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# Lake County All-Natural Hazards Mitigation Plan

Lake County, Illinois

October 2022

Update of the 2017 All-Natural  
Hazards Mitigation Plan

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## **Executive Summary**

In 2006, Lake County and participating Lake County municipalities developed and adopted the first *Lake County Countywide All-Natural Hazards Mitigation Plan (ANHMP)*. The Federal Emergency Management Agency (FEMA), through the Disaster Mitigation Act of 2000 (DMA 2000) and the Stafford Act require that a community develop and adopt a FEMA-approved natural hazard mitigation ANHMP to be eligible for hazard mitigation grant funds. DMA 2000 and the Stafford Act require that the mitigation ANHMP be updated and re-adopted every five years to maintain grant eligibility. This 2022 ANHMP is the third update of the 2006 ANHMP. The ANHMP is multi-jurisdictional, meaning the county and its participating municipalities must adopt the ANHMP.

This ANHMP meets all FEMA planning requirements including those of the FEMA National Flood Insurance Program (NFIP) and Community Rating System (CRS). The ANHMP allows Lake County and its participating communities to receive Hazard Mitigation Assistance Program (HMA) grant funding from FEMA to fund mitigation projects. CRS allows participating communities to earn credit towards discounts in flood insurance premiums. More can be learned about these programs at: <http://www.fema.gov/hazard-mitigation-grant-program>.

“Hazard mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event.”

FEMA

While this ANHMP meets federal planning requirements, it has also been prepared to address protection of life, health, and safety, and to reduce damage to property and infrastructure from natural hazards. This ANHMP assesses the natural hazards that affect Lake County, sets mitigation goals, considers mitigation efforts currently being implemented, evaluates additional mitigation strategies,

and recommends mitigation actions to be implemented over the next five years. The mitigation actions are designed to protect the people and assets of Lake County and are intended to be implemented by the public and the private sectors.

## **ANHMP Development**

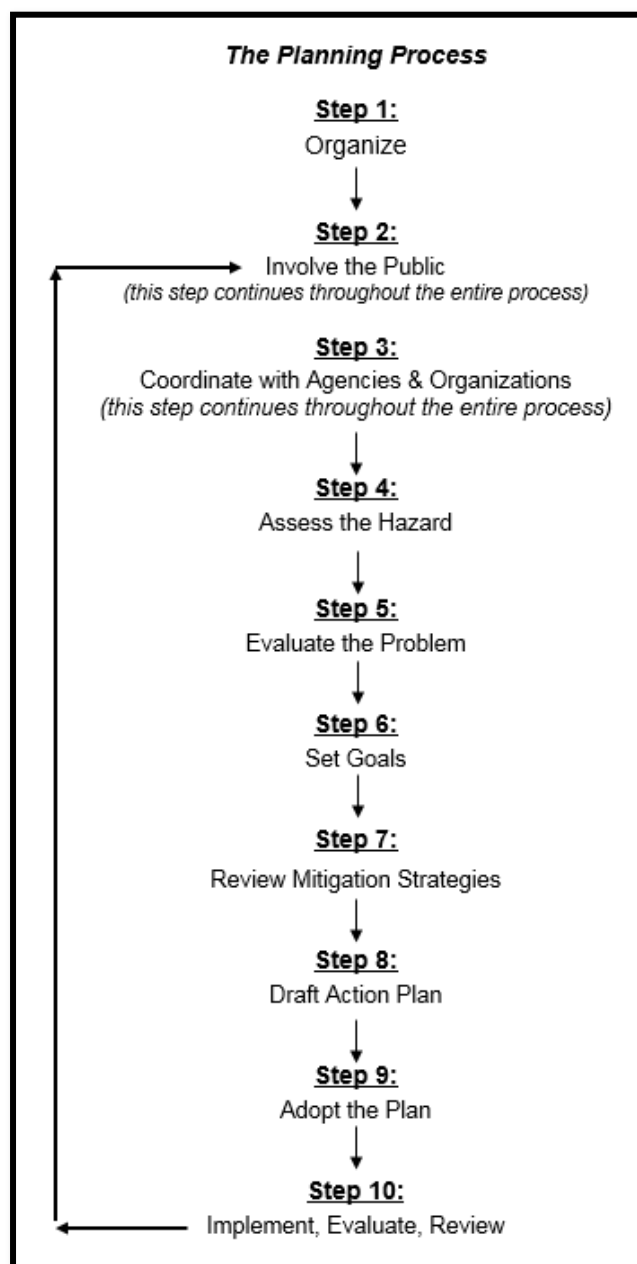
The ANHMP update was conducted with the input of the Lake County Hazard Mitigation Planning Committee (HMPC), which includes Lake County departments and agencies, Lake County municipalities and other stakeholders. The HMPC has been in place since the development of the 2006 ANHMP and has been meeting annually. The efforts of the HMPC were coordinated by the Lake County Stormwater Management Commission (SMC) and Lake County Emergency Management Agency (LCEMA).

The update of the ANHMP was based on discussion and data provided by the participating municipalities as they followed the recommended 10-step planning process. An ANHMP introduction and a description of the planning process are presented in Chapters 1 and 2. Natural hazards that can impact Lake County have been assessed in Chapter 3. Goals and guidelines established by the HMPC are presented in Chapter 4. Six mitigation strategies and a capabilities assessment of Lake County are examined in Chapter 5. The ANHMP action plan is detailed in Chapter 6, and procedures for monitoring and maintaining this ANHMP are included in Chapter 7.

## Chapter Summary:

### Planning Process

The HMPC followed a 10-step planning process to update the ANHMP. The HMPC met five times



from January to April 2022. The HMPC 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 ANHMP does not replace other planning efforts, such as community comprehensive plans, or the Lake County Comprehensive Stormwater Management Plan. This ANHMP complements those efforts.

The public was invited to participate through several concurrent means, including HMPC meetings, online surveys, paper surveys, press releases, newsletter articles, and the Lake County website. A public meeting was held on April 19, 2022, at the Central Permit Facility in Libertyville, Illinois. The public comment period opened on February 17, 2023.

### Natural Hazard Risk Assessment

The HMPC reviewed all potential natural hazards that could impact Lake County, and evaluated them based on their causes, their likelihood of occurring, and their impact on people, property, critical facilities, and the local economy. The information was based

on available technical studies and reports by the participating agencies and communities and on their past experiences.

The final approved plan will be available on the SMC website at:

<https://www.lakecountyil.gov/553/Stormwater-Management-Commission>

## Hazard Mitigation Goals and Guidelines

The goals of the ANHMP were reviewed and reaffirmed by the HMPC.

The ANHMP goals are to:

- Goal 1. Protect the lives, health, and safety of the people of Lake County from the impacts and effects of natural hazards.
- Goal 2. Protect public services, utilities, and critical facilities from potential damage from natural hazard events.
- Goal 3. Mitigate existing buildings to protect against damage from natural hazard events.
- Goal 4. Ensure that new developments do not create new exposures of people and property to damage from natural hazards.
- Goal 5. Mitigate to protect against economic and transportation losses due to natural hazards.

Chapter 4 presents guidelines developed by the HMPC to achieving the above goals and to facilitate the development of hazard mitigation action items.

## Hazard Mitigation Strategies

The HMPC considered mitigation strategies for the natural hazards shown on page ES-2. The HMPC 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 Lake County Watershed Development Ordinance. Lake County is strong in preventive measures through floodplain regulations and sustainable projects.

Property protection mitigation measures are used to modify buildings or property subject to existing damage. The HMPC agreed that special attention should be given to floodplain areas and designated repetitively flooded areas. SMC should continue with their voluntary floodplain acquisition program. Many measures can be implemented by the property owners, such as dry and wet floodproofing. Appropriate government activities include public information, technical assistance, and financial support. Emphasis has also been placed on critical facilities, particularly on understanding their vulnerability to wind and severe storm hazards.





Natural resource protection activities are aimed at preserving (or in some cases restoring) natural areas. These activities include preserving wetlands, control of erosion and sedimentation, stream restoration, and urban forestry management. Urban forestry programs are encouraged to protect utility lines from damage caused by trees during wind and ice storms.

The HMPC called for a better understanding of flood and other hazards to improve emergency management – preparedness, response, and recovery.

Structural mitigation projects such as the regional detention basins are still important components of the county’s comprehensive watershed management program. Additional watershed studies are still needed. The HMPC also recommended that each community establish a formal and regular program of drainage system maintenance and examine drainage improvements.

The HMPC identified numerous subject areas that would benefit from a coordinated public information program to focus on residents and property owners obtaining proper insurance and ways for people to protect themselves and their property from natural hazards.

## **Mitigation Action Plan**

The action plan outlines the recommended activities and initiatives to be implemented over the next five years. It is understood that implementation is contingent on the availability of resources (staff and funding). The action plan identifies those responsible for implementing the action items, and when they are to be completed.

Mitigation actions are not limited to those listed in the action plan. Other recommendations in this ANHMP (Chapter 5) should be implemented as opportunities arise.

## **Plan Adoption**

This ANHMP serves to recommend mitigation measures for Lake County. Adoption is also a requirement for recognition of the ANHMP by FEMA for mitigation funding programs.

The adoption of this *Lake County All-Natural Hazards Mitigation Plan* will be done by resolution of the county board, the city councils, and boards of trustees of each participating municipality. The municipal resolutions will adopt each action item that is pertinent to the community and a person responsible for it will be assigned. With adoption, the county and each municipality are individually eligible to apply for FEMA mitigation grant funding.

## **Summary**

This 2022 update to the ANHMP was developed by the Lake County HMPC as a multi-jurisdictional ANHMP to meet federal mitigation planning requirements. This ANHMP updated the examination of natural hazards facing Lake County, establishes mitigation goals, evaluates, and highlights the existing mitigation activities underway in Lake County, and recommends a mitigation action plan for the county and participating jurisdictions to undertake in the next five years. The mitigation efforts included in this ANHMP are for protecting people, property, and other assets of Lake County. Some action items are ongoing efforts while others are new. Implementation of all action items is contingent on the availability of staff and funding.

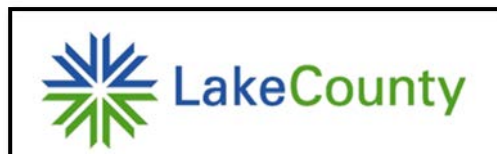
This ANHMP will be adopted by resolution by the Lake County Board and each participating jurisdiction. This ANHMP will be implemented and maintained through both countywide and individual initiatives as funding and resources become available.

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## **Chapter 1: Introduction**

Lake County, located in northeastern Illinois, is subject to natural hazards. Flooding, severe summer and winter storms, extreme cold and heat, and tornadoes are the most significant natural hazards that affect Lake County. These are some of the natural hazards that have the potential to threaten both life and property.

Significant tornadoes struck the county in 1965, 1996, 1997 and in 2015. Historically, flooding has been the most damaging and disruptive natural hazard in Lake County. Historical flooding in the Des Plaines watershed in 1986 caused over \$6 million in property damage. Major flood events were also experienced in 1993, 1996, 2000, 2004, 2013 and 2017. Lake County can also experience dangerous winds. High winds reaching 66 miles per hour were recorded as recently as 2002 and 100 miles per hour in July 2011. The county is also susceptible to severe storms. The latest severe winter storm occurred in early 2015 where parts of Lake County received up to 22 inches of snow. During this storm, winds reached up to 52 miles per hour. In April 2013, severe storms with intense rainfall created substantial flooding in urban areas, areas outside of the mapped floodplains and caused flood damage throughout much of northeastern Illinois.



Lake County understands the importance of addressing natural hazards to minimize damage and reduce chances for loss of life. Lake County mitigation programs include the implementation of the countywide Lake County Watershed Development Ordinance, developed by the Stormwater Management Commission (SMC) in 1992 to regulate new development so that flood problems do not increase and to limit building activities in the floodplain. Also, the SMC established a Floodplain Buyout Program to remove high-risk flood-prone property from flood problem areas. Since its establishment in 1997, this program has acquired over 200 properties using Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance program funding and state and local funds. Lake County and its municipalities enforce building codes to protect structures from wind and seismic hazards.



Lake County and the planning committee developed and adopted the Lake County All-Natural Hazards Mitigation Plan (ANHMP) in 2006 as a multi-jurisdictional plan. The ANHMP was updated in 2012 and 2017. This Lake County ANHMP is an update to the 2017 plan.

### **1.1 Purpose of the Plan**

The ANHMP allows Lake County and the participating communities to be eligible for Hazard Mitigation Grant funding through the FEMA the Hazard Mitigation Assistance (HMA) program. The HMA program includes the Hazard Mitigation Grant program, the Pre-Disaster Mitigation program, and the Flood Mitigation Assistance funds. The HMA program administers the hazard mitigation components of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the Stafford Act. Both acts require communities



to develop and adopt a FEMA-approved natural hazard mitigation plan before mitigation grant funds can be awarded.

This ANHMP meets all of FEMA’s hazard mitigation planning requirements including those of the FEMA National Flood Insurance Program’s (NFIP) and the Community Rating System (CRS). CRS allows participating communities to earn credit towards discounts in flood insurance premiums. HMA requires that mitigation plans be updated and readopted every five years. The Lake County SMC has received mitigation grant dollars from FEMA because of the ANHMP, and these grants have benefited property owners in incorporated and unincorporated communities of Lake County.

The ANHMP has also been prepared so that Lake County and participating communities can take a proactive approach to reduce the impact of natural hazards. The ANHMP identifies the hazards affecting the county, assesses vulnerability to the hazards, determines those hazards that have the greatest effect, determines the capability of local government to implement mitigation actions, and then recommends actions that will avoid or minimize the vulnerabilities to the hazards.

Mitigation, as defined by the FEMA, is “sustained action to reduce or eliminate the long-term risk to people and property from hazards and their effects.” By evaluating the county’s geography, geology, climatology, economics, infrastructure, land use controls, development regulations and expected growth, we can better understand natural hazard vulnerabilities. By exercising foresight when evaluating new development and redevelopment, and by taking actions to reduce the risk to the existing built environment, harm to people and damage to property from natural hazards can be reduced.

## **1.2 Organization of the Plan**

This update of the ANHMP has been organized into seven chapters:

- Chapter 1: Introduction** – includes the ANHMP’s purpose and organization, provides an overview of the county, a summary of Lake County land use, base maps, and a summary of critical facilities.
- Chapter 2: Planning Process** – presents the planning process followed for this update and summarized the changes made since the 2012 ANHMP. This chapter includes communities represented on the Lake County Hazard Mitigation Planning Committee.
- Chapter 3: Risk Assessment** – discusses the natural hazards that can impact Lake County as well as the summary of changes to these hazards found during the update process.
- Chapter 4: Mitigation Goals** – presents the Lake County mitigation goals and guidelines.

**Chapter 5: Mitigation Strategies and Capabilities Assessment** – provides a description of six mitigation strategy categories and summarized mitigation activities already underway in Lake County and recommendations for additional activities. The chapter also considers the current capabilities of the county and each municipality for implementing additional mitigation measures.

**Chapter 6: Action Plan** – discusses the consideration of countywide and community-specific mitigation action items to be implemented as staff and funding resources allow.

**Chapter 7: Plan Maintenance** – discussed plan adoption, outlines the ANHMP maintenance and monitoring efforts, continued public participation, and evaluating the plan.

### 1.3 Lake County Overview

Lake County is the most northeastern county in Illinois and is part of the Chicago metropolitan area along with Cook, Will, Kane and DuPage Counties. The county seat is Waukegan, Illinois. The total area of Lake County is 1,368 square miles: with a land area of 448 square miles and the remaining area being water. Elevations in the county range from 957 feet above sea level to 580 feet above sea level. Land in the county slopes to the southeast. Much of the water area in Lake County is Lake Michigan.

The county is composed of 53 individual communities (some partially in other counties) and 18 Townships. Lake County borders McHenry County to the west, Cook County to the south, and Lake Michigan to the east. Lake County is 23.5 miles from north to south. At its widest point, the southern county border, Lake County is 22.6 miles from east to west. A map of Lake County and its municipalities is provided in Exhibit 1: Lake County Municipalities, and a map of the townships is provided in Exhibit 2: Lake County Townships.



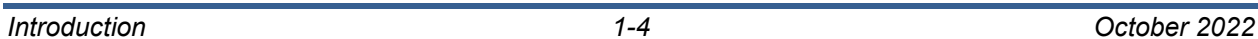
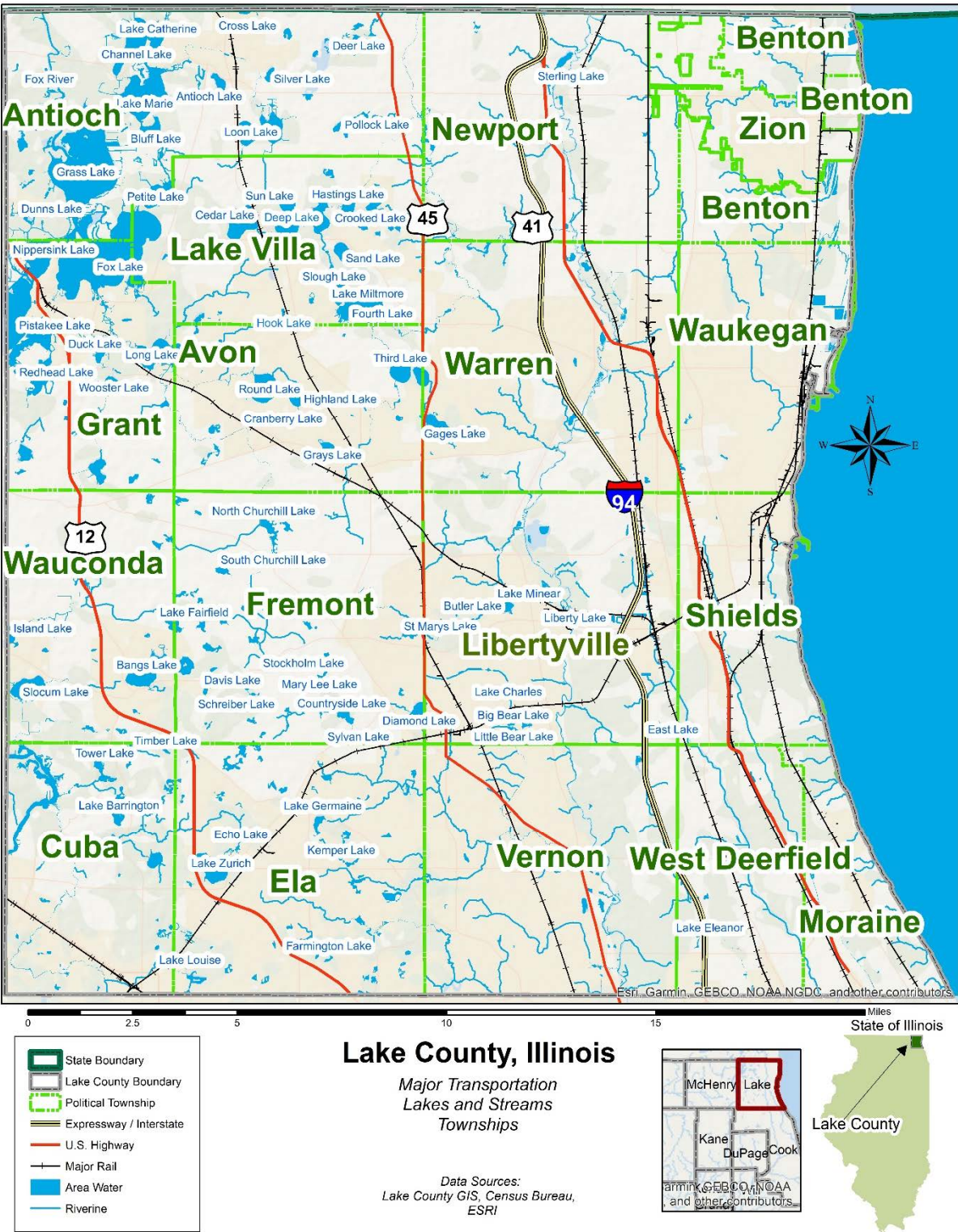




Exhibit 2: Lake County Townships





**Watersheds:** Lake County has four main watersheds; the Fox River, the Des Plaines River, Lake Michigan, and the North Branch Chicago River. The Fox River and the Des Plaines River originate in Wisconsin. The Fox River flows southwest through Lake County and into McHenry County. Des Plaines River and North Branch Chicago River flow south into Cook County.

**Climate:** Lake County has a temperate climate. Mean daily average temperatures during the winter in Lake County range from 20 to 32 degrees Fahrenheit. During the summer, this range is between 64-75°F. July is the hottest month in Lake County with an average temperature of 82°F, while January is the coldest at 14.8°F. The highest recorded temperature in the Chicago Metro area was 105°F in 1934. The total average annual precipitation is 36.1 inches.

**Population:** Lake County has a population of 714,342 and a population density of 1,572 people per square mile (2020 U.S. Census). There are approximately 269,378 housing units within the county. Lake County is the third most populated county in Illinois behind Cook County and DuPage County. The Lake County population makes up approximately 5.6% of the total population in the State of Illinois. The most populated municipality is the City of Waukegan with 89,321 people in the 2020 U.S. Census.

Population growth is overall increasing in the county, although the rate of growth has decreased since the 2000 census. Lake County has grown in population 1.4% from 2010 to 2020; a higher percent change in the last decade than both Cook and DuPage Counties. This rate of growth is much higher than the growth rate of the entire state of Illinois, which had a negative growth rate from 2010 to 2020. The Chicago Metropolitan Agency has projected population growth to continue for Lake County, with a projected population of over 950,000 by the year 2040, with 327,000 households. This would represent population growth rate of over 30% from 2010 figures, and a 25% housing growth rate. Population data from the 2020 Census are presented in Table 1.

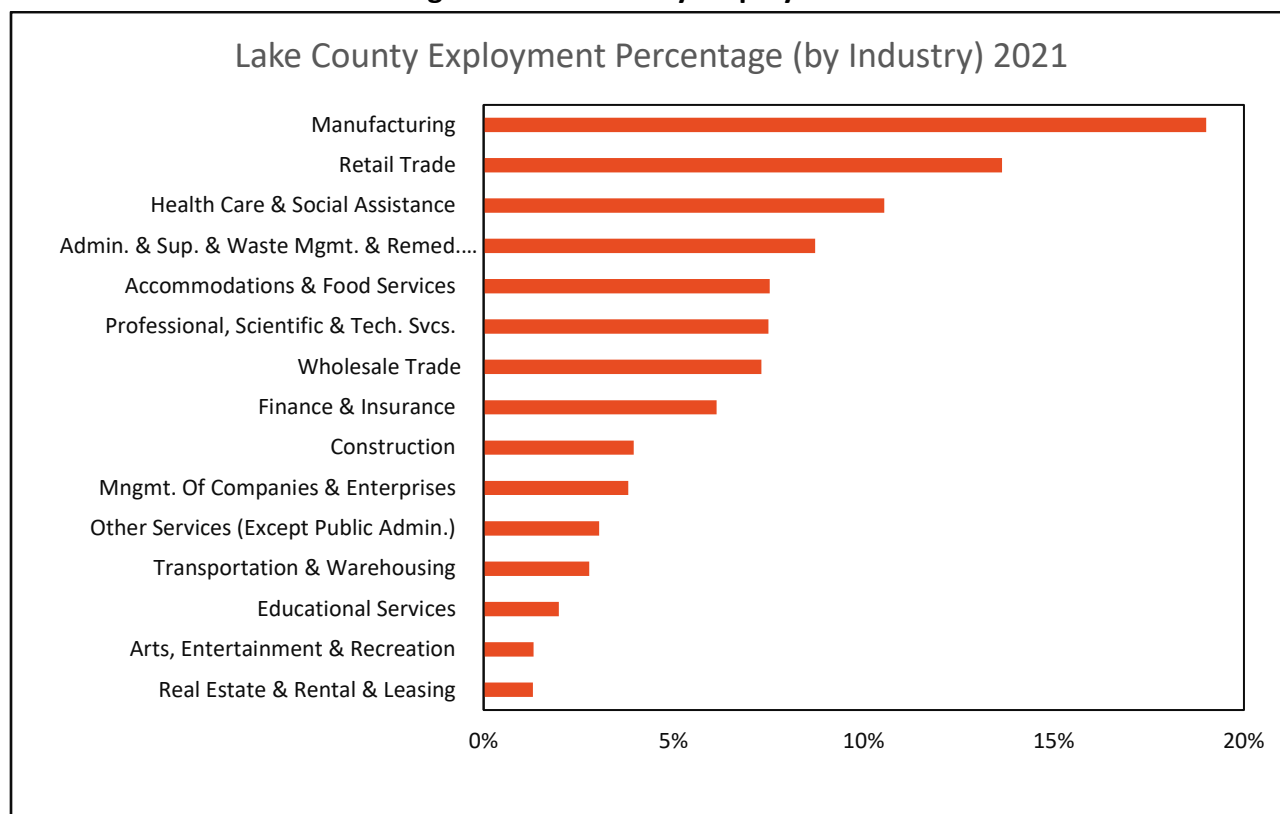
**Employment:** In 2020, the estimated workforce in Lake County was 320,154 people. The county's manufacturing sector employs the most people, accounting for 19.2% of the total workforce. Other notable sectors include retail trade (13.6%), health care and social assistance (11.3%) and finance and insurance (7.8%).

**Figure 1: Lake County Employment** demonstrates the employment breakdown by sector in Lake County. The top employer in Lake County is the Great Lakes Naval Station operated by the U.S. Department of Navy. Great Lakes Station employs approximately 26,200 people. The Great Lakes Station serves as the Navy's largest training center and is the largest military installation of any kind in the state of Illinois. The second largest employer in Lake County is Abbott Laboratories which employs approximately 13,000 people.

**Table 1: Lake County Township Population Data**

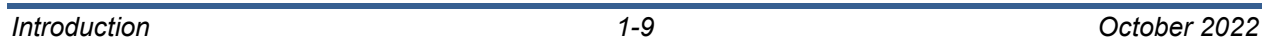
Township	Lake County		
	2010 Population	2020 Population	2040 Population Projected
Antioch Township	27,745	27,535	44,400
Avon Township	65,001	63,708	91,008
Benton Township	18,951	19,082	29,434
Cuba Township	16,826	17,292	18,765
Ela Township	42,654	45,287	50,724
Fremont Township	32,337	33,422	43,646
Grant Township	26,523	28,051	36,679
Lake Villa Township	40,276	39,796	53,306
Libertyville Township	53,139	54,192	64,852
Moraine Township	34,129	33,946	49,232
Newport Township	6,770	6,831	9,701
Shields Township	39,062	37,685	31,506
Vernon Township	67,095	71,377	86,024
Warren Township	64,841	65,883	79,332
Wauconda Township	21,730	23,628	35,089
Waukegan Township	90,893	90,386	105,419
West Deerfield Township	31,077	31,586	39,942
Zion Township	24,413	24,655	27,283
<b>Total:</b>	<b>703,462</b>	<b>714,342</b>	<b>896,341</b>

*Sources: 2010, 2020 U.S. Census*

**Figure 1: Lake County Employment**

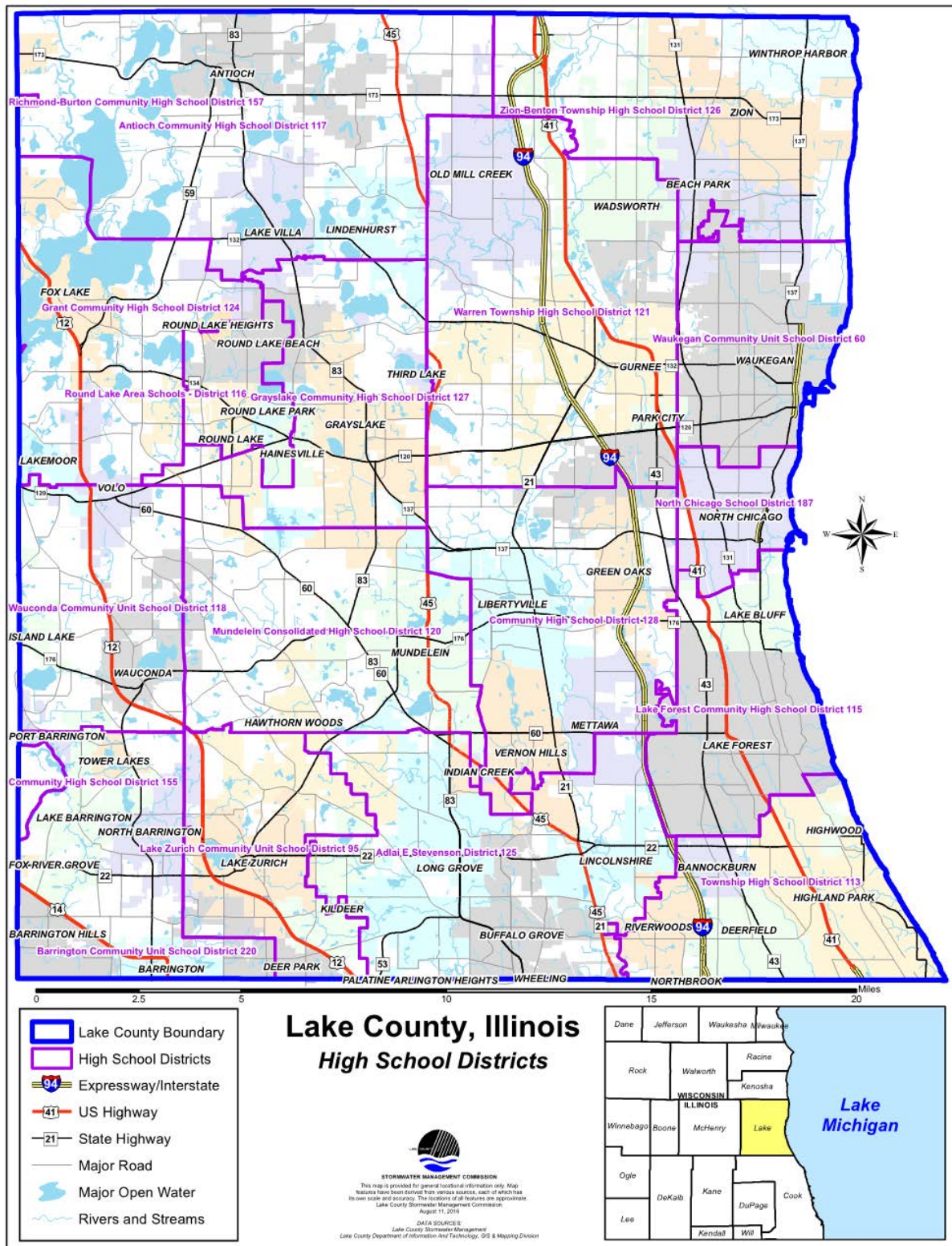
Source: U.S. Bureau of Labor Statistics

**Schools:** According to [Illinoischools.com](http://Illinoischools.com) Lake County has 51 public elementary and high school districts. They are shown in Exhibit 3: Lake County Elementary School Districts and Exhibit 4: Lake County High School Districts. Colleges include College of Lake County in Grayslake (also in Vernon Hills and Waukegan), Lake Forest College in Lake Forest, Trinity International University in Deerfield, and Rosalind Franklin University in North Chicago.





## Exhibit 4: Lake County High School Districts



## 1.4 Lake County Land Use and Development

Current Land Use: Lake County covers approximately 448 square miles of land area. Approximately 16% of Lake County is in the 100-year floodplain. The most current Lake County land use data is presented in **Error! Reference source not found.** and Table 2: Current Land Use. Total residential land use is the largest land use in Lake County, accounting for over 26% of the land. Public and private open space is also a large land use, accounting for over 19% of the total land area. Exhibit 5: Lake County Current Land Use shows current land use in Lake County.

**Figure 3: Lake County Future Land Use Percentiles**

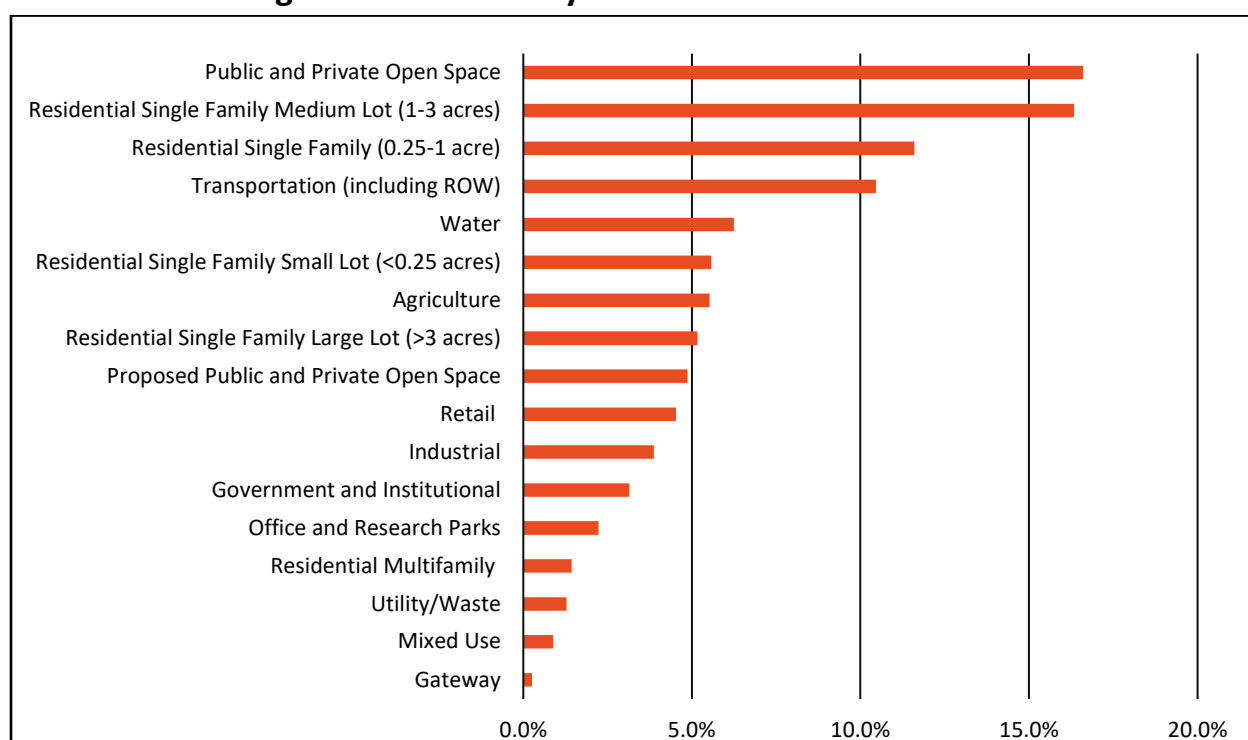


Figure 3: Future Land Use and Table 3: Planned Future Land Uses demonstrate the estimated future land uses within Lake County between 2020-2030. Areas to be designated for public and private open space utilize the most future land area in Lake County, accounting for over 20% of land. Single family residential lots from 0.25 to 1-acre account for nearly 12% of future use, while single family medium residential lots from 1 to 3 acres account for over 16%. Future land used for transportation purposes is estimated at over 10%.

Development Trends: Development is expected to continue throughout Lake County. As mentioned above, the Chicago Metropolitan Agency for Planning has projected that Lake County

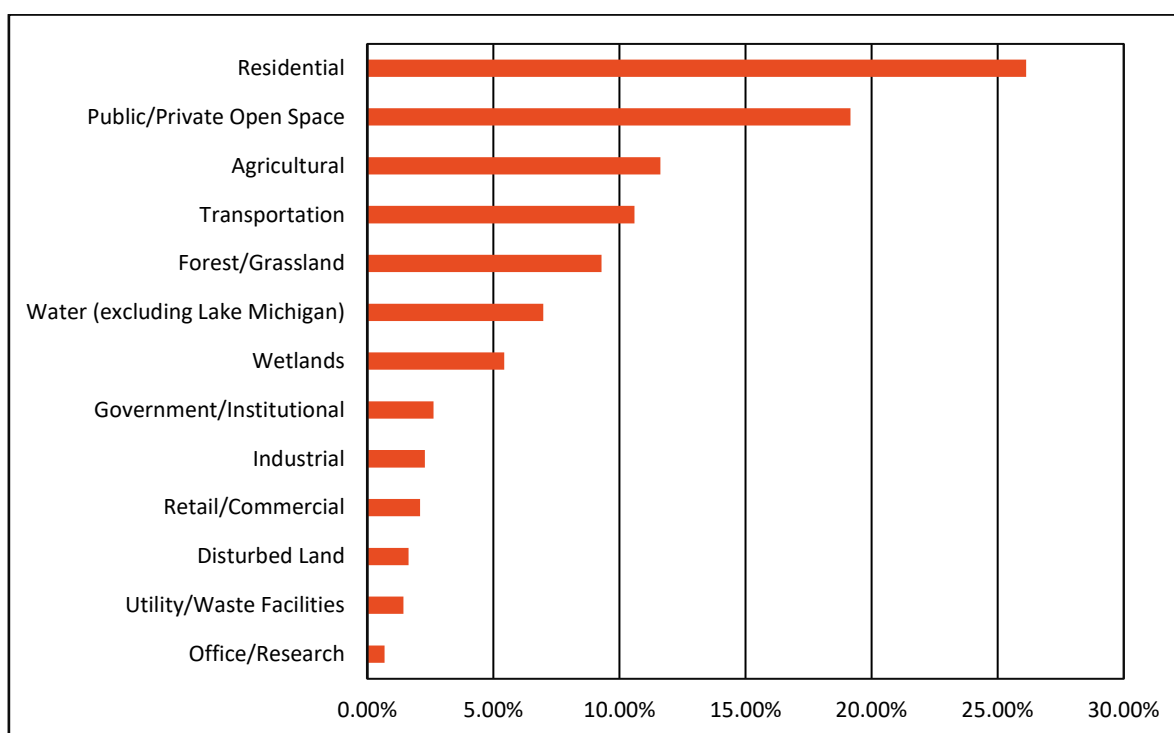
will grow to 327,000 households by the year 2040, from the current estimate of 253,386. This would represent over a 25% housing growth rate from 2010 figures.

Lake County places high importance on protecting its environmental resources, which includes lakes, rivers, and open spaces. Many communities have identified green space as an important quality of life factor in Lake County.



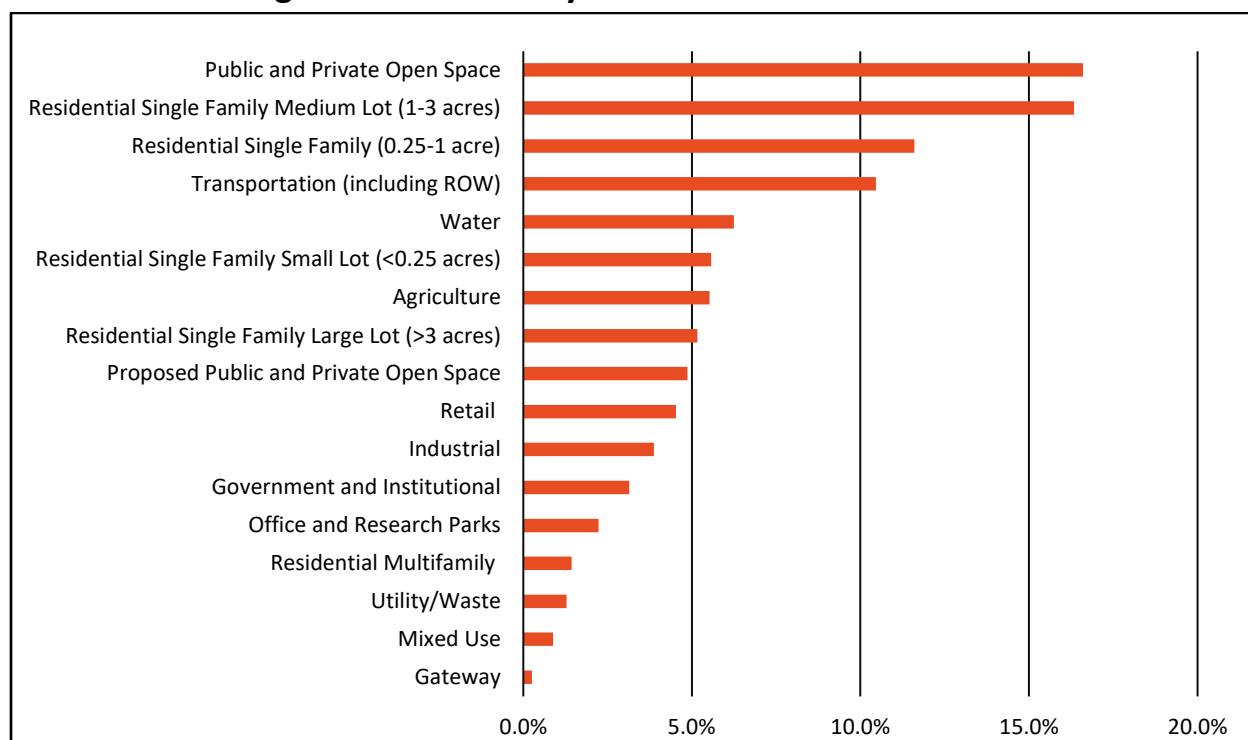
Exhibit 6: Lake County Environmental Resources **Inventory** shows the location of developed areas, Illinois Natural Areas Inventory Areas, Illinois biological survey stream corridors, protected conservation-oriented open space, other public and private open space, surface water including floodplains, floodways, wetlands, Stormwater Management Commission Flood Hazard Mitigation Areas, areas of steep slopes and areas of hydric soils. This data has been used by Lake County in the development of future comprehensive plans to allow for policies and actions by county agencies and the municipalities that respect environmental and cultural resources, while accommodating desirable development.

**Figure 2: Lake County Current Land Use**



**Table 2: Current Land Use**

Land Use	Acres	Percent
Agricultural	35,021	11.63%
Disturbed Land	4,938	1.64%
Forest/Grassland	27,970	9.29%
Government/Institutional	7,931	2.63%
Industrial	6,874	2.28%
Office/Research	2,046	0.68%
Public/Private Open Space	57,745	19.17%
Residential	78,748	26.14%
Retail/Commercial	6,318	2.10%
Transportation	31,945	10.60%
Utility/Waste Facilities	4,298	1.43%
Water (excluding Lake Michigan)	21,032	6.98%
Wetlands	16,369	5.43%
<b>Total</b>	<b>301,234</b>	<b>100.00%</b>

**Figure 3: Lake County Future Land Use Percentiles**

**Table 3: Planned Future Land Uses**

Land Use	Acres	Percent
Gateway*	798	0.26%
Mixed Use	2,640	0.88%
Utility/Waste	3,869	1.28%
Residential Multifamily	4,301	1.43%
Office and Research Parks	6,721	2.23%
Government and Institutional	9,458	3.14%
Industrial	11,651	3.87%
Retail	13,636	4.53%
Proposed Public and Private Open Space	14,659	4.87%
Residential Single-Family Large Lot (> 3 acres)	15,536	5.16%
Agriculture	16,648	5.53%
Residential Single-Family Small Lot (< 0.25 acres)	16,775	5.57%
Transportation (Including ROW)	31,483	10.46%
Residential Single Family (0.25 - 1 acre)	34,944	11.60%
Residential Single-Family Medium Lot (1 -3 acres)	49,202	16.34%
Public and Private Open Space	49,972	16.60%
Water	18,830	6.25%
<b>Total</b>	<b>301,122</b>	<b>100%</b>
*Gateway is an entrance through a wall, fence or where there is a gate		



Exhibit 5: Lake County Current Land Use

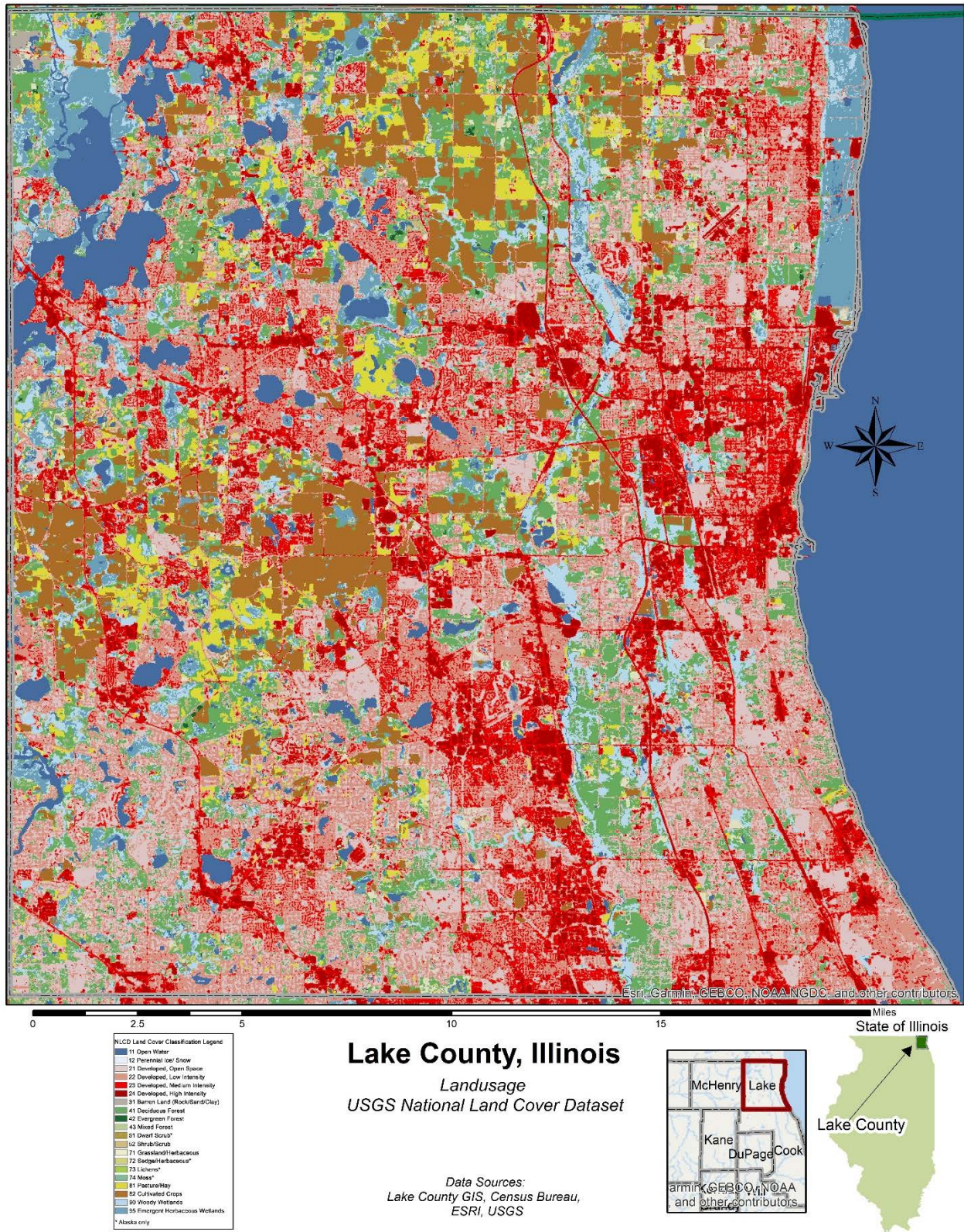
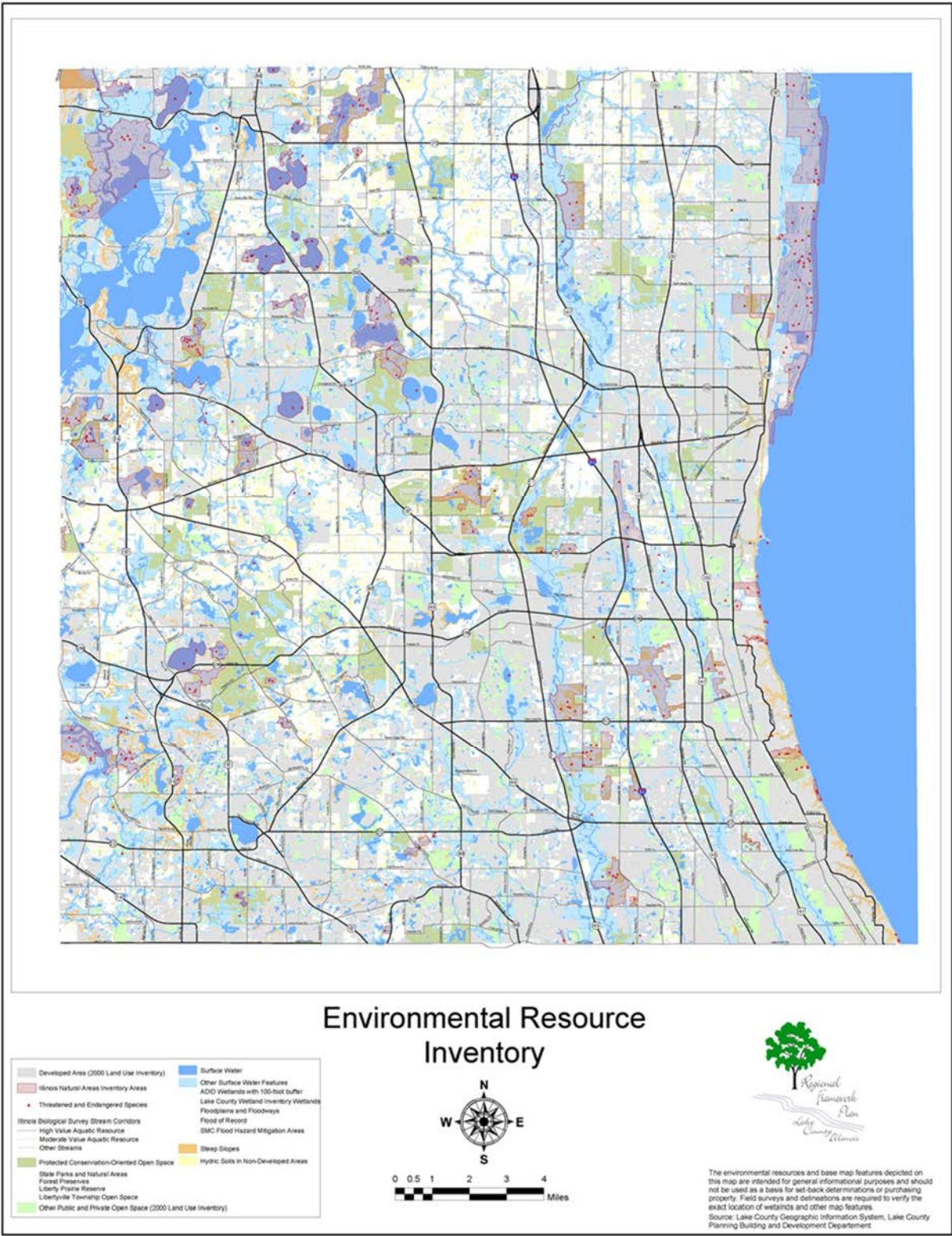




Exhibit 6: Lake County Environmental Resources Inventory



## 1.5 Lake County Critical Facilities

Critical facilities are buildings and infrastructure whose exposure or damage can affect the wellbeing of a large group. The continued operation of critical facilities is vital to preparedness, response, and recovery from any sort of event. 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 communication systems.
- 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, 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 for the ANHMP update. Lake County GIS Department maintained a database and GIS layers for critical facilities, however the County made use of this planning opportunity to update the critical facilities list.

Table 4: Lake County Critical Facilities and Exhibit 7: Lake County Critical Facilities present the critical facility data for Lake County. Table 4 summarizes critical facilities located in the 100-year floodplain. There are 39 critical facilities in the 100-year floodplain. Further investigation into critical facility locations, use of critical facility mapping, and protection of critical facilities is discussed in Chapters 3 and 5 of this ANHMP.

**Table 4: Lake County Critical Facilities**

Critical Facility Category	Number
Airports	7
City Halls	44
College /Universities	21
Fire Departments	65
Government Buildings	17
Health Department Offices	18
Helipads	11
Hospitals	9
Libraries	29
Metra Rail Stations	31
Museums	40
Nursing Home/Long Term Care Facilities	66
Police Stations	42
Schools	309
Township Offices	25
<b>TOTAL</b>	<b>714</b>

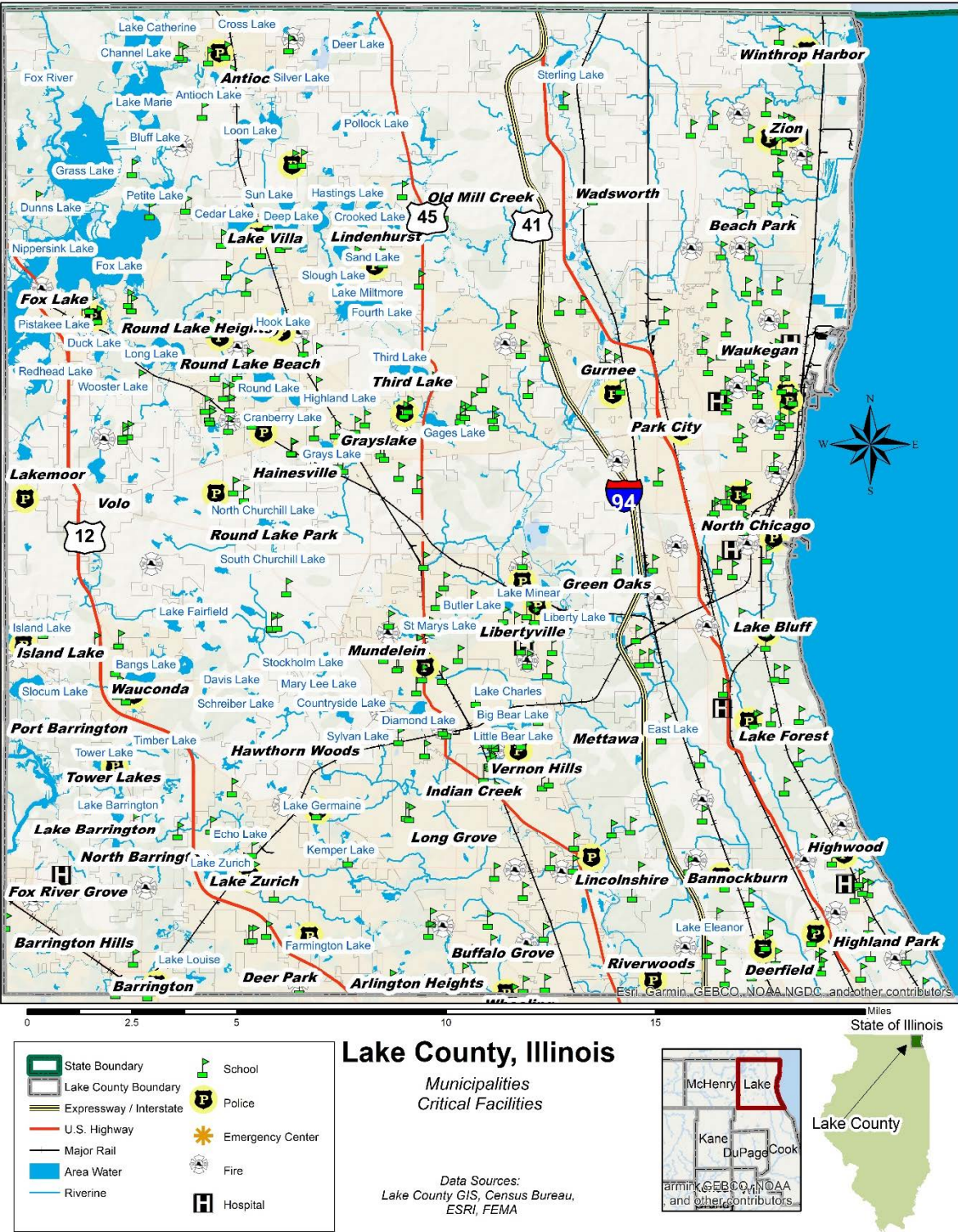




**Table 5: Lake County Critical Facilities Located in the 100-year Floodplain**

Critical Facility Category	Number
Airport Runway / Airfield	1
Amusement / Water Park	1
Auditorium / Concert Hall / Theater / Opera House	1
Golf Course	3
Hotel / Motel	1
Lake / Pond	1
Park	30
Shopping Mall / Complex	1
<b>Total</b>	<b>39</b>

Exhibit 7: Lake County Critical Facilities



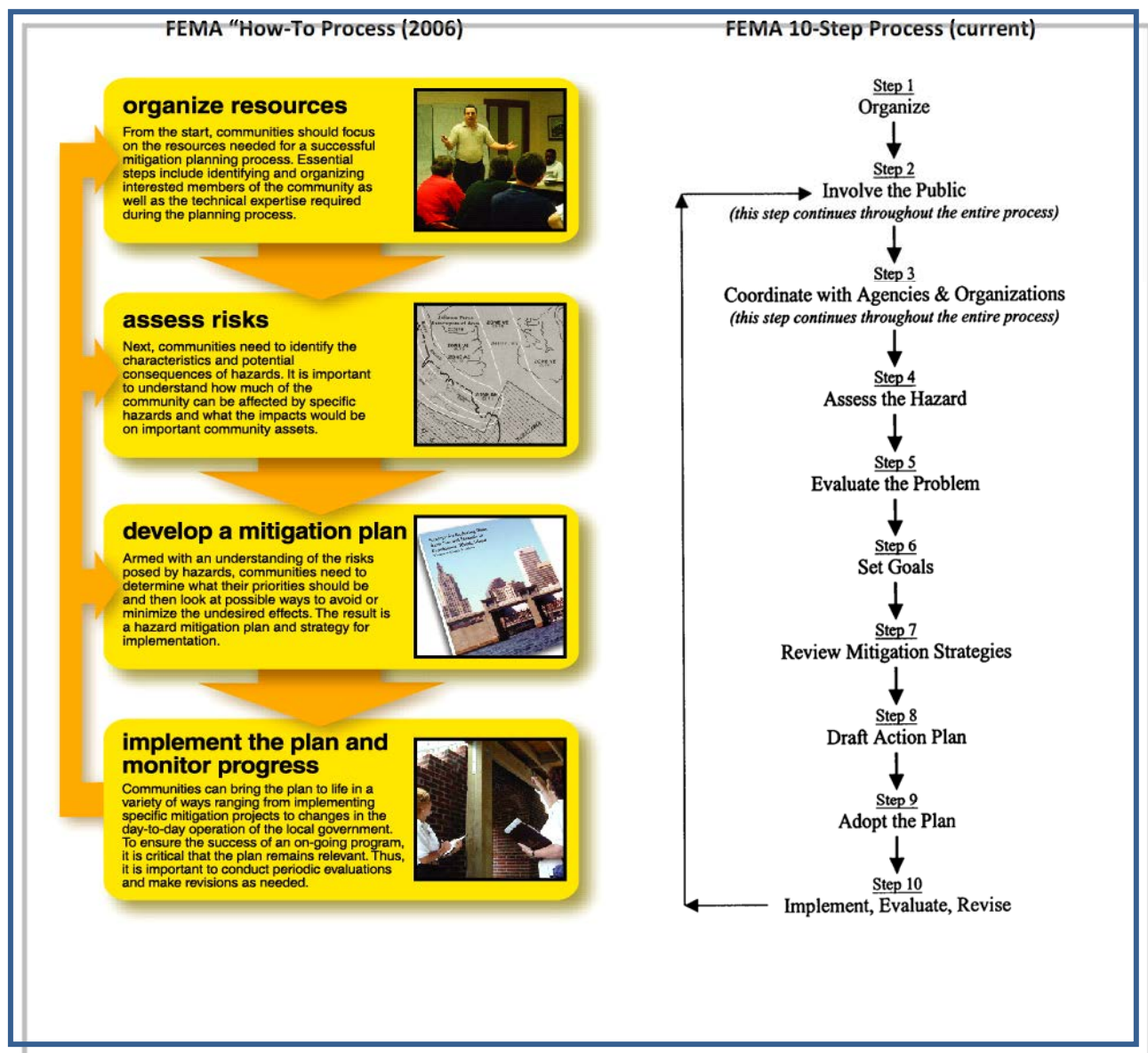
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## Chapter 2: Planning Process

### 2.1 Planning Approach

The Lake County ANHMP was first developed in 2006 utilized the four phases or steps of hazard mitigation planning as recommended by FEMA in the “State and Local Mitigation Planning How-To Guides” (FEMA 386-1 to 4) for the Disaster Mitigation Act (DMA) and the Hazard Mitigation Assistance (HMA) program. The 2012 and 2017 update of the ANHMP expanded the planning phases to the 10-step approach recommended by FEMA through the Community Rating System (CRS) program, shown in Figure 4.

**Figure 4: Mitigation Planning Process Steps Comparison**





For the 2022 update to the ANHMP, the FEMA 10-step process was again utilized, while ensuring that the requirements for DMA/HMA were met. The FEMA 10-step process provides Lake County with a more tailored approach to the ANHMP update and allows the ANHMP to qualify for credit under the CRS program. The Lake County Hazard Mitigation Planning Committee (HMPC) includes several Lake County departments and agencies and Lake County municipalities. The HMPC has been meeting annually since 2006. Regional, state, and federal agencies were invited to join the HMPC for the update of the ANHMP, and all meetings were open to the public. Participating members of the HMPC as well as all participants who attended one or more meetings are presented in Appendix A. Some small municipalities were represented by the Lake County staff.

A kickoff meeting with Lake County staff was held in January 2022. The HMPC met five times from January to April 2022 for the ANHMP update. The efforts of the HMPC were coordinated by the Lake County Stormwater Management Commission (SMC), Lake County Emergency Management Agency (LCEMA) and the Lake County Department of Planning, Building and Development. Other County departments participated and provided support for the plan update.

## **2.2 Update Process – Organization and Coordination**

The HMPC was brought together for the first meeting in ANHMP update process in January 2022. Lake County village boards and city councils provided SMC with “letters of intent” for participation in the 2022 ANHMP update at the time of the SMC grant application to the Illinois Emergency Management Agency. Municipalities are asked to adopt a resolution of participation for each subsequent update of the AHNMP.

Opportunities for neighboring counties in both Illinois and Wisconsin, agencies, nonprofits, and other interested parties to be involved in the planning process were made available, including:

- American Red Cross
- Chicago Metropolitan Agency for Planning
- City of North Chicago, Public Works
- Federal Emergency Management Agency
- Fox Waterway Agency
- Great Lakes Naval Station
- Illinois Department of Natural Resources, Office of Water Resources
- Illinois Department of Natural Resources, State Water Survey
- Illinois Emergency Management Agency
- Insurance Services Office, Community Rating System



- Kenosha County
- McHenry County Planning & Development
- National Weather Service
- U.S. Army Corps of Engineers
- U.S. Department of Agriculture, Natural
- Resources Conservation Service
- U.S. Department of Agriculture,
- Soil & Water Conservation District
- U.S. Fish and Wildlife
- U.S. State Geological Survey

Coordination (Step 3) with these organizations was accomplished through meetings, phone conversations and/or e-mail exchanges. During the planning process, the interested agencies were kept informed and invited to provide any comments in time for the public meeting.

Existing plans and programs of other agencies were reviewed throughout the planning process. Plans reviewed and incorporated are discussed further in Chapter 5.1.1 and in Table 44.

**Public Involvement:** Step 2 of the planning process was to obtain input from the public, particularly property owners that have been affected by natural hazards. The public was invited to participate through several concurrent means, including:

- Contact with HMPC members and their organizations
- A standing invitation to attend HMPC meetings
- Public surveys through local print, social media, and county websites.
- Press releases provided to local newspapers and included in the Lake County “E-Newsletter” and newspaper coverage

The ANHMP update process and HMPC meetings were publicized through social media, the Lake County SMC website, community newsletters, emails, and local newspapers. Examples of public involvement efforts are provided in Appendix B.

Lake County residents were invited to provide public input to the planning process through “Alchemer,” an online survey tool. The web link was included in news releases and promoted by HMPC members. The survey was open from March 1 through March 21, 2022. Twenty questions were presented, and results were used to evaluate the prioritization of natural hazards and to develop a sense of citizens’ understanding of their mitigation needs. Residents from 45 communities participated in the survey. Respondents ranked power outages, severe summer storms, severe winter storms, tornadoes, extreme heat, groundwater flood and flooding as hazard events of greatest concern.

*Public meeting:* A public meeting was held on April 19, 2022, at the Lake County Stormwater Management Building in Libertyville Illinois, to engage the public in the planning process and solicit feedback on mitigation initiatives throughout the county as well as identify personal mitigation activities homeowners could participate in.

The 2022 draft *Lake County All-Natural Hazards Mitigation Plan* was made available at the SMC website. Per SMC's own policies, adjacent jurisdictions and state and regional agencies were invited to review the draft during a 30-day comment period. Press releases included where the public could view the plan and forward comments. The public comment period extended from

**Hazard Assessment and Problem Evaluation:** Steps 4 and 5 make up the updated ANHMP risk assessment (Chapter 3). The natural hazards identified are based on previous plans, a 2011 HMPC prioritization exercise, and hazard events that occurred in Lake County between 2017 and 2022. During the February 2022 HMPC meeting, the hazard prioritization was reviewed, and a new hazard ranking methodology was adopted.

Chapter 3 examines the hazards, including a hazard assessment (what causes the hazard and the likelihood of occurrence), and provides a vulnerability assessment that estimates the impact of the hazard on life, health, property (e.g., homes, businesses, and critical facilities). The tasks involved with conducting the risk assessment for this plan included hazard identification, inventory of community assets vulnerable to the hazards, hazard events profile, magnitude, history, probability, impacts, flood insurance claims, repetitive losses, flood audits, future development trends, and mapping these components. Data was collected from all participating communities from January through April 2022 for the update of Chapter 3.

**Developing Goals:** Mitigation planning goals were developed by the HMPC for the update of the ANHMP. A goal setting exercise was conducted for the 2017 plan update. The goals and guidelines (objectives) presented in Chapter 3 were reaffirmed at the February 2022 HMPC meeting.

**Mitigation Strategy:** For the 2017 update of the ANHMP, mitigation strategies were developed for all priority natural hazards discussed in the risk assessment and are presented in Chapter 5. The mitigation strategies are organized into six general categories and all measures were reviewed in relationship to the goals guidelines. The six mitigation categories include: preventive measures, property protection, resource protection, emergency services, structural measures, and public information activities. The mitigation strategy recommendations and the capabilities of Lake County presented in Chapter 5 were updated based on the HMPC discussion at the March 2022 meeting, and the data collected from all participating communities from January through April 2022.

**Action Plan:** At the March 2022 HMPC Meeting and the April 2022 Jurisdictional workshops an updated action plan was formulated. Both countywide and community-specific action items were considered. The 2017 ANHMP action items were evaluated along with new action items formulated because of recent hazard events and based on new opportunities. Appendix D provides a summary of changes made from the 2017 action plan to the current action plan.

## **2.3 Plan Adoption and Implementation**

The County Board will adopt the 2022 ANHMP for the unincorporated areas of Lake County and the individual municipalities will adopt the plan for the incorporated areas (Action Item

1). The Lake County Stormwater Management Commission (SMC) was previously listed as a stakeholder in the planning process, for the 2022 ANHMP update the SMC is considered a full participant in the plan update process and will adopt the ANHMP in such capacity. Implementation of the updated ANHMP and the implementation steps were discussed at the February and March 2022 meetings of the HMPC. Plan maintenance approach is discussed in Chapter 7 (and Action Item 2).

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### Chapter 3: Risk Assessment

This chapter provides a risk assessment of natural hazards that could impact Lake County. The risk assessment is a continuation of previous ANHMP updates. Hazards have been evaluated based on HMPC input received from meetings and questionnaires. Hazard information has also been updated based on natural hazard events over the past five years, and available data and mapping. The risk assessment for priority hazards such as severe storms and floods includes a hazard analysis and a vulnerability assessment. Other hazards, such as earthquakes and dam failure, include only a hazard profile in this ANHMP update. The vulnerability assessment includes a hazard profile which includes a description of the nature of the hazard, past occurrences and damages, and the likelihood or probability of the hazard occurring in the future. Lake County assets, when applicable, have been examined to estimate potential exposure and potential losses attributable to natural hazards. A summary of the risk assessment for Lake County is provided at the end of this chapter.

#### 3.1 Natural Hazards in Lake County

A key step in preventing disaster losses in Lake County is developing a comprehensive understanding of the hazards that pose risks to its communities. The risk assessment terms in Table 7 can be found throughout this ANHMP.

**Table 6: Defined Risk Assessment Terms**

<b>HAZARD</b>	Event or physical conditions that have the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, other types of harm or loss
<b>RISK</b>	Product of a hazard's likelihood of occurrence and its consequence to society
<b>VULNERABILITY</b>	Degree of susceptibility and resilience of the community and environment to hazards

*Source: Federal Emergency Management Agency, 2001*

The local risk assessment summary is a process or application of a methodology for evaluating risk as defined by probability and frequency of occurrence of a hazard event, exposure to people and property to the hazard, and consequences of that exposure. Different methodologies exist for assessing the risk of hazard events, ranging from qualitative to quantitative.

A list of potential hazards was re-reviewed by the HMPC to determine if the classification of high, moderate, and low-risk hazards described in the 2017 ANHMP were still applicable. A 2022 survey of the HMPC indicated that these hazards should be included in the ANHMP. A natural hazard screening worksheet/survey was then completed to create a list of possible hazards that could affect Lake County. Committee members were asked to rank the impact or consequences on their community, assess the frequency, and area of vulnerability for each hazard.

The risk rating for each hazard in every participating jurisdiction summarized on Appendix A were determined by adding impact, occurrence, and vulnerability scores according to values



assigned to impact factors for each hazard. Full category definitions and ranking results are available in Appendix B.

Priority natural hazards were selected for analysis from that review. Hazards were ranked to provide structure and prioritize the mitigation goals and actions discussed in this ANHMP. Based on these ratings, a priority of high, moderate, or low was assigned to each hazard. The hazards ranked as being of highest concern for the 2022 ANHMP are severe summer storm, severe winter storm, power outages, and tornado.

**Table 7: Hazard Risk Ranking Summary**

Hazard Ranking	Hazard Event	Category
1	Severe Summer Storm	High
2	Severe Winter Storm	High
3	Power Outages	High
4	Tornado	Moderate
5	Extreme Heat	Moderate
6	Flood	Moderate
7	Drought	Moderate
8	Groundwater Flooding	Moderate
9	Earthquake	Low
10	Erosion	Low
11	Dam Failure	Low
12	Seiche	Low

Table 8 presents a list of all disaster and emergency declarations that have occurred in Lake County, according to the FEMA through October 2022. This list presents the foundation for identifying what hazards pose the greatest risk within Lake County.

**Table 8: Presidential Disaster (DR) & Emergency Declarations (EM) in Lake County**

Declaration	Declaration Date	Event Details
FEMA DR-194	April 25, 1965	Tornadoes, Severe Storms, and Flooding
FEMA DR-227	April 25, 1967	Tornadoes
FEMA DR-373	April 26, 1973	Severe Storms, Flooding
FEMA EM-3068	January 16, 1979	Blizzards and Snowstorms
FEMA DR-776	October 7, 1986	Severe Storms and Flooding
FEMA DR-997	July 9, 1993	Great Midwest Flood
FEMA DR-1110	April 23, 1996	Tornadoes, Severe Storms
FEMA EM-3134	January 8, 1999	Winter Snowstorm
FEMA EM-3161	January 17, 2001	Severe Winter Storm
FEMA EM-3230	September 7, 2005	Hurricane Sheltering
FEMA DR-1729	September 25, 2007	Severe Storms and Flooding
FEMA EM-3283	March 13, 2008	Snow
FEMA DR-1771	June 24, 2008	Severe Storms and Flooding

**Table 8: Presidential Disaster (DR) & Emergency Declarations (EM) in Lake County**

Declaration	Declaration Date	Event Details
FEMA DR-1960	March 17, 2011	Severe Winter Storm and Snowstorm
FEMA DR-4116	May 10, 2013	Severe Storms, Straight-Line Winds and Flooding

Note that six federal disasters were declared which included Lake County since the adoption of the 2006 ANHMP. Cook County to the south of Lake County had two disasters declared: DR-1800 for flooding on September 13, 2008, and DR-1935 for flooding in July-August 2010. Lake County was impacted by these events, but damage did not warrant the county being included in the declaration.

