet facilities
  - 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 (not all communities are shown in table)

Municipality	Flood Response Procedures	Critical Facilities Protection Procedures	Personnel Trained for Damage Assessment
Algonquin	Yes	Yes	Yes
Bull Valley	No	No	No
*Cary	No	No	Yes
Crystal Lake	Yes	No	Yes
Fox River Grove	No	No	No
*Greenwood	No	No	No
Harvard	No	No	No
*Hebron	No	No	No
*Holiday Hills	No	Yes	No
Huntley	No	No	No
Johnsburg	Yes	No	No
Lake in the Hills	Yes	No	Yes
*Lakewood	Yes	Yes	Yes
*Marengo	Yes	No	No
*McCullom Lake	No	No	No
McHenry	Yes	Yes	No
Oakwood Hills	No	No	No
Prairie Grove	No	No	No
*Richmond	No	No	No
*Ringwood	No	No	No
Spring Grove	Yes	No	Yes
*Trout Valley	No	No	No
*Union	No	No	No
Wonder Lake	No	No	Yes

Municipality	Flood Response Procedures	Critical Facilities Protection Procedures	Personnel Trained for Damage Assessment
Woodstock	No	Yes	No
McHenry County	No	No	Yes

*Results from 2010 plan

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. 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.

The McHenry County Department of Planning & Development's Water Resources 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

10. Continue to update emergency operations plans for the County, and continue to develop municipal emergency operations plans with a NIMS-compliant template.
11. 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.
12. Continue work toward 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.
13. 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.
14. Conduct annual emergency response training exercises. Look for multi-jurisdiction training opportunities.
15. Develop a disaster recovery strategy for the County and municipalities that includes the identification of mitigation efforts.
16. All parcels in the floodplain should be identified using the County's GIS mapping for planning, warning and response purposes.
17. 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.
18. Response procedures for floods and other hazards should be incorporated in all emergency operations planning and response where appropriate. For example, public works departments, MCDOT and township highway departments should pre-identify sandbag staging locations for residents.
19. All communities should strive to obtain a StormReady designation.
20. Develop flood stage maps for the County's major streams to make use of gaging networks, warning systems and GIS mapping capabilities.
21. Research funding for additional rainfall and river gages. Also the County and communities should look to expand the National Weather Service observer's network.

22. Develop emergency transportation plans that allow for emergency coordination and evacuation (routing).

8.9 References

23. McHenry County website.
24. IDNR-OWR website: http://dnr.state.il.us/owr/
25. IDNR and USGS websites: http://il.water.usgs.gov/nwis-w/IL/datasum.components/owrtable.cgi?table=norm
26. Survey of McHenry County, municipalities and townships, 2015.
27. Illinois Emergency Management Agency
28. FEMA website
29. *Flood Fighting*, Illinois Department of Transportation, Division of Water Resources, 1985.
30. Guidelines on Community Local Flood Warning and Response Systems, Federal Interagency Advisory Workgroup on Water Data, 1985.
31. Information on StormReady communities can be found on the National Weather Service website, www.nws.noaa.gov/stormready/.
32. *CRS Coordinator's Manual*, Community Rating System, FEMA, 2007.
33. CRS Credit for Flood Warning Programs, FEMA, 1999.

CHAPTER 9 - PUBLIC INFORMATION

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

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.

Figure 9-1 Disaster Planning

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 (Figure 9-1)
- 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 (Figure 9-2)
- Special meetings such as floodproofing open houses

Local implementation: McHenry County and all municipalities provide community newsletters and/or community news on their websites. 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 websites: 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 website.

9.2 Library and Websites

Figure 9-2 Public Resources

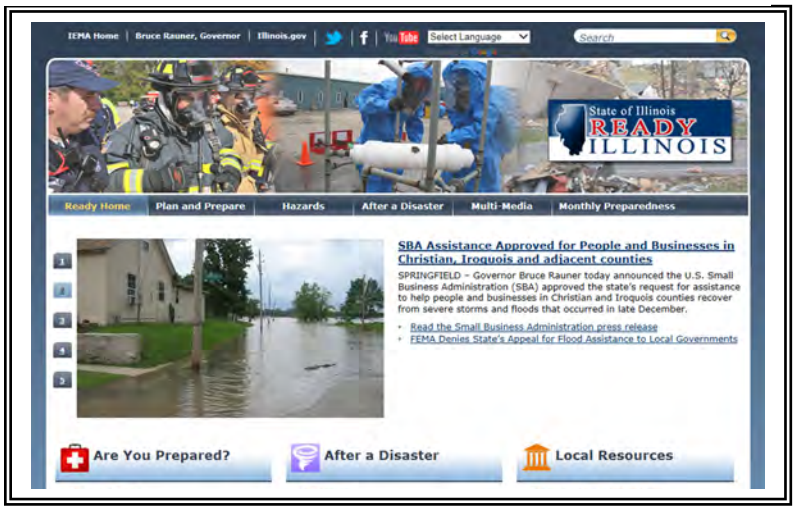
The community library and local websites are obvious places for residents to seek information on hazards, hazard protection, and protecting natural resources. Books and pamphlets on hazard mitigation can be given to libraries, many of them obtained free from state and federal agencies. Libraries also have their own public information campaigns with displays, lectures, and other projects, which can augment the activities of the local government.

Today, websites 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 websites, 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, websites can link to information for homeowners on how to retrofit for tornadoes, earthquakes and floods and a "FEMA for Kids" site. This website (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 Crystal Lake, the City of Harvard, the village of Johnsburg, the City of Marengo, and the City of McHenry provides information on hazards and hazard mitigation. McHenry County, the Village of Algonquin, the Village of Lakewood, and the City of McHenry provide website links to hazard information and hazard mitigation.

Figure 9-3 "Ready Illinois" website



The State of Illinois has created a website called "Ready Illinois" that provides information for before, during and after an emergency (Figure 9-3). Numerous other agency website links are provided at this site.

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.

Table 9-1 McHenry County Communities Providing Technical Assistance to Property Owners

(not all communities are listed in table)

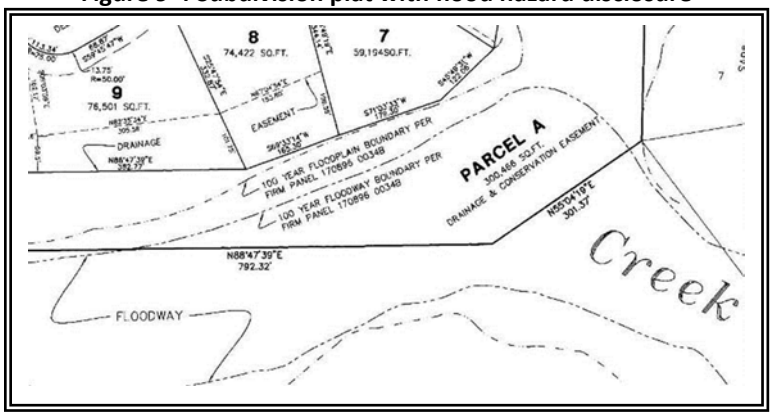
Community	Read FIRMs for Property Owners?	Property Visits for Hazard Protection Advice?
Algonquin	Yes	Yes
Bull Valley	No	No
Cary	Yes	Yes
Crystal Lake	Yes	Yes
Fox River Grove	No	No
Harvard	Yes	Yes
*Holiday Hills	Yes	Yes
Huntley	Yes	Yes
Johnsburg	Yes	Yes
Lake in the Hills	Yes	Yes
*Lakewood	No	Yes
*Marengo	Yes	Yes
McHenry	Yes	Yes
Oakwood Hills	Yes	No
Prairie Grove	Yes	No
Spring Grove	Yes	No
Wonder Lake	No	No
Woodstock	Yes	Yes
McHenry County	Yes	Yes
TOWNSHIP		
*Algonquin	No	Yes

*Results from 2010 plan

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. There are three regulations, one federal and two state, require that a potential buyer of a parcel be told of their exposure to a hazard.

Figure 9-4 Subdivision plat with flood hazard disclosure



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 Food 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.

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 Figure 9-4).

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 page 9-7.
- 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 made 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 2016 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.

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 websites 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 by communities (e.g., building codes and the countywide Stormwater Management 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. Websites 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 Department of Health 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 websites 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 website.
7. McHenry County community survey, 2016.
8. Municipal websites.

Figure 9-5 Flood Safety

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.

Figure 9-6 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

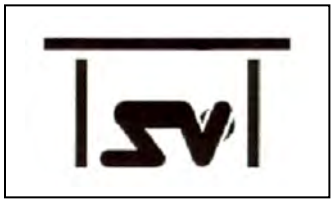
Duck or drop down to the floor.

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.



CHAPTER 10 - ACTION PLAN

10.1 Action Plan Overview

Figure 10-1 Mitigation Committee

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 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.

During the 2016 Plan update, it was recommended that action status be provided at the municipal level to start moving toward jurisdiction-specific actions. The 2010 actions were emailed out to the Mitigation Committee members for review. The 2010 actions were reviewed in-person at January 2016 meeting; however, attendance was low. Therefore, the actions were reviewed again with attendees during the March 2016 meeting. In addition, several follow-up calls were made to specific jurisdictions to obtain an action status update. In some cases, a

jurisdiction-specific action status was not applicable or was not obtained. The Mitigation Committee will continue to build on these efforts in future updates of this Plan.

