COOK COUNTY
MULTI-JURISDICTIONAL
HAZARD MITIGATION PLAN
VOLUME 1 – PLANNING-AREA-WIDE ELEMENTS

FINAL

July 2019

Prepared for:

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Integrated Solutions Consulting

We would like to acknowledge the hard work, professionalism and dedication from our vendor, Integrated Solutions Consulting in this massive and successful plan.

Special Acknowledgments

We would like to acknowledge the following DHSEM staff for their professionalism and support throughout the hazard mitigation process:

William Barnes- Executive Director

Thomas Tilton- Deputy Director of Operations

The DHSEM would like to thank the Steering Committee Chairs, Sandra Frum and Matt Doughtie, and the Steering Committee members for their leadership and perseverance during the update of the Cook County Multi- Jurisdictional Hazard Mitigation Plan. Furthermore, DHSEM would like to thank our partner Cook County agencies, planning partners, elected officials, and community leaders for their support and participation. Through the collective effort of those who have been acknowledged and many others, Cook County will continue to take steps to increase its ability to prepare, respond, and mitigate natural hazards through the Cook County Multi-Jurisdictional Hazard Mitigation Plan.

Executive Summary

Hazard mitigation is the use of long-term and short-term policies, programs, projects, and other activities to alleviate the death, injury, and property damage that can result from a disaster. Cook County and a coalition of 121 municipal planning partners prepared and updated the **2019 Cook County Multi-Jurisdictional Hazard Mitigation Plan** (**MJ-HMP**) in order to identify the risks posed by hazards and find ways to reduce their impacts. The plan reduces risk for those who live in, work in, and visit the County.

Cook County Profile

Cook County is located in northeast Illinois on the western shore of Lake Michigan (see *Figure: Planning Area*). It is the most populous of the 102 counties in Illinois, with a 2018 estimated population of 5.18 million. In terms of area, it is the sixth largest county, covering approximately 945 square miles. Cook County makes up roughly 41 percent of the population of Illinois. The surrounding counties are Lake and McHenry to the north, Kane, and DuPage to the west, and Will to the southwest. Lake Michigan is the county's eastern border along with the State of Indiana.

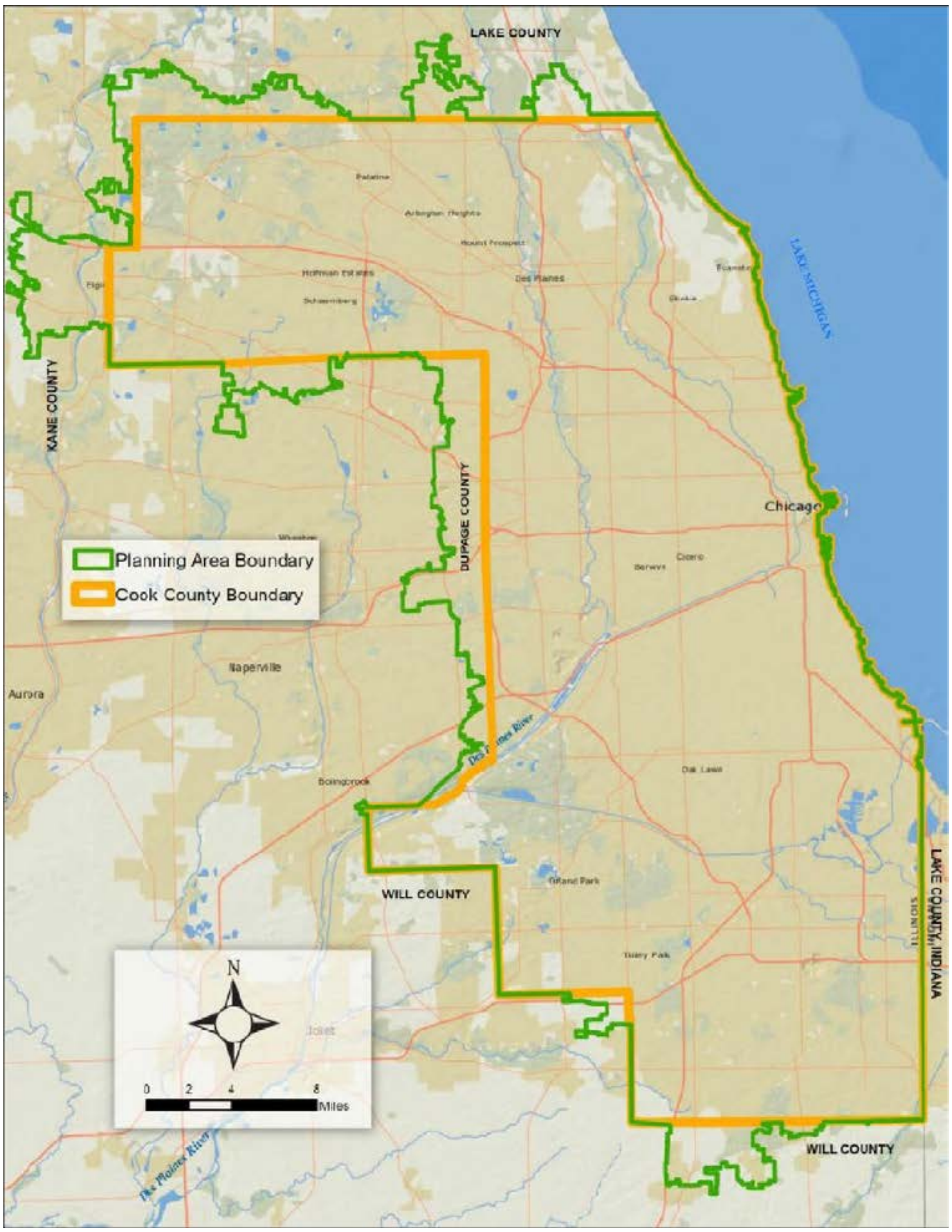
Cook County is the second most populous county in the United States, after Los Angeles County. The county contains 135 municipalities, covering about 85 percent of the area of the county. The remaining unincorporated areas are under the jurisdiction of the Cook County Board of Commissioners, a 17-member board elected by district.

The planning area's economy is strongly based in the educational services, health care, and social assistance industry, followed by the professional, scientific, management, administrative, and waste management industries. Major businesses include, but are not limited to, the U.S. Government, Advocate Health System, JPMorgan Chase, Jewel-Osco, United Airlines, Abbott Laboratories, American Airlines, and Walgreens. Major educational and research institutions in the county include Northwestern University, Loyola University, DePaul University, the University of Chicago, and the University of Illinois at Chicago.

Cook County has experienced 19 hazard events since 1967 for which federal disaster declarations were issued. The Spatial Hazard Events and Losses Database for the United States (SHELDUS), maintained by the University of South Carolina, includes many more hazard events. For Cook County, SHELDUS lists 851 instances of direct property, crop, monetary, or human loss due to a hazard event from 1960 through 2017 - an average of approximately 15 various direct loss events per year.

Participating Partners and the Planning Area

The responsibility for hazard mitigation lies with many, including private property owners; business and industry; and local, state, and the federal government. Through multi-jurisdictional partnerships, local jurisdictions within an area that has uniform risk exposure can pool resources and eliminate redundant planning activities. Cook County opened this planning effort to all municipalities within the County. *Table: Planning Partners* lists the planning partners that participated in the planning process and are covered under this plan. The planning area was defined as all incorporated and unincorporated areas of Cook County as well as the incorporated areas of cities that cross county boundaries. The planning area boundary is shown in the figure below (*Figure: Planning Area*).



The jurisdictions not participating in the 2019 MJ-HMP are border jurisdictions and are part of other county mitigation plans. See Coordination with other Agencies, Partners and Neighboring Jurisdictions.

TABLE: PLANNING PARTNERS PLANNING PARTNERS COVERED BY THIS HAZARD MITIGATION PLAN

North	Central	South
Arlington Heights	Bellwood	Alsip
Barrington	Berkeley	Bedford Park
Bartlett	Berwyn	Blue Island
Des Plaines	Broadview	Bridgeview
Elk Grove Village	Brookfield	Burbank
Evanston	City of Chicago	Burnham
Glencoe	Cicero	Calumet City
Glenview	Countryside	Calumet Park
Golf	Elmwood Park	Chicago Heights
Hanover Park	Forest Park	Chicago Ridge
Hoffman Estates	Forest View	Country Club Hills
Inverness	Franklin Park	Crestwood
Kenilworth	Harwood Heights	Dixmoor
Lincolnwood	Hillside	Dolton
Morton Grove	Hodgkins	East Hazel Crest
Mount Prospect	Indian Head Park	Evergreen Park
Niles	LaGrange	Flossmoor
Northbrook	LaGrange Park	Ford Heights
Northfield	Lyons	Glenwood
Palatine	Maywood	Harvey
Park Ridge	McCook	Hazel Crest
Prospect Heights	Melrose Park	Hickory Hills
Rolling Meadows	Norridge	Hometown
Schaumburg	Northlake	Homewood
Skokie	North Riverside	Justice
South Barrington	Oak Park	Lansing
Streamwood	River Forest	Lemont
Wheeling	River Grove	Lynwood
Wilmette	Riverside	Markham
Winnetka	Rosemont	Matteson
	Schiller Park	Merrionette Park

	Stickney	Midlothian
	Stone Park	Oak Forest
	Summit	Oak Lawn
	Westchester	Olympia Fields
	Western Springs	Orland Hills
		Orland Park
		Palos Heights
		Palos Hills
		Palos Park
		Park Forest
		Phoenix
		Posen
		Richton Park
		Riverdale
		Robbins
		Sauk Village
		South Chicago Heights
		South Holland
		Steger
		Thornton
		Tinley Park
		University Park
		Willow Springs
		Worth
Not Participating in 2019 Cook County MJ-HMP	***Not Participating in 2019 Cook County MJ-HMP***	***Not Participating in 2019 Cook County MJ-HMP***
Barrington Hills	Bensenville	Frankfort
Buffalo Grove	Burr Ridge	Woodridge
Deerfield	Elmhurst	
Deer Park	Hinsdale	
East Dundee	Oak Brook	
Elgin		
Roselle		

Plan Development and Organization

The 2019 Cook County MJ-HMP was updated by a planning team of Cook County Department of Homeland Security and Emergency Management staff and expert consultants, with guidance from a steering committee representing the planning partners and other local stakeholders. The key steps in updating the plan were as follows:

1. Determine the Planning Area and Resources
2. Build and Reconvene the Planning Team
3. Outreach Strategy
4. Review and Update Community Capabilities
5. Update and Conduct the Risk Assessment
6. Update the Mitigation Strategy
7. Keep the Plan Current
8. Review and Adopt the Plan
9. Create a Safe and Resilient Community

The final plan consists of two volumes. **Volume 1** includes all federally required elements of a disaster mitigation plan that apply to the entire planning area. **Volume 2** consists of all federally required jurisdiction-specific elements, in individual annexes for each participating jurisdiction.

Mission Goals and Objectives

The defined mission for the 2019 Cook County MJ-HMP is to "Identify risks and sustainable, cost-effective actions to mitigate the impact of natural hazards to protect the life, health, safety, welfare, and economy of the communities of Cook County." Mitigation **goals** were established as follows:

1. Develop and implement sustainable, cost-effective, and environmentally sound risk-reduction (mitigation) projects.
2. Protect the lives, health, safety, and property of the citizens of Cook County from the impacts of natural hazards.
3. Protect public services and critical facilities, including infrastructure, from loss of use during natural hazard events and potential damage from such activities.
4. Involve stakeholders to enhance the local capacity to mitigate, prepare for, and respond to the impacts of natural hazards.
5. Develop, promote, and integrate mitigation action plans.
6. Promote public understanding of and support for hazard mitigation.

Thirteen **objectives** were established for the plan that meet multiple goals, serving as stand-alone measurements of the effectiveness of the mitigation action. Proposed mitigation actions were evaluated in part based on how many goals and objectives they would help to fulfill.

1. Eliminate or minimize disruption of local government operations caused by natural hazards through all phases of emergency management.
2. Increase the resilience of (or protect and maintain) infrastructure and critical facilities.
3. Consider the impacts of natural hazards on future land uses in the planning area, including possible impacts from climate change.
4. Integrate hazard mitigation policies into land use plans in the planning area.
5. Develop, improve, and protect systems that provide early warnings, emergency response communications, and evacuation procedures.
6. Use the best available data, science and technologies to educate the public and to improve understanding of the location and potential impacts of natural hazards, the vulnerability of building types and community development patterns, and the measures needed to protect life safety.
7. Retrofit, purchase, or relocate structures in high hazard areas, including those known to be repetitively damaged.
8. Establish partnerships among all levels of local government, the private sector, and/or nongovernmental organizations to improve and implement methods to protect people and property.
9. Provide or improve flood protection on a watershed basis with flood control structures and drainage maintenance plans.
10. Strengthen codes and land use planning and their enforcement, so that new construction or redevelopment can avoid or withstand the impacts of natural hazards.
11. Encourage mitigation through incentive-based programs, such as the Community Rating System, Firewise, and StormReady programs.
12. Reduce natural hazard-related risks and vulnerability to potentially isolated populations within the planning area.
13. Encourage hazard mitigation measures that result in the least adverse effect on the natural environment and that use natural processes.

Hazards Addressed

The steering committee considered the full range of natural hazards that could impact the planning area and identified the following hazards as presenting the most significant concern:

- Dam or levee failure
- Drought
- Earthquake
- Flood
- Severe weather
- Severe winter weather
- Tornado

Detailed risk assessments were performed for each of these hazards of concern. Also, a brief qualitative review was conducted of technological and human-caused hazards of interest epidemic or pandemic, nuclear power plant incident, secondary impacts from incoming evacuees, widespread power outage, hazardous material incident, and coastal erosion. Climate Change was addressed for each hazard, as applicable.

Risk Assessment Methodology

The risk assessments of the identified hazards of concern describe the risks associated with each hazard. The following steps were used to define the risk of each hazard:

- Profile and update each hazard, describing the geographic area it affects, its frequency and severity, and the warning time provided before a hazard event occurs.
- Use maps of hazard impact areas, as appropriate, to determine and update how many structures, facilities, and systems are exposed to each hazard.
- Assess the vulnerability of exposed structures and infrastructure based on exposure and the probability of occurrence of a hazard event. Tools such as the Federal Emergency Management Agency's (FEMA's) hazard-modeling program called Hazus-MH were used to perform this assessment for flood, dam failure, earthquake hazards, and tornado. Outputs similar to those from Hazus-MH were generated for other hazards, using maps generated by the Hazus-MH program.

A detailed inventory of critical facilities and infrastructure were reevaluated for this plan using GIS applications. Over 6,000 facilities were inventoried and uploaded into the Hazus-MH model to support the risk assessment.

Profile of Cook County Hazards of Concern

The following hazards are addressed in the 2019 Cook County MJ-HMP. A brief description of each hazard is included in this section of the Executive Summary. For a more detailed analysis of each hazard, please refer to Part 2. Risk Assessment.

- Dam and Levee Failure
- Drought
- Earthquake
- Flood
- Severe Weather
- Severe Winter Weather
- Tornado

Dam and Levee Failure

There are 40 dams in Cook County, all regulated by the Water Resources Division of the Illinois Department of Natural Resources (IDNR). Importantly, 24 of these dams are classified as “high" (10) or "significant" (14) hazard, which means they have significant downstream populations at risk if the dam should fail. Flooding as a result of a dam and levee failure would significantly impact properties and communities in the inundation zones. No records of dam failures in the planning area are available, however.

There are also nine levee systems in Cook County. Although there is no history of levee failures in the planning area, it should be noted that the State of Illinois experienced levee failures in 1993 and 2008. In 1993, 17 levee systems breached along the Mississippi River and the Illinois River just north of where it meets the Mississippi River. Over 237,000 acres along the rivers were flooded.

Warning time for dam or levee failure varies depending on the cause of the failure. In events of extreme precipitation or massive snowmelt, evacuations can be planned with sufficient time. In the event of a structural failure due to an earthquake, there may be no warning time. Cook County and its planning partners have established protocols for flood warning and response for dam failure in the flood warning portion of its adopted emergency operations plan. These protocols are tied to the emergency action plans created by the dam owners.

Important issues associated with dam and levee failure include the following:

- Federally regulated dams have an adequate level of oversight and sophistication in their emergency action plans. However, the protocol for notifying downstream citizens of imminent failure needs to be tied to local emergency response planning.
- Mapping that estimates inundation depths is needed for non-federal-regulated dams to better assess the risk associated with dam failure from these facilities.
- Most dam failure mapping required at federal levels requires determination of the probable maximum flood, which is a worst-case scenario and generally the event with the lowest probability of occurrence. For non-federal-regulated dams, mapping of dam failure scenarios that are less extreme than the probable maximum flood but have a higher probability of occurrence could better illustrate areas potentially impacted by more frequent events to support emergency response and preparedness.
- The concept of residual risk associated with structural flood control projects should be considered in the design of capital projects and the application of land use regulations.
- Addressing security concerns and the need to inform the public of the risk associated with dam failure is a challenge for public officials. Not all levees are reflected in the current flood mapping, which makes complete delineation of the hazard area difficult.

See **Part 2. Risk Assessment - Chapter 6. Dam and Levee Failure** for the full analysis.

Drought

Droughts originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time (a few weeks or a couple of months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months or years, the drought is considered to be long-term. Drought generally affects large geographic areas, so drought descriptions in the hazard mitigation plan are usually for the entire State of Illinois rather than the immediate planning area of Cook County.

The most severe droughts in Illinois occurred in the summer of 1934, the summer of 1931 and 1954. All three of these events were categorized as extreme droughts. More recently, in September 1983, all 102 counties were declared state disaster areas because of high temperatures and insufficient precipitation. In 1988, 54 percent of the state was impacted by drought-like conditions, resulting in disaster relief payments to landowners and farmers exceeding $382 million. Historical drought data for the planning area indicate there have been at least seven (7) significant droughts in the last 115 years, which equates to a drought every 16 years on average, or a minimum of a 6.25-percent chance of a drought in any given year.

Drought can have a widespread impact on the environment and the economy, although it typically does not result in loss of life or damage to property, as do other natural disasters. The National Drought Mitigation Center describes likely drought impacts as those affecting agriculture, water supplies, and the risk of fire.

Scientists at this time do not know how to predict drought more than a month in advance for most locations. How long a drought lasts depends on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on the global scale.

Crucial issues associated with drought include the following:

- Identification and development of alternative water supplies
- Use of groundwater recharge techniques to stabilize the groundwater supply
- The probability of increased drought frequencies and durations due to climate change
- The promotion of active water conservation even during non-drought periods.

See Part 2. Risk Assessment - Chapter 7. Drought for the full analysis.

Earthquake

An earthquake is the vibration of the earth's surface following a release of energy in the earth's crust. Earthquakes tend to occur along faults, which are zones of weakness in the crust. Earthquakes occur throughout Illinois, with most in the southern third of the state. Over 360 earthquakes have occurred in Illinois during the past 20 years, with 32 resulting in damage. Fifteen events have been recorded in Cook, DuPage, Kane, Kendall, and Will Counties since 1804. Cook County has experienced three earthquakes ranging from a magnitude of 3 (categorized as "minor") to 4.9 (categorized as "light").

The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties generally result from falling objects and debris, because the shocks shake, damage or demolish buildings and other structures. Disruption of communications, electrical power supplies and gas, sewer and water lines should be expected. Earthquakes may trigger fires, dam failures, or releases of hazardous material, compounding their effects. Any seismic activity of 6.0 or greater on faults within the planning area would have significant impacts throughout the county. Earthquakes of this magnitude or higher would lead to a massive failure of structures built on loose soils. Levees and revetments constructed on such soils would likely fail, representing a loss of critical infrastructure. These events could cause secondary hazards, including mudslides, that would further damage structures.

There is currently no reliable way to predict an earthquake at any given location with any significant warning time. Research is being done with warning systems that use the low energy waves that precede major earthquakes to give approximately 40 seconds notice that a major earthquake is about to occur. The warning time is very short but it could allow for someone to get under a desk, step away from a hazardous material they are working with or shut down a computer system.

Important issues associated with earthquakes include the following:

- The public perception of the earthquake risk within the planning area is low. It can be difficult to get the public to think about earthquake mitigation with little or no perceived risk.
- Most of the planning area's building stock was built prior to 1975 when seismic provisions became uniformly applied through building code applications. A building stock analysis that looks at the potential fragility of the older building stock constructed without building code influence would be beneficial in the identification of seismic mitigation projects.
- More earthquake mapping is needed for the planning area.
- Critical facility owners/operators should be encouraged to create or enhance continuity of operations plans using the information on risk and vulnerability contained in the Cook County hazard mitigation plan.
- Geotechnical standards should be established that take into account the probable impacts of earthquakes in the design and construction of new or enhanced facilities.
- The County has over 6 miles of earthen levees and revetments on soft, unstable soil. These soils are prone to liquefaction, which would severely undermine the integrity of these facilities.
- There are a large number of earthen dams within the planning area. Dam failure warning and evacuation plans and procedures should be reviewed and updated to reflect the dams' risk potential associated with earthquake activity in the region.

See **Part 2. Risk Assessment - Chapter 8. Earthquake** for the full analysis.