Based on the input from the HMPC and the record of hazard events in Lake County, priorities from the 2016 ANHMP were reevaluated at the February 2022 update meeting. It was decided that the pandemic would not be included in the 2022 ANHMP since it is addressed throughout other planning mechanisms within the county. Lake County priority hazards include:

- Flood
- Tornado
- Severe Summer Storms
- Severe Winter Storms
- Dam Failure
- Shoreline and Coastal Erosion
- Ravine Erosion
- Drought
- Earthquake
- Power Outages

Some of these hazards can be interrelated. For example, severe thunderstorms can produce high winds which can cause tornado activity. Thus, discussion of these hazards may overlap where necessary throughout this risk assessment. Also, some hazardous elements include lightning and hail activity; discussion of seiche and derechos. The risk assessments for priority hazards such as severe storms and floods includes a hazard analysis and a vulnerability assessment. Other hazards, such as earthquakes and dam failure, include only a hazard profile in this ANHMP update. While the HMPC understands that power outage is most often a secondary hazard to natural hazards, they felt it should be evaluated and mitigation strategies should be identified.

Table 9 summarized the status of hazards considered in the ANHMP risk assessment from the 2006 to this 2022 update. As shown, hazards were either *continued*, *deleted*, *changed*, or *new* hazards were identified.

**Table 9: Evaluation of Hazards for Inclusion in 2022 Risk Assessment**

YEAR ADDED	TYPE OF HAZARD	STATUS	TYPE OF HAZARD
2006	Flood	Continued	Flood
2006	High Wind	Continued	Severe Summer Storms
2006	Severe Thunderstorm	Continued	
2006	Hail	Continued	
2006	Severe Winter Storm	Continued	Severe Winter Storm
2006	Tornado	Continued	Tornado
2006	Dam Failure	Continued	Dam Failure
2006	Ravine Bank Erosion	Continued	Riverine and Ravine
2006	Lake Erosion	Continued	Shoreline Erosion
2006	Extreme Heat	Continued	Temperature Extremes (Heat and Cold)
2012	Drought	Continued	Drought
2012	Earthquake	Continued	Earthquake
2017	Power Outages	Continued	Power Outages

### 3.2 Summary of Lake County Assets

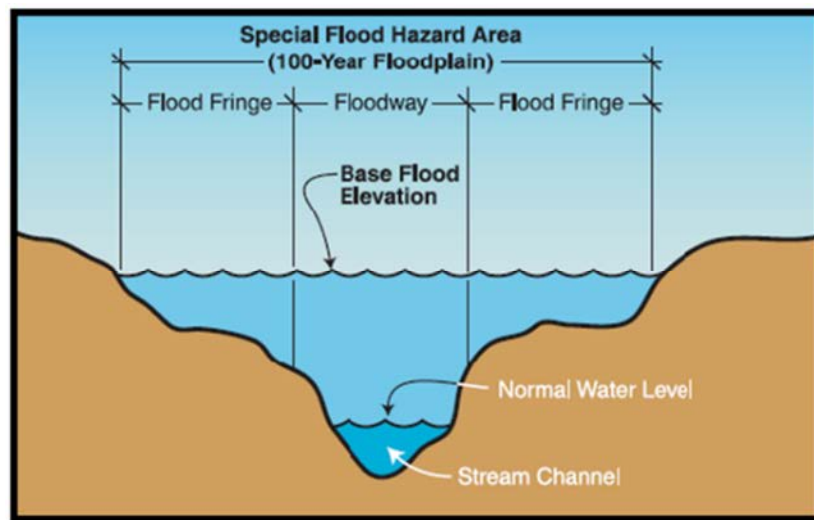
Lake County assets include people, buildings, infrastructure, businesses, and institutions, the land, and natural resources. Chapter 1 of this ANHMP presents population, workforce, land use, development trend and critical facility data. Assets were derived from the county critical facilities database in conjunction with FEMA HAZUS MH critical asset inventory lists. A detailed listing of assets is in Appendix B along with the hazard area tabular data for each hazard.

### 3.3 Flood

A flood is a natural event for rivers and streams and occurs when a normally dry area is inundated with water. Excess water from snowmelt or rainfall accumulates and overflows onto the stream banks and adjacent floodplains. As illustrated in Figure 5, floodplains are lowlands, adjacent to rivers, streams, and creeks that are subject to recurring floods. Flash floods, usually resulting from heavy rains or rapid snowmelt, can flood areas not typically subject to flooding, including urban areas. Extreme cold temperatures can cause streams and rivers to freeze, causing ice jams and creating flood conditions.

Floods are considered hazards when people and property are affected. In Illinois, flooding occurs commonly and can occur during any season of the year from a variety of sources. Pipelines, bridges, and other infrastructure can be damaged when high water combines with flood debris. Basement flooding can cause extensive damage for homeowners. Flooding can also cause extensive damage to crop lands. Several factors determine the severity of floods, including rainfall intensity and duration, topography, and ground cover.

Figure 5: Description of a Floodplain



**Riverine flooding** originates from a body of water, typically a river, creek, or stream, as water levels rise onto normally dry land. Water from snowmelt, rainfall, freezing streams, ice flows, or a combination thereof, causes the river or stream to overflow its banks onto adjacent floodplains. Winter flooding usually occurs when ice in the rivers creates dams or streams freeze from the bottom up during extreme cold spells. Spring flooding is usually the direct result of melting winter snowpacks, heavy spring rains, or a combination of the two. There are two types of riverine flooding:

- **Flash floods** can occur anywhere when a large volume of water flows or melts during a brief period, usually from slow moving thunderstorms or rapid snowmelt. Because of the localized nature of flash floods, clear definitions of hazard areas do not exist. These types of floods often occur rapidly with significant impacts. Rapidly moving water only a few inches deep can lift people off their feet, and only a depth of one to two feet is needed to sweep cars away. Most flood deaths result from flash floods.
- **Overbank flooding** is the most common form of riverine flooding and occurs when water surpasses the banks of a river or stream of any size.

**Urban flooding** or local drainage problems can occur anywhere in Lake County. Most local drainage problems result in shallow flooding on roads, yards and, sometimes, in buildings.



In some areas, a development is in a drainage way or in a depressional ponding area. Inadequately maintained drainage ditches, undersized storm sewers, and failing tile drains or storm sewers are common causes of local flooding.

Local drainage problems have the greatest damage impact on homes with drive-down basement garages and split-level homes in low lying areas. In the case of drive-down garages, water accumulating on the street finds a low driveway and fills a home's basement. Split-level homes provide easy access for surface floodwaters to enter through the ground level windows.



Since much of Lake County was once tiled to provide drainage for farmland, failed or inadequate drain tiles can be a large problem in the developing areas of the county if not properly addressed. Many tiles are old and were not designed to handle the stormwater loads that current development produces. The same is also true for older undersized storm sewer systems. Most storm drains and road culverts in place today are not designed to carry more than the 10-year storm.

**Depressional flooding** is common in Lake County. Lake County has a gently rolling landscape that includes many depressional areas left from the Wisconsin Glacial Period. The widespread problem with development in many of these depressional areas is that there is no natural outlet for runoff. Some depressions are former wetlands that are drained with field tiles originally installed to make them farmable. In many cases the tiles are old, in disrepair, and often have limitations for handling the increased volumes of runoff that result from development. When the drainage system for depressional areas becomes overloaded, runoff will simply fill up a depression. Without an adequate outlet, the floodwater will remain until it evaporates, seeps into the ground or trickles through a tile.

**Sanitary Sewer Backups** There are few combined sewers in Lake County where stormwater and wastewater discharges are transported in the same pipe system. Therefore, most of the sanitary sewer backups are caused by infiltration of stormwater into the sanitary sewer pipes, leaky utility access holes and inappropriate connections from residential storm drains, roof drains and sump pumps to sanitary sewer lines. In some places, excess stormwater in sanitary sewers causes utility access hole covers to lift off, and sewage finds its way into rivers and lakes via the storm drainage system. The contamination of surface waters with sewage degrades water quality by adding fecal coliform and excess nutrients that reduce dissolved oxygen in the water and can lead to the spread of communicable diseases. Beach closures and swimming bans are a common result.

**Erosion and Sedimentation** Areas prone to the most erosion damage are the bluffs and ravines, lake shores, and high energy flow streams. Channelized stream reaches are less stable and more erosive than meandering sections. Erosion will be discussed in 3.11 Soil Erosion - Shoreline, Coastal and Ravine.

### 3.3.1 Lake County Watersheds

There are four major watersheds in Lake County, which are shown in **Error! Reference source not found.** along with 26 subwatersheds:

The **Fox River Watershed** is located on the western side of Lake County. The Fox River originates in Wisconsin and flows into the Fox Chain O' Lakes. A summary of the Fox River Watershed is presented in Table 10.

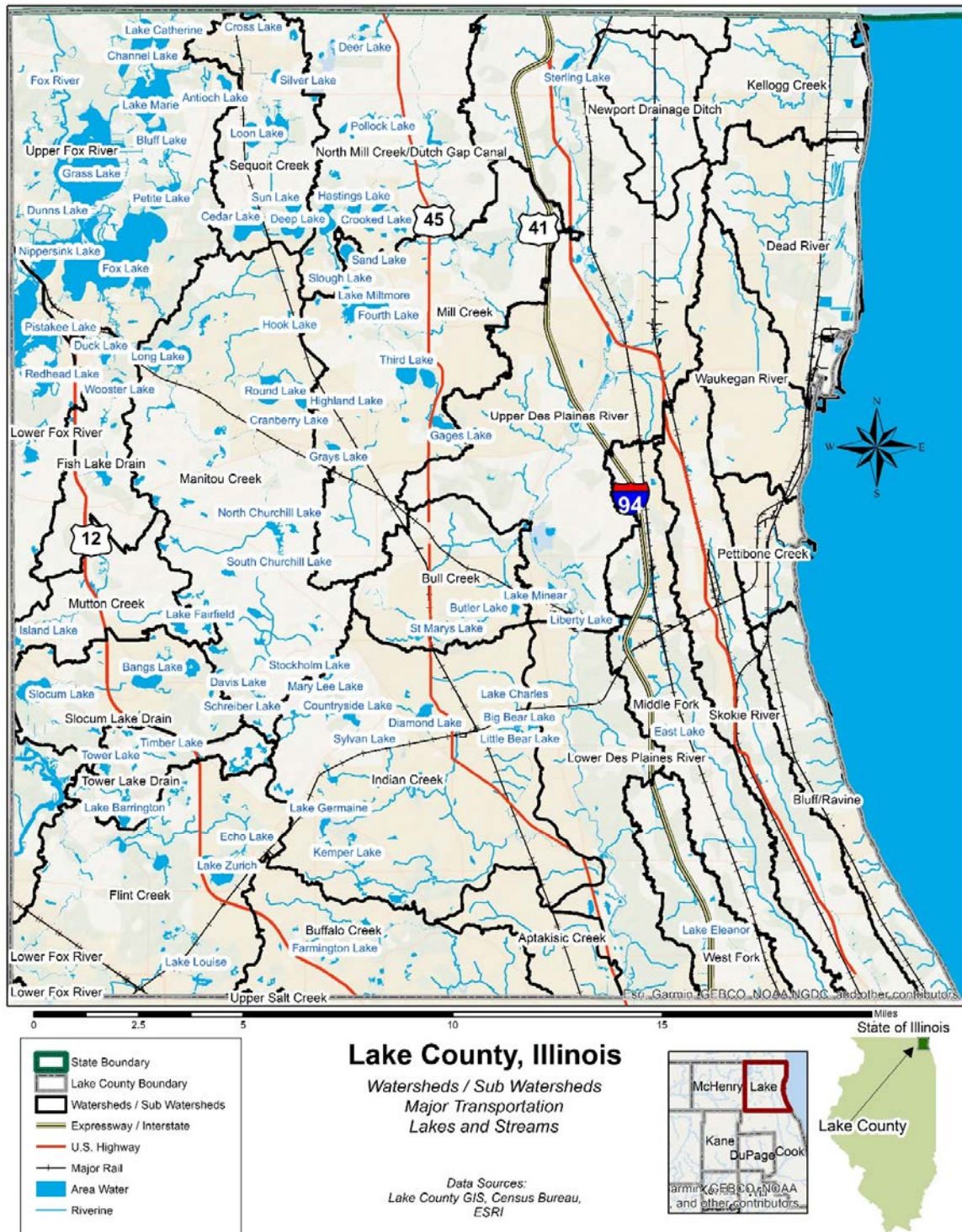
The water surface elevations in the Chain O' Lakes are controlled by the Stratton Lock and Dam (McHenry Lock and Dam, which is in McHenry County and operated by the IDNR-OWR. labels components of the Stratton Lock and Dam. Most days, discharge at the lock and dam allow safe lake levels for boat navigation and property protection. During flood events, sluice gates are opened to allow flood flows to pass downstream, however discharges must be balanced between potential flood damage in Lake County and potential flood damage in McHenry County. The construction activities involving the replacement of the existing sluice gates have been suspended as of the date of this this plan update and are awaiting construction funding appropriation is from the January 2012 "Operation of the Stratton and Algonquin Dams" IDNR-OWR report and shows their operational constraints that has for opening and closing the Stratton Dam gates.

The rural Fox River watershed has the greatest number of septic impacts with approximately 50 flood problem areas affected. Generally, lake area homes experience the highest level of septic impact. Almost half of the Fox watershed sites that suffer from septic damage are in the Upper Fox subwatershed in the Chain O' Lake's area.

The report is available online at:

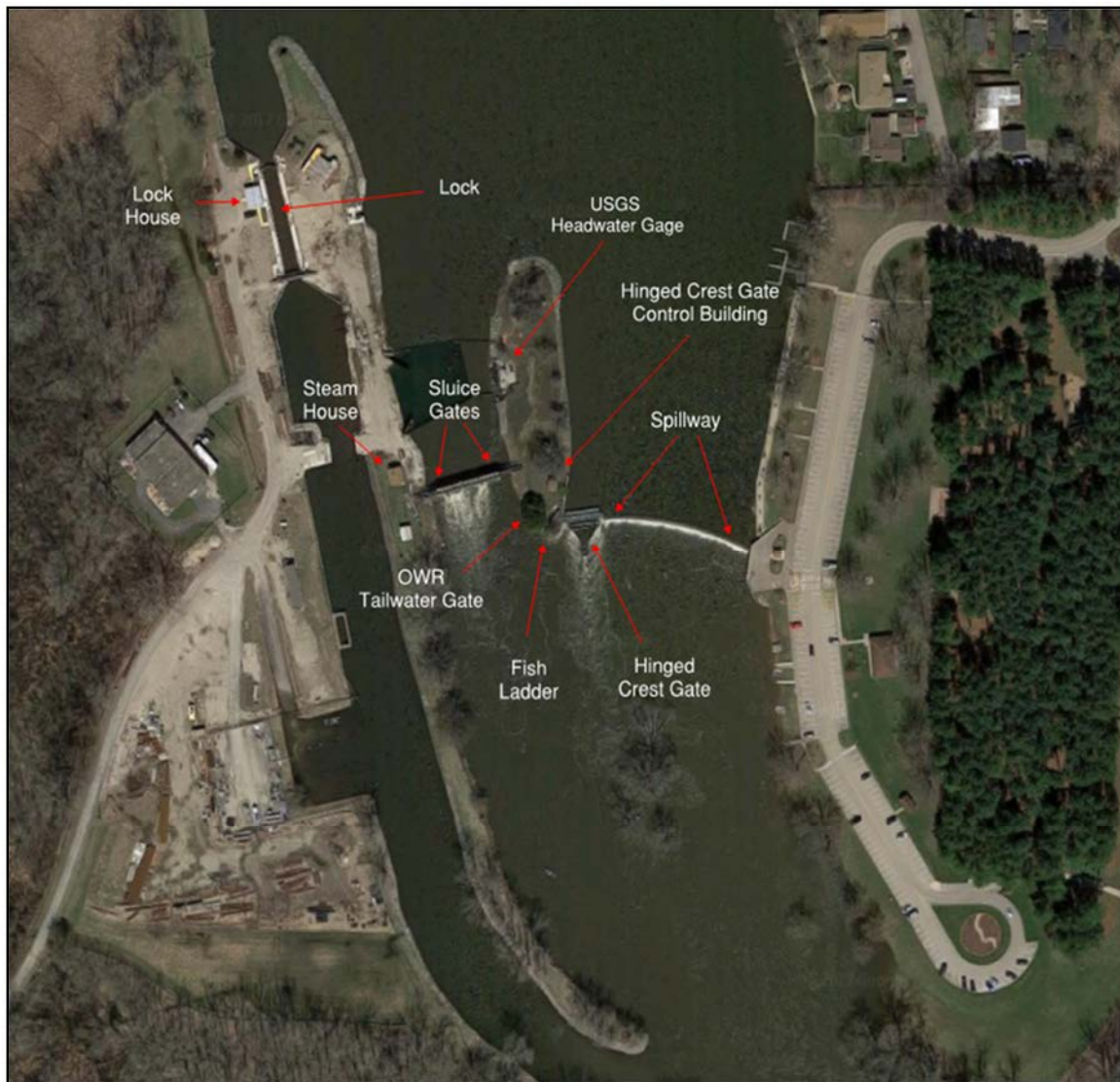
<https://www.dnr.illinois.gov/WaterResources/Documents/StrattonAlgonquinDams.pdf>

### Exhibit 8: Lake County 100-Year Floodplain and Floodway





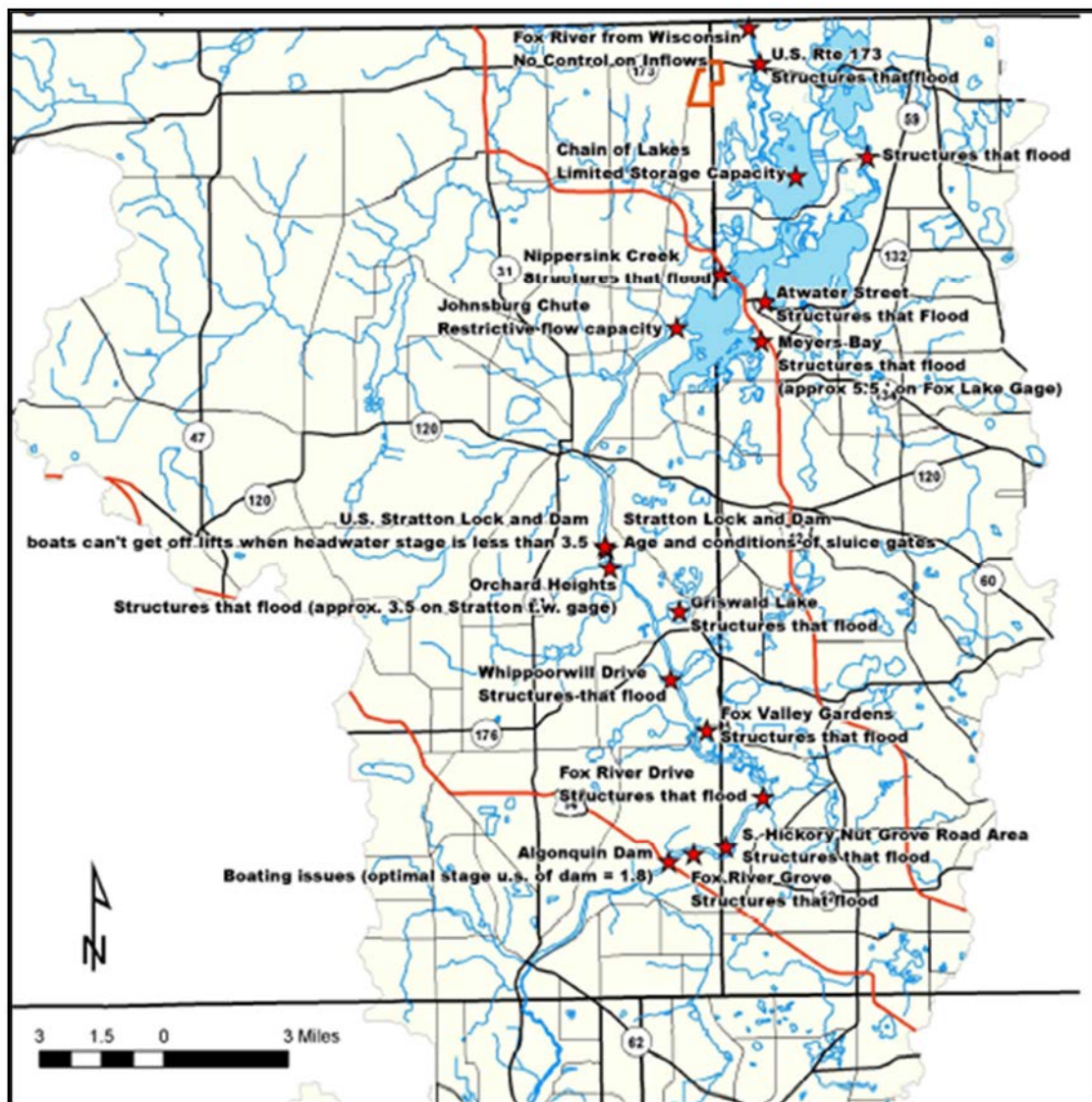
**Figure 6: Plan View of Stratton Lock and Dam**



Source: IDNR-OWR



**Figure 7: Operational Constraints at Stratton Lock and Dam**



Source: IDNR-OWR

Watershed-based plans have been developed for Fish Lake Drain (Update in Progress), Flint Creek (2018), Manitou Creek (Update In Progress), Sequoit Creek (2004) and 9 Lakes Watershed (2014) and are available at:

Fish Lake Drain:	<a href="http://www.lakecountyiil.gov/DocumentCenter/Home/View/10955">http://www.lakecountyiil.gov/DocumentCenter/Home/View/10955</a>
Manitou Creek:	<a href="http://www.lakecountyiil.gov/DocumentCenter/Home/View/3961">http://www.lakecountyiil.gov/DocumentCenter/Home/View/3961</a>
Sequit Creek :	<a href="http://www.lakecountyiil.gov/DocumentCenter/Home/View/3937">http://www.lakecountyiil.gov/DocumentCenter/Home/View/3937</a>
9 Lakes Watershed-Based Plan:	<a href="http://www.lakecountyiil.gov/DocumentCenter/Home/View/10927">http://www.lakecountyiil.gov/DocumentCenter/Home/View/10927</a>
Flint Creek:	<a href="https://www.lakecountyiil.gov/DocumentCenter/View/24315">https://www.lakecountyiil.gov/DocumentCenter/View/24315</a>

**Table 10: Fox River Watershed in Lake County**

Fox River Watershed:			
<b><u>Area:</u></b>	<b><u>Municipalities:</u></b>		
163 square miles	Antioch	Lakemoor	Round Lake Park
35% of County	Barrington	Lake Barrington	Tower Lakes
	Barrington Hills	Lake Villa	Volo
<b><u>Public Land:</u></b>	Fox Lake	Lake Zurich	Wauconda
12,816 acres	Fox River Grove	North Barrington	
	Hainesville	Round Lake	
<b><u>Wetlands:</u></b>	Hawthorn Woods	Round Lake Beach	
35,196 acres	Island Lake	Round Lake Heights	
<b><u>Subwatersheds:</u></b>	<b><u>Area (mi<sup>2</sup>):</u></b>	<b><u>Townships:</u></b>	
Upper Fox	32.7	Antioch	
Sequoit Creek	15.3	Avon	
Lower Fox	8.4	Cuba	
Fish Lake Drain	38.4	Ela	
Manitou Creek	9.4	Fremont	
Mutton Creek	10.9	Grant	
Slocum Lake Drain	11.0	Lake Villa	
Tower Lake Drain	10.2	Wauconda	
Flint Creek	26.7		

The Upper Des Plaines River watershed is in northeastern Illinois, Lake and Cook Counties, and Kenosha and Racine Counties in southeastern Wisconsin. A summary of the watershed is presented in Table 11: Des Plaines River Watershed in Lake County. The Upper Des Plaines is subject to significant flooding caused by lack of channel capacity of the mainstem of the Des Plaines River and tributaries to carry major flows during storms. Historical flooding in 1986 and 1987 resulted in over \$100 million in damage.

The main stems of the Fox and Des Plaines Rivers have flood characteristics that are vastly different from the other two major watersheds of the county. The Fox and Des Plaines Rivers experience their worst floods from rain events that last at least a few days, or from a series of small rain events over a longer duration. The greatest flooding along the Fox and Des Plaines occurred following longer rain events. The floods of 1960 and 1986 resulted from long steady rains which eventually overwhelmed the available floodplain storage and set new flood stage records on the Fox and Des Plaines Rivers respectively.

The 1986 event resulted from 10 days of widespread steady rain. It took the Des Plaines 4 weeks to pass this floodwater. For the larger Fox River, the time to pass this flood was 6 weeks. In comparison, the smaller watershed of the Skokie River drained down to normal only a few days after the rains ended. Long-duration rain events on snowpacks can also cause major flooding on the larger rivers.

Exhibit 8 of this ANHMP show the lakes located within the Fox River and Des Plaines River Watersheds. The lakes are a resource and a concern when the Fox River and Des Plaines Rivers are at flood stage for extended periods and lake levels are elevated as a result.

**Table 11: Des Plaines River Watershed in Lake County**

Des Plaines River Watershed				
<b><u>Area:</u></b>	<b><u>Municipalities:</u></b>			
202 mi <sup>2</sup>	Antioch	Indian Creek	Mundelein	
42% of County	Beach Park	Kildeer	Old Mill Creek	
	Buffalo Grove	Lake Villa	Riverwoods	
<b><u>Public Land:</u></b>	Deer Park	Lake Zurich	Round Lake Beach	
11,730 acres	Grayslake	Libertyville	Round Lake Park	
	Green Oaks	Lincolnshire	Third Lake	
<b><u>Wetlands:</u></b>	Gurnee	Lindenhurst	Vernon Hills	
20,595 acres	Hainesville	Long Grove	Wadsworth	
	Hawthorn Woods	Mettawa	Wheeling	
<b><u>Subwatersheds:</u></b>	<b><u>Area (mi<sup>2</sup>):</u></b>	<b><u>Townships:</u></b>		
North Mill Creek	21.5	Antioch	Lake Villa	Waukegan
Newport Drain	8.4	Avon	Libertyville	West Deerfield
Mill Creek	3.1	Benton	Newport	Zion
Upper Des Plaines	53	Ela	Vernon	
Bull Creek/Bull's Brook	12.3	Freemont	Warren	
Indian Creek	37.7			
Lower Des Plaines	18.2			
Buffalo Creek	13.7			
Aptakisic Creek	6.3			

Watershed-based plans have been developed for Mill Creek (2014), Buffalo Creek (2015), North Mill Creek (2015), Bull Creek (2008) and Indian Creek (2006) and are available at:

Mill Creek: <http://www.lakecountyil.gov/documentcenter/view/12203>

Buffalo Creek: <http://www.lakecountyil.gov/documentcenter/view/12897>

North Mill Creek: <http://www.lakecountyil.gov/documentcenter/view/12897>

Bull Creek: <http://www.lakecountyil.gov/documentcenter/view/11017>

Indian Creek: <http://www.lakecountyil.gov/documentcenter/view/11363>

**North Branch Chicago River Watershed** is noted for three long and narrow subwatersheds surrounding the three forks of the North Branch of the river. A summary of the watershed is presented in Table 12. Floods on the subwatersheds are determined by the direction of a storm. The worst flooding is caused by storms that move from north to south. The runoff moves under the storm front and concentrates as it goes downstream. Storms that pass east

to west produce smaller floods, and storms that pass south to north produce the smallest floods.

The worst floods are caused by day-long rain events, but because the watershed is so narrow, intense rain events can cause severe local flooding. The flood of record on the Skokie River in Highland Park was caused by a thunderstorm that rained only in the southern end of the watershed. Because of the channelization of these three forks, floodwaters usually drain away in just a few days.

For more information on the North Branch Chicago River Watershed, see the “North Branch Chicago River Watershed-Based Plan” (2008) for Lake and Cook Counties, Illinois, which is available the SMC website at:

North Branch Chicago River: <http://www.lakecountyil.gov/DocumentCenter/Home/View/10615>

**Table 12: North Branch of the Chicago River Watershed in Lake County**

North Branch Chicago River Watershed			
<b><u>Area:</u></b>	<b><u>Municipalities:</u></b>		
202 square miles	Bannockburn	Highwood	North Chicago
11% of County	Deerfield	Lake Bluff	Park City
<b><u>Public Land:</u></b>	Green Oaks	Lake Forest	Riverwoods
1,655 acres	Gurnee	Lincolnshire	Waukegan
<b><u>Wetlands:</u></b>	Highland Park	Mettawa	
4,390 acres			
<b><u>Subwatersheds:</u></b>	<b><u>Area (mi<sup>2</sup>):</u></b>	<b><u>Townships:</u></b>	
West Fork	8.6	Deerfield	Vernon
Middle Fork	19.8	Libertyville	Warren
Skokie River	21.9	Shields	Waukegan
			West Deerfield

Along **Lake Michigan** there are several small subwatersheds dominated by urban conditions. In these watersheds, systems of storm drains deliver runoff to ravines that drain into the lake. A summary of the watershed is presented in Table 13. Intense rain events overwhelm the storm drains and can cause significant localized flooding problems. The rapid rise and fall of water levels and velocities in the ravines have resulted in severe erosion. Unusual events like meteorological tsunamis (or meteotsunamis) can also occur on Lake Michigan. Meteotsunamis are large waves, similar to tsunami-waves, but are driven by air-pressure disturbances caused by fast-moving stormfronts.



**Table 13: Lake Michigan Watersheds in Lake County**

Lake Michigan Watersheds		
<b><u>Area:</u></b>	<b><u>Municipalities:</u></b>	
59.3 square miles	Beach Park	North Chicago
12% of County	Highwood	Winthrop Harbor
<b><u>Public Land:</u></b>	Highland Park	Waukegan
5,215 acres	Lake Bluff	Zion
<b><u>Wetlands:</u></b>	Lake Forest	*Naval Station
12,532 acres		Great Lakes
<b><u>Subwatersheds:</u></b>	<b><u>Area (mi<sup>2</sup>):</u></b>	<b><u>Townships:</u></b>
Kellogg Creek	8.9	Benton
Dead River	18.7	Deerfield
Waukegan River	17.6	Shields
Pettibone Creek	4.2	Waukegan
Bluff/Ravine	9.9	West Deerfield
		Zion

Watershed-based management plans have been developed for Kellogg Creek (2008), Dead River (2008), and the Waukegan River (2007) by the Lake County SMC. They are available at the Lake County SMC website. Also, more information on the all the Lake County watersheds can be found at:

Kellogg Creek: <http://www.lakecountyil.gov/DocumentCenter/Home/View/10571>

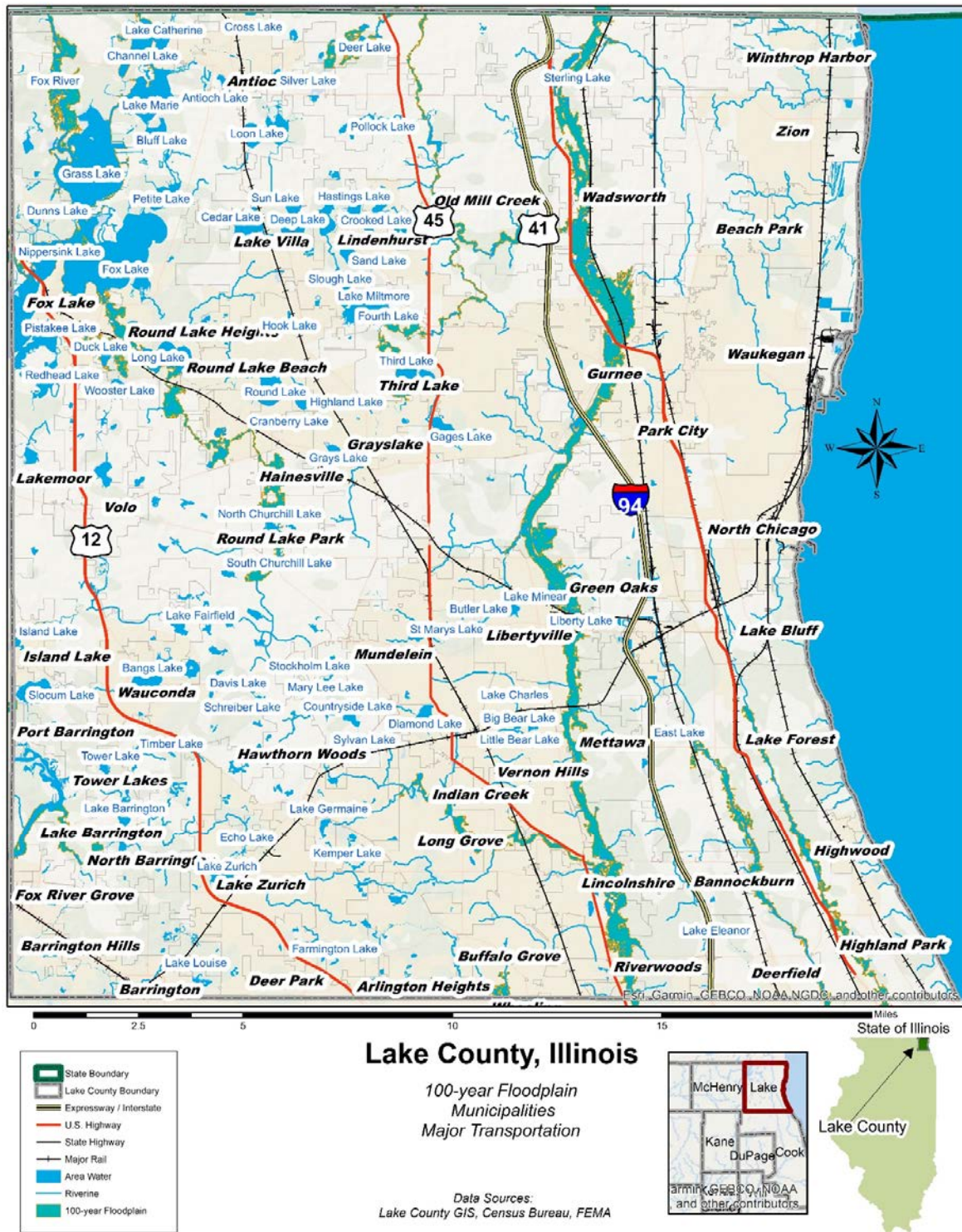
Dead River: <http://www.lakecountyil.gov/DocumentCenter/Home/View/10891>

Waukegan River: <http://www.lakecountyil.gov/DocumentCenter/View/10904>

### 3.3.2 Flood Hazard Profile

**Error! Reference source not found.**9 shows mapped regulatory floodplains and floodways in Lake County, which cover 57,143 acres. Mapped regulatory floodplains are defined as the area of land which is inundated with water during 100-year flood events. 100-year floods are defined as having a 1% chance of occurring in any given year, although this probability does not consider a changing climate. For a historical comparison of flooding in Lake County, the USGS Hydrologic Atlas (1963, 1968) places 52,898 acres within areas inundated as part of today's regulatory floodplains and floodways. Lake County has also identified over 487 areas that cover 8,590 acres of land with local drainage and flooding problems as of 2022. Over half of these areas reside outside of regulatory floodways and floodplains. Table 14 shows the percent of area land use in the Lake County 100-year floodplain, and a summary of the floodplain land area is shown in Table 15.

## Exhibit 9: Lake County 100-Year Floodplain and Floodway



**Table 14: Lake County Floodplain Land Use**

Floodplain Land Use	Acres	Percent of Floodplain
Agricultural	1,533.244702	2.68%
Disturbed Land	44.330565	0.08%
Forest/Grassland/Beach	2,030.657896	3.56%
Government/Institutional	279.55817	0.49%
Industrial	222.871604	0.39%
Office/Research	34.805843	0.06%
Public/Private Open Space	18,821.62418	32.96%
Rail	67.347523	0.12%
Residential	2,246.286854	3.93%
Retail/Commercial	422.154306	0.74%
Transportation	1,022.357028	1.79%
Utilities/Waste Facilities	712.36183	1.25%
Water (excluding Lake Michigan)	21,072.8151	36.90%
Wetlands	8,601.26772	15.06%
<b>TOTAL</b>	<b>57,111.68332</b>	<b>100.0%</b>

**Table 15: Lake County Estimate of Flood Prone Land**

Flood Areas	Acres	Square Miles	% of County Area
Floodplains	41,564.80	64.9	13.79%
Floodways	13,155.90	20.6	4.37%
500 Year	4,707.20	7.4	1.56%
Flood of Record	51,778.80	80.9	17.18%

The floodplains mapped in **Error! Reference source not found.**9 and the data in have been developed from the FEMA Flood Insurance Rate Maps (FIRMs) for Lake County effective on September 18, 2013, and February 17, 2016. The Lake County Flood Insurance Study (FIS) is dated February 17, 2016. As of the 2022 ANHMP update this information remains the latest available data provided via the FEMA map service center.

**SMC Flood Problem Areas Inventory:** In 1995 – 1996 the SMC conducted a flood damage inventory to identify flood problem areas. This was done with contacts and personal interviews with cities, villages, townships, homeowner associations, county agencies, county board members, private organizations, and individuals. Updates have been conducted in subsequent years for various watershed portions.

Problem sites were identified by subwatersheds and numbered. A standardized “Flood Problem Areas” information worksheet was developed for each site and pertinent information was added as it was obtained. A resident input questionnaire was also developed to gather additional information on local flooding problems. The problem areas were included in the county’s GIS database. Over 300 identified flood problem sites were field inspected to verify problem area

boundaries, assess the flood problem, and identify suitable mitigation solutions for the flood hazard area. The inventory only identifies areas experiencing historic flood damage to property and infrastructure. Flooding of open space and vacant land were not inventoried or mapped.

A summary of the Flood Problem Area Inventory is provided in Table 16 for the major Lake County watersheds and

Exhibit 10 shows the mapped flood problem areas. The inventory is updated as watershed plans are developed or updated. The most recent update occurred in 2022. Note that a flood problem site may include multiple buildings, roads, or other infrastructure, and more than one type of flooding may occur at a problem site.

**Table 16: Lake County Flood Problem Area Inventory Summary - 2022**

Type of Flooding & Number of Sites	Fox River	Des Plaines River	Lake Michigan	North Branch Chicago River	Total
Overbank Flooding	87	45	4	24	160
Local Drainage Problems	58	74	34	30	196
Depressional Flooding	67	40	4	8	93
Storm Sewer Backup	0	0	3	4	7
Sanitary Sewer/ Septic Failure	7	7	4	3	21
Associated Erosion	1	3	10	0	14
<b>Total:</b>	<b>220</b>	<b>169</b>	<b>59</b>	<b>69</b>	<b>491</b>

Flood Problem Site Locations:	Fox River	Des Plaines River	Lake Michigan	North Branch Chicago River	Total
Floodplain	71	20	3	9	103
Critical Facilities Subject to Flooding or Closure*	80	85	47	41	253
Outside Floodplain	144	126	66	51	387
Floodway**	5	24	3	12	44
Roads and Bridges Threatened by Flooding	186	135	62	60	443
<b>Total:</b>	<b>486</b>	<b>390</b>	<b>181</b>	<b>173</b>	<b>1230</b>

\*Includes all critical facilities assets including HAZUS inventory assets

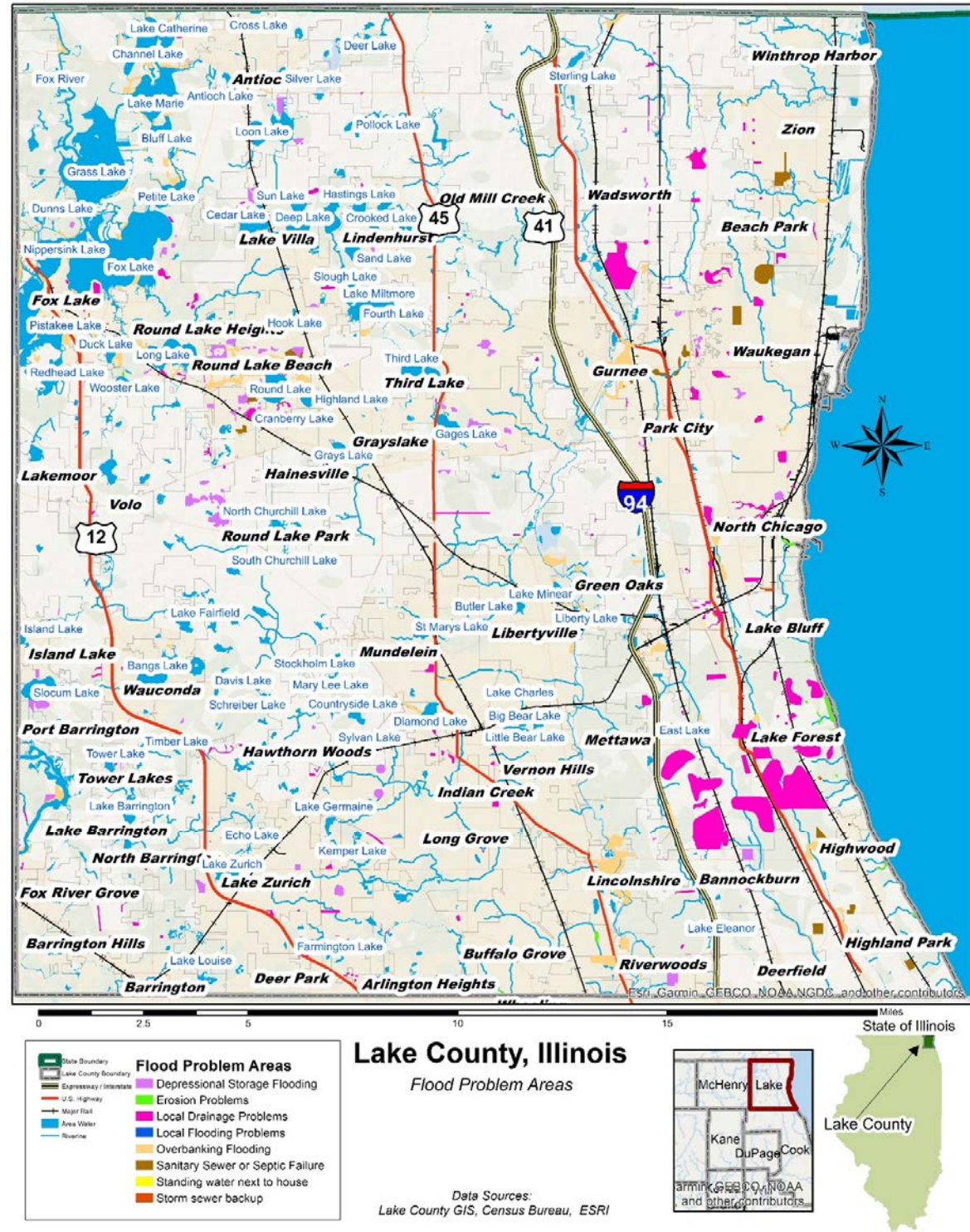
\*\*Sites reported multiple problems in these categories

An examination of National Flood Insurance Policies and Flood Insurance claims highlights the number of communities that have been impacted by past flooding. Table 17 shows Lake County community flood insurance coverage and flood insurance claims from 1978 to 2017. Note that policies are shown for an entire community, including the portions of communities in other counties. The policy coverage in Lake County is about the same as it was in the 2012 ANHMP, but the total claims paid amount increased by \$6 million, and is most likely due to the April 2013 and the July 2017 flood events. Since several Lake County municipalities are within other counties, it is difficult to separate claims for properties in Lake County versus other counties. During the 2022 plan update NFIP claims data was unavailable from FEMA; therefore, previous data provided in the 2017 ANHMP is considered the best available data.

More information is available about Lake County flooding at:

<http://www.lakecountyil.gov/3510/Flood-Information>







**Table 17: Lake County NFIP Flood Insurance Active Policies & Claims (9/30/2021)**

Community	NFIP CID	Number of Active Policies	Total Premium	Total Coverage	Number of Claims*	Total Paid
Village of Antioch	170358	79	\$80,203	\$16,801,200	71	\$788,569
Village of Bannockburn	170359	3	\$1,195	\$1,050,000	0	\$ -
Village of Barrington*	170057	36	\$18,330	\$8,713,600	20	\$320,931
Village of Barrington Hills*	170058	13	\$13,823	\$3,680,700	4	\$53,648
Village of Beach Park	171022	31	\$31,584	\$6,158,300	10	\$96,438
Village of Buffalo Grove*	170068	63	\$46,324	\$15,664,300	3	\$3,149
Village of Deer Park*	171028	5	\$4,183	\$1,725,000	4	\$26,319
Village of Deerfield*	170361	144	\$108,783	\$39,742,600	124	\$1,304,698
Village of Fox Lake*	170362	303	\$323,156	\$60,926,500	200	\$2,068,425
Village of Fox River Grove*	170477	31	\$38,051	\$6,966,100	1	\$3,712
Village of Grayslake	170363	61	\$56,852	\$13,419,800	4	\$14,412
Village of Green Oaks	170364	14	\$16,936	\$3,317,000	2	\$3,689
Village of Gurnee	170365	119	\$188,636	\$34,587,300	68	\$2,372,380
Village of Hainesville		1	\$333	\$280,000	0	\$ -
Village of Hawthorn Woods	170366	14	\$16,433	\$3,795,000	1	\$4,309
City of Highland Park	170367	161	\$167,868	\$45,566,100	61	\$217,120
City of Highwood	171033	0	\$ -	\$ -	0	\$ -
Village of Indian Creek	170369	0	\$ -	\$ -	0	\$ -
Village of Island Lake*	170370	35	\$24,526	\$7,955,700	1	\$743
Village of Kildeer	170371	19	\$22,694	\$5,520,000	1	\$27,352
Village of Lake Barrington	170372	17	\$12,504	\$4,568,400	3	\$20,807
Village of Lake Bluff	170373	10	\$3,660	\$2,871,800	0	\$ -
City of Lake Forest	170374	68	\$63,553	\$18,716,100	18	\$85,980
Village of Lake Villa	170375	14	\$10,270	\$3,239,600	10	\$25,827
Village of Lake Zurich	170376	15	\$6,291	\$3,980,000	6	\$54,425
Village of Lakemoor*	170915	31	\$24,331	\$4,368,300	0	\$ -
Village of Libertyville	170377	149	\$199,286	\$35,587,000	45	\$488,974
Village of Lincolnshire	170378	113	\$113,929	\$32,609,800	27	\$1,167,991
Village of Lindenhurst	170379	10	\$4,910	\$2,599,000	7	\$78,790
Village of Long Grove	170380	39	\$38,345	\$12,166,200	3	\$13,267
Village of Mettawa	170381	5	5059	\$1,530,000	1	\$8,558
Village of Mundelein	170382	48	\$49,580	\$11,808,700	11	\$59,544
Village of North Barrington	170383	19	\$14,713	\$ 5,395,900	2	\$25,381
City of North Chicago	170384	10	\$4,540	\$1,641,500	7	\$31,161
Village of Old Mill Creek	170385	0	\$ -	\$ -	1	\$7,433
City of Park City	170386	30	\$13,835	\$4,973,300	0	\$ -
Village of Port Barrington*	170478	44	\$47,485	\$9,757,600	38	\$390,094
Village of Riverwoods	170387	90	\$86,894	\$28,749,100	20	\$218,401
Village of Round Lake	170388	15	\$14,672	\$2,548,700	10	\$22,465
Village of Round Lake Beach	170389	218	\$201,300	\$32,868,600	67	\$417,458
Village of Round Lake Heights	170390	6	\$9,751	\$1,323,500	8	\$63,899

**Table 17: Lake County NFIP Flood Insurance Active Policies & Claims (9/30/2021)**

Village of Round Lake Park	170391	17	\$9,991	\$4,024,900	1	\$11,642
Village of Third Lake	170392	4	\$3,849	\$1,090,000	0	\$ -
Village of Tower Lakes	170393	5	\$7,507	\$1,305,000	0	\$ -
Village of Vernon Hills	170394	24	\$10,135	\$4,360,900	1	\$245
Village of Volo	171042	1	\$1,440	\$ 500,000	0	\$ -
Village of Wadsworth	170395	8	\$7,412	\$1,986,400	1	\$3,699
Village of Wauconda	170396	36	\$34,052	\$7,705,600	21	\$156,817
City of Waukegan	170397	77	\$83,218	\$17,610,200	10	\$410,921
Village of Wheeling	170173	813	\$921,455	\$172,221,300	126	\$1,174,048
Village of Winthrop Harbor	170398	10	\$4,219	\$2,596,000	2	\$21,534
City of Zion	170399	9	\$10,253	\$1,851,600	11	\$94,665
Unincorporated Lake County	170357	964	\$901,931	\$197,120,500	412	\$4,412,615
<b>TOTALS</b>		<b>4051</b>	<b>\$4,080,280</b>	<b>\$909,544,700</b>	<b>1444</b>	<b>\$16,772,535</b>

\* Since 1978

During the 2022 ANHMP Update process updated NFIP data was not made available from FEMA. This data provided is from the previous plan but is still considered the best available data.

### 3.3.3 Repetitive Flood Loss Properties

FEMA uses several definitions for repetitive loss structures. Since Lake County and many Lake County municipalities participate in the CRS, the CRS definition of repetitive loss is used in the plan. A “repetitive loss structure” is 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. A summary repetitive loss is in provided in Table 18.

The repetitive flood loss structures are located throughout the county but are more concentrated in the Fox River Watershed.

The repetitive loss properties were examined for this ANHMP update. Repetitive flood loss areas include one or more repetitive loss properties and the neighboring or nearby properties subject to similar flood damage. The repetitive loss areas numbers and names are shown in Table 18.

The naming convention used for the repetitive flood loss areas in 0 is: [Community Name – Subwatershed (or Lake) Name]. Each repetitive loss area has additional properties within the area. Neighboring or nearby properties with similar flood problems are included in the area. The total number of properties within a repetitive loss area are identified by the Lake County Planning, Building and Development Department for the CRS. PB&D also maintains the description of the cause of flooding at each area and the CRS-required list of addresses. The SMC assists the PB&D with this effort.

**Table 18: Lake County Repetitive Loss Structures (2022)**

Community	Number of Repetitive Loss Properties as of 11/1/2022	Mitigated	Remaining Repetitive Losses
Village of Antioch	7	3	4
Village of Barrington	1	0	1
Village of Beach Park	4	0	4
Village of Deerfield	15	5	10
Village of Fox Lake*	40	7	33
Village of Gurnee	15	6	9
City of Highland Park	10	2	8
Village of Lake Bluff	1	1	0
City of Lake Forest	1	1	0
Village of Libertyville	2	1	1
Village of Lincolnshire	10	0	10
Village of Lindenhurst	3	1	2
Village of North Barrington	1	0	1
City of North Chicago	9	0	9
Village of Port Barrington	2	0	2
Village of Riverwoods	3	2	1
Village of Round Lake	1	0	1
Village of Round Lake Beach	8	1	7
Village of Round Lake Heights	2	2	0
Village of Spring Grove	1	0	1
Village of Wadsworth	1	0	1
Village of Wauconda	2	0	2
Village of Waukegan	1	0	1
Village of Winthrop Harbor	1	0	1
Unincorporated Lake County	83	11	72
<b>TOTALS</b>	<b>222</b>	<b>41</b>	<b>181</b>

Since 2000, Lake County has conducted “flood audits” in repetitive loss areas. Table 19 shows the number of repetitive loss properties in each community. Many of the properties included in the properties that are shown as “To Be Audited” are within areas that had other flood audits conducted between 2000 and 2006. Mitigation of repetitive flood loss structures are discussed further in Chapter 5.

**Table 19: Lake County Repetitive Flood Loss Area Numbers and Names**

Rep. Loss Area Number	Rep. Loss Area Name	Number of Rep. Loss Properties in Area	Rep. Loss Area Number	Rep. Loss Area Name	Number of Rep. Loss Properties in Area
1	Antioch - Channel Lake	1	29	Fox Lake - Fox Lake 3	9
2	Beach Park - Dead River	3	30	Fox Lake - Fox Lake 4	1
3	County - Channel Lake	3	31	Fox Lake - Pistakee Lake 1	8
4	County - Countryside Lake	1	32	Fox Lake - Pistakee Lake 2	2
5	County - Flint Creek	1	34	Gurnee - Des Plaines River	9
6	County - Forest Lake	1	35	Highland Park - Middle Fork	1
7	County - Fox Lake 1	1	36	Highland Park - Skokie River 1	1
8	County - Grass Lake	1	37	Highland Park - Skokie River 2	1
9	County - Lake Marie	10	38	Highland Park - Skokie River 3	1
10	County - Local 1	1	39	Highland Park - Skokie River 4	1
11	County - Local 2	1	40	Lake Forest - Bluff/Ravine	1
12	County - Lower Des Plaines 2	2	41	Lake Forest - Skokie River	1
13	County - Lower Fox River 1	3	42	Libertyville - Lower Des Plaines	1
14	County - Lower Fox River 2	2	43	Libertyville - Minear Lake	1
15	County - Lower Fox River 3	1	44	Libertyville -Des Plaines River	3
16	County - Nippersink Lake 1	1	45	Lincolnshire - Des Plaines River	1
17	County - Nippersink Lake 2	1	46	Lindenhurst - Local 1	1
18	County - Petite Lake	1	47	Lindenhurst - Local 2	1
20	County - Skokie River	1	48	Riverwoods - Local	1
21	County - Slocum Lake	4	49	Round Lake - Local	1
22	County - Upper Des Plaines 1	2	50	Round Lake - Round Lake Drain	2
23	County - Upper Des Plaines 2	1	51	Round Lake Beach - Local	1
24	County - Upper Des Plaines 3	1	52	Round Lake Beach - Round Lake Drain 1	1
25	County - Upper Fox River	2	53	Round Lake Beach - Round Lake Drain 2	1
26	Fox Lake - Duck Lake 1	5	54	Round Lake Heights - Round Lake Drain	1
27	Fox Lake - Duck Lake 2	2	55	Wauconda - Bangs Lake	1
28	Fox Lake - Fox Lake 2	1	56	Waukegan - Dead River	1

**Table 20: “Flood Audited” Repetitive Loss Properties in Lake County**

<b>Community</b>	<b>Audited Repetitive Loss Properties</b>	<b>Repetitive Loss Properties to Be Audited</b>
Village of Antioch	0	1
Village of Beach Park	0	3
Village of Fox Lake	7	21
Village of Gurnee	1	8
City of Highland Park	3	2
City of Lake Forest	2	0
Village of Libertyville	0	5
Village of Lincolnshire	1	0
Village of Lindenhurst	1	1
Village of Riverwoods	1	0
Village of Round Lake	1	2
Village of Round Lake Beach	1	2
Village of Round Lake Heights	0	1
Village of Wauconda	0	1
City of Waukegan	1	0
Lake County (Unincorporated Areas)	12	30
<b>Totals:</b>	<b>31</b>	<b>77</b>
<b>Total Properties = 108</b>		

### 3.3.4 Past Floods and Future Flood Frequency

National Centers for Environmental Information (NCEI), maintained by the National Oceanic and Atmospheric Administration, records weather events as they are submitted for record. The NCEI has a record of the flooding in Lake County from 1996 to 2022, which are summarized in Table 22 and Table 23. Other small floods most likely occurred that did not get recorded. The NCEI data recorded no injuries or deaths with these events.

1986 Flood: Northeastern Illinois received almost one inch of rain daily from September 21 through October 4. On some days, there was as much as three inches. Over this two-week period, the Des Plaines watershed received up to 12.9 inches of rain compared to the normal monthly amount of 3 inches. The flooding in Lake County killed four people. One person drowned when his boat capsized, and three people had heart attacks fighting the flood.

On September 25, 2004, the river was two feet over flood stage and high enough to reach buildings. This flooding along with flooding in the Fox River/Chain of Lakes watershed resulted in a disaster declaration by the President on October 7 for Cook, Lake, Kane, and Lake Counties. The worst flooding in Lake County was in the Village of Gurnee, where approximately 100 buildings were flooded. Based on the flood insurance claims, they suffered an average of \$10,000 in damage.

Most severely affected were the public properties. Gurnee Grade School suffered structural damage when the northern half settled, cracking the walls and the roof. The Viking Junior High School was flooded. The police station basement floor buckled from hydrostatic pressure. The fire station was not damaged, but it was surrounded by flood water and due to



the closing of the Grand Avenue Bridge over the Des Plaines River part of the equipment had to be moved to the other side of the river.

The May 2004 flood attracted national attention and was destructive on a wide scale. River flooding was recorded across Lake County and portions of Cook and Lake counties, as well as local flash flooding from individual storms that occurred during that month. The river flooding, mainly on the Des Plaines River, had some origins in southern Wisconsin, but affected the river channel through Lake County and south into Cook County. Monthly rainfall totals peaked over ten inches across Lake and Cook counties, while six inches or more were observed further south including into northwest Indiana.

Throughout Lake County, overbank flooding occurs most extensively along the Des Plaines River. Recorded moderate and major flood event years are shown in Table 24.

Record crests occurred in the following years: 1938, 1960, 1979, 1986, 2004, 2009, 2010, 2011, 2013, 2014, and 2017.

**Table 21: Des Plaines River Flooding in Lake County**

Major Flooding		Moderate Flooding	
Year	Gauge Location(s)	Year	Gauge Location(s)
1960	Lincolnshire	1948	Lincolnshire
1976	Russell	1950	Lincolnshire
1978	Russell	1960	Gurnee
1986	Russell, Gurnee	1976	Gurnee
2001	Russell	1979	Gurnee
2004	Gurnee	1993	Gurnee
2007	Russell	2000	Gurnee, Russell
2009	Russell	2009	Lincolnshire
2013	Gurnee, Lincolnshire	2013	Russell
2017	Russell, Lincolnshire	2018	Lincolnshire
2019	Russell, Gurnee	2019	Gurnee, Lincolnshire
		2020	Lincolnshire
Source: National Weather Service (NWS)			

Since the 2017 ANHMP update, 14 flood related events have been reported via the NCEI totaling an estimated \$12,795,000 in property damages. The most notable event occurred on July 12, 2017, accounting for \$12,700,000 of these total damages. According to NCEI reports, torrential rainfall across much of Lake County during the morning of July 12th producing widespread flash flooding and major river flooding. Numerous roads were impassable and tree limbs were blown down. In Mundelein, numerous houses flooded. Since 2000, 36 flood events have occurred that did not result in any reported property damages.

**Table 22: Past Occurring Flood Events with Property Damage in Lake County**

Location	Date	Type	Property Damage
Wildwood/Chittenden	9/3/2018	Flash Flood	\$70,000
Forrest Lake	10/14/2017	Flash Flood	\$25,000
Barrington Hills	7/12/2017	Flash Flood	\$12,700,000
Channel Lake	4/17/2013	Flash Flood	\$4,700,000
Channel Lake	5/13/2010	Flash Flood	\$500,000
Russell	8/23/2007	Flood	\$100,000
Lake Bluff	8/7/2007	Flash Flood	\$10,000
Knollwood	3/21/2007	Flash Flood	\$50,000
<b>Total:</b>			<b>\$18,155,000</b>

Source: National Center for Environmental Information (NCEI)

The Village government estimated its cost for flood fighting and reconstruction to be over \$200,000. Damage to the Gurnee Grade School, the Viking Junior High School and the school district offices were estimated at \$1.2 million. Damage to Park District property was estimated at \$43,000. For additional historical and flooding information reference the Gurnee Flood Mitigation Plan at the Village of Gurnee. The average annual damage in Lake County for the flood was \$9.2 million.



Reported flood events over the past 36 years provide a framework for determining the future occurrence in terms of frequency for such events. The probability of the county and its municipalities experiencing a flood event can be difficult to quantify but based on historical record of 59 flood events since 1986, it can reasonably be assumed that a flooding event has occurred every 8 months (0.61 years) from 1986 through 2022.

$[(\text{Current Year } 2022) \text{ subtracted by } ((\text{Historical Year } 1986) = 36 \text{ Years on Record}]$

$[(\text{Years on Record})36] \text{ divided by } [( \text{Number of Historical Events } 59) = .61]$

Historic frequency calculates that there is likely a 100% chance of flash flooding and overland flooding occurring each year. Though unlikely, it is possible to have two 100-year flood events (1% chance per year), or even two 500-year floods (.2% chance per year) events occur within years, or even months, of each other.

### 3.3.5 Vulnerability - Impacts of Flooding

Lake County's population is expected to continue to grow and for development to continue. Lake County is currently susceptible to flooding and it should be anticipated that flood risk

will continue to grow. Lake County is undertaking several activities to abate this potential increase in flood risk, including the implementation of the Lake County Watershed Development Ordinance and comprehensive planning to protect against new flood damages (these efforts are summarized in Chapter 4). However, Lake County is part of four large watersheds and cannot regulate development in Wisconsin. Life, health and safety, buildings, critical facilities, infrastructure, and the economy are all affected by flooding in Lake County. As part of the vulnerability assessment conducted for Lake County, a HAZUS MH Flood Model 100-year event was used. The summary damage estimates are listed in the graphic below. The full HAZUS MH report is in Appendix E of the ANHMP.

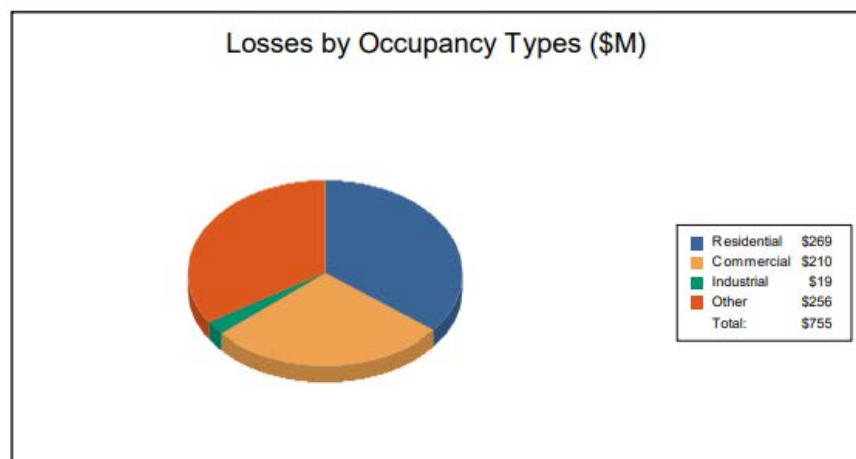
**Health and safety:** Safety during a flood, whether from overbank flooding or groundwater flooding (basements), is a concern. If clean-up after a flood is not properly done, then health problems can develop due to mold. Flooding roads and viaducts are dangerous. People continue to be at risk when driving through floodwaters; fast moving waters are a hazard to people inside and outside of cars. The highest flood depths are at the Fox River, but stormwater flooding away from the floodplain in Lake 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:** Building losses are broken into two categories: direct building losses and business interruption losses. Direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. Business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood. The total building-related losses were 369.80 million dollars. 51% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 35.65% of the total loss. The figure below provides a summary of the losses associated with the building damage.

**Figure 8: Building-related Economic Loss Estimates (Millions of Dollars)**

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Building Loss</u>						
	Building	132.58	21.66	4.97	6.86	166.07
	Content	66.88	67.08	11.84	55.23	201.02
	Inventory	0.00	1.38	1.25	0.09	2.71
	<b>Subtotal</b>	<b>199.46</b>	<b>90.11</b>	<b>18.05</b>	<b>62.18</b>	<b>369.80</b>
<u>Business Interruption</u>						
	Income	5.98	48.72	0.21	47.32	102.22
	Relocation	33.71	13.42	0.32	17.42	64.87
	Rental Income	15.84	9.71	0.05	1.81	27.42
	Wage	14.10	48.53	0.39	127.37	190.39
	<b>Subtotal</b>	<b>69.62</b>	<b>120.38</b>	<b>0.97</b>	<b>193.92</b>	<b>384.89</b>
ALL	<b>Total</b>	<b>269.08</b>	<b>210.49</b>	<b>19.03</b>	<b>256.09</b>	<b>754.69</b>



Source: HAZUS

**Critical Facilities and Infrastructure:** SMC data shows 39 of 2,883 critical facilities are located within the 100-year (1% chance of flooding each year) floodplain. It is assumed that all critical facilities in the floodplain could be closed due to flooding.

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

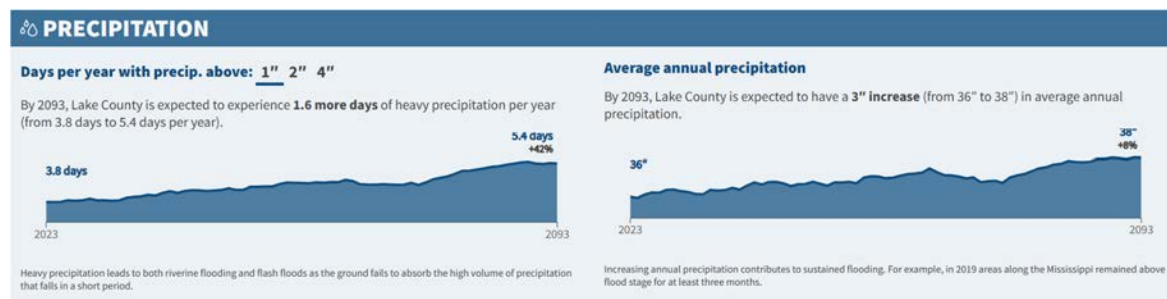
**Economic Impact:** Flood damage to businesses is difficult to estimate. Businesses that are disrupted by floods often must be closed. They lose their inventories, customers cannot reach them, and employees are often busy protecting or cleaning up their flooded homes. Business can be disrupted regardless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

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

**Multi-Jurisdictional Differences:** From data presented in section 3.3.2 Flood Hazard Profile, most of Lake County is vulnerable to flooding. The communities of Lake Bluff, Highwood,

Highland Park, North Chicago, and Winthrop Harbor are subject to coastal flooding from Lake Michigan.

**Climate Change Considerations:** Climate change is increasing the possibility for increased occurrences of flooding due to factors like increases in annual precipitation and intense rainfall becoming more common. Winter and spring precipitation contribute to flood risk in the Midwest and are projected to increase by up to 30% by the end of this century. Heavy precipitation events in the Midwest have increased in frequency and intensity since 1901 and are projected to increase through this century.<sup>1</sup> According to data provided by Neighborhoods At Risk “[Neighborhoods at Risk \(headwaterseconomics.org\)](https://headwaterseconomics.org),” in the 70-year projection shown below, Lake County communities could experience an increased rate of precipitation of 3” per year with an estimated 1.6 additional days of heavy precipitation.



### 3.4 Tornado

Wind can be defined as the motion of air relative to the earth’s surface. The horizontal component of the three-dimensional flow and the near-surface wind phenomenon are the most significant aspects of the hazard. Extreme windstorm events are associated with extratropical and tropical cyclones, winter cyclones, and severe thunderstorms and accompanying mesoscale offspring such as tornadoes and downbursts. Winds vary from zero at ground level to 200-mph in the upper atmospheric jet stream at 6 to 8 miles above the earth’s surface.

The damaging effects of windstorms associated with hurricanes may extend distances of more than 100 miles from the center of storm activity. Severe thunderstorms can produce wind downbursts and microbursts, as well as tornadoes. Severe windstorms result in as many as 1,200 tornadoes annually.

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 or 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 high wind velocities and wind-blown debris. According to the National Weather Service, tornado wind speeds can range between 30 to more than 300 miles per hour. They are more likely to occur during the spring and early summer months of March through June and 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. Destruction ranges from minor to catastrophic depending on the intensity, size, and duration of the storm. Structures made of light materials such as mobile



homes are most susceptible to damage. Each year, an average of over 1,000 tornadoes is reported nationwide, resulting in an average of 80 deaths and 1,500 injuries (NOAA).

The Enhanced Fujita Scale, also known as the “EF-Scale,” measures tornado strength and associated damages. The EF-Scale, shown in Table 23, is an update to the earlier Fujita scale that was published in 1971. It classifies United States tornadoes into six intensity categories based upon the estimated maximum winds occurring within the wind vortex. The EF-Scale has become the definitive metric for estimating wind speeds within tornadoes based upon the damage done to buildings and structures since it was implemented through the National Weather Service in 2007.

**Table 23: Enhanced Fujita Scale and Associated Damage**

EF-Scale Number	Wind Speed (MPH)	Type of Damage Possible
EF0	65-85	<b>Minor damage:</b> Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e., those that remain in open fields) are always rated EF0.
EF1	86-110	<b>Moderate damage:</b> Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	<b>Considerable damage:</b> Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136-165	<b>Severe damage:</b> Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	<b>Devastating damage:</b> Well-constructed houses and whole frame houses completely leveled; cars thrown, and small missiles generated.
EF5	>200	<b>Extreme damage:</b> Sturdy frame houses leveled off foundations and swept away; automobile-sized missiles fly more than 100 m (300 ft.); steel reinforced concrete structure badly damaged; high-rise buildings have significant structural deformation.

The Storm Prediction Center has developed damage indicators to be used with the Enhanced Fujita Scale for several types of buildings but can also be used to classify any high wind event. Some of the indicators for different building types are shown in table below.

**Table 24: Institutional Buildings**

Damage Description	Wind Speed Range (Expected in Parentheses)
Threshold of visible damage	59-88 MPH (72 MPH)
Loss of roof covering (<20%)	72-109 MPH (86 MPH)
Damage to penthouse roof & walls, loss of rooftop HVAC equipment	75-111 MPH (92 MPH)
Broken glass in windows or doors	78-115 MPH (95 MPH)
Uplift of lightweight roof deck & insulation, significant loss of roofing material (>20%)	95-136 MPH (114 MPH)
Façade components torn from structure	97-140 MPH (118 MPH)
Damage to curtain walls or other wall cladding	110-152 MPH (131 MPH)
Uplift of pre-cast concrete roof slabs	119-163 MPH (142 MPH)
Uplift of metal deck with concrete fill slab	118-170 MPH (146 MPH)
Collapse of some top building envelope	127-172 MPH (148 MPH)
Considerable damage to building envelope	178-268 MPH (210 MPH)

Source: Storm Prediction Center, 2009

**Table 25: Educational Institutions (Elementary Schools, High Schools)**

Damage Description	Wind Speed Range (Expected in Parentheses)
Threshold of visible damage	55-83 MPH (68 MPH)
Loss of roof covering (<20%)	66-99 MPH (79 MPH)
Broken windows	71-106 MPH (87 MPH)
Exterior door failures	83-121 MPH (101 MPH)
Uplift of metal roof decking; significant loss of roofing material (>20%); loss of rooftop HVAC	85-119 MPH (101 MPH)
Damage to or loss of wall cladding	92-127 MPH (108 MPH)
Collapse of tall masonry walls at gym, cafeteria, or auditorium	94-136 MPH (114 MPH)
Uplift or collapse of light steel roof structure	108-148 MPH (125 MPH)
Collapse of exterior walls in top floor	121-153 MPH (139 MPH)
Most interior walls of top floor collapsed	133-186 MPH (158 MPH)
Destruction of a large section of building envelope	163-224 MPH (192 MPH)

Source: Storm Prediction Center, 2009

**Table 26: Metal Building Systems**

Damage Description	Wind Speed Range (Expected in Parentheses)
Threshold of visible damage	54-83 MPH (67 MPH)
Inward or outward collapsed of overhead doors	75-108 MPH (89 MPH)
Metal roof or wall panels pulled from the building	78-120 MPH (95 MPH)
Column anchorage failed	96-135 MPH (117 MPH)
Buckling of roof purlins	95-138 MPH (118 MPH)
Failure of X-braces in the lateral load resisting system	118-158 MPH (138 MPH)
Progressive collapse of rigid frames	120-168 MPH (143 MPH)
Destruction of building	132-178 MPH (155 MPH)

Source: Storm Prediction Center, 2009

**Table 27: Electric Transmission Lines**

Damage Description	Wind Speed Range (Expected in Parentheses)
Threshold of visible damage	70-98 MPH (83 MPH)
Broken wood cross member	80-114 MPH (99 MPH)
Wood poles leaning	85-130 MPH (108 MPH)
Broken wood poles	98-142 MPH (118 MPH)
Broken or bent steel or concrete poles	115-149 MPH (138 MPH)
Collapsed metal truss towers	116-165 MPH (141 MPH)

Source: Storm Prediction Center, 2009

Intense winds can also occur outside of tornadoes, severe thunderstorms, and winter storms. These winds typically develop with intense pressure gradients and gusty frontal passages. The closer and stronger two systems (one high pressure, one low pressure) are, the stronger the pressure gradient, and therefore, the stronger the winds are.