In addition to existing actions, Mitigation Committee members were given a "New Mitigation Action Worksheet" to provide new actions and documented in Section 10.2

Organization, Prioritization and Assignment of Action Items: The action items in Section 10.2 are grouped into administrative items that include maintenance activities and 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 10-24 and show the agency assignments. Appendix XX provides action items assigned to each participating jurisdiction and example adoption resolutions. While this Chapter and Appendix XX 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 10-25, 10-26, and 10-27.

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 resolution 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 the 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.

Table 10-1 Action 1 Status

Stakeholder	Action 1 Status 2016

McHenry County	
Algonquin, Village Of	
Bull Valley, Village Of	
Cary, Village Of	
Crystal Lake, City Of	
Fox River Grove, Village Of	
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	
Island Lake, Village Of	
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	The 2016 McHenry County Hazard Mitigation Plan will be adopted by the county and incorporated jurisdictions once the plan receives "approved pending adoption" status from FEMA.
Lakewood, Village Of	
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City 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, Village Of	
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	
Dunham Township	The 2016 McHenry County Hazard Mitigation Plan will be adopted by the county and incorporated jurisdictions once the plan receives "approved pending adoption" status from FEMA.
Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	The 2016 McHenry County Hazard Mitigation Plan will be adopted by the county and incorporated jurisdictions once the plan receives "approved pending adoption" status from FEMA.
McHenry County Division of Transportation	

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 Plan 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 website).

Plan Reference: Chapters 1 and 10.

Table 10-2 Action 2 Status

Stakeholder	Action 2 Status 2016
McHenry County	The Mitigation Committee was formally adopted in 2010 and will continue to guide the planning process. The County Board adoption resolution of December 21, 2010 states that the "McHenry County Hazard Mitigation Committee is hereby established as a permanent advisory body." All participating jurisdictions have representation and the Mitigation Committee is reviewed for new members during each 5-year update.
Algonquin, Village Of	
Bull Valley, Village Of	
Cary, Village Of	
Crystal Lake, City Of	
Fox River Grove, Village Of	
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	
Island Lake, Village Of	
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	
Lakewood, Village Of	
Marengo, City Of	

McCullom Lake, Village Of	
McHenry, City 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, Village Of	
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	The Mitigation Committee was formally adopted in 2010 and will continue to guide the planning process. The County Board adoption resolution of December 21, 2010 states that the "McHenry County Hazard Mitigation Committee is hereby established as a permanent advisory body." All participating jurisdictions have representation and the Mitigation Committee is reviewed for new members during each 5-year update.
Dunham Township	
Hebron Township	
Marengo Fire-Rescue District	The Mitigation Committee was formally adopted in 2010 and will continue to guide the planning process. The County Board adoption resolution of December 21, 2010 states that the "McHenry County Hazard Mitigation Committee is hereby established as a permanent advisory body." All participating jurisdictions have representation and the Mitigation Committee is reviewed for new members during each 5-year update.
McHenry County Conservation District	
McHenry County Division of Transportation	

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 websites (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.

Table 10-3 Action 3 Status

Stakeholder	Action 3 Status 2016
McHenry County	Ongoing - McHenry County holds an annual meeting (at a minimum) for plan participants to review status of the Plan and actions. The meeting is typically held in November and an annual report is prepared (in compliance with the CRS).
Algonquin, Village Of	
Bull Valley, Village Of	
Cary, Village Of	
Crystal Lake, City Of	
Fox River Grove, Village Of	
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	
Island Lake, Village Of	
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	
Lakewood, Village Of	
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City 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, Village Of	
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	Ongoing - McHenry County holds an annual meeting (at a minimum) for plan participants to review

Dunham Township	status of the Plan and actions. The meeting is typically held in November and an annual report is prepared (in compliance with the CRS).
Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	Ongoing - McHenry County holds an annual meeting (at a minimum) for plan participants to review status of the Plan and actions. The meeting is typically held in November and an annual report is prepared (in compliance with the CRS).
McHenry County Division of Transportation	

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 6.7.

Table 10-4 Action 4 Status

Stakeholder	Action 4 Status 2016
McHenry County	In Progress - Between the adoption of the previous plan in 2010 and this update, seven additional Watershed Plans have been created. Some watersheds are wholly within McHenry County and some encompass areas within adjoining counties. The following Watershed Plans have been created: Nine Lakes Watershed-Based Plan (Island Lake & Port Barrington areas); Silver Creek & Sleepy Hollow Creek Watershed Plan (Crystal Lake, McHenry, Oakwood Hills & Prairie Grove areas); Boone-Dutch Creek Watershed Plan (Bull Valley, Johnsburg, McCullom Lake, McHenry, Ringwood, Wonder Lake & Woodstock areas); Woods Creek Watershed Plan (Algonquin, Crystal Lake & Lake in the Hills areas); Jelkes Creek Watershed Plan (Algonquin & Barrington Hills areas); Flint Creek Watershed-Based Plan (Barrington Hills area); and Spring Creek Watershed Plan (Barrington Hills & Fox River Grove areas)

Algonquin, Village Of	Algonquin adopted IEPA approved Woods Creek Watershed Plan (9/17/13), also with Crystal Lake -Jelkes Creek - Fox River Plan adopted 9/17/13 -Spring Creek Watershed adopted -Have watershed overlay district in zoning ordinance -Still need to do Crystal Creek Watershed Plan
Bull Valley, Village Of	Complete - The Boone and Dutch Creeks IEPA-compliant Watershed Plan includes Bull Valley.
Cary, Village Of	Portions of Cary are included by the Silver and Sleepy Hollow Creeks IEPA-compliant Watershed Plan
Crystal Lake, City Of	Complete and Ongoing Studies have been completed for both watersheds listed below and effective plans are now in place. Actions from plan are ongoing. Participant in Upper Kishwaukee Creek Watershed Participant in Silver Creek & Sleepy Hollow Creek Watershed Action Plan (5 year plan Effective 2012). Actions from the plan for Crystal Lake include: - Prairie Ridge Conservation Area and Educational Trails - Wetland and shoreline restoration at Veteran Acres Pond - Reduce invasive species at Sterne's Woods - Nature Center Exhibit - Establish an interpretive sign at Wingate Prairie Natural Wetland System at Crystal Lake Stormwater Detention Pond - Naturalize existing detention basin at Pingree Road - Install Permeable Pavers at Nature Center, 330 N. Main Street - Install Permeable Pavement at View Street, Corner of View and Lorraine St. - Install Permeable Pavement at Veterans Acres Park's Skate Shack - Install Permeable Pavement at Veteran Acres Park , 431 N. Walkup Ave. - Install Permeable Pavement at Rotary Shelter Lot, 431 N. Walkup Ave. - Stabilize existing trails and develop a new trail at Sterne's Woods Participant in Woods Creek Watershed Action Plan (5 yr. plan effective 2013). There are ~30 actions listed for Crystal Lake/Crystal Lake Park District. Two actions are listed as "critical" (to be implemented in 1-5 yrs.), 2 actions are listed as "high priority" (to be implemented in 1-10 yrs.), and all of the rest are "medium" or "low priority" (to be implemented in 10-20+ yrs.).
Fox River Grove, Village Of	Fox River Grove is included in the Spring Creek IEPA-compliant Watershed Plan
Greenwood, Village Of	Greenwood is included in the Boone and Dutch Creek and the Nippersink Creek IEPA-compliant Watershed Plans
Harvard, City Of	Harvard is included in the Lawrence Creek IEPA-compliant Watershed Plan
Hebron, Village Of	Hebron is included in the Nippersink Creek IEPA-compliant Watershed Plan
Holiday Hills, Village Of	Ongoing - A watershed study and plan will be completed when resources become available.
Huntley, Village Of	Completed - Study performed in the Watershed around the Wing Pointe Townhomes subdivision in 2015.
Island Lake, Village Of	Island Lake is included in the Nine Lakes IEPA-compliant Watershed Plan
Johnsburg, Village Of	Johnsburg is included in the Boone and Dutch Creeks IEPA-compliant Watershed Plan
Lake-In-The-Hills, Village Of	Status: Complete/Ongoing - a woods creek watershed study was completed (5 yr. plan effective 2013) ~35 actions for LITH in Plan. Five actions are listed as "critical" (to be implemented in 1-5 yrs.), 6 actions are listed as "high priority" (to be implemented in 1-10 yrs.), and all of the rest are "medium" or "low priority" (to be implemented in 10-20+ yrs.). Plan saved in Existing Actions folder for reference

Lakewood, Village Of	Lakewood is included in the Upper Kishwaukee Creek IEPA-compliant Watershed Plan
Marengo, City Of	Ongoing - A watershed study and plan will be completed when resources become available.
McCullom Lake, Village Of	McCullom Lake is included in the Boone and Dutch Creeks IEPA-compliant Watershed Plan
McHenry, City Of	McCullom Lake is included in the Boone and Dutch Creeks and Nippersink Creek IEPA-compliant Watershed Plans
Oakwood Hills, Village Of	Oakwood Hills is included in the Silver and Sleepy Hollow Creeks IEPA-compliant Watershed Plan
Prairie Grove, Village Of	Prairie Grove is included in the Silver and Sleepy Hollow Creeks IEPA-compliant Watershed Plan
Richmond, Village Of	Richmond is included in the Nippersink Creek IEPA-compliant Watershed Plan
Ringwood, Village Of	Ringwood is included in the Boone and Dutch Creeks and Nippersink Creek IEPA-compliant Watershed Plans
Spring Grove, Village Of	Spring Grove is included in the Spring Creek and Nippersink Creek IEPA-compliant Watershed Plans
Trout Valley, Village Of	Ongoing - A watershed study and plan will be completed when resources become available.
Union, Village Of	Ongoing - A watershed study and plan will be completed when resources become available.
Wonder Lake, Village Of	Wonder Lake is included in the Boone and Dutch Creeks and Nippersink Creek IEPA-compliant Watershed Plans
Woodstock, City Of	Woodstock is included in the Boone and Dutch Creeks, Nippersink Creek, and Upper Kishwaukee IEPA-compliant Watershed Plans
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	Ongoing - refer to community action status
Dunham Township	Ongoing - refer to community action status
Hebron Township	Completed - Done in 2012 by Drainage District #1
Marengo Fire-Rescue District	Ongoing - refer to community action status
McHenry County Conservation District	Ongoing - refer to community action status
McHenry County Division of Transportation	Ongoing - refer to community action status

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.