Flood

Flood Types and History

Two types of flooding are typical in Cook County: riverine flooding when water overflows the banks of a stream; and stormwater/urban drainage flooding, when storm runoff exceeds the capacity of local drainage systems in place to convey stormwater to a receiving body. 231 flooding events (including flood, flash flood, coastal flood, and heavy rains) have occurred in Cook County from 1996 to 2019. Flood events of historical significance occurred in the Cook County region in 1849, 1855, 1885, 1938, 1952, 1954, 1957, 1961, 1973, 1979, 1986, 1987, 1996, 2001, 2004, 2010, 2011, and 2013. Since 1972, 13 presidential-declared flood events in the County have caused over $628.5 million in property damage.

In the past 20 years, stormwater/urban drainage flooding has become the principal cause of flood losses in the Cook County planning area. Urban portions of the county annually experience nuisance flooding related to drainage issues. After flooding in August 2010, FEMA provided more than

$435 million in disaster recovery, response, and mitigation in Cook and DuPage Counties, and more than 75 percent of this went to individual homeowners, most of whom suffered sewer back-ups and basement flooding caused by stormwater/urban drainage flooding. The frequency and the magnitude of stormwater/urban drainage flooding in Cook County dictated the assignment of stormwater management within the County to a single entity—the Metropolitan Water Reclamation District of Greater Chicago.

Cook County experiences numerous episodes of the river and urban flooding every year; massive floods that can cause significant property damage typically occur every three to seven years.

Flood Mapping

Flood studies use historical records to determine the probability of occurrence for different river discharge (flow) levels. The flood frequency equals 100 divided by the discharge probability. For example, the 100-year discharge has a 1-percent chance of being equaled or exceeded in any given year. The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-year flood) is used as a regulatory boundary by many agencies. This boundary is a convenient tool for assessing risk in flood-prone communities. For most communities participating in the National Flood Insurance Program (NFIP), FEMA has prepared a detailed Flood Insurance Study that presents water surface elevations for the 1- percent annual chance flood and the 0.2-percent annual chance flood (the 500-year flood). The boundaries of the 100- and 500-year floodplains are shown on Flood Insurance Rate Maps.

FEMA has mapped over 78 square miles of the 100-year floodplain and 99 square miles of 500-year floodplain along 172 watercourses in the Cook County planning area. Approximately 8 percent of the County is located within mapped 100-year floodplains. As is the case for many communities, there is a need for updated maps that better reflect the actual flood risk. MWRD has created inundation maps, which may be a good resource for some communities.

It should be noted that mapping showing areas of urban flooding is limited in the County.

Flood Severity

The principal factors affecting flood damage are flood depth and velocity. The deeper and faster flood flows become, the more damage they can cause. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity, is especially true when a channel migrates over a broad floodplain, redirecting high-velocity flows and transporting debris and sediment.

The worst-case scenario for flooding in the Cook County planning area has happened numerous times in the past. It involves intense rainstorms that stall over the planning area, dropping rainfall totals in excess 6 inches over 48 hours (this scenario which is significantly exacerbated by the presence of snow pack on the ground), which leads to both riverine and stormwater/urban drainage flooding that can overwhelm flood response capabilities in the planning area. Significant roads can be blocked, preventing critical access for many residents and critical functions. High in-channel flows can cause water courses to scour, possibly washing out roads and creating more isolation problems.

Flood Warning

The Cook County flood threat system consists of a network of precipitation gages throughout the watershed and stream gages at strategic locations that continuously monitor and report stream levels. All of this information is analyzed by agencies such as the Cook County Department of Homeland Security and Emergency Management (DHSEM) and Metropolitan Water Reclamation District to evaluate the flood threat and possible evacuation needs.

Floods are generally classed as either slow-rise or flash floods. Due to the sequential pattern of meteorological conditions needed to cause serious slow-rise flooding, it is unusual for a slow-rise flood to occur without warning. Slow-rise floods may be preceded by a warning time from several hours, to days, to possibly weeks. Evacuation and sandbagging for a slow-rise flood may lessen flood damage. Flash floods are more difficult to prepare for, due to the extremely short warning time given, if any. Flash flood warnings usually require evacuation within an hour. However, potential hazard areas can be warned in advance of potential flash flooding danger.

Participation in Federal Flood Programs

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. Cook County entered the NFIP on April 15, 1981. The effective date for the current countywide Flood Insurance Rate Map is August 19, 2008. In addition to the County, most Cook County municipalities participate in the NFIP. As of October 2018, Cook County had 14,790 flood insurance policies providing $3.092 billion in insurance coverage. According to FEMA statistics, in the State of Illinois, there were 51,246 total losses (claims) between January 1, 1978, and January 31, 2019, for a total of approximately $545.36 million, an average of roughly $10,642 per claim.

Twenty-four communities in the planning area also participate in the Community Rating System (CRS) a voluntary program that encourages floodplain management activities that exceed the NFIP requirements. The CRS requires participating communities to identify repetitive loss areas, where flood insurance claims have been paid multiple times for individual properties. There are 1,775 such properties in Cook County as of October 2018.

Issues

Important issues associated with flooding include the following:

- The 2-D, unsteady-state modeling performed by the Metropolitan Water Reclamation District is considered to be the best available flood risk data for the planning area, but it is not the basis of FEMA's current effective Flood Insurance Rate Map. The District's flood hazard data should be formatted so that can be used to support risk assessment and thus validate best available data.
- The planning area has a large percentage of policies and losses outside a mapped hazard area.
- Basement flooding is a common problem.
- The stormwater/urban drainage flooding risk is not mapped, which makes it difficult to assess this hazard, other than looking at historical loss data.
- The risk associated with the flood hazard overlaps the risk associated with other hazards such as an earthquake. This provides an opportunity to seek mitigation alternatives with multiple objectives that can reduce the risk for multiple hazards.
- There is no consistency of land-use practices and regulatory floodplain management within the planning area. It is unclear how potential climate change may impact flood conditions in the planning area.
- The concept of residual risk should be considered in the design of future capital flood control projects and should be communicated with residents living in the floodplain.
- More information is needed on flood risk to support the concept of risk-based analysis of capital projects.
- There needs to be a sustained effort to gather historical damage data, such as high water marks on structures and damage reports, to measure the cost-effectiveness of future mitigation projects.
- Ongoing flood hazard mitigation will require funding from multiple sources.
- There needs to be a coordinated hazard mitigation effort between jurisdictions affected by flood hazards in the county.
- Floodplain residents need to continue to be educated about flood preparedness and the resources available during and after floods.
- The promotion of flood insurance as a means of protecting private property owners from the economic impacts of frequent flood events should continue.
- The economy affects a jurisdiction's ability to manage its floodplains. Budget cuts and personnel losses can strain the resources needed to support floodplain management.

See **Part 2. Risk Assessment - Chapter 9. Flood** for the full analysis.

Severe Weather

Severe weather refers to any dangerous meteorological phenomena with the potential to cause damage, serious social disruption, or loss of human life. It includes hail, heat, excessive heat, lightning, hail, fog, and high, strong, and thunderstorm winds. Severe-weather events can happen anywhere in the planning area. Severe local storms are probably the most common widespread hazard. They affect large numbers of people throughout Cook County and the surrounding region when they occur. The heat wave of July 1995 was one of the worst disasters in Illinois history, with over 700 deaths statewide over five-days.

Records from the National Climatic Data Center indicate approximately 1,386 severe weather events (not including heat and excessive heat events) in the planning area between 1950 and 2018 occurring between 503 separate days. NCDC data from 1996 to 2018 also records 57 heat or excessive heat events. This means that Cook County can expect approximately 9 days every year where at least one severe weather event is occurring. More specifically, this represents an average of approximately 11 thunderstorm wind, 7 hail, 3 heat or excessive heat, 1 lightning, and 1 high or strong wind event every year. According to the 2018 Illinois Natural Hazard Mitigation Plan, the planning area is designated as severely vulnerable to severe storms, with a high vulnerability to extreme heat as well. There were no significant fog events recorded for Cook County in the NCDC - NOAA data.

The most common problems associated with severe storms are immobility and loss of utilities. Roads may become impassable due to flooding, downed trees, or a landslide. Power lines may be downed due to high winds, and services such as water or phone may not be able to operate without power. Lightning can cause severe damage and injury. A worst-case severe-weather event would involve prolonged high winds during a thunderstorm. Such an event would have both short-term and longer-term effects. Initially, schools and roads would be closed due to power outages caused by high winds and downed tree obstructions. In more rural areas, some subdivisions could experience limited ingress and egress. Prolonged rain could produce flooding and overtopped culverts with ponded water on roads. Flooding could further obstruct roads and bridges, further isolating residents.

Meteorologists can often predict the likelihood of a severe storm or other severe weather events, which can give several days of warning time. The Chicago Office of the National Weather Service issues severe storm watches and warnings when appropriate to alert government agencies and the public of possible or impending weather events. The watches and warnings are broadcast over NOAA weather radio and are forwarded to the local media for re-transmission using the Emergency Alert System.

Important issues associated with severe weather include the following:

- Redundancy of power supply throughout the planning area must be evaluated. The capacity for backup power generation is limited.
- Public education on dealing with the impacts of severe weather needs to be provided Debris management (downed trees, etc.) must be addressed.
- The effects of climate change may result in an increase in the frequency of extreme heat events.

See Part 2. Risk Assessment - Chapter 10. Severe Weather for the full analysis.

Severe Winter Weather

The severe winter weather hazard encompasses heavy snow, lake-effect snow, blizzards, ice storms, sleet, cold/windchill, extreme cold temperatures and wind chill, frost/freeze, general winter weather, and winter storms. Severe winter weather events can happen anywhere in the planning area. NOAA identifies 178 of these severe winter weather events in the planning area from 1950 - 2018, excluding snowstorms classified as less than major snowstorms. The planning area typically receives 34 inches of snow each year and can expect to experience exposure to a severe winter weather event at least annually.

178 severe winter weather events were reported between 01/01/1950 and 06/01/2019, although Cold/Windchill and Extreme Cold/Windchill were not recorded in available data sets until 1997 and 2006, respectively. There have likely been many more of these events before those dates that were not recorded by the NCDC data. All events totaled $700,000 in property damage, 156 direct deaths and 8 indirect deaths, and 5 direct injuries and 3 indirect injuries.

Severe winter weather impacts can be significant. Roads may become impassable due to ice or snow. Power lines may be downed due to high winds or ice accumulation, and services such as water or phone may not be able to operate without power. Physical damage to homes and facilities can occur from wind damage or accumulation of snow or ice. Freezing rain can cause the most dangerous conditions. Ice buildup can bring down trees, communication towers, and wires, creating hazards for property owners, motorists, and pedestrians alike. Many severe winter weather events in the planning area have resulted in the loss of life.

Meteorologists can often predict likely severe winter weather, giving several days of warning time. The National Weather Service provides public warnings on storm, snow and ice events as appropriate to alert government agencies and the public of possible or impending weather events. Watches and warnings are broadcast over NOAA weather radio and are forwarded to local media for re-transmission using the Emergency Alert System.

Important issues associated with severe winter weather in the planning area include the following:

- The older building stock in the planning area is built to low code standards or none at all.
- These structures could be highly vulnerable to severe winter weather events such as windstorms.
- Redundancy of power supply must be evaluated.
- The capacity for backup power generation is limited.
- Isolated population centers are at significant risk.

See Part 2. Risk Assessment - Chapter 11. Severe Winter Weather for the full analysis.

Tornado

Tornadoes are the most violent of all atmospheric storms, and all of Illinois is susceptible to them, including Cook County. The tornado season runs March through August, although a tornado can occur in the state at any time. Many tornadoes have struck Cook County, including several within the Chicago city limits. According to NCDC data, there were 54 tornado and three funnel cloud events from 1954 to 2018, which totaled $118,337,750 in property damage, 39 deaths, and 770 injuries. The F4-rated Oak Lawn tornado in April 1967 was the deadliest tornado in the planning area, with 33 fatalities. The only F5 tornado to ever strike the Chicago area was on August 28, 1990, which additionally impacted Will and Kendall Counties. In total, 29 direct deaths, 350 injuries, and 250 million in property damage was recorded.

Tornadoes can cause fatalities and devastate a neighborhood in seconds. Winds can reach 300 mph, and damage paths can be more than a mile wide and 50 miles long. If a major tornado were to strike within the populated areas of Cook County, the damage could be widespread. Businesses could be forced to close for an extended period or permanently, fatalities could be high, many people could be homeless for an extended period, and routine services such as telephone or power could be disrupted. Buildings can be damaged or destroyed.

The local NWS office issues a tornado watch when tornadoes are possible in an area and a tornado warning when a tornado has been sighted or indicated by weather radar. The current average lead time for tornado warnings is 13 minutes. The National Weather Service has established a goal of 15 minutes in its strategic plan. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible.

Important issues associated with tornadoes in the planning area include the following:

- The older building stock in the planning area is built to low code standards or none at all. These structures could be highly vulnerable to tornadoes.
- Redundancy of power supply must be evaluated. The capacity for backup power generation is limited.
- The amount of the tornado zone that contains vacant, developable land is not known and would be valuable information for gauging the future development potential of the tornado zone.
- Declining growth rate makes it difficult for code standards to have impacts on new development. The planning area has insufficient suitable tornado shelters.
- Public awareness of tornado response protocols is a concern, given the area’s many visitors.

See Part 2. Risk Assessment - Chapter 12. Tornado for the full analysis

Planning Area Risk Ranking

Risk rankings were performed by each planning partner to compare the probable impacts of the hazards of concern. For each community, the rankings assessed the probability of each hazard's occurrence as well as its likely impact on people, property, and the economy. The results of the countywide ranking, which were used in establishing mitigation action and priorities, are summarized below.

TABLE: HAZARD RISK RANKING

Hazard Ranking	Hazard Event	Category
1	Severe Winter Weather	High
2	Severe Weather	High
3	Flood (including urban flooding)	High
4	Earthquake	Medium
5	Tornado	Medium
6	Drought	Low
7	Dam Failure	Low

Implementation

This section of the Executive Summary broadly describes the Plan Maintenance Strategy and Plan Adoption.

Plan Maintenance Strategy

The hazard mitigation plan includes a formal process to ensure that the 2019 Cook County MJ-HMP remains an active and relevant document and that the planning partners maintain their eligibility for relevant funding sources. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant. The strategy for ongoing maintenance of the plan includes the following components:

- **Plan Implementation**—Plan implementation and evaluation will be a shared responsibility among all planning partners and agencies identified as lead agencies in the mitigation action plans. Cook County DHSEM will assume lead responsibility for implementing the plan maintenance strategy.
- **Steering Committee**—It is recommended that a steering committee remain a viable body involved in key elements of the plan maintenance strategy. The steering committee will strive to include representation from the planning partners, as well as other stakeholders in the planning area.
- **Annual Progress Report**—The steering committee will convene to perform annual reviews. DHSEM will then prepare a formal annual report on the progress of the plan.
- **Plan Update**—The planning partnership intends to update the hazard mitigation plan on a five-year cycle from the date of initial plan adoption.
- **Continuing Public Involvement**—The public will continue to be apprised of the plan's progress through the Cook County hazard mitigation website and by copies of annual progress reports provided to the media. DHSEM has agreed to maintain the hazard mitigation plan website, and each planning partner has agreed to provide links to the website on their jurisdictional websites.
- **Incorporation into Other Planning Mechanisms**—All municipal planning partners are committed to creating a linkage between the hazard mitigation plan and their comprehensive plans by identifying a mitigation action as such and giving that action a high priority. As information becomes available from other planning mechanisms that can enhance this plan, that information will be incorporated via the update process.

Plan Adoption

The 2019 Cook County MJ-HMP will be submitted for a pre-adoption review to the Illinois Emergency Management Agency and FEMA before adoption by Cook County. Once pre-adoption approval has been provided, all planning partners will formally adopt the plan. Plan Adoption is addressed in Part 5. Plan Adoption of this plan.

Part 1. The Planning Process

Hazard mitigation is defined as a way to reduce or alleviate the loss of life, personal injury, and property damage that can result from a disaster through long- and short-term strategies. It involves strategies such as planning, policy changes, programs, projects, and other activities that can mitigate the impacts of hazards. The responsibility for hazard mitigation lies with many groups including private property owners, business and industry, and local, state, and federal governments.

The 2019 Cook County Multi-Jurisdictional Hazard Mitigation Plan (MJ-HMP) was updated by Integrated Solutions Consulting under a contract with the Cook County Department of Homeland Security and Emergency Management (DHSEM). The Cook County MJ-HMP is organized into two (2) volumes. Volume 1 addresses planning-area-wide elements for Cook County and all jurisdictions; and Volume 2 addresses jurisdiction-specific elements in annexes for each participating jurisdiction.

Chapter 1. Introduction to the Planning Process

This chapter provides the following introductory information regarding hazard mitigation planning and its purpose.

- Why Prepare this Plan?
- Who Will Benefit from this Plan?
- How to Use this Plan

Why Prepare this Plan?

This section presents information on the big picture of hazard mitigation planning, the primary hazards of concern in the Cook County area, and the purpose the hazard mitigation plan and process serves.

The Big Picture

The federal Disaster Mitigation Act (DMA) of 2000 (Public Law 106-390) required state and local governments to develop hazard mitigation plans as a condition for federal mitigation grant assistance. Prior to 2000, federal disaster funding focused on disaster relief and recovery, with limited funding for hazard mitigation planning. The DMA increased the emphasis on planning for disasters before they occur.

The DMA encourages state and local authorities to work together on pre-disaster planning and promotes sustainability for disaster resistance. “Sustainable hazard mitigation” includes the sound management of natural resources and the recognition that hazards and mitigation must be understood in the largest possible social and economic context. The enhanced planning network called for by the DMA helps local governments articulate accurate needs for mitigation, resulting in the faster allocation of funding and more cost-effective risk reduction projects.

This plan also meets FEMA planning requirements of the National Flood Insurance Program’s (NFIP) Community Rating System (CRS). CRS allows participating communities to earn credit towards discounts in flood insurance premiums. FEMA requires that mitigation plans be updated and readopted every five years.

Local Concerns

Natural hazards impact citizens, property, the environment, and the economy of Cook County. Dam and levee failure, drought, earthquake, flooding, severe weather, severe winter weather, and tornadoes are examples of hazards that have exposed Cook County residents and businesses to the financial and emotional costs of recovering after natural disasters.

The inevitability of natural hazards, a large and diverse population, and extensive critical infrastructure and critical facilities in Cook County created an urgent need to develop and update strategies, coordinate resources, and increase public awareness to reduce risk and prevent loss from future hazard events. Identifying risks posed by hazards and developing strategies to reduce the impact of a hazard event can help protect the life and property of citizens and communities. To accomplish these objectives, Cook County and a coalition of planning partners prepared this hazard mitigation plan and are committed to the continual update and maintenance of this important document. Several factors inform this planning effort:

- The Cook County area has significant exposure to numerous natural hazards that have caused hundreds of millions of dollars in past damage.
- Limited local resources make it difficult to be pre-emptive in risk reduction actions. Being able to leverage federal financial assistance is paramount to successful hazard mitigation in the area.
- The partners wanted to be proactive in their preparedness for the probable impacts of natural hazards.

With these factors in mind, Cook County committed to the continued preparation and maintenance of the plan by attaining grant funding for the effort and then securing technical assistance to facilitate a planning process that would comply with all program requirements related to this update.

Purposes for Planning

This hazard mitigation plan identifies resources, information, and strategies for reducing risk from natural hazards. Elements and strategies in the plan were selected because they meet a program requirement and because they best meet the needs of the planning partners and their citizens. One of the benefits of multi-jurisdictional planning is the ability to pool resources and eliminate redundant activities within a planning area that has uniform risk exposure and vulnerabilities. The Federal Emergency Management Agency (FEMA) encourages multi-jurisdictional planning under its guidance for the DMA. The plan will help guide and coordinate mitigation activities throughout the planning area. The plan was updated to meet the following objectives:

- Meet or exceed the requirements of the DMA.
- Enable all planning partners to continue using federal grant funding to reduce risk through mitigation.
- Meet the needs of each planning partner as well as state and federal requirements.
- Update the risk assessment that focuses on Cook County hazards of concern.

- Create a single planning document that integrates all planning partners into a framework that supports partnerships within the County, and puts all partners on the same planning cycle for future updates.
- Meet the planning requirements of FEMA's Community Rating System (CRS), allowing planning partners that participate in the CRS program to maintain or enhance their CRS classifications.
- Coordinate existing plans and programs so that high-priority mitigation actions are funded and implemented.

Who will Benefit from this Plan?

All citizens and organizations within the defined planning area are the ultimate beneficiaries of this hazard mitigation plan. The plan reduces risk for those who live in, work in, and visit the County and provides a viable planning framework for foreseeable natural hazards that may impact the County as well. It is also highly likely that secondary benefits will fall to those immediately outside of the planning area as well, not to mention the benefit that comes to state and federal entities and resources by having hazards competently addressed at the local level.

Participation in the development of the plan by key stakeholders in the County helped ensure that outcomes will be mutually beneficial for all involved. The resources and background information in the plan are applicable countywide, and the plan's goals and recommendations can lay groundwork for the development and implementation of further local mitigation activities and partnerships.

How to Use this Plan

This plan has been set up in two volumes so that elements that are jurisdiction-specific can easily be distinguished from those that apply to the whole planning area:

- **Volume 1** includes all federally required elements of a disaster mitigation plan that apply to the entire planning area. This includes the description of the planning process, public involvement strategy, goals and objectives, countywide hazard risk assessment, countywide mitigation actions, and a plan maintenance strategy. The following appendices at the end of Volume 1 include information or explanations to support the main content of the plan:
    - Appendix A - Acronyms and Definitions
    - Appendix B - Plan Process and Development Documentation
    - Appendix C - Public Participation Documentation
    - Appendix D - Concepts, Methods, and Data Sources Used for Hazard Mapping
    - Appendix E - Annual Progress Report Template and Process
    - Appendix F - Jurisdictional Linkage Strategy
    - Appendix G - Plan Adoption Resolutions from Planning Partners
    - Appendix H - References
- **Volume 2** includes all federally required jurisdiction-specific elements, in annexes for each participating jurisdiction.