**Downburst** winds, which can cause more widespread damage than a tornado, occur when air is carried into a storm's updraft, cools rapidly, and comes rushing to the ground. Cool air is denser than warm air, and therefore, wants to fall to the surface. On warm summer days, when the cool air can no longer be supported up by the storm's updraft, or an exceptional downdraft develops, the air crashes to the ground in the form of intense winds. These winds are forced horizontally when they reach the ground and can cause considerable damage. These types of intense winds can also be referred to as straight-line winds. Downbursts with a diameter of less than 2.5 miles are called microbursts and those with a diameter of 2.5 miles or greater are called macrobursts. A derecho, or bow echo, is a series of downbursts associated with a line of thunderstorms. This type of phenomenon can extend for hundreds of miles and contain wind speeds greater than 100 mph.

### 3.4.1 Tornado Hazard Profile

Next to flooding and winter storms, tornadoes are the most prevalent natural hazard in Lake County. The southeast half of Lake County is in a belt of high tornado frequency. Warnings for Lake County come from the National Weather Service office in Romeoville, IL. Peak tornado occurrences extend from March through May as past records indicate in . According to the University of South Carolina’s Hazards and Vulnerability Research Institute (SHELDUS) as well as the NCEI, Lake County has been impacted by 19 tornado events since 1957. Tornado touchdown locations are shown in Exhibit 11.

**Past Occurrences:** In April 1965, a tornado caused considerable property damage estimated to cost about \$500,000 in the western part of Gurnee. A tornado that struck Zion on April 19, 1996, caused enough damage to result in a federal disaster declaration for the county. Two people were injured, and damage was estimated at \$ 6.6 million. It was rated an F2 with a path between Lindenhurst and Gurnee in Lake County.

On May 18, 1997, Gurnee had another F2 touchdown. No damage or injuries were reported. Adequate prediction methods have not been developed for tornadoes, so a good warning system is the only defense. The most devastating was the March 28, 1920, F3 tornado that killed 8 people and injured 100. This tornado went through 3 counties, Kane, Cook, and Lake. It followed a path from southeast of La Fox to the south side of Elgin to Wauconda. A second notable event occurred on April 11, 1965, when Lake and McHenry Counties were struck by an F4 tornado. The tornado killed 6 people and injured 75. The tornado began in Crystal Lake and went on an 11-mile path that was as wide as 400 yards. Damage was estimated at \$1.5 million.

Other notable tornado events occurred on April 21, 1967, when an F4 killed one person and injured 100, the tornado struck Fox River Grove, Barrington Hills, and Lake Zurich, producing a damage path nine miles long. Lake Zurich was hardest hit with 140 homes destroyed and 463 damaged, and damage was estimated at \$10 million (USA Today Weather, January 6, 1999). On September 28, 1972, an F4 tornado injured 20 people in Lake County. The tornado followed a 5-mile path and damage was estimated at \$1 million. According to local historians on June 3, 1860, a destructive tornado swept the southern end of Lake County. In 2020, a tornado with peak winds of 90 mph touched down south of Route 173 near Channel Lake in Lake County. Mainly tree damage occurred along the path in Lake County with several trees uprooted with some minor structural damage just south of the state line.

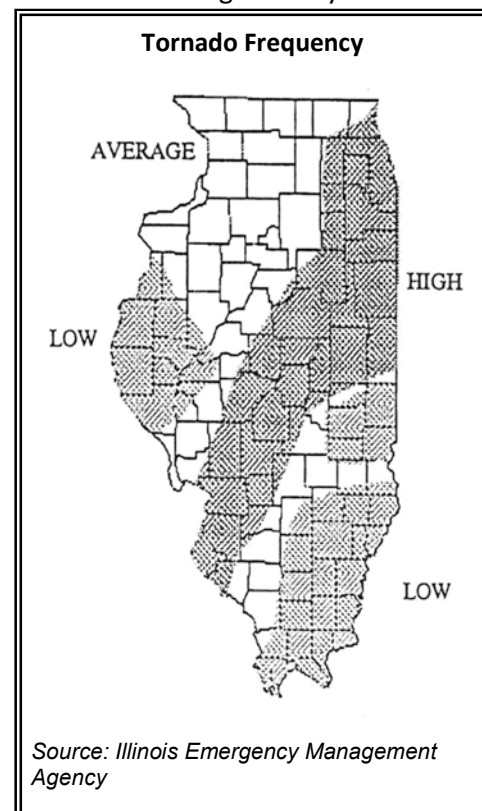
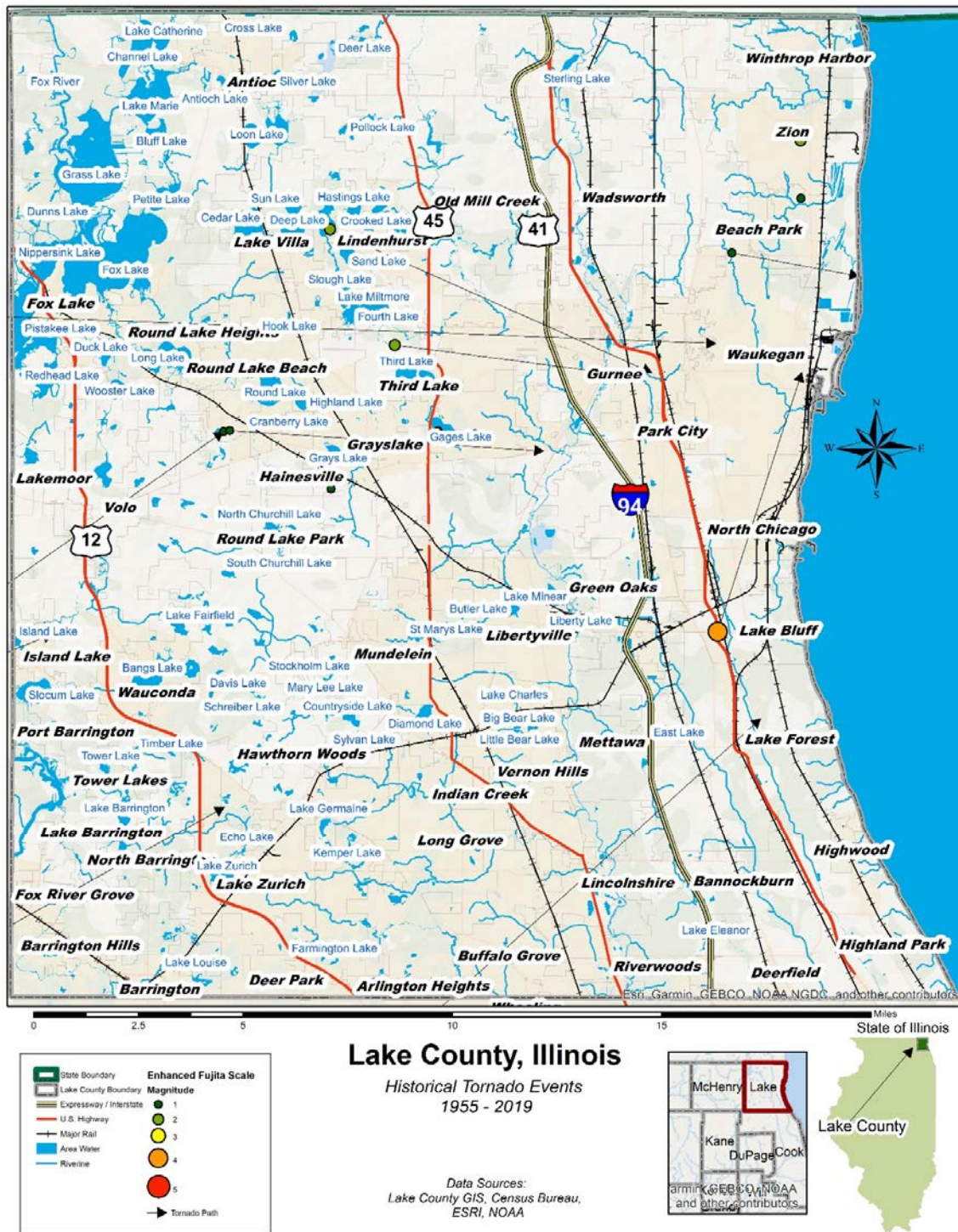




Exhibit 11: Lake County Tornado Touch Downs





**Table 28: Lake County Tornado History (1957-2022) (NCEI)**

Location	Date	Magnitude	Death	Injuries	Property Damage	Crop Damage
Countywide	3/14/1957	F1	0	0	\$3000	\$0
Countywide	10/9/1958	F2	0	0	\$2,500,000	\$0
Countywide	4/11/1965	F4	0	0	\$0	\$0
Countywide	4/11/1965	F2	0	0	\$250,000	\$0
Countywide	4/11/1965	F1	0	0	\$250,000	\$0
Countywide	4/21/1967	F4	1	97	\$2,500,000	\$0
Countywide	9/28/1972	F4	0	20	\$2,500,000	\$0
Countywide	6/20/1974	F0	0	0	OK	\$0
Countywide	11/10/1975	F1	0	0	\$25,000	\$0
Countywide	4/20/1976	F2	0	2	\$25,000	\$0
Countywide	8/9/1979	F1	0	0	\$25,000	\$0
Countywide	7/6/1986	F0	0	0	\$0	\$0
Countywide	6/29/1990	F1	0	0	\$25,000	\$0
Zion	4/19/1996	F2	0	2	\$6,600,000	\$0
Lindenhurst	5/18/1997	F2	0	0	\$0	\$0
Zion	4/18/2002	F0	0	0	\$0	\$0
Round Lake	9/02/2015	F0	0	0	\$1,000,000	\$0
(UGN) Waukegan Airport	09/03/2019	EF1	0	1	\$0	\$0
Channel Lake	08/10/2020	EF1	0	0	\$0	\$0
<b>Totals:</b>			<b>1</b>	<b>122</b>	<b>\$15,703,000</b>	<b>\$0</b>

There have been significant tornadoes in the Chicago metropolitan area. The deadliest tornado occurred on April 21, 1967, during an outbreak of 5 significant tornadoes. One tornado formed in Palos Hills in Cook County and traveled through Oak Lawn and the south side of Chicago. Thirty-three people died, and 500 people were injured by this 200-yard-wide tornado that traveled 16 miles and caused over \$50 million in damage. A second tornado in this weather system ripped through the southwest portion of Lake County destroying around 50 homes, damaging over 200 others, and demolishing Seth Paine Elementary School. The funnel began above the Police Headquarters of the Village of Barrington Hills at around 4:50 p.m. At 5:05 p.m. it struck Seth Paine at Miller Road and Route 22. It continued to the Acorn Acres Estates and severely damaged the Old Zeman Brewery on Gilmer Road east of Route 63. The only F5 tornado in the Chicago metropolitan area was on August 28, 1990. This tornado formed near Oswego and passed through Plainfield and Joliet (a 16-mile path). The tornado killed 29, injured 350, and caused \$165 million in damage.

Additional information was provided by the Village of Antioch regarding the April 19, 1996, Zion tornado. The wind damage that occurred in Antioch and along Highway 173 from Harvard to Zion (with the windstorm finally called a tornado in Zion) resulted in major damage throughout the Village of Antioch and Antioch Township. Several roofs were ripped off

buildings, numerous trees went down, at least one house had the entire side of it removed, and numerous other damages occurred because of this tornado.

**Future Probability:** With 19 occurrences over a 59-year period, the likelihood of a tornado hitting somewhere in the county is 0.288 (29%) in any given year, and from 1957 to 2022 a tornado has occurred once every 3.5 years.

*[(Current Year) 2022] subtracted by [(Historical Year) 1957] = 65 Years on Record*

*[(Years on Record) 65] divided by [(Number of Historical Events) 19] = 3.42*

Assuming a tornado affects one square mile and there are 470.55 square miles in Lake County, the odds of a tornado hitting any square mile in the County is 1 in 1,633 tornadoes each year or a 0.0006% chance. FEMA notes that approximately 1,000 tornadoes occur each year in the United States. Illinois is ranked number 8 in the United States in terms of tornadoes and 6 in terms of number of killer tornadoes between January 1, 1950, and September 30, 2003. Tornadoes are most likely to occur between March and June, but a tornado can occur at any time under the right circumstances. Over half of the tornadoes hit between 3:00 and 7:00 PM. Therefore, the probability of a tornado occurring in Illinois is high.

### 3.4.2 Vulnerability – Tornado Impact

All of Lake County is vulnerable to tornadoes. Past tornadoes have been deadly and have led to disaster declarations in Lake County. The potential for loss of life and significant property damage is growing in Lake County as the population and number of buildings increases. All assets located in Lake County can be considered at risk from tornadoes and wind events. This includes 714,342 people based on 2020 census, or 100% of the County's population and all critical facilities, structures, and infrastructure.

**Health and Safety:** Vulnerability to residents and buildings is as the county grows in population and building counts. Fifteen deaths and over 200 injuries have been attributed to tornadoes in Lake County. On average, Illinois experiences 4 tornado-related deaths each year. Based on tornado history in Illinois, advanced warning and taking appropriate shelter appears to be the best mitigation method for preventing death and injury.

Based on national statistics for 1970-1980, for every person killed by a tornado, 25 people were injured, and 1,000 people received some sort of emergency care.

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

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

**Damage to Buildings:** Structures within the direct path of a tornado vortex are often reduced to rubble. However, structures adjacent to the tornadoes path are often severely damaged by high winds flowing into the tornado vortex, known as inflow winds, or by debris. The buildings adjacent to the tornado path can be significantly impacted depending on the design and materials used in the building construction. Although tornadoes strike at random, making all buildings vulnerable, three types of structures are more likely to suffer damage:

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

To assess potential for building damage, several tornado scenarios have been developed and presented below. Based on an analysis conducted by the State of Illinois for the 2010 Illinois Natural Hazard Mitigation Plan, Lake County buildings have a median value of \$198,200. The scenarios below calculate estimated tornado damages and assume a damage area of 5 square miles.

**1) Average Lake County building density tornado damages:**

$5 \text{ mi}^2 \times 581 \text{ houses/mi}^2 = 2,905 \text{ homes damaged}$

$2,905 \text{ homes} \times \$228,600 \text{ per home} \times 50\% \text{ of value damaged} = \text{\$419 million}$

**2) Rural area average building density:**

$5 \text{ mi}^2 \times 80 \text{ houses/mi}^2 = 400 \text{ homes damaged}$

$400 \text{ homes} \times \$228,600 \text{ per home} \times 50\% \text{ of value damaged} = \text{\$58 million}$

**3) Urban area (Waukegan) average building density:**

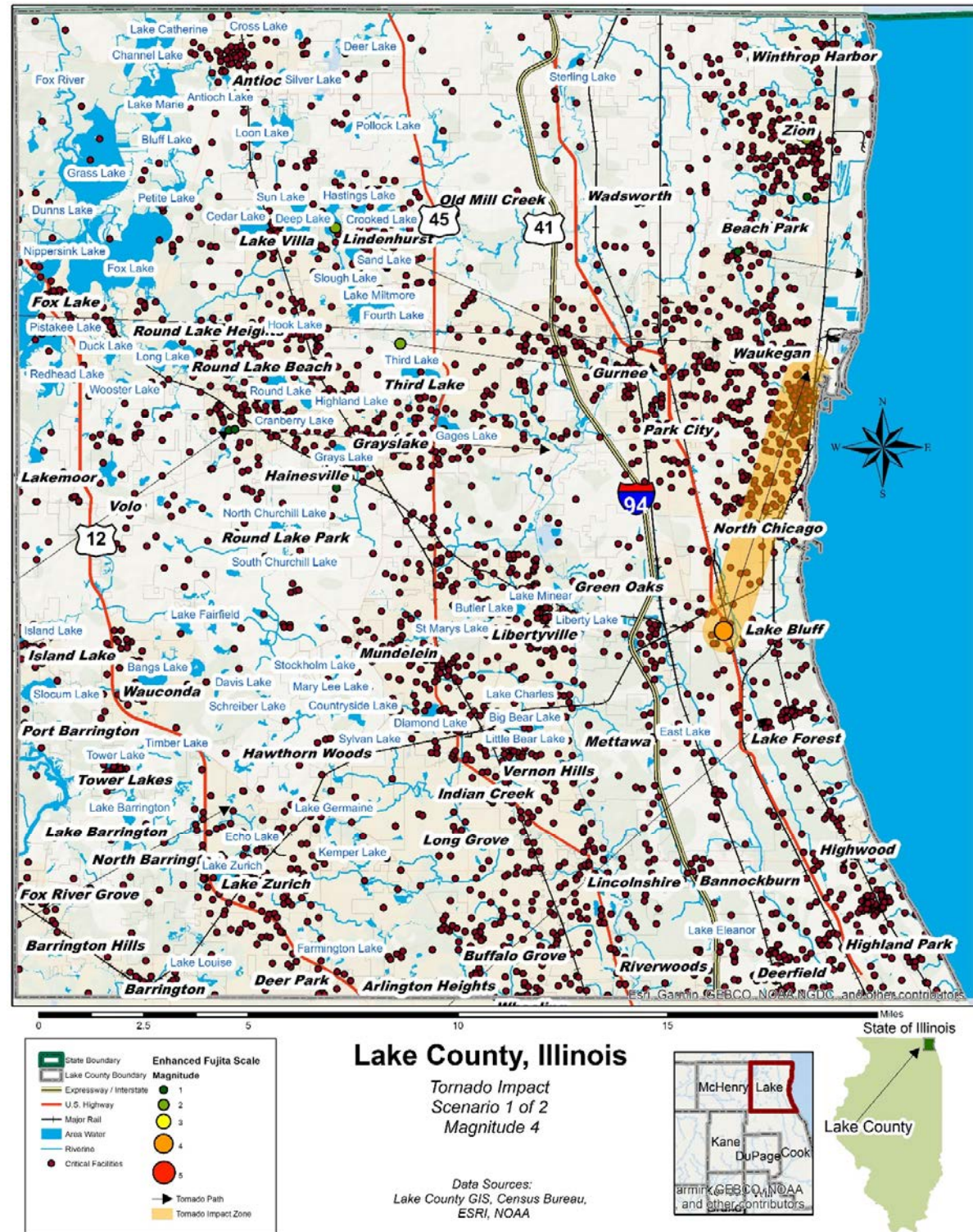
$5 \text{ mi}^2 \times 1,208 \text{ houses/mi}^2 = 6,040 \text{ homes damaged}$

$6,040 \text{ homes} \times \$228,600 \text{ per home} \times 50\% \text{ of value damaged} = \text{\$872 million}$

For a 5-square mile area the County's average exposure to tornado damage ranges from \$50 to \$60 million. Impact to buildings due to tornadoes is considered **high**.

A tornado scenario was developed for the 2022 ANHMP update following a "what-if" approach that simulated location-based damages. The September 1972 F4 tornado track was chosen from NOAA's Storm Prediction Centre database for the scenario, and the track was shifted over a heavily populated area with numerous critical assets. A 0.25-mile buffer was added to represent the wind field area associated with the tornado. The resulting analyses identified 80 critical facilities within the potential damage swath (see Appendix A). Exhibit 12 below depicts the scenario track and includes the buffer area as well as impacted critical facilities.





indoor areas, such as gyms and theaters. Impact to critical facilities for tornadoes is **moderate** since facilities are spread throughout the county.

**Economic Impact:** The major impact of a tornado on the local economy is damage to businesses and infrastructure. A heavily damaged business, especially already unprofitable ones, often must be closed.

Infrastructure damage is usually limited to above-ground utilities, such as power lines. Damage to roads and railroads is also localized. If transportation routes cannot be repaired promptly, alternate routes are usually available. Public expenditures include search and rescue, shelters, and emergency protection measures. The largest expenses are for repairs to public facilities, clean-up, and disposal of debris. Most public facilities are insured so the economic impact on the local funds is likely to be moderate.

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

**Multi-Jurisdictional Differences:** Each municipality in the county has an equal susceptibility to high winds from tornadic activity. Deteriorating older homes and aluminum-clad mobile homes continue to remain highly susceptible to wind events.

**Climate Change Considerations:** Climate change may be attributed to increases in tornado frequency. The confidence level for links between climate change and tornadoes is still low due to weaknesses in climate modeling, but this may change in the coming years as climate models improve in accuracy. Long-term tornado trend projection confidence is low due to low availability of observations.<sup>2</sup>

### 3.5 Severe Summer Storms

Dangerous and damaging aspects of severe storms are tornadoes, hail, lightning strikes, flash flooding, and winds associated with downbursts and microbursts. Thunderstorms associated with intense winds, heavy precipitation, and lightning strikes can all be hazardous. Intense winds and tornadoes can take down trees, damage structures, tip high profile vehicles, and create high velocity flying debris. Large hail can damage crops, dent vehicles, break windows, and injure or kill livestock, pets, and people. Severe storm weather conditions can exist during any season in Lake County, but they are referred to as severe summer storms to distinguish them from the severe winter storms addressed in this ANHMP.



**Waukegan, IL - September 2019**

Source: National Weather Service. Photo taken by Spencer Dant

**Thunderstorms** affect relatively small areas when compared to hurricanes and winter storms. Despite their small size, all thunderstorms are dangerous. A typical thunderstorm is 15 miles



in diameter and lasts an average of 30 minutes. Of the estimated 100,000 thunderstorms that occur each year in the United States, about 10 percent are classified as severe. The National Weather Service considers a thunderstorm severe if it produces hail at least 3/4 inch in diameter, winds of 58 MPH or stronger, or a tornado. Every thunderstorm needs three basic components: (1) moisture to form clouds and rain (2) unstable air which is warm air that rises rapidly and (3) lift, which is a cold or warm front capable of lifting air to help form thunderstorms.

**Lightning**, although not considered criteria for a severe thunderstorm by the National Weather Service definition, can accompany heavy rain during thunderstorms. Lightning develops when ice particles in a cloud move around and collide with other particles. These collisions cause a separation of electrical charges. Positively charged ice particles rise to the top of the cloud and negatively charged ones fall to the middle and lower sections of the cloud. The negative charges at the base of the cloud attract positive charges at the surface of the Earth. Invisible to the human eye, the negatively charged area of the cloud sends a charge called a stepped leader toward the ground. Once it gets close enough, a channel develops between the cloud and the ground. Lightning is the electrical transfer through this channel. The channel rapidly heats to 50,000 degrees Fahrenheit and contains approximately 100 million electrical volts. The rapid expansion of the heated air causes lightning.

**Hail** develops when a super cooled droplet of rain collects a layer of ice and becomes a hail stone. It continues to grow while sustained by an updraft. Once the hail stone cannot be held up any longer by the updraft, it falls to the ground. Hail up to 2.75 inches in diameter, nearly the size of a baseball, were reported in Lake County in 1967 according to the NCEI. Nationally, hailstorms cause nearly \$1 billion in property and crop damage annually as peak activity typically coincides with peak agricultural seasons. Severe hailstorms also cause considerable damage to buildings and automobiles but rarely result in loss of life.

**Table 29: Hail Size Reference**

Common Object	Size In Diameter (in.)
Pea	0.25"
Penny or Dime	0.75"
Quarter	1.00"
Half Dollar	1.25"
Golf Ball	1.75"
Tennis Ball	2.50"
Baseball	2.75"
Grapefruit	4.00"

### 3.5.1 Severe Storm Hazard Profile

Lake County is subject to severe storms ranging from thunderstorms to hurricane related rain, such as Hurricane Ike in September 2008. Severe storms which have the potential to cause flash flooding, tornadoes, downbursts, and debris. The severe storms profile in this section is primarily concerned with damage from hail, high winds, lightning, and other storm effects such as seiches.

Reported severe weather events over the past 62 years provide an acceptable framework for determining the magnitude of such storms that can be expected and planned for accordingly. FEMA places this region in Zone IV (250 MPH) for structural wind design (FEMA P-361, 2021). Large hail can damage structures, break windows, dent vehicles, ruin crops, and kill or injure people and livestock. Based on past occurrences, hail sizes greater than 3 inches in diameter are possible and should be accounted for in future planning activities. Non-tornadic, thunderstorm and non-thunderstorm winds over 100 mph should also be considered in future

planning initiatives. These types of winds can remove roofs, move mobile homes, topple trees, take down utility lines, and destroy poorly built or weak structures. A downburst is a small area of rapidly descending rain and rain-cooled air beneath a thunderstorm. The winds produced from a downburst often travel in one direction, and the worst damage is usually on the forward side of the downburst. The width of such a storm can range from 20 to 65 miles, and the length can reach 100 miles or more. Damaging, straight line winds are much more common than tornadoes and their damage is often incorrectly attributed to tornadoes. There have been 104 recorded hail events associated with thunderstorms that have either directly or indirectly impacted Lake County since 1963. These events are listed in and mapped in Exhibit 13.

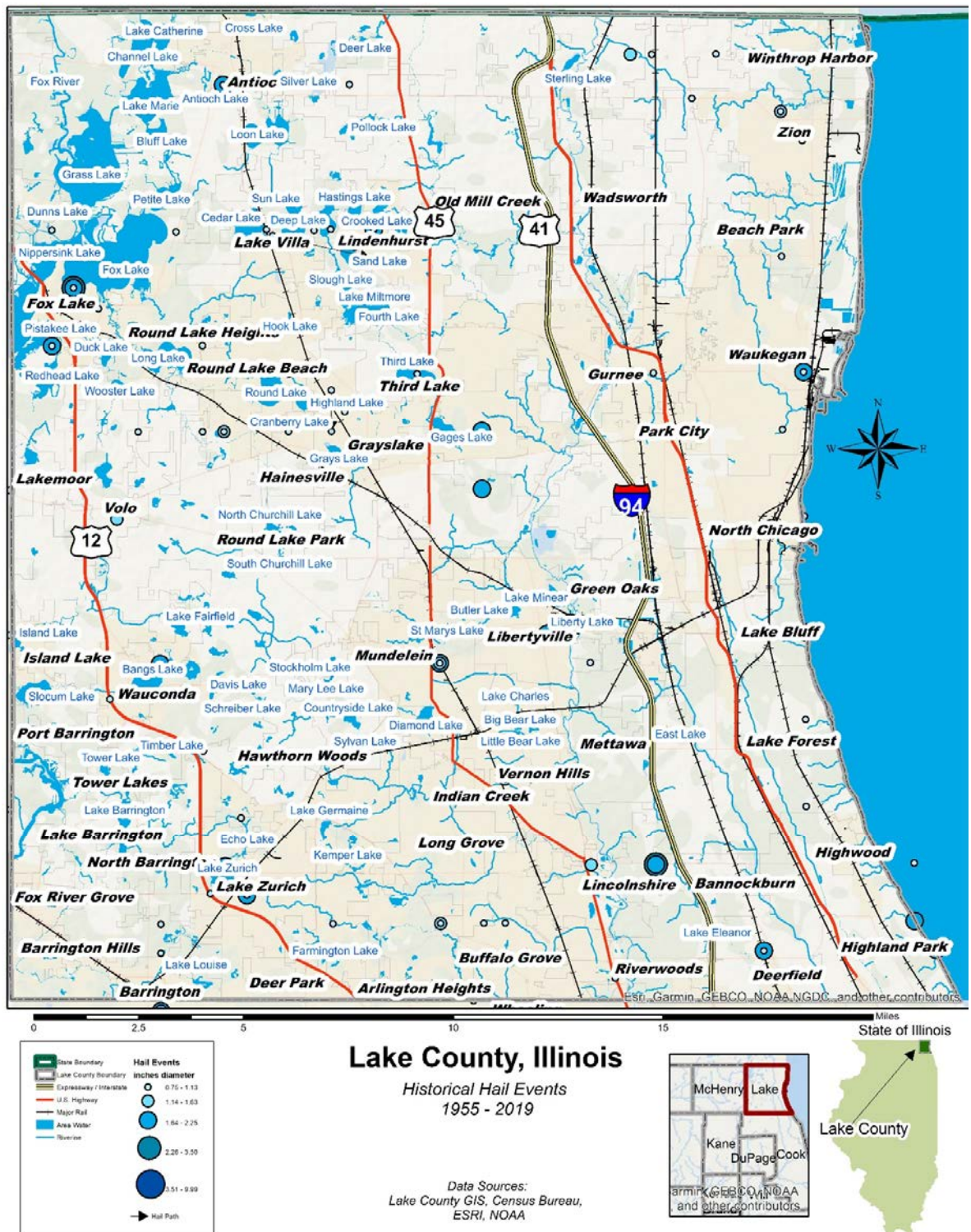
Lake County has been fortunate in that no deaths or injuries have been reported because of hail. In addition, there has been no property or crop damage attributed to hail within the county.

There have been 206 recorded severe wind events associated with thunderstorms that have either directly or indirectly impacted Lake County since 1960. The specifics of these events are shown in Table 30. Lake County, along with the rest of Illinois, is classified into Upper Midwest Wind Zone IV as shown in Figure 9. Zone IV is classified by winds with potential to reach up to 250 mph.

**Table 30: High Wind Events in Lake County (2011-2022)  
with Recorded Deaths, Injuries or Damages (NCEI)**

Location	Date	Magnitude	Deaths	Injuries	Property Damage
Winthrop Harbor	6/30/2011	65 kts.	0	0	\$5,000
Zion	6/30/2011	70 kts.	0	0	\$5,000
Beach Park	6/30/2011	65kts.	0	0	\$40,000
Unincorporated Lake County	6/30/2011	78 kts.	0	0	\$500,000
Highland Park	6/21/2011	60 kts.	0	0	\$5,000
Deerfield	6/21/2011	65 kts.	0	0	\$2,000
Mundelein	6/21/2011	60 kts.	0	0	\$2,000
Libertyville	6/21/2011	60 kts.	0	0	\$10,000
Unincorporated Lake County (SE Crooked Lake)	7/11/2011	55 kts.	0	0	\$1,000
Antioch	7/11/2011	55 kts.	0	0	\$10,000
Riverwoods	7/11/2011	60 kts.	0	0	\$30,000
Lindenhurst	8/30/2013	50 kts.	0	0	\$5,000
Antioch	11/17/2013	50 kts.	0	0	\$1,000
Lakemoor	6/21/2014	60 kts.	0	0	\$10,000
Unincorporated Lake County (E. of Old Oak Lake)	6/21/2014	60 kts.	0	0	\$20,000
Wauconda	6/14/2017	50 kts. EG	0	0	\$50,000
Antioch	6/28/2017	65 kts. EG	0	0	0.00K
Buffalo Grove	7/12/2017	50 kts. EG	0	0	0.00K
Waukegan	2/20/2018	55 kts. EG	0	0	0.00K
Waukegan Mem Apartments	7/1/2018	57 kts. MG	0	0	0.00K
North Barrington	9/25/2018	55 kts. EG	0	0	0.00K
Lake (zone)	2/24/2019	55 kts. MG	0	0	0.00K
Island lake	6/30/2019	50 kts. EG	0	0	0.00K
North Barrington	6/30/2019	55 kts. EG	0	0	0.00K
North Barrington	7/2/2019	50 kts. EG	0	0	0.00K
Antioch	9/11/2019	52 kts. EG	0	0	0.00K
North Barrington	9/13/2019	55 kts. EG	0	0	0.00K
Lake (zone)	11/27/2019	50 kts. EG	0	0	0.00K
Island Lake	6/9/2020	50 kts. EG	0	0	0.00K
Grayslake	6/26/2020	55 kts. EG	0	0	0.00K
Libertyville	7/9/2020	52 kts. EG	0	0	0.00K
Barrington	8/10/2020	60 kts. EG	0	0	0.00K
Round Lake Heights	8/10/2020	65 kts. EG	0	1	0.00K
Antioch	11/10/2020	60 kts. EG	0	0	0.00K
Lake (zone)	3/10/2021	50 kts. EG	0	0	0.00K
Lake (zone)	3/11/2021	52 kts. MG	0	0	0.00K
Antioch	4/29/2021	55 kts. MG	0	0	0.00K
Antioch	7/29/2021	50 kts. EG	0	0	0.00K
Lake Barrington	7/29/2021	55 kts. EG	0	0	0.00K
Buffalo Grove	8/10/2021	60 kts. EG	0	0	0.00K
Fox Lake	8/11/2021	60 kts. EG	0	0	0.00K
Williams Park	9/7/2021	60 kts. EG	0	0	0.00K
Vernon Hills	9/7/2021	55 kts. EG	0	0	0.00K
Highwood	9/7/2021	60 kts. EG	0	0	0.00K
Lake (zone)	12/15/2021	55 kts. MG	0	0	0.00K
(Ugn) Waukegan Airport	3/5/2022	54 kts. MG	0	0	0.00K
Lake (zone)	4/14/2022	55 kts. MG	0	0	0.00K
Prairie view	6/13/2022	50 kts. EG	0	0	0.00K
Antioch	6/15/2022	60 kts. EG	0	0	0.00K
Barrington Hills	7/4/2022	55 kts. EG	0	0	0.00K
Lake Bluff	7/21/2022	55 kts. EG	0	0	0.00K
Lakemoor	7/23/2022	60 kts. EG	0	0	0.00K
<b>TOTAL PROPRETY DAMAGE COSTS:</b>					<b>\$696,000</b>

Exhibit 13: Lake County Hail over 0.75"

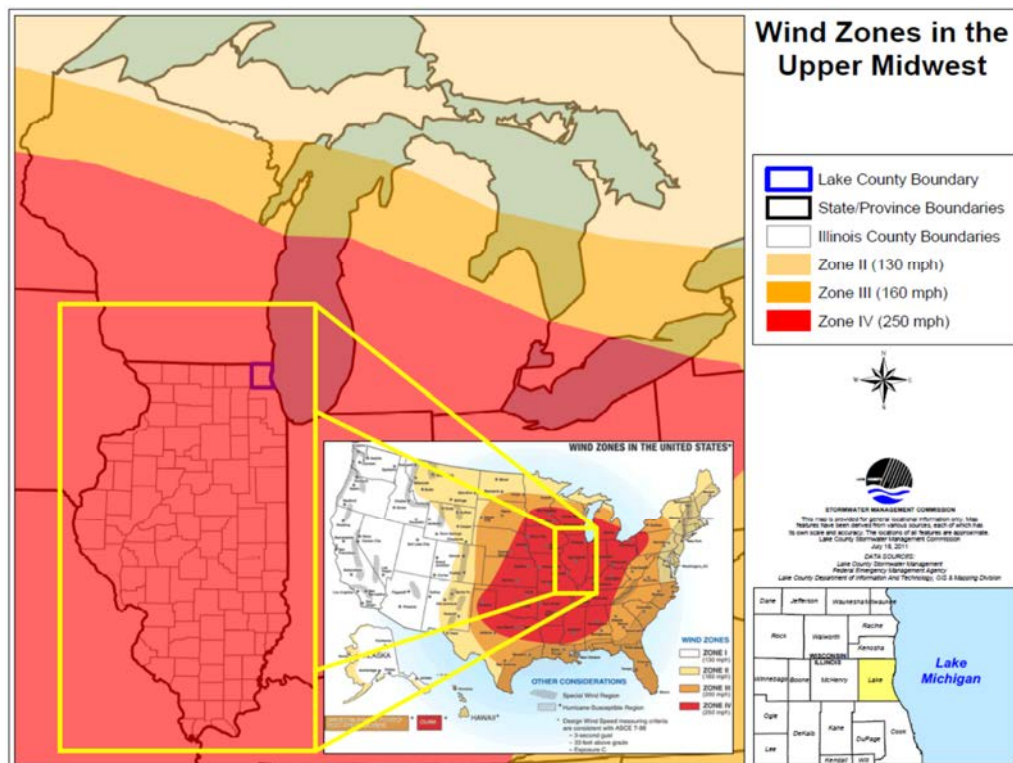




On April 19, 1996, a storm system moved into northern Lake County around 11:00 PM. These storms downed power lines and trees at Fox Lake, Chain O'Lakes, and West of Antioch. Multiple buildings in the County were damaged, including homes and barns. Twenty-six homes in Wadsworth were damaged, as well as multiple planes at the Waukegan Regional Airport. This storm led to two injuries, including a 5-year-old boy being taken to the hospital. The storm caused damages of \$5,000,000 to properties. The July 2011 wind event is discussed in section 3.13 Summary of Natural Hazards Risk Assessment.

Reported high wind events strikes over the past 62 years provide an acceptable framework for determining the future occurrence in terms of frequency for such events. The probability of the County and its municipality experiencing a high wind event associated with damages or injury can be difficult to quantify, but based on historical record of 206 high wind events since 1960 that have either caused damages to buildings and infrastructure or resulted in an injury or death, it can reasonably be assumed that this type of event has occurred once every 0.30 years from 1960 through 2022 or a frequency of 4 months.

**Figure 9: Upper Midwest Wind Zones**



$[(\text{Current Year } 2022) \text{ subtracted by } ((\text{Historical Year } 1960)] = 62 \text{ Years on Record}$

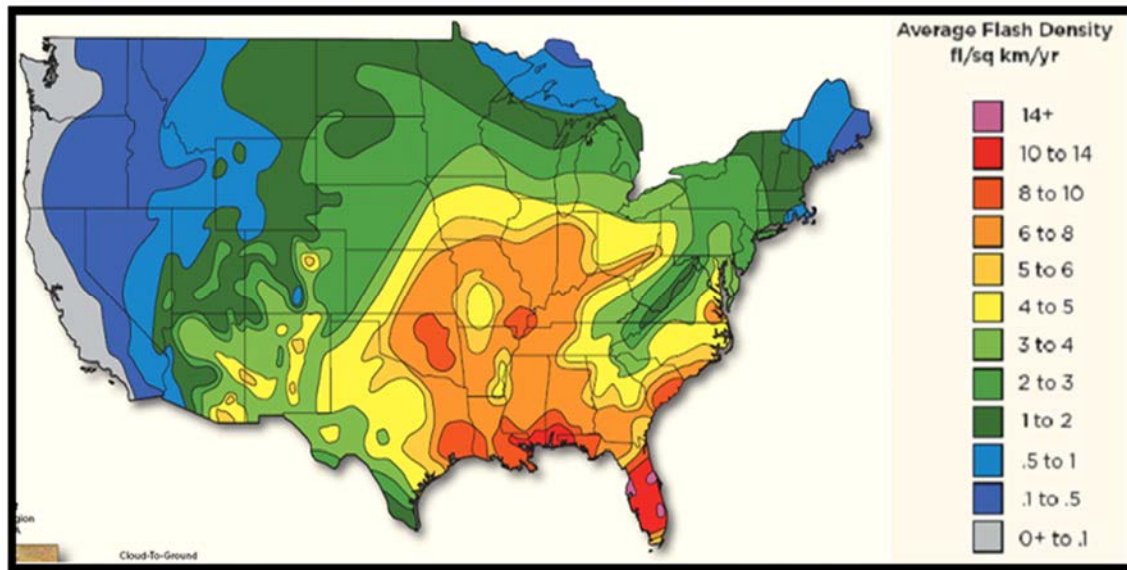
$[(\text{Years on Record } 62) \text{ divided by } ((\text{Number of Historical Events } 206 [\text{severe wind events}])] = 0.30$

Furthermore, the historic frequency calculates that there is a 100% chance of this type of event occurring each year.



**Lightning:** Except in cases where significant forest or range fires are ignited, lightning generally does not result in disasters. For the period of 1995 to 2011, NOAA reported one death, 3 injuries, and 18 damage reports in Lake County, as shown in Table 31. The property damage losses were primarily the result of lightning strikes to houses. The \$500,000 loss in 1998 was the result of a strike to a home with a million-dollar value. The strike resulted in considerable damage to the roof and attic of the building. Lake County recorded lightning strikes are mapped in Figure 10.

**Figure 10: Flash Density Associated with Lightning Strike**



Source : [www.lightningsafety.noaa.gov](http://www.lightningsafety.noaa.gov) (NOAA)

Reported lightning strikes over the past 27 years provide an acceptable framework for determining the future occurrence in terms of frequency for such events. The probability of the County and its municipality experiencing a lightning strike associated with damages or injury can be difficult to quantify but based on historical record of 22 lightning strikes since 1995 that have either caused damages to buildings and infrastructure or resulted in an injury or death, it can reasonably be assumed that this type of event has occurred once every year 1.23 years) from 1995 through 2022.

*[(Current Year) 2022] subtracted by [(Historical Year) 1995] = 27 Years on Record*

*[(Years on Record) 27] divided by [(Number of Historical Events) 22] = 1.23*

Furthermore, the historic frequency calculates that there is a 100% chance of this type of event occurring each year.

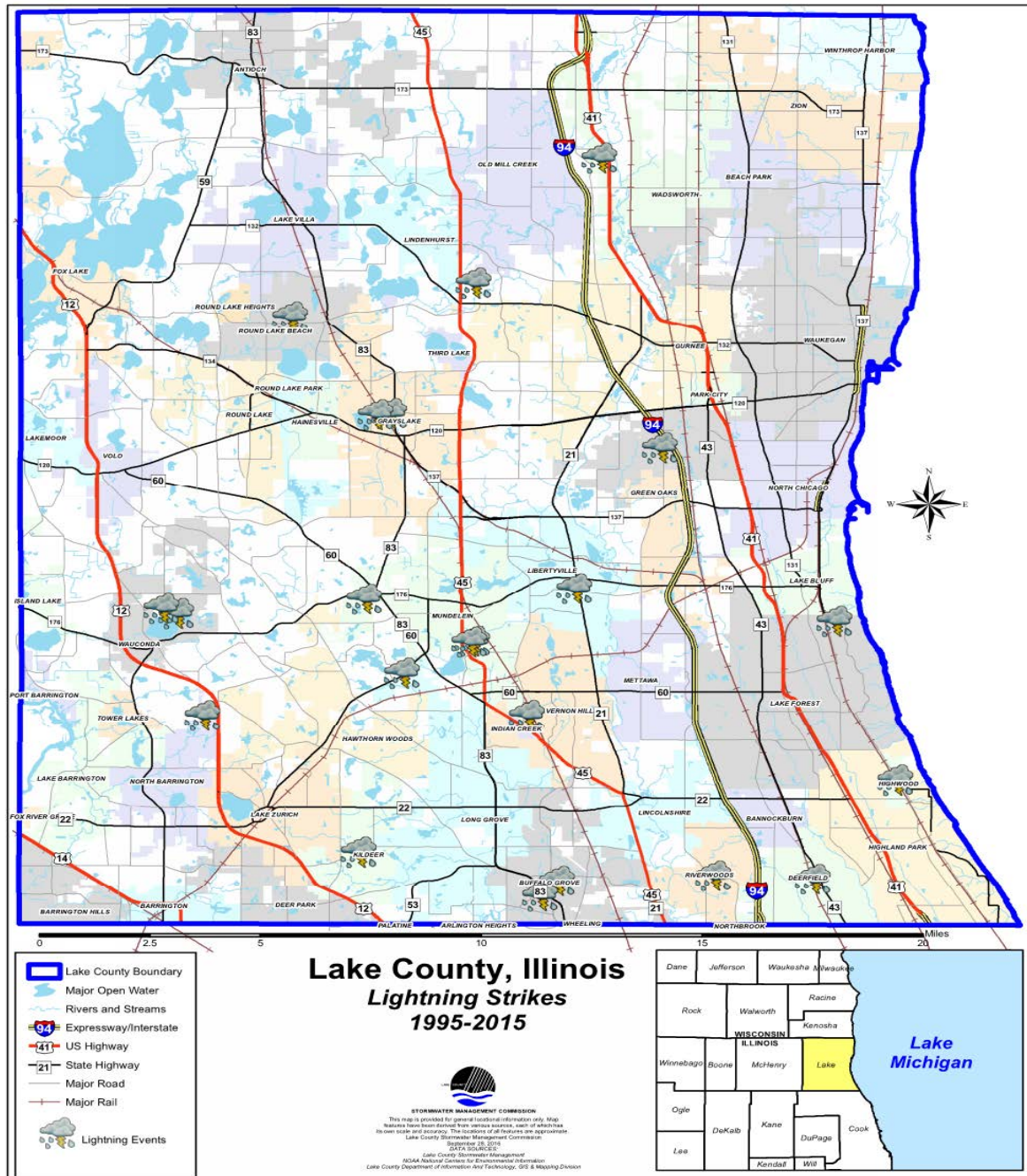
**Table 31: Lightning Strikes in Lake County (1995-2022) (NCEI)**

Location	Date	# Of Fatalities	# Of Injuries	Property Damages
Round Lake Beach	8/9/1995	0	1	\$0
Highwood	8/9/1995	0	1	\$5,000
Waukegan	5/28/1998	0	0	\$500,000
Kildeer	9/11/2000	0	0	\$100,000
Libertyville	9/22/2000	0	0	\$25,000
Buffalo Grove	6/3/2002	1	1	\$0
Riverwoods	7/7/2003	0	0	\$0
Vernon Hills	5/30/2006	0	0	\$75,000
Wadsworth	5/30/2006	0	0	\$200,000
Grayslake	8/24/2006	0	0	\$40,000
Buffalo Grove	8/24/2006	0	0	\$200,000
Wauconda	4/25/2008	0	0	\$15,000
Wauconda	4/25/2008	0	0	\$25,000
Lake Villa	6/5/2008	0	0	\$10,000
Diamond Lake	7/11/2008	0	0	\$130,000
Mundelein	8/4/2008	0	0	\$50,000
Ivanhoe	6/7/2009	0	0	\$200,000
Deerfield	6/18/2010	0	0	\$5,000
North Barrington	8/8/2010	0	0	\$100,000
Mundelein	9/21/2010	0	0	\$10,000
Wauconda	6/9/2011	0	0	\$150,000
Grayslake	7/22/2011	0	1	\$0
Forest Lake	9/19/2013	0	0	\$25,000
Highland Park	8/28/2018	0	2	\$0
Round Lake Hts.	9/20/2018	0	3	\$0
	<b>Total</b>	<b>1</b>	<b>8</b>	<b>\$1,865,000</b>

A **seiche** is a situation where lake water ahead of the storms is piled up along the downwind shore (e.g., Indiana and Michigan) and then sloshes back (e.g., to Illinois) and forth across the lake for several hours. Seiche events impact the greater Chicago area, along with Lake County, around once a year, according to Jim Alsopp, Warning Coordination Meteorologist, of the Chicago National Weather Service Office. This occurs when a line of severe thunderstorms with intense winds moves from NW to SE across the southern part of Lake Michigan. Because of the shape of the lake, the results are high waves which cause the lake level to rise rapidly. He said that they get a minor seiche about once per year where the water levels rise about 2 to 3 feet along the piers on Lake Michigan. In 1954, a 10-foot seiche wave caused eight deaths in Chicago and lakeshore damage along the Illinois Lake Michigan shoreline.

The most significant seiche event in the greater Chicago area occurred on June 26, 1954. On that date, a seiche formed because of a storm moving from NW to SE across Lake Michigan. This storm produced winds of up to 60 mph and caused a seiche to develop and strike the coast of Lake Michigan near Michigan City, Indiana. This seiche was then deflected by the shore and sent in a NW trajectory. It took more than an hour for that seiche to reach Chicago and created 10-foot waves. It struck the North Avenue Pier and swept fishermen into the lake. Most were rescued, however, eight drowned because of the incident. There have been no reported seiche events since the 2017 ANHMP update.

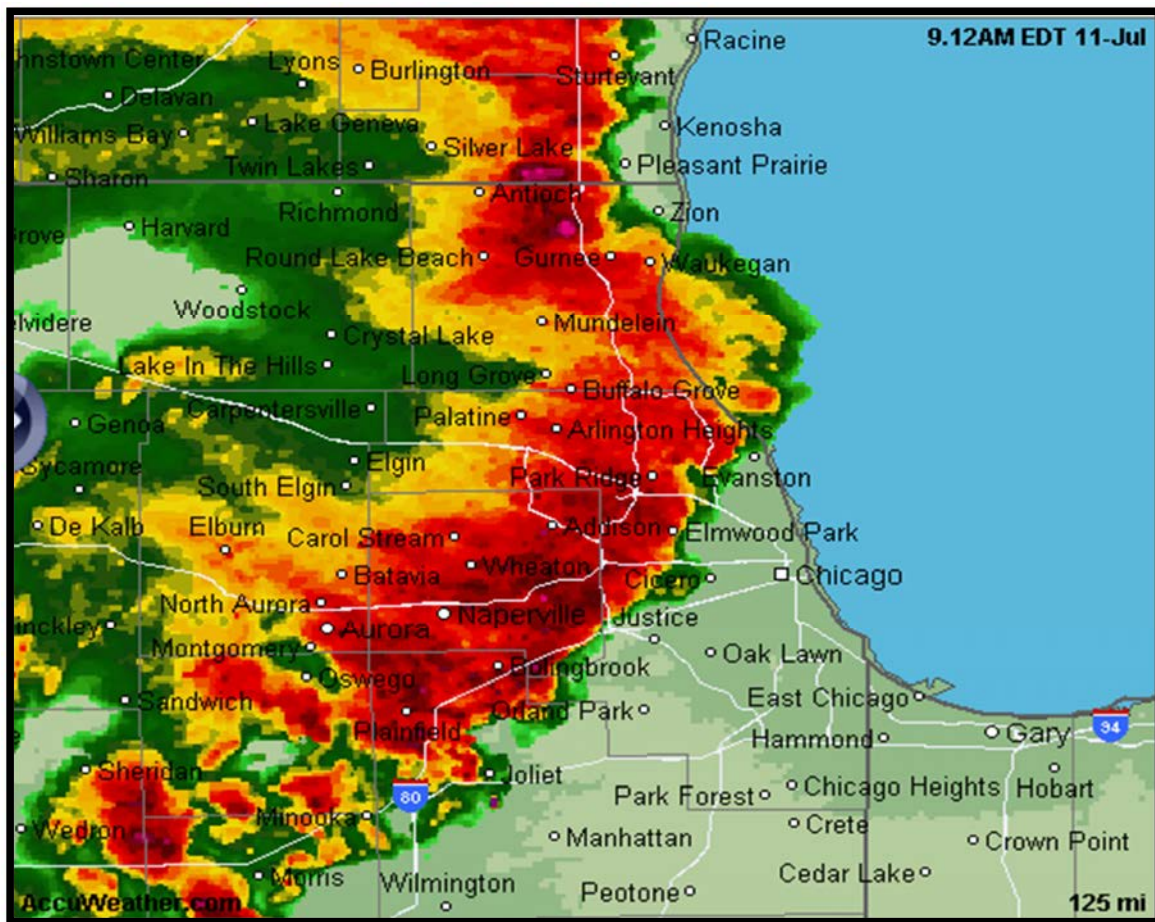
## Exhibit 14: Lake County Lightning Events



In July 2011, Northern Illinois was impacted by a derecho (also known as a land hurricane). A derecho is a widespread, long-lived windstorm that is associated with a band of rapidly moving showers or thunderstorms. The storm radar is shown in Figure 11.



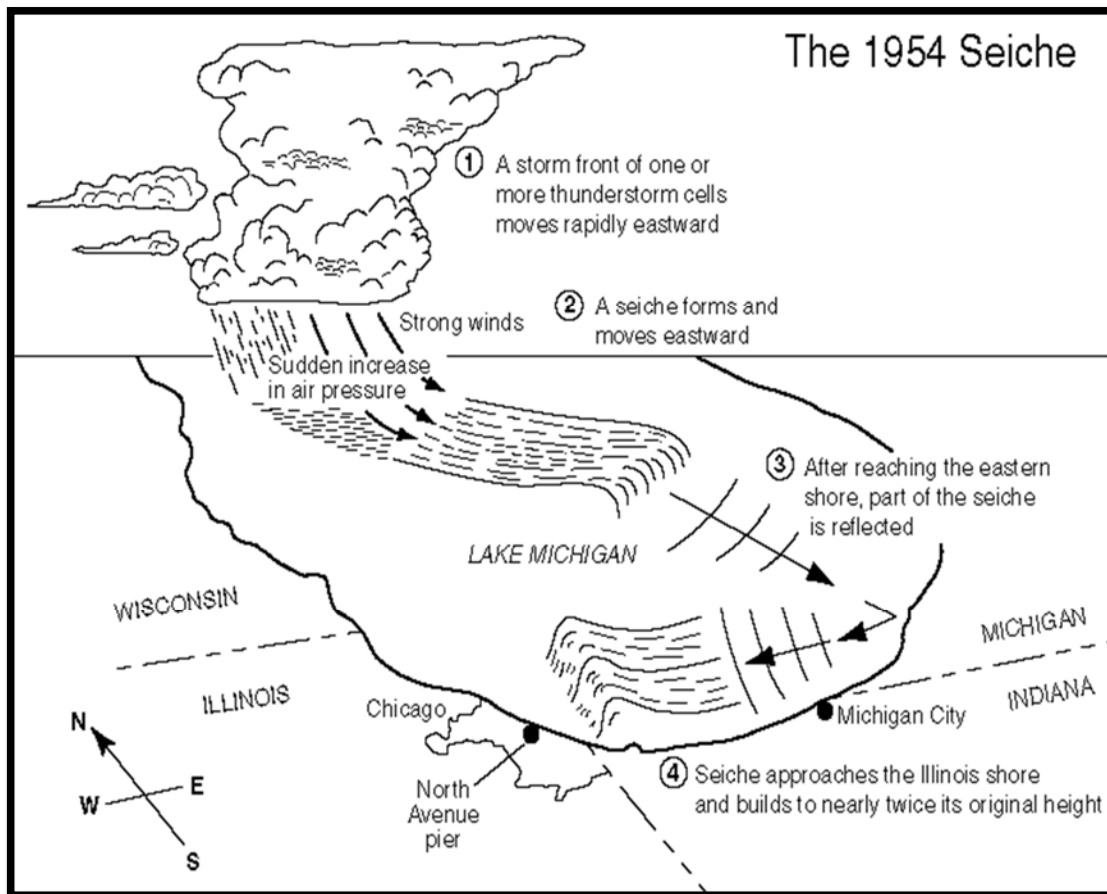
Figure 11: July 2011 Northern Illinois Derecho



Source: National Weather Service

This derecho, as it moved across Lake Michigan, produced recorded wind speeds exceeding 80 mph. These excessive winds forced water from the western side of Lake Michigan to the east. Once the derecho cleared and the winds subsided, the water began to rush back towards the west bank of Lake Michigan. As a result, a seiche warning was issued for the Chicago Lakefront up into Wisconsin. A 2-foot rise in the waters on the western edge of the Lake. Figure 12 shows a schematic diagram of a 1954 Lake Michigan seiche.

Figure 12: 1954 Lake Michigan Seiche



Source: Illinois State Geological Survey (ISGS)

### 3.5.2 Vulnerability—Severe Summer Storms Impact

Lake County is subject to severe “summer” storms throughout the year. Severe storms have the potential to cause flash flooding, tornadoes, downbursts, and debris. The severe storms profile in this section (3.5 Severe Summer Storms) is primarily concerned with damage from hail, high winds, lightning, and other storm affects.

All assets located in Lake County can be considered at risk from severe summer storms. This includes 714,342 people, or 100 percent of the county’s population and all buildings and infrastructure within the county.

**Health and Safety:** Three deaths and 31 injuries have been attributed to severe storms in Lake County. The threat to life and safety is present with severe thunder, lighting and windstorms. Hail rarely causes loss of life. No special health problems are attributable to thunderstorms, other than the potential for tetanus and other diseases that arise from injuries and damaged property. Impact to health and safety for severe summer storms is considered **moderate**.

**Damage to Buildings and Critical Infrastructure:** Damage to roofs and siding and cars is frequently reported because of hail events. Depending on the hail size and wind severity,



damage to awnings, glass, and siding can also occur. Critical facilities tend to be as vulnerable to severe storm damage as residences.

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

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

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

**Multi-Jurisdictional Differences:** Each municipality in the county has an equal susceptibility to severe storms and lightning. Predictability again causes a great problem when discussing the probability of damage from high wind events. Accurately predicting the time, location, and extent of damage by a thunderstorm or other severe weather events is difficult. However, thunderstorm events with high wind and dangerous lightning, are highly possible to occur across the county. These storms are prominent in the early spring and continue through late fall. If located in a densely populated area of the county, it is easy to estimate damages in the millions of dollars from these events.

**Climate Change Considerations:** Heavy summer precipitation is very likely to become more frequent and more intense with additional global warming.<sup>3</sup> Climate models consistently project environmental changes that would support an increase in the frequency and intensity of severe thunderstorms that combine tornadoes, hail, and winds (high confidence), but there is low confidence in the details of the projected increase.<sup>4</sup>

### 3.6 Severe Winter Storms

Lake County has been impacted by varying intensities of winter weather over the last century; however, the occurrence of severe winter weather in the county is relatively infrequent. Severe winter weather can cause hazardous driving conditions, communications and electrical power failure, community isolation and can adversely affect business continuity. This type of severe weather may include one or more of the following winter factors:

**Blizzards**, as defined by the National Weather Service, are a combination of sustained winds or frequent gusts of 35 mph or greater and visibilities of less than a quarter mile from falling or blowing snow for 3 hours or more. A blizzard, by definition, does not indicate heavy amounts of snow, although they can happen together. The falling or blowing snow usually creates large drifts from the intense winds. The reduced visibilities make travel, even on foot, particularly treacherous. The intense winds may also support dangerous wind chills. Ground blizzards can develop when intense winds lift snow off the ground and severely reduce visibilities.



Lake County  
Source: David Christensen

**Heavy snow** in enormous quantities may fall during winter storms. Six inches or more in 12 hours or eight inches or more in 24 hours constitute conditions that may significantly hamper travel or create hazardous conditions. The National Weather Service issues warnings for such events. Smaller amounts can also make travel hazardous but result in minor inconveniences most often. Heavy, wet snow before leaf abscission in the autumn or after trees have leafed out in the spring can break tree branches and cause power outages.

**Ice storms** develop when a layer of warm (above freezing), moist air aloft coincides with a shallow cold (below freezing) pool of air at the surface. As snow falls into the warm layer of air, it melts to rain, and then freezes on contact when hitting the frozen ground or cold objects at the surface, creating a smooth layer of ice. This phenomenon is called freezing rain. Similarly, sleet occurs when the rain in the warm layer subsequently freezes into pellets while falling through a cold layer of air at or near the Earth's surface. Extended periods of freezing rain can lead to accumulations of ice on roadways, walkways, power lines, trees, and buildings. Almost any accumulation can make driving and walking hazardous. Thick accumulations can bring down trees and power lines.

#### 3.6.1 Severe Winter Storm Hazard Profile

The science of meteorology and records of severe weather are not quite sophisticated enough to identify what areas of the county are at greater risk for damages. Therefore, all areas of the county are assumed to have the same winter weather risk countywide.

Severe winter weather can result in the closing of primary and secondary roads, particularly in rural locations, loss of utility services, and depletion of oil heating supplies. Environmental impacts often include damage to shrubbery and trees due to heavy snow loading, ice build-up, and/or high winds which can break limbs or even bring down large trees. Gradual melting of snow and ice provides excellent groundwater recharge; however, high temperatures following a heavy snowfall can cause rapid surface water runoff and severe flash flooding.

The State of Illinois has an extensive history of severe winter weather. In the winter of 2011, the state was hit by a series of winter storms. These storms included ice storms, followed by unseasonably warm temperatures and high rainfall totals, all of which resulted in extensive flooding and mudslides. This series of storms resulted in Presidential Declaration FEMA-DR-1960-IL. This declaration provided over eighty-four million dollars in recovery funds. These funds included Public Assistance and Hazard Mitigation Grant funds.

During the evening of January 18<sup>th</sup>, 2019, heavy snow developed over northern Illinois and continued through the late morning of January 19<sup>th</sup>. Chicago O'Hare set a daily record low of -23 on the morning of January 30<sup>th</sup> and -21 on the morning of January 31<sup>st</sup>.

Winter weather is a common occurrence in Illinois throughout the winter and early spring months. According to the NCEI, there have been 65 winter events in Lake County since 1994 (Table 32). The potential severities of winter storms are often difficult to predict, but through identifying various indicators of weather systems, and tracking these indicators, it provides means of monitoring winter weather. Understanding the historical frequency, duration, and spatial extent of winter weather assists in determining the likelihood and potential severity of future occurrences.

**Table 32: Severe Winter Storms in Lake County (1994-2022) (NCEI)**

Event Type	Date	Event Type	Date
Winter Storm	12/6/1994	Winter Storm	12/19/2008
Heavy Snow	1/18/1995	Winter Storm	1/9/2009
Winter Storm	12/8/1995	Winter Storm	3/28/2009
Winter Storm	1/9/1997	Winter Storm	12/26/2009
Winter Storm	1/15/1997	Winter Storm	1/7/2010
Heavy Snow	11/14/1997	Winter Storm	2/9/2010
Heavy Snow	1/8/1998	Winter Storm	12/11/2010
Heavy Snow	3/9/1998	Winter Storm	1/31/2011
Heavy Snow	1/1/1999	Blizzard	2/1/2001
Heavy Snow	3/8/1999	Winter Storm	1/20/2012
Heavy Snow	2/8/2000	Winter Storm	2/23/2012
Blizzard	12/11/2000	Heavy Snow	2/7/2013
Winter Storm	1/31/2002	Heavy Snow	2/26/2013
Winter Storm	3/2/2002	Winter Storm	3/5/2013
Winter Storm	3/4/2003	Heavy Snow	2/4/2014
Heavy Snow	1/4/2005	Blizzard	2/1/2015
Winter Storm	1/20/2006	Heavy Snow	11/20/2015
Winter Storm	11/30/2006	Winter Storm	2/8/2018
Winter Storm	12/1/2006	Winter Storm	11/25/2018
Blizzard	2/13/2007	Winter Storm	1/18/2019
Blizzard	2/25/2007	Winter Storm	1/27/2019
Winter Storm	12/4/2007	Ice Storm	2/5/2019
Heavy Snow	12/15/2007	Ice Storm	2/11/2019
Heavy Snow	12/31/2007	Winter Storm	4/14/2019
Winter Storm	1/29/2008	Winter Storm	1/25/2021
Winter Storm	1/31/2008	Winter Storm	1/30/2021
Winter Storm	2/1/2008	Winter Storm	2/15/2021
Winter Storm	2/5/2008	Winter Storm	1/1/2022
Winter Storm	3/21/2008		



**Heavy Snowstorms** can immobilize a region and paralyze a city. These events can strand commuters, close airports, stop supplies from reaching their destinations and disrupt emergency and medical services. Accumulations of snow can cause roofs to collapse and knock down trees and power lines. Rural homes and farms may become isolated and unprotected livestock may be lost. The cost of snow removal, repairing damage, and the loss of business can have economic impacts on cities and towns.

Reported heavy snow events over the past 28 years provide an acceptable framework for determining the future occurrence in terms of frequency for such events. The probability of the County and its municipalities experiencing a winter storm event can be difficult to quantify but based on a historical record of 56 winter storm events since 1994, it can reasonably be assumed that this type of event has occurred once every 0.50 years from 1994 through 2022.

*[(Current Year) 2022] subtracted by [(Historical Year) 1994] = 28 Years on Record  
[(Years on Record) 28] divided by [(Number of Historical Events) 56] = 0.50*

The historic frequency calculates that there is a 100% chance of a severe winter storm event occurring each year.

**Ice** accumulations can lead to downed trees, utility poles and communication towers. Ice can disrupt communications and power while utility companies repair severe damage. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces. An ice storm is a type of winter storm characterized by freezing rain. The US National Weather Service defines an ice storm as a storm which results in the accumulation of at least 0.25 inch of ice on exposed surfaces.

Five ice storms were recorded by the NCEI on January 26, 1997, December 1 and December 11, 2007, and on February 5 and 11, 2019. The December 1, 2007, event had \$1,000 of recorded damage. The ice storms in 2019 led to tree limb and power line damage in some areas.

The probability of the county and its municipalities experiencing an ice event can be difficult to quantify but based on historical record of five ice events since 1994, it can reasonably be assumed that this type of event has occurred once every 5.6 years from 1994 through 2022.

*[(Current Year) 2022] subtracted by [(Historical Year) 1994] = 28 Years on Record  
[(Years on Record) 28] divided by [(Number of Historical Events) 5] = 5.6*

The historic frequency calculates that there is a 18% chance of this type of event occurring each year, but it is recognized that ice storm conditions that may be coupled with snowstorm events may mean that the frequency may be greater than the data presents.

### **3.6.2 Vulnerability - Winter Storm Impact**

All of Lake County is vulnerable to severe winter storms. Severe winter storms can lead to power outages, downed trees and branches, hypothermia, injuries, and loss of life. Climate data maintained by the Illinois State Water Survey indicates that between 1900 and 2000, Illinois can expect to receive a six inch or more snowfall within a 48-hour period at least twice

a year. In Illinois, severe winter storm losses since 1950 average an estimated \$102 million, annually. Severe weather storms can immobilize large areas with rural areas being particularly impacted by impassable roads.

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

While vehicular accidents are often caused by the driver's lapse in judgment, the weather and its impact on roads are also a major factor. Blowing snow, ice and slush create slippery pavement making vehicle travel less safe during and immediately following winter storms. The injuries and deaths that occur when winter storms are present could be reduced through mitigation.

While most injuries caused by snow and ice storms result from vehicle accidents, about 25% of all winter storm injuries occur to people caught outside in a storm. Windchill magnifies the impact of cold temperatures by increasing the rate of heat loss and lowering body temperature at faster rates. Frostbite (damage to tissue) to hands, feet, ears, and nose, and hypothermia (lowering of body temperature below 95° F) are common winter storm injuries.

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

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

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

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

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

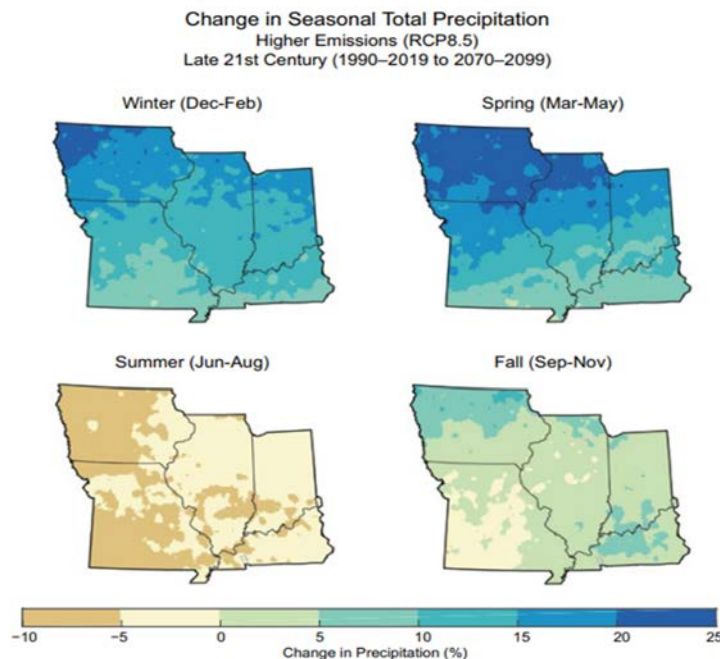
**Economic Impact:** Loss of power means businesses and manufacturing concerns must close. Loss of access due to snow or ice-covered roads has a similar effect. There are also impacts when people cannot get to work, to school, or to the store.

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

**Multi-Jurisdictional Differences:** Each municipality in the county has an equal susceptibility to severe winter storms and most storms impact the entire county and the northeastern Illinois region.

**Climate Change Considerations:** Climate change is expected to cause a shift to warmer winters, fewer snow days, and more winter rainfall. The number of freezing winter nights has decreased in Illinois. By the end of the 21st century, unprecedented warming of 4–9°F under the lower scenario and 8–14°F under the higher scenario is likely in Illinois. This is likely to be accompanied by a longer growing season, and less severe extreme cold.<sup>5</sup> For the end of the 21st century and the higher scenario, substantial increases in precipitation are projected for winter (+10% to +20%). By the end of the century, the statewide average winter precipitation is projected to change from 7–9 inches under the higher scenario (RCP8.5). The maps below show projected changes (%) in the seasonal total precipitation for late 21st century under a higher) scenario for the Midwestern United States for winter (upper left), spring (upper right), summer (lower left), and fall (lower right). All projected values are shown as changes compared with 1990–2019 averages.

**Figure 13: Percentage of Change in Precipitation by Season**



Sources: NCICS and The University of Edinburgh.

### 3.7 Drought

Drought is a normal part of virtually all climates, including areas with high and low average rainfall. It is caused by a deficiency of precipitation and can be aggravated by other factors such as hot temperatures, high winds, and low relative humidity.

Droughts can be grouped into meteorological, hydrologic, agricultural, and socioeconomic categories. Representative definitions commonly used to describe the types of droughts are summarized below:

**Meteorological** drought is defined solely on the degrees of dryness, expressed as a departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.

**Hydrologic** drought generally last longer than agricultural droughts, and result in below-average streamflow, depletion in reservoir storage, or shortages in groundwater supplies, which can cause severe impacts to water supplies. A hydrological drought usually only occurs if there has been below-normal precipitation for 6 or more months. It can last 1 to 2 years or even longer in rare cases.

**Agricultural** drought is defined principally in terms of soil moisture deficiencies relative to water demands crops during the growing season.

**Socioeconomic** drought associates the supply and demand of economic goods or services with elements of meteorological, hydrologic, and agricultural drought. Socioeconomic drought occurs when the demand for water exceeds the supply because of a weather-related supply shortfall. The incidence of this type of drought can increase because of a change in the amount of rainfall, a change in societal demands for water (or vulnerability to water shortages), or both.

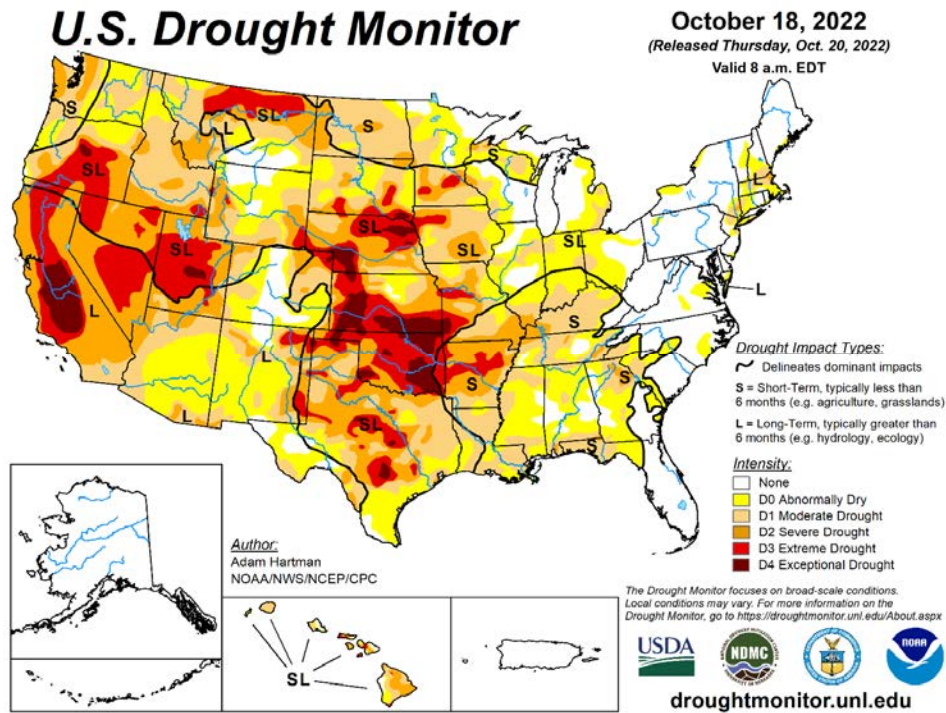
The Standardized Precipitation Index (SPI) is a drought index based on the probability of an observed precipitation deficit occurring over a given prior period. The assessment periods considered range from 1 to 36 months. The variable time scale allows the SPI to describe drought conditions important for a range of meteorological, agricultural, and hydrological applications. For example, soil moisture conditions respond to precipitation deficits occurring on a relatively brief time scale, whereas groundwater, streamflow, and reservoir storage respond to precipitation deficits arising over many months.