Table 10-5 Action 5 Status

Stakeholder	Action 5 Status 2016
McHenry County	Deferred - Funding is not available on the local, state or federal level at this point to install additional gages throughout the county. Since adoption of the McHenry County Hazard Mitigation Plan in 2010, the county has started cost sharing with the Wonder Lake Homeowners Association for the Nippersink Creek Stream Gage. In 2013, the Division of Transportation added a stream gauge as part of a bridge replacement to a Road Weather Information System (RWIS) over the Piscasaw Creek. Previous efforts to secure FEMA mitigation funds for gages were not successful. Additional opportunities for stream gage installation will be explored as funding becomes available.
Algonquin, Village Of	Village is interested in adding another gauge on the Fox River Add on in Crystal Creek (near Towne Park) if funding is available; medium priority
Bull Valley, Village Of	
Cary, Village Of	
Crystal Lake, City Of	Ongoing - Crystal Lake is interested in exploring this action through a partnership with the county (county maintains responsibility). Currently, Crystal Lake performs weekly checks on water levels throughout the city
Fox River Grove, Village Of	
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	county-level action - Community is supportive of county's ongoing efforts to install and maintain gages as funding becomes available
Holiday Hills, Village Of	
Huntley, Village Of	no plans to do so and there is no program in place
Island Lake, Village Of	
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	county-level action - Community is supportive of county's ongoing efforts to install and maintain gages as funding becomes available; Installation of stream gages for Woods Creek at LITH Dam and Crystal Lake at LITH Dam was pursued under IEMA Mitigation Grant funding, but the project was not accepted.
Lakewood, Village Of	
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City 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, Village Of	
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	
Dunham Township	
Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	
McHenry County Division of Transportation	In 2013, the Division of Transportation added a stream gauge as part of a bridge replacement to a Road Weather Information System (RWIS) over the Piscasaw Creek.

County-level action - Community is supportive of county's ongoing efforts to install and maintain gages as funding becomes available

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, McHenry County Division of Transportation, or other appropriate departments or offices.

Deadline: 36 months.

Cost: Staff time and equipment.

Benefits: Development and agriculture have led to a reduction of stream capacity, and as a result, upstream flooding 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 6.7.

Table 10-6 Action 6 Status

Stakeholder	Action 6 Status 2016
McHenry County	In Progress - As required by the IEPA MS4 Permit, MCDOT completes annual inspections of all ponds, detention/retention facilities, stream channel outfalls, and storm drainage outfalls which fall under the jurisdiction of the MCDOT (road rights-of-way) and County facilities. Each municipality that is part of the MS4 program also should be completing these inspections. Inspections on private property are not being completed at this time and no short term plan is in place to institute this program.
Algonquin, Village Of	Ongoing - There is currently a program in place (maintenance occurs after storms in ordinance public works assists police dept. Weekly check of stream gauges)
Bull Valley, Village Of	
Cary, Village Of	Closed
Crystal Lake, City Of	Partially complete and ongoing. The Public Works Department provides drainage system maintenance which includes specific areas of scheduled inspection, cleaning, and rebuilds of its storm sewer system. Repairs and maintenance are also completed upon requests or as needed throughout the entire system. Public Works utilizes a map that identifies specific private and public drainage locations which are periodically inspected. We have started updating our storm system maps into our GIS mapping system to improve the accuracy of our entire storm system.
Fox River Grove, Village Of	Ongoing - This is a part of their regular operation - weekly, if not biweekly, task for the Public Works Department. When action needs to be undertaken there are organizations that generate revenue specifically for those projects (debris clearing).
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	Ongoing - Every spring the Public Works Department cleans out catch basins, looks for signs in storms sewers and check them as necessary. Clean up of the watershed (ex. Beaver dams are an issue. They have to catch beavers periodically and remove dams. Specifically along Eakin Creek) Check outfalls at least 1 time a year. Inspect the dam in town annually and when there is a half-inch of rainfall.
Island Lake, Village Of	

Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	Complete - Village maintains an active drainage system inspection and maintenance program meeting the requirements of the CRS
Lakewood, Village Of	Ongoing through public works
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City Of	
Oakwood Hills, Village Of	
Prairie Grove, Village Of	Ongoing - Intending to put something more structural in place
Richmond, Village Of	
Ringwood, Village Of	
Spring Grove, Village Of	
Trout Valley, Village Of	
Union, Village Of	
Wonder Lake, Village Of	
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	
Dunham Township	
Hebron Township	Drainage District #1 maintains its ditches and waterways
Marengo Fire-Rescue District	Keep - there is no established program in place but the community does inspect drainage and remove debris/obstructions from streams/drainage as needed
McHenry County Conservation District	Ongoing
McHenry County Division of Transportation	From the Division of Transportation and as part of NPDES/MS- 4, Planning & Development input is needed here.

Deferred - Currently there is no formal program in place and funding would be needed for implementation. Defer to county.

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.

Table 10-7 Action 7 Status

Stakeholder	Action 7 Status 2016
McHenry County	In Progress - The McHenry County Stormwater Management Ordinance prohibits filling of flood hazard areas. Impacts to wetlands (dumping of materials) would also require a permit. The ordinance does not specifically prohibit the dumping of landscape waste, but the result of the dumping is what the ordinance regulates (filling of flood hazard area or wetland).
Algonquin, Village Of	Ongoing - Ordinance in place (Municipal Code 6C.04)
Bull Valley, Village Of	
Cary, Village Of	Have an ordinance regarding illegal discharge
Crystal Lake, City Of	Complete and ongoing - The City's Illicit Discharge Ordinance in Chapter 595 of the City Code addresses the requirements of this item.
Fox River Grove, Village Of	
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	A formal ordinance is not known to be in place but community will continue exploration of ordinance development. Will also explore implementation in lieu of an ordinance through the building department.
Island Lake, Village Of	

Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	Maintains enforceable dumping ordinances through its Municipal Code.
Lakewood, Village Of	Ongoing - They have a dumping ordinance (implemented by the police dept.)
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City Of	
Oakwood Hills, Village Of	
Prairie Grove, Village Of	Ongoing - An ordinance is in place but needs to be updated for specific dumping actions.
Richmond, Village Of	We have an ordinance and want to maintain and update.
Ringwood, Village Of	
Spring Grove, Village Of	
Trout Valley, Village Of	
Union, Village Of	
Wonder Lake, Village Of	
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	
Dunham Township	
Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	Ordinance in place
McHenry County Division of Transportation	

A formal ordinance is not known to be in place but community will continue exploration of ordinance development.

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 reduced and safety is improved.

Plan Reference: Chapter 6 discussion (including Table 6-1) and Recommendation 2 under Section 6.7.