All planning partners will adopt Volume 1 in its entirety and their respective jurisdiction-specific annex within (Volume 2).

Chapter 2. Plan Methodology

To update the 2019 Cook County MJ-HMP, the County followed a process that had the following primary objectives:

- Secure grant funding
- Form a planning team
- Establish a planning partnership
- Define/Reassess the planning area
- Engage the Steering Committee
- Coordinate with other agencies
- Review existing programs
- Engage the public

These objectives are discussed in the following sections.

Grant Funding

This planning effort was supplemented by a grant to the Cook County Department of Homeland Security and Emergency Management (DHSEM) from FEMA through the Illinois Emergency Management Agency (IEMA). FEMA/IEMA hazard mitigation grants provide 75 percent in federal funds to a plan or a project and 25 percent non-federal funds are required as matching funds.

Formation of the Planning Team

Cook County hired Integrated Solutions Consulting (ISC) to assist with the update and implementation of the plan. The Integrated Solutions Consulting project manager and lead project planner reported directly to a County-designated project manager. A planning team was formed to lead the planning effort, made up of the following members:

- Gene Ryan, Cook County DHSEM
- Kim Nowicki, Cook County DHSEM
- Thomas Tilton, Cook County DHSEM
- Dana Curtiss, Cook County DHSEM
- Patrick Steffes, Cook County DHSEM
- Ray Kay, Cook County MABAS Illinois
- Natalia Derevyanny, Cook County Bureau of Administration
- Sharon Cuncannan, Cook County Finance
- John Rogan, ISC project principal
- Daiko Abe, ISC project manager

- Sabeen Shamsi, ISC lead project planner
- Nathaniel Marlette, ISC planner
- Hasani Gunn, ISC planner
- Cassandra Wolff, ISC, senior GIS analyst
- Betsy Lopez, ISC, risk assessment lead
- George DeTella, ISC outreach team lead
- Earl Zuelke, ISC Subject Matter Expert
- Victor Evans, ISC Subject Matter Expert
- Bill Schatz, ISC Subject Matter Expert
- Lauren Martin, ISC Subject Matter Expert

Establishment of the Planning Partners

Each jurisdiction wishing to join the planning partnership was asked to provide a "letter of intent to participate" that designated a point of contact for the jurisdiction and confirmed the jurisdiction's commitment to the process and understanding of expectations. A list of the participating jurisdictions is maintained in the following section: Participating Partners and the Planning Area.

Cook County townships were invited to participate in meetings and workshops throughout the planning process. Townships are included, and meet DMA planning requirements, through the County's adoption of the 2019 Cook County MJ-HMP.

Defining the Planning Area

The planning area was defined as all incorporated and unincorporated areas of Cook County as well as the incorporated areas of cities that cross county boundaries.

The planning area boundary is shown in *Figure: Planning Area*. All partners to this plan have jurisdictional authority within this planning area. Other municipalities that are partially in Cook County are participating in the mitigation planning efforts of adjacent counties. The 14 jurisdictions that meet these criteria include:

- Buffalo Grove - Cook and Lake
- Barrington Hills - Cook, Kane, Lake and McHenry
- Deerfield - Cook and Lake
- Deer Park - Cook and Lake
- East Dundee - Cook and Kane
- Elgin - Cook and Kane
- Bensenville - Cook and DuPage

- Burr Ridge - Cook and DuPage
- Elmhurst - Cook and DuPage
- Hinsdale - Cook and DuPage
- Frankfort - Cook and Will
- Oak Brook - Cook and DuPage
- Roselle - Cook and DuPage
- Woodridge - Cook, DuPage and Will

The Steering Committee

Hazard mitigation planning enhances collaboration and support among diverse parties whose interests can be affected by hazard losses. In 2014, a steering committee was formed to oversee all phases of the plan. The members of this committee included key planning partner staff, elected officials, citizens, and other stakeholders from within the planning area. The steering committee was, again, instrumental in the update of the 2019 Cook County MJ-HMP.

During the 2019 update of the Plan, the steering committee agreed to meet as often as needed throughout the course of the plan's development. The planning team facilitated each steering committee meeting, which addressed a set of objectives based on the work plan established for the plan. The steering committee met in 2018 and multiple times from May 2019 through July 2019. Meeting agendas, notes, and attendance logs are available for review at the Cook County Hazard Mitigation website.

The steering committee was responsible for:

- The updating and prioritizing of natural hazards that impact Cook County
- Defining critical facilities and providing necessary updates
- Updating the plan's mission, goals, and objectives
- The overall planning area's capability assessment and consideration of mitigation alternatives
- The identification of new mitigation actions and the update of past countywide mitigation action items

The recommendations of the steering committee were provided to the planning partners via a series of webinars and workshops.

The membership of the steering committee that supported the 2019 Cook County MJ-HMP update is detailed in the following table (*Table: Steering Committee Membership*).

Table: Steering Committee Membership 2019 Cook County Multi-Jurisdictional Hazard Mitigation Plan (MJ-HMP) Update				
No	**Name**	**Title**	**Committee Position**	**Agency/Organization**
1	Sandra Frum	Village President/Member	Co-Chair	Northbrook/Northwest Municipal Conference
2	Matt Doughtie	Senior Emergency Management Coordinator	Co-Chair	City of Chicago Office of Emergency Management and Communications (OEMC)
3	Yvette Alexander-Maxie	Regional Manager, External Relations	Member	American Red Cross
4	Michael Cosme	Senior Civil Engineer	Member	Metropolitan Water Reclamation District of Greater Chicago
5	Rich Fisher	Senior Civil Engineer	Alternate	Metropolitan Water Reclamation District of Greater Chicago
6	Adam James	Drainage and Utilities Manager	Alternate	Cook County Transportation and Highways Department
7	Kevin Lyne	Deputy Operations Section Chief	Member	Illinois Mutual Aid Box Alarm System (MABAS)
8	Raymond Kay	Homeland Security Branch Chief	Alternate	Illinois Mutual Aid Box Alarm System (MABAS)
9	John McNelis	Project Engineer/Township Liaison	Member	Cook County Transportation and Highways Department
10	Kimberly Nowicki	Regional Planner	Member	Cook County Department of Homeland Security and Emergency Management
11	Paul Osman	Chief, Statewide Floodplain Section/National Flood Insurance Program	Alternate	Illinois Department of Natural Resources, Office of Water Resources
12	David Ramos	Deputy Director	Alternate	City of Chicago Office of Emergency Management and Communications
13	Gene Ryan	Chief of Planning	Member	Cook County Department of Homeland Security and Emergency Management
14	John Schaefer	Public Works Director/President	Member	Village of Homewood/Suburban Public Works Directors Association
15	Marilyn Sucoe	Northeast Floodplain Program Coordinator	Member	Illinois Department of Natural Resources, Office of Water Resources
16	Kevin Schnoes	Deputy Director	Member	Cook County Department of Environment and Sustainability

17	Dominic Tocci	Deputy Director of Community Development	Member	Cook County Bureau of Economic Development

Coordination with Other Agencies, Partners, and Neighboring Jurisdictions

Opportunities for involvement in the planning process must be provided to neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (Title 44 of the Code of Federal Regulations (44 CFR), Section 201.6(b)(2)).

Agency coordination was accomplished by the planning team as follows:

Steering Committee Involvement—Agency representatives were invited to participate on the Steering Committee. The Steering Committee represented a wide range of councils of governments, members of academia, government representatives, watershed management entities, and other stakeholders.

Agency Notification—The following agencies were invited to participate in the plan development process from the beginning and were kept apprised of plan development milestones:

- FEMA Region V
- Illinois Emergency Management Agency
- City of Chicago Office of Emergency Management and Communications
- Cook County Transportation and Highways Department
- Cook County Department of Environment and Sustainability
- Cook County Bureau of Economic Development
- Metropolitan Water Reclamation District of Greater Chicago
- American Red Cross

These agencies received meeting announcements, meeting agendas, and meeting minutes by e-mail throughout the plan development process. These agencies supported the effort by attending meetings or providing feedback on issues.

Stakeholders & Subject Matter Experts

Stakeholder Outreach Activity	Date	Location	Details of Activity
Points of Contact Outreach	July 12, 2018	Online Bulletin	Online Bulletin sent to previous list of Points of Contact describing the Hazard Mitigation Plan Update.

Calumet Storm Water Collaborative	April 05, 2019		Chief and Regional Planner attended stakeholder meetings to increase participation and discuss plan update.
Upper Salt Creek and Poplar Creek Watershed Planning Council	April 17, 2019	Al Larson Prairie Center for the Arts, 201 Schaumburg Court, Schaumburg, IL	Chief and Regional Planner attended stakeholder meetings to increase participation and discuss plan update
NEIL COAD Meeting	April 18, 2019		Chief and Regional Planner attended stakeholder meetings to increase participation and discuss plan update
West Central Municipal Conference (HMP Presentation)	April 24, 2019		Chief and Regional Planner attended stakeholder meetings to increase participation and discuss plan update
Addison Creek Groundbreaking Ceremony	April 24, 2019		Chief and Regional Planner attended stakeholder meetings to increase participation and discuss plan update
Cal-Sag Watershed Planning Council	April 29, 2019	Willow Springs Village Hall, One Village Circle, Willow Springs, IL	Chief and Regional Planner attended stakeholder meetings to increase participation and discuss plan update
DHSEM Town Hall Meeting (South)	May 01, 2019	Oak Forest, IL	Chief and Regional Planner attended stakeholder meetings to increase participation and discuss plan update
DHSEM Town Hall Meeting (North)	May 02, 2019	Schaumburg, IL	Chief and Regional Planner attended stakeholder meetings to increase participation and

			discuss plan update
Calumet Storm Water Collaborative	May 03, 2019		Chief and Regional Planner attended stakeholder meetings to increase participation and discuss plan update
South Barrington Emergency Management Committee Meeting	May 06, 2019	30 S. Barrington Road, South Barrington, IL 60010	Chief and Regional Planner attended stakeholder meetings to increase participation and discuss plan update
Little Calumet Watershed Planning Council	May 09, 2019	Offices of the South Suburban Mayors and Managers Association, 1906 W. 174th Street, East Hazel Crest, IL	Chief and Regional Planner attended stakeholder meetings to increase participation and discuss plan update
Lower Des Plaines River Watershed Planning Council	May 23, 2019	55 E North Ave Northlake, IL 60164	Chief and Regional Planner attended stakeholder meetings to increase participation and discuss plan update
Metro-County Emergency Management Coordinators Monthly Meeting	June 07, 2019	MABAS Readiness Center 233 W Hintz Rd, Wheeling, IL 60090	Cook County DHSEM, Executive Director William Barnes and Gene Ryan attended the Metro-County Emergency Management Coordinators Monthly Meeting.
Border Municipality Email Outreach	June 19, 2019	Email Chain	Regional Planner sent email to all municipalities sharing area with both Cook and neighboring County, confirming participation in 2019 Update.

Steger Multi-County Flood Response Meeting	July 10, 2019	Village of Steger, IL	Cook County DHSEM partnered with Will County to support the citizens of the Village of Steger with facilitating a needs assessment following recent flooding. Village stakeholders were given access to both counties as part of this multi- county hazard mitigation effort.

Neighboring Counties—The following counties were invited to participate in the plan development process and were kept apprised of plan development milestones. They are: Lake County, IL; Will County, IL; DuPage County, IL; McHenry County, IL; and Kane County, IL.

DHSEM routinely briefed the Metro-County Emergency Management Coordinators Monthly Meeting on Cook County's ongoing update to its Multi-Jurisdictional Hazard Mitigation Plan (MJ-HMP).

Additional Neighboring Community Participation

Person Participating	Neighboring Jurisdiction	Organization	Participation Description
John Arie, Chief of Police	Lake County, IL	Barrington Police Department	Chief Arie is participating in both the Lake and Cook County HMP Updates.
Kali Thomas, Planning Coordinator	DuPage County, IL	DuPage County OHSEM	Kali indicated which communities had participated in the 2018 Update to DuPage County's HMP.
Michael McGuigan, EMA	Lake County, IL	Bartlett Emergency Management Agency	Michael McGuigan is participating in both the Lake and Cook County HMP Updates.

Border Municipality Outreach and Integration:

The Planning Team determined twenty-two (22) municipalities sharing a border – border municipality – with Cook County and one or more other counties. These counties include DuPage, Kane, Lake, McHenry and Will.

In the 2014 HMP, four border municipalities participated in the Cook HMP and another County HMP; one border municipality participated in the Cook HMP.

The Planning Team asked the Federal Emergency Management Agency (FEMA) and the Illinois Emergency Management Agency (IEMA) for guidance on how to: maximize mitigation planning and project opportunities for the border municipalities; and increase plan coordination and integration between counties and municipalities.

The FEMA/IEMA guidance and recommendation is centered on three primary concepts:

1. The general rule is the municipality should participate in the HMP of the county containing most of the municipality geographically.
2. However, if a county is a sub-applicant for HMA grants, and the work was occurring in the community, the community will need to participate and adopt the HMP of the county that is the sub-applicant. For example, Bartlett is in Cook County, DuPage County and Kane County. The majority of Bartlett is in Cook County, so if Bartlett were a sub-applicant and participated in the Cook County HMP and the HMP was current, Bartlett would meet the planning requirement. If Kane County were the sub-applicant for a mitigation project where the project location was in Bartlett, then Bartlett would need to have participated in and adopted the Kane County HMP.
3. Counties, with border municipalities, should collaborate to ensure each municipality is ideally participating in multiple county plans and importantly, as a minimum, ensure each municipality is actively participating in at least one county mitigation plan and/or program.

Stated simply, a border municipality participating in each appropriate county mitigation plan has a greater degree of coverage and potential opportunities than staying in one plan.

Based on the guidance from FEMA/IEMA, the Planning Team decided the most comprehensive approach for a border municipality was to recommend and encourage each municipality to participate in all appropriate county mitigation planning. This includes municipalities already participating in the Cook County 2014 HMP and the 2019 MJ-HMP Update. In the development of the 2019 MJ-HMP the Planning Team did increase the number of border municipality multi-county participation from five to eight.

Cook County, once the 2019 MJ-HMP is complete, has committed to moving from a relatively static mitigation plan to a Mitigation Program. As part of the Mitigation Program, during the annual review and update process, Cook County will continue to promote and encourage the border counties and municipalities to participate in all appropriate mitigation planning and programs. This inter-county coordination will provide municipalities with more and simplified mitigation funding opportunities.

No	Jurisdiction Name	Cook County Region	Counties	2014/16/18 Cook Plan Participation	2019 Cook Plan Participation	County Plan Participation	Cook County Jurisdictional KMS	DuPage County Municipal KMS
1	Barrington	North Region	Cook and Lake	No	Yes	Lake 2017 Cook 2019	https://barrington.isc-cemp.com/	
2	Barrington Hills	North Region	Cook, Kane, Lake and McHenry	No	No	Lake 2017	https://barringtonhills.isc-cemp.com/	
3	Bartlett	North Region	Cook, DuPage and Lake	No	Yes	DuPage 2018 Cook 2019	https://ccdhsem-bartlett.isc-cemp.com	https://bartlett.isc-cemp.com
4	Bensenville	Central Region	Cook and DuPage	No	No	DuPage 2018	https://ccdhsem-bensenville.isc-cemp.com	https://bensenville.isc-cemp.com
5	Buffalo Grove	North Region	Cook and Lake	No	No	Lake 2017	https://buffalo.isc-cemp.com	
6	Burr Ridge	Central Region	Cook and DuPage	No	No	DuPage 2018	https://ccdhsem-burrridge.isc-cemp.com	https://burrridge.isc-cemp.com
7	Deerfield	North Region	Cook and Lake	No	No	Lake 2017	https://deerfield.isc-cemp.com/	
8	Deer Park	North Region	Cook and Lake	No	No	Lake 2017	https://deerpark.isc-cemp.com/	
9	East Dundee	North Region	Cook and Kane	No	No	Kane 2015	https://eastdundee.isc-cemp.com/	
10	Elgin	North Region	Cook and Kane	No	No	Kane 2015	https://elgin.isc-cemp.com	
11	Elk Grove Village	North Region	Cook, DuPage and Lake	Yes	Yes	DuPage 2018 Cook 2019	https://ccdhsem-elkgrove.isc-cemp.com	Not currently available

12	Elmhurst	Central Region	Cook and DuPage	No	No	DuPage 2018	https://ccdhsem-elmhurst.isc-cemp.com	https://elmhurst.isc-cemp.com
13	Frankfort	South Region	Cook and Will	No	No	Will County 2013	Not currently available	
14	Hanover Park	North Region	Cook and DuPage	Yes	Yes	DuPage 2018 Cook 2019	https://hanover.isc-cemp.com	https://hanoverpark.isc-cemp.com
15	Hinsdale	Central Region	Cook and DuPage	No	No	DuPage 2018	https://ccdhsem-hinsdale.isc-cemp.com	https://hinsdale.isc-cemp.com
16	Lemont	South Region	Cook, DuPage and Will	Yes	Yes	DuPage 2018 Cook 2019	https://lemont.isc-cemp.com/	Not currently available
17	Oak Brook	Central Region	Cook and DuPage	No	No	DuPage 2019	https://ccdhsem-oakbrook.isc-cemp.com	https://oakbrook.isc-cemp.com
18	Park Forest	South Region	Cook and Will	No	Yes	Will 2013 Cook 2019	https://parkforest.isc-cemp.com/	
19	Roselle	North Region	Cook and DuPage	No	No	DuPage 2018	https://ccdhsem-roselle.isc-cemp.com	https://roselle.isc-cemp.com
20	Steger	South Region	Cook and Will	Yes	Yes	Will 2013 Cook 2019	https://steger.isc-cemp.com/	
21	University Park	South Region	Cook and Will	No	Yes	Will County 2013 Cook 2019	https://universitypark.isc-cemp.com/	
22	Woodridge	South Region	Cook, DuPage and Will	Yes	No	DuPage 2018	Not currently available	https://woodridge.isc-cemp.com/

The following letter was sent to neighboring county EMAs:

On June 7, 2019, DHSEM Chief of Planning Gene Ryan and I briefed the Metro-County Emergency Management Coordinators Monthly Meeting on Cook County's ongoing update to its Multi-Jurisdictional Hazard Mitigation Plan (MJ-HMP). During the briefing, we identified those municipalities which share areas/borders with both Cook County and your jurisdiction. As we explained, FEMA and IEMA now recognize the importance of a municipality's participation in the HMP of each County in which it resides. Take, for example, the Village of Steger which straddles the Cook/Will border and recently experienced highly localized but very destructive flooding. Steger is a participant in, and adopted, the Cook 2014 HMP. The Village also participated in the Will County HMP but failed to adopt it. As such, were the municipality to qualify for federal disaster funding, only half of the Village would be covered.

During Cook County's 2019 MJ-HMP Update Process, our outreach to the border municipalities achieved some hard-won success. Please review the attached Cook County 2019 MJ-HMP Update – Cook, DuPage, Kane, McHenry and Lake Shared Border Status Report. The attached report will be a part of our 2019 MJ-HMP submission to IEMA/FEMA.

The concept of the report, and its importance is to ensure that every border municipality is, at least, included in one County HMP and, ideally, the HMP for every County in which it resides for this year and/or subsequent years (through the HMP update process).

Cook County wants to continue this important process in the following years as we develop our mitigation plan into a mitigation program. To that end, we intend to strongly encourage all border municipalities to either join or continue with Cook County's 2019 MJ-HMP Update. We would appreciate your support in ensuring all border municipalities join all appropriate HMPs over the next few years.

Thank you, all, for your help in this very important initiative.

Regards,

Director William Barnes

Neighboring Communities and Adverse Impacts

One of the benefits of using the Online Planning System, and organizing jurisdictions by North, Central and South regions, was to ensure neighboring communities had full visibility of each other's mitigation initiatives. This was done to ensure synergies were identified, when applicable, and that mitigation actions in one community would not adversely impact another nearby community. During the mitigation workshops, community representatives were encouraged to collaborate with neighboring jurisdictions during the update and identification of new mitigation strategies.

Pre-Adoption Review—The agencies listed above, and the Steering Committee, were provided an opportunity to review and comment on this plan. Each agency was sent an e-mail message informing them that draft portions of the plan were available for review.

Local Jurisdiction Plan Participation

The following local jurisdictions and organizations/agencies throughout Cook County participated in the 2019 MJ-HMP:

- North Region Municipalities: 30
- Central Region Municipalities: 35
- South Region Municipalities: 56
- City of Chicago Organizations and Departments: 17
- Cook County Departments and Organizations: 5

Local Planning Team activities included the following below. Each region in the corresponding subsections (i.e. North Region Participation, Central Region Participation, etc.) indicates the level of participation by each jurisdiction. This section explains, in greater detail, the key activities and supporting documentation. More information about each of these activities is also provided in the following section: Plan Participation Validation

2016 Annual Report Update

In 2016, Cook County DHSEM requested all participating jurisdictions of the 2014 Cook County MJ-HMP to submit a 2016 Annual Report Update, which included any new hazards, status on their mitigation efforts, and any new mitigation projects. In total, 115 jurisdictions provided an update.