### 3.7.1 Drought Hazard Profile

There is no commonly accepted approach for assessing risk associated with droughts given the varying types and indices. Drought risk is based on a combination of the frequency, severity, and spatial extent (the physical nature of drought) and the degree to which a population or activity is vulnerable to the effects of drought. The degree of Lake County's vulnerability to drought depends on the environmental and social characteristics of the region and is measured by its ability to anticipate, cope with, resist, and recover from drought.

Mapping of the current drought status is published by US Drought Monitor, which is produced through a partnership between the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration:

<https://droughtmonitor.unl.edu/>



Due to the nature of drought, it is extremely difficult to predict, but through identifying various indicators of drought, and tracking these indicators, it provides us with a crucial means of monitoring drought. Understanding the historical frequency, duration, and spatial extent of drought assists in determining the likelihood and potential severity of future droughts. The characteristics of past droughts provide benchmarks for projecting similar conditions into the future. The probability of Lake County and its municipalities experiencing a drought event can be difficult to quantify but based on historical record of 20 droughts since 2005, it can reasonably be assumed that this type of event has occurred once every .85 years from 2005 through 2022.

The Palmer Drought Severity Index (PDSI) was developed by Wayne Palmer in the 1960s and uses temperature and rainfall information in a formula to determine dryness. It has become the semi-official drought index. The Palmer Index is most effective in determining long term drought—a matter of several months—and is not as good with short-term forecasts (a matter of weeks). It uses a 0 as normal, and drought is shown in terms of minus numbers; for example, minus 2 is moderate drought, minus 3 is severe drought, and minus 4 is extreme drought. The index is shown below in Table 33.

**Table 33: Drought Severity Classification**

Drought Severity	Return Period (Years)	Description of Possible Impacts	DROUGHT MONITORING INDICES		
			Standardized Precipitation Index (SPI)	NDMC* Drought Category	Palmer Drought Index
Minor Drought	3 to 4	Going into drought; short-term dryness slowing growth of crops or pastures; fire risk above average. Coming out of drought; some lingering water deficits; pastures or crops not fully recovered.	-0.5 to -0.7	D0	-1.0 to -1.9



**Table 33: Drought Severity Classification**

Drought Severity	Return Period (Years)	Description of Possible Impacts	DROUGHT MONITORING INDICES		
			Standardized Precipitation Index (SPI)	NDMC* Drought Category	Palmer Drought Index
Moderate Drought	5 to 9	Some damage to crops or pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing, or imminent, voluntary water use restrictions requested.	-0.8 to -1.2	D1	-2.0 to -2.9
Severe Drought	10 to 17	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed	-1.3 to -1.5	D2	-3.0 to -3.9
Extreme Drought	18 to 43	Major crop and pasture losses; extreme fire danger; widespread water shortages or restrictions	-1.6 to -1.9	D3	-4.0 to -4.9
Exceptional Drought	44 +	Exceptional and widespread crop and pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells creating water emergencies	Less than -2	D4	-5.0 or less

Source: National Drought Mitigation Center

The following summarizes the previous occurrences as well as the extent or severity of the drought events in Lake County:

Information obtained from the Illinois Emergency Management Agency shows three reported drought events in Lake County between 1983 and August 31, 2009. Comprehensive damage information was either unavailable or none was recorded for any of the events. Also, no drought-related injuries or deaths were reported. In 1983, all 102 Illinois counties were proclaimed state disaster areas because of hot temperatures and insufficient precipitation beginning in mid-June.

In 1988, approximately half of the counties in Illinois (including Lake 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 because of this drought.

In 2005, drought conditions impacted much of the state, including Lake 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. According to the NCEI this drought, listed from June 2005 to February 2006, had no significant property damage loss since 2005, and no significant damages to agriculture have occurred either.

From May 18, 2021, through March 1, 2022, there were an additional 11 reported events of drought through the (NCEI) database. During this time drought conditions ranged from severe to extreme throughout most of Lake County and northern Illinois. No significant property damage or loss of life occurred due to the drought conditions.

The chance of a drought occurring in any year is most likely less than 10 percent, but droughts can extend over multiple years. "Hotter summer temperatures will increase the severity of naturally occurring droughts and, with lengthier dry spells, increase the risk of flash droughts, which start and intensify rapidly."

The National Oceanic and Atmospheric Administration Paleoclimatology Program studies drought by analyzing records from tree rings, lake and dune sediments, archaeological remains, historical documents, and other environmental indicators to obtain a broader picture of the frequency of droughts in the United States. According to their research, "...paleoclimatic data suggest that droughts as severe as the 1950's drought have occurred in central North America several times a century over the past 300-400 years, and thus we should expect (and plan for) similar droughts in the future. The paleoclimatic record also indicates that droughts of a much greater duration than any in the 20th century have occurred in parts of North America as recently as 500 years ago." Based on this research, the 1950's drought situation could be expected approximately once every 50 years or 20% chance every ten years. An extreme drought, worse than the 1930's "Dust Bowl," has an approximate probability of occurring once every 500 years or a 2% chance of occurring each decade. (NOAA, 2003). Although this data is outdated, it is the most recent that is easily A 500-year drought with a severity comparable to the 1930's that destroys the agricultural economy and can increase the likelihood of Earthquake/Seismic Activities is an example of an exceptional drought event.

Impacts to vegetation and wildlife can include death from dehydration and spread of invasive species or disease because of stressed conditions. Fire suppression has decreased the prevalence of the drought-tolerant tree species, such as oak, hickory, and pine, while increasing the abundance of species with higher moisture requirements, such as maples. This results in greater risk of declines in forest health and productivity as the frequency of drought conditions increases.<sup>7</sup> Environmental impacts are more likely at the interface of the human and natural world. The loss of crops or livestock due to drought can have far-reaching economic effects. Wind and water erosion can alter the visual landscape and dust can damage property. Water-based recreational resources are affected by drought conditions.

### **3.7.2 Vulnerability – Drought Impacts**

**Health and Safety:** Drought events affect the entire county in any one of the four drought categories discussed above. The majority of Lake County and its municipalities use groundwater for drinking water. With the anticipated growth in the total county population, this will be a growing concern. The agricultural community will continue to be affected by droughts that are predicted to worsen under the increasing impacts of climate change. All communities in Lake County are subject to drought-related impacts. A drought, however, evolves slowly over time and the population typically has ample time to prepare for its effects. Should a drought impact the water available for public water systems or individual wells, the availability of clean drinking water could be compromised. This situation would require emergency actions and could possibly overwhelm the local government and financial resources.

**Damage to Buildings and Critical Infrastructure:** Drought had negligible impact on buildings. Possible losses/impacts to critical facilities include the loss of critical function due to low water supplies. Severe droughts can negatively affect drinking water supplies. Should a public water system be affected, the losses could total into the millions of dollars if outside water is shipped in. Private springs/wells could also dry up. Possible losses to infrastructure include the loss of potable water.

**Economy Impact:** The largest economic impact of drought is to agriculture. While livestock can be impacted, the greatest concern is for row crops and produce.

**Multi-Jurisdictional Differences:** Due to the nature of drought, all jurisdictions within Lake County are expected to be impacted equally due to drought conditions.

**Climate Change Considerations:** Over the last 120 years, mean precipitation has increased from 5 to 20%, varying across the state, and the number of 2-inch rain days in Illinois has increased by 40%, reflecting major regional changes in the hydrologic cycle. Over the same time period, extreme droughts have become less common. As average daily temperature in Illinois increase, hotter summer temperatures will increase the severity of naturally occurring droughts and, with lengthier dry spells, increase the risk of flash droughts, which start and intensify rapidly.

The agricultural community will continue to be affected by droughts that are predicted to worsen under the increasing impacts of climate change. Climate change may increase risks of inadequate surface water supply in drought conditions as surface water supply is often limited by low streamflow unless it is augmented by in-channel or off-channel storages. More intense summer droughts could result in lower water tables during peak pumping conditions in the summer, potentially reducing the sustainability of the groundwater resource used in water supply. As mentioned previously, most of Lake County relies on groundwater for drinking water.

Drought is likely to be a concern in Illinois in some years even if annual precipitation increases as projected due to the three following factors. First, increased temperatures will lead to more evaporation from soils (evapotranspiration) and potentially increase demand for irrigation due to drier soils. Secondly, summer precipitation is projected to decrease, especially by late century under the higher emission scenario. Lastly, there is strong evidence that the distribution of precipitation will change over time, with more heavy rain events and a possible increase in the maximum number of consecutive dry days.<sup>6</sup>

### 3.8 Earthquake

An earthquake is the motion or trembling of the ground produced by sudden displacement of rock usually within the upper 10–20 miles of the Earth’s crust. Earthquakes can affect hundreds of thousands of square miles, cause damage to property measured in the tens of billions of dollars, result in loss of life and injury to hundreds of thousands of persons, and disrupt the social and economic functioning of the affected area. Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking which is dependent upon amplitude and duration of the earthquake (FEMA, 1997).

The impact an earthquake event has on an area is typically measured in terms of earthquake intensity. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. A detailed description of the Modified Mercalli Intensity Scale is shown in Table 34.

**Table 34: Modified Mercalli Intensity**

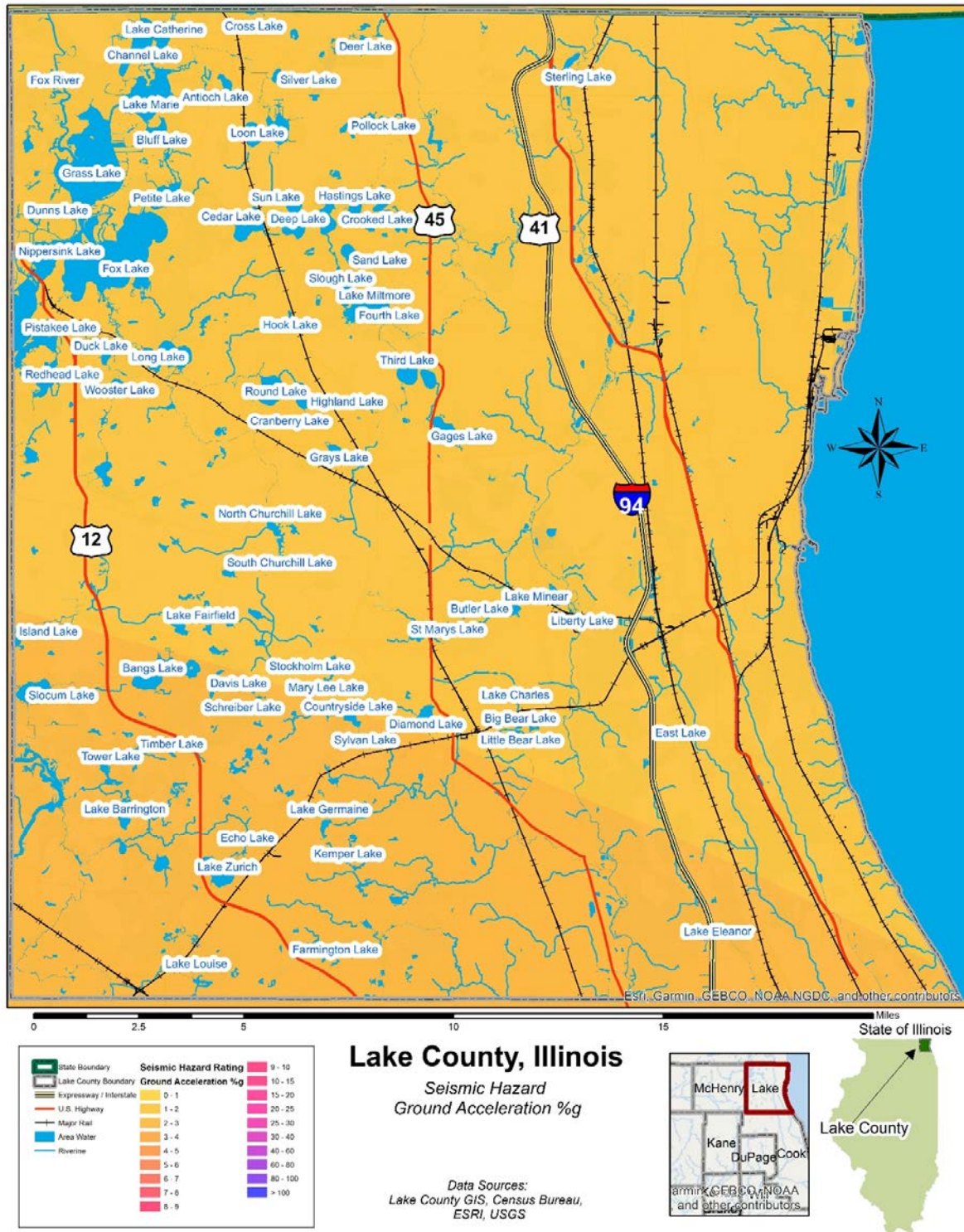
Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs	<4.2
II	Feeble	Some people feel it	
III	Slight	Felt by people resting; like a truck rumbling by	
IV	Moderate	Felt by people walking	
V	Slightly Strong	Sleepers awake; church bells 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	<6.9
IX	Ruinous	Some houses collapse, ground cracks, pipes break open	
X	Disastrous	Ground cracks profusely, many buildings destroyed, liquefaction and landslides widespread	<7.3
XI	Very Disastrous	Most buildings and bridges collapse, roads, railways, pipes and cables destroyed, general triggering of other hazards	<8.1
XII	Catastrophic	Destruction, trees fall, ground rises and falls in waves	>8.1

One way to express an earthquake's severity is to compare its acceleration to the normal acceleration due to gravity. Peak ground acceleration (PGA) measures the strength of ground movements in this manner. PGA represents the rate in change of motion of the earth's surface during an earthquake as a percent of the established rate of acceleration due to gravity. The lack of noticeable activity in Lake County can be partly attributed to the PGA. PGA is partly determined by what soils and bedrocks are present in the area.

In Lake County, the PGA is relatively low. Lake County is in the border area of eight (8) to six (6) PGA. This is interpreted as the area having the possibility of eight (8) percent to six (6) percent of gravities acceleration listed as 1g. These numbers would be denoted as 0.08g and 0.06g respectively. When the peak acceleration nears 0.1g, damage may be caused to poorly constructed buildings while acceleration nearing 0.2 would create loss of balance and greater damage to lesser quality structures.



**Exhibit 15: Lake County Seismic Hazard Ground Acceleration Map**





### 3.8.1 Earthquake Hazard Profile

Southern Illinois lies on the immediate boundary of the New Madrid fault, centrally located at New Madrid, Missouri. This fault has created significant activity over the last 200 years. The most intense activity occurred in the years 1811-1812. Two earthquakes estimated to be 7's on the Richter scale hit the New Madrid Fault. However, Lake County is located on the edge of the New Madrid fault area. According to the USGS-National Seismic Hazard Mapping Project (NSHMP), Lake County is predicted to have only a 2-3% chance of a magnitude 5.0 or greater earthquake over a 100-year period.

Illinois has recorded 364 earthquakes over the last two centuries. Most earthquakes have had epicenters in the Southern portion of the state and have not been felt in Lake County. Recent Earthquakes in Illinois are shown in Table 35.

An earthquake in northern Illinois occurred on February 10, 2010, at around 4:00 a.m. USGS recorded the earthquake as 3.8 in magnitude with the epicenter at Pingree Grove in Kane County and was felt in Lake County. Prior to that, a 5.2 earthquake on April 18, 2008, with epicenter in Wabash County, Illinois, was felt in Lake County. As shown in Figure 14 people in Lake County reported feeling the earthquake. People can report to USGS through their "Did You Feel It" website. USGS classified the Lake County reports from the April 2008 earthquake as "II" or weak. According to the USGS there have been no reports of earthquakes from 2017 to the current ANHMP update.

The future probability of earthquakes in Illinois is 100%, however the probability for a seismic event with the epicenter within Lake County is low. A large magnitude event in southern Illinois will be felt in Lake County, though the event would most likely cause limited structural damage in Lake County. Primarily historic and masonry buildings would be damaged.

**Table 35: Recent Earthquakes in Illinois**

Richter Scale	Date	Epicenter
5.0	May 10, 1987	Near Lawrenceville, IL
4.5	Sep. 28, 1989	15 miles south of Cairo, IL
4.7	Apr. 27, 1989	15 miles SW of Caruthersville, MO
4.6	Sep. 26, 1990	10 miles south of Cape Girardeau, MO
4.6	May 3, 1991	10 miles west of New Madrid, MO
4.2	Feb. 5, 1994	Lick Creek-Goreville Area
4.2	June 28, 2004	10 miles NNW of Ottawa, IL
5.2	April 18, 2008	Wabash County, Illinois
3.8	February 10, 2010	Pingree Grove, Kane County, IL
3.2	November 4, 2013	Summit, Cook County, IL
2.9	March 25, 2015	Lake in the Hills, McHenry County
3.4	May 29, 2015	Fairfield, Wayne County, IL

*Sources: 2010 and 2013 Illinois Natural Hazard Mitigation Plan, and USGS*

### 3.8.2 Vulnerability – Earthquake Impact

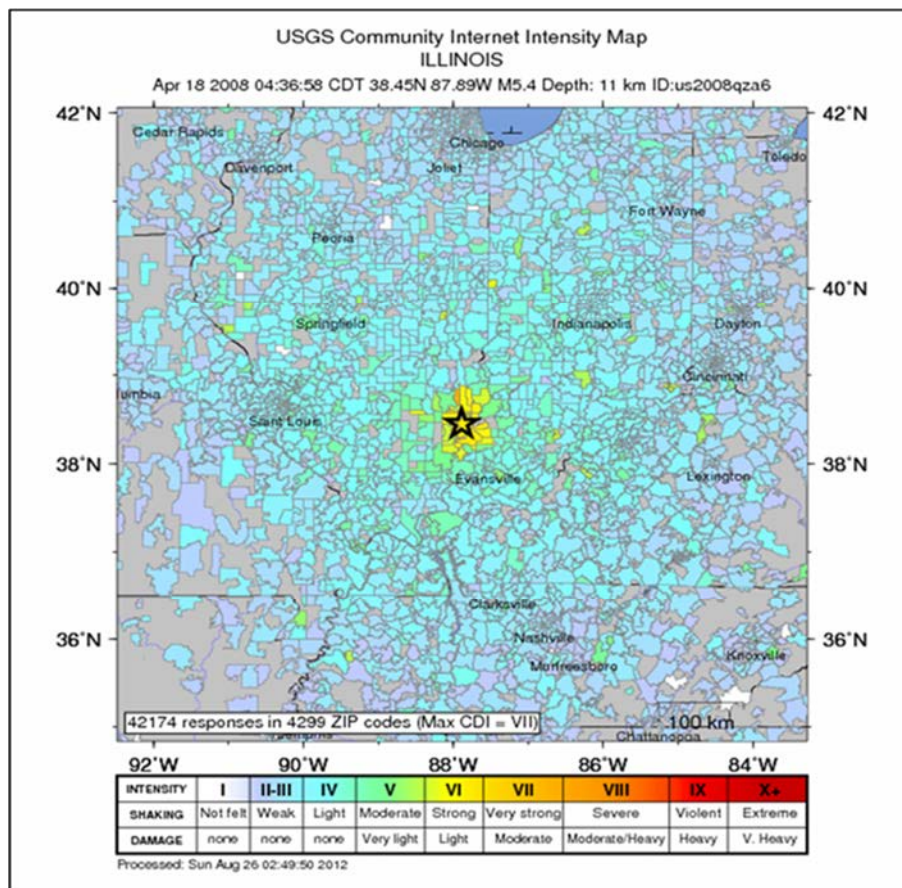
As mentioned previously, Lake County has peak acceleration much below that number, thus providing a buffer from most seismic activity. However, to the proximity to the New Madrid

Fault Line, the State of Illinois could be subject to an earthquake with a magnitude of 7.0 or more. Northern Illinois has had earthquakes with magnitudes of four and five in the previous century. These events are infrequent, and thus, predicting the amount of damage would be difficult due to a lack of history of events with epicenters in Lake County. The most active seismic county in proximity to Lake is Cook County, with eight recorded events.

**Health and Safety:** Health and safety concerns due to earthquakes for the people of Lake County is low.

**Damage to Buildings and Critical Infrastructure:** As mentioned, historic and masonry buildings could be damaged by a large southern Illinois. Most other buildings, and especially those built under a building code, would have little or no damage. Some content damage can be expected if items fall from shelves.

**Figure 14: “Did You Feel It” Reports for April 18, 2008, Earthquake in Wabash County, Illinois**



**Economic Impacts:** Potential for business loss due to earthquakes is low, however environmental impacts of earthquakes can be numerous, particularly if indirect impacts are considered. Some examples are shown below, but are unlikely to occur in Lake County:

- Induced tsunamis and flooding or landslides
- Poor water quality

- Damage to vegetation
- Breakage in sewage or toxic material containment
- Breakage of natural gas and other pipelines that serve Lake County
- Induced tsunamis and flooding or landslides
- Poor water quality
- Damage to vegetation
- Breakage in sewage or toxic material containment
- Breakage of natural gas and other pipelines that serve Lake County

**Multi-Jurisdictional Differences:** All Lake County jurisdictions can be impacted by earthquakes.

**Climate Change Considerations:** Although research on links between earthquakes and climate change is currently limited, some data suggest that drought (specifically extended ones that deplete rhizosphere soil moisture and/or groundwater loss/extraction) can influence earthquakes.<sup>9</sup>

### 3.9 Dam Failure

A dam is defined as a barrier constructed across a watercourse for storage, control, or diversion of water. Dams typically are constructed of earth, rock, concrete, or mine tailings. A dam failure is the collapse, breach, or other failure, often resulting in down-stream flooding.

A dam impounds water in the upstream area, referred to as the reservoir. The amount of water impounded is measured in acre-feet. An acre-foot is the volume of water that covers an acre of land to a depth of one foot. As a function of upstream topography, even a very small dam may impound or detain many acre-feet of water. Two factors influence the potential severity of a full or partial dam failure: the amount of water impounded, and the density, type, and value of development and infrastructure located downstream.

Dam failures typically occur when spillway capacity is inadequate and excess flow overtops the dam, or when internal erosion (piping) through the dam or foundation occurs. Complete failure occurs if internal erosion or overtopping results in a complete structural breach, releasing a high-velocity wall of debris-laden water that rushes downstream.

Dam failures can result from any one or a combination of the following causes:

- Prolonged periods of rainfall and flooding, which cause most failures
- Inadequate spillway capacity, resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage or piping
- Improper maintenance, including failure to remove trees, repair internal seepage problems, replace lost material from the cross section of the dam and abutments, or maintain gates, valves, and other operational components
- Improper design, including the use of improper construction materials and construction practices
- Negligent operation, including the failure to remove or open gates or valves during high flow periods
- Failure of upstream dams on the same waterway
- Landslides into reservoirs, which cause surges that result in overtopping
- High winds, which can cause significant wave action and result in substantial erosion

- Earthquakes, which typically cause longitudinal cracks at the tops of the embankments, which can weaken entire structures

Dam failure hazards are localized impacts and affect inundation areas downstream of the dam. Discharge from a dam breach is usually several times the 1% chance flood, called the probable maximum flood, and requires a dam breach analysis (hydraulic modeling study) to accurately estimate. Determining the impact of flooding due to dam failure is difficult to accomplish, especially for estimating loss of life. Loss of life is a function of the time of day, warning time, awareness of those affected and failure scenarios. Many dam safety agencies have used “population at risk,” a more quantifiable measurement of the impact to human life, rather than “loss of life.” Population at risk is the number of people in structures within the inundation area that would be subject to significant personal danger, if they took no action to evacuate. The impacts of a dam failure are contingent on many factors and, therefore, cannot be concisely described.

When they do occur, dam or levee failures can have a greater environmental impact than that associated with a flood event. Substantial amounts of sediment from erosion can alter the landscape changing the ecosystem. Hazardous materials can be carried away from flooded out properties and distributed throughout the floodplain. Industrial and agricultural chemicals and wastes, solid wastes, raw sewage, and common household chemicals comprise most of hazardous materials spread by flood waters along the flood zone, polluting the environment and contaminating private property and the community’s water supply.

Dam owners or operators are responsible for creating an Emergency Action Plan (EAP) that includes suggestions for dam protection, and procedures to notify emergency management authorities to conduct Emergency Operation Plans (EOPs). According to FEMA, an EOP defines the scope of preparedness and emergency management activities for a specific jurisdiction. EOPs are the responsibility of the governing jurisdiction at the state and local levels. Pre-event planning that can include risk assessment, plan preparation, and public outreach are also important components for reducing dam failure risk and potential damage.

### **3.9.1 Dam Hazard Profile**

Although no dam failures have been reported in Lake County, Grandwood Park Lake Dam was reported to have increased flooding issues starting in 2012 and being in danger of collapse in following years. The 2016 Mill Creek Watershed Plan determined a need for dam rehabilitation after analyzing the dam structure, embankment, and local impacts. LCSMC launched a dam rehabilitation project in 2018 in collaboration with partners including Grandwood Park and the Grandwood Park Park District. The project was successfully completed in 2019 and resulted in a reduced flood hazard.

Existing dam classification systems are numerous and vary within and between both federal and state agencies. Although differences in classification systems exist, they share a common thread: each system attempts to classify dams according to the potential impacts from a dam failure or mis-operation, should it occur. The hazard potential classification does not reflect in any way on the current condition of the dam (e.g., safety, structural integrity, flood routing capacity).



Ribbon cutting at Grandwood Park Lake Dam Grand Reopening on Sept 20, 2019.

State and federal classifications are the two primary dam hazard potential classification systems utilized in Lake County. Illinois dam classifications are defined under Ill. Admin. Code tit. 17, § 3702.30), and used to permit construction, operation, and maintenance of dams by the IDNR Division of Water Resource Management (DWRM). Federal dam safety hazard classifications can be found in FEMA's *Federal Guidelines for Dam Safety Hazard Potential Classification System for Dams* publication.

According to Title 17 Illinois Administrative Code (IAC), dams are categorized by Illinois state dam safety regulators in one of three classes according to the degree of threat to life and property in the event of dam failure:

**Class I:** “dams that are located where failure has a high probability to cause loss of life or substantial economic loss more than that which would naturally occur downstream of the dam if the dam had not failed. A dam has a high probability for causing loss of life or substantial economic loss if it is located where its failure may cause additional damage to such structures as a home, hospital, a nursing home, a highly traveled roadway, a shopping center, or similar type facilities where people are normally present downstream of a dam.” Similar to that of FEMA High Hazard Potential.

**Class II:** “dams located where failure has a moderate probability for causing loss of life or may cause substantial economic loss more than that which would naturally occur downstream of the dam if the dam had not failed. A dam has a moderate probability for causing loss of life or substantial economic loss if it is 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 of facilities where people are downstream of the dam for only a portion of the day or on a more sporadic basis.” Similar to FEMA Significant Hazard Potential.

**Class III:** “dams located where failure has a low probability for causing loss of life, where there are no permanent structures for human habitation, or minimal economic loss more than that which would naturally occur downstream of the dam if the dam had not failed. A dam has a low probability for causing loss of life or minimal economic loss if it is located where its failure may cause additional damage to agricultural fields, timber



areas, township roads or similar type areas where people are seldom present and where there are few structures.” Similar to FEMA Low Hazard Potential.

Dams in Lake County are listed in Table 36. Not listed is the Stratton Lock and Dam in McHenry. A potential failure of the Stratton Dam at the Stratton Lock and Dam would have a significant impact on the Fox Chain O’ Lakes in Lake County, but the condition of the dam and the locks are closely monitored by IDNR-OWR.

The Federal Emergency Management Agency (FEMA) categorizes dams “according to the degree of adverse incremental consequences of a failure or mis-operation of a dam. The National Inventory of Dams uses the federal classification system. Dams are federally categorized into Low, Significant and High Hazard Potential based on the probable loss of human life and the impacts on economic, environmental, and lifeline interests. Improbable loss of life exists where persons are only temporarily in the potential inundation area.

1. **Low Hazard Potential:** dams where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner’s property.
2. **Significant Hazard Potential:** dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns.
3. **High Hazard Potential:** dams where failure or mis-operation will probably cause loss of human life.

The location of all Lake County dams is mapped in Exhibit 16. An EAP is not required by the State of Illinois but is strongly recommended by the Illinois Department of Natural Resources. To find out if an EAP is in place, contact your State or emergency management agency, or visit the National Inventory of Dams website: <http://nid.usace.army.mil>

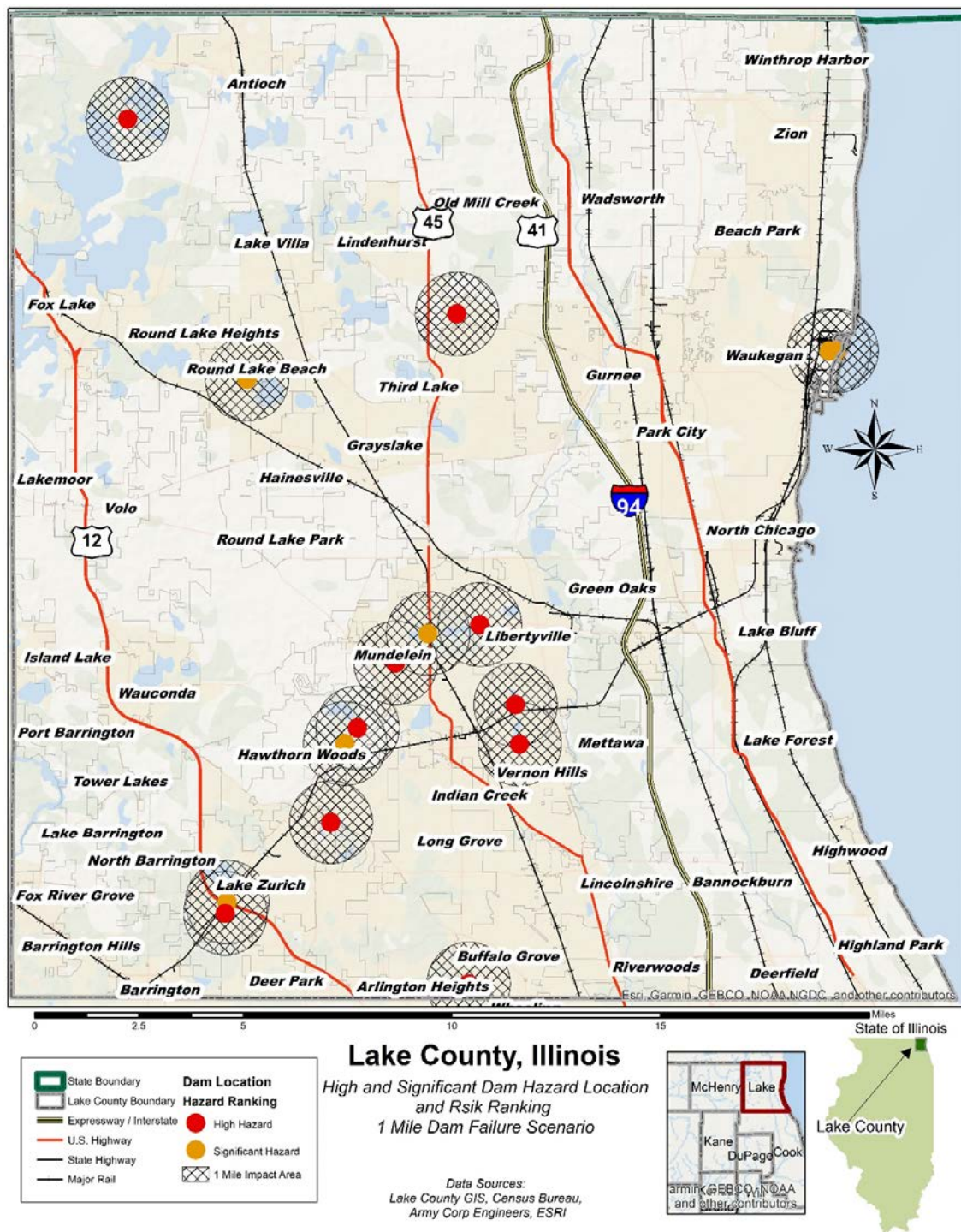
**Table 36: State Dam Hazard Classifications for Lake County**

Name of Dam	Stream	Hazard Potential	Class
Buffalo Creek	Buffalo Creek	High	I
Countryside Lake	Indian Creek	High	I
Forest Lake	Tributary to Indian Creek	High	I
Hawthorn Parkway	Seavey Drainage Ditch	High	I
Lake Charles	Seavey Drainage Ditch	High	I
St. Mary's Lake	Bull Creek	High	I
Tullamore	Seavey Drainage Ditch	High	I
Lancaster Court	Trib. Flint Creek	High	II
Coopers Farm Sediment Storage	Lake Marie - Off stream	High	N/A
Grandwood Lake	Mill Creek	High	N/A
Round Lake	Trib. Manitou Creek	Significant	II
Gray Hawk Center	Tributary of Flint Creek - Off stream	Significant	N/A
Loch Lomond	Bull Creek	Significant	N/A
Sylvan Lake	Trib. Indian Creek	Significant	N/A
Waukegan Station East Ash Pond	Trib. Lake Michigan	Significant	N/A
Waukegan Station West Ash Pond	Trib. Lake Michigan	Significant	N/A
Barclay Station Detention	Aptakisic Creek	Low	N/A
Countryside Landfill	Avon-Fremont Drainage Ditch	Low	N/A
Hawthorn Woods Country Club WWTP	Tributary of Indian Creek - Off stream	Low	N/A
Lake Amy	Cotton Creek-Off stream	Low	N/A
Lake Linden	Trib. Hastings Lake	Low	N/A
Lakeland Estates	Trib. Fox River	Low	N/A
Pond 2a	Trib. Fish Lake	Low	N/A
Rasmussen Lake	North Mill Creek	Low	N/A
Slocum Lake	Slocum Lake Ditch	Low	N/A
Timber Lake	Trib. Tower Lake	Low	N/A
Tower Lake	Trib. Fox River	Low	N/A
White Lake	Trib. Hastings Creek	Low	N/A
Lake Zurich Retail Center	No name	N/A	II

**Table 37: Name of Dam and National Inventory of Dam (NID) ID #**

Name of Dam	Owner	City	Water Course	Type	Height (Ft)	Length (Ft)	Max Storage (AF)	Max Discharge (ft <sup>3</sup> /s)
Waukegan Station East Ash Pond NID IL50696	Midwest Generation, LLC	Waukegan	Trib Lake Michigan	RE	20	N/A	120	N/A
Waukegan Station West Ash Pond NID IL50697	Midwest Generation, LLC	Waukegan	Trib Lake Michigan	RE	20	N/A	140	N/A
Round Lake NID IL00593	Village Of Round Lake Beach	Round Lake Beach	Trib Manitou Creek	RE	9	140	1484	187
Sylvan Lake NID IL00640	Sylvan Lake Homeowners Association	Long Grove	Trib Indian Creek	RE	15	120	207	N/A
Pond 2a NID IL55122	DRH Cambridge Homes	Voio	Trib Fish Lake	RE	8	180	125	395
Gray Hawk Center NID IL55044	Hamilton Partners, Inc.	Lake Zurich	Trib Flint Creek - Offstream	RE	8	450	19	N/A
Hawthorn Woods Country Club WWTP NID IL55113	Toll il WHCC Lp	Hawthorn Woods	Trib Indian Creek - Offstream	RE	17	1300	164	N/A
Loch Lomond ID IL00652	Loch Lomond POA	Mundelein	Bull Creek	RE	14	550	821	2823
Coopers Farm NID IL55139	IDNR	Antioch	Lake Marie - Offstream	RE	13	2500	6	N/A
Forest Lake NID IL00638	Ela Township Highway Dept.	Hawthorn Woods	Trib Indian Creek	RE	11	125	561	1684
Countryside Lake NID IL01001	Countryside Lake Association	Long Grove	Indian Creek	RE	9	165	934	1292
St. Mary's Lake NID IL00654	Archdiocese Of Chicago	Libertyville	Bull Creek	PG	12	389	966	320
Lake Charles NID IL01149	Village Of Vernon Hills	Vernon Hills	Seavey Drainage Ditch	CN	9	390	494	4800
Barclay Station Detention NID IL50192	PENOBSCOT	Vernon	Aptakisic Creek	Other	9	560	200	700
Tullamore NID IL50260	Mundelein Park & Recreation District	Mundelein	Seavey Drainage Ditch	RE	17	600	106	1000
Countryside Landfill NID IL55008	Waste Management	Grayslake	Avon-Fremont Drainage Ditch	RE	13	960	66	N/A
Hawthorn Parkway NID IL55031	Village Of Vernon Hills	Vernon Hills	Seavey Drainage Ditch	RE	9	200	910	N/A
Lancaster Court NID IL55174	Columbus Nova	Deer Park	Trib Flint Creek	RE	8	240	N/A	N/A
Grandwood Lake NID IL55177	Grandwood Park Park District	Grandwood Park	Mill Creek	RE	N/A	N/A	N/A	N/A
Tower Lake NID IL00630	Tower Lakes Improvement Association	Fox River Grove	Trib Fox River	RE	12	200	421	N/A
Lake Linden NID IL00646	Morton Engel	Lindenhurst	Trib Hastings Lake	RE	10	600	169	N/A
Slocum Lake NID IL50007	Williams Park Improvement Association	Wauconda	Slocum Lake Ditch	RE	8	30	900	185
Lake Amy NID IL00636	Oak Hollow Farm	Wauconda-Offstream	Cotton Creek-Offstream	RE	18	370	62	N/A
Rasmussen Lake NID IL01181	Lake County Forest Preserve District	Millburn-Offstream	North Mill Creek	RE	19	600	370	N/A
Timber Lake NID IL00632	Michael Graff	Tower Lake	Trib Tower Lake	RE	20	320	292	N/A
White Lake NID IL00644	Neumann Homes, Inc.	Hickory Corners-Offstream	Trib Hastings Creek	RE	11	650	217	N/A
Buffalo Creek NID IL50013	MWRD	Long Grove	Buffalo Creek	RE	27	620	1695	19684
Lakeland Estates NID IL00614	Tower Lakes Improvement Association	Tower Lake	Trib Fox River	RE	9	140	87	N/A

# Exhibit 16: High and Significant Dam Hazard Locations



A dam can fail at any time, given the right circumstances. However, the probability of future occurrence is for regulated dams can be reduced due to proactive preventative action in compliance with IDNR-OWR's dam safety program. Illinois' dam safety program provides for

safety recommendations for signs, buoys, and short and long-term structural modifications – including dam removal.

As a dam ages, the likelihood of failure increases as undesirable woody vegetation on the embankment, deteriorated concrete, inoperable gates, and corroded outlet pipes become problems. Since dam failures are often exacerbated by flooding, the probability of dam failures can be associated with projected flood frequencies. Dam structures on the Des Plaines River can cause impairment to riverine natural dynamics, instream hydraulics, instream habitat and floodplain habitats. Lake County removed the last two dams on the Des Plaines River in Lake County in 2016.

### 3.9.2 Vulnerability – Dam Failure Impact

Dam-breach analyses and the mapping of potential dam breach inundation areas are the most appropriate means for examining the impact to people and to property. A vulnerability analysis for dam failure for the dams listed has not been conducted for the dams listed in due to insufficient data. Vulnerability analyses can be conducted as individual dam failure analyses and inundation mapping are completed. Exhibit 16 identifies significant and high hazard dams as well as a 1-mile buffer area around the identified dams. The intersect function was utilized within the ArcGIS ArcMap application to identify critical facilities that fall within a 1-mile radius of these areas. This methodology was developed to provide a baseline of areas of potential concern due to data limitations related to available inundation mapping. Based on the analyses performed, 291 critical facilities fall within the 1-mile buffer areas throughout Lake County. A full listing of these assets is included in Appendix B.

Jurisdiction	Severe Winter Storm	Tornado	Severe Summer Storm	Extreme Heat	Flood	Drought	Groundwater Flood	Earthquake	Erosion	Dam Failure	Seiche	Power Outage
Antioch	H	H	H	M	H	L	VL	L	VL	L	VL	H
Bannockburn	H	M	H	H	M	L	H	L	L	VL	VL	H
Barrington	H	H	H	L	M	M	L	L	VL	VL	VL	M
Barrington Hills	H	H	H	H	H	M	H	L	L	M	L	H
Beach Park	H	H	H	M	L	M	M	H	M	VL	L	H
Buffalo Grove	H	H	H	H	M	M	VL	L	M	L	M	H
Deer Park,	H	H	H	H	M	M	M	M	M	M	L	H
Deerfield	M	M	M	M	M	M	VL	VL	M	VL	VL	M
Fox Lake	H	H	H	H	H	H	H	H	M	M	L	H
Fox River Grove	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL
Grayslake	L	M	M	L	M	L	L	VL	VL	VL	VL	L
Green Oaks	H	M	H	M	M	L	L	VL	VL	VL	VL	L
Gurnee	H	H	H	H	H	H	H	L	M	VL	VL	H
Hainesville	H	H	H	H	H	H	H	M	L	L	VL	H
Hawthorn Woods	H	H	H	M	L	L	M	L	VL	VL	VL	L



Jurisdiction	Severe Winter Storm	Tornado	Severe Summer Storm	Extreme Heat	Flood	Drought	Groundwater Flood	Earthquake	Erosion	Dam Failure	Seiche	Power Outage
Highland Park	H	H	H	H	H	M	M	M	H	VL	L	H
Highwood	H	H	H	H	H	H	M	H	L	L	L	H
Indian Creek	H	H	H	M	M	L	L	L	L	VL	VL	M
Island Lake	H	M	M	H	H	L	H	VL	VL	VL	VL	L
Kildeer	H	H	M	M	M	M	M	H	M	VL	VL	H
Lake Barrington	H	L	H	H	M	L	M	L	H	M	M	H
Lake Bluff	H	M	H	M	M	VL	VL	L	H	VL	L	M
Lake County	H	H	H	H	H	M	H	L	L	M	L	H
Lake Forest	H	L	H	H	H	M	M	VL	M	VL	L	H
Lake Villa	H	H	H	H	H	H	H	M	L	VL	VL	H
Lake Zurich	H	H	M	M	M	L	M	VL	L	L	VL	L
Lakemoor	H	H	H	H	H	H	M	M	L	VL	L	H
Libertyville	L	M	M	M	M	M	L	L	L	L	VL	M
Lincolnshire	H	M	H	L	H	L	L	VL	M	L	L	H
Lindenhurst	H	H	M	M	M	L	M	L	L	VL	H	H
Long Grove	M	M	M	M	M	L	M	M	M	VL	L	M
Mettawa	M	M	H	H	M	M	H	H	VL	VL	VL	M
Mundelein	H	L	H	H	M	L	M	L	H	M	M	H
North Barrington	H	H	H	L	M	M	L	L	VL	VL	VL	M
North Chicago	H	L	H	H	H	L	L	VL	L	VL	VL	H
Park City	H	H	H	H	H	H	VL	VL	M	VL	VL	M
Port Barrington	H	H	H	H	H	H	H	M	M	M	L	H
Riverwoods	M	M	M	M	M	L	M	L	M	VL	L	M
Round Lake	H	H	H	H	M	M	M	H	M	VL	VL	H
Round Lake Beach	H	M	H	M	H	M	H	L	H	L	M	H
Round Lake Heights	H	H	H	H	H	M	M	M	M	VL	VL	H
Round Lake Park	H	H	H	H	H	H	H	M	H	L	VL	H
Third Lake	M	M	H	M	M	M	VL	VL	H	M	VL	H
Tower Lake	M	M	M	M	M	M	M	L	M	L	L	H
Vernon Hills	H	H	H	M	L	L	L	VL	L	VL	VL	M
Volo	H	H	M	M	M	VL	VL	M	VL	VL	VL	M
Wadsworth	M	M	H	H	M	M	H	H	VL	VL	VL	M
Wauconda	H	M	H	H	M	M	M	L	M	VL	VL	H
Waukegan	H	M	H	H	M	M	M	L	M	VL	VL	H
Winthrop Harbor	M	H	H	H	H	H	M	H	H	M	VL	H
Zion	H	L	H	H	H	M	H	M	H	VL	VL	H

Appendix B.

**Multi-Jurisdictional Differences:** Most Lake County communities have a dam located within their jurisdiction, as shown in Exhibit 16. Nine of the eleven Class I and II dams listed in Table 36 are in the Des Plaines River Watershed (Buffalo Creek, Bull Creek, Indian Creek, and Seavey Drainage Ditch). The other two dams (Class II) are within the Fox River Watershed (Manitou Creek and unnamed).

**Climate Change Considerations:** Increases in rainfall may outpace dam capacities depending on their maximum storage. See

<b>Name of Dam</b>	<b>Stream</b>	<b>Hazard Potential</b>	<b>Class</b>
Buffalo Creek	Buffalo Creek	High	I
Countryside Lake	Indian Creek	High	I
Forest Lake	Tributary to Indian Creek	High	I
Hawthorn Parkway	Seavey Drainage Ditch	High	I
Lake Charles	Seavey Drainage Ditch	High	I
St. Mary's Lake	Bull Creek	High	I
Tullamore	Seavey Drainage Ditch	High	I
Lancaster Court	Trib. Flint Creek	High	II
Coopers Farm Sediment Storage	Lake Marie - Off stream	High	N/A
Grandwood Lake	Mill Creek	High	N/A
Round Lake	Trib. Manitou Creek	Significant	II
Gray Hawk Center	Tributary of Flint Creek - Off stream	Significant	N/A
Loch Lomond	Bull Creek	Significant	N/A
Sylvan Lake	Trib. Indian Creek	Significant	N/A
Waukegan Station East Ash Pond	Trib. Lake Michigan	Significant	N/A
Waukegan Station West Ash Pond	Trib. Lake Michigan	Significant	N/A
Barclay Station Detention	Aptakiscic Creek	Low	N/A
Countryside Landfill	Avon-Fremont Drainage Ditch	Low	N/A
Hawthorn Woods Country Club WWTP	Tributary of Indian Creek - Off stream	Low	N/A
Lake Amy	Cotton Creek-Off stream	Low	N/A
Lake Linden	Trib. Hastings Lake	Low	N/A
Lakeland Estates	Trib. Fox River	Low	N/A
Pond 2a	Trib. Fish Lake	Low	N/A
Rasmussen Lake	North Mill Creek	Low	N/A
Slocum Lake	Slocum Lake Ditch	Low	N/A
Timber Lake	Trib. Tower Lake	Low	N/A
Tower Lake	Trib. Fox River	Low	N/A
White Lake	Trib. Hastings Creek	Low	N/A
Lake Zurich Retail Center	No name	N/A	II

Table 37 to reference dam storage capacity.

### 3.10 Temperature Extremes

Extreme temperatures can be dangerous due to the way that they affect individuals who are exposed to them. Extreme heat is usually defined through a combination of temperature and humidity. Extreme cold is based on the temperature with wind chill. The recorded extreme heat events have occurred from June through September. Recorded extreme cold events in Northern Illinois have occurred from December through February. Extreme temperatures can be dangerous to people and crops.

**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 is the number one weather-related killer in the United States. It causes more fatalities each year than floods, lightning, tornadoes, and hurricanes combined.

**Table 38: Relationship between Heat Index & Heat Disorders**

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

Source: NOAA

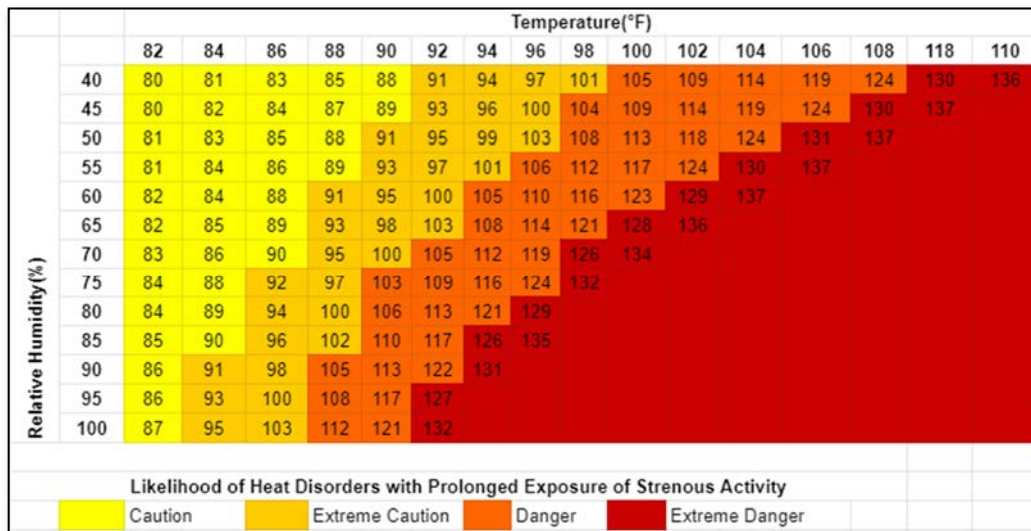
In the Midwest, summers tend to combine both high temperature and high humidity. Heat disorders generally have to do with a reduction or collapse of the human body's ability to shed heat due to circulatory changes or a chemical (salt) imbalance caused by too much sweating. When the body heats too quickly to cool itself safely, or when too much fluid is lost through dehydration or sweating, the body temperature rises, and heat-related illnesses may develop. The heat index, or apparent temperature, is what the temperature feels like to the human body when relative humidity is combined with air temperature. When relative humidity is high, the rate of sweat evaporation decreases and increases the apparent temperature. A high heat index increases the risk for heat disorders. shows heat index levels depending on the humidity and temperature.

The most significant extreme heat event recorded by the NCEI in the area occurred in 1995. According to NOAA, an intense heat wave affected northern Illinois from Wednesday, July 12 through Sunday, July 16, 1995. The 1995 heat wave tied or broke several temperature records at Rockford and Chicago. But what set this heat wave apart from others was the extremely high humidity. Dew point temperatures peaked in the lower 80s late Wednesday the 12th and Thursday the 13th and were generally in the middle and upper 70s through the rest of the hot spell. The combined and cumulative effects of several days of high temperatures, high humidity, intense July sunshine (100% possible sunshine recorded at O'Hare Airport in Chicago July 13) and light winds took their toll. 583 people died because of the heat in Chicago and surrounding areas. Lake County recorded 1 death in Ingleside because of this heat wave.

Since 2017 the NCEI has reported 2 events of heat and excessive heat. In July 2017, peak afternoon heat indices were between 110 to 115 degrees. A notable heat wave persisted from June 13 to June 16 in 2022, with highs in the 90s each day. No injuries or deaths were attributed to the events.



**Figure 15 NOAA's National Weather Service Heat Index**

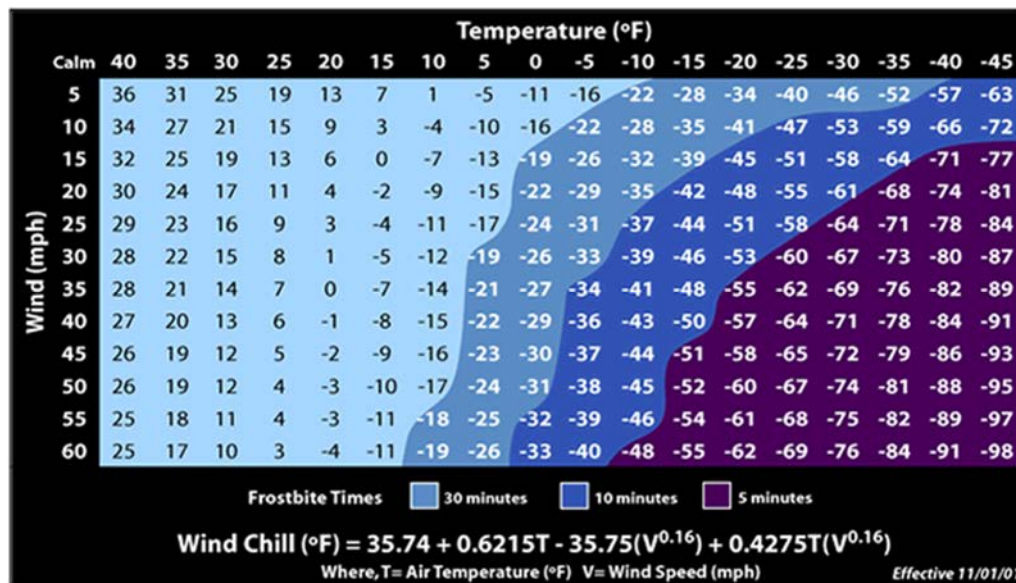


**Extreme Cold:** The term “extreme cold” can have varying definitions in hazard identification. Generally, extreme cold events refer to a prolonged period (days) with extremely cold temperatures. An extreme cold event to the National Weather Service can refer to a single day of extreme or record-breaking 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. An extreme cold event occurred on January 29, 2019, that lasted approximately two days. The coldest temperature in Chicago in 34 years was recorded during the 2019 event, and highs on January 30 were only in the negative double digits.

**Wind Chill Index:** The Wind Chill Index is a measure of the rate of heat loss from exposed skin caused by the combined effects of wind and cold. As the wind increases, heat is carried away from the body at a faster rate, driving down both the skin temperature and eventually the internal body temperature.

Exposure to extreme wind chills can be life threatening. The NOAA's chart below 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 approach -19°F and below, there is an increased likelihood that continued exposure will lead to individuals developing cold-related illnesses.

Figure 16: Wind Chill Chart



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

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

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

Extreme cold is also responsible for several fatalities each year. Threats, such as hypothermia and frostbite, can lead to loss of fingers and toes or cause permanent kidney, pancreas, and liver injury and even death. Major winter storms can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, and cold temperatures. Fifty percent of cold-related injuries happen to people over sixty years of age. More than seventy-five percent happen to males, and almost twenty percent occur within the home.

Extreme cold, in extended periods, although infrequent, could occur throughout the winter months in Lake County. Heating systems compensate for the cold outside. Most people limit their time outside during extreme cold conditions, but common complaints usually include pipes freezing and cars refusing to start. When cold temperatures and wind combine, dangerous wind chills can develop.

**Table 39: Cold Weather Threat Levels**

<b>Excessive Cold Threat Level</b>	<b>Threat Level Descriptions</b>
<b>Extreme</b>	<b>"An extreme threat to life and property from excessive cold."</b> It is likely that wind chill values will drop to -35F or below for 3 hours or more. Or, lowest air temperatures less than or equal to -20F
<b>High</b>	<b>"A high threat to life and property from excessive cold."</b> It is likely that wind chill values will drop to -28F to -35F for 3 hours or more. Or, lowest air temperature -15F to -20F.
<b>Moderate</b>	<b>"A moderate threat to life and property from excessive cold."</b> It is likely that wind chill values will drop to -20F to -28F or below for 3 hours or more. Or, lowest air temperature -10F to -15F.
<b>Low</b>	<b>"A low threat to life and property from excessive cold."</b> It is likely that wind chill values will drop to -15F to -20F or below for 3 hours or more. Or, lowest air temperature -5F to -10F.
<b>Very Low</b>	<b>"A very low threat to life and property from excessive cold."</b> It is likely that wind chill values will drop to -10F to -15F or below for 3 hours or more. Or, lowest air temperature zero to -5F.
<b>Non-Threatening</b>	<b>"No discernable threat to life and property from excessive cold."</b> Cold season weather conditions are non-threatening.

### 3.10.1 Extreme Temperature Hazard Profile

Table 40 shows the past extreme heat events in northeastern Illinois. The most severe event was in July 1995, which resulted in 583 fatalities. Most of the deaths occurred in Cook County. The temperatures soared to record highs in July with the hottest weather occurring from July 12 to July 16. The high of 106°F (41°C) on July 13 was the second warmest July temperature (warmest being 110°F (43°C) set on July 23, 1934) since records began at Chicago Midway International Airport in 1928. Nighttime low temperatures were unusually high; in the upper 70s and lower 80s°F (about 26°C) as well. Record humidity levels also accompanied the hot weather. The heat index reached 119°F (48°C) at O'Hare airport, and 125°F (52°C) at Midway Airport.

**Table 40: Extreme Heat Events in Lake County (1995-2022)**

Location	Date	# of Fatalities	# of Injuries
Northeast Illinois	July 12, 1995	583	0
Northeast Illinois	July 21, 1999	13	0
Northeast Illinois	July 28, 1999	99	0
Northeast Illinois	July 04, 2012	0	0
Lake County	July 19, 2019	0	0
Lake County	June 14, 2022	0	0
<b>TOTALS</b>		<b>695</b>	<b>0</b>

No damage was reported with the recorded extreme heat events. Reported high heat events over the past 16 years provide an acceptable framework for determining the future occurrence in terms of frequency for such events. The probability of the county and its municipalities experiencing a high heat event can be difficult to quantify but based on a historical record of 4 heat events since 1995, it can reasonably be assumed that this type of event has occurred once every 6.75 years from 1995 through 2022.

*[(Current Year) 2022] subtracted by [(Historical Year) 1995] = 27 Years on Record*

*[(Years on Record) 27] divided by [(Number of Historical Events) 4] = 6.75*

The historic frequency calculates that there is an 18% chance of an extreme heat event occurring each year.

**Extreme Cold:** Table 41 shows the recorded extreme cold events for northeastern Illinois.

Reported extreme cold events over the past 21 years provide a framework for determining the future occurrence in terms of frequency for such events. The probability of the county and its municipalities experiencing an extreme cold event can be difficult to quantify but based on a historical record of 12 extreme cold events occurring since 1996, it can be estimated that this type of event has occurred once every 1.75 years from 1996 through 2022.

**Table 41: Extreme Cold Events in Lake County (1996-2022)**

Location	Date	# of Fatalities	# of Injuries
Northeast Illinois	2/2/1996	3	0
Northeast Illinois	1/23/2003	1	0
Northeast Illinois	1/29/2004	0	0
Northeast Illinois	2/18/2006	1	0
Northeast Illinois	2/3/2007	0	0
Northeast Illinois	2/10/2008	0	0
Northeast Illinois	12/21/2008	0	0
Northeast Illinois	1/15/2009	0	0
Northeast Illinois	1/06/2014	0	0
Lake County	01/29/2019	0	0
Lake County	02/14/2021	0	0
Lake County	01/26/2022	0	0
<b>TOTALS</b>		5	0

*[(Current Year) 2022] subtracted by [(Historical Year) 1996] = 26 Years on Record*

*[(Years on Record) 26] divided by [(Number of Historical Events) 12] = 2.17*

The historic frequency calculates that there is a 46% chance of an extreme cold event occurring each year.

### **3.10.2 Vulnerability – Extreme Temperature Impact**

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

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



dehydration. Children and the elderly are most at risk. Loss of life is common with extreme heat events.

Loss of life is also common with extreme cold events. Safety is also a large concern during extreme cold events, and numerous injuries can occur, including frostbite and other accidents. Therefore, the impact on people due to extreme heat and extreme cold is **high**.

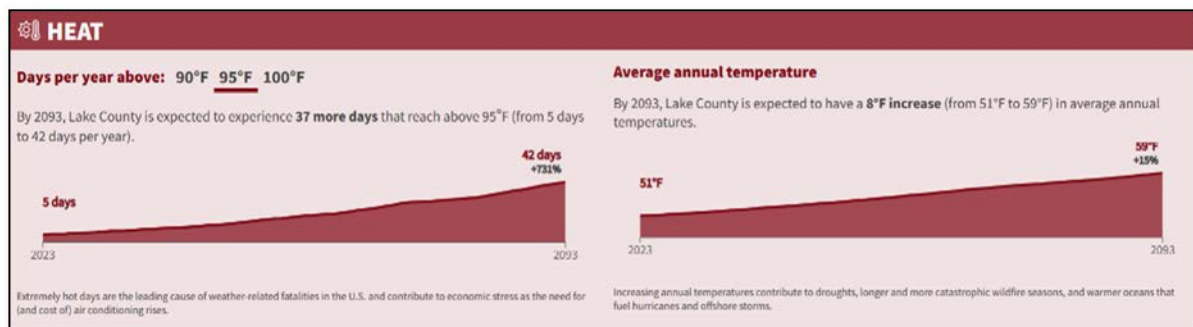
**Damage to Buildings:** Heat has little or no impact on structures. Extreme cold can cause water pipes to burst, but there is limited other damage. Impact on buildings is **low**.

**Damage to Critical Facilities:** Extreme heat can have an impact on the demand on electric utilities, otherwise the impact to critical facilities due to extreme heat is **low**. Extreme cold can have an impact on community-owned water mains that can burst.

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

**Multi-Jurisdictional Differences:** All of Lake County is at risk with extreme temperatures.

**Climate Change Considerations:** The frequency intensity of extreme heat events is increasing in Illinois due to climate change. By the end of the century, the annual hottest 5-day maximum temperature in northern Illinois is projected to increase from 92°F to a range of 96–104°F under the lower scenario and 100–110°F under the higher scenario (RCP8.5).<sup>2</sup> According to data provided by Neighborhoods At Risk, Lake County could experience an average annual temperature increase of 8 degrees and experience an additional 37 days that reach above 95 degrees.



### 3.11 Soil Erosion - Shoreline, Coastal and Ravine

Erosion is a natural process. Streams, riverbanks, and lake shorelines in their natural state erode slowly, and then often re-stabilize with vegetative growth. Changes in shorelines due to development, changed or removed vegetation, or higher frequencies of flooding destabilize shorelines and accelerate erosion. Erosion can be destructive to property and put structures at risk. Lake County is affected by three types of erosion: shoreline, coastal, and ravine.

*“Erosion may be the result of naturally occurring inputs, such as precipitation, or human intervention in the form of urban development, forestry, mining, flow diversions, flood regulation, navigation, and other activities. The basic premise is that streams are constantly attempting to attain a state of balance involving the stream geometry (dimensions, pattern, profile), the properties of the stream bed, the bank material, and the external inputs imposed. “*

*FEMA Riverine Erosion Hazard Areas, 9/99*

### **3.11.1 Shoreline Erosion Hazard Profile**

Shoreline erosion, for purposes of this discussion, includes the erosion conditions associated with rivers, streams, and inland lakes in Lake County. Erosion can generate streambank or shoreline loss and accumulate and/or deposit sediment downstream or within the lake. Shoreline erosion can alter the location of the stream (centerline). The flow velocities in eroded streams are also altered and can exacerbate the erosion conditions.

These conditions can be created due to an alteration of the shoreline or due to the changing water levels in the stream or the lake. Development and urbanization create more runoff – and create runoff more often. This means that streams must carry more water and carry it more often, and at higher velocities. The higher velocity flows can strip vegetation and carry soil and sediment. Scour along the banks and in the stream or river is created by the higher velocity flows. The fluctuating stream levels impact the vegetation along the streams and the vegetation can be lost. Channelized stream reaches are less stable and more erosive than meandering sections.

Along lakes, higher lake levels can impact both the vegetation and the soil along the shoreline. Velocity is not a concern alone inland lake shores, but wave action from wind or boats can compound the impact of higher lake levels.

When eroded, soil is transported downstream, and the sediment can reduce the carrying capacity of streams and can fill culverts. The rate of shoreline erosion is difficult to estimate. Water quality is impacted by erosion.

All eroded sediment is eventually deposited where water flow slows (i.e., lakes, wetlands, stream channels or floodplains). The site where sediment accumulates may be far from the eroded area. Sedimentation can block culverts and ditches, cause the loss of channel conveyance, and reduce floodplain storage, thereby creating or worsening flooding problems. In addition to exacerbating flood problems, excessive sediment loads degrade water quality and recreational assets. Sediment removal can be very expensive and may be cost prohibitive.

### **3.11.2 Coastal Erosion Hazard Profile**

Illinois is included in the 34 coastal states of the United States due to Lake Michigan and Lake County is subject to coastal erosion. Coastal Erosion is measured as the rate of change in the position or horizontal displacement of a shoreline over a period of time. It is generally associated

with storm surges, hurricanes, windstorms, and flooding hazards, and may be exacerbated by human activities such as boat wakes, shoreline hardening, and dredging.

Coastal erosion is a hydrologic hazard defined as the wearing away of land and loss of beach, shoreline, or dune material because of natural coast processes or manmade influences. It can be manifested as recession and degradation of major dune systems or development of steep scarps along the near shore beach face. Natural coastal processes that cause coastal erosion include the actions of winds, waves, and currents. Human influences include construction of seawalls, jetties, navigation inlets and dredging, boat wakes and other interruptions of physical processes. Natural or human caused, coastal erosion is a “destroyer hazard,” meaning that the land is lost or destroyed because of the erosion.

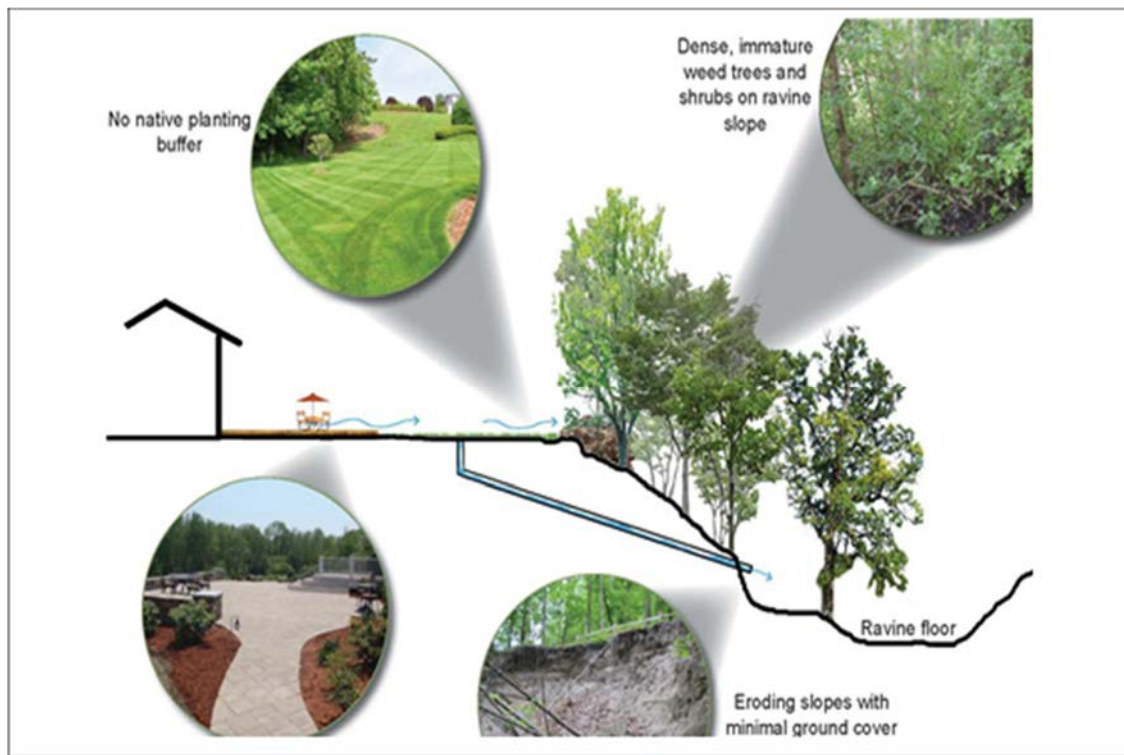
Coastal erosion is the landward displacement of the shoreline caused by the forces of waves and currents (as defined by the US National Oceanic and Atmospheric Administration). It is the process that affects the landmass of an area as a consequence of a body of water acting upon it. Lake County is bordered entirely on the east by Lake Michigan, and the southern two-thirds of the Lake Michigan shoreline includes steep slopes that are affected by erosion. Other areas of the Lake Michigan shoreline can be impacted by changing lake levels.

The shoreline of Lake Michigan is not static. “The historical record of coastal change along the Illinois shore of Lake Michigan indicates that the most dynamic coastal area in the state of Illinois is located between the Illinois-Wisconsin state line and the Waukegan Harbor” (ISGS, 1998:1). Erosion and accretion create a constant need to dredge harbor areas and fill along the shoreline.

### **3.11.3 Ravine Erosion Hazard Profile**

The steeper the channel and the greater the runoff volume, then the higher the flow velocity and the greater the erosion potential. Similarly, the steeper the bank, the more potential there is for instability and erosion. Areas prone to the most erosion damage are the ravines. Ravine erosion is of concern to Lake County’s Lake Michigan Watershed. Flowing water has the energy to erode most of the soils in Lake County.

Figure 17 is from the Openlands’ “Landowner’s Guide: Ravine and Tableland Preservation,” (2013). It shows the tree growth that, with potentially shallow roots, can tear away the bank with high flow velocities. The graphic also shows an outfall pipe well above the ravine floor that can erode the bank, even when the ravine is dry, with flow coming from pipes.

**Figure 17: Ravine and Tableland Preservation**

#### 3.11.4 Vulnerability - Erosion Hazard Impact

Erosion in the ravines commonly threatens sanitary sewers, roads, and building foundations. Lake erosion affects boat facilities, septic systems and building foundations. Erosion on fast flowing streams may threaten bridges and roads and may also encroach on septic systems and foundations. Bank erosion impacts can potentially affect 4.58% of Lake County. This consists of areas with slopes 8% or greater, which translates to approximately 13,900 acres out of a total of approximately 303,600 acres in Lake County. This percentage is for all of Lake County, both inland and coastal slopes.

The greatest potential for erosion occurs on steep slopes. According to the Lake County Regional Framework Plan, steep slopes, 8% and greater in Lake County cover approximately 16,895 acres, or 18.52 square miles, which translates into approximately 4% of the County area.

A coastal erosion hazard can potentially affect 4% of the communities within Lake County (per the Regional Framework Plan). To provide the most accurate information for each affected community in Lake County, aerial maps should be overlaid with coastal erosion maps to determine the location of potentially impacted structures. The information should then be ground-proofed to determine the number and type of impacted structures. This information will identify the magnitude of potential impacts that coastal erosion can cause to the County, specifically determining the number of structures located along the shoreline of Lake Michigan. This activity should be considered during the next 5-year update.

Highland Park, Highwood, Lake Bluff, Lake Forest, and North Chicago are potentially affected by coastal erosion; however, the risk is low to structures in these communities.

Property in several communities, including Beach Park, are being impacted by ravine erosion. Heavy rainfall and flooding events have created unstable slopes along Bull Creek. These slopes continue to slump and slide. Foundations can potentially be compromised by a slope failure. The homes could potentially be destroyed and injury or the loss of life could result.



**Beach Park, Illinois**

The potential of bank erosion in Lake County is relatively **high** due to the number of steep ravines and coastal slopes, streams, and channels in the Lake Michigan Watersheds. There has been no recorded history, however, of landslides in Lake County.

**Multi-Jurisdictional Differences:** The communities of Lake Bluff, Lake Forest, Highwood, Highland Park, North Chicago, and Winthrop Harbor are subject to coastal flooding from Lake Michigan.

**Climate Change Considerations:** Increased precipitation and more intense rain events associated with climate change will increase soil erosion. Warmer temperatures increase rates of evaporation and plant transpiration, leading to more moisture in the atmosphere, more precipitation overall, and heavier precipitation events. This phenomenon is best described as an acceleration of the water cycle. This acceleration leads to problems like more flooding, increased soil erosion, reduced water quality, and the disruption of activities such as farming and transportation. The changing pattern of increased overall precipitation and heavy precipitation events is happening throughout the Midwest.

Additional research is needed to fully understand this coastal and shoreline erosion to predict climate change related impacts on Lake County's coastline. "Warmer future temperatures will result in more evaporation (from the Lake) and evapotranspiration (from soils) during the summer and winter, when there is expected to be less future lake ice. Although some studies (e.g., Lofgren and Rouhana 2016; Notaro et al. 2015) have suggested modest changes in future lake levels of a few inches' decrease or increase, there is significant uncertainty in these projections. Because of the potential for higher lake levels to damage coastal infrastructure and increase coastal erosion, there is substantial concern about the potential for projected increases of winter and spring precipitation to increase lake levels."