Table 10-8 Action 8 Status

Stakeholder	Action 8 Status 2016
McHenry County	In Progress - The Department of Planning and Development would issue permits for the proposed infrastructure work within unincorporated portions of McHenry County and the non-certified communities. All Division of Transportation structures are inspected dependent on the event. 2015/2016 the Division of Transportation replaced a bridge on Franklinville Road prone to flooding. 2015 a new bridge was installed adjacent to the existing structure. 2016 the existing structure will be removed after a new channel realignment with the new bridge is established. The new bridge has a wider opening to allow more flow with less velocity and accommodate the realigned channel. Continued identification of public infrastructure that needs to be mitigated; in the event of a disaster declaration, several structures/infrastructure may have sustained damage that require repair and mitigation through public assistance funds.
Algonquin, Village Of	Woods Creek box culverts will be expanded/replaced; Crystal Creek bridge on Main Street needs to be replaced; Continue open space/wetland restoration and maintenance; Currently working on streetscape program for crystal creek bridge area a (3-5 yrs.) bridge will be replaced; Harper Drive/Multi-Use Trail Project in-progress. Includes tree removal, grading, retaining walls, storm sewer installation, asphalt path, wood boardwalk, and landscape restoration. Completion schedule mid-2016; Copper Oaks Subdivision and Drainage Improvements project in-progress; Highland Avenue Project - replacement of existing roadway, installation of curb and gutter, storm sewer and detention area, spot sidewalk removal and replacements, resurfacing of Presidential Park parking lot, and construction of a new trail (late 2016); Multiple other road improvements planned (1-10 years); continued identification of public infrastructure that needs to be mitigated; in the event of a disaster declaration, several structures/infrastructure may have sustained damage that require repair and mitigation through public assistance funds.
Bull Valley, Village Of	
Cary, Village Of	

Crystal Lake, City Of	The City of Crystal Lake continually evaluates the need for mitigation improvements to protect from natural hazards and is in the process of updating the 2007 Flooding Study which identifies and prioritizes areas in need of mitigation improvements.
Fox River Grove, Village Of	
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	
Island Lake, Village Of	
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	Complete - No critical facilities are located in the floodplain. Other hazards are considered during planning for major improvements. In the event of a disaster declaration, several structures/infrastructure may have sustained damage that require repair and mitigation through public assistance funds.
Lakewood, Village Of	
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City 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, Village Of	Ongoing - Diversions/Channel Improvements planned (lake being dredged 2016 and swale project in-progress); Thompson Road Bridge Replacement - FED; East Wonder Lake Road Resurface - ARRA; Thompson Road Watermain Extension - ARRA; Wonderview Resurfacing - MFT; Memory Trail Watermain Extension - CDBG; Highland Shores Water Tower Removal - CDBG; Other - In the event of a disaster declaration, several structures/infrastructure may have sustained damage that require repair and mitigation through public assistance funds.
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	
Dunham Township	
Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	
McHenry County Division of Transportation	Add to EMA response: All Division of Transportation structures are inspected dependent on the event. 2015/2016 the Division of Transportation replaced a bridge on Franklinville road prone to flooding. 2015 a new bridge was installed adjacent to the existing structure. 2016 the existing structure will be removed after a new channel realignment with the new bridge is established. The new bridge has a wider opening to allow more flow with less velocity and accommodate the realigned channel.

Ongoing - Continued identification of public infrastructure that needs to be mitigated; in the event of a disaster declaration, several structures/infrastructure may have sustained damage that require repair and mitigation through public assistance funds.

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 Department of Planning and Development 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 4.9.

Table 10-9 Action 9 Status

Stakeholder	Action 9 Status 2016
McHenry County	In Progress - The Department of Planning and Development continues to ensure the county is meeting all NFIP requirements. The County is a Class 8 CRS community. As a result, the County must maintain compliance with the NFIP (and CRS requirements).
Algonquin, Village Of	
Bull Valley, Village Of	
Cary, Village Of	
Crystal Lake, City Of	Complete and ongoing - The City of Crystal Lake ensures any development within the regulatory floodplain meets the NFIP minimum standards.
Fox River Grove, Village Of	
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	
Island Lake, Village Of	
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	Ongoing - LITH is a Class 6 CRS community. As a result, the community must maintain compliance with the NFIP (and CRS requirements).
Lakewood, Village Of	
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City 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, Village Of	
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	
Dunham Township	
Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	
McHenry County Division of Transportation	

Ongoing - Will continue to comply with the NFIP through maintenance and enforcement of the McHenry County Stormwater Management Ordinance.

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: The McHenry County Department of Planning and Development 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.

Table 10-10 Action 10 Status

Stakeholder	Action 10 Status 2016
McHenry County	Deferred - The County's repetitive loss properties have been identified and are reminded annually of the threat to their property. The County is a CRS community and has repetitive loss properties so could gain additional CRS credit through a repetitive loss area study. Funding and manpower are not available on the local level at this point to create a plan for the repetitive flood loss areas throughout the county.
Algonquin, Village Of	
Bull Valley, Village Of	Delete - There are no repetitive loss properties in the community.
Cary, Village Of	Delete - There are no repetitive loss properties in the community.
Crystal Lake, City Of	Ongoing - The City of Crystal Lake continues to educate the homeowners at the one repetitive loss property regarding how to protect themselves and their neighborhood from flood damage. Crystal Lake is a CRS community and has repetitive loss properties so could gain additional CRS credit through a repetitive loss area study done locally or by the county.
Fox River Grove, Village Of	
Greenwood, Village Of	Delete - There are no repetitive loss properties in the community.
Harvard, City Of	
Hebron, Village Of	Delete - There are no repetitive loss properties in the community.
Holiday Hills, Village Of	

Huntley, Village Of	Delete - There are no repetitive loss properties in the community. Even when they have bad years they do not experience property loss over all because they are located on a ridge. The community is fairly new and was built with the most recent flood/stormwater/zoning codes and ordinances.
Island Lake, Village Of	Delete - There are no repetitive loss properties in the community.
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	Ongoing - LITH repetitive loss properties have been identified and are reminded annually of the threat to their property. LITH is a CRS community and has repetitive loss properties so could gain additional CRS credit through a repetitive loss area study done locally or by the county.
Lakewood, Village Of	Delete - There are no repetitive loss properties in the community.
Marengo, City Of	
McCullom Lake, Village Of	Delete - There are no repetitive loss properties in the community.
McHenry, City Of	
Oakwood Hills, Village Of	Delete - There are no repetitive loss properties in the community.
Prairie Grove, Village Of	Delete - There are no repetitive loss areas in the community, so this action can be deleted for Prairie Grove.
Richmond, Village Of	Delete - There are no repetitive loss properties in the community.
Ringwood, Village Of	Delete - There are no repetitive loss properties in the community.
Spring Grove, Village Of	Delete - There are no repetitive loss properties in the community.
Trout Valley, Village Of	Delete - There are no repetitive loss properties in the community.
Union, Village Of	Delete - There are no repetitive loss properties in the community.
Wonder Lake, Village Of	Delete - There are no repetitive loss areas in the community so this action can be deleted for Wonder Lake.
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	
Dunham Township	
Hebron Township	
Marengo Fire-Rescue District	Delete - refer to community action
McHenry County Conservation District	Delete - refer to community action
McHenry County Division of Transportation	Delete - refer to community action

Ongoing - Not a CRS Community but does have repetitive loss properties. May be completed in the future if resources become available or part as a county study.

Action Item 11: Identification of Floodplain Structures

In addition to examining repetitive 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 Department of 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.

Table 10-11 Action 11 Status

Stakeholder	Action 11 Status 2016
McHenry County	FEMA and the Illinois State Water Survey have begun a Risk MAP project for the Fox River Watershed in McHenry, Lake, Kane and Cook Counties. McHenry County and the Fox River Watershed municipalities participating in the efforts could potentially identify additional flood-risk areas. McHenry County continues to work with IL State Water Survey to identify flood risk and mitigation needs within the Upper Fox River Watershed (covers the east half of the county). Discovery process should identify where new studies are needed, inaccurate mapping, overtopped roads, residential flooding and repetitive loss structures (FEMA issued a Discovery Report 9/2013). Planning & Development staff recently attended Mitigation Planning meeting to identify required actions; this information will be compiled in FEMA's Mitigation Action Tracker; intent of database is to be a source for FEMA to refer to when funding mitigation projects. Development of Building Footprints would help to determine structures in the floodplain; currently only able to analyze parcels and not the actual building location.
Algonquin, Village Of	Would like to evaluate properties and consider acquiring a couple homes along the Fox River. However, they have done some work to alleviate the issues shoreline; rock retaining walls (cosmetic & structural - Cornish/River Front park). Have identified some structures on GIS including several areas that are identified as having past flooding (complete) and developed an inventory of building footprints.
Bull Valley, Village Of	
Cary, Village Of	
Crystal Lake, City Of	Same status as County – Not completed as of the 2016 plan update. Wants to keep as a long term action. Not high priority.
Fox River Grove, Village Of	
Greenwood, Village Of	

Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	Completed - Last year someone completed a watershed study that remapped the floodplain showing structures in the floodplain. The community hired a consultant to measure elevation and acquired Elevation Certificates from the property owners. Submitted a LOMA and it was approved (Wing Pointe Townhomes - 2015).
Island Lake, Village Of	There are no structures in the floodplain.
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	Complete - LITH has no critical facilities in the floodplain. Other facilities in the floodplain are identified on the County GIS and Village Maps.
Lakewood, Village Of	Complete - There are no structures in the floodplain.
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City Of	
Oakwood Hills, Village Of	
Prairie Grove, Village Of	Remove – There are no structures in the floodplain.
Richmond, Village Of	
Ringwood, Village Of	
Spring Grove, Village Of	
Trout Valley, Village Of	
Union, Village Of	
Wonder Lake, Village Of	
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	
Dunham Township	
Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	

McHenry County Division of Transportation	

Ongoing - This would likely be completed at the county level; refer to County action status.

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.