2018 Annual Report Update

In 2018, Cook County DHSEM requested all participating jurisdictions of the 2014 Cook County MJ-HMP to submit a 2018 Annual Report Update, which included any new hazards, status on their mitigation efforts, and any new mitigation projects. In total, 112 jurisdictions provided an update. 2018 Annual Reports can be found here: 2018 Annual Reports

Participation in the 2018 Annual Report was a key activity in initiating the 2019 Cook County MJ-HMP Update.

2019 Letter of Intent

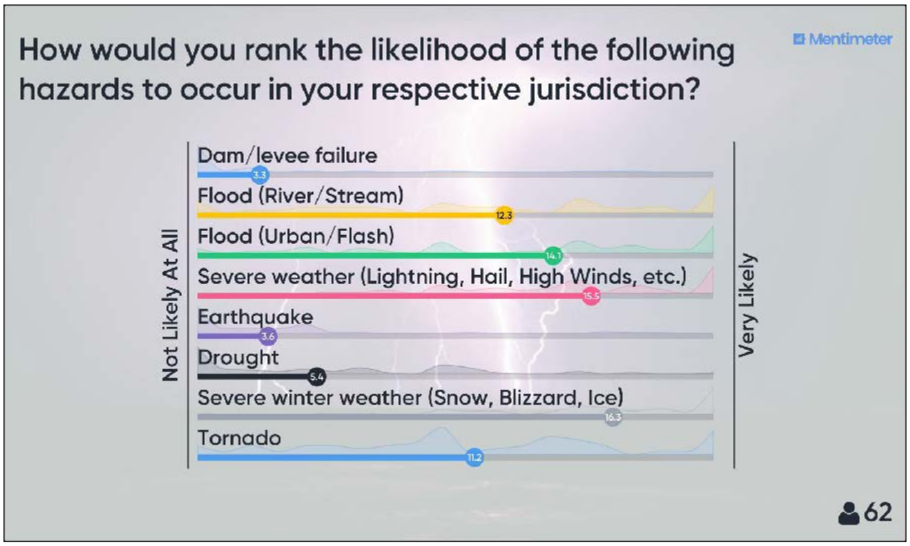
Starting in 2018, Cook County DHSEM requested all jurisdictions in Cook County to submit a Letter of Intent, demonstrating their commitment to being part of the 2019 MJ-HMP. In total, 115 jurisdictions provided a signed Letter of Intent.

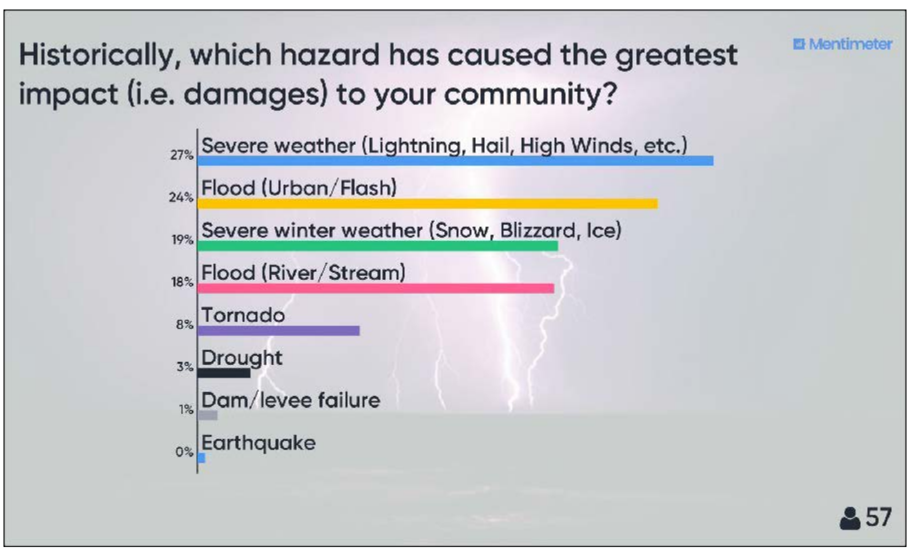
Mitigation Orientation Webinar

A series of webinars to introduce the mitigation planning process to local officials was conducted. In total, nine (9) webinars were conducted over a one-week period, including morning, afternoon, evening and weekend webinars. Of the 121 participating jurisdictions, 92 jurisdictions (including Cook County Departments and Organizations) attended at least one webinar session.

Regional Mitigation Meeting/Workshops

Six (6) workshops were strategically held throughout Cook County to identify hazards and update and consider new mitigation strategies. A total of 112 participating jurisdictions (including City of Chicago Departments and Cook County Departments and Organizations) were able to attend at least one of the workshops. Workshop topics and activities helped participants integrate and consider input from the public regarding key hazards of concerns and potential mitigation strategies. This was done by sharing results from the mitigation survey that was made available to county residents. Tools, such as Mentimeter, which is a real-time and interactive polling software, allowed participants to be fully engaged and provide necessary feedback and validation on hazard risks and mitigation priorities. It also allowed the Planning Team to compare results across the various regions within the County.





As Needed Local Outreach Meetings

The Planning Team worked with individual jurisdictions and planning partners in order to provide one-on-one guidance and support. Local outreach meetings occurred on an as-needed basis.

Community Mitigation Survey Participation

In order to ensure the public had an opportunity to influence the mitigation plan update process, a county-wide survey was conducted. More information about the survey is included here: Community Mitigation Survey Participation

2019 Municipal HMP Annex

As part of the 2019 MJ-HMP update, all participating jurisdictions and planning partners were required to create and/or update their respective Municipal HMP Annex. 2019 Municipal HMP Annexes can be found here: 2019 Municipal HMP Annex. Each municipal annex included the following information:

- Hazard Mitigation Plan Point of Contact
- Jurisdiction Profile
- Capability Assessment
- Jurisdiction-Specific Natural Hazard Event History
- Hazard Risk Ranking
- Hazard Mitigation Actions
- Future Needs to Better Understand Risk/Vulnerability
- Additional Comments

- HAZUS-MH Risk Assessment Results
- Hazard Mapping

New Mitigation Actions

Each participating jurisdiction was required to consider and submit at least one new mitigation action as part of the 2019 MJ-HMP. New mitigation actions are documented in each respective Municipal HMP Annex.

2019 MJ-HMP and Municipal Annex Review and Approval

As part of the draft review and approval process, each participating jurisdiction was asked to review the 2019 MJ-HMP and their respective Municipal Annex. Jurisdictions were able to provide their approval, or any additional changes/improvements, by utilizing the online planning system's "Comment" tool.

Online Planning System

The Online Planning System (https://cookcountydhsem.isc-cemp.com), Cook County DHSEM Knowledge Management System (KMS), gave members of the Steering Committee and Local Planning Team access to 2014 MJ-HMP and 2019 MJ-HMP Update resources, including documents and forms, instructions and examples, and contact for Project Team members. In addition, the Online Planning System featured real-time access to the Plan and comment functionality. The former provided users with immediate access to 2014 MJ-HMP and 2019 MJ-HMP Updates resources--including documents, forms, instructions, and examples. Crucially, the latter provided users the ability to directly interact with Project Team members, encouraging engagement throughout the planning process and collaboration. The comment function was intuitive, allowing users to quickly acclimate to the system:

To make a comment, users were instructed to click on the Comment link on the bottom of the content page and a pop-up box would appear. The person used the drop-down box to designate whether the comment was a Feedback or an Observation. After entering the comment, they clicked the Send Comments button to submit.

- The comments tool allowed the user to make comments on any page within the manual and mark the comment as an observation or feedback
- The comments for pages were visible to all administrators and users who had editing privileges for the specific page.
- The comment would appear after the page refreshes (if user is allowed to view comments). An email notification was sent to users who were designated to receive comment notification.

The jurisdictions listed in the table below were represented by one or more municipal officials. Representatives not only attended the meetings, but also participated by gathering appropriate data and historical information, completed the community preparedness survey, participated in their community hazard analysis, identified new mitigation strategies, updated past mitigation strategies, and participated in other efforts (i.e. webinars, phone interviews, and reviewing drafts).

Local mitigation planning team representatives and their contact information and the documentation of participation in the Plan update are available in Volume 2 .

Plan Participation Validation[1]

Appendix B: Plan Process and Development Documentation provides the necessary detail and documentation of the various plan development activities that took place during the update of the 2019 Cook County MJ-HMP.

The appendix details plan participation validation for local jurisdictions. In accordance with best practices as outlined in CPG 101, Cook County DHSEM and its partners embraced the whole community approach throughout the 2019 MJ-HMP Update process, involving civic leaders, community representatives and organizations, and the general public. Understanding that critical infrastructure and key resources (CIKR), as well as public opinion and hazard likeliness, can dramatically change in a five-year period, the DHSEM and its partners leveraged in-person, on-site outreach opportunities to educate stakeholders and collect and validate the information. To support the 2019 MJ-HMP Update process, the following were facilitated for jurisdiction leaders and POCs:

- Annual Report Participation
- Letters of Intent
- Local Government Meetings
- Webinars
- Hazard Mitigation Planning Workshops

[1] Personal contact information has been removed to protect individual privacy.

Review of Existing Plans and Programs

Hazard mitigation planning must include review and incorporation, if appropriate, of existing plans, studies, reports and technical information (44 CFR, Section 201.6(b)(3)). Chapter 4: Cook County Profile provides a review of laws and ordinances in effect within the planning area that can affect hazard mitigation actions. In addition, the following programs can affect mitigation within the planning area:

- The 2018 Illinois Natural Hazard Mitigation Plan
- Hazard mitigation plans for the adjacent counties of Lake, DuPage, and Will
- The Cook County Stormwater Management Plan and 2018 Annual Report (developed by the Metropolitan Water Reclamation District of Greater Chicago)
- The Cook County Watershed Management Ordinance
- Six detailed watershed plans developed by the Metropolitan Water Reclamation District of Greater Chicago (Lower Des Plaines, Poplar Creek, Upper Salt Creek, Little Calumet River, Cal-Sag Channel, and the Chicago River, North Branch)
- 2016-2019 Cook County Consolidated Plan
- Cook County's 2014 Community Development Block Grant Disaster Recovery Action Plan (including Substantial Amendment 5 in 2017)
- Next Century Conservation Plan for the Forest Preserve District of Cook County.
- Transition Report Mayor Lori E. Lightfoot (2019)

An assessment of all planning partners' regulatory, technical, and financial capabilities to implement hazard mitigation actions is presented in the individual jurisdiction-specific annexes in Volume 2. Many of these relevant plans, studies and regulations are cited in these capability assessments.

Updates of Prior Plans

Cook County completed its initial MJ-HMP in 2014. Integrated Solutions Consulting and the planning team reviewed the 2014 plan prior to beginning this five-year update process for 2019.

Public Involvement

Broad public participation in the planning process helps ensure that diverse points of view about the planning area's needs are considered and addressed. The public must have opportunities to comment on disaster mitigation plans during the drafting stages and prior to plan approval (44 CFR, Section 201.6(b)(1)). The Community Rating System (CRS) expands on these requirements by making CRS credits available for optional public involvement activities. The Cook County DHSEM with partners Integrated Solutions Consulting, Inc. (ISC), and the Metropolitan Water Reclamation District (MWRD) engaged Cook County stakeholders and its citizens prior to and throughout the 2019 MJ-HMP Update process. Per Federal Emergency Management Agency (FEMA) *Comprehensive Preparedness Guide 101* (CPG 101) guidance, our public outreach efforts encompassed all 135 jurisdictions, leveraging our expertise to educate the population and engage them in developing new mitigation actions. The following section details our public outreach strategy, including a combination of in-person and virtual methods.

Public Involvement Strategy & Activities

In accordance with best practices as outlined in CPG 101, this public-private effort engaged the whole community, reaching citizens and key stakeholders across all 135 jurisdictions. Elements of virtual public outreach included the 2019 Cook County Preparedness Survey, local government meetings, social media, such as Twitter and Nextdoor, and hazard mitigation plan public meetings. The physical component of the outreach efforts focused on maximizing attendance at hazard mitigation meetings.

Appendix C: Public Participation Documentation details the specific activities and results from the Planning Team's public outreach efforts.

2019 Cook County Community Preparedness Survey

An integral component of the 2014 MJ-HMP public involvement strategy was the use of a questionnaire. To engage the whole community in the 2019 MJ-HMP Update process, DHSEM and ISC developed the 2019 Cook County Community Preparedness Survey to engage the general public by providing information on the update process while collecting and validating information from citizens throughout all 135 jurisdictions. The 37-question web-based tool was used to gauge household preparedness for natural hazards and the public's knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. The results of the survey were used by the Steering Committee guide them in developing objectives and mitigation strategies.

The survey was accessible to the public from May 20, 2019 to June 21, 2019 via multiple websites, including the City of Chicago Office of Emergency Management and Communications (OEMC) website. In addition, a link to the survey was disseminated through various social media platforms, local government websites, and press releases (see Survey Outreach). As emphasized in the National Response Framework (NRF), resilient communities are borne out of prepared individuals and strong leadership across governments, agencies, and businesses. Accordingly, the survey gauged the community's overall resiliency by collecting thousands of responses from respondents that represent the diverse backgrounds of the County.

Over 6,532 responses were collected during the 2019 MJ-HMP Update, more than tripling the previous response rate of over 1,800 from the 2014 MJ-HMP survey. A copy of the survey, as well as a summary of results, is presented in 2019 Cook County Community Preparedness Survey Results. One specific outreach effort via Nextdoor garnered over 30,000 views.

2019 Cook County Community Preparedness Survey

Instructions

To Whom It May Concern:

Cook County is conducting a study to better understand the preparedness needs and risk perceptions of its residents as part of the County's Multi-Jurisdictional 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.

Survey Completion Date
Please complete the survey by June 21, 2019.

CONTACT US
If you have any questions, please contact:

Kimberly Nowicki, MScTRM, IPEM
Regional Planner
Cook County Department of Homeland Security & Emergency Management
Email: kimberly.nowicki@cookcountyil.gov

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.
Thank you for your participation.

Figure: 2019 Cook County Community Preparedness Survey

City of Chicago | Mayor Lori E. Lightfoot

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June 4, 2019

Community Preparedness Public Survey

As part of the 2019 Cook County Hazard Mitigation Plan, OEMC's partners at Cook County Department of Homeland Security & Emergency Management have released a Community Preparedness Survey for public feedback. Please take a few minutes to provide your input!

https://www.surveygizmo.com/s3/4967566/2019-Cook-County-Community-Preparedness-Survey-copy?fbclid=IwAR19nhKQH5fSo3L857AOH_tV5gr7FGY07jHDS953L5L5P9dA4fuPj51cm30

Figure: City of Chicago OEMC - June 4, 2019 Community Preparedness Survey ([Survey Page])

2019 Hazard Mitigation Plan Meetings

Cook County DHSEM, with the help of ISC and MWRD, facilitated four successful public meetings across the North, South, and Central regions of the County. These public meetings were divided into two series: The Hazard Mitigation Plan Process and the 2019 Cook County MJ-HMP Update Draft Review.

Hazard Mitigation Plan Public Meetings, Series I

The first series of public meetings focused on educating the public on what hazard mitigation is, what it means, and how to work together to create a more resilient community. This included formal presentations, interactive group discussions, and defining new mitigation actions within each participants' respective jurisdiction.

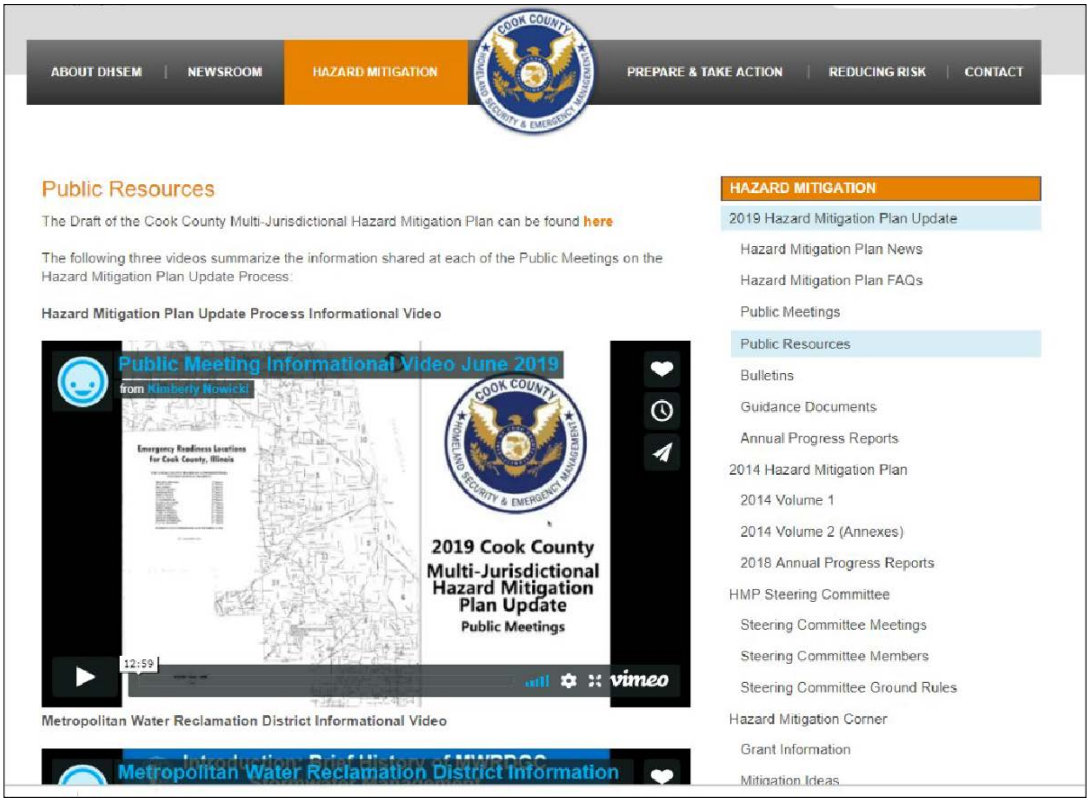
Hazard Mitigation Plan Public Meetings, Series II

Whereas the first series of the Hazard Mitigation Plan Public Meetings focused on educating and collecting information from the public, the second series of the meetings focused on reviewing the 2019 MJ-HMP Update draft with community members of participating municipalities.

2019 Hazard Mitigation Plan Web site and Draft

A web site dedicated specifically for hazard mitigation was developed so the public would have continual access to the hazard mitigation plan process and subsequent updates. Videos of public meetings were hosted on the website, as well as bulletins, fact sheets, a draft of the 2019 MJ-HMP, and mitigation success stories. The website will be maintained to ensure the public has continual engagement and input on new and ongoing mitigation strategies.

Website: https://www.cookcountyhomelandsecurity.org/hmp-faqs



Appendix C: Public Participation Documentation details the specific activities and results from the Planning Team's public outreach efforts.

Plan Development Chronology/Milestones

The table below summarizes important milestones in the 2019 update of the Cook County MJ-HMP.

Plan Development Milestones			
Date	**Event**	**Description (meeting objectives)**	**Attendance**
2014			
2014	Submit and Adopt the 2014 Cook County MJ- HMP		N/A
2015			
2016			
2016	Annual Reports submitted for the Cook County MJ- HMP		N/A
2017			
2018			
2018	Annual Reports submitted for the Cook County MJ-HMP		N/A
2018	Letters of Intent submitted by planning partners		N/A
2019			
2019	Update the 2019 Cook County MJ-HMP		N/A
July 15, 2019	Submit the 2019 Cook County MJ-HMP		N/A

Part 2. Risk Assessment

The goal of mitigation is to reduce the future impacts of a hazard including loss of life, injury or disability, property damage, disruption to local and regional economies, and the expenditure of public and private funds for recovery. Sound mitigation must be based on a sound risk assessment. A risk assessment involves quantifying the potential loss resulting from a disaster by assessing the vulnerability of buildings, infrastructure, and people.

Chapter 3. Identified Hazards of Concern and Risk Assessment Methodology

Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards. It allows emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. The process focuses on the following elements:

- Identify hazards—Use all available information to determine what types of disasters may affect a jurisdiction, how often they can occur, and their potential severity.
- Assess vulnerability—Determine the impact of natural hazard events on the people, property, environment, economy, and lands of the region.
- Estimate cost—Estimate the cost of potential damage that could be avoided by mitigation.

The risk assessment for this hazard mitigation plan evaluates the risk of natural hazards prevalent in the planning area and meets requirements of the DMA (44 CFR, Section 201.6(c)(2)).

Identified Hazards of Concern

For this plan, the Steering Committee considered the full range of natural hazards that could impact the planning area and then listed hazards that present the greatest concern. The process incorporated review of state and local hazard planning documents, as well as information on the frequency, magnitude, and costs associated with hazards that have impacted or could impact the planning area. Anecdotal information regarding natural hazards and the perceived vulnerability of the planning area's assets to them was also used. Based on the review, this plan addresses the following hazards of concern:

- Dam/levee failure
- Drought
- Earthquake
- Flood
- Severe weather
- Severe winter weather
- Tornado

Except for dam/levee failure, this plan assesses only natural hazards. However, Chapter 13 provides a qualitative discussion of the following technological and human-caused hazards of interest:

- Epidemic or pandemic

- Nuclear power plant incident
- Secondary impacts from the mass influx of evacuees
- Widespread power outage
- Hazardous material incident
- Coastal Erosion

Per FEMA's mandate to address all natural hazards, the following natural hazards were not included because these hazards do not directly impact Cook County. They are:

- Avalanche
- Hurricane
- Sea Level Rise
- Storm Surge
- Tsunami

Climate Change

This hazard mitigation plan addresses climate change as a secondary impact of natural hazards. A qualitative discussion of climate change and its potential impact on natural hazard risks is provided in Chapter 5. While many models are currently being developed to assess the potential impacts of climate change, there are currently none available to support hazard mitigation planning. As these models are developed in the future, this risk assessment may be enhanced to better measure these impacts.