### **3.12 Power Outage**

**Overview:** Although power outages are classified as technological disasters, they are a common secondary effect of natural disasters and were chosen to be included in the 2022 update to the ANHMP. A power outage is the loss of electrical power in a facility or community. Power outages can cause the failure of key systems such as lighting, heating, air conditioning, ventilation, computer systems, life support, and water pumping stations, sewage treatment, telecommunications, and many others. Failure of one or more of these systems in jurisdictions can cause life safety or health concerns.

Power outages may be the cause of several natural disasters; most commonly wind events, or the cause of a manmade incident such as accidental cutting of a power line. The most common scenarios of natural disasters resulting in power outages include:

- Winds may blow down trees or tree limbs which fall onto power lines, breaking them (most common).
- High winds may blow down utility poles snapping power lines.
- Ice and snow may weigh down power lines causing breakage.

Construction or maintenance operations may also accidentally cut power lines. Most of these incidents are localized to a small area.

A power outage may last anywhere from several minutes to weeks. The duration of the outage depends on several factors including: size and scope of the disaster, type of facilities affected, availability of response resources by the utility owner. ComEd owns most of the electrical utility infrastructure within Lake County.

**Measurements:** Power outages are measured by the number of facilities or the percentage of a jurisdiction without electrical power. A power outage may affect only one single family house, or an area spanning entire states in extreme cases.

The size and scope of the natural disaster affects the quantity of customers impacted. Existing utility infrastructure may also affect the quantity of outages throughout the jurisdiction.

**Historical Events:** A July 11, 2011, wind event was termed a “derecho” by the National Weather Service. More recently, on August 10, 2020, a large line of thunderstorms called a derecho swept across the Midwest and created an EF-1 tornado in the Rogers Park neighborhood of Chicago. A derecho is “a widespread, long-lived windstorm. Derechos are associated with bands of rapidly moving showers or thunderstorms variously known as bow echoes, squall lines, or quasi-linear convective systems.”

The National Weather Service provided the following description of the August 2020 event:

“A well-organized and long-lived complex of storms produced widespread severe wind damage across Iowa, northern Illinois, and northern Indiana during the day on Monday, August 10. Much of this severe wind was significant (75+ mph winds) resulting in many downed trees, several toppled-over semi-trucks,

and many communities receiving at least some minor structural damage. Within the broader area of severe winds, 15 tornadoes were confirmed across northern Illinois and northwest Indiana.”

See Figure 11 for the National Weather Service radar image of the storm event. Estimates. Local officials estimated that nearly one million customers lost power across northern Illinois at the height of the derecho and some people were without power for several days. The August 2020 derecho blew down trees, tree limbs and powerlines throughout Lake County. Communities instituted special plans for coordinating the clean-up efforts of property owners and for collecting and removing trees and other debris.

**Property Damage:** Lack of power rarely causes damage to facilities. Secondary effects due to lack of power, such as freezing pipes may cause extreme localized property damage.

**Damage to Critical Facilities:** Many critical facilities throughout Lake County have partial or complete backup power sources such as standby generators which will automatically start up when electrical power is lost. Facilities that typically have back up power generation include Hospitals, Police and Fire Stations, and Emergency Operations Centers (EOCs).

Smaller systems such as computers, life support, alarm and telecommunications systems may have a local Uninterrupted Power Supply (UPS) directly attached to maintain power during a disaster.

**Health and Safety:** Loss of electrical power can cause an immediate significant threat to life safety and public health. Critical facilities such as hospitals, nursing homes, and long-term care facilities are dependent upon electricity to maintain life support systems. First responder facilities such as police and fire departments require power to ensure effective emergency response efforts. Lack of power at these facilities can potentially place residents within the jurisdiction in immediate danger.

Public health may be negatively affected due to the sanitation systems that require electricity to function. Water treatment facilities and restaurants require sufficient power to ensure drinking water and food are treated properly. Lack of electricity at these locations may cause both short- and long-term health issues.

Downed live power lines also pose an immediate life safety issue. Live power lines on the ground or close to the ground because of a storm can kill or severely injure anyone who comes in contact with them. Vehicles or facilities in contact with live downed power lines are also susceptible to damage and the people within them are susceptible to injury or death.

**Economic Impact:** Businesses without power may be unable to process transactions, or maintain adequate heating/cooling regulations, and therefore be forced to close until power is restored. The actual dollar amount of economic impact is dependent upon the size, scope, and duration of the power outage.

**Climate Change Considerations:** Critical infrastructure may be challenged by increases in flooding or be in poor condition in lower-income communities. Individuals who are dependent

on home medical equipment (or even refrigeration to keep insulin and other medicines cool) may also lose their life-saving medical support during power outages.

### **3.13 Summary of Natural Hazards Risk Assessment**

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

#### **3.13.1 Impact of the Hazards**

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

- Health and safety
- Damage to buildings
- Damage to critical facilities and infrastructure
- Economic impact

The Low-Moderate-High ratings discussed on page 3-4 of this Chapter were used to classify the impacts of the hazards for the four major areas of concern. This approach allows for a better understanding of the risk or vulnerability and allows for updates or refinements to the ANHMP risk assessment in future plans. The HMPC discussed the findings to determine the overall impact the priority hazards on the County and the municipalities. The hazards and their impact are shown in Table 46, “Summary of Lake County Natural Hazards.” The different columns on the table represent the following:

- **Annual Chance or Frequency:** The annual chance column in the table shows the likelihood of occurrence in any given year. These numbers are discussed in the “Frequency” section of each hazard.
- **Impact Location:** The location and area affected by a single occurrence is shown.
- **Square Miles Impacted:** The portion of the County that is vulnerable to the hazard.
- **Value of vulnerable property:** The property damage exposure computed in
- 3.2 Summary of Lake County Assets of this Chapter.
- **Potential Damage:** The range of potential damage that could occur for the square miles impacted and the value of exposed property.
- **Impact on Health and Safety:** This category relates to health and safety hazards. Ratings of high, medium, or low are

shown.

- **Impact on Buildings:** The vulnerability of structural damage to buildings or other property damage.
- **Critical Facilities:** The types of critical facilities and infrastructure that are affected are listed.
- **Economic Impact:** Typical impacts on businesses and utilities are listed in this column.

Hazard	Annual Chance	Impact Location	Square Miles Affected	Impact on			
				Health & Safety	Buildings	Critical Facilities	Economy
Floods	1%	Floodplains	89.3	Moderate	High	Moderate	High
Floods	10%	(Local Drainage)	448	Moderate	Moderate	Moderate	Moderate
Tornado	0.01%	Countywide	10	High	High	Moderate	Moderate
Tornado	30%	Communities	5	High	High	Moderate	Moderate
Severe Summer Storms	100%	Communities	448	Moderate	Moderate	Moderate	Low
Severe Winter Storms	100%	Countywide	448	Moderate	Moderate	Moderate	Low
Drought	1%	Countywide	448	High	Moderate	Low	Moderate
Earthquake	100%	Countywide	448	Low	Low	Moderate	Low
Dam Failure	0%	Countywide	448	--	--	--	--
Extreme Temperatures	18%	Countywide	448	High	Low	Low	Low
Erosion	--	Countywide	36				
Power Outage		Countywide					

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

Appendix A shows the Lake County hazard identification by community and township for the natural hazards evaluated in Table 45. The findings of the hazard analysis and profile of Chapter 2 and the vulnerability assessment were used as the foundation of goals and guidelines and mitigation activities developed in Chapter 5.





### 3.13.2 Comparison to State of Illinois 2018 Natural Hazard Mitigation

The Illinois Emergency Management Agency (IEMA) hazard rating system has five levels:

IEMA Hazard Rating	ANHMP Rating
Very Low	Low
Low	Moderate
Medium	
High	High
Severe	

The IEMA hazard rating levels are based on historical/probability, vulnerability, severity of impact and population. The 2018 Illinois Natural Hazard Mitigation Plan utilized improved historical and damage information in the risk assessment and hazard rating levels were adjusted for many counties.

**Table 42: IEMA Hazard Ratings for Lake County**

Hazard	IEMA Rating 2013	IEMA Rating 2018 (Rank of All Counties)	ANHMP Rating
Floods	Elevated (99 of 102)	Medium (57 of 102)	High/Moderate
Tornado	Elevated (51 of 102)	Medium (76 of 102)	High
Severe Storms and Wind	Severe	Severe (72 of 102)	Moderate
Severe Winter Storms	High	High	Moderate
Drought	Guarded	Medium (55 of 102)	Moderate
Earthquake	Guarded	Low/Medium	Low
Extreme Heat	Guarded	Medium (69 of 102)	Low

IEMA's hazard ratings for Lake County identified natural hazards in the 2013 and 2018 Illinois Natural Hazard Mitigation Plan and are shown in Table 42.

The 2018 Illinois Natural Hazard Mitigation Plan raised the rating for tornado hazards in Lake County from elevated to high. The rating for severe winter storms was reduced to high, and extreme heat was reduced to guarded. The 2013 IEMA ratings for Lake County are somewhat comparable with the summary of impacts in Table 48 of this Chapter for all hazards shown in Table 48. IEMA's 2013 analysis placed Lake County 99<sup>th</sup> of 102 counties for loss estimation for floods. However, the 2013 Illinois Natural Hazard Mitigation Plan shows Lake County having 5 flood-related disaster declarations from 1981 to 2013, and Lake County is number 11 on the list of counties with the most repetitive flood loss properties. IEMA used a risk assessment software

called HAZUS. HAZUS relies on default building data and other factors that may have led to a poor analysis for Lake County.

The risk assessment for this ANHMP plan places severe summer storms as “moderate” and IEMA rates them as “severe.” This difference may be due to the ANHMP associating flooding that results from severe summer storms with floods and IEMA makes use of the information from disaster declarations that may be for severe storms, but the result of the severe storm is flooding.

Overall, IEMA’s risk assessment for the State is a generalized examination of counties. IEMA’s assessment certainly serves to provide a review of the Lake County risk assessment provided in this ANHMP.

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## **Chapter 4: Mitigation Goals**

The Hazard Mitigation Planning Committee (HMPC) established the goals for this ANHMP. The goals were developed to reflect community priorities, to be consistent with current countywide planning efforts, and in consideration of the impact of each natural hazard that affects Lake County. In June 2011, the HMPC participated in three exercises to outline the mitigation goals and for mitigation guidelines. The results of the exercise are summarized below to show how the ANHMP goals and guidelines were developed. The goals and guidelines included in this chapter were reviewed in February 2022 by the HMPC and re-affirmed as appropriate for Lake County and its municipalities through 20.

### **4.1 Community Priorities and Plan Direction**

To better understand community priorities, HMPC members selected their top five choices to create a list of potential priorities. For community priorities, the top 5 selected responses were:

1. Improve employment opportunities
2. Improve roads and highways
3. Improve/get more businesses
4. Provide a safe place to live and work
5. Improve water quality

For the second and third exercises, “What to Focus On” and “How to Fund and Implement,” HMPC members worked in groups and the top five choices of each table were shared with the entire group. The results from group to group for each of the exercises were very similar.

For the exercise “What to Focus On,” the top five responses given by the small groups included:

1. Protecting people’s lives
2. Protecting public health
3. Protecting streets and utilities
4. Protecting public services
5. Protecting existing buildings

For the exercise “How to Fund and Implement,” the top five responses given by the small groups included:

6. Make people aware of how they can protect themselves
7. Make people aware of the hazards they face
8. Develop public/private partnerships
9. Help people protect themselves
10. New developments should pay full cost of protection measures

## **4.2 Goals and Guidelines**

From the above responses, the goals and guidelines listed below were developed. The goals represent the mitigation activity outcome, and the guidelines represent the best methods to work towards the goals. At the July 2011 meeting, the HMPC reviewed the goals and guidelines. The goals and guidelines presented in this chapter are the foundation of the Action Plan, presented in Chapter 6.

The ANHMP goals are listed below:

- |                |  |
|----------------|--|
| <b>Goal 1)</b> | Protect the lives, health, and safety of the people of Lake County from the impact and effects of natural hazards. |
| <b>Goal 2)</b> | Protect public services, utilities, and critical facilities from potential damage from natural hazard events.      |
| <b>Goal 3)</b> | Mitigate existing buildings to protect against damage from natural hazard events.                                  |
| <b>Goal 4)</b> | Ensure that new developments do not create new exposures of people and property to damage from natural hazards.    |
| <b>Goal 5)</b> | Mitigate to protect against economic and transportation losses due to natural hazards.                             |

The following guidelines are for achieving the goals and to facilitate the development of hazard mitigation action items:

- |                     |  |
|---------------------|--|
| <b>Guideline 1)</b> | Focus natural hazards mitigation efforts on floods, tornadoes, severe summer and winter storms, dam failure, erosion, extreme temperatures, and drought  |
| <b>Guideline 2)</b> | Make people aware of the hazards they face and focus mitigation efforts on measures that allow property owners and service providers to help themselves. |
| <b>Guideline 3)</b> | Identify specific projects to protect lives and mitigate damage where cost-effective and affordable.   |



- Guideline 4)** Use available local funds, when necessary, to protect public services, critical facilities, lives, health and safety from natural hazards.
- Guideline 5)** Develop and foster public agency and private property owner partnerships to fund and implement mitigation measures and examine equitable approaches for the local cost of mitigation, such as user fees.
- Guideline 6)** Strive to improve and expand business, transportation and education opportunities in Lake County in conjunction with planned mitigation efforts.

### **4.3 Consistent with Other Plans**

The developed goals and guidelines were compared to the goals included in the following plans, and found to be consistent and supporting:

Lake County Comprehensive Stormwater Management Plan, 2016

Lake County Regional Framework Plan, amended in October 2014

Goals from the ANHMP should be incorporated into other plans of the County and municipalities, as deemed appropriate.

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## **Chapter 5: Mitigation Strategies and Capability Assessment**

This chapter examines the hazard mitigation activities that are currently being implemented in Lake County, examines various hazard mitigation strategies that can be undertaken in the future, and assesses the capabilities of Lake County and the municipalities for implementing some of these future mitigation measures.

As described in Chapter 1, Lake County is a growing county in both population and development. Chapter 3 presents the priority hazards identified in this ANHMP (**Error! Reference source not found.**) as flood, tornado, severe summer and winter storms and drought, and earthquakes. Other hazards include dam failure and landslides. The HMPC concluded that these are priority hazards from both a countywide and a community specific perspective. For example, while there are no mapped floodplains in the Village of Indian Creek, flooding impacts the residents of Indian Creek as they travel to work or school, and mitigation efforts undertaken by Lake County for severe winter storms benefits the entire county as people travel to work or school.

This chapter presents a comprehensive list of hazard mitigation recommendations that provide a menu of options for the development of the action plan presented in Chapter 6 of this ANHMP and presents an assessment of Lake County and the municipalities' capability of implementing these measures. These alternatives are consistent with the ANHMP goals presented in Chapter 4. All mitigation strategies recommended in this chapter are available to all communities, and communities are not specifically identified for each strategy. Throughout this Chapter reference is made to the Lake County Stormwater Management Commission (SMC) and the Lake County Watershed Development Ordinance (WDO). The SMC has regulatory, project and funding authority for stormwater, floodplain, wetland and water quality management in both the corporate and unincorporated areas of Lake County. The WDO sets watershed development standards that exceed NFIP and state minimum requirements. The technical committee of the SMC includes SMC staff and municipal staff. They meet monthly to evaluate the implementation of and compliance with the WDO, and to provide input of watershed planning efforts undertaken by the SMC. The Lake County Emergency Management Agency (LCEMA) hosts a similar committee to foster countywide approaches to hazard mitigation and emergency response.

Six basic strategies may be applied to mitigate the potential damage to property and impact to health and safety from natural hazards. Each strategy includes mitigation measures that are appropriate for different conditions, as shown in

**Table 43: Natural Hazard Mitigation Activities.** For instance, planning and regulation measures as preventative strategies are more appropriate for developing areas, while property protection strategies are approaches for existing development and buildings.

A considerable number of hazard mitigation measures are already being implemented either throughout Lake County or with certain areas of the County. For example, the administration and enforcement of building codes provides protection of buildings from wind, flood and earthquake events. Preventive and natural resources protection measures are provided through the implementation of the Lake County stormwater management program.

**Table 43: Natural Hazard Mitigation Activities**

Natural Hazards:	Preventive	Property Protection	Emergency	Resource Protection	Structural Measures	Public Information
Floods (100-year/10-year)	X	X	X	X	X	X
Tornado/High Wind	X	X	X			X
Severe Summer Storms/Hail	X	X	X	X	X	X
Severe Winter Storms	X		X			X
Dam Failure	X		X	X	X	X
Wildfire	X	X	X	X		X
Erosion	X	X		X	X	X
Extreme Heat						X
Extreme Cold		X	X			X
Sewer Backup	X			X		X
Drought	X			X		X
Groundwater	X			X		X

Both the ongoing Lake County mitigation efforts and additional mitigation approaches are discussed below. At the end of each section relevant recommendations are listed. Note that specific project locations are not identified with many of the recommendations. For many recommendations, numerous project locations exist. Selection of specific project areas, for floodplain acquisition projects for example, is related to the voluntary interest of property owners and the commitment of community funds. It is understood that project locations will be included in various project scopes of work as they are developed.

The following sections provide more detailed discussions of the six hazard mitigation strategies.

## 5.1 Preventive Measures

As the name implies, preventive measures are designed to keep flooding problems from getting worse. They ensure that future development does not increase flood damage and include actions that maintain the drainage system's capacity to carry away floodwaters. The cost of implementing most prevention measures is relatively low in comparison to most remedial measures to reduce future damage. Preventive measures include activities such as:

- Planning and Zoning
- Watershed Regulations
- Building Codes
- Standards for Manufactured Homes
- Critical Facility Construction Requirements
- Lake County Green Guide



### 5.1.1 Planning and Zoning

“Planning” can cover a variety of community plans including, but not limited to, comprehensive plans, land use plans, transportation plans, capital improvement plans, and economic development plans. While plans generally have limited authority, they reflect what the community would like to see happen in the future. Plans also guide other local measures such as capital improvements and the development of ordinances.

Comprehensive land use plans generally identify how a community should be developed. Use of the land can be tailored to match flooding hazards, typically by reserving flood prone areas for parks, recreational trails, open space, golf courses, or similar compatible uses. Lake County adopted the *Lake County Regional Framework Plan* in 2007 and is currently in the process of updating that plan.

Development in Lake County is also directed by the 2002 *Lake County Comprehensive Stormwater Management Plan* adopted by the Lake County Stormwater Management Commission (SMC) to address county-wide stormwater planning needs and watershed regulations. The first countywide *County Comprehensive Stormwater Management Plan* was adopted in 1990 in response to worsening flooding, drainage and water quality problems. SMC has developed several watershed-based plans for four major watersheds of the county including:

**Fox River Watershed:** Fish Lake Drain, Flint Creek, Manitou Creek and Sequoit Creek

**Des Plaines River Watershed:** North Mill Creek, Bull Creek and Indian Creek

**North Branch Chicago River Watershed:** North Branch of the Chicago River (Lake & Cook Counties)

**Lake Michigan Watershed:** Kellogg Creek, Dead River and the Waukegan River

Adopted and draft plans and other information on the ongoing SMC planning efforts are available at: [Lake County Watershed Plans](#)

A zoning ordinance regulates development by dividing the community into zones or districts and setting development criteria for each district. Zoning can be used to control development so that existing flood problems are not worsened, and new flood problems are not created.

The Lake County zoning ordinance, applicable to the unincorporated areas of Lake County, uses the overlay zoning approach. The Lake County ordinance classifies floodplains, wetlands, lakes, ponds, drainage ways and drainage way soils with other natural resources as “natural resource protection areas.” This classification requires that a pre-determined ratio of open space be met for developments impacting the designated natural resources.

In addition, site development regulations limit the uses allowed in floodplains. Allowable uses, depending upon the underlying zoning district, may include parks, golf courses, boating facilities, parking lots, roads, nurseries, and others.

Many Lake County municipalities have incorporated floodplain development restrictions into their zoning ordinances. A review of municipal zoning ordinances for development of the 1990 Comprehensive Stormwater Management Plan found that 19 of 29 zoning ordinances reviewed

included floodplain districts/requirements. (Forty ordinances were collected for the county's 51 municipalities, but only the 29 that were dated 1970 or later were reviewed.) Since the adoption of the WDO in 1992, additional municipalities and the County of Lake have incorporated the floodplain development restrictions of the WDO into their zoning and development ordinances.

Subdivision ordinances specifically govern how land will be subdivided into lots and regulate standards for infrastructure provided by the developer including roads, sidewalks, utilities, stormwater detention, storm sewers and drainage ways. Building codes should establish flood protection standards for all structures. Table 4447 provides a list of community plans and ordinances.

### 5.1.2 Watershed Development Regulations

As noted above, the WDO has been in place in Lake County since 1992. The goal of the WDO is to ensure that new development does not increase existing stormwater problems or create new ones. The WDO establishes minimum countywide standards for stormwater management, including floodplains, detention, soil erosion/sediment control, water quality treatment, and wetlands.

The WDO is implemented by the SMC or by "Certified Communities." Forty-one of the 52 municipalities in the county are standard Certified Communities. The designation allows those communities to enforce WDO standards within their own jurisdictions, except for isolated wetlands. SMC reviews isolated wetlands unless a community becomes "Wetland Certified." Table 45 shows the Lake County "Certified Communities".

**Table 44: Lake County Plans and Ordinances**

Community	Comprehensive Plan	Stormwater Mgmt. Plan	Capital Improvement Plan	Land Use Plan Only	Zoning Ordinance	Subdivision Ordinance	Historical Preservation Ordinance
Village of Antioch	Yes	Yes			Yes	Yes	
Village of Bannockburn			Yes		Yes	Yes	
Village of Barrington	Yes	Yes	Yes	Yes	Yes		
Village of Barrington Hills					Yes		
Village of Beach Park					Yes		
Village of Buffalo Grove	Yes	Yes	Yes	Yes	Yes	Yes	
Village of Deer Park	Yes				Yes		
Village of Deerfield	Yes	Yes	Yes	Yes	Yes	Yes	
Village of Fox Lake	Yes					Yes	
Village of Fox River Grove	Yes		Yes		Yes	Yes	
Village of Green Oaks	Yes	Yes		Yes	Yes	Yes	
Village of Gurnee		Yes	Yes		Yes	Yes	
Village of Hainesville	Yes				Yes	Yes	
Village of Hawthorn Woods	Yes	Yes			Yes	Yes	
City of Highland Park	Yes	Yes	Yes		Yes	Yes	Yes
Village of Highwood					Yes		

Table 44: Lake County Plans and Ordinances

Community	Comprehensive Plan	Stormwater Mgmt. Plan	Capital Improvement Plan	Land Use Plan Only	Zoning Ordinance	Subdivision Ordinance	Historical Preservation Ordinance
Village of Indian Creek					Yes		
Village of Island Lake	Yes	Yes		Yes	Yes	Yes	
Village of Kildeer	Yes		Yes	Yes	Yes		
Village of Lake Barrington	Yes	Yes	Yes	Yes	Yes	Yes	
Village of Lake Bluff	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City of Lake Forest	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Village of Lake Villa	Yes	Yes			Yes	Yes	
Village of Lake Zurich	Yes		Yes	Yes			Yes
Village of Lakemoor	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Village of Libertyville	Yes		Yes	Yes	Yes	Yes	
Village of Lincolnshire	Yes		Yes	Yes	Yes	Yes	
Village of Lindenhurst	Yes	Yes			Yes		
Village of Long Grove	Yes				Yes	Yes	
Village of Mettawa					Yes		
Village of Mundelein	Yes	Yes	Yes	Yes	Yes	Yes	
Village of North Barrington	Yes				Yes	Yes	
City of North Chicago			Yes		Yes	Yes	
Village of Old Mill Creek	Yes				Yes		
City of Park City					Yes	Yes	
Village of Port Barrington		Yes			Yes	Yes	
Village of Riverwoods	Yes				Yes	Yes	
Village of Round Lake	Yes	Yes		Yes	Yes	Yes	
Village of Round Lake Beach	Yes	Yes			Yes	Yes	
Village of Round Lake Heights	Yes				Yes	Yes	
Village of Round Lake Park	Yes	Yes	Yes	Yes	Yes	Yes	
Village of Tower Lakes	Yes	Yes			Yes	Yes	
Village of Third Lake					Yes		
Village of Vernon Hills	Yes		Yes	Yes	Yes	Yes	
Village of Volo	Yes				Yes	Yes	
Village of Wadsworth	Yes				Yes	Yes	
Village of Wauconda	Yes	Yes	Yes	Yes	Yes	Yes	
Village of Winthrop Harbor					Yes		
Village of Wheeling	Yes				Yes		
City of Zion	Yes				Yes		
Naval Station Great Lakes							
Lake County	Yes		Yes	Yes	Yes	Yes	

For unincorporated areas, the [Lake County Planning, Building and Development Department \(PB&D\)](#) is the permitting agency. SMC is the permitting agency for [Non-Certified Communities](#). Even in Certified Communities, however, certain floodway and floodplain development applications are forwarded to SMC for review and approval. A [WDO Permit](#) is required for major and minor development, and public road construction. Table 45 shows the Certified Community status for the WDO and provided the Community Identification Numbers (CID) for the Lake County communities that participate in the National Flood Insurance Program (NFIP).



The NFIP sets the minimum floodplain regulation requirements for local floodplain ordinances. The State of Illinois enforces floodway standards that go beyond the NFIP minimum standards. Standards in the WDO reflect state and federal requirements for floodplain regulation and address specific Lake County flooding problems that occur in depressional storage areas and in unmapped floodplains/floodways.

To address flooding in unmapped floodplains, the WDO definition of a regulatory floodplain includes smaller tributaries subject to more than one square mile of drainage, and depressional areas, not associated with streams, that have a storage volume of 0.75-acre feet or more when inundated by the base flood.

Many Lake County municipal ordinances exceed the WDO standards in one aspect or another. The WDO ensures minimum requirements are met but does not prohibit individual communities from implementing stricter standards to protect their property owners from flooding. The WDO includes detention requirements that control the rate of stormwater release from developments. The allowable release rate is the determinant of the volume of stormwater that needs to be detained. The WDO specifies a uniform release rate for the entire County regardless of watershed. Although the WDO addresses the rate of stormwater release, it does not fully regulate the increased volume of runoff. The increased volume of runoff ultimately collects in these large river basins resulting in higher flood elevations. Some runoff volume is addressed through the water quality requirement in the WDO.

**Table 45: Lake County WDO Certified Communities**

Community	Certified	IWLC Review	CID	Community	Certified	IWLC Review	CID
Village of Antioch	X	X	170358	Village of Lindenhurst	X	X	170379
Village of Bannockburn	X	X	170359	Village of Long Grove	X	X	170380
Village of Barrington	X		170057	Village of Mettawa	X <sup>2</sup>	X	170381
Village of Barrington Hills	X		170058	Village of Mundelein	X		170382
Village of Beach Park ❖			171022	Village of North Barrington	X	X	170383
Village of Buffalo Grove	X		170068	City of North Chicago	X		170384
Village of Deer Park	X	X	170028	Village of Old Mill Creek	X	X	170385
Village of Deerfield	X		170361	City of Park City			170386
Village of Fox Lake	X <sup>2</sup>		170362	Village of Port Barrington	X		170478
Village of Fox River Grove	X	X	170477	Village of Riverwoods	X	X	170387
Village of Grayslake	X <sup>2</sup>		170363	Village of Round Lake	X	X	170388
Village of Green Oaks	X	X	170364	Village of Round Lake Beach	X		170389
Village of Gurnee	X		170365	Village of Round Lake Heights	X		170390
Village of Hainesville	X	X	171005	Village of Round Lake Park	X	X	170391
Village of Hawthorn Woods	X	X	170366	Village of Third Lake	X		170392
City of Highland Park	X		170367	Village of Tower Lakes			170393
City of Highwood	X	X	--	Village of Vernon Hills	X		170394
Village of Indian Creek			--	Village of Volo	X <sup>2</sup>	X	171042
Village of Island Lake	X	X	170370	Village of Wadsworth ❖			170395
Village of Kildeer	X	X	170371	Village of Wauconda	X	X	170396
Village of Lake Barrington	X	X	170372	City of Waukegan	X <sup>2</sup>		170397
Village of Lake Bluff	X		170373	Village of Wheeling			170173
City of Lake Forest	X		170374	Village of Winthrop Harbor ❖			170398
Village of Lake Villa	X		170375	City of Zion ❖			170399
Village of Lake Zurich	X		170376	Lake County Forest Preserve			
Village of Lakemoor			170915	Lake County Public Roads			
Village of Libertyville	X		170377	County of Lake		X	170357
Village of Lincolnshire ❖			170378				

<https://www.lakecountyl.gov/2343/Certified-Communities>

IWLC = Isolated Waters of Lake County

X<sup>1</sup> Conditional IWLC Certification

X<sup>2</sup> Conditional Standard Certification

❖ Issues Single Family Home Permits (Minor Development Category)

Other aspects of the WDO are discussed in 5.3 Resource Protection of this Chapter including erosion protection. The WDO was updated in October 2021 by the SMC and the assistance of the SMC's Technical Advisory Committee (TAC). More information and WDO resource documents are provided on the SMC Website: [Lake County Watershed Development Ordinance WDO.](#)

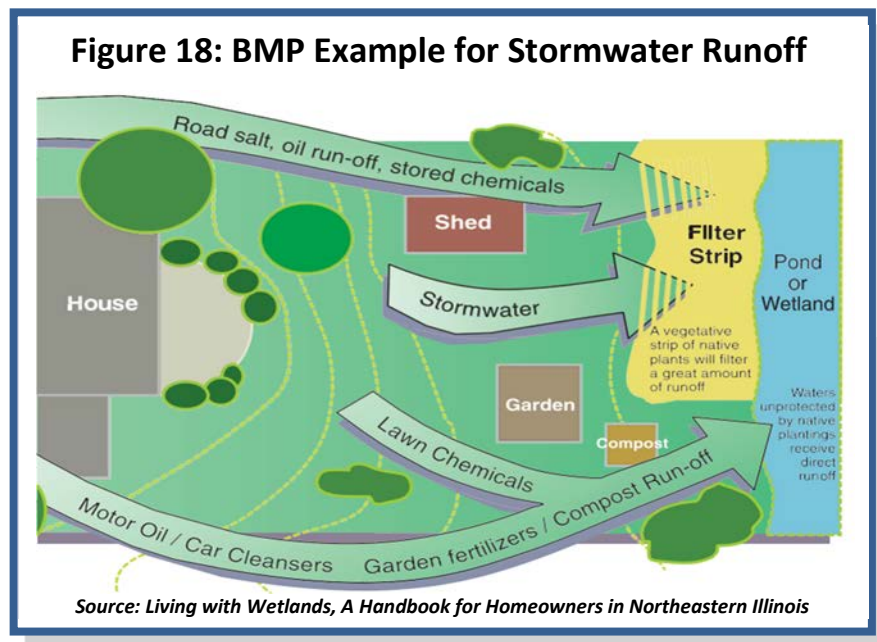


### 5.1.3 Best Management Practices

Stormwater Best Management Practices (BMPs) are used to help ensure longevity and improve the health of Lake County's watersheds. BMPs are a practice or combination of practices that are an effective, practicable means of preventing or reducing the amount of pollution generated by nonpoint sources. All stakeholders, including homeowners, businesses, organizations, and municipalities can implement BMPs. BMPs can be as simple as using phosphorous-free fertilizer to a more complex activity like a project restoring a large section of degraded streambank. BMPs can slow stormwater runoff and improve water quality.

The SMC website provides specific BMPs for different stakeholder groups:

[www.lakecountyil.gov/2261/Stormwater-Best-Practices](http://www.lakecountyil.gov/2261/Stormwater-Best-Practices).



BMPs can be integrated before, during, and after development. BMPs will not only help the environment, but in many cases, they also can save you time and money. Every BMP is beneficial to the environment regardless of its relative cost, but it is the unique combination of implementing BMPs for each property that will help establish a healthy watershed.

The WDO includes many water quality provisions that are within site development, detention, erosion control and wetland standards. **Error! Reference source not found.** shows the goal of the water quality impacts that can occur without water quality provisions incorporated into site design.

### 5.1.4 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 tornadoes, high winds, snowstorms, and earthquakes. When properly designed, and constructed according to code, the average building can withstand the impacts of most of these natural events.

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.
- Mandating overhead sewers for all new basements to prevent sewer backup.
- Includes NFIP minimum standards for structures built in A Zones (riverine flooding) and V Zones (coastal flooding).

The predominate model building codes being adopted by communities are the International Code series (I-Codes), including the International Residential Code (IRC) and the International Building Code (IBC). The I-Codes require buildings to be built to the “design flood elevation” or DFE, which is effectively the base flood elevation (BFE) or 100-year elevation. Note that the WDO establishes a flood protection elevation (FPE), which is 2 feet above the BFE, so the WDO requirements exceed the I-Codes.

The most recent version of the I-Codes is 2021. Some Lake County communities enforce the BOCA code, but most communities administer and enforce the IRC and IBC.

Fortified 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 that go beyond building codes. The specific requirements for a protected or a “fortified” home are available through the IBHS website at <https://disastersafety.org>. On the web site, a postal code (zip code) can be entered, and regional recommendations are made for maintenance, new construction and businesses.

New construction should also include the construction of an underground shelter or “safe room” at the first-floor level to protect the lives of the occupants. A building code could require them in new construction. Tornado safe rooms are discussed further in section 5.2 Property Protection of this chapter.

Code Administration: Enforcement of code standards is very important. Adequate inspections are needed during construction to ensure that the builder understands and implements the requirements. The Building Code Effectiveness Grading Schedule (BCEGS) is a national program used by the insurance industry to determine how well new construction is protected from wind, earthquake and other non-flood hazards. The BCEGS is similar to the National Flood Insurance Program (NFIP) Community Rating System and the century-old fire insurance rating scheme.

With BCEGS, building permit programs are reviewed and scored, a class 1 community is the best, and a class 10 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.

### **5.1.5 Standards for Manufactured Homes**

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 U.S. 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 Tie Down Code are enforced by the Illinois Department of Public Health (IDPH). The State code includes equipment and installation standards. Installation must be done in accordance with manufacturers’ specifications. There is a voluntary program for installers to be trained and certified.

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

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

### **5.1.6 Critical Facility Construction**

Critical facilities, defined in Chapter 1 for purposes of this ANHMP, are generally constructed with public funds. The exception is usually health care facilities. The source of public funds can be federal, state, or local. State of Illinois and federal government executive orders require higher flood protection standards for critical facilities when funded with state or federal dollars. Both orders require compliance when state or federal funds are used for the construction or permitting of any critical facility. Both the state and federal orders have consistent interpretations of “critical facilities.”

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

**Excerpt from Illinois Executive Order 5 (2006):**

2. All State Agencies engaged in any development within a Special Flood Hazard Area shall undertake such development in accordance with the following:
  - A. All development shall comply with all requirements of the National Flood Insurance Program (44 C.F.R. 59-79) and with all requirements of 92 Illinois Administrative Code Part 700 or 92 Illinois Administrative Code Part 708, whichever is applicable.
  - B. In addition to the requirements set forth in preceding Section A, the following additional requirements shall apply where applicable:
    1. All new Critical Facilities shall be located outside of the floodplain. Where this is not practicable, Critical Facilities shall be developed with the lowest floor elevation equal to or greater than the 500-year frequency flood elevation or structurally dry flood proofed 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 flood proofed to at least the Flood Protection Elevation.
    3. Modifications, additions, repairs or replacement of existing structures may be allowed so long as the new development does not increase the floor area of the existing structure by more than twenty (20) percent or increase the market value of the structure by fifty (50) percent, and does not obstruct flood flows. Floodproofing activities are permitted and encouraged, but must comply with the requirements noted above.
3. State Agencies which administer grants or loans for financing development within Special Flood Hazard Areas shall take all steps within their authority to ensure that such development meets the requirements of this Order.
4. State Agencies responsible for regulating or permitting development within Special Flood Hazard Areas shall take all steps within their authority to ensure that such development meets the requirements of this Order.

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

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

### 5.1.7 Other Preventive Measures

Many times, after a flood, flood victims say they would have taken steps to protect themselves if only they had known they had a flood prone property. Three regulations, one federal and two state, require that a potential buyer of a parcel be told of any flood hazard.

*Federal law:* Federally regulated lending institutions must advise applicants for a mortgage or other loan that is to be secured by an insurable building that the property is in a floodplain as shown on the Flood Insurance Rate Map (FIRM). Flood insurance is required for buildings located within the 100-year floodplain if the mortgage or loan is federally insured. This program does not apply to flood prone areas that are not mapped on the FIRMs. Flood prone areas that are frequently not mapped include the floodplains of smaller channels and many depressional areas. Depressional area flooding is a significant problem. The use of older flood studies in rapidly developing areas also results in outdated floodplain maps that do not reflect the actual flood risk.

*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 a Special Flood Hazard Area.

*Illinois Residential Real Property Disclosure Act:* This law, which went into effect on October 1, 1994, 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. The 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.

### **5.1.8 Preventive Measure Recommendations**

Complete current and accurate floodplain maps for all Lake County watersheds and submit to FEMA for adoption.

The County and municipalities that participate in the NFIP should ensure that they fully and properly administer and enforce the requirements of the NFIP.

The County and municipalities should ensure that they fully enforce all provisions of the WDO and the forthcoming amendments.

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.

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.

The adequacy or current requirements for manufactured home and recreational vehicle parks for protection from natural hazards should be examined, especially concerns pertaining to placement in flood prone areas, tie downs and sheltering.

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.

Offices responsible for design, construction or permitting critical facilities should ensure that the design accounts for natural hazards and adjacent land uses.

Communities (certified and non-certified) need to understand and consistently enforce the WDO, and the TAC should continue their efforts in these areas.

Communities should consider joining the NFIP's CRS program. For the municipalities already involved in CRS, they should work to improve their CRS class.

Communities should encourage the use of back-up power sources or generators to address power outages.

## **5.2 Property Protection**

Property protection measures are used to modify or remove buildings subject to flood damage rather than to keep floodwaters away. Because of the widespread extent of flood damage



caused by shallow, low velocity flooding in Lake County, traditional flood control structures such as levees and reservoirs are generally not economically justifiable in most areas. Individual property protection measures are usually the most preferred and cost-effective flood mitigation measures in these circumstances. Many property protection measures do not affect a building's appearance or uses, making them particularly appropriate for historical sites and landmarks.

Although most property protection measures are paid for and implemented by individual property owners, there is increasing government interest and cost-share funding available for building relocation and acquisition, which are permanent solutions to flood damage. While property protection is viewed as the property owner's responsibility, local governments can actively support and promote private efforts by providing technical assistance and incentives. Property protection measures include activities such as:

- Building Acquisition/Relocation
- Building Elevation, Floodproofing or Barriers
- Building Structural Retrofitting
- Insurance

### **5.2.1 Building Acquisition/Relocation**

Acquisition ensures that buildings in a flood prone area will cease to be subject to damage. The major difference is that acquisition is undertaken by a government agency, so the cost is not borne by the property owner, and the land is converted to an appropriate public use such as a park. Acquiring and clearing buildings from the floodplain, or severe ravine or other erosion areas, is not only the best long-term flood protection measure, it also is a way to convert a problem area into a community asset that can provide environmental and recreational benefits. Building acquisition can address issues including flooding, severe storms, dam failure, and erosion.

The Village of Gurnee purchased properties in the 1990s when they came up for sale in the floodway. In 1997, the SMC began coordinating the county's acquisition projects in Sturm Subdivision and William's Park, two of the most repetitively flood damaged locations in the county. Acquisition funds were provided through the FEMA Hazard Mitigation Assistance Programs. Since then, SMC has coordinated several additional FEMA Hazard Mitigation grant applications for the acquisition of flood prone properties in Fox Lake, Gurnee, Lake Forest, Lindenhurst, Round Lake Beach, and areas of unincorporated Lake County.

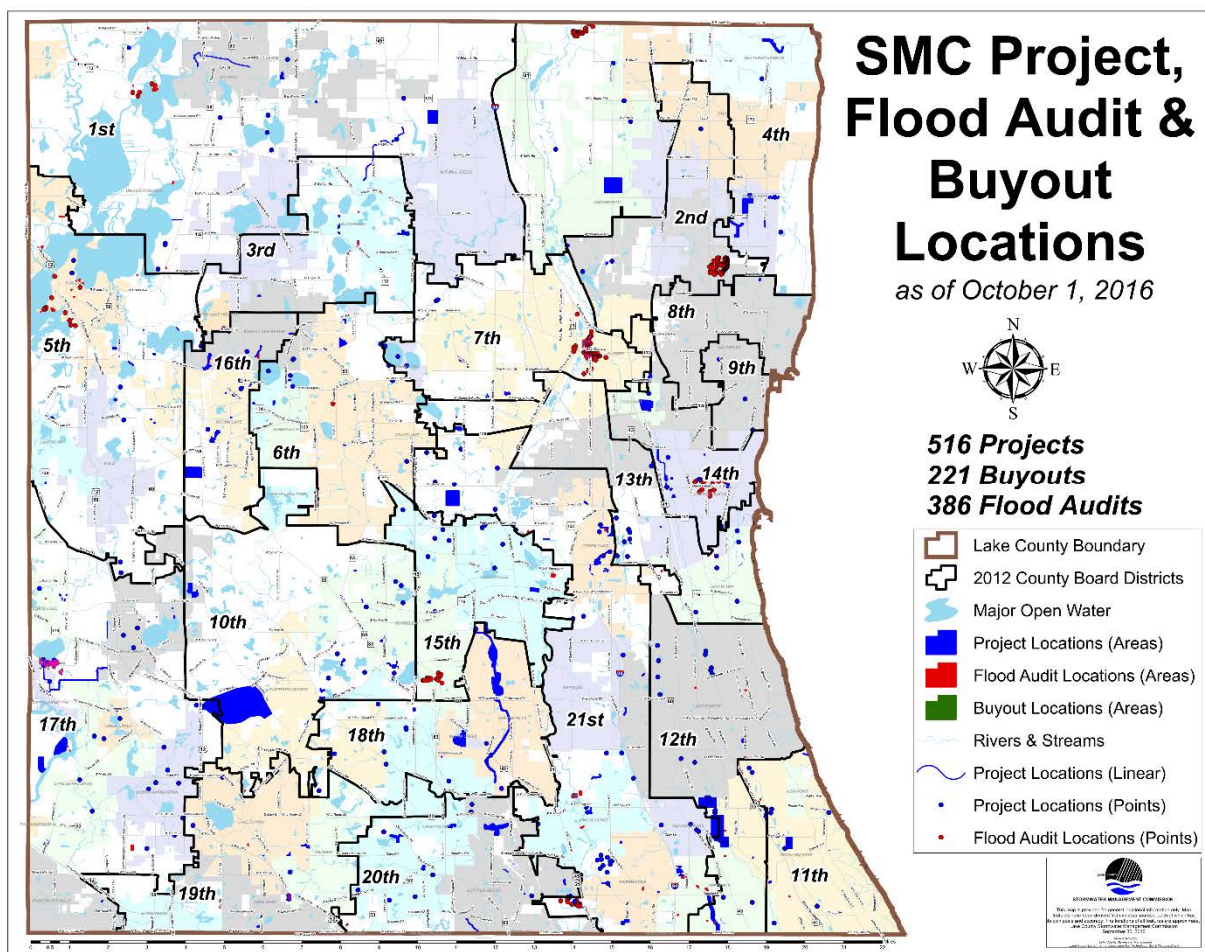


**Building demolition in progress in Fox Lake**

To date, dozens of repetitive flood loss and floodplain properties have been acquired throughout Lake County. The FEMA funds are provided through IEMA to cover 75% of project costs. Cost share funds (25%) have been provided by the participating municipalities and the SMC. The structures on the acquired properties have been demolished and the property converted to open space.

Exhibit 17 shows the location of SMC flood audit and floodplain buyout locations. SMC currently has two grant applications under review with FEMA which includes sixteen properties throughout the county.

**Exhibit 17: Lake County SMC Flood Audit and Floodplain Buyout Locations**



**Building Relocation:** Moving a building to higher ground is the surest and safest way to protect it from flooding. While almost any building can be moved, the cost goes up for heavier structures, such as those made of brick, and for large or irregularly shaped buildings. Building relocation is generally cost-effective where flooding is relatively severe and/or frequent. Buildings that have suffered structural damage or contamination from frequent or long duration flooding should not be considered for relocation.

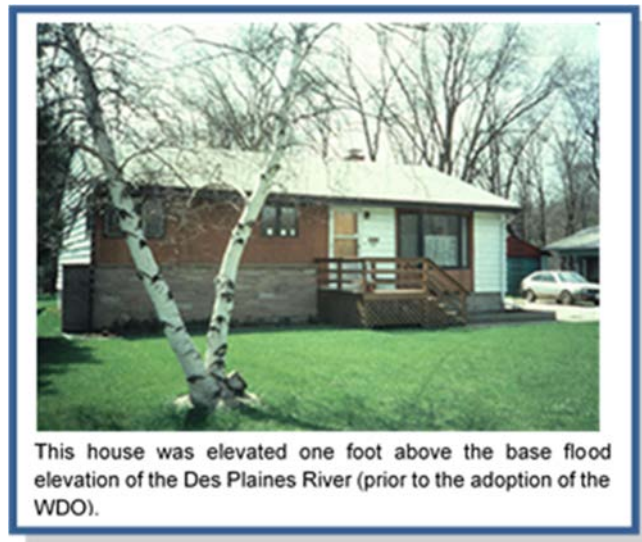
While relocation is typically the responsibility of the building owner, government-sponsored loans or grants may be available for cost-share. Communities and county-wide agencies could play a greater role in building relocation by improving public and local official awareness of this option, identifying and prioritizing buildings or properties well-suited for relocation, and by locating potential cost-share funds to assist individual property owners.

### 5.2.2 Building Elevation, Floodproofing or Barriers

**Elevation:** Raising or elevating a house above the flood level protects the structure and contents from flood damage. When flooding occurs, water levels stay below the main floor, causing no damage to the structure or its contents. Raising a building above the flood level is less expensive than acquiring it or moving it and can be less disruptive to a neighborhood. Commonly practiced in flood prone areas nationwide, this protection technique is required by law for new and substantially damaged residences located in a 100-year floodplain.

Although flood damage can be reduced significantly or eliminated through building elevation, there are some limitations to remaining in a flood prone location. While the building itself is elevated sufficiently to be protected from flood damage, flooding may isolate the building making it inaccessible. In addition, flood waters can result in a loss of utility service in flooded areas making the building uninhabitable even though it is not damaged, and pollutant contamination in floodwaters will still threaten health and safety.

As with acquisitions, structural elevation projects are voluntary. SMC has determined that cost-share for elevation projects is required from the homeowner and are best pursued by municipalities rather than the county.



**Barriers:** Constructing barriers, such as floodwalls and berms, can keep floodwaters from reaching a building. Berms are commonly used in areas subject to shallow flooding. Not considered engineered structures, berms are made by regrading or filling an area. Low floodwalls may be built around stairwells to protect the basement and lower floor of a split-level home.



Example of floodwall protection.

By keeping water away from the building walls, the problems of seepage and hydrostatic pressure are reduced.

Use of floodwalls and berms must also include a plan to install drainpipes and/or sump pumps to handle leaks and water seepage through or under the barrier, and to get rid of water that may collect inside



the barrier. Care must be taken in the design, location and installation of berms or floodwalls to ensure that floodwaters are not inadvertently pushed onto an adjacent property.

**Floodproofing:** Floodproofing covers measures that provide either wet floodproofing or dry floodproofing. In areas where there is shallow flooding, dry floodproofing measures can be used to prevent water from entering some buildings. A wet floodproofing strategy will allow water to enter the building, but moves damageable belongings, appliances, and utilities out of harm's way.

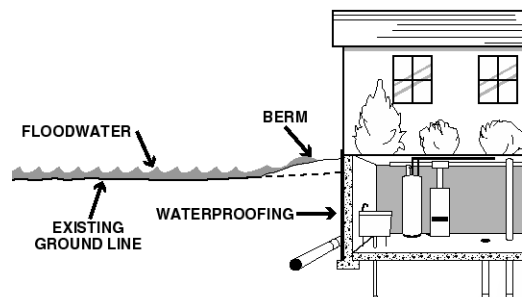
**Dry Floodproofing:** Dry floodproofing is a combination of practices that are used to seal a building against floodwaters. Walls, floors, and all openings must be sealed and made watertight. Buildings with crawlspaces generally cannot be dry flood proofed because water can seep under walls into the crawlspace. However, buildings on slabs and buildings with basements can benefit from dry floodproofing.

#### **Dry Floodproofing - Buildings on slab**

- Walls are coated with waterproofing compounds or plastic sheeting.
- Openings, such as doors, windows, sewer lines and vents, are closed either permanently, with removable shields, or with sandbags.

#### **Dry Floodproofing - Buildings with basements**

- Waterproofing compound is applied to the walls before fill is placed against the side of the house.
- Installation of a subsurface drain tile and sump pumps is necessary to handle water that will naturally seep through the fill.
- Surface water is kept away from the walls with backfill (see illustration).



A structural engineer should be consulted to design the dry floodproofing measures due to the need to address hydrostatic pressure against foundation walls that occur during floods.

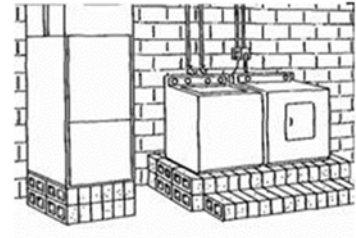
**Wet Floodproofing:** Wet floodproofing provides damage protection from floodwaters that cannot be kept out of a building. It is a relatively simple means of making sure that nothing gets damaged when floodwaters enter the building. Wet floodproofing includes some of the least expensive and easiest mitigation practices to install. Wet floodproofing

approaches range from moving valuable items to a higher floor to rebuilding the floodable area. At the very least, several low-cost steps can be taken to wet flood proof a structure. Simply moving furniture and electrical appliances out of the flood prone area of the building can

prevent thousands of dollars in damages. Wet floodproofing measures work wherever there is a level above the flood zone to which items can be relocated; in general, wet floodproofing does not work for one-story houses where living areas get flooded.

**Wet Flood Proofing:**

- Everything subject to damage by water or sediment is moved to a higher level or out of the building.
- For example, the electrical panel and the furnace should be relocated to an upper floor.
- Where flooding is not expected to be deep, items needing protection may be placed on platforms or blocks.



**Sewer backup protection:** Basement flooding can occur when the sanitary system overloads with stormwater and backs sewage up into the basement through the sanitary line. Even when sanitary and storm waters are carried in separate pipes, and they are though nearly all of Lake County, sewer backup can occur when cross connections between the storm and sanitary sewers exist, or if there are infiltration or inflow problems into the lines.

Houses which have downspouts, footing drain tile, and/or a sump pump connected to the sanitary sewer service may be inundated when heavy rains overload the system. Installing secondary power systems including back-up batteries or generator powered pump systems will ensure that the pumps continue to function during power outages. In addition to these sources, sanitary lines can also be inundated by stormwater by way of runoff infiltration into old leaky pipes or where the sanitary utility access holes are not properly sealed. Several Lake County communities experience very high sewage flows following heavy rain events. As in the case of Wauconda, some wastewater treatment plants cannot adequately treat the heavy volume of combined stormwater and sewage, so the plant is bypassed, and sewage is discharged directly to surface waters untreated.



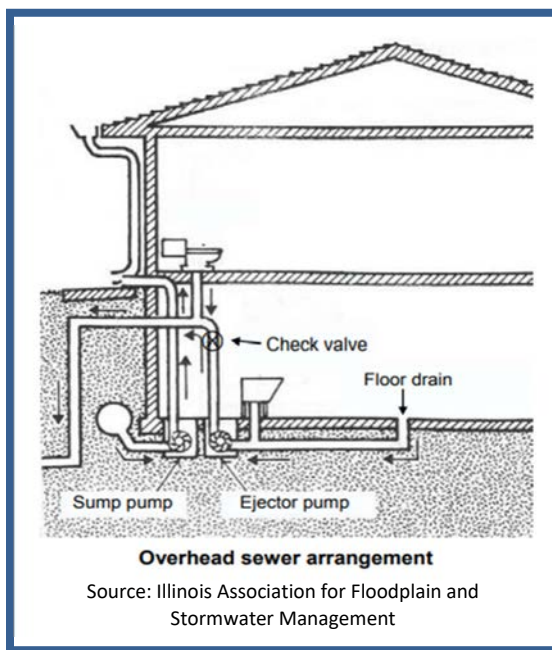
If allowed by the local code, sump pumps, downspouts and footing drains should be disconnected from the sanitary sewer line and the rain and groundwater directed out onto the ground, away from the building. The solution to stormwater overload of the sanitary system also includes the need for timely maintenance of sanitary lines, including periodic televising and cleaning of the sanitary sewer lines to remove tree roots and other blockages, repairing or replacing pipe where it leaks, and upgrading old wastewater treatment facilities that are inadequate for the existing level of use. Until sanitary infiltration is fixed, a property owner may use four approaches to protect sanitary sewer openings from backup. Floor drain plugs or floor



drain standpipes can be installed to keep water from flowing out of the floor drain into the building. However, these may not be effective if water gets deep enough in the sewer system to flow out of the next lowest opening, which is likely to be a toilet or utility sink.

Overhead sewers and backup valves are more expensive, but more secure for this circumstance. An overhead sewer keeps water in the sewer line during a backup. A backup valve allows sewage to flow out, while preventing backups from entering the building.

**Septic system modification:** In Lake County, septic failure is a common secondary result of flooding. Having septic tanks pumped as needed during periods of ponding, soil saturation or following a flood is one method of maintaining the usefulness of septic systems. In cases where the size of a single septic tank is inadequate, a second tank should be installed.



A second strategy to improve septic usefulness during high water periods would be to install an alternative system. The Wisconsin Mound septic system is constructed in soil, gravel, and sand layers above the existing grade. The Wisconsin Mound may function better than traditional systems during high groundwater periods, but even their usefulness is limited under flood conditions.

### 5.2.3 Building Structural Retrofitting

**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. Safe rooms are built by connecting all parts of the shelter together (walls, roof, and foundation) using adequate fasteners or tie downs. This helps 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 intense winds of a tornado. More information on safe rooms can be found in FEMA Publication 320.

Another retrofitting approach for tornadoes and high winds is to secure the roof, walls and foundation with adequate fasteners or tie downs. This helps 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.

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

- Shelters
- Storm shutters
- Lightning rods
- Strengthening connections and tie-downs (similar to tornado retrofitting)
- Impact-resistant glass in windowpanes
- Surge protectors at electrical outlets



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

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

**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 will not fall over during a quake
- Installing latches on drawers and cabinet doors
- Mounting picture frames and mirrors securely
- Installing flexible utility connections for water and gas lines
- Anchoring and bracing propane tanks and gas cylinders

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

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

Earthquake Retrofitting–Infrastructure and Lifelines: Infrastructure hardening, attention to lifelines and bridge strengthening are crucial 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.

#### **5.2.4 Insurance**

Insurance does not prevent flooding or flood damage; it helps an owner protect their property investment by paying for repairs and replacement of items damaged in a flood. While a typical homeowner's insurance policy does not cover a property for flood damage, flood insurance coverage is available through the National Flood Insurance Program, as is additional basement backup insurance.

National Flood Insurance: In Lake County forty-three municipalities and the County participate in the National Flood Insurance Program (NFIP). Flood insurance is required as a condition of certain types of federal aid and most bank loans and mortgages for buildings located in the 100-year floodplains identified on the FEMA Flood Insurance Rate Maps.

While the NFIP requires flood insurance for those at greatest risk, there are several weaknesses in the program. Many of the buildings subject to flooding in Lake County are not located in the 100-year floodplain as identified on the FEMA maps. In addition, many policy holders drop flood insurance following a period of dry years or after their mortgage is paid off, and/or do not buy enough insurance to cover their total risk (for instance for building contents).

Despite the federal law, it is estimated that fewer than 1 in 4 floodplain properties are covered under NFIP (Flood Hazard Mitigation in Northeastern Illinois, 1995). Nationally, 25% of NFIP claims are for flood damage to buildings located outside of the 100-year floodplain (the

insurance requirement zone). In Lake County, approximately 30% of the flood insurance policies are for properties outside the floodplain.

Table 46 shows the number of insurance policies for each Lake County community. CID in is the NFIP community identification number.

Flood insurance is available for anyone, regardless of building location, and premiums are lower if your structure is not in a mapped floodplain. For this reason, if there is any risk of flood damage to a property, it is prudent to have flood insurance.

There are ramifications for not having insurance required by the NFIP when future flood damage occurs. If property owners who were required to purchase insurance as a condition of receiving disaster assistance for a previous flood dropped the policy, they would lose their right to any future disaster assistance. In addition, under-insured public buildings will have the amount of flood insurance they should have carried deducted from any disaster assistance they may be eligible for after a flood.

**Community Rating System (CRS):** FEMA created the NFIP's CRS program in 1990. It is designed to recognize floodplain management and other watershed management activities that go beyond NFIP minimum requirements. Communities that participate in the NFIP can apply for the CRS. When appropriate applications and reviews are completed, a community is awarded a CRS class rating. Residents and property owners of that community then qualify for a flood insurance premium rate reduction that ranges from 5 to 45 percent. CRS credit is provided for 18 creditable activities, organized under four categories:

- Public Information
- Flood Damage Reduction
- Mapping and Regulations
- Flood Preparedness

The CRS is a voluntary program and is modeled after the fire insurance rating system. Insurance premiums are adjusted based on the rating of the community. Numerous watershed and floodplain management activities in Illinois and Lake County exceed the minimum NFIP requirements and therefore earn communities notable CRS credit.

Community Rating System			
CRS		Premium Reduction	
Class	Credit Points	SFHA*	Non-SFHA
1	4,500+	45%	10%
2	4,000 – 4,499	40%	10%
3	3,500 – 3,999	35%	10%
4	3,000 – 3,499	30%	10%
5	2,500 – 2,999	25%	10%
6	2,000 – 2,499	20%	10%
7	1,500 – 1,999	15%	5%
8	1,000 – 1,499	10%	5%
9	500 – 999	5%	5%
10	0 – 499	0	0

Community Rating System			
CRS		Premium Reduction	
Class	Credit Points	SFHA*	Non-SFHA

\*SFHA = Special Flood Hazard Area



Credit points are then earned from the following categories, listed by activity number:

Public Information		Flood Damage Reduction	
310	Elevation Certificates	510	Floodplain Management Planning
320	Map Information	520	Acquisition and Relocation
330	Outreach Projects	530	Flood Protection
340	Hazard Disclosure	540	Drainage System Maintenance
350	Flood Protection Library		
360	Flood Protection Assistance		
370	Flood Insurance Promotion		
Mapping and Regulations		Warning and Response	
410	Floodplain Mapping	610	Flood Warning and Response
420	Open Space Preservation	620	Levees
430	Higher Regulatory Standards	630	Dams
440	Flood Data Maintenance		
450	Stormwater Management		

**Table 46: Lake County Flood Insurance Status**

NFIP CID	CRS Class	Community	Flood Insurance Policies as of 9/30/2021	NFIP CID	CRS Class	Community	Flood Insurance Policies as of 9/30/2021
170358		Village of Antioch	8	170378	5	Village of Lincolnshire	10
170359		Village of Bannockburn	0	170379		Village of Lindenhurst	3
170057		Village of Barrington	1	170380		Village of Long Grove	2
170058		Village of Barrington Hills	0	170381		Village of Mettawa	0
171022		Village of Beach Park	4	170382		Village of Mundelein	0
170068	7	Village of Buffalo Grove	0	170383		Village of North Barrington	1
170028		Village of Deer Park	0	170384		City of North Chicago	9
170361	6	Village of Deerfield	18	170385		Village of Old Mill Creek	--
170362		Village of Fox Lake	42	170386		City of Park City	0
		Village of Fox River Grove	0		7	Village of Port Barrington	2
170363		Village of Grayslake	0	170387	6	Village of Riverwoods	4
170364		Village of Green Oaks	0	170388		Village of Round Lake	1
170365	6	Village of Gurnee	15	170389		Village of Round Lake Beach	10
171005		Village of Hainesville	0	170390		Village of Round Lake Heights	2
170366		Village of Hawthorn Woods	0	170391		Village of Round Lake Park	0
170367	8	City of Highland Park	12	170392		Village of Third Lake	0
171033		City of Highwood	--	170393		Village of Tower Lakes	0
170369	NO SFHA	Village of Indian Creek	--	170394		Village of Vernon Hills	0
170370		Village of Island Lake	0	171042		Village of Volo	0
170371		Village of Kildeer	0	170395		Village of Wadsworth	1

**Table 46: Lake County Flood Insurance Status**

NFIP CID	CRS Class	Community	Flood Insurance Policies as of 9/30/2021	NFIP CID	CRS Class	Community	Flood Insurance Policies as of 9/30/2021
170372		Village of Lake Barrington	0	170396		Village of Wauconda	2
170373		Village of Lake Bluff	0	170397		City of Waukegan	0
170374	7	City of Lake Forest	3	170173	6	Village of Wheeling	0
170375		Village of Lake Villa	0	170398		Village of Winthrop Harbor	1
170376		Village of Lake Zurich	0	170399		City of Zion	0
170915		Village of Lakemoor	0	170357	6	Lake County	91
170377	6	Village of Libertyville	3				

Table 46 shows the CRS class for Lake County and the Lake County municipalities that currently participate in the CRS. The CRS class rating and insurance premium reductions are shown in the table below. Properties in the FEMA Special Flood Hazard Areas (SFHAs), or the 100-year floodplain, receive a 5 percent premium reduction for every improvement in the CRS class. Properties outside the SFHA already have a reduced premium (since they are outside the floodplain), and therefore have a lower premium reduction than properties in the SFHA.

**Basement Backup Insurance:** The NFIP will cover seepage and sewer backup for an additional deductible provided there is a general condition of flooding in the area that was the proximate cause of the basement getting wet. Several insurance companies offer coverage for damages incurred should a sump pump fail or sewer line back up. Most exclude damage from surface flooding that would be covered by the NFIP.

**Other Insurance:** Insurance is also available for earthquakes other hazards such as sinkholes. Most of these coverages are included to a property policy as a policy rider.

### 5.2.5 Repetitive Flood Loss Properties

Chapter 3 discusses the Lake County and Lake County community repetitive loss properties (properties with two federal flood insurance claims of at least \$1,000 in any 10-year period). Protecting repetitive loss buildings is a priority with FEMA and IEMA mitigation funding programs.

The factors listed below should be used to determine appropriate property protection measures for repetitive loss properties. 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 crawlspace 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 30 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. Lake County has used the above direction in the development of “flood audits” that have been performed in repetitive loss areas. Repetitive loss areas were first identified during the development of the 2004 Draft Lake County Flood Mitigation Plan (around 2000). Letters were sent to property owners within selected repetitive loss areas to determine their interest in having a flood audit done for their property. Combined, SMC and Gurnee have conducted over 400 flood audits.

As discussed in Section 3.3.3 Repetitive Flood Loss Properties, and shown in Table 18 and of Chapter 3 of this ANHMP, there are over 100 properties on the Lake County repetitive loss list, located in 18 municipalities and unincorporated Lake County. The repetitive loss properties were grouped into 56 Repetitive Loss Areas (see Table 19). Of the remaining repetitive loss properties, about half have had flood audits (see Table 20). A flood audit also means that SMC at one time coordinated with the property owners about the flood audit process and the potential for mitigation project funding.

Though a number of repetitive loss properties have not been audited, many are in areas where nearby properties were audited. All the properties are single family homes. Of the 30 plus audited properties, all but two are single family residential.

A notable number of unmitigated repetitive loss properties are located on or near major Lake County lakes. When flooding occurs on the Fox Chain of Lakes, the flooding lasts for weeks. Long flood periods can also be experienced for properties along the Des Plaines River. During the flood audit, the range of flood mitigation options presented in the ANHMP will be investigated.

### **5.2.6 Property Protection Recommendations**

- All buildings and critical facilities in the floodplain, SMC problem areas and depressional storage areas, with priority given to buildings or facilities in the floodway, should be mitigated, to the extent that the measures are cost effective and feasible.
- All buildings and critical facilities in or out of the floodplain and subject to damage due to erosion, should be mitigated, to the extent that the measures are cost effective and feasible. For example, the homes being impacted

in the Bull Creek Watershed in Beach Park.

- Identified repetitive flood loss areas should be further investigated through flood audits, and flood prone structures should be mitigated.
- SMC should continue to conduct flood audits and to pursue hazard mitigation grants for the acquisition of properties that are cost effective and have interested property owners.
- Investigate property-owner incentives for elevations, barriers and floodproofing.
- Establish and disseminate guidelines for local officials for determining what mitigation measures are appropriate to protect property for various circumstances for floods, severe storms, wind events (microbursts), tornadoes and other priority hazards in Lake County.
- Available property protection and public education materials for all priority hazards should be consolidated and tailored for Lake County. Materials should address measures that can help owners reduce their exposure to damage by natural hazards and the different types of insurance coverage that are available.
- Critical facilities, including lift stations and other infrastructure facilities, should be audited to determine their vulnerability and hazard mitigation needs, including back-up power needs during power outages.
- Mitigation projects should be pursued for vulnerable critical facilities, including public facilities and health-care related facilities. 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.
- The availability of tornado shelters or safe rooms in Lake County should be investigated.
- Safe rooms should be constructed wherever needed in Lake County with priority given to schools and critical faculties.
- Develop action plan to identify and remedy illicit hook ups and sewer infiltration that maps and prioritizes problem areas for remediation. This can be done as a county coordinated community program in conjunction with NPDES Phase 2 requirements.
- Encourage business recovery plans.
- Feasible mitigation projects should be funded through grants or through capital funding.
- All property owners should be encouraged to determine if they are adequately insured for natural hazards.
- Each public entity (county, community, schools, and other agencies) should evaluate its own properties, with a priority given to critical facilities, to determine vulnerabilities to damage from natural hazards.

### **5.3 Resource Protection**

Natural resource protection measures serve to restore or preserve the natural functions of the floodplain and other components of the watershed storage and drainage system. Adverse impacts caused by various natural hazards can also be addressed through resource protection methods. These measures are implemented by a variety of public and private parties ranging from local park districts, forest preserves and regulatory agencies to land developers and farmers. The Liberty Prairie Reserve is an example of resource protection. Other resource protection measures include activities such as:

- Open space preservation
- Wetland protection
- Erosion and sediment control
- Streambank restoration
- Groundwater protection
- Urban forestry
- Historic and natural area protection

#### **Liberty Prairie Reserve**

*The Liberty Prairie Reserve is located in the area bordered by Routes 120 and 137 from north to south, and Route 21 and Prairie Crossing on Route 45 from east to west. The Reserve is a unique example of open space preservation that is a combination of public and private ownership. 1,500 acres of the 2,500-acre reserve is currently protected as open space. The natural landscape of the Reserve, combined with agricultural and residential land uses, has been protected through both outright acquisition and conservation easements.*

### **5.3.1 Open Space Preservation**

Open space preservation throughout a watershed is important for a variety of natural hazard and environmental reasons. Preserving floodplains and natural sites of water storage, such as wetlands and low-lying areas maintain the existing stormwater storage capacities of an area. These sites can also serve as recreational areas, greenway corridors, provide habitat for local flora and fauna, and improve water quality. Open space may also be maintained as a park, golf course, or in agricultural use.

Upland areas within a watershed may be key to limiting runoff that will worsen flooding problems, important for water quality and groundwater recharge. Purchase of land is the most common approach to open space preservation; however, other methods can be considered in addition. More affordable examples of open space preservation practices include the purchase or dedication of an easement that limits use of the parcel in exchange for a tax abatement or as a condition of development approval, and the purchase of development rights for a property.

In Lake County, the Forest Preserve District, local park districts and townships have prevented millions of dollars of flood damage through the foresighted acquisition of floodplain. The Lake County Forest Preserve District alone owns nearly 7,000 acres of land adjacent to the Des Plaines River, over 1,000 acres along the Skokie, Middle and West Forks of the North Branch of Chicago River, and about 300 acres adjacent to the Fox River.

Parks and golf courses follow the course of the Skokie River providing areas of floodplain storage. Private not-for-profit organizations are also active in preserving open space in Lake County. These groups include Lake Forest Open lands, Lake Bluff Open lands, Liberty Prairie Conservancy, and the Lake County Land Conservancy.



**The Des Plaines River Trail is an excellent example of floodplain open space that serves the entire community.**

*Source: Lake County Forest Preserve District.*

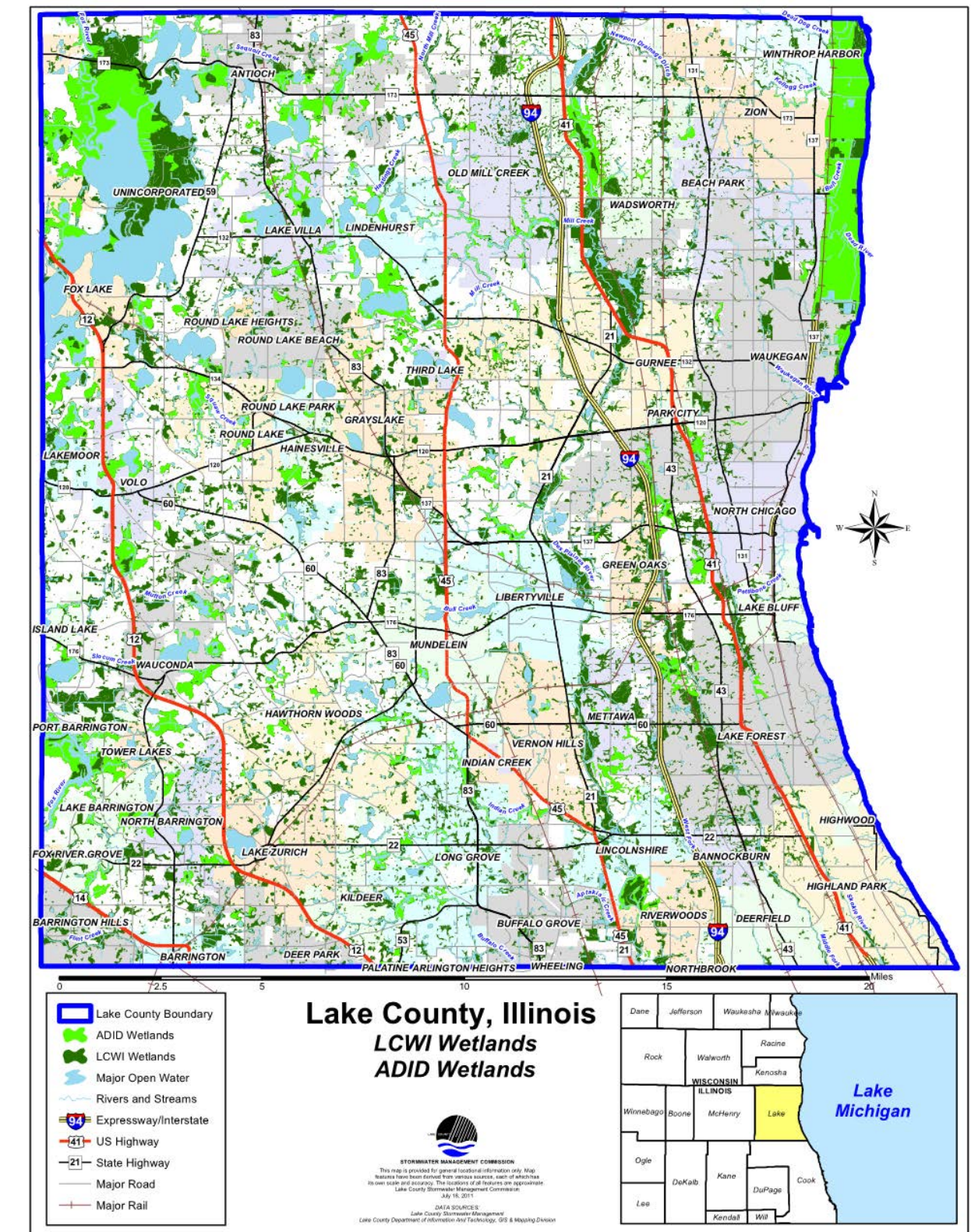


### **5.3.2 Wetland Protection Regulations & Soil Erosion and Sediment Control**

Wetlands are usually found in floodplains or depressional areas. They provide numerous natural and beneficial functions that warrant protection. Exhibit 18 shows the open water and lake areas of Lake County wetland protection along rivers and around the lakes is critical for water quality and ecosystem protection.