Table 10-12 Action 4 Status

Stakeholder	Action 12 Status 2016
McHenry County	Ongoing - As part of this Plan update, a preliminary critical facility investigation was performed using GIS analysis (building points and floodplain). The analysis performed included all identified critical facilities in the county but does not include elevations of the structures. EMA will review and update information on critical facilities within McHenry County. This information will then be utilized by GIS to input a map layer. An analysis will be performed as funding permits.
Algonquin, Village Of	There are no known at-risk critical facilities (or previous damaged critical facilities), however, future losses are possible so could be completed as part of a county-level study.
Bull Valley, Village Of	
Cary, Village Of	
Crystal Lake, City Of	
Fox River Grove, Village Of	Ongoing - Unknown if there are critical facilities in the floodplain. If there are any in the floodplain they were there before the regulations were in place and they do not have any plans to demolish any structures.
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	

Holiday Hills, Village Of	
Huntley, Village Of	There are no critical facilities in the floodplain. Ordinances in place to prevent this from happening, however, future damages are possible so this could be completed as part of a county-level study.
Island Lake, Village Of	Ongoing - There are no known at-risk critical facilities (or previous damaged critical facilities) in Lakewood, however, future losses are possible so could be completed as part of a county-level study.
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	Complete - No further mitigation efforts are required for critical facilities in LITH, however, future losses are possible so could be completed as part of a county-level study.
Lakewood, Village Of	Ongoing - There are no known at-risk critical facilities (or previous damaged critical facilities) in Lakewood, however, future losses are possible so could be completed as part of a county-level study.
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City Of	
Oakwood Hills, Village Of	
Prairie Grove, Village Of	Ongoing - No CF in floodplain nor has there been any issues or previous damage, however, future losses are possible so could be completed as part of a county-level study.
Richmond, Village Of	
Ringwood, Village Of	
Spring Grove, Village Of	
Trout Valley, Village Of	
Union, Village Of	
Wonder Lake, Village Of	
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	
Dunham Township	
Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	
McHenry County Division of Transportation	

Ongoing - This would likely be completed at the county level; refer to County action status.

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.

Table 10-13 Action 4 Status

Stakeholder	Action 13 Status 2016
McHenry County	Ongoing - The McHenry County Stormwater Management Ordinance does not regulate protection levels for specific types of development (e.g., critical facilities). The Ordinance requires all new structures' first floor elevations be built to two feet above the base flood elevation. In the 2016 update we will look to add information relating to earthquakes and the Executive Order.
Algonquin, Village Of	Ongoing - Modify and update facilities as funds become available; refer to County action status.
Bull Valley, Village Of	
Cary, Village Of	
Crystal Lake, City Of	In Progress - Many of these critical facilities have been identified by the City and incorporated into the Com Ed Joint Operations Center plans for the Crystal Lake service area to restore power as a priority.
Fox River Grove, Village Of	
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	

Huntley, Village Of	
Island Lake, Village Of	Ongoing/In Progress - Village Hall will be going through renovations.
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	Ongoing - No further mitigation efforts are required for critical facilities in LITH, however, future facility development will comply with county ordinance (refer to county status).
Lakewood, Village Of	Ongoing for any new/future critical facility. Example: new sewer plant is under construction and the design was developed with the consideration of natural hazards. It is also not in the floodplain.
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City 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, Village Of	
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	
Dunham Township	
Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	
McHenry County Division of Transportation	

Ongoing - Refer to County action status.

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 Department of Planning & Development – Water Resources 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 Recommendation 4 in Section 5.7.

Table 10-14 Action 4 Status

Stakeholder	Action 14 Status 2016
McHenry County	In 2011, the Department of Planning and Development coordinated with the McHenry County Emergency Management Agency and the McHenry County Conservation District (MCCD) to prepare a grant application requesting funding to purchase nine flood-prone houses along the lower Nippersink Creek. On June 20, 2014, FEMA announced the release of $914,519 in Hazard Mitigation Grant Program (HMGP) funds to McHenry County for the acquisition and demolition of 10 residential structures in the Nippersink Creek floodplain. Following demolition, these properties will be maintained as permanent open space in the community. Through HMGP, FEMA will pay 75 percent of the $1,219,359 eligible project cost. The remaining 25 percent of the funds, $304,840, will be provided by non-federal sources. The Illinois Department Natural Resources (IDNR) submitted this project to FEMA as part of their match for FEMA funds allowing the entire project to be funded at 100%, $1.2 million from IDNR-OWR to purchase 9 structures & 3 vacant parcels adjacent to Nippersink Creek; partnering with MCCD, who will demolish structures and restore properties. County will transfer properties to MCCD to maintain as open space in perpetuity; an intergovernmental agreement is being drawn up by the State's Attorney's office. The McHenry County Stormwater Management Ordinance requires certain structures' first floors be elevated to two feet above the base flood elevation. Those would include those that are new within the floodplain, substantially damaged, or proposed substantial improvements. The County would issue permits for all work in the floodplain and at that point would ensure the structure is designed to meet the Ordinance provisions. No priority is set on properties.
Algonquin, Village Of	Ongoing - Encourage homeowners to protect properties through education. As need is determined for property mitigation, pre- and post-disaster funding sources will be explored to implement the project.
Bull Valley, Village Of	
Cary, Village Of	In 2013, the Village of Cary applied for a grant requesting funding to purchase four flood prone houses at the intersection of Sunset and Crest in Cary. On October 14, 2014 FEMA announced the release of $971,295 in Hazard Mitigation Grant Program (HMGP) funds to the village of Cary, Ill., for the acquisition and demolition of four residential structures in the floodplain. Following demolition, these properties will be maintained as permanent open space in the community. Through HMGP, FEMA will pay 75 percent of the $1,295,060 eligible project cost. The remaining 25 percent of the funds, $323,765, will be

	provided by the village of Cary.
Crystal Lake, City Of	Ongoing - No current mitigation needs. As need is determined for property mitigation, pre- and post-disaster funding sources will be explored to implement the project. Disaster funding would be routed through county: refer to county action status.
Fox River Grove, Village Of	Ongoing - There are currently no properties eligible for buyouts. As need is determined for property mitigation, pre- and post-disaster funding sources will be explored to implement the project. Disaster funding would be routed through county: refer to county action status.
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	Ongoing - Wing Point Homes are in need of mitigation action. As additional need is determined for property mitigation, pre- and post-disaster funding sources will be explored to implement the project. Disaster funding would be routed through county: refer to county action status.
Island Lake, Village Of	
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	Ongoing - LITH repetitive loss properties have been identified and are reminded annually of the threat to their property. Pre- and post-disaster funding sources will be explored to implement mitigation project. Disaster funding would be routed through county: refer to county action status.
Lakewood, Village Of	
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City 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, Village Of	Ongoing - Currently a project leveling on home using back taxes. As additional need is determined for property mitigation, pre- and post-disaster funding sources will be explored to implement the project. Disaster funding would be routed through county: refer to county action status.
Woodstock, City Of	

ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	
Dunham Township	
Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	
McHenry County Division of Transportation	

Ongoing - As need is determined for property mitigation, pre- and post-disaster funding sources will be explored to implement the project. Disaster funding would be routed through the county: refer to County action status.

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 in Section 5.7.

Table 10-15 Action 4 Status

Stakeholder	Action 15 Status 2016
McHenry County	Ongoing - McHenry County will apply for a Safe Room project within the 2016 updated plan for the Division of Transportation facility. The Department of Planning & Development will review permit applications for safe room developments in unincorporated areas of McHenry County. Neither the Unified Development Ordinance nor the Stormwater Management Ordinance requires the installation of safe rooms. As funding becomes available or vulnerabilities or determined, the retrofit or development of safe rooms will be explored further.
Algonquin, Village Of	Ongoing - Emergency medical distribution; Several high schools used for shelters (have set ups for emergency situations); Consider safe rooms in future for senior housing developments (*low priority); as funding becomes available, safe rooms retrofit and development will be considered.

Bull Valley, Village Of	
Cary, Village Of	
Crystal Lake, City Of	Ongoing/In-progress - Community Development Department has informational flyers available at the front desk regarding safe rooms. Additional information can be accessed at the following web page: www.fema.gov/safe-rooms; www.iccsafe.org; www.fema.gov/fema-p-361-safe-rooms-tornadoes-and-hurricanes-guidance-community-and-residential-safe-rooms; Safe room information will be included in a community newsletter sent to all residents. As vulnerability or funding is identified, safe room retrofit or development will be explored: refer to county status.
Fox River Grove, Village Of	Ongoing - As vulnerability or funding is identified, safe room retrofit or development will be explored; refer to county status (low priority).
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	
Island Lake, Village Of	
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	Deferred - Safe rooms are not currently planned in any LITH construction. As vulnerability or funding is identified, safe room retrofit or development will be explored.
Lakewood, Village Of	
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City Of	
Oakwood Hills, Village Of	
Prairie Grove, Village Of	Ongoing - Police Basement would be a great place for a safe room because it is structurally sound (would need generator), however, funding is needed.
Richmond, Village Of	Ongoing - Silver Trees Shelter area for elderly and disabled housing is in place. As additional vulnerability or funding is identified, safe room retrofit or development will be explored: refer to county status.
Ringwood, Village Of	
Spring Grove, Village Of	
Trout Valley, Village Of	

Union, Village Of	
Wonder Lake, Village Of	
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	
Dunham Township	
Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	
McHenry County Division of Transportation	No action at this time. McHenry County will apply for a Safe Room project within the 2015 updated plan for the Division of Transportation facility.

Ongoing - As vulnerability or funding is identified, safe room retrofit or development will be explored: refer to County action status.

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 County, the Village of Lake in the Hills, and the Cities of Crystal Lake and Woodstock already participate in CRS, and they should continue their participation.

Responsible Agency: McHenry County Department of 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 Chapter 4 Recommendation 11 in Section 4.9.