Methodology

The risk assessments in Chapter 6 through Chapter 12 describe the risks associated with each identified hazard of concern. Each chapter describes the hazard, the planning area's vulnerabilities, and probable event scenarios. The following steps were used to define the risk of each hazard:

- **Identify and profile each hazard**—The following information is given for each hazard:
  - General background of the hazard
  - Geographic areas most affected by the hazard
  - Records of past events and frequency estimates
  - Severity and extent estimates
  - Warning time likely to be available for response
  - Possible secondary hazard events

- **Determine exposure to each hazard**—Exposure was determined by analyzing hazard maps, historical occurrences, and an inventory of structures, facilities, and systems to determine which of them would be exposed to each hazard.
- **Assess the vulnerability of exposed facilities**—Vulnerability of exposed structures and infrastructure was determined by interpreting the probability of occurrence of each event and assessing structures, facilities, and systems that are exposed to each hazard. Tools such as GIS and FEMA's hazard-modeling program called Hazus-MH were used to perform this assessment for the flood, dam failure, and earthquake hazards. Outputs similar to those from Hazus were generated for other hazards, using maps generated by the Hazus program.

Risk Assessment Tools

This section addresses the various tools and methodologies utilized as part of the 2019 MJ-HMP update of the Risk Assessment.

Mapping

A review of national, state and county databases were performed to locate available spatially based data relevant to this planning effort. Maps were produced, as needed during the 2019 Cook County MJ-HMP update, using GIS software to show the spatial extent and location of identified hazards when such data was available. These maps are included in the hazard profile chapters of this document. Information regarding the data sources and methodologies employed in these mapping efforts is located in Appendix D.

Dam Failure, Earthquake and Flood—Hazus-MH

Overview

In 1997, FEMA developed the Hazards U.S., or Hazus, model to estimate losses caused by earthquakes and identify areas that face the highest potential for loss. Hazus was later expanded into a multi-hazard methodology, Hazus-MH, with new models for estimating potential losses from hurricanes and floods.

Hazus-MH is a GIS-based program used for risk assessments, mitigation planning, and emergency planning and response. It provides a wide range of inventory data, such as demographics, building stock, critical facility, transportation, and utility lifeline, and multiple models to estimate potential losses from natural disasters. The program maps and displays hazard data and the results of damage and economic loss estimates for buildings and infrastructure. Its advantages include the following:

Provides a consistent methodology for assessing risk across geographic and political entities.

- Provides a way to save data so that it can readily be updated as population, inventory, and other factors change and as mitigation planning efforts evolve.
- Facilitates the review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.
- Supports grant applications by calculating benefits using FEMA definitions and terminology.

- Produces hazard data and loss estimates that can be used in communication with local stakeholders.
- Is administered by the local government and can be used to manage and update a hazard mitigation plan throughout its implementation.

Levels of Detail for Evaluation

Hazus-MH provides default data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. The model can carry out three levels of analysis, depending on the format and level of detail of information about the planning area:

- **Level 1**—All of the information needed to produce an estimate of losses is included in the software's default data. This data is derived from national databases and describes in general terms the characteristic parameters of the planning area.
- **Level 2**—More accurate estimates of losses require more detailed information about the planning area. To produce Level 2 estimates of losses, detailed information is required about local geology, hydrology, hydraulics, and building inventory, as well as data about utilities and critical facilities. This information is needed in a GIS format.
- **Level 3**—This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the planning area.

Application for This Plan Update

The following methods were used to assess specific hazards for this plan:

- **Flood**—A Level 2, user-defined analysis was performed for both general building stock and critical facilities in 2014. GIS parcel/address and assessor data (replacement cost values and detailed structure information) from Cook County were loaded into Hazus-MH to update the general building stock data. An updated critical facilities inventory was used in place of the Hazus-MH defaults for essential facilities, transportation, and utilities. Current Cook County digital flood insurance rate maps (DFIRMs) were used to delineate flood hazard areas and estimate potential losses from the 10%, 1%- and 0.2%-year flood events (also referred to as the 10, 100 and 500-year flood events). Using the DFIRM floodplain boundaries and a countywide digital elevation model generated from Cook County 2008 Ortho Imagery Project LIDAR data, flood depth grids were generated for each flood event and integrated into the model. During the 2019 update, the Planning Team, in coordination with Cook County GIS, reassessed data and the availability of data to determine if a more robust analysis would result in outputs representing a significant change from 2014. Analyses, using the same methodology were conducted, resulting in little to no major changes. It was determined that future analyses need to incorporate municipal-level GIS inputs and further coordination with local GIS databases, as available. New analyses were conducted for jurisdictions participating for the first time in the Cook County MJ-HMP.

- **Dam Failure**—Dam failure inundation mapping for the planning area was collected where available. This data was imported into Hazus-MH and a modified Level 2 analysis was run using the flood methodology described above. During the 2019 update, the Planning Team, in coordination with Cook County GIS, reassessed data and the availability of data to determine if a more robust analysis would result in outputs representing a significant change from 2014. Analyses, using the same methodology were conducted, resulting in little to no major changes. It was determined that future analyses need to incorporate municipal-level GIS inputs and further coordination with local GIS databases, as available.

- **Earthquake**—A Level 2 analysis was performed to assess earthquake risk and exposure. Earthquake shake maps and probabilistic data prepared by the U.S. Geological Survey (USGS) were used for the analysis of this hazard. An updated general building stock inventory was developed using replacement cost values and detailed structure information from assessor tables. An updated inventory of essential facilities, transportation, and utility features was used in place of the Hazus-MH defaults. The standard Hazus analysis for the 1% and 0.2% probabilistic events was modeled, along with two scenario events:

Similar to the previous analyses for Flood and Dam Failure, during the 2019 update, the Planning Team, in coordination with Cook County GIS, reassessed data and the availability of data to determine if a more robust analysis would result in outputs representing a significant change from 2014. Analyses, using the same methodology were conducted, resulting in little to no major changes. It was determined that future analyses need to incorporate municipal-level GIS inputs and further coordination with local GIS databases, as available. New analyses were conducted for jurisdictions participating for the first time in the Cook County MJ-HMP.

- A Magnitude-7.1 scenario event on the Wabash Fault (Scenario Earthquake 1)

- A re-creation of the 1909 event that occurred 7 miles southwest of Lemont (Scenario Earthquake 2)

Tornado

A four-step approach was used to develop a probabilistic tornado analysis, as described below.

Step 1: Identify Historical Data

This step involved collecting tornado data for Cook County from the National Oceanic and Atmospheric Administration (NOAA). This data source identified 54 tornadoes from 1950 through 2018 that impacted Cook County (69 years). The magnitude of the identified tornadoes on the Enhanced Fujita Scale ranged from EF0 to EF4.

Step 2: Generate Statistics

Data collected for each tornado included location, width, length, Fujita scale rating, date, and damage. Of the tornado events classified as EF2 or above, the vast majority of them moved toward the northeast. Tornadoes can move erratically and touch down at several locations with different widths; however, to simplify the hazard generation model, tornadoes were assumed to move in a straight line with a constant width and wind speed. *Table: Tornado Data Analysis Results* shows a summary of the data for the identified events.

TABLE: TORNADO DATA ANALYSIS RESULTS						
Enhanced Fujita Scale	**Number of Events**	**Probability (% annual chance)**	**Total Length (miles)**	**Average Length (miles)**	**Width (feet)**	**Average Width (feet)**
EF0	16	23%	5.46	0.34	595	37
EF1	21	30%	60.36	2.87	1554	74
EF2	14	20%	39.5	2.82	1132	81
EF3	1	1%	9.2	9.2	200	200
EF4	2	3%	18.3	9.15	1960	980
Total	**54**	**77% annual chance of at least 1 tornado**	**192.62 miles**	**2.46 miles**	**5441 feet**	**101 feet**

Tornado probabilities for Cook County were calculated based on the number of events of a particular magnitude over a 69-year period. No EF5 events were recorded over that time period. *Table: Tornado Probability Summary* compares the probability of each magnitude of event in Cook County compared to the nationwide probability. These statistics were used to help create the simulated storm events for each municipality in Step 4.

TABLE: TORNADO PROBABILITY SUMMARY						
	Probability (% annual chance of occurrence)					
	EF0	**EF1**	**EF2**	**EF3**	**EF4**	**EF5**
Nationwide	38.9%	35.6%	19.4%	4.9%	1.1%	0.1%
Cook County	23%	30%	20%	1%	3%	N/A

Step 3: Develop Damage Curves

To generate damage curves, detailed damage assessments were identified and analyzed, including assessments for the two EF4 events. An EF5 event outside the study region was used to supplement the Cook County damage assessments: the 1996 Oakfield tornado in Wisconsin. The damage assessments provided data on the location of the tornado, wind speeds, width, and damage, including the number of buildings damaged and amount of damage. The tornado location was mapped using the damage assessment document and overlaid onto a historical aerial photo to identify how many structures were there at the time of the event (exposure). The damage assessment identified which structures were damaged or destroyed and at what magnitude. The County's tax assessor database was used to calculate exposure values, and those values were converted to the appropriate year. For example, the 1967 Oak Lawn tornado damage values were compared to the 1967 exposure values by converting the 2013 values provided by the County into 1967 values.

Step 4: Model 1-Percent-Annual-Chance and 0.2-Percent-Annual-Chance Events and Calculate Losses

This step involved using the historical tornado data and the probability statistics associated with them to simulate 60,000 years of tornadoes. Since, on average, the county experiences one tornado a year, this represents nearly 60,000 tornado events. The length, width, starting point, direction, and ending point were simulated based on historical characteristics (e.g. there was a 96-percent chance each tornado would move northeast).

The tornado impact area was mapped for each simulated storm, and losses were determined using the individual structures in the impact area and the loss ratios developed in Step 3. The losses for these simulated events were analyzed for each jurisdiction to determine the loss from the 1-percent-annual-chance and 0.2-percent-annual-chance (usually EF4 and EF5) events. This methodology is similar to that used by the Hazus-MH hurricane model.

During the 2019 update, the Planning Team, in coordination with Cook County GIS, reassessed data and the availability of data to determine if a more robust analysis would result in outputs representing a significant change from 2014. Analyses, using the same methodology were conducted, resulting in little to no major changes. It was determined that future analyses need to incorporate municipal-level GIS inputs and further coordination with local GIS databases, as available. New analyses were conducted for jurisdictions participating for the first time in the Cook County MJ-HMP.

Severe Weather and Severe Winter Weather

Similar to 2014, historical data was not adequate to model future losses for severe weather and severe winter weather. A qualitative analysis was conducted using the best available data and professional judgment. Locally relevant information was gathered from a variety of sources. Frequency and severity indicators include past events and the expert opinions of emergency management specialists and others. The primary data source was the Cook County GIS database, augmented with state and federal data sets. Additional severe weather data was downloaded from the Natural Resources Conservation Service and the National Climatic Data Center.

Drought

The risk assessment methodologies used for this plan focus on damage to structures. Because drought does not impact structures, the risk assessment for drought was more limited and qualitative than the assessment for the other hazards of concern.

Uncertainties

Loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct a study
- Incomplete or outdated inventory, demographic or economic parameter data
- The unique nature, geographic extent, and severity of each hazard
- Mitigation measures already employed
- The amount of advance notice residents have to prepare for a specific hazard event.

These factors can affect loss estimates by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. The results do not predict precise results and should be used only to understand relative risk. Over the long term, Cook County and its planning partners will collect additional data to assist in estimating potential losses associated with other hazards.

Future analyses need to incorporate municipal-level GIS inputs and further coordination with local GIS databases and end-users, as available.

Planning Area Regions

The hazard profiles in this plan assess the planning area by region (North, Central, and South). The risk exposure and vulnerability analyses list results by these regions. The jurisdictions in each region are listed in *Table: Jurisdictions by Region*. Individual results for each planning partner are shown in the jurisdictional annexes in Volume 2. The jurisdictions not participating in the 2019 MJ-HMP are border jurisdictions and are part of other county mitigation plans.

TABLE: PLANNING PARTNERS
PLANNING PARTNERS COVERED BY THIS HAZARD MITIGATION PLAN

North	Central	South
Arlington Heights	Bellwood	Alsip
Barrington	Bensenville *(Not Participating in 2019 Cook County MJ- HMP)*	Bedford Park
Barrington Hills *(Not Participating in 2019 Cook County MJ-HMP)*	Berkeley	Blue Island
Bartlett	Berwyn	Bridgeview
Buffalo Grove *(Not Participating in 2019 Cook County MJ-HMP)*	Broadview	Burbank
Deerfield *(Not Participating in 2019 Cook County MJ- HMP)*	Brookfield	Burnham
Deer Park *(Not Participating in 2019 Cook County MJ-HMP)*	Burr Ridge *(Not Participating in 2019 Cook County MJ-HMP)*	Calumet City
Des Plaines	City of Chicago	Calumet Park
East Dundee *(Not Participating in 2019 Cook County MJ-HMP)*	Cicero	Chicago Heights
Elgin *(Not Participating in 2019 Cook County MJ-HMP)*	Countryside	Chicago Ridge
Elk Grove Village	Elmhurst *(Not Participating in 2019 Cook County MJ-HMP)*	Country Club Hills
Evanston	Elmwood Park	Crestwood

Glencoe	Forest Park	Dixmoor
Glenview	Forest View	Dolton
Golf	Franklin Park	East Hazel Crest
Hanover Park	Harwood Heights	Evergreen Park
Hoffman Estates	Hillside	Frankfort *(Not Participating in 2019 Cook County MJ-HMP)*
Inverness	Hinsdale *(Not Participating in 2019 Cook County MJ-HMP)*	Flossmoor
Kenilworth	Hodgkins	Ford Heights
Lincolnwood	Indian Head Park	Glenwood
Morton Grove	LaGrange	Harvey
Mount Prospect	LaGrange Park	Hazel Crest
Niles	Lyons	Hickory Hills
Northbrook	Maywood	Hometown
Northfield	McCook	Homewood
Palatine	Melrose Park	Justice
Park Ridge	Norridge	Lansing
Prospect Heights	Northlake	Lemont
Rolling Meadows	North Riverside	Lynwood
Roselle *(Not Participating in 2019 Cook County MJ-HMP)*	Oak Brook *(Not Participating in 2019 Cook County MJ-HMP)*	Markham
Schaumburg	Oak Park	Matteson
Skokie	River Forest	Merrionette Park
South Barrington	River Grove	Midlothian
Streamwood	Riverside	Oak Forest
Wheeling	Rosemont	Oak Lawn
Wilmette	Schiller Park	Olympia Fields
Winnetka	Stickney	Orland Hills
	Stone Park	Orland Park
	Summit	Palos Heights
	Westchester	Palos Hills
	Western Springs	Palos Park
		Park Forest
		Phoenix
		Posen
		Richton Park
		Riverdale
		Robbins
		Sauk Village
		South Chicago Heights
		South Holland

		Steger
		Thornton
		Tinley Park
		University Park
		Willow Springs
		Worth
		Woodridge *(Not Participating in 2019 Cook County MJ-HMP)*

Chapter 4. Cook County Profile

Cook County was created on January 15, 1831. The County is located in the upper northeastern section of the State of Illinois and has more than 800 local governmental units (Cook County Website).

Cook County is located in northeast Illinois on the western shore of Lake Michigan. It is the most populous of Illinois' 102 counties, with a 2013 estimated population of 5.24 million, 2018 estimate of 5.18 million, and 2019 estimate of 5.21 million, according to the U.S. Census Bureau and World Population Review. It is the sixth largest county in the state by area, covering 946 square miles. Cook County makes up approximately 40 percent of the population of Illinois. The surrounding counties are Lake and McHenry to the north, Kane, and DuPage to the west, and Will to the southwest. Lake Michigan is the county's eastern border.

Cook County is the second most populous county in the United States, after Los Angeles County ([World Population Review]()). According to the [Cook County Government Website](), the County contains 135 municipalities, covering about 85 percent of the area of the county. The remaining unincorporated areas are under the jurisdiction of the Cook County Board of Commissioners, a 17-member board elected by district ([Cook County Website]()).

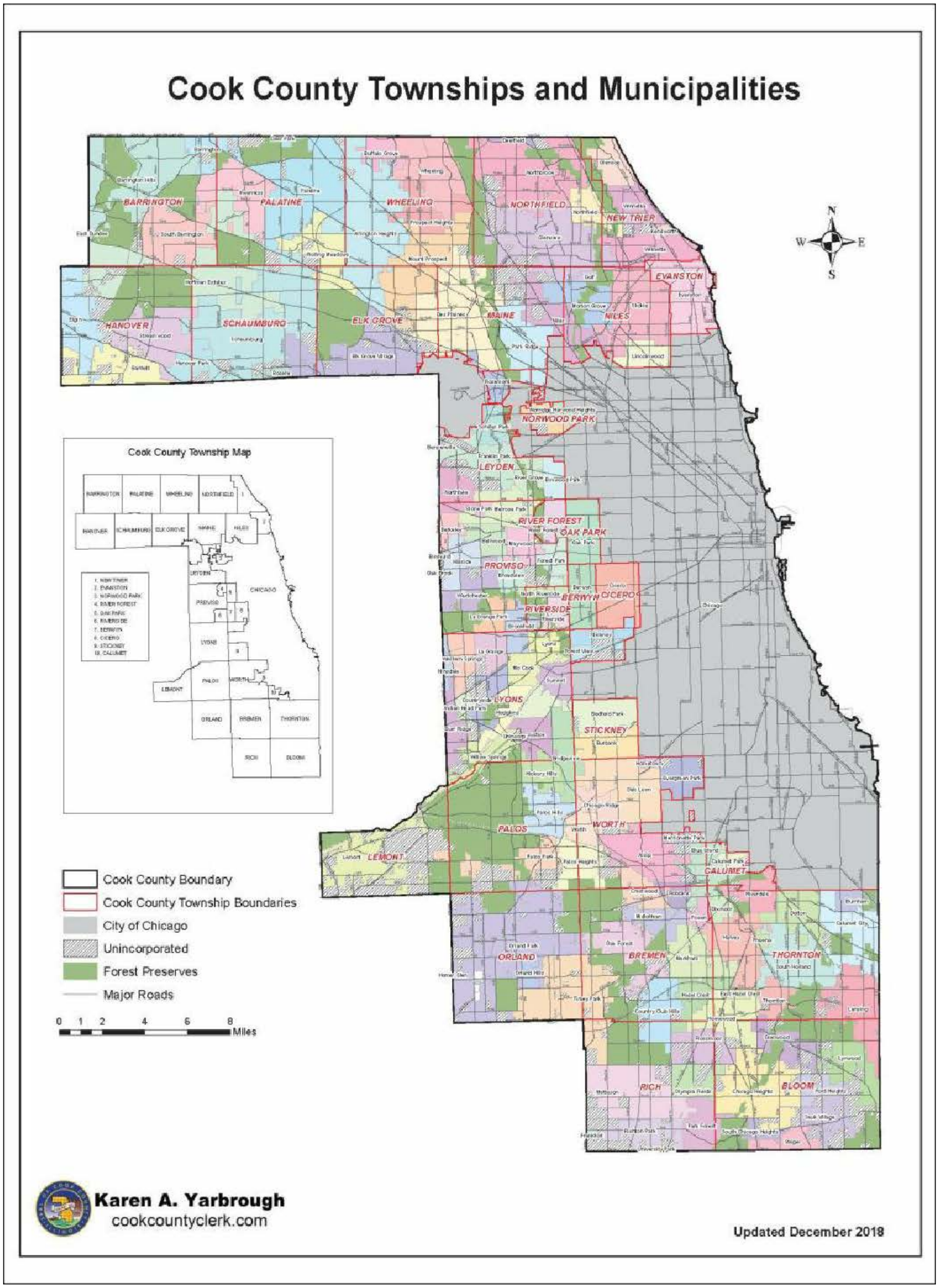


Figure: [Cook County with Municipalities]()

Jurisdictions and Attractions

The City of Chicago is the county seat. Based on Census Data, the 2018 estimated population size of Chicago is over 2.7 million. Given that the 2018 population estimate for the entire County was 5.18 million, the City of Chicago makes up more than half of the entire County's population. The land area of the City of Chicago covers roughly 24 percent of the county's area and is one the nation's top ten most populous cities, currently following only New York City and Los Angeles (US Census). The 135 municipalities in the county range in size from Chicago with over 2.7 million residents to small communities such as Thornton, Kenilworth, East Hazel Crest, East Dundee, and Phoenix with fewer than 3,000 residents. The most populous jurisdictions after Chicago are Elgin, Cicero, Arlington Heights, Evanston, Schaumburg, Palatine, and Skokie (Cook County Government Website Open Data).

In 1914, Cook County was the first place to create a forest preserve. The Forest Preserve District of Cook County, with nearly 70,000 acres, is the largest forest preserve district in the United States and receives an estimated 62 million visitors each year (Forest Preserve District of Cook County, 2019). Other major attractions in the Cook County area include the Lincoln Park Zoo, Brookfield Zoo, Lake Michigan beaches, Chicago's Museum Campus, and the Chicago Botanic Garden.