Wetlands located in the Waters of the U.S. (WOUS) are regulated by the U.S. Army Corps of Engineers (Corps). Local wetland programs are important for addressing gaps in the federal regulations, particularly for smaller wetlands, unregulated activities, and indirect hydrologic impacts. Local wetland programs can require undisturbed buffers be maintained around wetlands.

The WDO provides standards for the isolated wetlands no longer under the jurisdiction of the Corps. If your project may impact a wetland, you are required to submit a Jurisdictional Determination to determine if the wetland is an Isolated Waters of Lake County (IWLC) or a WOUS.



As rain hits the ground, especially where there is bare soil as on farm fields and at construction sites, soil is picked up and washed downstream. This erosion of soil produces sediment that may end up in waterways far from the eroded area. Erosion also occurs along streambanks and shorelines as the volume and velocity of flow or wave action destabilize and wash away the soil.

Sediment suspended in the water tends to 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. The impact of erosion from construction sites can be controlled by methods like ditch checks and silt fences. Proper placement and maintenance of erosion protection is important to prevent sediment accumulation in waterways.

Lake County's SMC, United States Army Corps of Engineers, United States Department of Agriculture, and the Natural Resources Conservation Service all have intergovernmental agreements in place to ensure proper and appropriate soil erosion and sediment control measures are installed and maintained on various development sites. The three agencies meet quarterly to coordinate on potential site violations.

BMP discussed in section



**Example of a strawbale ditch check to prevent erosion.**

*Source: City of Milwaukee*



5.1.3 Best Management Practices of this Chapter are also important for wetland protection and erosion and sediment control.

### **5.3.3 Stream Restoration**

Our understanding of the need for stream, streambank and riparian environment protection has grown significantly in the 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 reference ecosystem (that is typically based off its historical trajectory).

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

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 appropriate vegetation, long term maintenance costs are lower than if the banks were concrete. The Natural Resources Conservation Service estimates that over a 10-year period, the combined costs of installation and maintenance of a natural landscape may be one-fifth of the cost for conventional landscape maintenance, e.g., mowing turf grass.

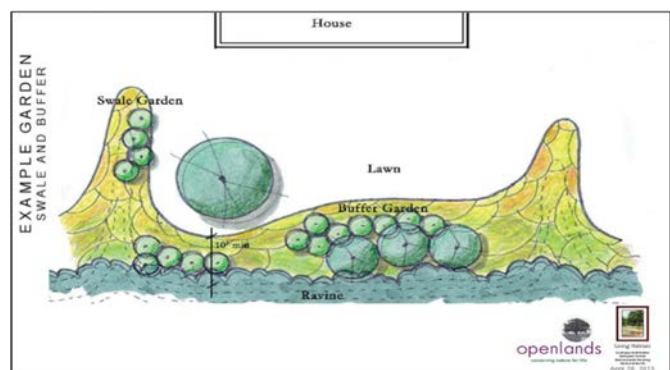
It is worth noting that rivers will take the most efficient or shortest path as the waters flows downstream. Because of debris, scour and other factors, a stream might meander through an area. During a flood, though, the stream will attempt to straighten itself or adjust its course. This is a natural occurrence, but manmade influences on this cycle should be minimized.

### 5.3.4 Erosion Protection

The Lake County WDO includes provision for address erosion with new development or redevelopment. Existing developments and property owners can take steps to reduce the potential for erosion.

The “Landowner’s Guide to Ravine and Tableland Preservation,” (2013) by Openlands is one resource guide available to help. A link to this guide is available on the Lake County website (SMC and Lake Michigan Watershed). The guide encourages limiting runoff to ravines, ensuring that sewer outfalls are at the ravine floor, and the planting and maintenance of native vegetation and trees in buffer areas along the ravine. Though written for ravine and tableland, the recommendations in the

**Figure 19: Erosion Resistant Garden**





guide for good practices and vegetation are applicable to any shoreline or streambank in the County. Figure 19 is an example garden from the Landowner's Guide.

The Illinois Department of Natural Resources, Office of Water Resources (IDNR-OWR) have developed the "Illinois Coastal Management Program." Their 2011 report includes a section on "Coastal Erosion Assessment and Planning." Permit from IDNR-OWR are required for coastal projects. Small projects fall under General Permits. Hardening of the coastline or other structures require a regular permit.

### **5.3.5 Groundwater Protection**

Groundwater concerns in Lake County pertain to both groundwater quantity (or groundwater availability) and groundwater quality. 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 several factors. Several types of ground cover, soils and aggregate layers have differing abilities to filter the infiltrating waters. Because of human activity, much of the rain or snow melt runoff that becomes seepage has many opportunities to collect pollutants. Pollutants need to be filtered back out either while the water is still above ground, or when it is seeping through the ground. Because soils and aggregate layers may not have the ability to fully "treat" the seepage before it becomes groundwater, it is essential to reduce the human-caused pollutants.

All groundwater was at one-time surface water. Rain and snowmelt 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.

### **5.3.6 Urban Forestry**

Most damages caused by wind, ice and snowstorms is to trees. Downed trees and branches break utility lines and damage buildings, parked vehicles, and anything else that was under them. A forestry program (urban or rural) can reduce the damage potential of trees.

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.

By having stronger trees, programs of proper pruning, and on-going evaluation of the trees, communities can prevent considerable 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.

To qualify as a Tree City USA community must meet four standards established by The Arbor Day Foundation and the National Association of State Foresters:

- A Tree Board or Department
- A Tree Care Ordinance
- A Community Forestry Program with an Annual Budget of at Least \$2 Per Capita
- An Arbor Day Observance and Proclamation

#### Communities Participating in Tree City USA

Village of Antioch	Village of Grayslake	Village of Lake Zurich	Village of Port Barrington
Village of Bannockburn	Village of Gurnee	Village of Libertyville	Village of Tower Lakes
Village of Barrington	Village of Hawthorne Woods	Village of Lincolnshire	Village of Vernon Hills
Village of Buffalo Grove	City of Highland Park	Village of Lindenhurst	Village of Wauconda
Village of Deer Park	Village of Lake Bluff	Village of Mundelein	Village of Wheeling
Village of Deerfield	City of Lake Forest	Village of North Barrington	

### 5.3.7 Historic and Natural Area Protection

Lake County has over 90 homes, hotels, other buildings, and districts included on the National Register of Historic Places. Additional sites are maintained by the Lake Forest/Lake Bluff Historical Society, the Fox Lake-Grant Township Historical Society, the Grayslake Historical Society, and the Waukegan Historical Museum. 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.

There are also ten historic bridges in Lake County that are listed in the “Historic Bridges of the U.S.” list as shown in Table 50.

**Table 47: Historic Bridges in Lake County**

<b>Community and Crossing</b>					
	<b>Road or Path</b>	<b>Bridge Type</b>	<b>Status</b>	<b>Year Built</b>	<b>Year of Rehab.</b>
<b>Highland Park - Ravine Bridges</b>					
	Central Avenue	Concrete Arch	Open to Traffic	1935	--
	Dean Avenue Bridge	Truss	Open to Traffic	1928	1965
	South Deere Park Drive	Arch	Open to Traffic	--	--
<b>Lake Forest - Ravine Bridges</b>					
	Bluffs Edge Drive	Steel arch	Open to Pedestrians	1896	--
	Lake Road	Arch	Open to Traffic	1912	1978
	Ringwood Road	Arch	Open to Traffic	1913	1995
	Walden Lane (1 & 2)	Steel Arches	Open to Traffic	1914	1995
<b>Long Grove - Buffalo Creek Crossing</b>					
	Coffin Road	Truss	Open to Traffic	1925	1981
<b>Waukegan - Waukegan River Crossing</b>					
	Genesee Street	Three-span Arch	Open to Traffic	1913	1984

Source: *Bridgehunter.com*

### 5.3.8 Resource Protection Recommendations

- 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.
- An open space network should be designated and mapped based on the information collected in data layers for the area-wide conservation and development map. Soils, historic, archeological, or cultural sites and recreation potential should also be added as considerations for designation of land in the open space network.
- Communities should implement an urban forestry program that qualifies them to become a Tree City, USA.
- The public and decision makers should be informed about the hazard mitigation benefits of restoring rivers, wetlands, and other natural areas.
- Better monitoring and enforcement of BMP performance.
- Complete watershed assessments and plans that incorporate specific BMPs based on watershed condition for all 26

of Lake County's subwatersheds.

## 5.4 Emergency Services

Emergency services measures protect people during and after a flood. The primary responsibility for protecting lives and property from natural hazards lies with the local government. Lake County and many cities and villages have emergency management offices to coordinate warning, response, and recovery during a disaster. Lake County Emergency Management Agency (LCEMA) is operated through the County Administrator's Office. At the state level, local emergency management programs are coordinated by the Illinois Emergency Management Agency (IEMA).

### Emergency Service Activities Address:

- Floods
- Tornadoes
- Severe Storms
- Winter Storms
- Extreme Heat
- Extreme Cold
- Dam Failure
- Wildfire

In Illinois, all counties, and those communities with populations greater than 10,000 are required by law to have a state-accredited emergency services and disaster program. Municipal emergency management programs respond to disaster situations that occur in their corporate boundaries. The LCEMA is responsible for all unincorporated areas in the county and incorporated communities that do not implement their own emergency management program. Emergency management programs include activities such as:

- Emergency Planning
- Threat Recognition
- Warning
- Response
- Recovery & Mitigation
- Critical Facility Protection

### 5.4.1 Emergency 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 require frequent reviews to keep contact names and telephone numbers current and to make

sure that supplies and equipment that will be needed are still available. 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.

The LCEMA maintains and implements the County's EOP, and is responsible for the review of EOPs developed by the municipalities. LCEMA also facilitates emergency management exercises with the municipalities. Lake 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, health care, area employers, and other members.

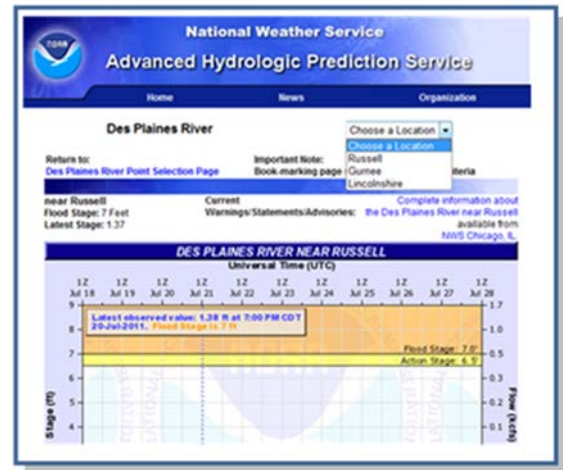
All Lake County municipalities have emergency management personnel, and the majority of municipalities have either developed and adopted EOPs or are developing EOPs. All communities are working towards National Incident Management System (NIMS) compliance. Most communities have rooms that are converted 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, IPWMAN, IEMMAS, PHMAS) can be utilized in any phase of an emergency or disaster.

### 5.4.2 Threat Recognition

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. Effective threat recognition is key for emergency managers and local officials to protect life, health, safety and property from the impact of natural hazards.

**Floods:** A complete flood threat recognition system measures rainfall, snow conditions, soil moisture, and stream flows upstream to calculate the time and height of the flood crest downstream.



The National Weather Service (NWS) tracks precipitation, monitors river stages and issues flood crest forecasts during potential flood situations. The NWS continuously relays weather information through radio transmissions, and flood forecasts are also available via the Internet. A system of stream and rain gages jointly operated by the United States Geological Survey (USGS) and the SMC supplement that data available to the NWS.

Table 48 shows NWS prediction locations for the Des Plaines and Fox Rivers. Stages are unique to a location and sometime difficult to relate to upstream or downstream locations. The creation of flood stage maps is one alternative to understanding a predicted flood stage and the extent of a flood inundation area.



**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. 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.

**Winter Storms:** The NWS is again the prime agency for predicting winter storms. Severe snowstorms can often be forecasted days in advance of the expected event, which allows time for warning and preparation. Though more difficult, the NWS can also forecast ice storms.

**Table 48: NWS Flood Forecast Points**

River/Location	Action Stage (ft.)	Flood Stage (ft.)
<b>Des Plaines River</b>		
Russell	6.5	7.0
Gurnee	6.5	7.0
Lincolnshire	11.5	12.5
Des Plaines	4.5	5.0
<b>Fox River</b>		
Antioch	--	739
Stratton L&D	3.5	4.0

**Other Hazards:** Lake County dispatch centers receive other severe weather alerts from the LEADS system. These alerts are issued by the Illinois State Police who monitor the NOAA Weather Wire, or through their monitoring of NOAA weather radios. Police and fire stations, schools, county and municipal buildings, and some private facilities have been issued Weather Radios, or they are notified over the EAS from the LCEMA.

**Figure 20: Flood Forecast and Rain and Stream Gage Links**

IL Dept. of Natural Resources (IDNR): <a href="https://www.dnr.illinois.gov/WaterResources/Pages/Surveillance.aspx">https://www.dnr.illinois.gov/WaterResources/Pages/Surveillance.aspx</a>
National Weather Service (NWS): <a href="http://www.weather.gov">http://www.weather.gov</a>
United States Geological Service (USGS): <a href="https://waterdata.usgs.gov/il/nwis/rt">https://waterdata.usgs.gov/il/nwis/rt</a>

### 5.4.3 Warning

Earlier and accurate warning leads to better response. Most warning programs have two levels of notification:

***A flood watch:*** conditions are right for flooding.

***A flood warning:*** a flood has started or is expected to occur in the community.

Warning notifications may be disseminated by the community in a variety of ways, including:

- Outdoor warning sirens
- Sirens on public safety vehicles
- Commercial or public radio or TV stations
- The Weather Channel
- Cable TV emergency news inserts
- Reverse 911
- Telephone trees/mass telephone notification
- NOAA Weather Radio
- Tone-activated receivers in key facilities
- Door-to-door contact
- Mobile public-address systems
- Cellular phone text messages
- E-mail or social media 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. Just as important as issuing a warning is telling people what to do. Warning programs should have a public information aspect. For example, 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). The Village of Lake Zurich recently dedicated \$500,000 in its 2015-2016 budget to install a system that sends text or email alerts warning of potential flood conditions.

The Lake County Administrator is the officially designated Public Information Officer during an emergency. The Emergency Management Coordinator (EMC) assists him. The Lake County Sheriff's Office is responsible for operating a dispatch center. The dispatch center communicates with all county departments and is responsible for disseminating warning information to the public and notifying key response personnel during an emergency.

The County has its own radio network for emergencies called the Radio Amateur Civil Emergency Services (RACES) that maintains a school warning system and can also tie into hospitals and nursing homes in an emergency. Lake County schools, businesses and several County agencies have installed 156.210 MHz warning radio receivers for early notification. If the situation warrants, the County Board Chairman, or his alternate, notify the EMC to activate the Emergency Alert System (EAS). The public warning system for natural and technological disasters includes the Outdoor Warning Siren Alert Tone.

Outdoor warning sirens have been installed in many locations throughout the county. (Areas in the county where the outdoor warning sirens are insufficient have been identified by Emergency Services.)

Several the designated sirens can be activated manually at the siren site during a disaster. Community EMA coordinators, fire chiefs, mayors and police chiefs are authorized to activate these systems. The siren is a signal to the public to turn on televisions or radios to an emergency broadcast station where emergency public information and instructions on the type of protective actions that need to be taken are broadcast.

There is also a Lake County Public Emergency Notification System (PENS) that uses tone activated police radios. In addition to the EAS and radio system, the EMC also passes flood warning information to affected communities and townships by telephone. The fire and police departments provide mobile sirens and public-address systems, and door-to-door notifications when necessary. The EMC is responsible for notifying the IEMA Communications Center of all disaster warnings.

**StormReady:** The NWS 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.

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 NWS is a good measure of a community's emergency warning program for weather hazards. Currently, the following Lake County communities are StormReady communities:

Village of Gurnee

Village of Hawthorne Woods

Village of Libertyville

#### **5.4.4 Response**

The protection of life and property is the goal of effective emergency response. Concurrent with threat recognition and issuing warnings, a community should respond with actions that can prevent or reduce damage and injuries. Typical actions and responding parties include the following:






- Activating the emergency operations center (emergency management)
- Closing streets or bridges (police or public works)
- Shutting off power to threatened areas (utility company)
- Passing out sand and sandbags (public works)
- Ordering an evacuation (chief elected official)
- Holding children at school/releasing children from school (school district)
- Opening evacuation shelters (Red Cross)
- Monitoring water levels (engineering)
- Security and other protection measures (police)






Once a threat is recognized, the priority is to alert others through the warning system. The second priority is to respond with actions that can prevent or reduce damage or injury. When resources at the local level and state level are insufficient to deal with a large-scale flood emergency, assistance is available from the federal government.

Response plans ensure that all response activities are appropriate for the expected hazard. The *Lake County Emergency Operations Plan (EOP)* was updated in 2014.

Table 49 identifies, as an example, the typical flood response assignments in Lake County.

**Table 49: Lake County Flood Response Assignments**

<b>Activating the emergency operations center:</b>	
	Lake County Emergency Management Agency (EMA) Coordinator coordinates emergency response of all county agencies
<b>Sandbagging certain areas:</b>	
	EMA office provides bags and has Sandbagger machine, public works or township road department coordinate operations with citizen volunteers
<b>Maintaining highway system: storm sewers, streets, bridges:</b>	
	Lake County Division of Transportation (signs/markings, debris removal, storm sewer and drainage structure repair)
<b>Closing streets or bridges:</b>	
	Police/sheriff's department coordinated with appropriate road authority
<b>Protecting water supplies &amp; wastewater treatment facilities:</b>	
	Department of Public Works
<b>Shutting off power to threatened areas:</b>	

 Utility companies
<b>Releasing children from school:</b>
 School districts
<b>Ordering an evacuation:</b>
 Lake County Board Chairman, Sheriff's Office, Mayor, local police
<b>Opening evacuation shelters - providing welfare services:</b>
 EOC, Townships, Red Cross, Salvation Army, Lake County Chaplains, Catholic Charities
<b>Guarding sandbag walls, evacuated areas &amp; other protection measures:</b>
 Local police/Sheriff

However, the HMPC feels that the EOP should be supplemented with emergency response teams for issues relating to the health department and mitigation opportunities.

Various county departments and agencies are responsible for maintaining their own emergency management procedures and response equipment. The EOP identifies and describes the activities of county departments and agencies responsible for event response. The LCEMA supports and coordinates municipal disaster response. As mentioned above, about 30 Lake County municipalities maintain and implement their own EOPs.

#### 5.4.5 Critical Facility Protection

A summary of Lake County critical facilities is presented 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.

Protecting critical facilities during a hazard event is a vital part of any emergency service effort. If a critical facility is flooded, for example, workers and resources may be unnecessarily drawn away from protecting the rest of the community. If such a facility is prepared, it will be better able to support the community's flood response efforts.

Most critical facilities have full-time professional managers or staff is responsible for the facility during a disaster. These people often have their own emergency response plans. State law requires hospitals, nursing homes, and other public health facilities to develop such plans.

The LCEMA maintains lists of critical facilities in the County, but the information is not compiled for all critical facilities. It is the individual community or township's responsibility to plan for critical facility response within their jurisdiction.



### **5.4.6 Recovery and Mitigation**

Preventing dangers to health and safety is critical after a hazard event. Recovery plans should identify appropriate measures to take. Recovery plans also should identify which agencies will be responsible for carrying out these measures.

Appropriate measures for protecting public health and safety include:

- Providing safe drinking water
- Inspection of shelter food preparation and distribution facilities
- Inspection of food facilities prior to re-opening after flooding
- Insure adequate sanitary facilities for sheltered population
- Providing appropriate inoculations
- Cleaning up debris and garbage
- Regulating reconstruction to ensure that it meets all code requirements

The EOP covers responsibilities for most of these measures. Within Lake County, the police, sheriff, or reserves are responsible for protecting evacuated areas. Depending on road authority, the Tollway Authority, Illinois Department of Transportation (395 miles), Lake County Department of Transportation (270 miles) or the Township highway departments (530 miles) are responsible for clearing roads. A response and recovery checklist are included in the Highways Appendix of the EOP.

The Lake County Health Department, in cooperation with the Public Works Department and the appropriate water treatment agencies (including JAWA), test the water supply throughout the emergency to insure it has not been contaminated. The Health Department is also responsible for inspection of food services, runs necessary inoculation programs, and will check private wells and septic systems that have been flooded within 14 days of request. The Public Health Appendix of the EOP includes a response and recovery checklist that covers these responsibilities excluding the checking of private wells and septic systems. The Lake County Red Cross is responsible for the operation of shelters.

While the EOP is silent about flood clean up responsibilities, the LCEMA office supports community efforts at cleanup and debris removal from curbside (citizens are required to get the trash and debris to the curb).

Appropriate post-disaster mitigation actions include, but are not limited to:

- 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

### **5.4.7 Emergency Services Recommendations**

- All communities should strive to obtain a StormReady designation.
- Continue to update emergency operations plans for the County and continue to develop municipal emergency operations plans with a NIMS compliant template.
- Continue work for NIMS compliance for the County and all municipalities and provide training on NIMS and Incident Command Structure (ICS) for all first responders and other identified personnel for compliance.
- Improve information sharing between Lake County, municipal/township agencies, and services providers, such as ComEd, during and after natural hazard events. Systems should be put in place to help ensure that response and recovery efforts are coordinating and well communicated.
- Add a “Flood Annex” to the Lake County Emergency Operations Plan.
- Establish an emergency response assessment teams, including a mitigation team and a health department team.
- Response procedures for severe storm and high wind hazards should be incorporated in all emergency operations planning and response where appropriate.
- Incorporate more proactive flood response activities in emergency plans. (i.e., identify and closely monitor known problem constrictions in drainage system; system of monitoring lake levels by lake associations for lakes with associated flood problem areas; guidance to property owners on when and how to turn off utilities during flood)
- Standardize and improve system of flood damage reporting by the county, townships, and municipalities in computerized database format.
- The County and communities should ensure that alternative power sources are available at critical structures and shelters.
- Establish a “You Are Not Alone” program for seniors and the handicapped.
- Install and maintain lightning detection systems for population and/or active sites.
- 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.
- Conduct annual emergency response training exercises and table-top exercises. Look for multi-jurisdiction training

opportunities.

- Develop a disaster recovery strategy for the County and municipalities that includes the identification of mitigation efforts.
- 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.
- Develop flood stage maps for the County's major streams to make use of gaging networks, warning systems and GIS mapping capabilities.
- The County should provide more information to communities regarding stream gage readings and emergency response actions.
- Research funding for additional rainfall and river gages.
- Also, the County and community should look to expand the National Weather Service observer's network.
- Continue use and funding of the County's Reverse-911 system and utilize other applications of that system for natural hazard warning and response.
- Develop emergency transportation plans that allow for emergency coordination and evacuation (routing).
- Maintain and update snow removal plans.

## 5.5 Structural Measures

Structural projects are projects that are constructed to protect people, buildings, and infrastructure from damage due to natural hazards. Preventing damage due to flooding is the primary focus of structural projects. Structural projects are usually funded by public agencies. Structural measures include activities such as:

Watershed Planning

Improving Crossways/Roadways

Regional Flood Control

Drainage & Storm Sewer Improvements

Management of Existing Dams

### 5.5.1 Watershed Planning

A watershed is an area of land draining to a river or stream. It includes rivers, streams, lakes, and wetlands. Everyone lives in a watershed, and everyone contributes to the health of the watershed. Communities are often time in more than one watershed. 8 shows the Lake County Watersheds. The major watersheds of Lake County are the Fox River Watershed, the Des Plaines River Watershed, the Lake Michigan Watershed, and the North Branch of the Chicago River Watershed.

In the 1970s and 1980s the watershed was studied by state and federal agencies (IDNR-OWR, the Corps and NRCS) for purposes of FEMA floodplain mapping and for purposes of identifying flood control projects to address existing flooding. Watershed studies are based on hydrologic (rainfall-runoff) models and hydraulic (extent and depth of flooding) models. As development has expanded throughout Lake County, these models have become increasingly less reliable for depicting the full extent of the 100-year flood, for example. As funds become available, SMC has

been remodeling watershed sub-basins and developing watershed plans. Completed and underway watershed studies in Lake County include:

**SMC and County Board Adopted Watershed Based Plans:**

- Des Plaines River Watershed-Based Plan (Des Plaines) (Adopted 2018)
- Bull Creek/Bull's Brook Watershed-Based Plan (Des Plaines) (Adopted March 2009)
- Fish Lake Drain Watershed-Based Plan (Fox River) (Adopted March 2009)
- Indian Creek Watershed-Based Plan (Des Plaines River) (Adopted March 2009)
- North Branch of the Chicago River Watershed-Based Plan (Chicago River) (Adopted May 2008)
- Sequoit Creek Watershed Plan (Fox River) (Adopted July 2004)
- Manitou Creek Watershed Plan (Fox River) (Adopted May 2004)
- North Mill Creek/Dutch Gap Watershed-Based Plan (Des Plaines) (Adopted 2012)
- Dead River Watershed-Based Plan (Lake Michigan) (Adopted 2008)
- Kellogg Creek Watershed-Based Plan (Lake Michigan) (Adopted 2008)
- Newport Drain Watershed Plan (Des Plaines)
- Flint Creek Watershed-Based Plan (Fox River) (Adopted 2018)
- Waukegan River Watershed Plan (Lake Michigan)

Watershed studies conducted in the 1970s and 1980s did not examine wetlands, critical environmental areas, or water quality. Current watershed plans examine these issues as well as flood issues. Many the watershed plans list homes that should be further examined for flood proofing. Other plans collected flooding questionnaire from residents within the projects. These efforts expand the database of SMC flood problem areas (shown in

**Exhibit** in Chapter 3) and adds to the list of properties that need a flood audit from the SMC.

### **5.5.2 Regional Flood Control**

Structural flood control measures are used to prevent floodwaters from reaching properties, thus preventing damage. These measures generally involve construction of man-made structures to control water flows. Because of their size and cost, structural projects typically are implemented with the help of state or federal flood control agencies such as the IDNR-OWR, the Corps, and the NRCS.

Since structural flood control is generally the most expensive type of mitigation measure in terms of installation costs, maintenance requirements and environmental impacts, a thorough alternative assessment should be conducted before choosing a structural flood control measure. In some circumstances, smaller structural flood control measures may be included in a package of several recommended measures for a project area where non-structural measures would not be practical or effective.

Because larger structural flood control projects have regional or watershed-wide implications, they are often planned at a regional level by the state and federal agencies that provide most of the project funding. Nonetheless, communities should participate in and coordinate with regional flood control studies to insure they are practical, effective and have community acceptance.

Flood control studies have been done by federal and state agencies on the North Branch of the Chicago, Des Plaines and Fox Rivers. Some recommendations from these studies for reservoirs and levees have been constructed, others have not.

Three flood control reservoirs have been constructed in Lake County on the North Branch of the Chicago River. Following study recommendations made by the Soil Conservation Service (1974) and the Corps (1988), the Duffy Lane Reservoir was constructed in 1990, and the Atkinson Road and Deerfield Reservoirs were completed in 1992. Buffalo Creek Reservoir, north of Lake Cook Road has also been constructed to protect properties in Cook County.

### **5.5.3 Management of Existing Dams**

IDNR-OWR manages the state's dam safety program that requires dam permits and operations and maintenance plans. The strictness of the permit requirements and plans is dependent on several factors including the level of hazard caused by dam failure, dam height and impoundment capacity.

The primary determinant is dam hazard. Dams are rated as being either Class I, II, or III hazard depending on the damage risk for surrounding and downstream people and properties. As discussed in section 3.9 Dam Failure in Chapter 3 of this ANHMP, there are 32 dams in Lake County under IDNR-OWR's jurisdiction. The Stratton Lock and Dam in McHenry is not included in the Lake County list but is of high concern to Lake County.

In Lake County dams are largely managed and controlled by a municipality, lake or homeowners' association, drainage district or private property owner. There is no county established inspection program or operations and maintenance requirement. The Lake County Watershed Development Ordinance (WDO) requires that the appropriate IDNR-OWR permit (or letter indicating that no permit is required) be received for all projects requiring a dam prior to the issuance of a WDO permit.

#### **Dam Risk Reduction Measures:**

Risk reduction measures can be implemented by any entity that may be affected by or is at risk from a dam failure, including state and local governments; communities; dam owners and operators; and individual property and business owners.

The most effective risk reduction occurs when all parties—from the state government to community agencies to dam owners to at-risk individuals—are aware of each other's actions and coordinate them effectively. No entity can act alone and expect to be successful. Working together maximizes risk reduction in every phase of the risk reduction process (pre-event, mid-event/response, and post-event/recovery).

Risk reduction measures aimed at reducing the likelihood of a dam failure and improving the resilience of those impacted by a potential dam failure should be tailored to the needs of all stakeholders. Stakeholders must understand their roles and responsibilities to ensure effective risk reduction and incident management. Strategies, frameworks, initiatives, plans, and procedures must be flexible and adaptable to the unique and dynamic environment created by each disaster. One of the initial critical steps is identifying the at-risk population and



understanding each stakeholder's mission, objectives, obligations, and expectations for risk reduction. Ensuring effective communication among stakeholders will improve coordination among the various entities, particularly following a dam failure.

#### **5.5.4 Improving 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 too small culvert that is serving as a constrictor creating backwater and causing localized flooding may be replaced with a larger culvert to eliminate flooding at the waterway crossing point. The potential for worsening adjacent or downstream flooding needs to be considered before implementing any crossing or roadway drainage improvements.

#### **5.5.5 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. In addition to sediment, debris and weedy vegetation removal, drainage maintenance can also involve using best management practices (BMPs) to stabilize eroding shorelines or streambanks. 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.

In Lake County, parks, public works or highway departments, the Forest Preserve District, or the drainage districts where rights-of-way are established, or easements have been granted generally perform channel maintenance activities. Channel maintenance and restoration have also been a part of several river/stream projects such as the pool/riffle installation of the Waukegan River restoration project, and streambank stabilization using bioengineering along sections of Flint Creek in Barrington and Lake Zurich and the West Fork of the North Branch of the Chicago River in Deerfield.

In the case of detention ponds, generally a property owners' association is responsible for maintenance at residential developments. Detention ponds on public properties are maintained by the appropriate government jurisdiction.

Lake County allocated money for fiscal year 1998 to establish a drainage improvement fund for small projects in unincorporated Lake County. The Lake County Planning and Development Department (PB&D) is establishing the procedure for expenditure of these funds.

In addition to this fund, Watershed Management Board (WMB) and Community Development Block Grant (CDBG) funding have been used for drainage system improvements in the past. WMB funding is administered by the SMC and awarded on a competitive basis as 50% cost-share funding for projects sponsored by communities. CDBG funds are administered by the PB&D based on recommendations by the Community Development Commission.

There is currently no coordinated program or maintenance standards established at the county-level to consistently perform on-going drainage maintenance. Maintenance is typically done on an as-needed basis in response to problems or complaints about blockages or erosion. In many cases property owners must consent to the maintenance program. This may require legal negotiations to obtain maintenance easements.

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 generally results in very little maintenance being accomplished.

The SMC developed “A Citizen’s Guide for Riparian Area Management,” which educates landowners about debris removal and riparian landscaping. SMC anticipates adopting stream maintenance standards in the future to provide guidance and consistency for maintenance in Lake County.

### **5.5.6 Structural Measure Recommendations**

- SMC and communities should investigate the need and ability to improve the capacity of drainage systems.
- Drainage studies, for both system capacity and detention needs, should be conducted for local drainage problem areas, as identified, and areas should be included in the SMCs mapping of flood problem areas.
- Communities should undertake steps to reduce inflow and infiltration into sewer system to reduce sewer backups.
- Develop, adopt and implement protocol for drainage system maintenance standards countywide (waterways, swales, detention basins, levees, reservoirs).
- Study the feasibility of structural flood control projects within Lake County watersheds and pursue funding for feasible projects.
- Provide preventative maintenance for susceptible landslide areas.
- Pursue funding for studies and construction of feasible local and regional drainage projects.

## **5.6 Public Information**

Mitigation of all-natural hazards can be accomplished through effective public information activities. This is also true for addressing health issues and pandemics. Public information activities advise property owners, renters, businesses, and local officials about hazards and ways

to protect people and property. These activities can motivate people to take the steps necessary to protect themselves and others. A successful hazard mitigation program involves a public information strategy and involves both the public and private sectors. Public information includes activities such as:

- Library and website resources
- Outreach projects
- Technical assistance

Individual property owners usually implement property protection measures; therefore, a community mitigation program should include measures to encourage and assist owners in protecting their property from flood damage. Public information activities advise property owners, and potential property owners, about flood hazards and how to protect lives and property from the hazards.

In addition to raising awareness about the hazards of flooding, public information activities also educate community residents and businesses about the beneficial functions local floodplains provide. These activities are usually implemented by a public information office but can also be the basis for developing a cooperative program with several different local agencies or departments.

A community has passive and active ways to inform residents about flood hazards and damage mitigation. Passive ways to provide information include providing reference materials and map information in the public library, at government agency offices and on a web page. Active approaches include outreach projects and providing technical assistance. Four measures for a public outreach program are considered in this plan.

### **5.6.1 Library and Website Resources**

- Community libraries are an obvious place for residents to seek information about flooding and flood protection. Maintaining and updating library resources with this information is an effective public information strategy, since most people turn to the library when they want to research a topic.
- In addition to maintaining a resource file, libraries also frequently sponsor their own public information campaigns that might include displays, lectures and newsletter articles. Arranging one of these types of activities with the library can support and augment county or municipal public information campaigns on flooding.
- In Lake County, information on flood awareness and response is currently available at the SMC, LCEMA and other Lake County department websites, and at the American Red Cross office in Mundelein.
- SMC has developed and distributes many brochures to other agencies and the public that address flood mitigation and response and serves as a clearinghouse for flood information available from the state and federal government and other agencies. Examples of SMC publications include:
- Guides for homeowners on riparian area management and maintenance of subdivision stormwater Best

#### Management Practices

- A “who to call” list for drainage and flooding problems.
- SMC also maintains flood hazard information on its homepage through the Lake County website. The American Red Cross, the Federal Emergency Management Agency and the Illinois Department of Natural Resources Office of Water Resources also have print materials available in their office libraries.

### **5.6.2 Outreach Projects**

In addition to supplying information in a passive manner through library resources, a community may want to engage in several more proactive approaches directed to those people at greatest risk. Proactive approaches reach out to people and give them information, even when they do not ask for it. Outreach projects are designed to encourage people to seek out more information on flood protection. They may include:

- Mailing notices to flood prone property owners to introduce the idea of property protection
- Holding workshops, “open houses” or other special events
- Distribution of “how to” brochures, videos or handbooks to property owners’ associations, (or to individuals upon request)
- Presentations at meetings of neighborhood groups
- Providing programs and information at public venues such as malls or fairs
- Media blitzes, including newspaper articles, and radio and television news releases and interview shows, and Lake County TV cable channel

To be most effective, outreach projects should include information on property protection measures that homeowners can apply and be locally designed and tailored to meet local conditions.

The county sponsored its first official “Flood Awareness Week” in 1997. SMC organized weeklong activities that were co-sponsored by various County departments and agencies involved in flood hazard awareness and response. A day-long workshop was held for planners, realtors, and insurance agents. Other events included an evening program for the public that included several segments including an overview of the County’s flood hazard; an introduction of all the local players in flood response, flood protection and mitigation; and “where to go” or “who to call” for help. Flood awareness and safety messages and publications are permanently featured on SMC’s website.

### **5.6.3 Technical Assistance**

In one-on-one sessions with property owners, community officials such as code enforcement staff or building inspectors can provide advice and information on identifying flood hazards at the site, correcting local drainage problems, floodproofing, dealing with contractors, and funding. More intensive assistance for highly flood prone properties may include conducting a “flood audit” that includes a written report covering remedial measures. Formal “flood audits” are currently not provided as a county service.

Several county agencies advise residents on flood risk and flood protection. The SMC provides advice and technical assistance to property owners associations, municipal governments and other local government units for areas that experience flooding on a watershed or regional scale. The PB&D offers technical assistance to property owners in unincorporated Lake County that experience relatively minor drainage and flooding problems.

Municipalities are responsible for providing this assistance within their jurisdictions, although not all have a system to do so, leaving some municipal residents without help. The appropriate municipal contact is generally the public works department.

The Lake County Health Department provides technical guidance related to septic system failure and well contamination. Because flood events occur on an unpredicted and often infrequent basis, a good public information program is necessary for a successful flood mitigation program. When flood mitigation measures involve multiple partners or property owners, the acceptance of a flood mitigation proposal may rely upon an educated partnership and public. A public information program is also necessary to make private property owners aware of the options available to protect themselves from future flood damage, and to convince them that flood mitigation is a good expenditure of their funds.

#### **5.6.4 Public Information Recommendations**

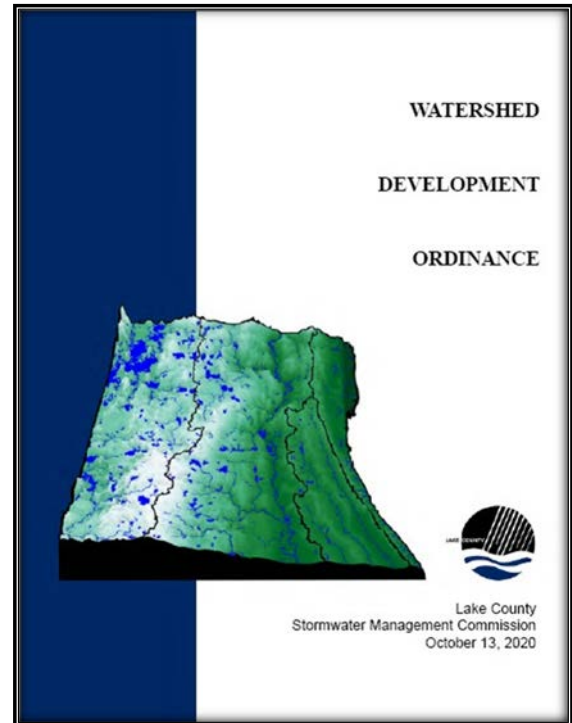
- LCEMA, SMC and other county agencies should build a county-wide partnership for coordinated delivery of public information materials and activities.
- Communities in the NFIP should provide floodplain information for property owners.
- Communities in the NFIP should promote flood insurance to residents and property owners.
- Develop and implement a system to coordinate the distribution of flood mitigation and response guidance materials for pre-flood outreach to at risk property owners.
- Increase outreach to community plan departments and commissions to strengthen local understanding and review of development proposals and their compliance with WDO standards.
- Educate property owners on safe rooms. Prepare informational materials on how to construct safe rooms in homes and other buildings.
- Develop a method that helps identify safe rooms and encourages their use.
- Educate property owners and residents about safety during severe summer and winter storms.
- Provide information to property owners and residents about safe use of generators and safe cooking during power outages.
- Provide information that identifies locations of cooling and warming shelters.



## 5.7 Capability Assessment Summary

Lake County and the municipalities have notable existing capabilities to minimize future vulnerabilities to hazards. Section 5.1 Preventive Measures discusses the plans, ordinances, and programs that can help prevent or minimize possible future impacts of hazards. The WDO addressed new development, but also strives to mitigate the impact of existing development. Tables throughout this chapter also summarize and highlight community activities, and other sections of this chapter depict activities underway to address existing vulnerabilities.

The Lake County government arrangement allows communities to take individual mitigation projects or to participate with the county. For example, communities can pursue their own buyouts, or they can participate with the SMC to address environmental and demolition/restoration needs. Municipalities have the choice of relying on the county for watershed development issues or making their own determinations through the WDO Certified Community approach. Communities have numerous mutual aid agreements, and LCEMA is working to reduce overall vulnerability.



The constraints facing Lake County and the communities include both limited staff resources and funds that can be directed toward implementing hazard mitigation actions. To a great extent, communities will need to rely on technical and financial assistance from regional, state and federal resources to effectively implement hazard mitigation actions over the next five years. The current economy has severely limited funding throughout Lake County.

During the development of this draft Hazard Mitigation Plan and after reviewing other recent planning initiatives, it is clear that municipalities have the capability to bring together citizens, government representatives, and local officials to work closely together in crafting a better future for their communities. That same cooperative effort, if joined with the appropriate technical and financial assistance from regional, state, and federal resources, can be harnessed to implement the priority hazard mitigation actions described in Section 6 on this plan. A sustained effort by the citizens, staff, and local officials can create a more sustainable and disaster resistant future for Lake County.

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## Chapter 6: Action Plan

This chapter contains the 2022 ANHMP Action Plan. The action items presented in this Chapter were developed from the action items presented in the 2017 ANHMP, from the HMPC meetings and discussions, and the list of mitigation recommendations presented in Chapter 5.

### 6.1 Development of Current Action Plan

The Action Plan included in this Chapter was developed by the HMPC as part of this ANHMP update and the 2022 update.

All action items, whether listed specifically for a community or not, and all recommendations included with the mitigation strategies in Chapter 5 of the ANHMP should be considered for funding should IEMA or FEMA mitigation grant opportunities arise for any community that participated in this 2022 update.

**Action Items:** For this 2022 update, the HMPC discussed the effectiveness of the 2017 action plan and action items. Most all 2017 action times applied to most all communities. For the 2022 plan development, the County and communities identified action items applicable to the County and to the communities. Next the communities identified action items to be undertaken with the update. The community specific action items are listed in Section

**Table 51: Summary of 2022 Action Items and ANHMP Goals**

No.	Action Item:	Action Item to Be Implemented By:				
		Lake County Board	Lake County	Municipal Boards & Councils	Municipal Staff	Other Stakeholders
1	Adoption	✓		✓		
2	Monitor & Maintain		✓		✓	
3	Incorporate ANHMP in Other Plans	✓	✓	✓	✓	✓
4	Implement WDO & NFIP		✓		✓	
5	Public Information		✓		✓	✓
6	Alternate Power Sources				✓	✓
7	Mitigation of Critical Facilities		✓		✓	✓
8	Capacity of Drainage Systems		✓		✓	
9	Maintain Drainage Systems		✓		✓	
10	Property Protection Projects		✓		✓	✓
11	Reduce Inflow and Infiltration				✓	
12	Wind Mitigation & Safe Rooms	✓	✓	✓		
13	Tree City USA				✓	
14	NIMS Compliance	✓	✓	✓	✓	✓
15	Improve Building Codes		✓		✓	
16	Seek Grant Funding		✓		✓	
17	StormReady		✓		✓	
18	Emergency Response		✓		✓	
19	Response & Recovery Information	✓	✓		✓	✓
20	CRS Participation		✓		✓	

**Table 51: Summary of 2022 Action Items and ANHMP Goals**

No.	Action Item:	Action Item to Be Implemented By:				
		Lake County Board	Lake County	Municipal Boards & Councils	Municipal Staff	Other Stakeholders
21	Continue to map natural hazard impacts and continue vulnerability assessments		✓			
22	SMC Flood Mitigation Projects		✓			
23	Development of Flood Stage Maps		✓			
24	Snow removal plan		✓		✓	
25	Utility tree trimming		✓		✓	
26	Sump Pump Disconnects		✓		✓	
27	Local Drainage Studies		✓		✓	
28	Increase Detention		✓		✓	
29	Investigate Countywide Warning System		✓		✓	
30	Investigate Future Conditions and the Impact on Depth and Frequency of Flooding		✓		✓	
31	Lincolnshire Creek Improvements				✓	
32	Mitigate Septic Discharge, Leaching into Waterways		✓		✓	
33	Implement the FFRMS				✓	
34	(A)Bank Stabilization, (B) Resize culvert, (C) Stormwater Conveyance Improvements and (D) Update Building Codes.			✓	✓	
35	Catch basins			✓	✓	
36	(A)Alternate power source, (B)Streambank stabilization and (C)Increase culvert capacity			✓	✓	
37	(A)Expand swale system and (B) Increase stormwater flow capacity			✓	✓	
38	Increase storm sewer capacity			✓	✓	
39	Shoreline stabilization			✓	✓	
40	Increase detention volume at Highlands Subdiv.			✓	✓	
41	Drainage improvements and additional storm sewer			✓	✓	
42	(A)Flood buyouts, (B) New electronic sign,(C)Shoreline stabilization and (D)New storage shed for emergency supplies			✓	✓	
43	Implement program to review and clear retention pond culverts			✓	✓	
44	(A) Drainage Ditch Streambank Stabilization , (B) Shoreline Stabilization, (C) Inflow & Infiltration (I/I) Mitigation, (D) Lagoons and outfall channel, and (E) Mutton Creek Streambank Stabilization			✓	✓	
45	Yeoman Creek bank stabilization			✓	✓	
46	(A,B)Residential Buyouts or Elevation,. (C,D) Drainageway Restoration/Conveyance		✓			
47	(A,B) Restoration/Conveyance and (C) Flood Access/Elevate Roadway at Liden Ave		✓			
48	(A,B) Drainage Infrastructure, (C,D) Residential Buyouts or Elevations		✓			
49	(A,B,C,D) Drainage Infrastructure improvements		✓			
50	(A) Dam Replacement at Sylvan Lake Dam, (B,C,D) Infrastructure enhancements		✓			
51	(A,B) Drainageway Restoration/Conveyance, (C) Drainage Infrastructure and (D) Flood buyouts or elevations		✓			

**Table 51: Summary of 2022 Action Items and ANHMP Goals**

No.	Action Item:	Action Item to Be Implemented By:				
		Lake County Board	Lake County	Municipal Boards & Councils	Municipal Staff	Other Stakeholders
52	(A,B,C,D,E,F) Drainage Infrastructure improvements		✓			
53	(A) Levee Enhancements, (B,C,D,E,F,G,H) Drainage Infrastructure and (I) Stormwater storage		✓			
54	(A,B) Flood Access/Elevate Roadway (C,D) Residential Buyouts or Elevations		✓			
55	(A,B,C,D,E) Drainage Infrastructure improvements		✓			
56	(A) Residential Buyouts or Elevations, (B,C,D) Drainage Infrastructure and (E) Flood Proofing		✓			
57	(A,B,C,D,E,F,G,H,I,J,K,L,M) Drainage Infrastructure, (N,O) Drainageway Restoration/Conveyance and (P,Q,R) Stormwater Storage		✓			
58	(A) Residential Buyouts or Elevations at and (B) Creek conveyance		✓			
59	(A,B) Drainage Infrastructure improvements		✓			
60	Drainage Infrastructure improvements		✓			
61	(A) Improve Northwood Subdivision Stormwater Transmission and Storage, (B) Stabilize & Enhance Arboretum Club Shoreline, (C) Emergency Operations Center Communications Equipment, (D) Enhanced Emergency Communications Program			✓	✓	



### 6.3 Action Items by Community of this Chapter.

Like the recommendations made with the mitigation strategies presented in Chapter 5, all action items presented in this Chapter are available to all communities. All action items in this Chapter and all recommendations in Chapter 5 should be taken to be elements of this ANHMP, and therefore eligible items for funding with FEMA mitigation grant funds.

**Prioritization:** Action items are prioritized within this Chapter in the order that they are presented, beginning with Action Item 1. The Action Items 1 through 4 are called for in the FEMA mitigation planning guidance. The prioritization of remaining action times was established based on HMPC discussions, and the number of communities included in the action item. Appendix E shows the action items in priority order. The action items address the priority hazards discussed in Chapter 3 and the goals and guidelines presented in the Chapter 4. shows the action items in priority order as associates them with the hazard mitigation goals of this ANHMP.

**Action item format:** Action items assign responsibilities and deadlines to the appropriate agencies. Each action item contains a brief description and a section for the responsible agency, the deadline for accomplishing the action item, the costs (and potential funding sources), and the benefits. Potential funding sources include the FEMA Hazard Mitigation Assistance programs: The Hazard Mitigation Grant Program (HMGP), the Building Resilient Infrastructures and Communities (BRIC), and the Flood Mitigation Assistance Program (FMA).

The action items are summarized in **Error! Reference source not found.**<sup>53</sup> and show the agency assignments. While this Chapter provides the action items in a priority order, 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 are shown in **Error! Reference source not found.**.

*Please note,* based on a hazard event, opportunity, property owner interest or available funding, the county or the communities may choose to implement a lower priority action prior over a higher priority action, or implement a recommendation included in Chapter 5 of this ANHMP that is not included in this action plan, and request grant funding. All mitigation opportunities should be considered.

## 6.2 Lake County ANHMP Priority Action Items

Lake County and Lake County municipalities and other appropriate agencies will work to implement the following action items in the next five years as staff and funding resources allow:

### Action Item 1: Plan Adoption

The County Board, City Councils, Boards of Trustees, and other governing boards, as appropriate, will adopt this Lake County All-Natural Hazards Mitigation Plan (ANHMP) update by resolution. Each agency resolutions should adopt the pertinent action items contained in this Chapter of the ANHMP.

**Responsible Agency:** County Board, City Councils, Village Boards, Boards of Trustees.

**Deadline:** 6 months.

**Cost:** Staff time.

**Benefits:** Adoption of the updated ANHMP ensures that County, municipalities, and other agencies are authorized to implement the action items with available resources.

**Plan Reference:** Chapters 2 and 7.

### **Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance**

A Lake County Local Planning Committee (HMPC) meeting will be held at least once a year to evaluate and monitor progress on implementation of the ANHMP, and to organize for the next update of this ANHMP. An annual report should be submitted to the County Board by the HMPC as an information item.

**Responsible Agency:** Lake County Stormwater Management Commission (SMC) and Lake County Emergency Management Agency (LCEMA) and the HMPC.

**Deadline:** HMPC to meet each year. 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 considering progress, changed conditions, and new opportunities.

**Plan Reference:** Chapters 2 and 7.

### **Action Item 3: Incorporate ANHMP into Other County and Municipal Plans**

As noted in Table 4447, Lake County communities have a variety of plans and ordinances in place. Actions identified in this ANHMP should be incorporated into comprehensive, stormwater management, capital improvement, land-use, and emergency management plans, zoning ordinances, building codes, and post-disaster mitigation policies and procedures. Each jurisdiction participating in this ANHMP will be responsible for reviewing their plans, ordinances, and policies and, as appropriate, revising those documents.

Each community that has adopted this mitigation plan will take the following actions to facilitate the incorporation of mitigation actions into their plans and ordinances:

Within one year of the adoption of the ANHMP by the community, the lead individual for each community (emergency manager, public works director, engineer, or planner) will lead a local committee that will complete an evaluation of the Villages Plans, Codes and Ordinances to determine those that need to be modified to incorporate the action items of the ANHMP.

When the plans, codes or ordinances are updated or modified for any purpose, a recommendation will be made to make the modifications noted in number 1 above.

Next time the ANHMP is updated or modified, a review will be completed within one year of adoption to determine if any additional modifications must be made to local plans, codes, or ordinances.

**Responsible Agency:** County Board, City Councils, Village Boards, Boards of Trustees, and County and municipal offices.

**Deadline:** 5 years.

**Cost:** Staff time.

**Benefits:** Adoption of the updated ANHMP ensures that County, municipalities, townships, and other agencies are authorized to implement the action items with available resources.

**Plan Reference:** Chapter 5, Section 5.1 Preventive Measures.

#### **Action Item 4: Continued Implementation of the WDO and NFIP Requirements**

Lake County and municipalities, whether certified or non-certified, should continue to fully implement and enforce the Lake County Watershed Development Ordinance (WDO) for all applicable developments. The WDO incorporates the NFIP minimum standards, and while the Planning, Building and Development (PB&D) administers the WDO for unincorporated Lake County, all NFIP municipalities are still ultimately responsible for ensuring that development within the regulatory floodplain meets the NFIP minimum standards.

**Responsible Agency:** SMC, PB&D, and municipal NFIP coordinators.

**Deadline:** Ongoing.

**Cost:** Staff time.

**Benefits:** Community compliance with the NFIP is essential.

**Plan Reference:** Chapter 5, Section 5.1 Preventive Measures.

#### **Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property**

Education regarding natural hazards that can impact Lake County should be provided to all Lake County property owners and residents. Many public information efforts have been implemented, but these efforts should be improved to reach people more effectively and to provide effective messages regarding life, health and safety and property protection. Public information and education efforts should focus on severe summer and winter storms, floods and tornadoes and materials should be developed specifically for Lake County and tailored to Lake County needs.

**Responsible Agency:** LCEMA, SMC, HMPC, Lake County Health Department (LCHD), LCDOT and municipalities.

**Cost:** Staff time and publication costs.

**Benefits:** A county-based approach is the most cost-effective approach and will offer the greatest benefit. Public information efforts can address nearly every natural hazard and more than one hazard can be discussed with an audience at one time.

**Plan Reference:** Chapter 5.

#### **Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters**

The July 2011 storms in Lake County highlighted the need for alternate power sources at critical facilities. The HMPC recognizes that FEMA mitigation funds are not available for this action item but recognizes the importance of all agencies and facility and shelter owners determining back-up power source needs and obtaining equipment and/or service.

**Responsible Agency:** Emergency management agencies and facility and shelter owners.

**Deadline:** 36 months.

**Cost:** Variable.

**Benefits:** Adoption of the updated ANHMP ensures that County, municipalities, townships and other agencies are authorized to implement the action items with available resources.

**Plan Reference:** Chapter 5, Section 5.4 Emergency Services.

**Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures**

Critical facilities should be evaluated to determine their vulnerability to tornadoes, severe storms and floods. The availability of safe rooms and sheltering should be reviewed. Critical facilities have been mapped in the County's GIS. As the County further examines building footprints and floodplains as part of the stormwater management program, the review of critical facilities should be included. Approximately 20 Lake County critical facilities are in the floodplain, and other critical facilities are vulnerable to wind and severe storms. Where necessary, critical facilities should be mitigated and protected from identified natural hazards.

**Responsible Agency:** SMC, LCEMA, GIS Division, municipalities, critical facility owners.

**Deadline:** 24 months.

**Cost:** Staff time. Potential funding sources include HMGP, BRIC, and FMA.

**Benefits:** Critical facilities that can function during hazard events allow for better protection of people and property. Shelters and safe rooms save lives. Review and mitigation of critical facilities will benefit Lake County through preparedness, response and recovery.

**Plan Reference:** Chapter 5, Section 5.2 Property Protection and 5.4 Emergency Services.

**Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters**

When opportunities arise and when downstream areas are not adversely impacted (or mitigated), communities should strive to increase the capacity of drainage systems. Drainage improvements may include opening restrictive culverts or bridges, storm sewer improvements, etc. When appropriate and when opportunities are identified, the systems should be augmented with additional detention or retention to reduce runoff rates and runoff volumes.

**Responsible Agency:** SMC, LCDOT, municipal public works and engineering.

**Deadline:** Ongoing.

**Cost:** Staff time and project-specific costs.

**Benefits:** Local flooding outside of the floodplain and riverine (floodplain) flooding can be reduced.

**Plan Reference:** Chapter 5, Section 5.5 Structural Measures.

**Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts**

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 need maintenance. Also, bridges and culverts (active or abandoned) that restrict flood flows should be evaluated. The removal or enlargement of stream crossings, in cases where a modification will not cause an increase in downstream flooding, should be considered and funded. Streambank and ravine or shoreline stabilization efforts should also be evaluated and implemented. Public information should be provided to property owners on how best to protect streambanks and shorelines.

**Responsible Agency:** Lake County, municipalities, and townships. This can include public works departments, township road districts, or other appropriate departments or offices.

**Deadline:** 36 months.

**Cost:** Staff time and equipment.

**Benefits:** Development and agriculture have led to a reduction of stream capacity, and upstream flooding as a result may be increasing. A restoration of stream capacity may mitigate upstream damage, 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 5, Section 5.5 Structural Measures.

#### **Action Item 10: Implement Property Protection Projects for Flood Mitigation**

Properties that are exposed to flood damage, severe storms, and severe erosion throughout Lake 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, floodproofing, or retrofitting. Priority should be given to repetitive loss properties and homes subject to the impacts of severe erosion, however, all flood prone properties (floodplain, depressional storage or SMC problem areas) including critical facilities should be included.

**Responsible Agency:** SMC, municipal NFIP coordinators.

Community Specific Action Item for: Lake County and NFIP municipalities, including (by watershed):

**Des Plaines River:** Antioch, Beach Park, Buffalo Grove, Deer Park, Grayslake, Green Oaks, Gurnee, Hainesville, Hawthorn Woods, Kildeer, Lake Villa, Lake Zurich, Libertyville, Lincolnshire, Lindenhurst, Long Grove, Mettawa, Mundelein, Old Mill Creek, Riverwoods, Round Lake Beach, Third Lake, Vernon Hills, and Wadsworth

**Fox River:** Antioch, Fox Lake, Fox River Grove, Hainesville, Hawthorn Woods, Island Lake, Lake Barrington, Lake Villa, Lake Zurich, Lakemoor, North Barrington, Round Lake, Round Lake Beach, Round Lake Heights, Round Lake Park, Tower Lakes, Volo, and Wauconda

**North Branch Chicago River:** Bannockburn, Deerfield, Green Oaks, Gurnee, Highland Park, Highwood, Lake Bluff, Lake Forest, Lincolnshire, Mettawa, North Chicago, Park City, Riverwoods, and Waukegan

**Lake Michigan:** Beach Park, Highland Park, Lake Bluff, Lake Forest, North Chicago, Winthrop Harbor, Waukegan, and Zion

**Deadline:** Ongoing.

**Cost:** Identified per project. Potential funding sources include HMGP, BRIC, and FMA.

**Benefits:** Properties will be protected from future flooding and from severe erosion. Also, the exposure of the NFIP will be reduced for insured and repetitive loss buildings. There will also be a reduction in emergency response as structures are protected or removed from flood prone areas.

**Plan Reference:** Chapter 5, Section 5.2 Property Protection.

#### **Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups**



Municipalities should evaluate options and implement programs to reduce the inflow and infiltration of stormwater into the sanitary sewer system to reduce the wastewater treatment plant flow during severe storm and flood events. Efforts can be undertaken on a regional basis.

**Responsible Agency:** Municipalities.

**Deadline:** 36 months.

**Cost:** Staff time and equipment.

**Benefits:** When inflow and infiltration is reduced, the risk of sewage overflows or untreated discharge into the Lake County river system are avoided. Also, sewer backups can be avoided and damage to buildings can be reduced.

**Plan Reference:** Chapter 5, Section 5.2 Property Protection and 5.5 Structural Measures.

#### **Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering**

Wind mitigation, and safe rooms and sheltering, needs can arise through planning efforts, building design efforts, and retrofitting opportunities. When needs, safety, and sheltering deficiencies are identified, alternatives for providing mitigation should be developed and funding sought.

**Responsible Agency:** All Lake County agencies and municipal departments.

**Deadline:** 5 years.

**Cost:** Project specific.

**Benefits:** Prevent loss of life.

**Plan Reference:** Chapter 5, Section 5.1 Preventive Measures, 5.2 Property Protection and 5.4 Emergency Services.

#### **Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)**

Lake County municipalities that are Tree City USA communities will maintain their status in the nationwide program, and communities that are not in the program will consider joining the program. It is understood that each municipality will make these considerations based on available staffing and financial resources.

**Responsible Agency:** Public works department or another 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 5, Section 5.3 Resource Protection.

#### **Action Item 14: Continue Work for NIMS Compliance**

The county and all municipalities should ensure that they are NIMS compliant. Training opportunities for all first responders and other identified personnel on NIMS and ICS should be shared with all agencies.

**Responsible Agency:** County Board, City Councils, Village Boards, Boards of Trustees, County and municipal offices.

**Deadline:** Ongoing.

**Cost:** Staff time.

**Benefits:** All officials trained in NIMS allows for better hazard preparedness, response and recovery.

**Plan Reference:** Chapter 5, Section 5.4 Emergency Services.

### **Action Item 15: Improve Building Codes and Building Code Enforcement**

Communities that have not adopted the International Code series of building codes should do so, and for all communities, future code revisions should be pursued to strengthen new buildings against damage by high winds, tornadoes, hail, earthquakes, and flooding. The Building Code Effectiveness Grading Schedule (BCEGS) program is designed to evaluate the code adoption and enforcement efforts of a community, with emphasis on natural hazard mitigation. The County and most municipalities participate in BCEGS, and communities should strive to improve their rating to a 4/4, if not already attained. Requiring tornado “safe rooms” in certain structures should be considered. The floodplain provisions (design flood elevation) should also be considered in conjunction with the Lake County WDO.

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, flood provisions, and any other provisions applicable to hazard mitigation.

**Responsible Agency:** County and municipal building code departments.

**Deadline:** Ongoing.

**Cost:** Staff time and cost of training.

**Benefits:** Effective implementation and enforcement of building codes provides mitigation for severe summer and winter storms, including wind events, floods and earthquakes. Through rigorous enforcement of the latest available codes, utilizing adequately staffed and trained code enforcement professionals; these efforts will be reflected through more favorable BCEGS classifications.

**Plan Reference:** Chapter 5, Section 5.1 Preventive Measures

### **Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects**

The County, municipalities, 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 BRIC, 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:** Lake County, municipalities, other agencies, and institutions.

**Community Specific Action Item for:** Lake County and ALL interested municipalities.

**Deadline:** As needed.

**Cost:** 25% of plan or project cost (non-federal share). Potential funding sources include HMGP, BRIC, and FMA.

**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 HMPC to benefit from the mitigation planning effort.

**Plan Reference:** Chapter 5

#### **Action Item 17: Continue Participation or Consider Participation in StormReady**

Lake County municipalities that are National Weather Service StormReady communities will maintain their status in the nationwide program, and Lake County communities, other agencies, and colleges should consider joining the 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:** LCEMA, municipal EMA, police and fire, other agencies, and institutional emergency managers.

**Deadline:** 24 months.

**Cost:** Staff time, and equipment purchases for some communities.

**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. Given the County's population, all efforts to prevent injury, save lives, and protect property are of high value.

**Plan Reference:** Chapter 5, Section 5.4 Emergency Services

#### **Action Item 18: Improve Emergency Response and Develop Assessment Teams**

Lake County and the municipalities should work to improve emergency response and to develop assessment teams for emergency management response, health department concerns and needs and for post-disaster mitigation.

If a community waits until a disaster occurs to plan post-disaster mitigation policies and procedures, they are too late. The time to prepare is before the disaster occurs. Preparation includes assigning post disaster tasks to:

- Determine the extent of the damages, including whether the structures are substantially damaged as defined in the WDO
- Determine the health and safety needs
- Ensure that the public is aware of actions that they should be taking, and that the community is taking to mitigate damages, as well as encouraging property owners and renters to work with their insurance agents to help cover their losses
- Ensuring that residents have the proper permits before repairing structures and ensuring that the repair is completed according to code
- Determine what mitigation actions are appropriate given the extent of damages
- Determine whether any temporary permit and construction moratoriums need to be put in place after the disaster

Response teams should be developed through the LCEMA and other county agencies and the HMPC. Individuals that may be needed for post disaster activities should be trained, should be

aware of their potential assignments and should prepare documents that they may need to use after the disaster occurs.

**Responsible Agency:** LCEMA, LCHD, SMC, PB&D, municipalities, and other agencies.

**Deadline:** 18 months.

**Cost:** Staff time.

**Benefits:** This action ensures that the needs of the county can be addresses quickly after a hazard event and to pursue mitigation opportunities as the earliest possible time.

**Plan Reference:** Chapter 5, Section 5.4 Emergency Services.

#### **Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities**

Improve information sharing between Lake County, municipal/township agencies and services providers, such as ComEd, during and after natural hazard events. Systems should be put in place to help ensure that response and recovery efforts are coordinating. Additional training opportunities should be identified, including annual exercises and tabletop exercises.

**Responsible Agency:** LCEMA, municipal EMAs, utility companies.

**Deadline:** Ongoing.

**Cost:** Staff time.

**Benefits:** Regular maintenance of streams, drainage ways and stormwater Best Management Practices will help reduce localized flooding problems.

**Plan Reference:** Chapter 5, Section 5.4 Emergency Services.

#### **Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System**

Municipalities that participate in the NFIP should consider participating in the Community Rating System (CRS). Lake County and several communities already participate in CRS, and they should also continue their participation.

**Responsible Agency:** 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 both comprehensive watershed management and emergency response planning. Lake County and the municipalities enforce higher regulatory standards than FEMA and participate in many creditable CRS activities.

**Plan Reference:** Chapter 5, Section 5.2 Property Protection.

#### **Action Item 21: Continue to Map Natural Hazard Impacts and Continue Vulnerability Assessments**

Lake County should continue to identify the number and type of existing structures, infrastructure, and critical facilities at risk to natural hazards and to map available data and information. Also, the potential dollar losses from vulnerable hazards should be assessed and used to evaluate potential hazard mitigation projects.

**Responsible Agency:** SMC and LCEMA.

**Deadline:** Ongoing.

**Cost:** Staff time.

**Benefits:** This will ensure that Lake County takes a consistent approach to hazard mitigation, and develops other plans with the protection of life, health, safety, business, and property in mind.

**Plan Reference:** Chapter 5, Section 5.1 Preventive Measures and 5.4 Emergency Services.

## **Action Item 22: Continue with Identification and Implementation of SMC Flood Mitigation**

### **Projects**

Based on the findings in Chapter 3 of this ANHMP, it is important for the Lake County SMC to continue with their watershed management efforts for the purpose of flood mitigation in unincorporated Lake County and within the Lake County municipalities. The SMC should continue making use of their annual funding and available FEMA grant funding to provide flood mitigation. Based on the number of SMC flood problem areas identified (see Table 16), the SMC recognized the Des Plaines River and the Fox River watersheds as priority areas.

Priority actions for the **Des Plaines River Watershed** in the next five years include:

- Floodplain buyout program
- Floodplain remapping/studies for Newport Creek, Indian Creek, Bull Creek, and Mill Creek
- Watershed planning/coordination for Des Plaines River - Phase II, North Mill Creek, Newport Creek, Bull Creek, and Indian Creek

Involved communities: Antioch, Beach Park, Buffalo Grove, Green Oaks, Grayslake, Gurnee, Hainesville, Hawthorn Woods, Indian Creek, Kildeer, Lake Forest, Lake Zurich, Libertyville, Lincolnshire, Lindenhurst, Long Grove, Mettawa, Mundelein, Old Mill Creek, Park City, Riverwoods, Round Lake Beach, Round Lake Park, Third Lake, Vernon Hills, Wadsworth, Wheeling, Zion

Priority actions for the **Fox River Watershed** in the next five years include:

- Floodplain buyout program
- Floodplain remapping/studies for Fish Lake Drain, Sequoit Creek, Manitou Creek, and Round Lake Drain/Eagle Creek/Long Lake
- Watershed planning/coordination for Fish Lake Drain

Involved communities: Antioch, Barrington, Barrington Hills, Deer Park, Fox Lake, Fox River Grove, Grayslake, Hainesville, Hawthorn Woods, Island Lake, Lake Barrington, Lake Villa, Lake Zurich, Lakemoor, Lindenhurst, Mundelein, North Barrington, Port Barrington, Round Lake, Round Lake Beach, Round Lake Heights, Round Lake Park, Tower Lakes, Wauconda, Volo.

Priority actions for the **North Branch of the Chicago River Watershed** in the next five years include:



- Increase flood storage capacity and detention
- Floodplain buyout program
- Watershed planning/coordination for Skokie River
- Flood response/damage assessments

Involved communities: Bannockburn, Deerfield, Green Oaks, Gurnee, Highland Park, Highwood, Lake Bluff, Lake Forest, Lincolnshire, Mettawa, Park City, North Chicago, Riverwoods, Waukegan.

Priority actions for the **Lake Michigan Watershed** in the next five years include:

- Floodplain buyout program
- Floodplain remapping/studies for Kellogg Creek
- Watershed planning/coordination for Dead Creek and Kellogg Creek
- Flood response/damage assessments

Involved communities: Beach Park, Highland Park, Highwood, Lake Forest, Lake Bluff, North Chicago, Wadsworth, Waukegan, Winthrop Harbor, Zion.

Ongoing and anticipated efforts of the SMC in the next five years for **all four major watersheds** include:

- Flood response/damage assessments
- Local drainage project cost-share program
- Rain gauge program
- GIS mapping and countywide base flood elevation layer, LOMA/LOMRs
- Implementation of Watershed Development Ordinance (WDO)

**Responsible Agency:** SMC.

**Deadline:** Based on SMC annual budget and available grant funding.

**Cost:** Project specific.

**Benefits:** All of Lake County benefits from the continuation of the SMC's countywide efforts for the protection of property, transportation, and health and safety during minor and major flood events.

**Plan Reference:** Chapter 3, Section

3.3 Flood, and Chapter 5.

### **Action Item 23: Develop of Flood Stage Maps**

Flood stage maps should be developed to show varying depths of flooding and the respective area of inundation for floodplain areas within Lake County's major watersheds. The maps should be developed by watershed based on available hydrologic and hydraulic models. Flood stage maps can be used by all agencies to determine early protection actions.

**Responsible Agency:** SMC, LCEMA, and GIS Division.

**Deadline:** Based on available grant funding.

**Cost:** Approximately, \$100,000. Potential funding sources include HMGP, BRIC, and FMA.

**Benefits:** Flood stage mapping would provide a depiction of the most at-risk structures, intersections, and utilities in the floodplain. They would aid in mitigation project planning. Most importantly, they would provide data for emergency response (and response planning) and allow communities to assess and identify needed resources.

**Plan Reference:** Chapter 5, Section 5.4 Emergency Services.

#### **Action Item 24: Develop or Enhance the Community's Snow Removal Plan**

Severe winter storms are a priority hazard for Lake County. People and businesses are impacted by heavy snow and blizzard conditions. Impassable roads are a problem for emergency services. Products and techniques for clearing roads or dealing with icy conditions are changing. Some of the newer approaches help protect the environment.

**Responsible Agency:** Municipalities, Townships.

**Deadline:** Based on available grant funding.

**Cost:** Staff time for the development of enhanced plans.

**Benefits:** Reduced community costs if efficiencies are found. Savings for businesses that can remain open are some of the other benefits. Emergency services should also be improved.

**Plan Reference:** Chapter 5, Section 5.4 Emergency Services.

#### **Action Item 25: Utility Tree Trimming**

Trees and branches on power lines is a common hazard. Down power lines can impact significant areas. More attention and better scheduling (rotation) of tree trimming would benefit communities and unincorporated Lake County.

**Responsible Agency:** Communities and utility companies.

**Deadline:** Ongoing.

**Cost:** Community staff time to coordinate with utility companies.

**Benefits:** Safety and fewer power outages.

**Plan Reference:** Chapter 5, Section 5.2 Property Protection.

#### **Action Item 26: Sump Pump Disconnects**

Sump pumps, when operating properly can keep basements dry from rainwater that collects around foundations. In many areas of the county, sump pumps discharge directly into the underground sewer system. The discharge contributes to the amount of sanitary sewage that needs to be treated at wastewater treatment plants or contributes to the total runoff that storm sewers need to carry. This action item calls for the disconnection of sump pump discharge from the sewer system(s), and for the discharge to be above ground. This could be to lawns or French drains. Communities should consider changes in regulations to accomplish the disconnects; other communities could consider rebate or other incentive programs.

**Responsible Agency:** Communities.

**Deadline:** Next five years.

**Cost:** Staff time, and funding of potential rebate efforts.

**Benefits:** Less runoff allowed in the sanitary or combined sewer system reduces the potential for sewage backup. Less pump discharge in the stormwater system reduces flood heights.

**Plan Reference:** Chapter 5, Section 5.2 Property Protection.

**Action Item 27: Conduct Local Drainage Studies**

Urban flooding and local drainage issues should be investigated by communities and by the SMC to determine alternatives to reduce the impact of flooding to buildings and infrastructure.