Table 10-16 Action 4 Status

Stakeholder	Action 16 Status 2016

McHenry County	In progress - County is currently a CRS Class 8. McHenry County has adopted the State Plumbing Code and State Energy Efficiency Code. We are in the process of adopting the 2015 ICC codes. Once this action is complete, McHenry County will be eligible for an improved Community Rating System (CRS) classification.
Algonquin, Village Of	Ongoing - Interested in joining but needs more information (medium priority).
Bull Valley, Village Of	
Cary, Village Of	
Crystal Lake, City Of	In Progress - Currently a Class 6 community. Looking to improve during their recertification process in 2017 (high priority).
Fox River Grove, Village Of	
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	
Island Lake, Village Of	
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	In progress - LITH is a Class 6 CRS community. Lake-In-The-Hills changed their Community Rating System rating from 7 to 6 as of October 2011. The additional points were gained by formalizing their drainage maintenance plan and adoption of the Natural Hazards Mitigation Plan.
Lakewood, Village Of	
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City 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, Village Of	
Woodstock, City Of	In progress - The City of Woodstock is a Class 7 CRS community.

Ongoing - Community may consider joining but further research is needed to determine cost-effectiveness.

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 should 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.

Table 10-17 Action 17 Status

Stakeholder	Action 17 Status 2016
McHenry County	Ongoing - County is in program and will continue.
Algonquin, Village Of	Ongoing - Algonquin is in program and will continue.
Bull Valley, Village Of	
Cary, Village Of	
Crystal Lake, City Of	In-progress - Staff researched and analyzed the standards needed to receive Tree City USA designation. Staff determined that this is attainable after minor changes to the City Code are made. In Spring of 2016, staff will present these changes before City Council. Once approved, staff will complete and submit an application for designation. The City will also have to commit to following through with our "Tree Care Ordinance", annually budgeting at least $2/capita for tree care, and reciting an official Arbor Day proclamation.
Fox River Grove, Village Of	Considering - Already participates in cleanup day annually around Arbor day celebration.

Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	Not Participating; not planning to in the future; it has been discussed but would be long-term possibly.
Island Lake, Village Of	
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	Ongoing - Lake in the Hills is in program and will continue.
Lakewood, Village Of	Ongoing - Lakewood is in program and will continue.
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City Of	
Oakwood Hills, Village Of	
Prairie Grove, Village Of	Not currently participating; has been discussed in the long term - low priority
Richmond, Village Of	
Ringwood, Village Of	
Spring Grove, Village Of	
Trout Valley, Village Of	
Union, Village Of	
Wonder Lake, Village Of	
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	

Dunham Township	
Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	
McHenry County Division of Transportation	

Deferred - Not Participating at this time

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.

Table 10-18 Action 18 Status

Stakeholder	Action 18 Status 2016
McHenry County	On October 21, 2014, McHenry County became the 24th county in Illinois to meet the StormReady requirements and 11th county in the Chicago County Warning Area. McHenry County also became a Weather Ready National Ambassador. The Division of Transportation installed 15 StormReady signs at key entry ways to the County on the County roadways.
Algonquin, Village Of	In-progress - The Village has submitted the application and waiting approval.
Bull Valley, Village Of	

Cary, Village Of	
Crystal Lake, City Of	In-progress - The City was approached by McHenry County EMA to consider applying for StormReady status. As an active participant in severe weather preparedness, the City is probably close to being able to obtain this status without much additional effort. We will consider pursuing StormReady status in 2016.
Fox River Grove, Village Of	Remove - community does not have the resources to participate at this time
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	Remove - community does not have the resources to participate at this time
Island Lake, Village Of	
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	
Lakewood, Village Of	
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City 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, Village Of	
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	

Coral Township	
Dunham Township	
Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	
McHenry County Division of Transportation	The Division of Transportation installed 15 Storm Ready signs at key entry ways to the County on the County roadways.

Ongoing - approached by McHenry County EMA to consider applying for StormReady status.

Action Item 19: Strengthen Building Codes and Code Enforcement Training

Communities that have not adopted the International Code Council 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, Stormwater Management Ordinance, 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 4.9.

Table 10-19 Action 19 Status

Stakeholder	Action 19 Status 2016

McHenry County	In Progress - In 2016, the Planning and Development Department updated amendments to the building codes and are currently working toward adopting the 2015 ICC series. Currently, the county's codes reference the 2006 IBC, IRC, IMC, IFC; the 2008 NEC; and the 2012 IECC.
Algonquin, Village Of	
Bull Valley, Village Of	
Cary, Village Of	
Crystal Lake, City Of	In Progress - Building Division is currently in process of reviewing the 2015 ICC codes for adoption. They plan to adopt new codes in the next two years, however, the community is concerned as to whether they should wait and adopt the 2018 Codes when they are released based on the timing of their planned adoption. Building inspectors participate in ongoing training throughout the year to keep up to date on new information.
Fox River Grove, Village Of	Ongoing - Contract for the building department and they are responsible for code enforcement. Every so often they look at the plan, reevaluate it and make updates as needed. (Building Plan Ch. 6)
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	
Island Lake, Village Of	Ongoing- Building code enforcer keeps up with the codes, updates and enforcement. Investigation of the adoption of latest 2015 ICC will be considered in the future.
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	Ongoing - LITH has adopted portions of the 2012 ICC series and staff trained in the codes and their enforcement. Investigation of the adoption of latest 2015 ICC will be considered in the future.
Lakewood, Village Of	
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City Of	Ongoing - Investigation of the adoption of latest 2015 ICC will be considered in the future. Current codes are 2006.
Oakwood Hills, Village Of	
Prairie Grove, Village Of	Ongoing - High priority to keep codes up to date; building inspectors are subcontracted from City of McHenry, however, so extent of training is unknown.
Richmond, Village Of	In Progress - We are in the process of adopting the updated international codes.
Ringwood, Village Of	
Spring Grove, Village Of	

Trout Valley, Village Of	
Union, Village Of	
Wonder Lake, Village Of	In Progress - Currently adopted codes are from 2003. Investigation of the adoption of latest 2015 ICC will be considered in the future.
Woodstock, City Of	

Ongoing - Investigation of the adoption of latest 2015 ICC will be considered in the future.

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.

Table 10-20 Action 20 Status

Stakeholder	Action 20 Status 2016
McHenry County	In Progress - In 2014, the County received a mitigation grant (HMGP) for $1.1M to acquire 41 separate parcels and demolish approximately fifteen structures in the regulatory floodplain. The County has not completed the project as of the update. McHenry County Division of Transportation, Emergency Management, and the Soil & Water Conservation District have met to discuss possible funding for a Living Snow Fence project. The project would also include the Farm Bureau of McHenry County. The County will continue to pursue future grants for mitigation projects.
Algonquin, Village Of	
Bull Valley, Village Of	
Cary, Village Of	

Crystal Lake, City Of	In Progress - The City of Crystal Lake continually applies for grant funding as it becomes available. Will also work in partnership with the county for FEMA-related funding.
Fox River Grove, Village Of	
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	
Island Lake, Village Of	Ongoing - Island Lake has a person who sits on the Board of Trustees who is educated in grant writing and will provide support. Currently investigating options.
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	Deferred - Installation of stream gages was pursued under IEMA mitigation grant funding. The project was not accepted.
Lakewood, Village Of	
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City 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, Village Of	
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	
Dunham Township	

Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	
McHenry County Division of Transportation	Change EMA response to read Division of Transportation not Department.

Ongoing - As mitigation needs arise, we will work with the County to investigate funding sources (FEMA funds would be routed through the county). Funding sources beyond FEMA may also be available including US EPA, US HUD, and US DOT which would also require County partnership.

Action Item 21: Implementation of the Water Resources Action Plan

The County, municipalities and townships should implement the water quality and groundwater protection measures recommended by the "McHenry County Water Resources 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.

Table 10-21 Action 21 Status

Stakeholder	Action 21 Status 2016
McHenry County	Ongoing - The County is currently reviewing the recommendations in the WRAP and prioritizing activities that are of benefit to the County. Implementation of the recommendations is an ongoing activity. The County regularly participates on the Northwest Water Planning Alliance (NWPA) Executive Committee and the Technical Advisory Committee. The goal of this organization is to collaboratively plan for and steward water resources to ensure sustainable water supply through education and outreach and utilize best policies and practices to protect drinking water supplies. The County also participates in the Northern Regional Groundwater Protection Planning Committee.
Algonquin, Village Of	Ongoing - Refer to County action status. Algonquin has adopted and implemented elements of it.
Bull Valley, Village Of	
Cary, Village Of	Ongoing - Cary has adopted the plan. Refer to County action status.

Crystal Lake, City Of	In Progress - The City continues to review and reference the Water Resources Action Plan (WRAP) that was created by the McHenry County Groundwater Taskforce, which the City Council passed a resolution on May 4, 2010 for that recommendation. The City continues to participate and improve the Municipal Separate Storm Sewer System MS4 program, and this information has been placed on the City's website for public information. The Crystal Lake Public Works Staff regularly participates on the Northwest Water Planning Alliance (NWPA) technical advisory committee. The goal of this organization is to collaboratively plan for and steward water resources to ensure sustainable water supply through education and outreach and utilize best policies and practices to protect drinking water supplies.
Fox River Grove, Village Of	
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	
Island Lake, Village Of	
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	Complete - LITH has adopted a groundwater protection ordinance and actively manages the program.
Lakewood, Village Of	
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City 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, Village Of	
Woodstock, City Of	
ALL TOWNSHIPS ARE NOT LISTED	

Coral Township	
Dunham Township	
Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	
McHenry County Division of Transportation	

Ongoing - Refer to County action status.