Historical Overview

Cook County was established as Illinois' 54th county on January 15, 1831, around the site of the Fort Dearborn settlement at the mouth of the Chicago River. The county was named after Daniel Pope Cook, an early Illinois political figure. Cook County elected its first officials on May 7, 1831. (Cook County, 2013). The following history of subsequent county growth is summarized from the Chicago Historical Society (Chicago Historical Society, 2013):

- When the county was organized in 1831 with approximately 100 residents in 2,464 square miles, it encompassed much of today's Lake, DuPage, Will, McHenry, and Cook counties. By 1839, it had reduced in area to its current boundaries and had expanded to a population of over 4,000.
- The 1830s and 1840s were dominated in the county by agriculture. Chicago, Wheeling, Gross Point, Lyons, Summit, Brighton, Willow Springs, Calumet, Blue Island, and Thornton were agricultural centers, serving farmers with stores, churches, and schools.
- In 1848, Cook County subdivided into 27 townships, which took on some of the county responsibilities: collecting taxes, running schools, supervising elections, and maintaining local roads.
- Urban development spread from 1860 through 1890. Chicago's 1889 annexation shifted more than 225,000 county residents to within the city and expanded the city's physical size from 43 to 169 square miles. About 90 percent of the county's population lived in the city at that time.
- Farming in Cook County did not disappear, but outlying growth by 1900 was largely suburban.
- With the spread of the population to suburban communities, the proportion of the county's population living in Chicago dropped to 83 percent by the 1940s. Skokie and Oak Lawn were among the most quickly growing suburbs during the 1950s and 1960s.

- The 1970s and 1980s saw the development of most of the remaining farmland in the county. By then, contiguous urban growth had engulfed both the remaining farms and the suburban residential and industrial areas that had once been distinct from the city center.
- No further annexation by the city took place, however, and by 1990 Chicago accounted for only 55 percent of the county's population.

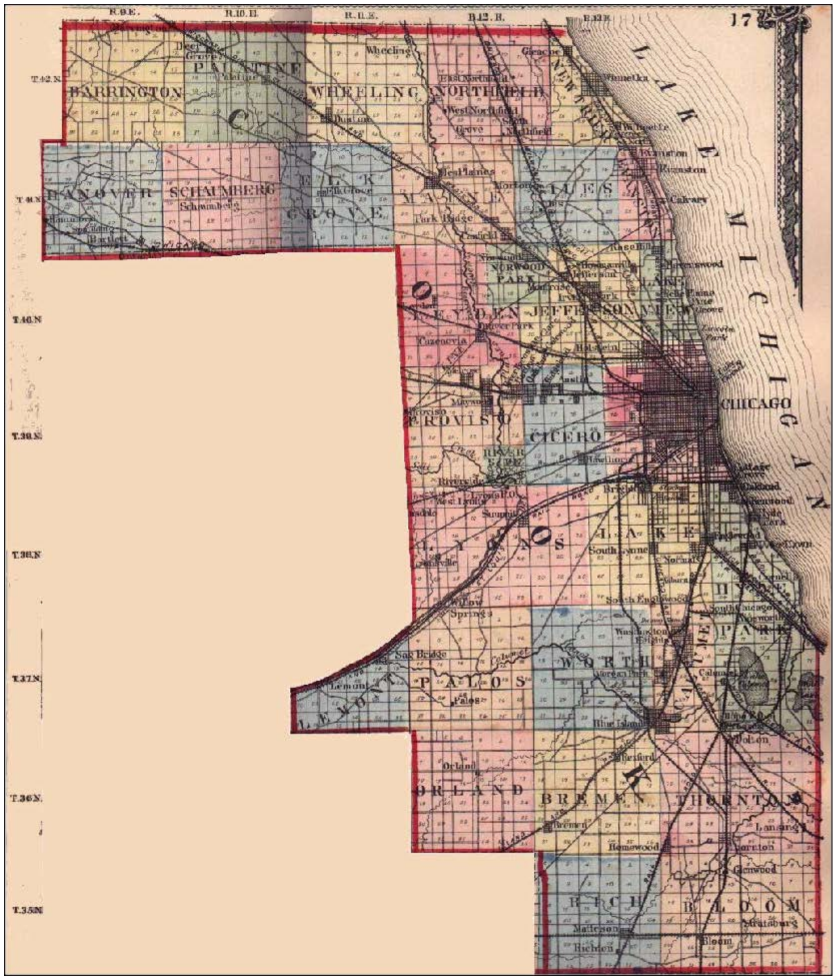


Figure: [1870 Cook County Township Map]

Major Past Hazard Events

Presidential disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A presidential disaster declaration puts federal recovery programs into motion to help disaster victims, businesses, and public entities. Some of the programs are matched by state programs. Cook County has experienced 19 events since 1967 for which presidential disaster declarations were issued. These events are listed below in the table.

TABLE: PRESIDENTIAL DISASTER DECLARATIONS FOR EVENTS IN THE PLANNING AREA

Type of Event	Disaster Declaration Number	Declaration Date

Tornado	DR*-227	4/25/1967
Flood	DR-351	9/4/1972
Flood	DR-373	4/26/1973
Severe Storm	DR-509	6/18/1976
Snow	EM*-3068	1/16/1979
Severe Storm	DR-643	6/30/1981
Flood	DR-776	10/7/1986
Flood	DR-798	8/21/1987
Flood	DR-997	7/9/1993
Severe Storm	DR-1129	7/25/1996
Severe Storm	DR-1188	9/17/1997
Snow	EM-3134	1/8/1999
Snow	EM-3161	1/17/2001
Hurricane	EM-3230	9/7/2005
Severe Storm	DR-1729	9/25/2007
Severe Storm	DR-1800	10/3/2008
Severe Storm	DR-1935	8/19/2010
Snow	DR-1960	3/17/2011
Flood	DR-4116	5/10/2013

**DR indicates "major disaster declaration." EM indicates "emergency declaration" Source: FEMA, 2019*

Another source of information on past hazard events is the Spatial Hazard Events and Losses Database for the United States (SHELDUS), formerly maintained by the University of South Carolina and now by Arizona State University. SHELDUS draws upon a variety of national data sources to list hazards that resulted in any monetary loss, human injury, or human fatality. The database includes many more hazard events than those for which presidential disaster declarations were made. For Cook County, SHELDUS lists 851 instances of monetary or human loss due to a hazard event and 119 crop loss events (SHELDUS, 2019).

The National Oceanic and Atmospheric Administration (NOAA) data is the primary source utilized in the Hazard Mitigation Plan. Below is a summary of all the hazards that were counted by NOAA. Further analysis of the data set is available under each hazard under the "Past Events" sections. NOAA does not collect data on Earthquakes and Dam and Levee Failures. Additional data was utilized and is analyzed in the hazard profiles.

TABLE: SUMMARY OF EXTENT OF NATURAL HAZARDS					
Hazard	**Total Events since 1950**	**Total Property Damage**	**Total Crop Damage**	**Total Deaths (Direct)**	**Total Injuries (Direct)**
Drought	7	0	0	0	0
Flood (including flash flooding, flooding, heavy rain, and coastal flooding)	231	$506,040,000	0	4	0
Severe Weather (including thunderstorm wind, hail, heat and excessive heat, lightning, and high and strong wind)	1,443	$44,820,600	0	371	122
Severe Winter Weather (including blizzard, cold/wind chill, extreme cold/wind chill, frost/freeze, heavy snow, ice storm, lake-effect snow, sleet, winter storm, and winter weather)	178	$700,000	0	156	5
Tornado (including tornado and funnel cloud)	57	$118,337,750	0	39	770
TOTAL	**1,909**	**$163,158,350**	**0***	**570**	**897**

**Crop damage would only include what has been reported (typically reported to USDA for insurance or grant purposes).*

Sources: NOAA

Additionally, NOAA data highlighted events that cost over $1 billion in the past decade. While both events listed below expanded outside of Cook County, the County received substantial damage from both "billion-dollar" events:

- Illinois Flooding and Severe Weather - April 2013: A slow-moving storm system created rainfall totals of 5 to 10 inches across northern and central Illinois including the Chicago metro. This resulted in damage to many homes and businesses. There was also severe weather damage from wind and hail across Indiana and Missouri. Total Estimated Costs: $1.1 ($1.2) Billion; 4 Deaths
- Groundhog Day Blizzard - February 2011: A large winter storm impacted many central, eastern and northeastern states. The city of Chicago was brought to a virtual standstill as between 1 and 2 feet of snow fell over the area. Total Estimated Costs: $1.8 ($2.1) Billion; 36 Deaths

Review of the declared disaster events and loss-causing hazard events helps identify targets for risk reduction and ways to increase a community’s capability to avoid large-scale events in the future.

Physical Setting

This section addresses the geology of Cook County and climate.

Geology

The landforms of Cook County are mostly the result of glacial processes. Significant topographic features include broad level plains that were once lake beds, ridges formed as moraines marking the outer margins of glaciers, and elongated sandy spits, bars, and beach ridges formed along the shores of the ancestor lakes of present-day Lake Michigan. The highest point in Cook County is almost 1,000 feet above sea level, at the northwest corner of the county. Land over most of the county slopes gradually toward Lake Michigan to the east, intersected by north-south trending stream-cut valleys. Most of the central and southeastern portion of Cook County is a low flat plain (ISGS, 2004).

Upper-level soils are mostly the result of glacial processes. Locally, layers of sand and gravel supply residential users with good quality groundwater. According to the USDA Natural Resource Conservation Service's Web Soil Survey, there are nearly 140 distinct soil types throughout Cook County.

The greatest risk for the groundwater resources in these areas is from surface contamination of relatively shallow aquifers. More than half of Cook County is underlain by glacial till. The low flat plain in the east-central part of the county is mostly silt and clay. These sediments were deposited in the former glacial lake, are composed of silt and clay, and are not considered aquifers (ISGS, 2004).

The top of the bedrock in Cook County consists mainly of pure to silty dolomite, forming a bedrock aquifer. These rocks range in thickness from zero in small areas in the northwestern part of the county to more than 300 feet on the far eastern side along the lakeshore. The porosity and permeability of the rocks are mainly the results of fractures and dissolution cavities in the dolomite. The rock itself has no porosity. The water is recharged locally from precipitation and, where the overlying glacial materials are thin, the upper bedrock aquifer is susceptible to groundwater contamination. Greater groundwater yields are available in deeper sandstone layers (ISGS, 2004).

The Des Plaines Disturbance is in north-central Cook County is a roughly circular area of about 25 square miles that is intensely faulted. Some of these faults may have as much as 600 feet of vertical movement. The faulted bedrock is beneath 75 to 200 feet of glacial drift. The disturbance has been indicated as a probable meteorite-impact structure. Seismic reflection data suggest that there are numerous other faults within the bedrock of Cook County, but none are currently active (ISGS, 2004).

Cook County has large deposits of stone, gravel, sand, and clay used as building materials. The Thornton Quarry, located near Thornton in Cook County, is the large limestone quarry in the world. The County relies on these resources as they provide jobs and millions of dollars in state revenue (USDA, 2012).

Climate

According to the Forest Preserves of Cook County, Illinois has faced a 1˚F increase in average annual temperature since the start of the 20th century. Recent climate projections predict further increases in annual temperatures and an increased frequency of extreme weather events (Sustainability and Climate Resiliency Plan). In the City of Chicago, as well as other highly paved urban areas in Cook County, the "urban heat island" effect can raise temperatures from 4-10˚F on hot summer days (Chicago Climate Action Plan).

Typically, the Cook County area can be described as a humid continental climate with hot summers and cold winters. Generally, cold dry air from Canada dominates the area in winter, warm humid air from the Gulf of Mexico dominates in summer, and dry warm air from the Pacific Ocean dominates in the fall.

High temperatures average 84°F in July and often reach 100ºF or more in summer. Low temperatures average 18°F in January and have been recorded as low as the –20s. Humidity in the summer and wind in the winter intensify the problems of extreme temperature that endanger the population. Average rainfall for the area is 38 inches and average snowfall is 34 inches. The last spring frost typically occurs around May 1 and the first fall frost typically occurs around October 15. Annually, 13.4 days reach temperatures above 90°F, which is cooler than most places in Illinois, and 113.3 reach nighttime temperatures below freezing, which is still warmer than most places in Illinois. Also on average, 5.4 days of the year, temperatures at nighttime fall below 0°F. August is the wettest month and May is rainiest. February is both the driest month in terms of inches of rainfall and days with rain. Annually, Cook receives 123.6 days of rain.

Cook County does receive more rain and snowfall than most places in Illinois; however, the County is considered drier than most of Illinois. Typically, 6 months of the year have significant snowfall with January having 10.8 inches of snow on average (NCDC-NOAA cross-referenced to Sperling).

Land Use

Chicago Metropolitan Agency for Planning (CMAP) produced a "Lands in Transition" paper which highlighted transitioning land use. Out of the region measured in the report, Cook County had the highest acreage of protected lands.

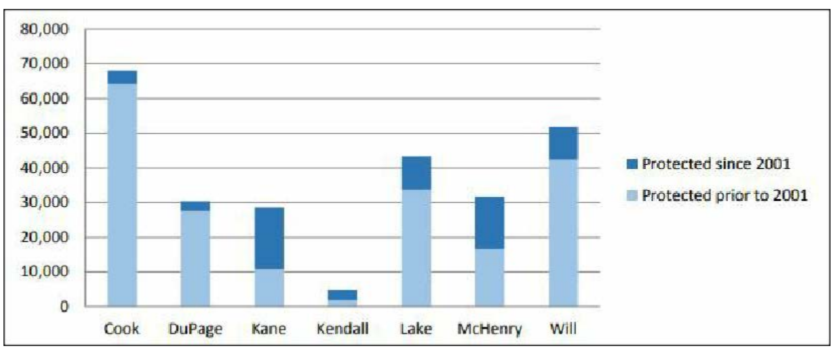


Figure: Protected land by county, in acres

Sources: CMAP Land Use Inventory, Illinois Department of Natural Resources, County Forest Preserves or Conservation Districts, Kendall County Forest Preserve District Master Plan, and I-View: Prairie State Conservation Coalition's database of Illinois protected natural lands.

For northeastern Illinois (including Cook County), agricultural, natural, and open lands continue to transition in land use. Land use is important to hazard mitigation because combined, land development and protection decisions have impacts on the market viability of area farms, habitat connectivity of our natural areas, and the costs associated with constructing and maintaining new infrastructure and services. In turn, these decisions have ramifications not only for new residents and businesses in growing areas but also for their existing neighbors, nearby municipalities, and the region as a whole. From 2001 to 2015, nearly 140,000 acres of agricultural and natural lands were developed while 61,500 acres of land were permanently protected. The majority of this development was in DuPage and Kane County, however, development did occur in Cook County (see map below). Important to note is the previously already high development on lands in Cook County, particularly in Chicago. In Cook County, from 2011 to 2015, over 10,000 acres of natural land was developed and 5,000 acres of agricultural land were developed. Since 2001, three-quarters of greenfield development occurred on agricultural lands, leading to a reduction of over 100,000 acres of land involved with agricultural production. While the economic impact of the loss of 100,000 acres of agricultural lands in the region is not known, it is assumed to include not only the loss of production revenues but also cascading effects on the processing and distribution-related industries in the region.

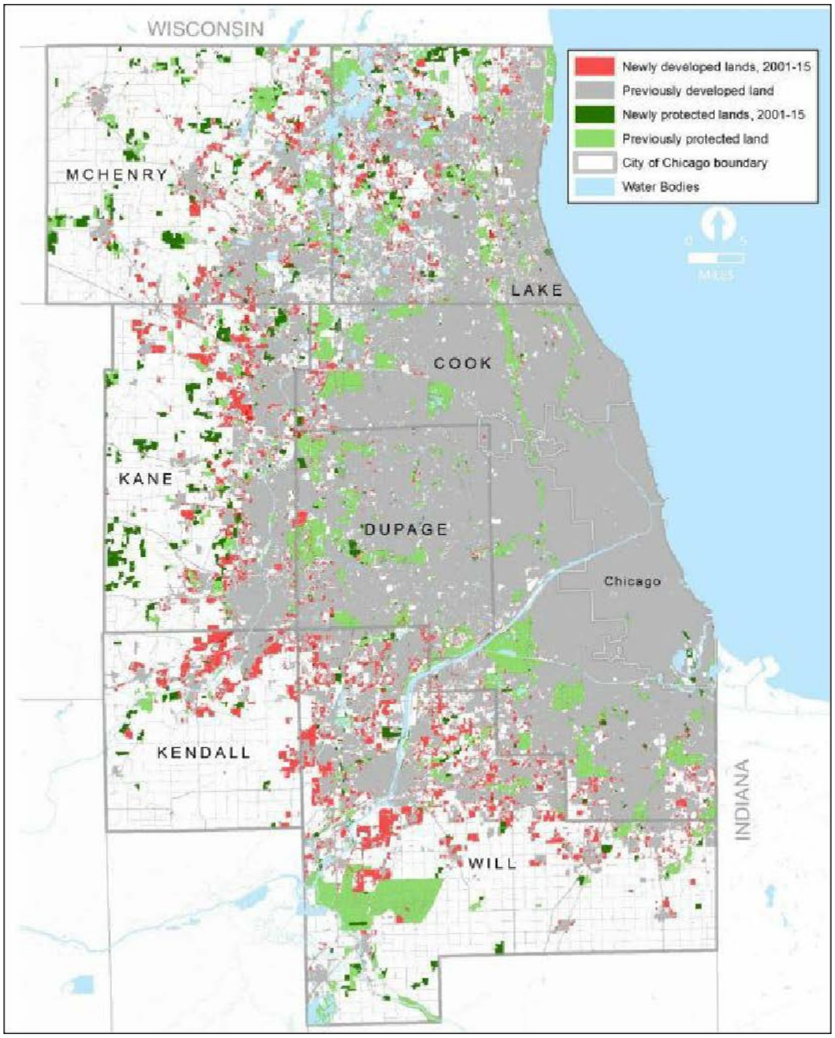


Figure: Newly developed and newly protected lands in the Chicago region, 2001-15

Sources: CMAP 2001-2011 National Land Cover Dataset, 2015 Northeastern Illinois Development Database, 2001/2005/2013 CMAP Land Use Inventory, 2012-2015 National Conservation Easement Database, 2014 Kendall County Forest Preserve District Master Plan, 2016 Trust for Public Land Conservation Almanac, and 2016 I-View: Prairie State Conservation Coalition's database of Illinois protected natural lands.

Important to hazard mitigation is understanding the impacts of development. At the watershed scale, impervious cover can lead to water pollution, erosion, and degraded stream health. The majority of Cook County exceeds 10% impervious cover threshold which impacts the health of the streams.

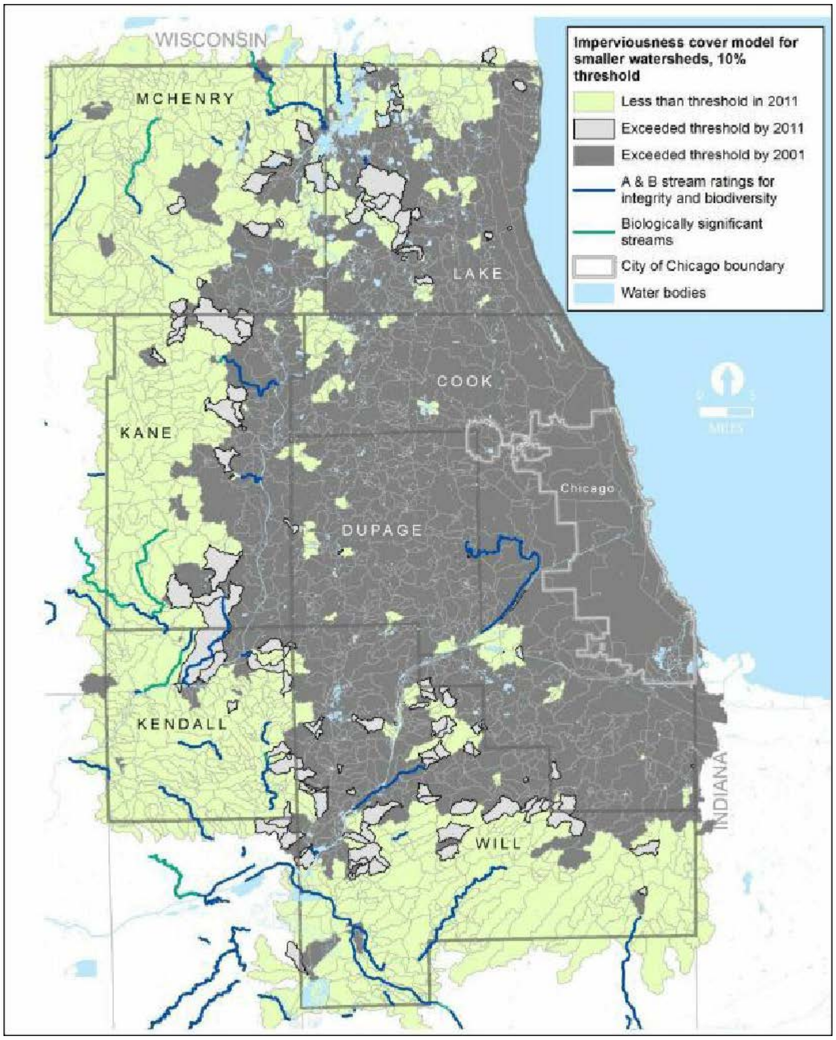


Figure: Sub-watershed catchments that exceeded 10% impervious cover, 2001 and 2011

Source: CMAP 2001-11 National Land Cover Dataset, 2015 Northeastern Illinois Development Database, Illinois Department of Natural Resources, and CMAP analysis of National Hydrography Dataset Plus v2.