**Responsible Agency:** Municipalities and SMC.

**Deadline:** A study typically has a year's timeframe.

**Cost:** Dependent on the size of the area to be studied or the number of buildings in the area.

**Benefits:** Reduced flood losses and community disruption.

**Plan Reference:** Chapter 5, Section 5.2 Property Protection and 5.5 Structural Measures.

**Action Item 28: Increase Stormwater Detention Capacity**

Where opportunities are identified, additional stormwater detention capacity should be created. This may include the expansion of storage capacity at existing sites or new sites. While the Lake County WDO required storage of runoff due to developed, a large remedial effort is needed to detain and retain stormwater from older development.

**Responsible Agency:** Municipalities and SMC.

**Deadline:** Based on opportunities that arise.

**Cost:** Varies by project.

**Benefits:** Reduced flood losses and community disruption.

**Plan Reference:** Chapter 5, Section 5.5 Structural Measures

**Action Item 29: Investigate Countywide Warning System**

Warning dissemination for natural hazard events is key to protecting life and safety. Some areas of the County have some warning systems in-place. Additional warning systems should be investigated that would be effective for various seasons and various patterns of populated locations (e.g., daytime or nighttime). The investigation should examine alternatives, costs, potential phasing, and so forth.

**Responsible Agency:** Lake County EMA and municipal EMA (LEPC).

**Deadline:** 5 years.

**Cost:** Staff time and potential study costs.

**Benefits:** Better protected population.

**Plan Reference:** Chapter 5, Section 5.4 Emergency Services.

**Action Item 30: Investigate Future Conditions and the Impact on Depth and Frequency of Flooding**

Future conditions can include new development, redevelopment or changing weather and weather patterns, and should be investigated with new studies or updates to existing studies to determine potential increases in flood characteristics (depth and extent) and in frequency.

**Responsible Agency:** SMC.

**Deadline:** Ongoing.

**Cost:** Incremental cost to future study efforts.

**Benefits:** Flood damage resilience.

**Plan Reference:** Chapter 5, Section 5.5 Structural Measures.

**Action Item 31: Lincolnshire Creek Improvements**

Lincolnshire Creek in Lincolnshire should be studied to identify alternatives to reduce flood losses.

**Responsible Agency:** Village of Lincolnshire.

**Deadline:** To be determined.

**Cost:** To be determined.

**Benefits:** Reduced flood losses and impact to residents.

**Plan Reference:** Chapter 5, Section 5.5 Structural Measures.

**Action Item 32: Mitigate Septic Discharge; Leaching into Waterways**

Maintenance of septic systems is important for the protection of water quality for both surface water and groundwater. Preventing ground water pollution from failing septic systems should be a priority of every community and every homeowner. Contamination of the ground water source can lead to pollution of local wells, lakes, streams, and ponds – exposing family, friends and neighbors to waterborne diseases and other health risks. When a septic system fails, inadequately treated domestic waste can reach the ground water. Bacteria and viruses from human waste can cause dysentery, hepatitis, and typhoid fever. Many serious outbreaks of these diseases have been caused by contaminated drinking water. Nitrates and phosphates, also found in domestic wastewater, can cause excessive algae growth in lakes and streams called algal blooms. These blooms cause aesthetic problems and impair other aquatic life. Nitrate is also the cause of methemoglobinemia, or blue baby syndrome, a condition that prevents the normal uptake of oxygen in the blood of young babies.

**Responsible Agency:** SMC.

**Deadline:** Ongoing.

**Cost:** Staff time and printing of outreach information.

**Benefits:** Water quality.

**Plan Reference:** Chapter 5, Section 5.2 Property Protection and 5.5 Structural Measures.

**Action Item 33: Implement the Federal Flood Risk Management Standard (FFRMS)**

Executive Order 13690 calls for a flood protection standard for projects implemented with federal funds. New construction and substantial improvements implemented through private developers or property owners must meet the flood standard within the Lake County WDO, which is the base flood elevation plus 2 feet of freeboard. If a federal agency sets a standard because of the FFRMS, that exceeds the WDO standard, then communities must meet the higher standard when federal dollars are included in a community project.

**Responsible Agency:** All agencies.

**Deadline:** Ongoing.

**Cost:** Project specific.

**Benefits:** Lower flood insurance premiums (better insurance rating) and additional flood resiliency.

**Plan Reference:** Chapter 5, Section 5.1 Preventive Measures.

**New Action Items 2022**

**Village of Beach Park**

**Action Item 34A: Improve/Enhance Manor Rd Culvert and Bull Creek Bank Stabilization**

**Responsible Agency:** Village of Beach Park

**Deadline:** 2023-2024

**Cost:** \$ 1,000,000

**Funding Source:** Grant funds/Village funds

**Benefits:** Reduced flooding and property damage, improved stormwater capacity and conveyance

**Hazards Addressed:** Erosion and Flood

**Goals Addressed:** 1,3 and 5

**Priority:** High

**Action Item 34B: Resize Major Ave, culvert at Bull Creek**

**Responsible Agency:** Village of Beach Park

**Deadline:** 2023-2024

**Cost:** \$ 1,000,000

**Funding Source:** Village funds

**Benefits:** Reduced flooding and property damage, improved stormwater capacity and conveyance

**Hazards Addressed:** Erosion and Flood

**Goals Addressed:** 1,3 and 5

**Priority:** High

**Action Item 34C: North Ave. Stormwater Conveyance Improvements**

**Responsible Agency:** Village of Beach Park

**Deadline:** 2025-2026

**Cost:** \$ 2,300,000

**Funding Source:** STP, SMC and Local Funds

**Benefits:** Reduced flooding and property damage, improved stormwater capacity and conveyance

**Hazards Addressed:** Erosion and Flood

**Goals Addressed:** 1,3 and 5

**Priority:** High

**Action Item 34D: Update Building Codes to 2018 IBC**

**Responsible Agency:** Village of Beach Park

**Deadline:** 2022

**Cost:** NA

**Funding Source:** NA

**Benefits:** Enhance resiliency and IBC compliance throughout the village.

**Hazards Addressed:** All Hazards

**Goals Addressed:** 3 and 4

**Priority:** High

**Village of Buffalo Grove**

**Action Item 61A: Improve Northwood Subdivision Stormwater Transmission and Storage**

**Responsible Agency:** Village of Buffalo Grove

**Deadline:** 2025

**Cost:** \$11,800,000

**Funding Source:** Local & grant funds

**Benefits:** Flood mitigation to 19 streets and dozens of properties in Buffalo Grove and unincorporated Lake County

**Hazards Addressed:** Flood

**Goals Addressed:** 1, 2, 3, 5

**Priority:** High

**Action Item 61B: Stabilize & Enhance Arboretum Club Shoreline**

**Responsible Agency:** Village of Buffalo Grove

**Deadline:** 2027

**Cost:** \$2,500,000

**Funding Source:** Local & grant funds

**Benefits:** Benefits to public safety, flood mitigation (local & downstream), water quality

**Hazards Addressed:** Erosion, drought tolerance, flood

**Goals Addressed:** 1, 2

**Priority:** Medium

**Action Item 61C: Emergency Operations Center Communications Equipment**

**Responsible Agency:** Village of Buffalo Grove

**Deadline:** 2025

**Cost:** \$250,000

**Funding Source:** Local & grant funds

**Benefits:** Improved emergency management utilizing aging communication equipment as a back-up for operational continuity during emergency events.

**Hazards Addressed:** All

**Goals Addressed:** 1, 2

**Priority:** High

**Action Item 61D: Enhanced Emergency Communications Program**

**Responsible Agency:** Village of Buffalo Grove

**Deadline:** TBD pending CRM development completion

**Cost:** \$150,000

**Funding Source:** Local & grant funds

**Benefits:** Enhanced emergency communications to businesses and residents enabling local authorities to send more targeted communications during disaster events.

**Hazards Addressed:** All

**Goals Addressed:** 1

**Priority:** Medium

**Fox River Water Agency**

**Action Item 35: Catch basins at border near Illinois/Wisconsin and the mouths of tributaries flowing into the river**



**Responsible Agency:** Fox River Watershed Agency

**Deadline:** 2024

**Cost:** \$10,000,000

**Funding Source:** NA

**Benefits:** Prevention of sediment deposits

**Hazards Addressed:** Dam Failure, Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,2,4 and 5

**Priority:** High

### Village of Gurnee

**Action Item 36A:** Identify needs and obtain alternate power source for critical facilities, supply generator with ATS at Lee Ave. lift station and generator backup at Westgate lift station.

**Responsible Agency:** Village of Gurnee

**Deadline:** 2023

**Cost:** \$50,000

**Funding Source:** Utility fund/local

**Benefits:** Provide backup power supply.

**Hazards Addressed:** All Hazards

**Goals Addressed:** 1,2 and 3

**Priority:** High

**Action Item 36B:** Streambank stabilization along Swanson Trig tributary east of CP Railroad, West of Union Pacific Railroad, South of 132 and North of Washington St.

**Responsible Agency:** Village of Gurnee

**Deadline:** 2025

**Cost:** TBD

**Funding Source:** TBD

**Benefits:** Implementing programs to enhance drainage systems

**Hazards Addressed:** Erosion

**Goals Addressed:** 1 and 3

**Priority:** Medium

**Action Item 36C:** Increase culvert flow capacity at Grove Ave.

**Responsible Agency:** Village of Gurnee

**Deadline:** 2024

**Cost:** \$20,000

**Funding Source:** Capital funds/local

**Benefits:** Prevent flood overtopping

**Hazards Addressed:** Erosion and Flood

**Goals Addressed:** 2 and 5

**Priority:** Medium

### Village of Kildeer

**Action Item 37A:** Expand village swale system to increase stormwater flow capacity.

**Responsible Agency:** Village of Kildeer

**Deadline:** 2023

**Cost:** \$200,000

**Funding Source:** Grant funds

**Benefits:** Prevent flooding at Andover and Hickory Hill Rd, Grove Rd, Pine Lake Circle, Cambridge Dr, Buffalo Run and Cliffside Dr.

**Hazards Addressed:** Erosion and Flood

**Goals Addressed:** 1,2 and 3

**Priority:** High

**Action Item 37B:** Increase stormwater flow capacity by resizing culvert at Buffalo Run and Cliffside Dr.

**Responsible Agency:** Village of Kildeer

**Deadline:** 2023

**Cost:** \$250,000

**Funding Source:** Grant funds

**Benefits:** Reduce damages to village streets and private property

**Hazards Addressed:** Erosion and Flood

**Goals Addressed:** 1,2 ,3 and 4

**Priority:** High

#### Village of Lake Bluff

**Action Item 38:** Increase storm sewer capacity to drain West Scranton viaduct.

**Responsible Agency:** Village of Lake Bluff

**Deadline:** 2030

**Cost:** \$10,000,000

**Funding Source:** Grant funds

**Benefits:** Protect public safety and business access

**Hazards Addressed:** Flood and Severe Summer Storm

**Goals Addressed:** 1,2 and 5

**Priority:** High

#### Village of Lake Zurich

**Action Item 39:** Shoreline stabilization at Buffalo Creek

**Responsible Agency:** Village of Lake Zurich

**Deadline:** 2024

**Cost:** TBD

**Funding Source:** Grant funds

**Benefits:** Protect area from erosion

**Hazards Addressed:** Erosion and Flood

**Goals Addressed:** 1

**Priority:** Medium

#### Village of Libertyville

**Action Item 40:** Increase detention volume at Highlands subdivision phase 1 including reconstruction of Nicholas Dowden Park South for detention storage.

**Responsible Agency:** Village of Libertyville

**Deadline:** 2023

**Cost:** \$7,000,000

**Funding Source:** Grant funds

**Benefits:** Prevent structure/building damage and loss of roadways

**Hazards Addressed:** Flood, Groundwater, and Severe Summer Storms

**Goals Addressed:** 1, 3 and 5

**Priority:** High

### Village of Lincolnshire

**Action Item 41:** Windsor Dr. area drainage improvements, adding additional storm sewer to reduce roadway flooding.

**Responsible Agency:** Village of Lincolnshire

**Deadline:** 2023

**Cost:** \$4,500,000

**Funding Source:** Grant funds and stormwater management fees

**Benefits:** Prevent roadway and park flooding

**Hazards Addressed:** Flood and Severe Summer Storms

**Goals Addressed:** 1, 2 and 5

**Priority:** High

### Village of Port Barrington

**Action Item 42A:** Flood buyouts of homes in floodplain

**Responsible Agency:** Village of Port Barrington

**Deadline:** Ongoing

**Cost:** \$150,000

**Funding Source:** Grant funds

**Benefits:** Removal of homes from floodplain

**Hazards Addressed:** Flood

**Goals Addressed:** 1, 2,3,4 and 5

**Priority:** High

**Action Item 42B:** Purchase new electronic sign for village entrance to provide emergency notifications.

**Responsible Agency:** Village of Port Barrington

**Deadline:** 2023

**Cost:** \$25,000

**Funding Source:** Grant funds

**Benefits:** Enhance public notifications of emergencies.

**Hazards Addressed:** All Hazards

**Goals Addressed:** 1, 2,3,4 and 5

**Priority:** High

**Action Item 42C: Shoreline stabilization of natural island in Nielson Channel.**

**Responsible Agency:** Village of Port Barrington

**Deadline:** TBD

**Cost:** \$150,000

**Funding Source:** Grant funds

**Benefits:** Decrease erosion in the area

**Hazards Addressed:** Erosion

**Goals Addressed:** 1, 2,3,4 and 5

**Priority:** High

**Action Item 42D: Construction of new storage shed for emergency response supplies including sandbag and bagging equipment.**

**Responsible Agency:** Village of Port Barrington

**Deadline:** 2022

**Cost:** \$8,000

**Funding Source:** FMA

**Benefits:** Increase longevity of response and recovery materials

**Hazards Addressed:** All Hazards

**Goals Addressed:** 1, 2,3,4 and 5

**Priority:** Low

**Village of Volo**

**Action Item 43: Implement program to review and clear retention pond culverts utilized for stormwater drainage.**

**Responsible Agency:** Village of Volo

**Deadline:** Ongoing

**Cost:** \$1,000 annually

**Funding Source:** TBD

**Benefits:** TBD

**Hazards Addressed:** Flood

**Goals Addressed:** 1, 2,3,4 and 5

**Priority:** High

**Village of Wauconda**

**Action Item 44A: Bangs Lake Drainage Ditch Streambank Stabilization**

Streambank stabilization, improved drainage capacity and flow, improved water quality for Bangs Lake Drainage Ditch from Bangs Lake in Wauconda to Slocum Lake in Slocum Lake (Approx. 3 miles)

**Responsible Agency:** Villages of Wauconda & Slocum Lake, Slocum Lake Drainage District, Wauconda Township

**Deadline:** TBD

**Cost:** \$ 9,504,000

**Funding Source:** TBD

**Benefits:** Reduced shoreline erosion, improved drainage capacity & flow, improved water quality

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Priority:** High

**Action Item 44B: Circle Channel Shoreline Stabilization Project**

Shoreline Stabilization, volume enhancements and water quality improvements to the Circle Channel of Bangs Lake in Wauconda, Illinois.

**Responsible Agency:** Village of Wauconda

**Deadline:** TBD

**Cost:** \$ 2,265,600

**Funding Source:** TBD

**Benefits:** Reduced shoreline erosion, improved drainage, and water quality.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Priority:** High

**Action Item 44C: Inflow & Infiltration (I/I) Mitigation**

Excess rain and groundwater entering the sewer system through inflow & infiltration has a negative Impact on the sewer system and wastewater treatment plant capacity. The limitation of the system because I/I leads to increase sanitary sewer surcharging, overflows (SSOs) and basement back-ups (BBs).

**Responsible Agency:** Village of Wauconda

**Deadline:** 2027 Projected Completion

**Cost:** \$ 1,489,000

**Funding Source:** Sewer & Water fees

**Benefits:** Reduced property damage from BBs and reduced environmental impacts of SSOs. More efficient wastewater treatment and conveyance.

**Hazards Addressed:** Flood and Severe Summer Storms

**Priority:** High

**Action Item 44D: Larkdale Lagoons and Outfall Channel**

The shoreline stabilization of the lagoons and outfall channel (Approx. 1.6 miles) would protect Property and improve stormwater capacity and flow of stormwater

**Responsible Agency:** Village of Wauconda

**Deadline:** TBD

**Cost:** \$ 3,780,000

**Funding Source:** TBD

**Benefits:** Reduced property loss and improved drainage capacity & flow

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Priority:** High

**Action Item 44E: Mutton Creek Streambank Stabilization**

Streambank stabilization and capacity improvements for a 2.51-mile segment of Mutton Creek.

**Responsible Agency:** Village of Wauconda

**Deadline:** TBD

**Cost:** \$ 7,944,000

**Funding Source:** TBD

**Benefits:** Reduced erosion and improved capacity and flow

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Priority:** Low

**Action Item 44F: Develop a Stormwater Master Plan**

The development of a Stormwater Master Plan will provide the Village with a long-term plan to address flooding and related stormwater management issues over the next several decades.

**Responsible Agency:** Village of Wauconda

**Deadline:** January 2023

**Cost:** \$ 40,000

**Funding Source:** TBD

**Benefits:** Reduced flooding and property damage, improved stormwater capacity and conveyance

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Priority:** High

**City of Waukegan**

**Action Item 45: Yeoman Creek bank stabilization.**

**Responsible Agency:** City of Waukegan

**Deadline:** 2026

**Cost:** \$5,000,000

**Funding Source:** TBD

**Benefits:** Prevent erosion and reduce stormwater backup for residential structures, businesses and roadway flooding.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3 and 5

**Priority:** High

**Unincorporated Lake County**

**Antioch Township**

**Action Item 46 (A, B, C, D):** Residential Buyouts or Elevations **(A)** West Loon Lakes and **(B)** Loon Lakes. Drainageway Restoration/Conveyance at Sequoit Creek TWP Range Sections **(C)** 46-10-16 and **(D)** 46-10-17.

**Responsible Agency:** Lake County

**Deadline:** TBD All

**Cost:** (A, B) TBD, (C) \$500K-\$1.5M, (D) \$500K-\$1.5M

**Funding Source:** Federal, State & Local

**Benefits:** Reduce flood losses and enhance drainage capacities.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3,4 and 5

**Priority:** (A, B) Medium, (C, D) Low



**Avon Township**

**Action Item 47 (A, B, C,):** Drainageway Restoration/Conveyance at **(A)** Gages Lake Drain and **(B)** Four Corner's Basin and **(C)** Flood Access/Elevate Roadway at Liden Ave.

**Responsible Agency:** Lake County

**Deadline:** (A, B, C, D) TBD

**Cost:** (A,) \$500K-\$1M, (B) \$500K-\$1M, (C, D) TBD

**Funding Source:** Federal, State & Local

**Benefits:** Reduce flood losses and enhance drainage capacities.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3,4 and 5

**Priority:** (A, B) High, (C,) Medium

**Cuba Township**

**Action Item 48 (A, B, C, D):** Drainage Infrastructure at **(A)** North Oaks and **(B)** Chicago Highlands. Residential Buyouts or Elevations at **(C)** Snuff Valley Rd and **(D)** Pioneer Grove Rd.

**Responsible Agency:** Lake County

**Deadline:** (A, B) 2025-2026, (C)TBD

**Cost:** (A,) \$1M-\$2M, (B) \$1M-\$2M, (C) \$2M-\$3M

**Funding Source:** Federal, State & Local

**Benefits:** Reduce flood losses and enhance drainage capacities.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3,4 and 5

**Priority:** (A, B, C, D) Medium

**Ela Township**

**Action Item 49 (A, B, C, D):** Drainage Infrastructure enhancements at **(A)** Abbey Glenn Subdivision, **(B)** Forest Lake Subdivision. **(C)** Forest Lake Subdivision, and **(D)** Echo Lake.

**Responsible Agency:** Lake County

**Deadline:** (A, B, C) 2027, (D)TBD

**Cost:** (A,) \$1M-2M, (B) \$1M-2M, (C) \$1M-2M (D) \$500K-\$1M

**Funding Source:** Federal, State & Local

**Benefits:** Reduce flood losses and enhance drainage capacities.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3,4 and 5

**Priority:** (A, B, C) High, (D) Medium

### Fremont Township

**Action Item 50 (A, B, C, D):** (A) Dam Replacement at Sylvan Lake Dam. Drainage Infrastructure at (B) Lake Fairfield Estates Subdivision., (C) Summer Hill Estates Subdivision. and (D) Diamond Lake.

**Responsible Agency:** Lake County

**Deadline:** (A,) 2025-2026, (B, C, D) TBD

**Cost:** (A,) \$2M, (B) \$500K-1.5M, (C) \$500K-1.5M (D) \$500K-\$1.5M

**Funding Source:** Federal, State & Local

**Benefits:** Reduce flood losses and enhance drainage capacities.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3,4 and 5

**Priority:** (A,) High, (B, C, D) Medium

### Grant Township

**Action Item 51 (A, B, C, D):** Drainageway Restoration/Conveyance at (A) Four Corner's Basin and (B) Fish Lake Drain. (C) Drainage Infrastructure at Duck Lake Woods. (D) Residential Buyouts or Elevations at Meyers Bayview Terrace.

**Responsible Agency:** Lake County

**Deadline:** (A,) 2027, (B, C, D) TBD

**Cost:** (A,) \$1M-\$2M, (B) \$500K-1.5M, (C) \$500K-1.5M (D) TBD

**Funding Source:** Federal, State & Local

**Benefits:** Reduce flood losses and enhance drainage capacities.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3,4 and 5

**Priority:** (A,) High, (C, D) Medium, (B) Low

### Lake Villa Township

**Action Item 52 (A, B, C, D, E, F):** Drainage Infrastructure at Venetian Village Subdivision. TWP Range Sections (A) 45-10-02, (B) 45-10-10, (C) Fox Lake Hills Chesney Area, (D) Orchard Gardens of Fox Lake Hills, (E) Sand Lake Outlet and (F) Cedar Crest Subdivision

**Responsible Agency:** Lake County

**Deadline:** (A,) 2027, (B) 2027, (C) 2026-2027, (D, E) TBD, (F) 2027-2028

**Cost:** (A,) \$1M-\$2M, (B) \$1M-\$2M, (C) \$2M-\$3M (D) \$500K-\$1.5M, (E) \$500K-\$1.5M, (F) \$500K-\$1.5M

**Funding Source:** Federal, State & Local

**Benefits:** Reduce flood losses and enhance drainage capacities.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3,4 and 5

**Priority:** (A, B, C) High, (D, E, F) Medium

### Libertyville Township

**Action Item 53 (A, B, C, D, E, F, G, H, I):** (A) Levee Enhancements at North Libertyville Estates Subdivision Drainage Infrastructure at (B) Winchester Road Soccer Complex, (C) Bull Creek

Subdivision, **(D)** Countryside Manor Subdivision, **(E)** Japar Industrial Park, **(F)** Bradley Road Industrial Park, **(G)** Old School Forest Preserve., and **(H)** Terre Fair Subdivision **(I)** Stormwater Storage at Casey Rd Open Space.

**Responsible Agency:** Lake County

**Deadline:** (A,) 2025-2026, (B, C, D, E,F) TBD,(G, H, I) 2027

**Cost:** (A,) \$3M, (B) \$500K-\$1.5M, (C) \$500K-\$1.5M (D) \$500K-\$1.5M, (E) \$500K-\$1.5M, (F) \$500K-\$1.5M, (G) \$500K-\$1.5M, (H) \$500K-\$1.5M, (I)\$3M

**Funding Source:** Federal, State & Local

**Benefits:** Reduce flood losses and enhance drainage capacities.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3,4 and 5

**Priority:** (A) High, (B, C, D, E, F) Medium, (G, H, I) Low

### Newport Township

**Action Item 54 (A, B, C, D):** Flood Access/Elevate Roadway at Russell Road TWP Range Sections **(A)** 46-11-02, **(B)** 46-11-03. Residential Buyouts or Elevations at Russel TWP Sections **(C)** 46-11-02 and **(D)** 46-11-03.

**Responsible Agency:** Lake County

**Deadline:** (A, B) 2026-2027, (C, D) TBD

**Cost:** (A,) \$2M-\$3M, (B) \$2M-\$3M, (C) TBD (D) TBD

**Funding Source:** Federal, State & Local

**Benefits:** Reduce flood losses and enhance drainage capacities.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3,4 and 5

**Priority:** (A, B) High, (C, D) Medium

### Shields Township

**Action Item 55 (A, B, C, D, E):** Drainage Infrastructure at **(A)** Arden Shores Subdivision, **(B)** North Shore Properties Subdivision, **(C)** Terrace Oaks, **(D)** Rockland Manor Subdivision and **(E)** Basilwood Subdivision

**Responsible Agency:** Lake County

**Deadline:** (A, B, C, D, E) TBD

**Cost:** (A) \$500K-\$1.5M, (B) \$500K-\$1.5M, (C) \$500K-\$1.5M, (D) \$500K-\$1.5M, (E) \$500K-\$1.5M

**Funding Source:** Federal, State & Local

**Benefits:** Reduce flood losses and enhance drainage capacities.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3,4 and 5

**Priority:** (A, B, C, D) Medium

### Vernon Township

**Action Item 56 (A,B,C,D,E):** **(A)** Residential Buyouts or Elevations at Pekara Subdivision Drainage Infrastructure at **(B)** Prairie View, **(C)** Horatio Gardens Subdivision, and **(D)** Woodbine Estates Subdivision **(E)** Flood Proofing at Aptakisic Creek Commercial Area.

**Responsible Agency: Lake County**

**Deadline:** (A, B, C) TBD, (D, E) 2027

**Cost:** (A) TBD (B) \$500K-\$1.5M, (C) \$500K-\$1.5M, (D) \$500K-\$1.5M, (E) \$500K

**Funding Source:** Federal, State & Local

**Benefits:** Reduce flood losses and enhance drainage capacities.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3,4 and 5

**Priority:** (A) High, (B, C) Medium, (D, E) Low

**Warren Township**

**Action Item 57 (A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R):** Drainage Infrastructure at (A) Del-Mar Woods Subdivision, (B) Wooded Glen Gardens Subdivision, (C) Grandwood Dr & Rt 132, (D) Tangueray Meadows Subdivision, (E) Warren Twp High School, (F) North Shore Lands, (G) Orchard Valley Pond, (H) Gages Lake Rd & Rt 45, (I) Warren Twp High School, (J) Woodland Meadows Subdivision (K) Wildwood on Gages Lake Subdivision, (L) Pinewood Creek Subdivision, (M) Wildwood on Gages Lake Subdivision, and Gages Lake Subdivision Drainageway Restoration/Conveyance at (N) Hunt Club Farms Lake drain and (O) Lambs Corner Creek. Stormwater Storage at (P) Deerpath Subdivision headwaters, (Q) Grandwood Park Subdivision Headwaters and (R) Summerfields Subdivision

**Responsible Agency: Lake County**

**Deadline:** (A, B, D, N, P, Q, R) 2025-2026, (C) 2027, (E, F, G, H, I, J, K, L, M) TBD

**Cost:** (A) \$2M-\$3M (B) \$1M-\$2M, (C) \$500K-\$1.5M, (D) \$500K-\$1.5M, (E) \$500K-\$1.5M, (F) \$500K-\$1.5M, (G) \$500K-\$1.5M, (H) \$500K-\$1.5M, (I) \$500K-\$1.5M, (J) \$500K-\$1.5M, (K) \$500K-\$1.5M, (L) \$3M, (M) \$500K-\$1.5M, (N) \$1M-\$2M, (O) \$500K-\$1.5M, (P) \$3M, (Q) \$3M, (R) \$2M-\$3M

**Funding Source:** Federal, State & Local

**Benefits:** Reduce flood losses and enhance drainage capacities.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3,4 and 5

**Priority:** (A, B, C, D, N, P, Q, R) High, (E, H, I, J, K, L) Medium, (F, G, M, O) Low

**Wauconda Township**

**Action Item 58 (A, B):** (A) Residential Buyouts or Elevations at Williams Park Subdivision. (B) Creek Conveyance at Fiddle Creek

**Responsible Agency: Lake County**

**Deadline:** (A, B) TBD

**Cost:** (A) TBD (B) \$750K

**Funding Source:** Federal, State & Local

**Benefits:** Reduce flood losses and enhance drainage capacities.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3,4 and 5

**Priority:** (A, B) Medium

**Waukegan Township**

**Action Item 59 (A, B):** Drainage Infrastructure at **(A)** North Shore Highlands and **(B)** North Shore Lands.

**Responsible Agency:** Lake County

**Deadline:** (A,) 2026-2027, (B) TBD

**Cost:** (A) \$2M-\$3M (B) \$500K-\$1.5M

**Funding Source:** Federal, State & Local

**Benefits:** Reduce flood losses and enhance drainage capacities.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3,4 and 5

**Priority:** (A) High, (B) Medium

**West Deerfield Township**

**Action Item 60:** Drainage Infrastructure at Del-Mar Woods Subdivision

**Responsible Agency:** Lake County

**Deadline:** 2025-2026

**Cost:** \$1M-\$2M

**Funding Source:** Federal, State & Local

**Benefits:** Reduce flood losses and enhance drainage capacities.

**Hazards Addressed:** Erosion, Flood and Severe Summer Storms

**Goals Addressed:** 1,3,4 and 5

**Priority:** High

**Village of Buffalo Grove**

**Action Item 61 (A, B, C, D):** See Page 6-16.

**Table 50: Summary of 2022 ANHMP Hazard Mitigation Action Items**

No.	Action Item:	Action Item to Be Implemented By:				
		Lake County Board	Lake County	Municipal Boards & Councils	Municipal Staff	Other Stakeholders
1	Adoption	✓		✓		
2	Monitor & Maintain		✓		✓	
3	Incorporate ANHMP in Other Plans	✓	✓	✓	✓	✓
4	Implement WDO & NFIP		✓		✓	
5	Public Information		✓		✓	✓
6	Alternate Power Sources				✓	✓
7	Mitigation of Critical Facilities		✓		✓	✓
8	Capacity of Drainage Systems		✓		✓	
9	Maintain Drainage Systems		✓		✓	
10	Property Protection Projects		✓		✓	✓
11	Reduce Inflow and Infiltration				✓	
12	Wind Mitigation & Safe Rooms	✓	✓	✓		
13	Tree City USA				✓	
14	NIMS Compliance	✓	✓	✓	✓	✓
15	Improve Building Codes		✓		✓	
16	Seek Grant Funding		✓		✓	
17	StormReady		✓		✓	
18	Emergency Response		✓		✓	
19	Response & Recovery Information	✓	✓		✓	✓
20	CRS Participation		✓		✓	
21	Continue to map natural hazard impacts and continue vulnerability assessments		✓			
22	SMC Flood Mitigation Projects		✓			
23	Development of Flood Stage Maps		✓			
24	Snow removal plan		✓		✓	
25	Utility tree trimming		✓		✓	
26	Sump Pump Disconnects		✓		✓	
27	Local Drainage Studies		✓		✓	
28	Increase Detention		✓		✓	
29	Investigate Countywide Warning System		✓		✓	
30	Investigate Future Conditions and the Impact on Depth and Frequency of Flooding		✓		✓	
31	Lincolnshire Creek Improvements				✓	
32	Mitigate Septic Discharge; Leaching into Waterways		✓		✓	
33	Implement the FFRMS				✓	
34	(A) Bank Stabilization, (B) Resize culvert, (C) Stormwater Conveyance Improvements and (D) Update Building Codes.			✓	✓	
35	Catch basins			✓	✓	



**Table 50: Summary of 2022 ANHMP Hazard Mitigation Action Items**

No.	Action Item:	Action Item to Be Implemented By:				
		Lake County Board	Lake County	Municipal Boards & Councils	Municipal Staff	Other Stakeholders
36	(A)Alternate power source, (B)Streambank stabilization and (C)Increase culvert capacity			✓	✓	
37	(A)Expand swale system and (B) Increase stormwater flow capacity			✓	✓	
38	Increase storm sewer capacity			✓	✓	
39	Shoreline stabilization			✓	✓	
40	Increase detention volume at Highlands Subdiv.			✓	✓	
41	Drainage improvements and additional storm sewer			✓	✓	
42	(A)Flood buyouts, (B) New electronic sign,(C)Shoreline stabilization and (D)New storage shed for emergency supplies			✓	✓	
43	Implement program to review and clear retention pond culverts			✓	✓	
44	(A) Drainage Ditch Streambank Stabilization , (B) Shoreline Stabilization, (C) Inflow & Infiltration (I/I) Mitigation, (D) Lagoons and outfall channel, and (E) Mutton Creek Streambank Stabilization			✓	✓	
45	Yeoman Creek bank stabilization			✓	✓	
46	(A,B)Residential Buyouts or Elevation,. (C,D) Drainageway Restoration/Conveyance		✓			
47	(A,B) Restoration/Conveyance and (C) Flood Access/Elevate Roadway at Liden Ave		✓			
48	(A,B) Drainage Infrastructure, (C,D) Residential Buyouts or Elevations		✓			
49	(A,B,C,D) Drainage Infrastructure improvements		✓			
50	(A) Dam Replacement at Sylvan Lake Dam, (B,C,D) Infrastructure enhancements		✓			
51	(A,B) Drainageway Restoration/Conveyance, (C) Drainage Infrastructure and (D) Flood buyouts or elevations		✓			
52	(A,B,C,D,E,F) Drainage Infrastructure improvements		✓			
53	(A) Levee Enhancements, (B,C,D,E,F,G,H) Drainage Infrastructure and (I)Stormwater storage		✓			
54	(A,B) Flood Access/Elevate Roadway (C,D) Residential Buyouts or Elevations		✓			
55	(A,B,C,D,E) Drainage Infrastructure improvements		✓			
56	(A) Residential Buyouts or Elevations, (B,C,D) Drainage Infrastructure and (E) Flood Proofing		✓			
57	(A,B,C,D,E,F,G,H,I,J,K,L,M) Drainage Infrastructure, (N,O) Drainageway Restoration/Conveyance and (P,Q,R) Stormwater Storage		✓			
58	(A) Residential Buyouts or Elevations at and (B) Creek conveyance		✓			
59	(A,B) Drainage Infrastructure improvements		✓			
60	Drainage Infrastructure improvements		✓			
61	(A) Improve Northwood Subdivision Stormwater Transmission and Storage, (B) Stabilize & Enhance Arboretum Club Shoreline, (C) Emergency Operations Center Communications Equipment, (D) Enhanced Emergency Communications Program			✓	✓	

**Table 51: Summary of 2022 Action Items and ANHMP Goals**

No.	Action Item:	Action Item to Be Implemented By:				
		Lake County Board	Lake County	Municipal Boards & Councils	Municipal Staff	Other Stakeholders
1	Adoption	✓		✓		
2	Monitor & Maintain		✓		✓	
3	Incorporate ANHMP in Other Plans	✓	✓	✓	✓	✓
4	Implement WDO & NFIP		✓		✓	
5	Public Information		✓		✓	✓
6	Alternate Power Sources				✓	✓
7	Mitigation of Critical Facilities		✓		✓	✓
8	Capacity of Drainage Systems		✓		✓	
9	Maintain Drainage Systems		✓		✓	
10	Property Protection Projects		✓		✓	✓
11	Reduce Inflow and Infiltration				✓	
12	Wind Mitigation & Safe Rooms	✓	✓	✓		
13	Tree City USA				✓	
14	NIMS Compliance	✓	✓	✓	✓	✓
15	Improve Building Codes		✓		✓	
16	Seek Grant Funding		✓		✓	
17	StormReady		✓		✓	
18	Emergency Response		✓		✓	
19	Response & Recovery Information	✓	✓		✓	✓
20	CRS Participation		✓		✓	
21	Continue to map natural hazard impacts and continue vulnerability assessments		✓			
22	SMC Flood Mitigation Projects		✓			
23	Development of Flood Stage Maps		✓			
24	Snow removal plan		✓		✓	
25	Utility tree trimming		✓		✓	
26	Sump Pump Disconnects		✓		✓	
27	Local Drainage Studies		✓		✓	
28	Increase Detention		✓		✓	
29	Investigate Countywide Warning System		✓		✓	
30	Investigate Future Conditions and the Impact on Depth and Frequency of Flooding		✓		✓	
31	Lincolnshire Creek Improvements				✓	
32	Mitigate Septic Discharge, Leaching into Waterways		✓		✓	
33	Implement the FFRMS				✓	
34	(A)Bank Stabilization, (B) Resize culvert, (C) Stormwater Conveyance Improvements and (D) Update Building Codes.			✓	✓	
35	Catch basins			✓	✓	
36	(A)Alternate power source, (B)Streambank stabilization and (C)Increase culvert capacity			✓	✓	

**Table 51: Summary of 2022 Action Items and ANHMP Goals**

No.	Action Item:	Action Item to Be Implemented By:				
		Lake County Board	Lake County	Municipal Boards & Councils	Municipal Staff	Other Stakeholders
37	(A)Expand swale system and (B) Increase stormwater flow capacity			✓	✓	
38	Increase storm sewer capacity			✓	✓	
39	Shoreline stabilization			✓	✓	
40	Increase detention volume at Highlands Subdiv.			✓	✓	
41	Drainage improvements and additional storm sewer			✓	✓	
42	(A)Flood buyouts, (B) New electronic sign,(C)Shoreline stabilization and (D)New storage shed for emergency supplies			✓	✓	
43	Implement program to review and clear retention pond culverts			✓	✓	
44	(A) Drainage Ditch Streambank Stabilization , (B) Shoreline Stabilization, (C) Inflow & Infiltration (I/I) Mitigation, (D) Lagoons and outfall channel, and (E) Mutton Creek Streambank Stabilization			✓	✓	
45	Yeoman Creek bank stabilization			✓	✓	
46	(A,B)Residential Buyouts or Elevation,. (C,D) Drainageway Restoration/Conveyance		✓			
47	(A,B) Restoration/Conveyance and (C) Flood Access/Elevate Roadway at Liden Ave		✓			
48	(A,B) Drainage Infrastructure, (C,D) Residential Buyouts or Elevations		✓			
49	(A,B,C,D) Drainage Infrastructure improvements		✓			
50	(A) Dam Replacement at Sylvan Lake Dam, (B,C,D) Infrastructure enhancements		✓			
51	(A,B) Drainageway Restoration/Conveyance, (C) Drainage Infrastructure and (D) Flood buyouts or elevations		✓			
52	(A,B,C,D,E,F) Drainage Infrastructure improvements		✓			
53	(A) Levee Enhancements, (B,C,D,E,F,G,H) Drainage Infrastructure and (I)Stormwater storage		✓			
54	(A,B) Flood Access/Elevate Roadway (C,D) Residential Buyouts or Elevations		✓			
55	(A,B,C,D,E) Drainage Infrastructure improvements		✓			
56	(A) Residential Buyouts or Elevations, (B,C,D) Drainage Infrastructure and (E) Flood Proofing		✓			
57	(A,B,C,D,E,F,G,H,I,J,K,L,M) Drainage Infrastructure, (N,O) Drainageway Restoration/Conveyance and (P,Q,R) Stormwater Storage		✓			
58	(A) Residential Buyouts or Elevations at and (B) Creek conveyance		✓			
59	(A,B) Drainage Infrastructure improvements		✓			
60	Drainage Infrastructure improvements		✓			
61	(A) Improve Northwood Subdivision Stormwater Transmission and Storage, (B) Stabilize & Enhance Arboretum Club Shoreline, (C) Emergency Operations Center Communications Equipment, (D) Enhanced Emergency Communications Program			✓	✓	

### **6.3 Action Items by Community**

Community-specific action items are listed below for each participating community in Lake County. These are action items that the communities will strive to implement in the next five years. As part of each community's adoption and implementation of this ANHMP, any action item listed in this chapter and any recommendation in Chapter 5 may be implemented should resources, including grant funds, become available.

#### **Lake County**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System
- Action Item 21: Continue to Map Natural Hazard Impacts and Continue Vulnerability Assessments
- Action Item 22: Continue with Identification and Implementation of SMC Flood Mitigation Projects
- Action Item 23: Develop of Flood Stage Maps
- Action Item 29: Investigate Countywide Warning System
- Action Item 30: Investigate Future Conditions and the Impact on Depth and Frequency of Flooding
- Action Item 46: Residential Buyouts or Elevations (A) West Loon Lakes and (B) Loon Lakes. Drainageway Restoration/Conveyance at Sequiot Creek TWP Range Sections (C) 46-10-16 and (D) 46-10-17.
- Action Item 47: Drainageway Restoration/Conveyance at (A) Gages Lake Drain and (B) Four Corner's Basin. (C) Flood Access/Elevate Roadway at Liden Ave.

- Action Item 48: Drainage Infrastructure at (A) North Oaks and (B) Chicago Highlands . Residential Buyouts or Elevations at (C) Snuff Valley Rd and (D) Pioneer Grove Rd.
- Action Item 49: Drainage Infrastructure enhancements at (A) Abbey Glenn Subdiv., (B) Forest Lake Subdiv. (C) Forest Lake Subdiv. and (D) Echo Lake.
- Action Item 50: (A) Dam Replacement at Sylvan Lake Dam. Drainage Infrastructure at (B) Lake Fairfield Estates Subdiv., (C) Summer Hill Estates Subdiv. and (D) Diamond Lake.
- Action Item 51: Drainageway Restoration/Conveyance at (A) Four Corner's Basin and (B) Fish Lake Drain. (C) Drainage Infrastructure at Duck Lake Woods. (D) Residential Buyouts or Elevations at Meyers Bayview Terrace.
- Action Item 52: Drainage Infrastructure at Venetian Village Subdiv. TWP Range Sections (A) 45-10-02, (B) 45-10-10, (C) Fox Lake Hills Chesney Area, (D) Orchard Gardens of Fox Lake Hills, (E) Sand Lake Outlet and (F) Cedar Crest Subdiv.
- Action Item 53: (A) Levee Enhancements at North Libertyville Estates Subdiv. Drainage Infrastructure at (B) Winchester Road Soccer Complex, (C) Bull Creek Subdiv., (D) Countryside Manor Subdiv., (E) Japar Industrial Park, (F) Bradley Road Industrial Park, (G) Old School Forest Preserve., and (H) Terre Fair Subdiv. (I) Stormwater Storage at Casey Rd Open Space.
- Action Item 54: Flood Access/Elevate Roadway at Russell Road TWP Range Sections (A) 46-11-02, (B) 46-11-03. Residential Buyouts or Elevations at Russel TWP Sections (C) 46-11-02 and (D) 46-11-03.
- Action Item 55: Drainage Infrastructure at (A) Arden Shores Subdiv., (B) North Shore Properties Subdiv.,(C) Terrace Oaks, (D) Rockland Manor Subdiv. and (E) Basilwood Subdiv.
- Action Item 56: (A) Residential Buyouts or Elevations at Pekara Subdiv. Drainage Infrastructure at (B) Prairie View, (C) Horatio Gardens Subdiv., and (D) Woodbine Estates Subdiv. (E) Flood Proofing at Aptakisic Creek Commercial Area.
- Action Item 57: Drainage Infrastructure at (A) Del-Mar Woods Subdiv., (B) Wooded Glen Gardens Subdiv.,(C) Grandwood Dr & Rt 132, (D) Tangueray Meadows Subdiv., (E) Warren Twp High School,(F) North Shore Lands, (G)Orchard Valley Pond, (H) Gages Lake Rd & Rt 45, (I) Warren Twp High School, (J) Woodland Meadows Subdiv. (K) Wildwood on Gages Lake Subdiv., (L) Pinewood Creek Subdiv., (M) Wildwood on Gages Lake Subdiv., and Gages Lake Subdiv. Drainageway Restoration/Conveyance at (N) Hunt Club Farms Lake drain and (O) Lambs Corner Creek. Stormwater Storage at (P) Deerpath Subdiv. headwaters, (Q)Grandwood Park Subd. headwaters and (R) Summerfields Subdiv.
- Action Item 58: (A) Residential Buyouts or Elevations at Williams Park Subdiv. (B) Creek Conveyance at Fiddle Creek
- Action Item 59: Drainage Infrastructure at (A) North Shore Highlands and (B) North Shore Lands.
- Action Item 60: Drainage Infrastructure at Del-Mar Woods Subdiv.

## **Village of Antioch**

Action Item 1: Plan Adoption

Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance

Action Item 3: Incorporate ANHMP into Other County and Municipal Plans

Action Item 4: Continued Implementation of the WDO and NFIP Requirements

Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property

Action Item 10: Implement Property Protection Projects for Flood Mitigation

Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering



## **Village of Bannockburn**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 17: Continue Participation or Consider Participation in StormReady

## **Village of Barrington**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities
- Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System
- Action Item 24: Develop or Enhance the Community's Snow Removal Plan
- Action Item 25: Utility Tree Trimming
- Action Item 26: Sump Pump Disconnects
- Action Item 27: Conduct Local Drainage Studies
- Action Item 28: Increase Stormwater Detention Capacity

## **Village of Barrington Hills**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 22: Continue with Identification and Implementation of SMC Flood Mitigation Projects

## **Village of Beach Park**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities
- Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System
- Action Item 32: Mitigate Septic Discharge; Leaching into Waterways
- Action Item 34A: Improve/Enhance Manor Rd Culvert and Bull Creek Bank Stabilization
- Action Item 34B: Resize Major Ave, culvert at Bull Creek
- Action Item 34C: North Ave. Stormwater Conveyance Improvements
- Action Item 34D: Update Building Codes to 2018 IBC

## **Village of Buffalo Grove**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities
- Action Item 24: Develop or Enhance the Community's Snow Removal Plan
- Action Item 25: Utility Tree Trimming
- Action Item 26: Sump Pump Disconnects
- Action Item 27: Conduct Local Drainage Studies
- Action Item 28: Increase Stormwater Detention Capacity
- Action Item 29: Investigate Countywide Warning System
- Action Item 61A: Improve Northwood Subdivision Stormwater Transmission and Storage
- Action Item 61B: Stabilize & Enhance Arboretum Club Shoreline
- Action Item 61C: Emergency Operations Center Communications Equipment
- Action Item 61D: Enhanced Emergency Communications Program

## **Village of Deer Park**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 18: Improve Emergency Response and Develop Assessment Teams



## **Village of Deerfield**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities
- Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System
- Action Item 26: Sump Pump Disconnects
- Action Item 27: Conduct Local Drainage Studies

## **Village of Fox Lake**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering

## **Village of Fox River Grove**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 35: Catch basins at border near Illinois/Wisconsin and the mouths of tributaries flowing into the river

## **Village of Grayslake**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities

## **Village of Green Oaks**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System

## **Village of Gurnee**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities
- Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System
- Action Item 23: Develop Flood Stage Maps
- Action Item 24: Develop or Enhance the Community's Snow Removal Plan
- Action Item 36A: Identify needs and obtain alternate power source for critical facilities, supply generator with ATS at Lee Ave. lift station and generator backup at Westgate lift station.
- Action Item 36B: Streambank stabilization along Swanson Trig tributary east of CP Railroad, West of Union Pacific Railroad, South of 132 and North of Washington St.
- Action Item 36C: Increase culvert flow capacity at Grove Ave.



## **Village of Hainesville**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering

## **Village of Hawthorn Woods**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 25: Utility Tree Trimming

## **City of Highland Park**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System
- Action Item 23: Develop Flood Stage Maps
- Action Item 24: Develop or Enhance the Community's Snow Removal Plan
- Action Item 32: Mitigate Septic Discharge; Leaching into Waterways

## **Village of Highwood**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering

## **Village of Indian Creek**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering

## **Village of Island Lake**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5 Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering



## **Village of Kildeer**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 24. Develop or Enhance the Community's Snow Removal Plan
- Action Item 37A: Expand village swale system to increase stormwater flow capacity.
- Action Item 37B: Increase stormwater flow capacity by resizing culvert at Buffalo Run and Cliffside Dr.

## **Village of Lake Barrington**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities

## **Village of Lake Bluff**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities
- Action Item 38: Increase storm sewer capacity to drain West Scranton viaduct.

## **City of Lake Forest**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering

## **Village of Lake Villa**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities
- Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System
- Action Item 24: Develop or Enhance the Community's Snow Removal Plan

## **Village of Lake Zurich**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 24: Develop or Enhance the Community's Snow Removal Plan
- Action Item 27: Conduct Local Drainage Studies
- Action Item 39: Shoreline stabilization at Buffalo Creek



## **Village of Lakemoor**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering

## **Village of Libertyville**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 40: Increase detention volume at Highlands subdivision phase 1 including reconstruction of Nicholas Dowden Park South for detention storage.

## **Village of Lincolnshire**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Consider Participation in Tree City USA (Urban Forestry)
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 20: Continue Participation in the NFIP's Community Rating System
- Action Item 24: Develop or Enhance the Community's Snow Removal Plan
- Action Item 31: Lincolnshire Creek Improvements
- Action Item 34: Des Plaines River Neighborhood Flood Protection
- Action Item 41: Windsor Dr. area drainage improvements, adding additional storm sewer to reduce roadway flooding.

## **Village of Lindenhurst**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering

## **Village of Long Grove**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities
- Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System

## **Village of Mettawa**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering



## **Village of Mundelein**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities
- Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System

## **Village of North Barrington**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System

## **City of North Chicago**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering

## **Village of Old Mill Creek**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering

## **City of Park City**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering

## **Village of Port Barrington**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities
- Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System
- Action Item 42A: Flood buyouts of homes in floodplain
- Action Item 42B: Purchase new electronic sign for village entrance to provide emergency notifications.
- Action Item 42C: Shoreline stabilization of natural island in Nielson Channel.
- Action Item 42D: Construction of new storage shed for emergency response supplies including sandbag and bagging equipment.



## **Village of Riverwoods**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System

## **Village of Round Lake**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities

## **Village of Round Lake Beach**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering

## **Village of Round Lake Heights**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities
- Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System

## **Village of Round Lake Park**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects

## **Village of Third Lake**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities



## **Village of Tower Lakes**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering

## **Village of Vernon Hills**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 18: Improve Emergency Response and Develop Assessment Teams

## **Village of Volo**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 13: Continue Participation or Consider Participation in Tree City USA (Urban Forestry)
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities
- Action Item 43: Implement program to review and clear retention pond culverts utilized for stormwater drainage.

## **Village of Wadsworth**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities

## **Village of Wauconda**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 44A: Bangs Lake Drainage Ditch Streambank Stabilization
- Action Item 44B: Circle Channel Shoreline Stabilization Project
- Action Item 44C: Inflow & Infiltration (I/I) Mitigation
- Action Item 44D: Larkdale Lagoons and Outfall Channel
- Action Item 44E: Mutton Creek Streambank Stabilization
- Action Item 44F: Develop a Stormwater Master Plan

## **City of Waukegan**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 9: Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 11: Reduce Inflow and Infiltration to Protect Against Sewer Backups
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 15: Improve Building Codes and Building Code Enforcement
- Action Item 16: Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities
- Action Item 20: Continue Participation or Consider Participation in the NFIP's Community Rating System
- Action Item 24: Develop or Enhance the Community's Snow Removal Plan
- Action Item 25: Utility Tree Trimming
- Action Item 26: Sump Pump Disconnects
- Action Item 27: Conduct Local Drainage Studies
- Action Item 30: Investigate Future Conditions and the Impact on Depth and Frequency of Flooding
- Action Item 45: Yeoman Creek bank stabilization.



## **Village of Winthrop Harbor**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other County and Municipal Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 5: Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property
- Action Item 10: Implement Property Protection Projects for Flood Mitigation
- Action Item 12: Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering

## **City of Zion**

Action Item 1: Plan Adoption

Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance

Action Item 3: Incorporate ANHMP into Other County and Municipal Plans

Action Item 4: Continued Implementation of the WDO and NFIP Requirements

## **Naval Station Great Lakes**

- Action Item 1: Plan Adoption
- Action Item 2: Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance
- Action Item 3: Incorporate ANHMP into Other Plans
- Action Item 4: Continued Implementation of the WDO and NFIP Requirements
- Action Item 6: Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters
- Action Item 7: Review of Critical Facilities and Implement of Appropriate Mitigation Measures
- Action Item 8: Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters
- Action Item 14: Continue Work for NIMS Compliance
- Action Item 17: Continue Participation or Consider Participation in StormReady
- Action Item 18: Improve Emergency Response and Develop Assessment Teams
- Action Item 19: Enhance Response and Recovery Information Sharing and Collaboration and Identify Additional Training Opportunities
- Action Item 21: Continue to Map Natural Hazard Impacts and Continue Vulnerability Assessments
- Action Item 23: Develop of Flood Stage Maps

## 6.4 Implementation Strategy

It is the goal of Lake County, the participating municipalities and the HMPC to pursue the action items listed in this Chapter. However, as mentioned in Section 6.1 Development of Current Action Plan, the other recommendations included in the ANHMP (i.e., in Chapter 5) are no less important and should be implemented as opportunities arise.

Specific communities and/or neighborhoods are not identified with the action items. This was intentional to ensure that all mitigation efforts with private property owners are indeed voluntary and not perceived as dictated.

A number of the action items are best pursued as countywide efforts. Those action items are noted in **Error! Reference source not found.** Also, the HMPC should continue to build partnerships and explore opportunities to leverage funds among state, federal, local, and private sources. “Stakeholders” in **Error! Reference source not found.** refers to other local, regional, state or federal agency, and/or the American Red Cross or the Lake County Forest Preserve District.

Plan monitoring and maintenance are discussed in Chapter 7 of this ANHMP.

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## **Chapter 7: Plan Maintenance**

As discussed in Chapter 2, the Lake County Hazard Mitigation Planning Committee (HMPC) was created for the purpose of plan monitoring and maintenance. The membership of the HMPC included representative from the participating communities. The HMPC has been meeting annually and annual meeting reports are posted on the SMC and County websites. The HMPC meetings and reports proved useful in the development of the ANHMP and the HMPC efforts fostered mitigation in Lake County.

The HMPC is coordinated by the SMC and the LCEMA. At the onset of the 2012 update, communities were asked to pass resolutions of participation in the HMPC (then the LPC), and the 2012 ANHMP adoption resolutions included a statement by the communities for continued participation on the HMPC and at annual meetings.

### **7.1 Plan Adoption**

Action Item 1 calls for all communities to adopt the 2022 ANHMP by resolution of the governing body within 6 months of the Lake County Boards adoption of this update. Adoption of the Plan ensures that County, municipalities, 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.

### **7.2 Maintenance and Monitoring**

Maintenance and monitoring of the *Lake County Natural Hazards Mitigation Plan* are addressed in Action Item 2. This action item explains how and when this ANHMP will be reviewed, revised, and updated. The HMPC will continue to meet at least annually to discuss implementation of this ANHMP:

- Act as a forum for hazard mitigation issues
- Disseminate hazard mitigation ideas and activities to all participants
- Allow for continued public participation in the implementation and future revisions
- Ensure incorporation of ANHMP's goals and guidelines into other planning documents
- Investigate mitigation opportunities
- Report on progress and recommended changes to the County Board and each municipality

Reports on progress should be both submitted (in writing) to SMC and LCEMA and presented and discussed at the annual HMPC meeting. The annual reports will facilitate the 5-year ANHMP update.



Mitigation plans are required by FEMA to be updated every five years (44 Code of Federal Regulations, Part 201). Mitigation plans may be updated sooner if any substantial revisions are recommended to the Action Plan in any year. If substantial revisions are by the HMPC to the ANHMP, then the plan must be re-adopted by the county and the participating communities. The 2022 ANHMP will be updated within 5 years of FEMA's final approval. Final FEMA approval comes in the form of a letter that is issued once a community submits IEMA and FEMA a copy of their adoption resolution.

### **7.3 Continued Public Participation**

Public participation of the ANHMP has included print articles, printed and online surveys, HMPC meetings open to the public and a public meeting. Comments on the planning process and the draft ANHMP were encouraged and welcome. The adopted ANHMP will be posted on the SMC website and links to exhibits (maps) included in the ANHMP will also be available. This will allow the public to view the maps at a better scale and more closely examine their community and their property. Public input and participation will be welcomed at the HMPC annual meetings. Other public information materials will be posted on the SMC and LCEMA websites and provided to the municipalities for website postings or print materials. Also, a public meeting will precede any amendments or updates to the plan.

### **7.4 Evaluating the Plan's Success**

Evaluation of the ANHMP will not only include checking whether mitigation actions are implemented or not, but also assess their degree of effectiveness and assess whether other hazards need to be addressed. This will be accomplished by reviewing the qualitative benefits (or avoided losses) of the mitigation activities, to the extent possible. These findings will be compared with the mitigation goals the plan sets out to achieve. The HMPC will also evaluate whether mitigation actions need to be discontinued or modified in any way in light of new developments in the community. The progress will be documented by the HMPC and submitted to the County Board and municipal councils on an annual basis.

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## Appendix A: Hazards Mitigation Planning Committee Hazard Exercise Ranking by Jurisdiction

### Hazard Ranking Methodology:

The hazard ranking methodology was based on impact, occurrence, and vulnerability for each of the identified hazards. The table below indicates the overall hazard rankings for each of the participating jurisdictions based on the updated 2022 ranking criteria:

**H**=High, **M**=Moderate, **L**=Low and **VL**=Very Low.

Numerical values were assigned as follows:

- **Impact:** Values in the parentheses were assigned based on the degree of impact to people and property from the hazard event:
  - **Very Low Risk (1)** = An event with minimal impacts to people, property, no outside assistance required.
  - **Low Risk (2)** = An event with minor impact on people, property, local assistance may be required.
  - **Moderate Risk (3)** = An event that will impact people, property and/or community operations such that people need community assistance. A moderate amount of time will be needed for recovery. State or federal assistance may be required.
  - **High Risk (4)** = An event that will severely impact people, property and/or community operations. A significant amount of time will be needed for recovery. State and federal assistance will be required.
- **Occurrence:** Values in the parentheses were assigned based on the frequency of occurrence in years for the hazard event:
  - **Very Low (1)** = Occurs every 100-199 years.
  - **Low (2)** = Occurs every 30-99 years.
  - **Moderate (3)** = Occurs every 10-29 years.
  - **High (4)** = Occurs every 3-9 years.
  - **Very High (5)** = Occurs every 1-2 years
- **Areas of Vulnerability:** Values in the parentheses were assigned based on the total area exposed to the hazard event:
  - **Very Low (1)** = Minimal localized event.
  - **Low (2)** = Specific neighborhoods more vulnerable to the hazard (example: Cross streets or cul-de-sac where frequent flooding occurs). If low is selected, representatives of the jurisdiction were asked to identify specific locations for vulnerabilities.
  - **Moderate (3)** = Widespread, approximately 25% of planning area vulnerable.
  - **High (4)** = Widespread, approximately 50% of the planning area vulnerable.
  - **Very High (5)** = Substantial, entire planning area vulnerable.

**Score Totals:** 0-3= Very Low (VL), 4-6= Low (L), 7-9= Moderate (M), 10-14= High (H)

<b>Hazards Mitigation Planning Committee Hazard Exercise Ranking by Jurisdiction</b> <b>(H=High, M=Moderate, L=Low and VL=Very Low)</b>												
<b>Jurisdiction</b>	<b>Severe Winter Storm</b>	<b>Tornado</b>	<b>Severe Summer Storm</b>	<b>Extreme Heat</b>	<b>Flood</b>	<b>Drought</b>	<b>Groundwater Flood</b>	<b>Earthquake</b>	<b>Erosion</b>	<b>Dam Failure</b>	<b>Seiche</b>	<b>Power Outage</b>
Antioch	H	H	H	M	H	L	VL	L	VL	L	VL	H
Bannockburn	H	M	H	H	M	L	H	L	L	VL	VL	H
Barrington	H	H	H	L	M	M	L	L	VL	VL	VL	M
Barrington Hills	H	H	H	H	H	M	H	L	L	M	L	H
Beach Park	H	H	H	M	L	M	M	H	M	VL	L	H
Buffalo Grove	H	H	H	H	M	M	VL	L	M	L	M	H
Deer Park,	H	H	H	H	M	M	M	M	M	M	L	H
Deerfield	M	M	M	M	M	M	VL	VL	M	VL	VL	M
Fox Lake	H	H	H	H	H	H	H	H	M	M	L	H
Fox River Grove	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL	VL
Grayslake	L	M	M	L	M	L	L	VL	VL	VL	VL	L
Green Oaks	H	M	H	M	M	L	L	VL	VL	VL	VL	L
Gurnee	H	H	H	H	H	H	H	L	M	VL	VL	H
Hainesville	H	H	H	H	H	H	H	M	L	L	VL	H
Hawthorn Woods	H	H	H	M	L	L	M	L	VL	VL	VL	L
Highland Park	H	H	H	H	H	M	M	M	H	VL	L	H
Highwood	H	H	H	H	H	H	M	H	L	L	L	H
Indian Creek	H	H	H	M	M	L	L	L	L	VL	VL	M
Island Lake	H	M	M	H	H	L	H	VL	VL	VL	VL	L
Kildeer	H	H	M	M	M	M	M	H	M	VL	VL	H
Lake Barrington	H	L	H	H	M	L	M	L	H	M	M	H
Lake Bluff	H	M	H	M	M	VL	VL	L	H	VL	L	M
Lake County	H	H	H	H	H	M	H	L	L	M	L	H
Lake Forest	H	L	H	H	H	M	M	VL	M	VL	L	H
Lake Villa	H	H	H	H	H	H	H	M	L	VL	VL	H
Lake Zurich	H	H	M	M	M	L	M	VL	L	L	VL	L
Lakemoor	H	H	H	H	H	H	M	M	L	VL	L	H
Libertyville	L	M	M	M	M	M	L	L	L	L	VL	M
Lincolnshire	H	M	H	L	H	L	L	VL	M	L	L	H
Lindenhurst	H	H	M	M	M	L	M	L	L	VL	H	H
Long Grove	M	M	M	M	M	L	M	M	M	VL	L	M
Mettawa	M	M	H	H	M	M	H	H	VL	VL	VL	M
Mundelein	H	L	H	H	M	L	M	L	H	M	M	H
North Barrington	H	H	H	L	M	M	L	L	VL	VL	VL	M
North Chicago	H	L	H	H	H	L	L	VL	L	VL	VL	H

<b>Hazards Mitigation Planning Committee Hazard Exercise Ranking by Jurisdiction</b> <b>(H=High, M=Moderate, L=Low and VL=Very Low)</b>												
<b>Jurisdiction</b>	<b>Severe Winter Storm</b>	<b>Tornado</b>	<b>Severe Summer Storm</b>	<b>Extreme Heat</b>	<b>Flood</b>	<b>Drought</b>	<b>Groundwater Flood</b>	<b>Earthquake</b>	<b>Erosion</b>	<b>Dam Failure</b>	<b>Seiche</b>	<b>Power Outage</b>
Park City	H	H	H	H	H	H	VL	VL	M	VL	VL	M
Port Barrington	H	H	H	H	H	H	H	M	M	M	L	H
Riverwoods	M	M	M	M	M	L	M	L	M	VL	L	M
Round Lake	H	H	H	H	M	M	M	H	M	VL	VL	H
Round Lake Beach	H	M	H	M	H	M	H	L	H	L	M	H
Round Lake Heights	H	H	H	H	H	M	M	M	M	VL	VL	H
Round Lake Park	H	H	H	H	H	H	H	M	H	L	VL	H
Third Lake	M	M	H	M	M	M	VL	VL	H	M	VL	H
Tower Lake	M	M	M	M	M	M	M	L	M	L	L	H
Vernon Hills	H	H	H	M	L	L	L	VL	L	VL	VL	M
Volo	H	H	M	M	M	VL	VL	M	VL	VL	VL	M
Wadsworth	M	M	H	H	M	M	H	H	VL	VL	VL	M
Wauconda	H	M	H	H	M	M	M	L	M	VL	VL	H
Waukegan	H	M	H	H	M	M	M	L	M	VL	VL	H
Winthrop Harbor	M	H	H	H	H	H	M	H	H	M	VL	H
Zion	H	L	H	H	H	M	H	M	H	VL	VL	H

## Appendix B: Critical Assets Within Hazard Area

### Critical Assets withing 1-Mile of High Hazard Dams

#### Critical Assets within Tornado Scenario Area

Name	Address	City	Year Built
Stanton School	101 Hawthorne Ln	Fox Lake	1971
Kidsuccess	218 Washington St	Ingleside	1972
Round Lake Middle School	2000 Lotus Dr	Round Lake Height	1985
Indian Hill Elem School	1920 Lotus Dr	Round Lake Height	1985
Immanuel Evangelical School	1310 N Frolic Ave	Waukegan	1966
Fox Lake Police Department	301 State Highway 59	Fox Lake	1972
Round Lake Beach Police Department	1947 North Municipal Way	Round Lake Beach	1991
Round Lake Area Park District Police	241 Orchard Lane	Round Lake	1991
Fox Lake Fire Department Station 2	306 Washington Street	Fox Lake	1972
Greater Round Lake Fire Protection Dist.	861 East Hook Drive	Round Lake Beach	1991
Gurnee Fire Department Station 2	6581 Dada Drive	Gurnee	1993



Critical Assets within 100-Year Flood Area			
NAME	OWNER TYPE	FEATURE	MUNICIPALITY
Campbell Airport	Private	Airport Runway / Airfield	Grayslake
Crane's Landing Golf Club	Private	Golf Course	Lincolnshire
Marriott Theatre in Lincolnshire	Private	Auditorium / Concert Hall / Theater / Opera House	Lincolnshire
Adler Park	Municipal	Park	Libertyville
Cumnor Court Park	Municipal	Park	Deerfield
Esper Petersen Park	Municipal	Park	Gurnee
Gridley Farm	Municipal	Park	Long Grove
Hérons Landing Park	Municipal	Park	Long Grove
Hidden Creek AquaPark	Municipal	Amusement / Water Park	Highland Park
Highland Pines Park	Municipal	Park	Long Grove
Larry Fink Memorial Park	Municipal	Park	Highland Park
Magnolia Park	Municipal	Park	Highland Park
Oak Hills	Municipal	Park	Long Grove
Old School Road Open Space	Municipal	Park	Mettawa
Red Top Park	Municipal	Park	Libertyville
Rivershire Park	Municipal	Park	Lincolnshire
Riverside Park	Municipal	Park	Libertyville
Rory David Park	Private	Park	Highland Park
Sleepy Hollow Park	Municipal	Park	Highland Park
Spring Lake Park	Municipal	Park	Lincolnshire
Stockbridge Wetland	Municipal	Park	Long Grove
Sugar Creek Park	Municipal	Park	Vernon Hills
Sullivan Woods	Municipal	Park	Vernon Hills
Trail Tree Park	Municipal	Park	Deerfield
Village Park - Waukegan	Municipal	Park	Waukegan
Lake Park	Municipal	Park	Gurnee
Adam's Park	Municipal	Park	Grandwood Park
Hidden Park	Municipal	Park	Grandwood Park
MacArthur Woods Forest Preserve	County	Park	
Nippersink Forest Preserve	County	Park	
Sedge Meadow Forest Preserve	County	Park	
West Skokie Nature Preserve	Non-Profit	Park	Lake Bluff
Half Day Forest Preserve	Private	Park	Lincolnshire
Depke Center	Private	Shopping Mall / Complex	Gurnee
Neal Marsh	Non-Profit	Park	Gurnee
The Links at Midlane	Private	Golf Course	Wadsworth
Buffalo Grove Golf Course	Municipal	Golf Course	Buffalo Grove
Lincolnshire Marriott Resort	Private	Hotel / Motel	Lincolnshire
Long Lake Open Space	State	Lake / Pond	Ingleside

**Critical Assets within 500-Year Flood Area**

NAME	OWNER	FEATURE	MUNICIPALITY
Highland Park Fire Department Station 34	Municipal	Fire Station / EMS Station	Highland Park
Campbell Airport	Private	Airport Runway / Airfield	Grayslake
Crane's Landing Golf Club	Private	Golf Course	Lincolnshire
Mother Rudd House Museum	Municipal	Museum	Gurnee
Marriott Theatre in Lincolnshire	Private	Concert Hall	Lincolnshire
Adler Park	Municipal	Park	Libertyville
Cumnor Court Park	Municipal	Park	Deerfield
Danny Cunniff Park	Municipal	Park	Highland Park
Esper Petersen Park	Municipal	Park	Gurnee
Gowe Park	Municipal	Park	Gurnee
Gridley Farm	Municipal	Park	Long Grove
Hérons Landing Park	Municipal	Park	Long Grove
Hidden Creek AquaPark	Municipal	Amusement / Water Park	Highland Park
Highland Pines Park	Municipal	Park	Long Grove
Larry Fink Memorial Park	Municipal	Park	Highland Park
Magnolia Park	Municipal	Park	Highland Park
Oak Hills	Municipal	Park	Long Grove
Old School Road Open Space	Municipal	Park	Mettawa
Red Top Park	Municipal	Park	Libertyville
Rivershire Park	Municipal	Park	Lincolnshire
Riverside Park	Municipal	Park	Libertyville
Rory David Park	Private	Park	Highland Park
Sleepy Hollow Park	Municipal	Park	Highland Park
Spring Lake Park	Municipal	Park	Lincolnshire
Stockbridge Wetland	Municipal	Park	Long Grove
Sugar Creek Park	Municipal	Park	Vernon Hills
Sullivan Woods	Municipal	Park	Vernon Hills
Trail Tree Park	Municipal	Park	Deerfield
Village Park - Waukegan	Municipal	Park	Waukegan
Lake Park	Municipal	Park	Gurnee
Adam's Park	Municipal	Park	Grandwood Park
Hidden Park	Municipal	Park	Grandwood Park
Cahokia Flatwoods Forest Preserve	County	Park	
Captain Daniel Wright Woods Forest Preserve	County	Park	
MacArthur Woods Forest Preserve	County	Park	
Mill Creek Forest Preserve	County	Park	
Nippersink Forest Preserve	County	Park	
Sedge Meadow Forest Preserve	County	Park	
West Skokie Nature Preserve	Non-Profit	Park	Lake Bluff
Half Day Forest Preserve	Private	Park	Lincolnshire
Depke Center	Private	Shopping Mall / Complex	Gurnee
Neal Marsh	Non-Profit	Park	Gurnee
The Links at Midlane	Private	Golf Course	Wadsworth
Lyons Prairie and Marsh	Non-Profit	Park	Barrington
Buffalo Grove Golf Course	Municipal	Golf Course	Buffalo Grove
Colonial Court	Private	Shopping Mall / Complex	Riverwoods
Estonian House	Non-Profit	Community / Recreation Center	Riverwoods
Lincolnshire Marriott Resort	Private	Hotel / Motel	Lincolnshire
Long Lake Open Space	State	Lake / Pond	Ingleside
Lake County Public Works - Grandwood Park Water Tower	County	Water Tower	

## Appendix C: HMPC Participation and Documentation

### Lake County Hazard Mitigation Planning Committee (HMPC) and Participants

#### January 2022, Meeting

First Name	Last Name	Organization / Agency
Tom	Shaughnessy	Antioch Township
Darren	Monico	Buffalo Grove
Andrea	Larson	Buffalo Grove
Christofer	Nikkinen	City of Zion
		Lake County, Grayslake, Island Lake, Lindenhurst, Round Lake,
Daniel	Eder	Winthrop
Kurt	Baumann	Harbor
David	Ziegler	Gurnee
Nick	Leach	Gurnee
John	Malcolm	Hawthorn Woods
Ron	Milasano	Highland Park
Jake	Halley	Integrated Solutions Consulting
Leah	Rausch	ISC
Nia	Gumbs	ISC
Michael	Talbett	Kildeer
Geoff	Perry	Kildeer, Long Grove, Long Grove, Riverwoods
Al	Giertych	Lake County DOT
Domingo	Kaller	Lake County Emergency Management
REBECCA	KUMAR	Lake County Emergency Management Agency
Joel	Krause	Lake County PBD
Mike	Prusila	Lake County SMC
Mia	Gerace	Lake County SMC
Michael	Brown	Lake Zurich
Jeff	Cooper	Libertyville
Ernesto	Huaracha	Lake County SMC
Patrick	Bleck	Round Lake Heights & Round Lake Park
Scott	Firnbach	Round Lake Park
Kurt	Woolford	Lake County SMC
Sharon	Osterby	Lake County SMC
Brian	Frank	Lake County SMC
Robert	Palmer	South Barrington
Jeff	Laramy	Lake County SMC
Justin	Keenan	Village of Deerfield
Benjamin	Metzler	Village of Green Oaks
Heather	Galan	Village of Gurnee - Alternate
Erika	Frable	Village of Hawthorn Woods
Wally	Dittrich	Village of Lincolnshire
Sam	Barghi	Village of Lincolnshire
Jonathan	Meyer	Volo

**February 2022, Meeting**

First Name	Last Name	Organization/Agency
Tom	Shaughnessy	Antioch Township
Joesph	Wieser	Buffalo Grove Emergency Management
Robert	Phillips	Deerfield
Mike	Depouw	Ela Township
Alicia	Dodd	Fremont Township
Kurt	Baumann	Grayslake, Island Lake, Lindenhurst, Round Lake, and Winthrop Harbor
Benjamin	Metzler	Green Oaks
Ronald	Milanesio	Highland Park
Nia	Gumbs	ISC
Matt	Stanley	ISC
Jake	Halley	ISC
Glenn	Heistand	ISWS
Andrew	Heuser	Lake County
Ernesto	Huaracha	Lake County
Al	Giertych	Lake County Division of Transportation
Rebecca	Kumar	Lake County EMA
Daniel	Eder	Lake County EMA
Scott	Robertson	Lake County Health Dept.
Mike	Prusila	Lake County SMC
Brian	Frank	Lake County SMC
Sharon	Osterby	Lake County SMC
Mia	Gerace	Lake County SMC
Domingo	Kaller	Lake County SMC
Geoff	Perry	Long Grove, Riverwoods
Darren	Monico	Village of Buffalo Grove
Heather	Galan	Village of Gurnee
Nick	Leach	Village of Gurnee
John	Malcolm	Village of Hawthorn Woods
Michael	Talbett	Village of Kildeer
Michael	Brown	Village of Lake Zurich
Jeff	Cooper	Village of Libertyville
Sam	Bargi	Village of Lincolnshire Public Works
EJ	Kueker	Village of Port Barrington
Patrick	Bleck	Village of Round Lake Heights and Round Lake Park
Al	Falco	Village of Round Lake Park
Johnathan	Meyer	Village of Volo
Jacob	Mann	Village of Wauconda
Amy	Sarver	Warren Township
Mike	Reynolds	Wauconda

**March 2022, Meeting**

Michele	Bauman	Avon Township
Joseph	Wieser	Buffalo Grove
Ronald	Milanesio	City of Highland Park
Christofer	Nikkinen	City of Zion
Jairo	Rodriguez	Hainesville
Jacob	Wellbank	Hainesville and North Barrington
Matthew	Bartlett	Hawthorn Woods
Jake	Halley	Integrated Solutions Consulting
Nia	Gumbs	ISC
Michael	Talbett	Kildeer
Andrew	Heuser	Lake County
Daniel	Eder	Lake County
Sharon	Osterby	Lake County
REBECCA	KUMAR	Lake County Emergency Management Agency
Scott	Robertson	Lake County Health Dept.
Mia	Gerace	Lake County SMC
Mike	Prusila	Lake County SMC
Michael	Brown	Lake Zurich
Geoff	Perry	Long Grove, Riverwoods, Bannockburn, Lake Barrington
Patrick	Bleck	Round Lake Heights and Round Lake Park
Brian	Frank	SMC
Jeff	Laramy	SMC
Michelle	Pope	SMC
Arnold	Donato	Stormwater Management Commission
Domingo	Kaller	the county
Keli	Amato	The Village of Lake Zurich
MARK	TOBERMAN	TOWNSHIP HIGHWAY DEPARTMENT
Joel	Krause	Unincorporated Lake County
Michelle	Kozak	USACE
Kurt	Baumann	Various
Adrian	Marquez	Village of Beach Park
Andrea	Larson	Village of Buffalo Grove
Darren	Monico	Village of Buffalo Grove
Nick	Leach	Village of Gurnee
Jeff	Cooper	Village of Libertyville
Walter	Dittrich	Village of Lincolnshire
Sam	Barghi	Village of Lincolnshire
Ej	Kueker	Village of Port Barrington
DONNA	ERFORT	Village of Port Barrington
Al	Falco	Village of Round lake Park
Jacob	Mann	Village of Wauconda
Jacob	Wellbank	Villages of Hainesville and North Barrington
Jonathan	Meyer	Volo
Amy	Sarver	Warren Township
Mike	Reynolds	Wauconda

## 2. HMPC Meeting Agendas

### November 5, 2021, Meeting Agenda:



DATE: 11/5/2021

PURPOSE: Introduction and Initial Kickoff Meeting

#### **Introductions**

#### **Key Point of Contact**

#### **Next Steps: Contract, Project Work Plan Development**

#### **Plan Expiration Date and Other Key Dates (Grant deadlines, etc.)**

#### **Schedule**

#### **Online Planning System**

#### **Natural Hazard vs All Hazards**

#### **Hazards**

- Flood
- Tornado
- Severe Summer Storm
- Severe Winter Storms
- Drought
- Earthquake
- Temperature Extremes
- Erosion – Shoreline, Coastal, Ravine
- Power Outage

#### **HAZUS**

#### **Jurisdiction Stakeholders and Contact Information**

#### **Other Key Stakeholders**

- GIS contact

#### **Major Mitigation Projects**

#### **BRIC/HMGP**



**February 23, 2022, Meeting Agenda:**



**Lake County Countywide All-Natural Hazards Mitigation Plan (ANHMP)  
2022 Hazard Mitigation Plan Update**

**Steering Committee, Meeting #2  
February 23, 2022, | 1:00 – 3:00 PM (CST)**

**AGENDA**

- Introductions
- Upcoming Meetings
- Hazard Mitigation Planning Recap
- Community Profile
- Mitigation Goals
- Hazard Identification
- Explain Impacts
  1. Risk Assessment
  2. Hazard Mapping and Vulnerabilities
  3. Community Survey
- Steering Committee Hazards Assessment Survey
- Next Steps

**Support Team Contact**  
Matt Stanley  
Integrated Solutions Consulting  
[Matt.Stanley@i-s-consulting.com](mailto:Matt.Stanley@i-s-consulting.com)  
504.645.1616



**March 23, 2022, Meeting Agenda:**



**Lake County Countywide All-Natural Hazards Mitigation Plan (ANHMP)  
2022 Hazard Mitigation Plan Update**

**Planning Committee, Meeting #3  
March 23, 2022, | 1:00 – 3:00 PM (CST)**

**AGENDA**

- Introductions
- Community Survey Initial Results
- Planning Committee Survey Results/Hazard Rankings
- Mitigation Strategy
  1. Discuss action items status updates since 2020 ANHMP Annual Report
  2. April Workshop
- Upcoming Community Meetings and Workshop
- Next Steps

**Support Team Contact**  
Matt Stanley  
Integrated Solutions Consulting  
[Matt.Stanley@i-s-consulting.com](mailto:Matt.Stanley@i-s-consulting.com)  
504.645.1616



## **Appendix D: Public Information Activities**

Below are samples of public information and public involvement activities that were used during the development of the 2022 ANHMP update, including:

Press releases  
Web site information  
Lake County e-Newsletter  
Public Survey via Alchemer  
Alchemer Survey Summary  
Public meeting and public comment announcements  
Public meeting held on April 19, 2022  
Frequently asked questions

Public Information Materials:

Press Releases:

## Web Site Information:

### Lake County e-Newsletter



### Public Input Needed on All Natural Hazards Mitigation Plan update

Lake County and all interested municipalities are in the process of updating the Lake County All Natural Hazards Mitigation Plan (ANHMP). The ANHMP identifies activities and projects to reduce the damages caused by natural hazards such as tornadoes, floods, and severe summer and winter storms. Mitigation means anything that can be done to reduce the impact of a natural hazard.