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
- Websites 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 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.

Table 10-22 Action 22 Status

Stakeholder	Action 22 Status 2016
McHenry County	Ongoing - The Department of Planning and Development has created pamphlets and handouts for flooding, water quality, and water conservation. They are available in our office and online. The documents are also handed out at different seminars and educational activities throughout the county during the year. This will be a main focus in the updated 2016 Plan. The County has a public information officer (PIO) on staff.
Algonquin, Village Of	Ongoing - Nixle, village newsletter, utilizes social media for education and notification during emergency.
Bull Valley, Village Of	
Cary, Village Of	

Crystal Lake, City Of	Complete/In-progress - For several years the City has produced an emergency preparedness guide. Additional publications from various agencies related to severe weather are available on the City's website for access by the public at any time. The City also provides information related to emergency preparedness several times a year in the City's newsletters.
Fox River Grove, Village Of	
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	Ongoing - Newsletters that go out, posted on their website and sent out with water bills.
Island Lake, Village Of	Ongoing - Quarterly newsletter that goes out to the citizens that is tailored to the season and provides safety tips. The EMA speaks about safety at public events throughout the year. They are planning to link emergency management information in to the village website.
Johnsburg, Village Of	
Lake-In-The-Hills, Village Of	Deferred - LITH is willing to work with other County partners to improve the public information strategy. Opportunity to increase CRS credit through additional public information activity.
Lakewood, Village Of	
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City Of	
Oakwood Hills, Village Of	
Prairie Grove, Village Of	Deferred - There may be public information gaps. There is no public library; however, hazard information is available at the police station. Will investigate leveraging resources developed by the County and investigate more formal plans for the future.
Richmond, Village Of	
Ringwood, Village Of	
Spring Grove, Village Of	
Trout Valley, Village Of	

Union, Village Of	⌛
Wonder Lake, Village Of	⌛
Woodstock, City Of	Ongoing - Will investigate leveraging resources developed by the County and investigate more formal plans for the future. Opportunity to increase CRS credit through additional public information activities.
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	⌛
Dunham Township	⌛
Hebron Township	⌛
Marengo Fire-Rescue District	⌛
McHenry County Conservation District	⌛
McHenry County Division of Transportation	⌛

⌛ Deferred - Will investigate leveraging resources developed by the County and investigate more formal plans for the future.

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 websites that provide property protection information and provide their addresses to the County and municipal webmasters.

Responsible Agency: McHenry County 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.

Table 10-23 Action 23 Status

Stakeholder	Action 23 Status 2016
McHenry County	Ongoing/In-progress - Information is available on the County's website regarding property protection measures for flooding. Libraries around the county have been provided FEMA documents on property protection.
Algonquin, Village Of	Ongoing - There is reference information in the library and the police department lobby.
Bull Valley, Village Of	
Cary, Village Of	
Crystal Lake, City Of	Ongoing/In-progress - Information is available on the City's website regarding property protection measures for flooding. The City's Flood Study is cataloged in the Crystal Lake Public Library under two references. (REF 368.1 FLO and CRYSTAL LAKE REF 627.4 CRY) The City participates in the ICC Building Safety month campaign in May. A table with relevant material is set up in the main lobby. The materials are available for review or to take home and the materials are changed every week during the campaign. Additional information can be accessed at the following websites: www.fema.gov www.iccsafe.org www.illinois.gov www.iii.org
Fox River Grove, Village Of	
Greenwood, Village Of	
Harvard, City Of	
Hebron, Village Of	
Holiday Hills, Village Of	
Huntley, Village Of	
Island Lake, Village Of	
Johnsburg, Village Of	

Lake-In-The-Hills, Village Of	
Lakewood, Village Of	
Marengo, City Of	
McCullom Lake, Village Of	
McHenry, City 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, Village Of	
Woodstock, City Of	Deferred - Action generally related to CRS activity and community may investigate but future action, including leveraging of existing county and municipal resources, may be considered as need arises.
ALL TOWNSHIPS ARE NOT LISTED	
Coral Township	
Dunham Township	
Hebron Township	
Marengo Fire-Rescue District	
McHenry County Conservation District	

McHenry County Division of Transportation

Deferred - Action generally related to CRS activity but future action, including leveraging of existing county and municipal resources, may be considered as need arises.

Action Item 24: Warning System for Dunham Township

Build a warning system for areas in the southwest and southeast sections of Dunham Township.

Jurisdiction/Community: Dunham Township

Responsible Agency: McHenry County, municipalities and Dunham Township.

Deadline: Ongoing.

Cost: Staff time.

Potential Funding Source:

Priority:

Action Type:

Benefits:

2016 Status: New

Action Item 25: Power Outages for the Community of Algonquin

Need generators for all water and sewer facilities.

Jurisdiction/Community: Algonquin.

Responsible Agency: McHenry County and Algonquin.

Deadline: Ongoing.

Cost: Unknown.

Potential Funding Source: To Be Determined.

Priority: Moderate.

Action Type:

Benefits: Service for residents - clean water, sanitary.

2016 Status: New

Action Item 26: Replace Main Drain Tiles in Hebron Township

Hebron Drainage District is 101 years old and the main drain tiles are worn out and need replacement. The District collects taxes but are just enough to make repairs on an annual basis. Large rain events have necessitated many more repairs to the tile lines causing more issues with roads and culverts within the township's 7,000 acres including homes, farms, crops (row crops, veggies, bees, vineyards).

Jurisdiction/Community: Hebron Township – Mike VonBergen, representative for the Drainage District.

Responsible Agency: Township and Drainage District.

Deadline: Ongoing.

Cost: $2-5 million.

Potential Funding Source: Taxpayers, Landowners, or Grants.

Priority: High.

Action Type:

Benefits: Long term - priceless.

2016 Status: New

Action Item 27: Tornado Siren at Public Works Facility in the Village of Richmond

Build a tornado siren covering the Cunat area.

Jurisdiction/Community: Village of Richmond.

Responsible Agency: Richmond Public Works.

Deadline: Ongoing.

Cost: $25,000.

Potential Funding Source: To Be Determined.

Priority: High.

Action Type: Property Protection, Emergency Services, Public Education and Awareness.

Benefits: Protection (unintelligible) of Cunat area.

2016 Status: New.

Action Item 28: Review of Storm Sewers/Drainage System Maintenance for the Village of Richmond

Jurisdiction/Community: Village of Richmond.

Responsible Agency: Richmond Public Works.

Deadline: Ongoing.

Cost: Unknown.

Potential Funding Source: To Be Determined.

Priority: Moderate.

Action Type: Prevention, property protection, Natural Resource Protection, Structural Projects.

Benefits:

2016 Status: New.

Action Item 29: Outreach Projects (Seminars, Pamphlets, Etc.) in the Village of Richmond Addressing All Hazards

Jurisdiction/Community: Village of Richmond.

Responsible Agency: Richmond Police Department.

Deadline: Ongoing.

Cost: $5,000.

Potential Funding Source: Grant Funding.

Priority: Moderate.

Action Type: Prevention, Public Education and Awareness.

Benefits: Public Education and Awareness.

2016 Status: New.

Action Item 30: Develop a Reliable Means for Citizens in Crystal Lake to Receive Official Information from the City

During severe weather events and post-event restoration, there is in need for developing a reliable means for citizens to receive official information from the City. Crystal Lake is interested in establishing an Emergency Alert AM radio station.

ALERT AM broadcasts warnings for: AMBER Alerts, School Incidents, Flooding, Industrial Accidents, Terror Threats, Earthquakes, and Tornadoes, etc.

Jurisdiction/Community: Crystal Lake.

Responsible Agency: Crystal Lake

Deadline: Ongoing.

Cost: $25,000.

Potential Funding Source: Donations, grants, capital improvement project.

Priority: Moderate.

Action Type: Emergency Services.

Benefits: Life Safety, Enhanced Warning System.

2016 Status: New

Action Item 31: Remote/Regional Salt Storage for McHenry County

Winter Event Preparedness: Remote/Regional salt storage is needed. "A study conducted by Marquette University found that, when winter storms turn roads to ice, de-icing them with salt reduces accidents by 88% and injuries by 85%. Road salt also saves money. When snow and ice make roads impassable, it can cost state economies as much as $700 million a day — losses salt can mitigate." Quote from the Salt Institute said that due to previous winter events, the lack of salt storage and/or the availability/deliverability has presented diametric opposition to which public works departments including the Division of Transportation have tried to overcome. Having the ability to immediately access salt has been and continues to be an ongoing issue in McHenry County, which hampers the safety of the transportation roadways within the County.

Jurisdiction/Community: McHenry County.

Responsible Agency: McHenry County Division of Transportation.

Deadline: Ongoing.

Cost: High Cost Project.

Potential Funding Source: To Be Determined.

Priority: High.

Action Type: Prevention, Emergency Services.