The Table below shows current land use in the planning area based on 2013 land-use inventory data developed by the Chicago Metropolitan Agency for Planning (CMAP). Beginning with the 2010 Inventory, land use polygons are now derived directly from parcel GIS files provided by the seven counties in the CMAP region. Switching to a parcel base allows for greater accuracy as well as faster turnaround times for updates. The land use information is analyzed for each hazard that has a defined spatial extent and location. For hazards that lack this spatial reference, the following information serves as a baseline estimate of land use and exposure for the planning area. The distribution of land uses within the county will change over time and the next version of the Land Use Inventory data (2015) will be available in 2020.

The number of farms in Cook County decreased from 184 in 2007 to 127 in 2012; however, the acreage of farmland increased to 8,499 acres in 2012 from 8,198 acres in 2007 (Census of Agriculture).

TABLE: GENERAL LAND USE, 2013

Present Use Classification	Area (acres)	% of total
Single-Family Residential	180,985.7	29.5
Multi-Family Residential	30,674.1	5.0
Commercial	32,479.7	5.3
Industrial	36,258.9	5.9
Institutional	35,382.9	5.8
Mixed Use	2,482.5	0.4
Transportation and Other	157,150.9	25.6
Agricultural	15,375.5	2.5
Open Space	98,588.4	16.1
Vacant	23,613.6	3.9
Total	**612,992.3**	**100.0**

Source: CMAP, 2016. Chicago Metropolitan Agency for Planning Parcel-Based Land Use Inventory.

Critical Facilities and Infrastructure

Critical facilities and infrastructure are any facility, whether publicly or privately owned, that is vital to the Cook County planning area’s ability to provide essential services and protect life and property. Damage to such facilities and infrastructure that causes a short or long-term loss of their function would likely result in severe health and welfare, life-sustainment, economic, or other catastrophic impacts. The Steering Committee developed a definition for critical facilities to be used in this plan. Critical facilities are facilities that meet the following criteria:

- Facilities that are essential to the ability to respond to, mitigate and recover from the impacts of natural hazards
- Facilities that need an early warning to enable them to prepare for and respond to the impacts of natural hazards
- Facilities that by the nature of their operations, produce, manufacture or store materials that create exposure to secondary hazards of concern.

Critical facilities may include but are not limited to the following:

- **Essential facilities** for the health and welfare of the whole population (e.g., hospitals, police and fire stations, emergency operations centers, evacuation shelters, schools, and universities)
- **Transportation systems**, including airways, highways, railways, and waterways
- **Lifeline utility systems**, such as potable water, wastewater, oil, natural gas, electric power, and communication systems

- **High potential loss facilities**, such as nuclear power plants, dams, and military installations
- **Hazardous material facilities**, producing industrial/hazardous materials (e.g., corrosives, explosives, flammable materials, radioactive materials, and toxins)
- **Community gathering places**, such as parks, museums, libraries, community centers, senior centers, daycare centers, and veterans' halls
- **Facilities housing special needs populations**, such as nursing homes, continuing care retirement facilities, and housing likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a hazard event.

By identifying critical facilities before a natural disaster occurs, communities can make better decisions about how to expend resources to protect these key facilities. A detailed inventory of critical facilities and infrastructure was developed for this plan using GIS applications. The starting point for this process was the Hazus-MH default database. An interactive, secure web portal was created to facilitate the update of this inventory. Over 6,000 facilities were inventoried and uploaded into the Hazus-MH model to support this plan. *Table: Critical Facilities by Jurisdiction and Category* and *Table: Critical Infrastructure by Jurisdiction and Category* provide summaries of the general types of critical facilities and infrastructure, respectively, in each municipality and in unincorporated county areas. These tables indicate the location of critical facilities and infrastructure, not jurisdictional ownership. All critical facilities/infrastructure were analyzed in Hazus to help rank risk and identify mitigation actions. The risk assessment for each hazard qualitatively discusses critical facilities with regard to that hazard.

In addition to the facilities and infrastructure listed, Cook County maintains 1,426 miles of paved roadways, 132 bridges, 360 traffic signals, and seven pumping stations from four maintenance facilities (Cook County Transportation and Highways). In 2018, the Department of Transportation and Highways completed the Cook County Freight Plan, Lincoln Highway Logistics Corridor Strategic Plan, and over $23 million in construction projects including pavement preservation and rehabilitation activities at 13 locations, interim bridge repairs at Quentin Road over Salt Creek and East Lake Avenue over the North Branch of the Chicago River, major intersection improvements at Roselle Road and Schaumburg Road, and major improvements to Central Road (2018-23 Improved Transportation Program).

There are approximately 13,000 miles of water lines, 7,850 miles of wastewater lines, 5,200 miles of gas lines, 20 operating pipelines, and nine oil facilities.

Collectively these critical facilities and infrastructure need to be considered in emergency planning, emergency response, and mitigation of impacts from emergencies. For example, in 2018, the newly built $1 billion flood-control reservoir, the largest section of the Deep Tunnel project, was inundated with rain and melting snow. After the 5.1 billion-gallon system swelled to capacity, leftovers from the storm surge began backing up in basements and pouring out of overflow pipes into the Chicago River and other area streams during the next two days (Chicago Tribune). Another report highlights a million gallons being reversed from Chicago Area Waterways to Lake Michigan. While this report highlights a decrease due to the onset of TERP, one 2017 event reversed 2,746.20 million gallons (Reversals to Lake Michigan).

TABLE: CRITICAL FACILITIES BY JURISDICTION AND CATEGORY							
	Medical and Health	**Government Functions**	**Protective Functions**	**Schools**	**Hazmat (Tier II)**	**Other Critical Functions**	**Total**
Alsip	2	0	3	10	47	0	**62**
Arlington Heights *a*	12	0	5	30	18	0	**65**
Barrington *a*	3	0	3	8	3	0	**17**
Barrington Hills	0	0	2	0	0	0	**2**
Bartlett	3	0	3	7	6	0	**19**
Bedford Park	0	0	3	3	54	2	**62**
Bellwood	1	1	2	9	18	0	**31**
Bensenville	0	0	0	0	1	0	**1**
Berkeley	0	1	1	3	4	0	**9**
Berwyn	5	1	4	19	10	0	**39**
Blue Island	4	0	2	15	13	0	**34**
Bridgeview	4	0	4	5	30	5	**48**
Broadview	0	0	2	4	19	0	**25**
Brookfield	1	1	3	10	1	4	**20**
Buffalo Grove *a*	0	0	3	14	3	0	**20**
Burbank	4	0	3	13	5	3	**28**
Burnham	2	0	2	2	3	0	**9**
Burr Ridge	0	0	1	6	1	0	**8**
Calumet City	4	2	3	29	15	11	**64**
Calumet Park	3	0	1	5	1	0	**10**
Chicago	277	1	140	1227	947	1	**2593**
Chicago Heights	7	1	6	25	38	0	**77**
Chicago Ridge	1	0	3	7	7	0	**18**
Cicero	3	0	5	29	30	2	**69**

Country Club Hills	7	0	3	7	1	0	**18**
Countryside	4	1	1	3	16	12	**37**
Crestwood	4	1	2	7	8	1	**23**
Deer Park	0	0	0	0	0	0	**0**
Deerfield	3	0	0	0	1	0	**4**
Des Plaines	3	0	0	0	1	0	**4**
Dixmoor	0	0	1	2	2	1	**6**
Dolton	5	1	3	11	10	0	**30**
East Dundee	0	0	0	0	0	0	**0**
East Hazel Crest	0	1	2	0	1	0	**4**
Elgin	4	0	1	5	10	1	**21**
Elk Grove Village *a*	8	0	9	14	133	0	**164**
Elmhurst	0	0	0	0	0	0	**0**
Elmwood Park	1	1	3	7	0	0	**12**
Evanston	24	1	7	86	19	1	**138**
Evergreen Park	3	1	2	14	4	0	**24**
Flossmoor	2	0	2	9	0	0	**13**
Ford Heights	0	0	2	3	1	0	**6**
Forest Park	4	0	2	12	8	9	**35**
Forest View	0	0	2	0	7	0	**9**
Frankfort	0	0	0	0	0	0	**0**
Franklin Park	2	3	4	9	58	7	**83**
Glencoe	0	1	2	4	3	0	**10**
Glenview	12	0	6	21	15	0	**54**
Glenwood	2	2	3	5	9	1	**22**
Golf	0	0	1	0	1	1	**3**
Hanover Park *a*	2	0	2	11	4	2	**21**
Harvey	10	0	5	20	21	0	**56**
Harwood Heights	1	0	5	4	4	1	**15**

Hazel Crest	8	0	2	6	3	0	**19**
Hickory Hills	2	1	1	5	8	3	**20**
Hillside	3	1	2	6	17	0	**29**
Hinsdale	1	0	0	1	0	0	**2**
Hodgkins	0	0	2	1	15	1	**19**
Hoffman Estatesa	6	0	2	21	13	0	**42**
Hometown	0	1	2	2	0	0	**5**
Homewood	4	1	2	7	9	3	**26**
Indian Head Park	0	0	1	0	0	1	**2**
Inverness	1	1	2	2	0	2	**8**
Justice	1	0	3	5	1	3	**13**
Kenilworth	0	0	1	3	0	1	**5**
La Grange	5	1	2	19	5	4	**36**
La Grange Park	4	1	3	6	4	8	**26**
Lansing	3	1	5	16	15	0	**40**
Lemonta	4	2	3	8	20	0	**37**
Lincolnwood	6	1	2	5	6	9	**29**
Lynwood	1	1	2	1	1	1	**7**
Lyons	2	1	2	6	6	2	**19**
Markham	4	2	3	8	6	0	**23**
Matteson	3	0	3	11	10	0	**27**
Maywood	0	0	3	11	7	0	**21**
McCook	0	1	2	0	13	1	**17**
Melrose Park	3	1	3	11	46	0	**64**
Merrionette Park	0	0	2	2	0	0	**4**
Midlothian	2	0	3	13	3	11	**32**
Morton Grove	3	1	4	15	13	4	**40**
Mount Prospect	0	1	4	19	34	1	**59**
Niles	11	1	3	17	26	4	**62**

Norridge	2	0	1	11	0	0	**14**
North Riverside	1	0	2	3	1	0	**7**
Northbrook	8	2	4	29	26	5	**74**
Northfield	1	1	2	5	3	0	**12**
Northlake	3	0	3	8	23	0	**37**
Oak Brook	0	0	0	0	0	0	**0**
Oak Forest	6	0	3	18	3	0	**30**
Oak Lawn	8	1	4	24	19	0	**56**
Oak Park	5	1	4	25	4	0	**39**
Olympia Fields	6	1	1	3	2	1	**14**
Orland Hills	0	0	1	3	1	0	**5**
Orland Park	5	1	8	28	11	0	**53**
Palatine	4	1	6	29	17	0	**57**
Palos Heights	5	0	3	9	1	0	**18**
Palos Hills	4	1	4	11	2	14	**36**
Palos Park	2	0	2	2	4	0	**10**
Park Forest *a*	3	0	2	11	3	0	**19**
Park Ridge	11	1	4	21	4	0	**41**
Phoenix	1	0	2	2	0	0	**5**
Posen	0	0	2	5	3	0	**10**
Prospect Heights	3	1	3	7	5	13	**32**
Richton Park	2	1	2	3	2	0	**10**
River Forest	0	2	2	11	1	3	**19**
River Grove	0	1	1	11	4	0	**17**
Riverdale	0	0	2	9	17	0	**28**
Riverside	1	1	3	12	1	2	**20**
Robbins	2	1	2	6	0	0	**11**
Rolling Meadows	4	1	3	12	27	2	**49**
Roselle	0	0	0	1	0	0	**1**

Rosemont	1	0	3	1	15	5	**25**
Sauk Village *a*	5	0	2	8	10	5	**30**
Schaumburga	7	1	6	26	52	1	**93**
Schiller Park	1	1	3	4	17	8	**34**
Skokie	18	1	4	28	31	0	**82**
South Barrington	1	1	1	1	1	0	**5**
South Chicago Heights	1	0	2	3	3	0	**9**
South Holland	9	1	5	16	27	1	**59**
Steger *a*	0	2	4	5	1	2	**14**
Stickney	1	1	2	2	5	0	**11**
Stone Park	0	0	2	1	2	0	**5**
Streamwood	4	0	4	13	6	5	**32**
Summit	2	1	2	10	17	1	**33**
Thornton	1	0	2	2	3	0	**8**
Tinley Park *a*	5	1	4	24	16	1	**51**
University Park *a*	0	0	2	4	1	0	**7**
Westchester	1	2	3	9	3	5	**23**
Western Springs	3	1	3	10	1	3	**21**
Wheeling *a*	4	2	4	13	58	3	**84**
Willow Springs	0	0	2	4	7	2	**15**
Wilmette	3	0	3	18	6	5	**35**
Winnetka	0	1	2	10	1	4	**18**
Worth	1	1	2	5	3	0	**12**
Unincorporated County Areas	17	2	5	27	48	6	**105**
Total	**696**	**79**	**495**	**2551**	**2476**	**221**	**6518**
a. Municipality is partially located in another county; for planning purposes all facilities are included.							

TABLE:
CRITICAL INFRASTRUCTURE BY JURISDICTION AND CATEGORY

	Bridges	Water Supply	Wastewater	Power	Communication	Transportation	Dams	Total
Alsip	11	0	2	9	4	0	0	**26**
Arlington Heights *a*	7	0	1	5	8	4	0	**25**
Barrington *a*	2	0	1	0	0	1	0	**4**
Barrington Hills	2	0	0	0	0	0	2	**4**
Bartlett	2	0	1	0	1	1	0	**5**
Bedford Park	3	6	3	8	0	3	0	**23**
Bellwood	14	0	0	4	1	1	0	**20**
Bensenville	0	0	0	0	0	0	0	**0**
Berkeley	18	0	0	1	1	1	1	**22**
Berwyn	0	0	0	3	0	3	0	**6**
Blue Island	11	0	1	3	1	8	0	**24**
Bridgeview	4	1	0	1	0	0	0	**6**
Broadview	7	1	0	3	2	0	0	**13**
Brookfield	3	3	0	3	0	3	0	**12**
Buffalo Grove *a*	6	0	0	0	2	1	0	**9**
Burbank	0	1	2	0	0	0	0	**3**
Burnham	1	0	0	1	2	0	0	**4**
Burr Ridge	6	0	1	0	0	0	0	**7**
Calumet City	6	3	1	3	1	3	0	**17**
Calumet Park	7	0	0	0	0	2	0	**9**
Chicago	577	16	21	2	56	373	2	**1047**
Chicago Heights	7	0	1	5	2	2	0	**17**
Chicago Ridge	11	0	0	0	0	2	0	**13**
Cicero	3	2	0	8	1	8	0	**22**

Country Club Hills	11	0	0	1	0	0	0	**12**
Countryside	5	2	0	0	0	0	0	**7**
Crestwood	5	0	0	3	0	0	0	**8**
Deer Park	0	0	0	0	0	0	0	**0**
Deerfield	7	0	1	1	0	0	0	**9**
Des Plaines	47	1	1	9	5	6	0	**69**
Dixmoor	5	1	0	0	0	0	0	**6**
Dolton	10	0	0	2	0	2	0	**14**
East Dundee	0	0	0	0	0	0	1	**1**
East Hazel Crest	4	0	0	0	0	1	0	**5**
Elgin	6	0	1	0	1	0	0	**8**
Elk Grove VIllage *a*	10	0	0	3	3	1	0	**17**
Elmhurst	0	0	0	0	0	0	0	**0**
Elmwood Park	1	0	0	3	0	1	0	**5**
Evanston	11	2	1	10	3	14	0	**41**
Evergreen Park	0	0	0	2	0	0	0	**2**
Flossmoor	4	0	0	2	1	1	0	**8**
Ford Heights	2	0	0	0	1	0	0	**3**
Forest Park	5	4	0	1	0	4	0	**14**
Forest View	2	0	0	1	0	7	0	**10**
Frankfort	0	0	0	0	0	0	0	**0**
Franklin Park	7	6	6	8	1	4	0	**32**
Glencoe	9	2	1	2	1	1	0	**16**
Glenview	17	0	1	4	4	5	0	**31**
Glenwood	3	0	0	2	1	0	0	**6**
Golf	1	0	0	0	0	2	0	**3**
Hanover Park *a*	6	0	2	0	0	0	0	**8**
Harvey	4	1	0	4	2	3	0	**14**
Harwood Heights	0	0	0	0	0	0	0	**0**

Hazel Crest	7	0	1	0	0	1	0	**9**
Hickory Hills	2	2	1	0	1	0	0	**6**
Hillside	9	0	1	2	1	1	0	**14**
Hinsdale	6	0	1	0	0	0	0	**7**
Hodgkins	10	0	1	1	0	1	0	**13**
Hoffman Estates *a*	15	0	0	0	3	1	0	**19**
Hometown	0	0	0	0	0	0	0	**0**
Homewood	3	6	13	2	2	4	0	**30**
Indian Head Park	10	1	0	0	0	0	0	**11**
Inverness	0	0	0	0	0	0	0	**0**
Justice	5	1	1	1	0	0	0	**8**
Kenilworth	0	1	0	0	0	1	0	**2**
La Grange	1	3	0	0	2	3	0	**9**
La Grange Park	0	1	0	2	0	0	0	**3**
Lansing	6	0	0	2	2	4	0	**14**
Lemont *a*	8	0	1	3	2	19	0	**33**
Lincolnwood	4	0	0	2	0	1	0	**7**
Lynwood	7	0	1	1	0	1	0	**10**
Lyons	9	2	1	4	1	0	0	**17**
Markham	7	0	2	1	2	3	0	**15**
Matteson	10	0	0	0	0	2	0	**12**
Maywood	6	0	0	4	1	2	0	**13**
McCook	5	2	2	0	0	0	0	**9**
Melrose Park	4	0	0	4	1	3	0	**12**
Merrionette Park	0	0	0	0	0	0	0	**0**
Midlothian	6	0	0	0	0	1	0	**7**
Morton Grove	5	3	0	3	2	1	0	**14**
Mount Prospect	8	1	2	6	2	2	0	**21**
Niles	5	2	0	3	2	2	0	**14**

Norridge	0	0	0	0	0	0	0	**0**
North Riverside	3	0	0	0	0	2	0	**5**
Northbrook	20	1	20	5	6	2	1	**55**
Northfield	7	0	0	0	1	0	0	**8**
Northlake	14	0	1	2	0	1	0	**18**
Oak Brook	5	0	0	0	0	0	0	**5**
Oak Forest	3	0	0	0	3	1	0	**7**
Oak Lawn	3	0	1	6	2	3	0	**15**
Oak Park	5	0	0	4	2	7	0	**18**
Olympia Fields	3	0	0	1	0	4	0	**8**
Orland Hills	0	0	0	0	1	0	0	**1**
Orland Park	3	0	0	1	5	4	1	**14**
Palatine	7	0	4	3	5	2	1	**22**
Palos Heights	1	0	0	1	2	1	0	**5**
Palos Hills	4	0	0	1	2	1	0	**8**
Palos Park	3	0	1	1	1	1	0	**7**
Park Forest *a*	1	1	1	3	1	1	0	**8**
Park Ridge	7	0	0	5	2	5	0	**19**
Phoenix	0	0	0	0	0	0	0	**0**
Posen	8	0	0	0	0	0	0	**8**
Prospect Heights	5	2	2	1	0	4	0	**14**
Richton Park	3	0	0	1	0	3	2	**9**
River Forest	2	0	1	1	1	1	0	**6**
River Grove	3	1	0	1	2	3	0	**10**
Riverdale	6	0	0	2	2	6	0	**16**
Riverside	4	2	0	2	0	1	1	**10**
Robbins	7	0	0	0	0	1	0	**8**
Rolling Meadows	21	0	0	3	5	0	0	**29**
Roselle	2	0	0	1	0	0	0	**3**

Rosemont	20	0	0	0	2	5	0	**27**
Sauk Village *a*	3	1	1	0	0	0	0	**5**
Schaumburg *a*	28	0	0	2	9	6	3	**48**
Schiller Park	8	4	3	2	1	3	0	**21**
Skokie	15	0	2	12	5	6	0	**40**
South Barrington	0	0	0	0	0	0	2	**2**
South Chicago Heights	0	0	0	1	0	0	1	**2**
South Holland	14	0	0	2	1	3	0	**20**
Steger *a*	1	0	0	1	0	0	0	**2**
Stickney	1	0	1	1	0	5	0	**8**
Stone Park	0	0	0	1	0	0	0	**1**
Streamwood	2	0	3	0	1	0	1	**7**
Summit	24	1	1	0	2	5	0	**33**
Thornton	5	0	3	0	0	0	1	**9**
Tinley Park *a*	9	0	1	1	3	2	0	**16**
University Park *a*	2	0	1	0	0	1	0	**4**
Westchester	5	1	2	0	0	0	0	**8**
Western Springs	5	3	0	0	0	1	0	**9**
Wheeling *a*	13	0	2	3	3	3	1	**25**
Willow Springs	14	0	2	0	0	5	0	**21**
Wilmette	7	2	4	5	3	3	0	**24**
Winnetka	6	2	0	0	2	4	0	**14**
Worth	8	0	2	1	0	1	0	**12**
Unincorporated County Areas	111	4	7	9	5	11	10	**157**
Total	**1,499**	**102**	**143**	**244**	**209**	**639**	**31**	**2,867**

Demographics

Some populations are at greater risk from hazard events because of decreased resources, physical abilities, or other needs that may arise during these events. Elderly people, for example, may be more likely to require additional assistance. Research has shown that people living near or below the poverty line, those experiencing homelessness, the elderly (especially older single men), persons needing functional or access support services, women, children, ethnic minorities, and renters all experience, to some degree, more severe effects from disasters than the general population. These vulnerable populations may vary from the general population in risk perception, living conditions, access to information before, during, and after a hazard event, capabilities during an event, and access to resources for post-disaster recovery. Indicators of vulnerability—such as disability, age, poverty, and minority race and ethnicity—often overlap, and often in the geographically most vulnerable locations. Detailed spatial analysis to locate areas where there are higher concentrations of vulnerable community members would assist the County in extending focused public outreach and education to these most vulnerable citizens.