Public input and comments are important and all Lake County residents and property owners are encouraged to complete a short survey that can be found on the Internet at: <https://www.surveymonkey.com/r/HSMTMRL>.

Survey responses provided will help Lake County prioritize natural hazards that could impact residents and property owners, and to determine how to be better prepared for natural hazard emergencies.



## Public Survey via Alchemer:

To Whom It May Concern:

Lake County is conducting a study to better understand the preparedness needs and risk perceptions of its residents as part of the County's Hazard Mitigation Plan update process. To do so, a questionnaire has been distributed throughout the county, and you have been selected to participate. Your feedback is greatly needed and appreciated!

The questionnaire should only take about **10** minutes to complete. All responses will be kept confidential, and your participation is strictly voluntary. Your input will enable the County to better serve you.

### DEADLINE

Please complete the survey by March 21, 2022.

Thank you for your participation.

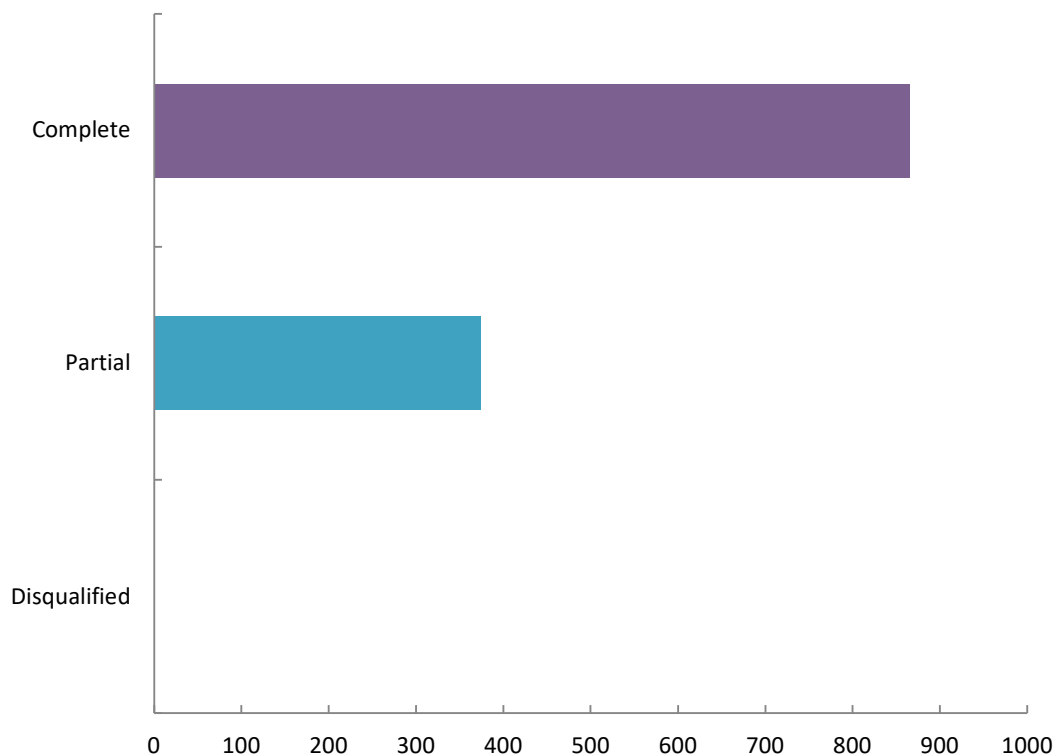
If you have any questions, please contact: **Sharon Osterby, Water Resource Professional Lake County Stormwater Management Commission, 847-377-7706.**

### DEFINITIONS

*Hazard Mitigation: The purpose of hazard mitigation planning is to identify policies and actions that can be implemented over the long term to reduce risk and future losses. Mitigation forms the foundation for a community's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage.*

## Public Survey Results:

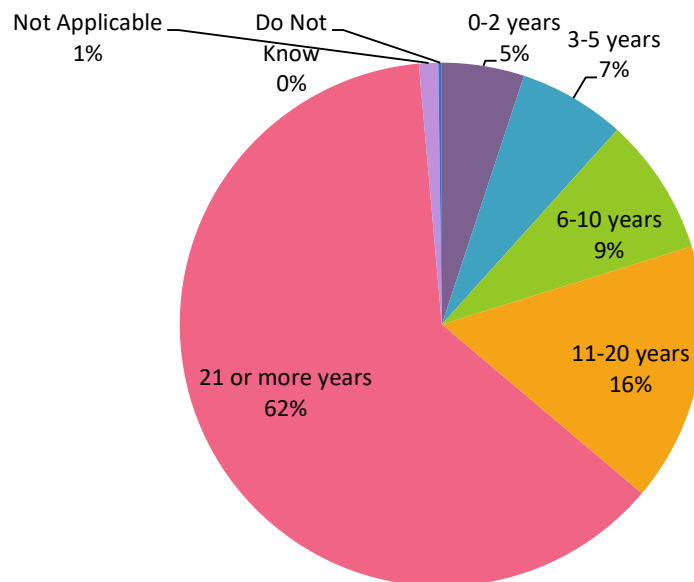
### Report for 2022 Lake County, IL: Disaster Preparedness and Mitigation Questionnaire/Public Survey



	Count	Percent
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Complete	865	69.8
Partial	374	30.2
Disqualified	0	0
Total	1,239	

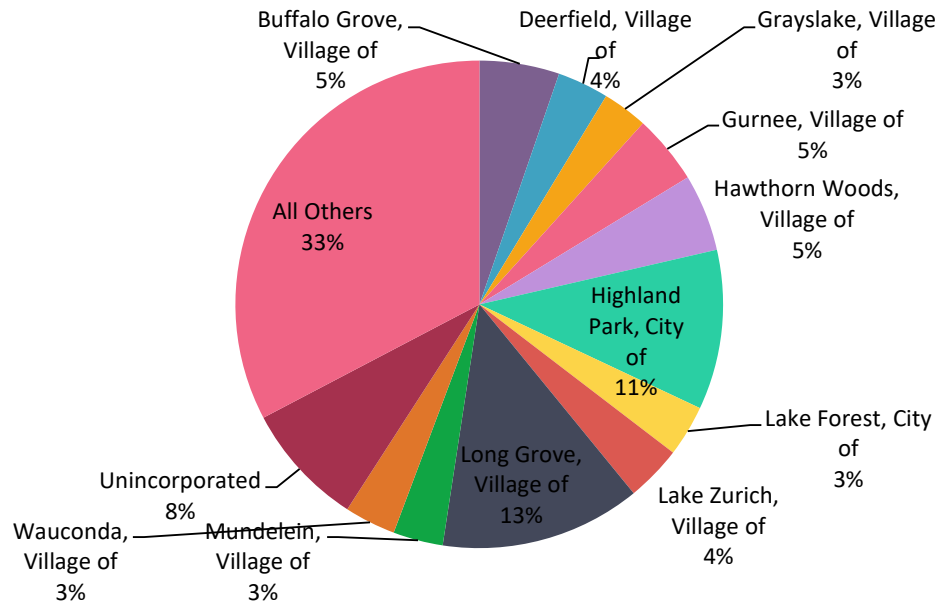
**1. Approximately how many years have you lived or worked (if you are not a resident) in Lake County, Illinois?**



Value	Percent	Count
0-2 years	5.1%	57
3-5 years	6.6%	74
6-10 years	8.5%	96
11-20 years	16.0%	180
21 or more years	62.5%	702
Not Applicable	1.2%	13

Do Not Know	0.2%	2
	Total	1,124

**2. Please indicate the jurisdiction that best represents the location of your home address/place of residence.**



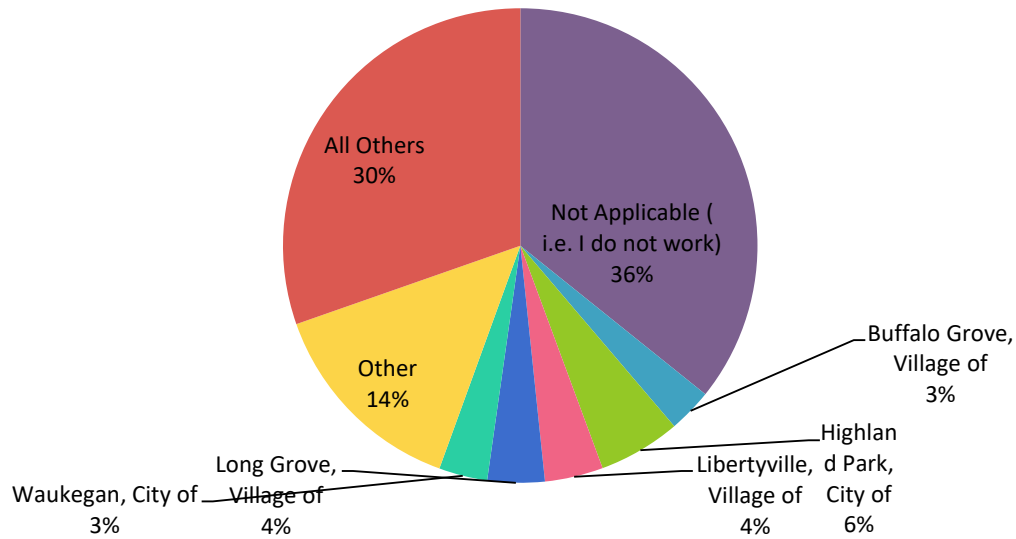
Value	Percent	Count
Antioch, Village of	2.1%	24
Bannockburn, Village of	0.1%	1
Barrington, Village of	0.8%	9
Beach Park, Village of	1.8%	20
Buffalo Grove, Village of	5.3%	59
Deer Park, Village of	1.6%	18
Deerfield, Village of	3.4%	38
Fox Lake, Village of	1.3%	15



Grayslake, Village of	3.0%	34
Green Oaks, Village of	0.9%	10
Gurnee, Village of	4.6%	52
Hainesville, Village of	0.4%	5
Hawthorn Woods, Village of	5.1%	57
Highland Park, City of	10.6%	119
Highwood, Village of	0.1%	1
Indian Creek, Village of	0.1%	1
Island Lake, Village of	0.5%	6
Kildeer, Village of	0.2%	2
Lake Bluff, Village of	1.2%	14
Lake Forest, City of	3.4%	38
Lake Villa, Village of	1.9%	21
Lake Zurich, Village of	3.7%	41
Libertyville, Village of	2.5%	28
Lincolnshire, Village of	2.0%	23
Lindenhurst, Village of	2.9%	32
Long Grove, Village of	13.3%	149
Mundelein, Village of	3.3%	37
North Barrington, Village of	0.4%	5
North Chicago, City of	0.1%	1

Port Barrington, Village of	0.2%	2
Riverwoods, Village of	0.4%	4
Round Lake, Village of	0.9%	10
Round Lake Beach, Village of	1.3%	15
Round Lake Heights, Village of	0.1%	1
Round Lake Park, Village of	0.7%	8
Third Lake, Village of	0.4%	4
Tower Lakes, Village of	0.4%	5
Vernon Hills, Village of	2.2%	25
Volo, Village of	1.0%	11
Wadsworth, Village of	1.0%	11
Wauconda, Village of	3.4%	38
Waukegan, City of	2.0%	23
Winthrop Harbor, Village of	0.4%	4
Zion, City of	0.8%	9
Unincorporated	8.2%	92
	Total	1,122

**3. Please indicate the jurisdiction that best represents the location where you work (i.e., place of business).**

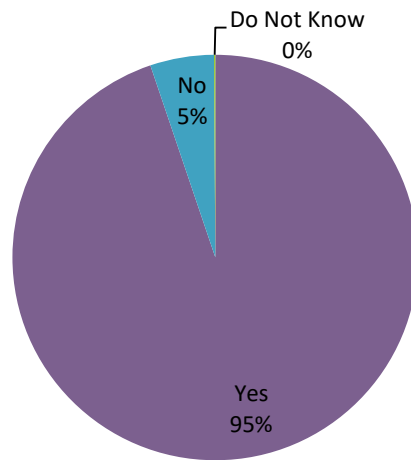


Value	Percent	Count
Not Applicable ( i.e. I do not work)	35.8%	395
Antioch, Village of	0.3%	3
Bannockburn, Village of	0.3%	3
Barrington, Village of	1.2%	13
Beach Park, Village of	0.4%	4
Buffalo Grove, Village of	3.0%	33
Deer Park, Village of	0.6%	7
Deerfield, Village of	2.2%	24
Fox Lake, Village of	0.6%	7
Fox River Grove, Village of	0.1%	1
Grayslake, Village of	1.5%	17

Green Oaks, Village of	0.1%	1
Gurnee, Village of	2.9%	32
Hainesville, Village of	0.1%	1
Hawthorn Woods, Village of	1.6%	18
Highland Park, City of	5.6%	62
Highwood, Village of	0.1%	1
Indian Creek, Village of	0.1%	1
Island Lake, Village of	0.1%	1
Lake Bluff, Village of	0.6%	7
Lake Forest, City of	1.9%	21
Lake Villa, Village of	0.1%	1
Lake Zurich, Village of	2.6%	29
Libertyville, Village of	4.0%	44
Lincolnshire, Village of	1.7%	19
Lindenhurst, Village of	0.4%	4
Long Grove, Village of	3.9%	43
Mundelein, Village of	2.2%	24
North Barrington, Village of	0.4%	4
North Chicago, City of	1.6%	18
Old Mill Creek, Village of	0.1%	1
Port Barrington, Village of	0.1%	1

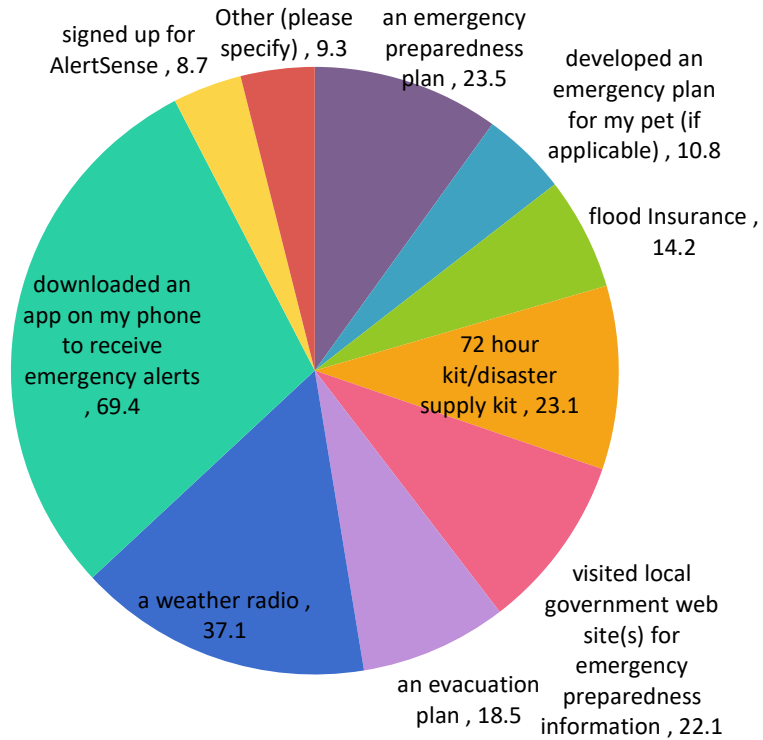
Riverwoods, Village of	0.6%	7
Round Lake, Village of	0.7%	8
Round Lake Beach, Village of	0.4%	4
Round Lake Park, Village of	0.4%	4
Tower Lakes, Village of	0.1%	1
Third Lake, Village of	0.2%	2
Vernon Hills, Village of	1.5%	17
Volo, Village of	0.3%	3
Wadsworth, Village of	0.3%	3
Wauconda, Village of	1.4%	15
Waukegan, City of	3.3%	36
Winthrop Harbor, Village of	0.1%	1
Zion, City of	0.5%	6
Other	14.1%	156
	Total	1,103

**4. Do you have consistent, and stable internet access?**



Value	Percent	Count
Yes	94.8%	924
No	5.1%	50
Do Not Know	0.1%	1
	Total	975

**5. Please indicate those activities you have done to prepare for emergencies and disasters. Please select ALL that apply. I have...**



Value	Percent	Count
an emergency preparedness plan	23.5%	198
developed an emergency plan for my pet (if applicable)	10.8%	91
flood Insurance	14.2%	120
72 hour kit/disaster supply kit	23.1%	195
visited local government web site(s) for emergency preparedness information	22.1%	186
an evacuation plan	18.5%	156
a weather radio	37.1%	313
downloaded an app on my phone to receive emergency alerts	69.4%	585



signed up for AlertSense	8.7%	73
Other (please specify)	9.3%	78

6. If you have an emergency supply kit, what items do you have in your kit? Please select ALL that apply.

Value	Percent	Count
I do not have an emergency/disaster supply kit	60.3%	532
Water	29.5%	260
Food (nonperishable)	26.3%	232
Battery-powered or hand crank radio and a NOAA Weather Radio with tone alert	23.5%	207
Flashlight	38.7%	341
First aid kit	34.2%	302
Extra batteries	29.7%	262
Whistle (to signal for help)	14.5%	128
Dust mask (to help filter contaminated air)	20.7%	183
Plastic sheeting and duct tape (to shelter in place)	11.9%	105
Moist towelettes, garbage bags and plastic ties (for personal sanitation)	19.5%	172
Wrench or pliers (to turn off utilities)	20.7%	183
Manual can opener (for food)	23.9%	211
Local maps	8.2%	72

Cell phone with chargers and a backup battery	21.4%	189
Prescription medications	17.2%	152
Non-prescription medications such as pain relievers, anti-diarrhea medication, antacids or laxatives	21.3%	188
Prescription eyeglasses and contact lens solution	13.8%	122
Infant formula, bottles, diapers, wipes and diaper rash cream	0.9%	8
Pet food and extra water for your pet	10.2%	90
Cash or traveler's checks	16.1%	142
Important family documents such as copies of insurance policies, identification and bank account records saved electronically or in a waterproof, portable container	13.6%	120
Sleeping bag or warm blanket for each person	18.7%	165
Complete change of clothing appropriate for your climate and sturdy shoes	13.4%	118
Fire extinguisher	20.2%	178
Matches in a waterproof container	12.8%	113
Feminine supplies and personal hygiene items	6.9%	61
Mess kits, paper cups, plates, paper towels and plastic utensils	15.6%	138
Paper and pencil	18.4%	162

Books, games, puzzles or other activities for children	7.4%	65
Other (please specify)	3.6%	32

**7. Please indicate where you go to obtain emergency and disaster related information?  
Please select ALL that apply.**

Value	Percent	Count
Local government web sites	59.7%	571
State government web sites	31.1%	298
Federal government web sites	30.1%	288
Web search	45.8%	438
Social media	30.8%	295
Voluntary organizations (example: American Red Cross, Salvation Army, etc.)	11.7%	112
Religious organization	3.6%	34
Local English-speaking television	40.9%	391
Local English-speaking radio	23.3%	223
Spanish-speaking television	0.8%	8
Local Spanish-speaking radio	0.4%	4
National news (radio and television)	41.9%	401
Print media - English (example: newspapers)	15.3%	146

Brochures and newsletters	5.2%	50
Word of mouth	26.5%	254
Other (please specify)	3.7%	35
Do not know	5.4%	52
Not applicable	1.5%	14

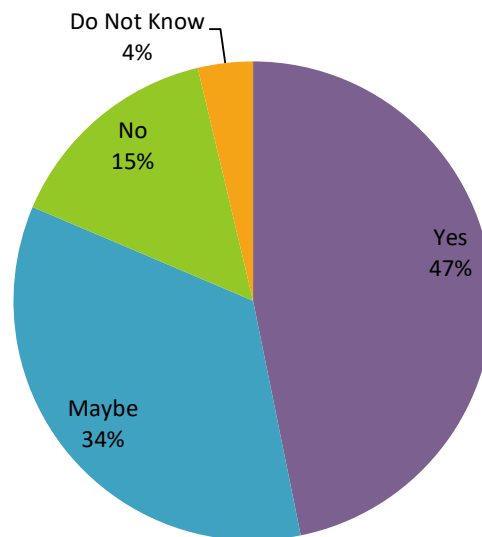
**8. Would you agree or disagree with the following statements?**

	Strongly Agree		Agree		Neither Agree nor Disagree		Disagree		Strongly Disagree		Do Not Know		Responses
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count
Lake County is providing the services necessary to prepare me for a disaster.	34	3.5%	213	22.1 %	334	34.6%	66	6.8%	40	4.1%	277	28.7%	964
I am familiar with Lake County's web site (www.lakecountyiil.gov) and can easily obtain information about emergencies and disasters.	95	9.9%	345	36.0 %	234	24.4%	125	13.0 %	40	4.2%	119	12.4%	958
During times of emergency, information	87	9.1%	374	39.2 %	248	26.0%	24	2.5%	14	1.5%	208	21.8%	955

is provided in a format I can understand.													
I can easily obtain emergency information in times of crisis.	78	8.2%	390	41.0 %	244	25.6%	48	5.0%	19	2.0%	173	18.2%	952

**9. Please indicate how Lake County can better assist you in preparing for emergencies and disasters (example: provide preparedness materials in my language).**

**10. If a disaster (i.e. snow storm) impacted Lake County, knocking out electricity and running water, would your household be able to manage on its own for at least three (3) days?**



Value	Percent	Count
Yes	46.8%	452
Maybe	34.6%	334
No	14.9%	144

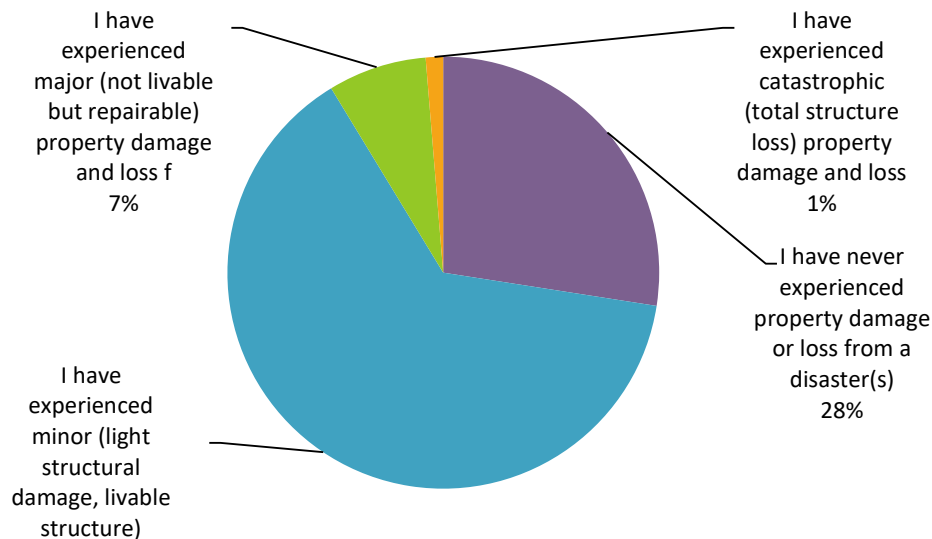
Do Not Know	3.7%	36
	Total	966

**11. Do you believe that your household and/or place of business might ever be threatened by the following hazards? Please rate what hazards present the greatest risk. Low Risk = Low impact on threat to life and property damage Medium Risk = Medium impact on threat to life and property damage High Risk = High impact on threat to life and property damage**

	Low Risk		Medium Risk		High Risk		Not Applicable		Responses
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count
Severe Winter Storm	144	16.7%	395	45.8%	321	37.2%	2	0.2%	862
Tornado	196	22.8%	398	46.3%	263	30.6%	3	0.3%	860
Severe Summer Storm	87	10.1%	398	46.2%	372	43.2%	4	0.5%	861
Extreme Heat	268	31.2%	397	46.3%	190	22.1%	3	0.3%	858
Flood	420	49.1%	274	32.0%	156	18.2%	6	0.7%	856
Drought	366	42.9%	338	39.6%	136	15.9%	14	1.6%	854
Groundwater flooding	331	38.6%	335	39.1%	181	21.1%	10	1.2%	857
Earthquake	656	77.3%	110	13.0%	40	4.7%	43	5.1%	849
Erosion	575	67.6%	156	18.4%	59	6.9%	60	7.1%	850
Dam Failure	572	67.3%	49	5.8%	28	3.3%	201	23.6%	850
Seiche (wind driven)	525	62.2%	57	6.8%	22	2.6%	240	28.4%	844

standing wave)									
Wildfire	566	66.6%	164	19.3%	51	6.0%	69	8.1%	850
Power Outages	106	12.4%	375	43.7%	375	43.7%	2	0.2%	858

**12. Please select the answer that best describes your experience.**



Value	Percent	Count
I have never experienced property damage or loss from a disaster(s)	27.5%	238
I have experienced minor (light structural damage, livable structure) property damage and loss from a disaster(s)	63.9%	553
I have experienced major (not livable but repairable) property damage and loss from a disaster(s)	7.4%	64
I have experienced catastrophic (total structure loss) property damage and loss from a disaster(s)	1.3%	11



	Total	866
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13. If you have experienced any damage(s) or injury(ies) from a disaster, please list the hazard(s) that caused the damages/losses and/or injuries (Example: flooding, wind, winter storm)

14. If you have experienced any damage(s) or injury(ies) from a disaster, please indicate where this occurred (Example: my home, on a roadway or intersection, at work, on vacation, etc.)

15. If you have experienced any damage(s) or injury(ies) from a disaster, please describe the damages and/or injuries. (Example: basement flooded, roof was damaged, vehicle was damaged, broken bones, lacerations, etc.)

16. Based on YOUR PERCEPTION of your jurisdiction's hazards, to what degree of emphasis would you expect your jurisdiction to mitigate the following hazards? Mitigation definition: The purpose of mitigation planning is to identify policies and actions that can be implemented over the long term to reduce risk and future losses. Mitigation forms the foundation for a community's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage.

No Mitigation Needed = No mitigation on this hazard is expected or needed  
 Low Priority = This hazard should be mitigated, but is not a high priority compared to other hazards  
 Medium Priority = It is important to mitigate this hazard  
 High Priority = It is a high priority to emphasize mitigation for this hazard

	No Mitigation Needed		Low Priority		Medium Priority		High Priority		Responses
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count
Severe Winter Storm	66	7.8%	136	16.1%	310	36.8%	331	39.3%	843
Tornado	72	8.5%	159	18.8%	262	31.0%	351	41.6%	844
Severe Summer Storm	48	5.7%	145	17.2%	317	37.7%	331	39.4%	841

Extreme Heat	88	10.5%	289	34.6%	300	35.9%	159	19.0%	836
Flood	53	6.3%	171	20.4%	295	35.2%	320	38.1%	839
Drought	145	17.3%	362	43.3%	243	29.1%	86	10.3%	836
Groundwater	91	10.9%	281	33.8%	255	30.6%	205	24.6%	832
Earthquake	338	40.3%	344	41.1%	80	9.5%	76	9.1%	838
Erosion	255	30.4%	334	39.8%	172	20.5%	79	9.4%	840
Dam Failure	440	53.1%	240	29.0%	73	8.8%	76	9.2%	829
Seiche (wind driven standing wave)	514	61.5%	213	25.5%	71	8.5%	38	4.5%	836
Wildfire	235	28.1%	329	39.4%	171	20.5%	101	12.1%	836
Power Outages	17	2.0%	65	7.8%	259	31.0%	494	59.2%	835

**17.If an evacuation was ordered for your area, please indicate how likely you would be to do the following.**

	Very Likely		Somewhat Likely		Not Very Likely		Not Likely at All		Do Not Know		Not Applicable		Responses
	Count	Row%	Count	Row%	Count	Row%	Count	Row%	Count	Row%	Count	Row%	Count
Immediately evacuate as instructed.	440	51.8%	285	33.6%	70	8.2%	17	2.0%	36	4.2%	1	0.1%	849
I would first consult with family and friends outside my household before deciding to evacuate.	262	31.8%	266	32.3%	147	17.8%	112	13.6%	22	2.7%	15	1.8%	824
Wait and see how bad the situation is	108	13.0%	286	34.5%	234	28.2%	164	19.8%	25	3.0%	12	1.4%	829

going to be before deciding to evacuate.													
Refuse to evacuate no matter what.	9	1.1%	23	2.8%	133	16.2%	589	71.6%	33	4.0%	36	4.4%	823

**18. What might prevent you from leaving your place of residence if there was an evacuation order? Please select ALL that apply.**

Value	Percent	Count
Pet	26.7%	224
Livestock	0.6%	5
Job	5.5%	46
Need to care for another person	12.4%	104
Spouse/Significant Other won't leave	14.7%	123
Need to stay and protect property	23.7%	199
Lack of money	10.0%	84
No place to go	23.6%	198
No transportation	4.8%	40
Traffic	21.7%	182
Lack of gas/fuel for vehicle	17.9%	150
Disability/Health Issues	10.3%	86
Other (please specify)	4.4%	37
No obstacles would prevent me from evacuating	34.8%	292

I would refuse to evacuate no matter what	0.7%	6
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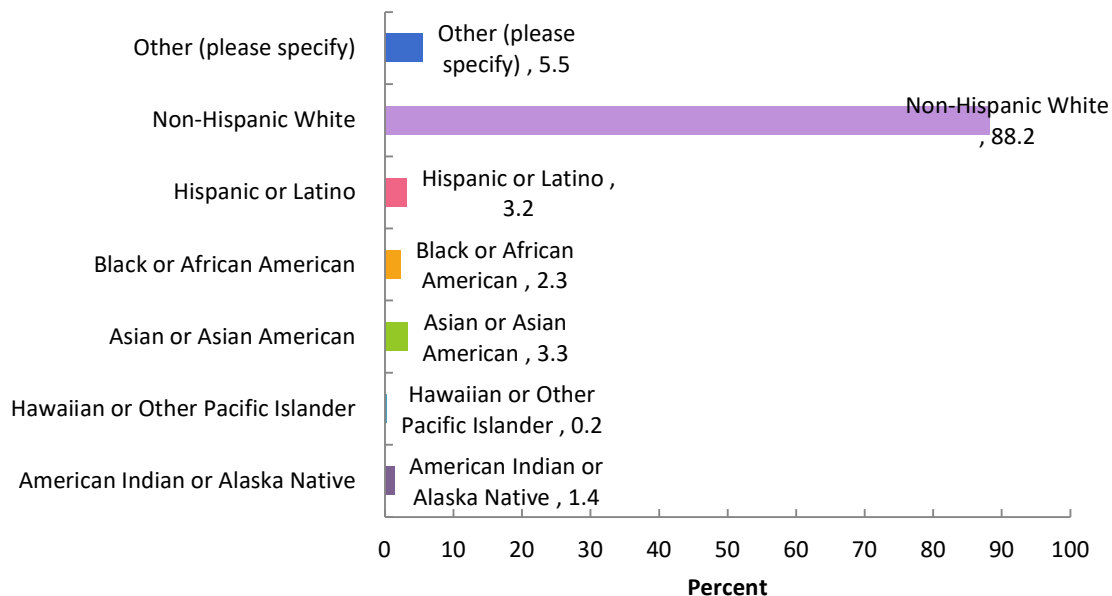
**19. What type of structure do you live in?**

Value	Percent	Count
Detached single family home	87.5%	752
Duplex, triplex, quadruple home	4.7%	40
Multi-family building – 2 stories or more (apartment/condo)	5.5%	47
Mobile home	0.2%	2
Manufactured home	1.4%	12
Do Not Know	0.1%	1
Other (please specify)	0.6%	5
	Total	859

**20. How many persons, including yourself, are currently living in your household?**

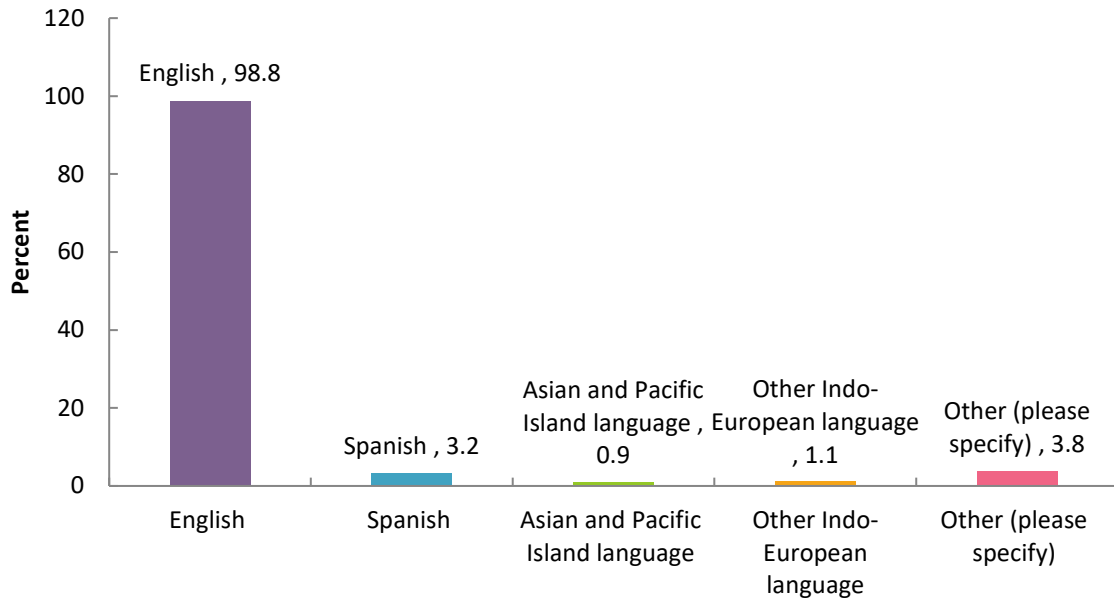
	Number of people in household		Responses
	Row %	Count	
Under age 5:	100.0%	431	431
Ages 6-10:	100.0%	435	435
Ages 11-19:	100.0%	474	474
Ages 20-44:	100.0%	513	513
Ages 45-64:	100.0%	620	620
Ages 65-79:	100.0%	595	595
Ages 80+	100.0%	430	430

**21. Which of the following best describes your race/ethnicity? Please select ALL that apply.**



Value	Percent	Count
American Indian or Alaska Native	1.4%	12
Hawaiian or Other Pacific Islander	0.2%	2
Asian or Asian American	3.3%	28
Black or African American	2.3%	19
Hispanic or Latino	3.2%	27
Non-Hispanic White	88.2%	739
Other (please specify)	5.5%	46

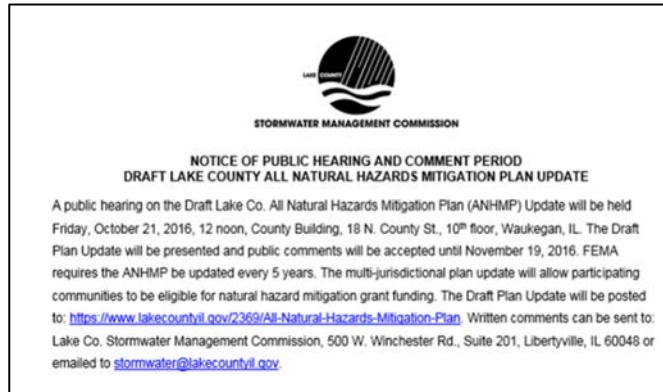


**22. Please indicate the language(s) spoken in your household. Please select ALL that apply.**

Value	Percent	Count
English	98.8%	839
Spanish	3.2%	27
Asian and Pacific Island language	0.9%	8
Other Indo-European language	1.1%	9
Other (please specify)	3.8%	32

*Sixty respondents provided their e-mail address (compared to thirty-two in 2011).*

1. Public meeting and public comment announcements:



"Public Meeting to Be Held on the Lake County All Natural Hazards Mitigation Plan"

The Lake County Hazard Mitigation Planning Committee is in the process of updating the Lake County All Natural Hazards Mitigation Plan. An update to the Plan is required every five years by the Federal Emergency Management Agency. A public meeting will be held on October 21 in Waukegan to review the proposed changes to the Plan.

The public is invited to attend this meeting and to provide comments on the Plan. The Plan identifies activities that can be undertaken by both the government and the private sector to reduce the safety hazards, health hazards, and property damage caused by floods, severe summer and winter storms, tornadoes, and other natural hazards.

The public meeting on Friday, October 21 at noon at the Lake County Building at 18 North County Street in Waukegan in the 10<sup>th</sup> Floor Assembly Room.

"Hazard mitigation" means doing everything that can be done to reduce the impact of the natural hazards on people and property. It does not necessarily mean controlling floodwaters or stopping tornadoes. These hazards are natural phenomena and, in many cases, mitigation means adjusting what people do in the face of this natural activity.

Lake County is subject to natural hazards that threaten life and health and have caused extensive property damage in the past. Again, while these hazards are acts of nature, the impacts on residents, public facilities, businesses, and private property can be reduced through hazard mitigation.

The update to the Lake County All Natural Hazards Mitigation Plan will be considered by the Lake County Board for adoption, and also for adoption by the Lake County municipalities that participated on the planning process. After the Plan is adopted, Lake County and the participating municipalities will continue to be eligible for hazard mitigation grant funding through the Illinois Emergency Management Agency and the Federal Emergency Management Agency.

For more information, contact Sharon Osterby of Lake County SMC at 847-377-7706.

2. Public meeting held:



**Lake County Countywide All-Natural Hazards Mitigation Plan (ANHMP)  
2022 Hazard Mitigation Plan Update**

**Public Meeting  
April 19, 2022, | 6:00 – 7:00 PM (CST)**

**AGENDA**

- Introductions
- What is Hazard Mitigation?
- Hazard Mitigation Plan Overview
- Hazards of Greatest Concern for Citizens of Lake County
- Examples of Home-Owner/Individual Mitigation Actions
- Question/Answer Session

**Support Team Contact**  
Matt Stanley  
Integrated Solutions Consulting  
[Matt.Stanley@i-s-consulting.com](mailto:Matt.Stanley@i-s-consulting.com)  
504.645.1616



8. Frequently Asked Questions:



Lake County All Natural Hazards Mitigation Plan – 2022 Update  
Frequently Asked Questions

**What is the Lake County All Natural Hazards Mitigation Plan (ANHMP)?**

The ANHMP addresses natural hazards that may impact Lake County and identifies activities to prevent, prepare for, and respond to, potential hazards (e.g., earthquakes, tornados, floods, snow, wind, hail, ice).

**Why was the ANHMP developed?**

The adoption of an ANHMP and updating it every 5 years, allows Lake County and participating Lake County municipalities to be eligible for federal disaster mitigation grants. The ANHMP also provides credit for communities that participate in FEMA's Community Rating System (CRS), which reduces flood insurance costs in those communities.

**Who developed the ANHMP?**

The ANHMP was developed by Lake County and participating Lake County municipalities.

**What is the update "process"?**

Our update process includes four (4) meetings with participating municipalities in January, February, March and April, 2022 to review the ANHMP's goals and action items, and to draft an updated plan. Updates on mitigation activities over the last 5 years will be included in the plan. Public input and comments are welcome. A draft of the updated ANHMP will be made available for public review and a public hearing/meeting, and sent to Illinois Emergency Management Agency (IEMA) and FEMA for review and approval. Once approved, plan adoption will be recommended to the County and participating municipalities.

**The ANHMP is considered multi-jurisdictional.**

Each government agency must adopt the ANHMP to maintain federal eligibility. The County Board adoption of the ANHMP is for unincorporated areas of the County. Each municipality must adopt the ANHMP covering their corporate boundaries.

**How do we adopt the ANHMP?**

By resolution. Communities have been provided with a sample adoption resolution and instructions on where to send a copy of the resolution for IEMA and FEMA's records.

**If we don't adopt the 2022 ANHMP is our community eligible for federal disaster assistance?**

Yes, the ANHMP is not tied to disaster assistance. The ANHMP is for mitigation grant purposes, which typically the need becomes apparent following a disaster. It is prudent to have an adopted mitigation plan.

**Who will implement the Mitigation Plan?**

Municipalities and Lake County upon plan adoption, and with other local government partners, will implement the ANHMP, as resources (staff time and funding) become available. An example of a joint effort may be the development of common public information materials.

**Who do we contact about the ANHMP update?**

Feel free to contact Susan Vancil of the SMC at <mailto:svancil@lakecountyil.gov> or 847-377-7714.

ANHMP Update FAQs - 2022

## Lake County ANHMP Update – Public Input Needed

Lake County and all interested municipalities are in the process of updating the Lake County All Natural Hazards Mitigation Plan. The Mitigation Plan identifies activities and projects to reduce the damages caused by natural hazards such as tornadoes, floods, and severe summer and winter storms. Mitigation means anything that can be done to reduce the impact of a natural hazard.

Public input and comments are important to the Mitigation Plan update. All Lake County residents and property owners are encouraged to complete a short survey that can be found on the Internet at: <https://survey.alchemer.com/s3/6719034/2022-Lake-County-IL-Disaster-Preparedness-and-Mitigation-Questionnaire-copy>

Survey responses provided will help Lake County prioritize natural hazards that could impact residents and property owners, and to determine how to be better prepared for natural hazard emergencies.

## Upcoming Plan Update Meetings

The Hazard Mitigation Planning Committee (HMPC) will be meeting on the following dates for the purpose of drafting the 2017 update to the ANHMP.

Wednesday, March 23, [2022](#) at 1:00 p.m. – 2:30 p.m.

Wednesday, April 20, [2022](#) at 1:00 p.m. – 2:00 p.m.

For more information and to follow the plan update process:  
<https://www.lakecountylvil.gov/2369/All-Natural-Hazards-Mitigation-Plan>

ANHMP Update FAQs - 2022

## Appendix E: Progress on 2017 Action Plan & Comparison to Current Action Plan

The 2017 All Natural Hazards Mitigation Plan (ANHMP) contained 22 action items that all communities included in their adoption of the ANHMP. The 2017 action items were developed by the Local Planning Committee, which is now the Hazard Mitigation Planning Committee (HMPC). Most action items from 2017 were carried over into the 2022 update of the ANHMP by the HMPC, however the HMPC did reprioritize several action items.

Appendix E's table below gives a status of the 2017 action items and shows a comparison to the 2022 action items. Community representatives were asked to submit specific community action items, and these items were addressed in the 2022 ANHMP.

2017 Action Plan Status and 2022 Action Plan Updates					
	2017 Plan Action Item	Status/Progress		2022 Plan Action Item	Change/Update/Priority
1.	Plan Adoption	Completed	34A.	Village of Beach Park: Improve/Enhance Manor Rd Culvert and Bull Creek Bank Stabilization	New (High)
2.	Participation on the Hazard Mitigation Planning Committee and Plan Monitoring and Maintenance	Completed/Ongoing	34B.	Village of Beach Park: Resize Major Ave, culvert at Bullcreek	New (High)
5.	Improve Natural Hazards Public Information Efforts with focus on the Promotion of Flood Insurance and How People Can Protect Themselves and Their Property	Ongoing	34C.	Village of Beach Park: North Ave. Stormwater Conveyance Improvements	New (High)
23.	Develop of Flood Stage Maps	Ongoing	34D.	Village of Beach Park: Update Building Codes to 2018 IBC	New (High)
18.	Improve Emergency Response and Develop Assessment Teams	Completed/Ongoing	35.	Village of Fox River: Catch basins at border near Illinois/Wisconsin and the mouths of tributaries flowing into the river	New (High)

3.	Incorporate ANH MP into Other County and Municipal Plans	Ongoing	36A.	Village of Gurnee: Identify needs and obtain alternate power source for critical facilities, supply generator with ATS at Lee Ave. lift station and generator backup at Westgate lift station.	New (High)
10.	Implement Property Protection Projects for Flood Mitigation	Ongoing	36B.	Village of Gurnee: Streambank stabilization along Swanson Trig tributary east of CP Railroad, West of Union Pacific Railroad, South of 132 and North of Washington St.	New (Medium)
21.	Continue to Map Natural Hazard Impacts and Continue Vulnerability Assessments	Ongoing	36C.	Village of Gurnee: Increase culvert flow capacity at Grove Ave.	New (Medium)
7.	Review of Critical Facilities and Implement of Appropriate Mitigation Measures	Completed/Ongoing	37A.	Village of Kildeer: Expand village swale system to increase stormwater flow capacity.	New (High)
16.	Seek Mitigation Grant Funding for Additional Mitigation Planning and Cost Beneficial Projects	Ongoing	37B.	Village of Kildeer: Increase stormwater flow capacity by resizing culvert at Buffalo Run and Cliffside Dr.	New (High)
4.	Continued Implementation of the WDO and NFIP Requirements	Ongoing	38.	Village of Lake Bluff: Increase storm sewer capacity to drain West Scanton viaduct.	New (High)
8.	Improve Capacity of Drainage Systems and/or Provide Additional Storage of Flood Waters	Completed/Ongoing	39.	Village of Lake Zurich: Shoreline stabilization at Buffalo Creek	New (Medium)
9.	Implement Maintenance Programs for Drainage Systems, Including Streambank and Ravine Stabilization Efforts	Completed/Ongoing	40.	Village of Libertyville: Increase detention volume at Highlands subdivision phase 1 including reconstruction of Nicholas Dowden Park South for detention storage.	New (High)
19.	Enhance Response and Recovery Information Sharing and Collaboration	Ongoing	41.	Village of Lincolnshire: Windsor Dr. area drainage improvements, adding	New (High)



	and Identify Additional Training Opportunities			additional storm sewer to reduce roadway flooding	
14.	Continue Work for NIMS Compliance	Ongoing	42A.	Village of Port Barrington: Flood buyouts of homes in floodplain	New (High)
6.	Identify Needs and Obtain Alternate Power Sources for Critical Facilities and Shelters	Completed/Ongoing	42B.	Village of Port Barrington: Purchase new electronic sign for village entrance to provide emergency notifications.	New (High)
15.	Improve Building Codes and Building Code Enforcement	Ongoing	42C.	Village of Port Barrington: Shoreline stabilization of natural island in Nielson Channel.	New (High)
20.	Continue Participation or Consider Participation in the NFIP's Community Rating System	Ongoing	42D.	Village of Port Barrington: Construction of new storage shed for emergency response supplies including sandbag and bagging equipment.	New (Low)
11.	Reduce Inflow and Infiltration to Protect Against Sewer Backups	Completed/Ongoing	43.	Village of Volo: Implement program to review and clear retention pond culverts utilized for stormwater drainage.	New (High)
13.	Continue Participation or Consider Participation in Tree City USA (Urban Forestry)	Ongoing	44A.	Village of Wauconda: Bangs Lake Drainage Ditch Streambank Stabilization	New (High)
17.	Continue Participation or Consider Participation in StormReady	Ongoing	44B.	Village of Wauconda: Circle Channel Shoreline Stabilization Project	New (High)
12.	Identify Wind Mitigation Opportunities for the Protection of Buildings, and to Provide Safe Rooms and Sheltering	Ongoing	44C.	Village of Wauconda: Inflow & Infiltration (I/I) Mitigation	New (High)
22.	Continue with Identification and Implementation of SMC Flood Mitigation Projects	Completed/Ongoing	44D.	Village of Wauconda: Larkdale Lagoons and Outfall Channel	New (High)

24.	Develop or Enhance the Community's Snow Removal Plan	Ongoing/Annually	44E.	Village of Wauconda: Mutton Creek Streambank Stabilization	New (High)
25.	Utility Tree Trimming	Ongoing	44F.	Village of Wauconda: Develop a Stormwater Master Plan	New (High)
26.	Sump Pump Disconnects	Ongoing	45.	City of Waukegan: Yeoman Creek bank stabilization	New (High)
27.	Conduct Local Drainage Studies	Ongoing			
28.	Increase Stormwater Detention Capacity	Completed/Ongoing			
29.	Investigate Countywide Warning System	Completed/Ongoing			
30.	Investigate Future Conditions Impact on Depth and Frequency of Flooding	Ongoing			
31.	Lincolnshire Creek Improvements	Completed/Ongoing			
32.	Mitigate Septic Discharge; Leaching into Waterways	Ongoing			
33.	Implement the FFRMS	Ongoing			

## Appendix F: 2022 Unincorporated Lake County New Actions

2022 Unincorporated Lake County New Actions			
Action #	Action Item	Status	Priority
46. A, B, C, D	Antioch Township, Residential Buyouts or Elevations (A) West Loon Lakes and (B) Loon Lakes. Drainageway Restoration/Conveyance at Sequoit Creek TWP Range Sections (C) 46-10-16 and (D) 46-10-17.	New	(A, B) Medium (C, D) Low
47. A, B, C	Avon Township, Drainageway Restoration/Conveyance at (A) Gages Lake Drain and (B) Four Corner's Basin. (C) Flood Access/Elevate Roadway at Liden Ave.	New	(A, B) High (C) Medium
48. A, B, C, D	Cuba Township, Drainage Infrastructure at (A) North Oaks and (B) Chicago Highlands. Residential Buyouts or Elevations at (C) Snuff Valley Rd and (D) Pioneer Grove Rd.	New	(A, B, C, D) Medium
49. A, B, C, D	Ela Township, Drainage Infrastructure enhancements at (A) Abbey Glenn Subdivision, (B) Forest Lake Subdivision (C) Forest Lake Subdivision, and (D) Echo Lake.	New	(A, B, C) High (D) Medium
50. A, B, C, D	Fremont Township, (A) Dam Replacement at Sylvan Lake Dam. Drainage Infrastructure at (B) Lake Fairfield Estates Subdivision, (C) Summer Hill Estates Subdivision and (D) Diamond Lake.	New	(A) High (B, C, D) Medium
51. A, B, C, D	Grant Township, Drainageway Restoration/Conveyance at (A) Four Corner's Basin and (B) Fish Lake Drain. (C) Drainage Infrastructure at Duck Lake Woods. (D) Residential Buyouts or Elevations at Meyers Bayview Terrace.	New	(A) High (C, D) Medium (B) Low
52. A, B, C, D, E, F	Lake Villa Township, Drainage Infrastructure at Venetian Village Subdivision TWP Range Sections (A) 45-10-02, (B) 45-10-10, (C) Fox Lake Hills Chesney Area, (D) Orchard Gardens of Fox Lake Hills, (E) Sand Lake Outlet and (F) Cedar Crest Subdivision	New	(A, B, C) High (D, E, F) Medium
53. A, B, C, D, E, F, G, H, I	Libertyville Township, (A) Levee Enhancements at North Libertyville Estates Subdivision Drainage Infrastructure at (B) Winchester Road Soccer Complex, (C) Bull Creek Subdivision, (D) Countryside Manor Subdivision, (E) Japar Industrial Park, (F) Bradley Road Industrial Park, (G) Old School Forest Preserve., and (H) Terre Fair Subdivision (I) Stormwater Storage at Casey Rd Open Space.	New	(A) High (B, C, D, E, F) Medium (G, H, I) Low
54. A, B, C, D	Newport Township, Flood Access/Elevate Roadway at Russell Road TWP Range Sections (A) 46-11-02, (B) 46-11-03. Residential Buyouts or Elevations at Russel TWP Sections (C) 46-11-02 and (D) 46-11-03.	New	(A, B) High (C, D) Medium
55. A, B, C, D	Shields Township, Drainage Infrastructure at (A) Arden Shores Subdivision, (B) North Shore Properties Subdivision, (C) Terrace Oaks, (D) Rockland Manor Subdivision and (E) Basilwood Subdivision	New	(A, B, C, D) Medium
56. A, B, C, D	Vernon Township, (A) Residential Buyouts or Elevations at Pekara Subdivision Drainage Infrastructure at (B) Prairie View, (C) Horatio Gardens Subdivision, and (D) Woodbine Estates Subdivision (E) Flood Proofing at Aptakisic Creek Commercial Area.	New	(A) High (B, C,) Medium (D, E) Low
57. A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R	Warren Township, Drainage Infrastructure at (A) Del-Mar Woods Subdivision, (B) Wooded Glen Gardens Subdivision, (C) Grandwood Dr & Rt 132, (D) Tangueray Meadows Subdivision, (E) Warren Twp High School, (F) North Shore Lands, (G) Orchard Valley Pond, (H) Gages Lake Rd & Rt 45, (I) Warren Twp High School, (J) Woodland Meadows Subdivision (K) Wildwood on Gages Lake Subdivision, (L) Pinewood Creek Subdivision, (M) Wildwood on Gages Lake Subdivision, and Gages Lake Subdivision Drainageway Restoration/Conveyance at (N) Hunt Club Farms Lake drain and (O) Lambs Corner Creek. Stormwater Storage at (P) Deerpath Subdivision headwaters, (Q) Grandwood Park Subdivision headwaters And (R) Summerfields Subdivision	New	(A, B, C, D, N, P, Q, R) High (E, H, I, J, K, L) Medium (F, G, M, O) Low
58. A, B	Wauconda Township, (A) Residential Buyouts or Elevations at Williams Park Subdivision (B) Creek Conveyance at Fiddle Creek	New	(A, B) Medium
59. A, B	Waukegan Township, Drainage Infrastructure at (A) North Shore Highlands and (B) North Shore Lands.	New	(A) High (B) Medium
60. A	West Deerfield Township, (A) Drainage Infrastructure at Del-Mar Woods Subdivision	New	(A) High

## Appendix G: HAZUS MH Flood Report



### Hazus: Flood Global Risk Report

**Region Name:** LakeCounty\_IL  
**Flood Scenario:** Full  
**Print Date:** Wednesday, October 26, 2022

**Disclaimer:**

*This version of Hazus utilizes 2010 Census Data.*

*Totals only reflect data for those census tracts/blocks included in the user's study region.*

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.*



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Flood Global Risk Report



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### General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Illinois

**Note:**

Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is approximately 471 square miles and contains 15,941 census blocks. The region contains over 242 thousand households and has a total population of 703,462 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 238,762 buildings in the region with a total building replacement value (excluding contents) of 130,102 million dollars. Approximately 91.82% of the buildings (and 79.55% of the building value) are associated with residential housing.



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## Building Inventory

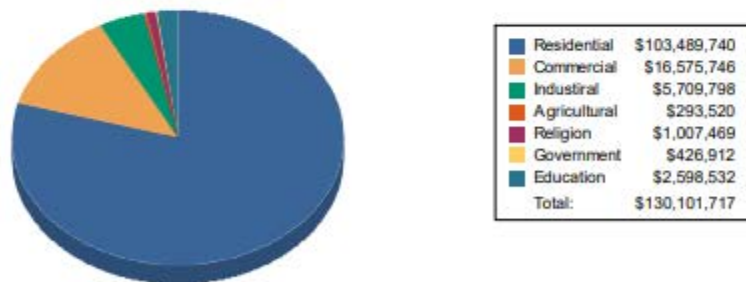
### General Building Stock

Hazus estimates that there are 238,762 buildings in the region which have an aggregate total replacement value of 130,102 million dollars. Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

**Table 1**  
**Building Exposure by Occupancy Type for the Study Region**

Occupancy	Exposure (\$1000)	Percent of Total
Residential	103,489,740	79.5%
Commercial	16,575,746	12.7%
Industrial	5,709,798	4.4%
Agricultural	293,520	0.2%
Religion	1,007,469	0.8%
Government	426,912	0.3%
Education	2,598,532	2.0%
<b>Total</b>	<b>130,101,717</b>	<b>100%</b>

**Building Exposure by Occupancy Type for the Study Region**  
**(\$1000's)**



Flood Global Risk Report



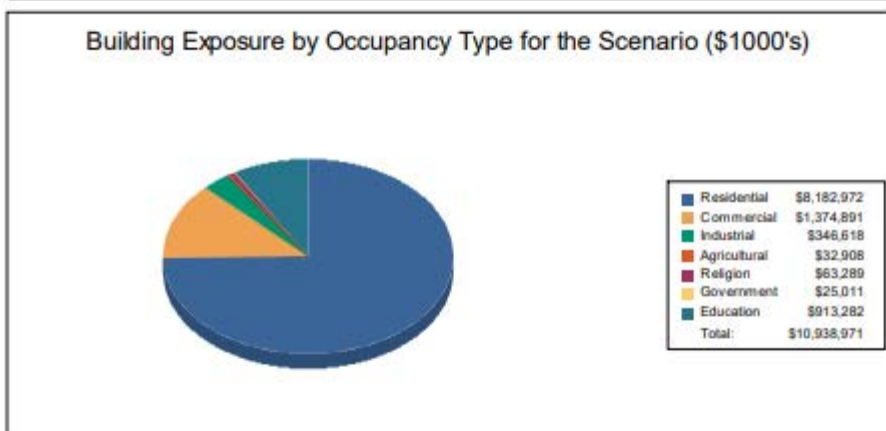
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**Table 2**  
**Building Exposure by Occupancy Type for the Scenario**

Occupancy	Exposure (\$1000)	Percent of Total
Residential	8,182,972	74.8%
Commercial	1,374,891	12.6%
Industrial	346,618	3.2%
Agricultural	32,908	0.3%
Religion	63,289	0.6%
Government	25,011	0.2%
Education	913,282	8.3%
<b>Total</b>	<b>10,938,971</b>	<b>100%</b>



### Essential Facility Inventory

For essential facilities, there are 9 hospitals in the region with a total bed capacity of 968 beds. There are 309 schools, 64 fire stations, 42 police stations and 1 emergency operation center.



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<b>Study Region Name:</b>	LakeCounty_IL
<b>Scenario Name:</b>	Full
<b>Return Period Analyzed:</b>	100
<b>Analysis Options Analyzed:</b>	No What-ifs

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure





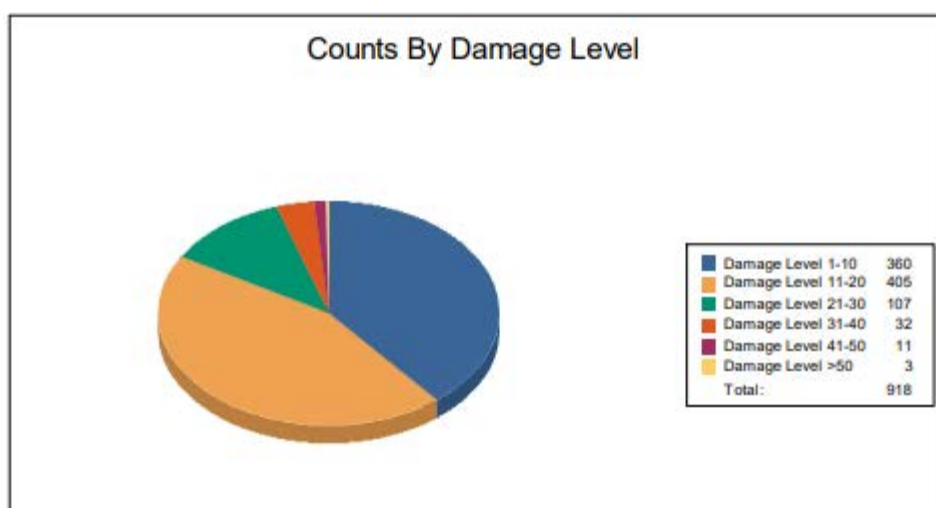
Hazus estimates that about 558 buildings will be at least moderately damaged. This is over 79% of the total number of buildings in the scenario. There are an estimated 3 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

[illegible]



Table 3: Expected Building Damage by Occupancy

Occupancy	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	1	20	4	80	0	0	0	0	0	0	0	0
Education	5	83	1	17	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	1	100	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	354	39	399	44	107	12	32	4	11	1	3	0
<b>Total</b>	<b>360</b>		<b>405</b>		<b>107</b>		<b>32</b>		<b>11</b>		<b>3</b>	



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Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	1	100	0	0	0	0	0	0	0	0	0	0
Manuf/Housing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	67	43	73	46	12	8	4	3	1	1	0	0
Steel	1	100	0	0	0	0	0	0	0	0	0	0
Wood	289	38	328	44	95	13	28	4	10	1	3	0



### Essential Facility Damage

Before the flood analyzed in this scenario, the region had 968 hospital beds available for use. On the day of the scenario flood event, the model estimates that 968 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate	At Least Substantial	Loss of Use
Emergency Operation Centers	1	0	0	0
Fire Stations	64	1	0	1
Hospitals	9	0	0	0
Police Stations	42	0	0	0
Schools	309	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

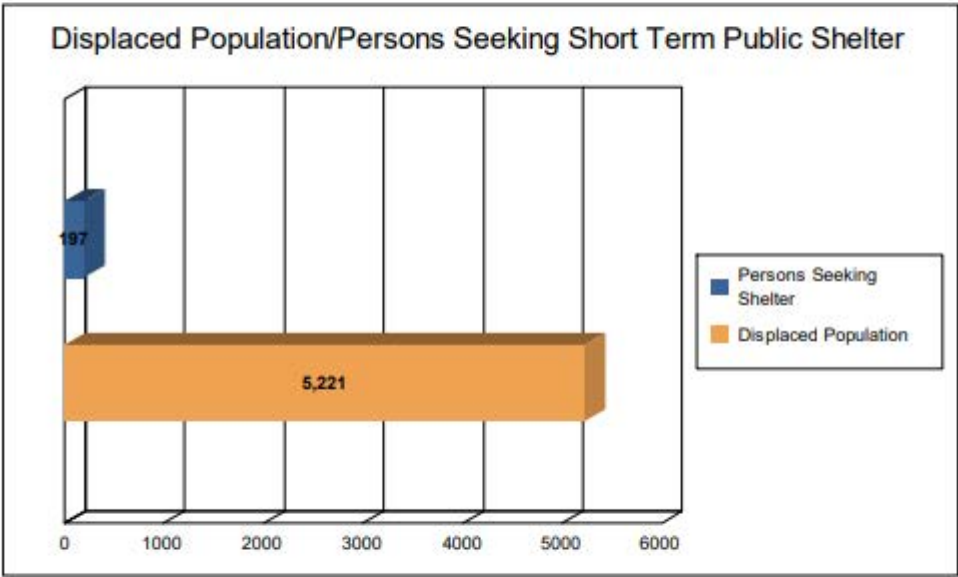
- (1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.
- (2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.



Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 1,740 households (or 5,221 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 197 people (out of a total population of 703,462) will seek temporary shelter in public shelters.







## Economic Loss

The total economic loss estimated for the flood is 754.69 million dollars, which represents 6.90 % of the total replacement value of the scenario buildings.

### **Building-Related Losses**

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

The total building-related losses were 369.80 million dollars. 51% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 35.65% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.



Flood Global Risk Report



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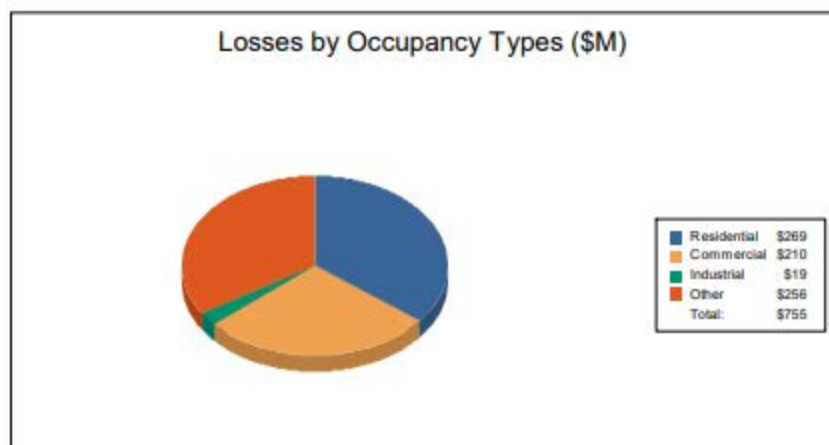




Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<b>Building Loss</b>						
	Building	132.58	21.66	4.97	6.86	166.07
	Content	66.88	67.08	11.84	55.23	201.02
	Inventory	0.00	1.38	1.25	0.09	2.71
	<b>Subtotal</b>	<b>199.46</b>	<b>90.11</b>	<b>18.05</b>	<b>62.18</b>	<b>369.80</b>
<b>Business Interruption</b>						
	Income	5.98	48.72	0.21	47.32	102.22
	Relocation	33.71	13.42	0.32	17.42	64.87
	Rental Income	15.84	9.71	0.05	1.81	27.42
	Wage	14.10	48.53	0.39	127.37	190.39
	<b>Subtotal</b>	<b>69.62</b>	<b>120.38</b>	<b>0.97</b>	<b>193.92</b>	<b>384.89</b>
<b>ALL</b>	<b>Total</b>	<b>269.08</b>	<b>210.49</b>	<b>19.03</b>	<b>256.09</b>	<b>754.69</b>



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**Appendix B: Regional Population and Building Value Data**

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
<b>Illinois</b>				
Lake	703,462	103,489,740	26,611,977	130,101,717
<b>Total</b>	<b>703,462</b>	<b>103,489,740</b>	<b>26,611,977</b>	<b>130,101,717</b>
<b>Total Study Region</b>	<b>703,462</b>	<b>103,489,740</b>	<b>26,611,977</b>	<b>130,101,717</b>

## **Appendix H: Resolutions and FEMA Approval**

[To be inserted.]