Benefits: Reduction in accidents/injuries, life safety, economic impacts, ability to purchase salt at reasonable rates.

2016 Status: New.

Action Item 32: Include the McHenry County Natural Hazards Mitigation Plan into Other Plans

As the county and municipalities develop or revise comprehensive or land use plans, emergency operations plans, and ordinances, the goals and guidelines of this Plan should be incorporated into those efforts.

Jurisdiction/Community: McHenry County and municipalities.

Responsible Agency: McHenry County and municipalities.

Deadline: Ongoing.

Cost: Staff time.

Potential Funding Source: To Be Determined.

Priority: Moderate.

Action Type: Preventive Measures, Emergency Services, Public Information.

Benefits: A holistic approach for McHenry County and municipalities to take a consistent approach to natural hazard mitigation, and develop other plans with the protection of life, health, safety, business and property protection in mind.

2016 Status: New.

10.3 Summary of Action Plan Items

Table 10-24 summarizes all 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) and chapter recommendations are shown in Tables 10-25, 10-26, and 10-27.

Appendix XX provides a list of specific Action Items assigned to the Mitigation Committee, the County and communities. Appendix XX 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 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 10-24 Action Items Responsible Agencies and Deadlines

Action Items	Responsible Agencies and Deadlines																	
	Hazard Mitigation Committee	County Board	Administrator	EMA	Planning & Development	Stormwater	Transportation	GIS	Health	Water Resources	City Council/Village Board	Emergency Management	Designated department(s)	Township Office	Road District	Fire District	Other Agencies	Deadline for first product (months)
1. Plan Adoption		X									X			X				6
2. Continuation of Mitigation Committee	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		On
3. Plan Monitoring and Maintenance	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		On
4. Watershed Studies					X	X												36
5. Expand Stream Gaging Network				X	X	X												12
6. Stream Maintenance Programs					X		X						X		X			36
7. Prohibited Waterway Dumping Ordinances					X								X					36
8. Mitigation of Public Infrastructure				X	X	X	X					X	X	X	X	X		As
9. Continued NFIP Compliance					X	X							X					On
10. Repetitive Loss Areas Study					X	X												24
11. Identification of Floodplain Structures:					X	X		X										36
12. Investigation of Critical Facilities				X	X	X		X				X		X	X	X	X	24
13. Critical Facilities Design with Natural Hazards Protection				X	X	X											X	On
14. Mitigation of Floodplain Properties - Property Protection Projects					X	X							X				X	On
15. Safe Rooms				X	X							X	X	X			X	36
16. Consider Community Rating System Participation				X	X								X					On
17. Urban Forestry – Consider Participation in Tree City USA					X								X					24
18. Consider Participation in StormReady				X														24
19. Strengthen Building Codes and Code Enforcement Training					X								X					24
20. Seek Mitigation Grant Funding			X	X	X						X	X	X	X	X	X		As
21. Implementation of the Water Resources Protection Action Plan		X			X	X					X		X					On
22. Development of a Public Information Strategy	X				X							X		X				12
23. Property Protection References	X				X							X		X				12
24. Warning System for Dunham Township				X								X		X				On
25. Prevent and manage power outages for Algonquin				X							X	X					X	On
26. Replace main tiles in the Hebron						X					X		X					On
27. Tornado siren in Richmond				X							X	X						On

28. Sewers/drainage system maintenance for Richmond						X	X				X				X		As
29. Outreach projects for Richmond				X							X						On
30. Develop a means for citizens in Crystal Lake to receive information				X							X	X					On
31. Remote/Regional salt storage for McHenry County		X					X										On

X = Can be recommended
On = Ongoing
As = As Available or Needed

Table 10-25 Action Items Goals

Action Items	Goals					
	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.
1. Plan Adoption	X	X	X	X	X	X
2. Continuation of Mitigation Committee	X	X	X	X	X	X
3. Plan Monitoring and Maintenance	X	X	X	X	X	X
4. Watershed Studies	X	X		X	X	
5. Expand Stream Gaging Network	X	X			X	
6. Stream Maintenance Programs		X	X		X	
7. Prohibited Waterway Dumping Ordinances		X	X		X	
8. Mitigation of Public Infrastructure		X			X	X
9. Continued NFIP Compliance	X	X				
10. Repetitive Loss Areas Study	X					X
11. Identification of Floodplain Structures:	X	X	X			
12. Investigation of Critical Facilities	X	X			X	
13. Critical Facilities Design with Natural Hazards Protection	X	X		X	X	X
14. Mitigation of Floodplain Properties - Property Protection Projects	X		X		X	X
15. Safe Rooms	X	X			X	X
16. Consider Community Rating System Participation	X				X	
17. Urban Forestry – Consider Participation in Tree City USA	X	X	X		X	
18. Consider Participation in StormReady	X	X			X	
19. Strengthen Building Codes and Code Enforcement Training	X			X	X	
20. Seek Mitigation Grant Funding	X		X		X	X
21. Implementation of the Water Resources Protection Action Plan	X	X	X	X	X	
22. Development of a Public Information Strategy	X	X	X	X	X	

23. Property Protection References	X	X	X	X	X	
24. Warning System for Dunham Township	X					X
25. Prevent and manage power outages for Algonquin	X	X				X
26. Replace main tiles in the Hebron		X			X	
27. Tornado siren in Richmond	X					X
28. Sewers/drainage system maintenance for Richmond		X				
29. Outreach projects for Richmond	X			X		
30. Develop a means for citizens in Crystal Lake to receive information	X					
31. Remote/Regional salt storage for McHenry County		X				

Table 10-26 Action Item Guidelines

Action Items	Guidelines						
	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.
1. Plan Adoption		X		X			
2. Continuation of Mitigation Committee		X		X			
3. Plan Monitoring and Maintenance				X			
4. Watershed Studies	X		X	X			
5. Expand Stream Gaging Network	X		X	X			
6. Stream Maintenance Programs	X			X			
7. Prohibited Waterway Dumping Ordinances	X			X			
8. Mitigation of Public Infrastructure	X			X			X
9. Continued NFIP Compliance	X			X			
10. Repetitive Loss Areas Study	X		X	X			
11. Identification of Floodplain Structures:	X		X	X			
12. Investigation of Critical Facilities	X		X	X			
13. Critical Facilities Design with Natural Hazards Protection	X			X			X
14. Mitigation of Floodplain Properties - Property Protection Projects	X		X	X		X	
15. Safe Rooms	X		X	X		X	
16. Consider Community Rating System Participation	X			X			
17. Urban Forestry – Consider Participation in Tree City USA	X			X			
18. Consider Participation in StormReady	X			X			
19. Strengthen Building Codes and Code Enforcement Training	X			X	X		
20. Seek Mitigation Grant Funding	X		X	X		X	X
21. Implementation of the Water Resources Protection Action Plan	X			X	X	X	X

22. Development of a Public Information Strategy	X	X		X		X	
23. Property Protection References	X	X		X		X	
24. Warning System for Dunham Township	X		X	X		X	
25. Prevent and manage power outages for Algonquin	X		X	X		X	
26. Replace main tiles in the Hebron	X			X			
27. Tornado siren in Richmond	X		X	X		X	
28. Sewers/drainage system maintenance for Richmond	X			X			
29. Outreach projects for Richmond		X		X	X	X	
30. Develop a means for citizens in Crystal Lake to receive information		X		X	X	X	
31. Remote/Regional salt storage for McHenry County			X	X			

Table 10-27 Action Item Recommendations

Action Items	Recommendations					
	Ch. 4. Preventive Measures	Ch. 5. Property Protection	Ch. 6. Structural Projects	Ch. 7. Resource Protection	Ch. 8. Emergency Services	Ch. 9. Public Information
1. Plan Adoption						X
2. Continuation of Mitigation Committee						X
3. Plan Monitoring and Maintenance						X
4. Watershed Studies	X		X			
5. Expand Stream Gaging Network	X		X		X	
6. Stream Maintenance Programs		X	X	X		
7. Prohibited Waterway Dumping Ordinances		X		X		
8. Mitigation of Public Infrastructure		X			X	
9. Continued NFIP Compliance	X	X				
10. Repetitive Loss Areas Study		X				
11. Identification of Floodplain Structures:	X	X		X	X	
12. Investigation of Critical Facilities		X			X	
13. Critical Facilities Design with Natural Hazards Protection	X				X	
14. Mitigation of Floodplain Properties - Property Protection Projects		X				
15. Safe Rooms		X			X	
16. Consider Community Rating System Participation	X	X				
17. Urban Forestry – Consider Participation in Tree City USA		X		X		
18. Consider Participation in StormReady		X		X		
19. Strengthen Building Codes and Code Enforcement Training	X					
20. Seek Mitigation Grant Funding	X	X	X		X	
21. Implementation of the Water Resources Protection Action Plan	X			X		
22. Development of a Public Information Strategy	X	X		X	X	X
23. Property Protection References	X	X		X	X	X
24. Warning System for Dunham Township					X	
25. Prevent and manage power outages for Algonquin					X	
26. Replace main tiles in the Hebron			X			
27. Tornado siren in Richmond					X	
28. Sewers/drainage system maintenance for Richmond			X			
29. Outreach projects for Richmond						X
30. Develop a means for citizens in Crystal Lake to receive information						X

31. Remote/Regional salt storage for McHenry County			X			