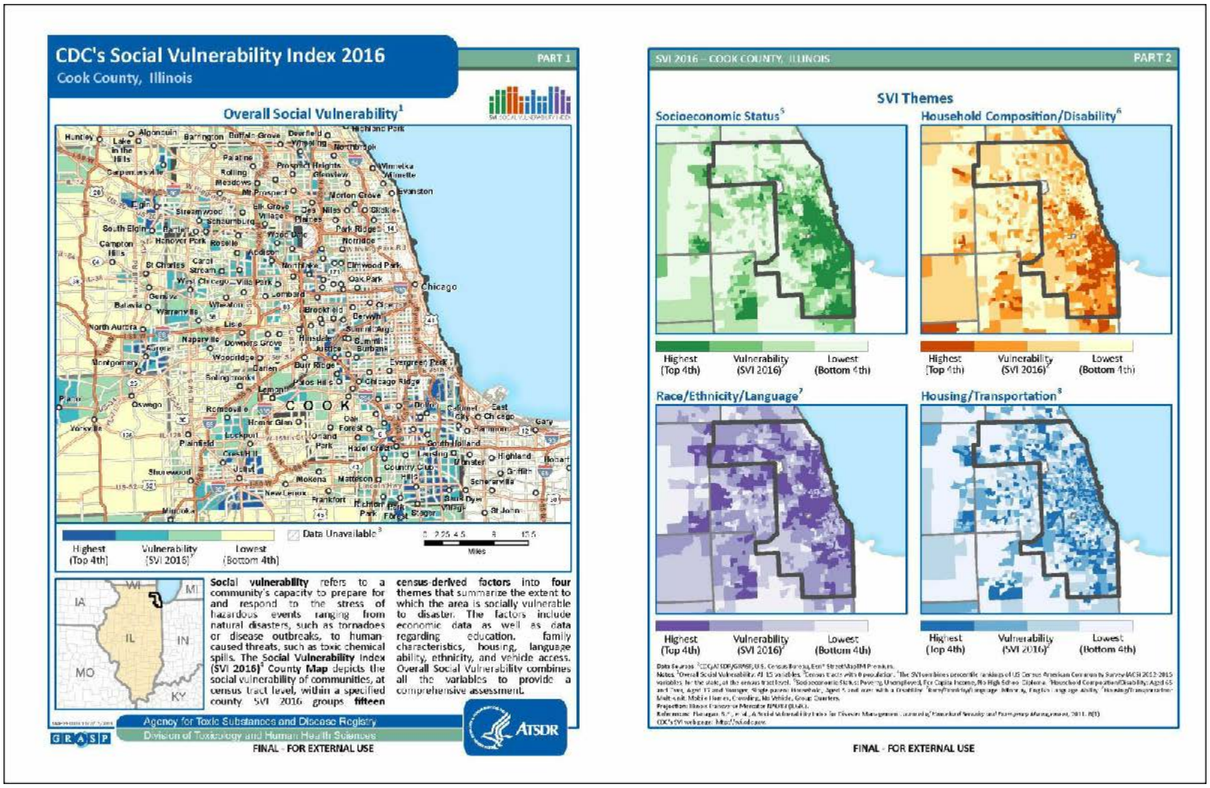
Cook County Public Health prepared the Community Health Status Assessment Findings for the WePLAN 2020. The report highlight vulnerable populations and the variability in location throughout Cook County. The report found that the County had a significant net increase in the overall number of vulnerable populations, including children living in poverty, in Suburban Cook County (SCC).

- From 2000 to 2009-2013, the number of people living in poverty in SCC increased by 71% (from 156,249 to 267,274 persons).
- Poverty rates ranged from over 16% in the South district to 6% in the North district.
- The number of children living in poverty in SCC more than doubled from 2000 to 2009-2013.
- A deplorable one out of every 4 children in the South district lives in poverty compared to 1 out of 10 children in the North district.
- Although there was very little population growth in Suburban Cook County, the racial/ethnic composition changed drastically. The total minority population increased by over 30%, while the non-Hispanic white population decreased by 14%.
- Hispanics had the largest rate of growth, 46% with the Non-Hispanic African American population increasing by 17%.
- In 2000, there were more African Americans than Hispanics (340,351 and 318,096 respectively), and by the 2010 Census, the Hispanic population (465,897) exceeded the African American population (399,822).

Highlighted below is the CDC's Social Vulnerability Index for Cook County and a larger PDF version can be downloaded here. The CDC's SVI databases and maps can be used to:

- Estimate the number of needed supplies like food, water, medicine, and bedding.
- Help decide how many emergency personnel are required to assist people.
- Identify areas in need of emergency shelters.

- Plan the best way to evacuate people, accounting for those who have special needs, such as people without vehicles, the elderly, or people who do not understand English well.
- Identify communities that will need continued support to recover following an emergency or natural disaster.



Population Characteristics

Population changes are useful socio-economic indicators. Knowledge of the composition of the population and how it has changed in the past and how it may change in the future is needed for making informed decisions about the future. Information about population is a critical part of planning because it directly relates to land needs such as housing, industry, stores, public facilities and services, and transportation. A detailed population chart is found at the end of this section and the table below highlights general population characteristics.

TABLE: GENERAL POPULATION CHARACTERISTICS OF COOK COUNTY, 2016	
General Population Characteristics, 2016	**Cook County Count/Percentage**
Total Population	5,227,575
Total Households	1,951,606
Average Household Size	2.6
% Population Change, 2000-10	-3.4
% Population Change, 2010-16	0.6
% Population Change, 2000-16	-2.8

Sources: [CMAP](), 2000 and 2010 Census, 2016 American Community Survey five-year estimates.

The U.S. Census Bureau estimated the planning area's population at 5,180,493 as of July 2018 (Census). Cook County is the largest of Illinois' 102 counties by population and also has the highest population density in the state, at over 5,495.1 people per square mile in 2010 and 5,542 in 2017. Projections showed population density will likely remain stable with a slight decrease from 2017-2022 (Open Data Network).

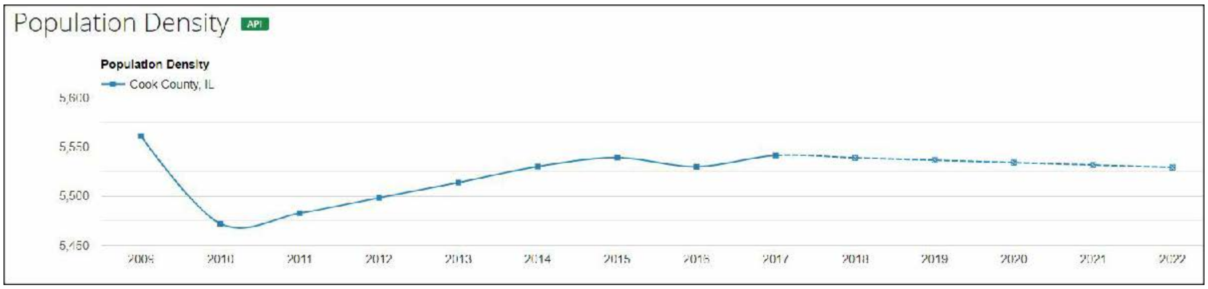
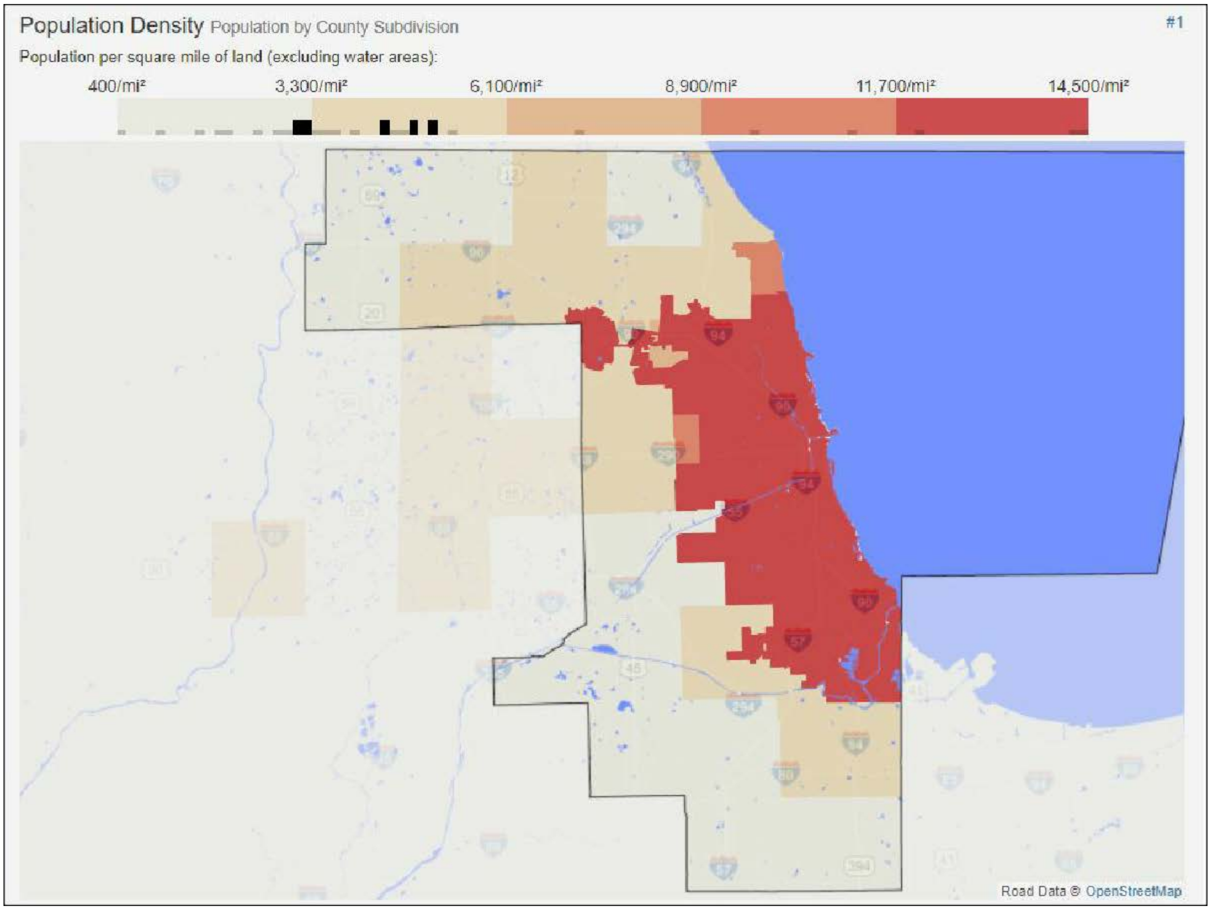


Chart: Population Density Projects

Source: Open Data Network from US Census American Community Survey, ODN Network, and API

As of July 1, 2018, the number of households was estimated to be 2,200,221 with an average of 2.63 persons per household (Census). Homeownership was 56.4% in 2017, which was a slight increase from 2016 value of 56% but below the US average of 63.8% in 2017 (Data USA).

In general, population per square mile was 5,495.1 (Census, 2010). Population and population density vary drastically across the County and are highlighted in the table and map below. The map shows that the areas in red have the highest population density (11,700 to 14,500 population per square mile of land excluding water areas) and the light beige as the lowest population density (less than 3,3300 population per square mile of land excluding water areas) (Statistical Atlas).



Map: Population Density by County Subdivision

Source: Statistical Atlas - go to site for an interactive map with population density by subdivision

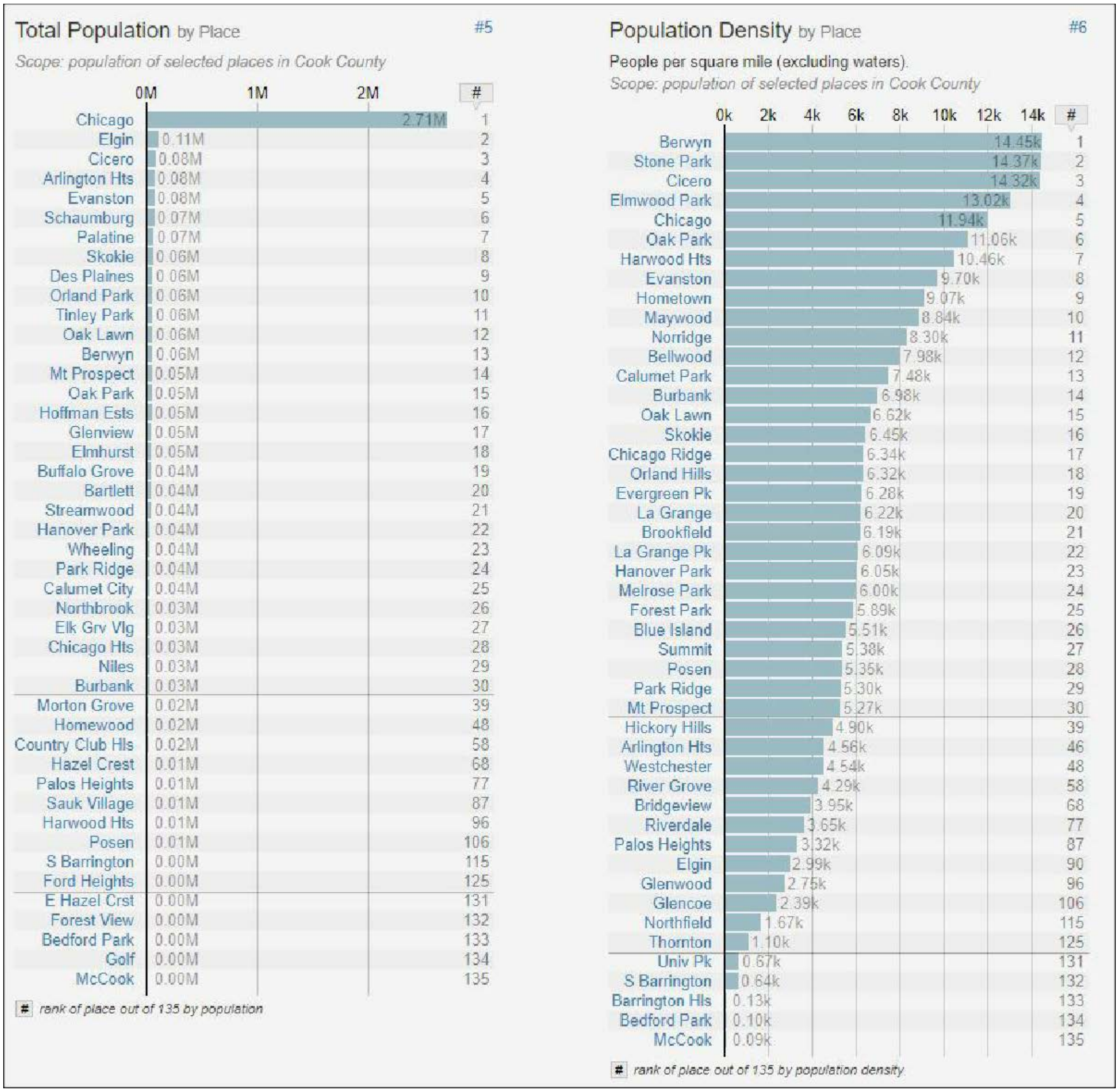


Chart: Population Total Density by County Place

Source: [Statistical Atlas]()

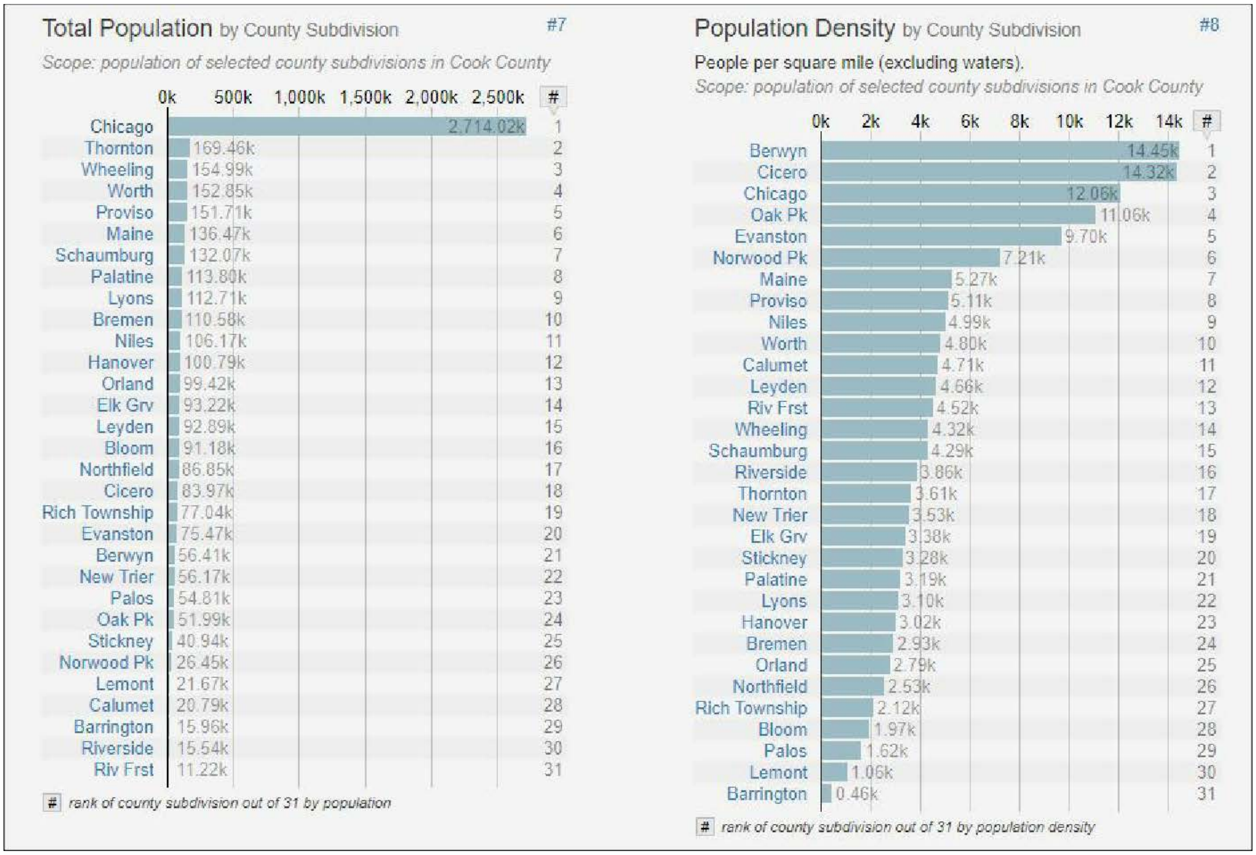


Chart: Population Total Density by County Subdivision

Source: [Statistical Atlas]

In 2010, only 1.8 percent of the planning area's residents lived outside incorporated areas. The unincorporated areas are:

- Bremen Township - 37.84 square miles and 2010 Census population was 110,118 with an unincorporated population of 2,194. It contains 1,392 unincorporated parcels and 754 unincorporated housing units
- Lemont Township - 21.08 square miles and 2010 Census population was 21,113 with an unincorporated population of 5,170. It contains 2,248 unincorporated parcels and 1,662 unincorporated housing units
- Leyden Township - 19.92 square miles and 2010 Census population was 92,890 with an unincorporated population of 14,756. It contains 2,872 unincorporated parcels and 2,971 unincorporated housing units.
- Maine Township - 26.16 square miles and 2010 Census population was 135,617 with an unincorporated population of 30,043. It contains 8,270 unincorporated parcels and 10,582 unincorporated housing units.

- Northfield Township - 34.63 square miles and 2010 Census population was 85,102, with an unincorporated population of 13,787. It contains 4,773 unincorporated parcels and 5,505 unincorporated housing units.
- Orland Township - 36.39 square miles and 2010 Census population was 97,558, with an unincorporated population of 5,226. It contains 2,334 unincorporated parcels and 1,670 unincorporated housing units (The Civic Federation).

TABLE: HISTORICAL POPULATION DATA

	Population		
	1990	**2000**	**2010**
Alsip	18,227	19,725	19,277
Arlington Heights	75,460	76,031	75,101
Barrington	9,504	10,168	—
Bartlett	19,373	36,706	—
Bedford Park	566	574	580
Bellwood	20,241	20,535	19,071
Berkeley	5,137	5,245	5,209
Berwyn	45,426	54,016	56,657
Blue Island	21,203	23,463	23,706
Bridgeview	14,402	15,335	16,446
Broadview	8,713	8,264	7,932
Brookfield	18,876	19,085	18,978
Burbank	27,600	27,902	28,925
Burnham	3,916	4,170	4,206
Burr Ridge	7,669	10,408	—
Calumet City	37,840	39,071	37,042
Calumet Park	8,418	8,516	7,835
Chicago	2,783,726	2,896,016	2,695,598
Chicago Ridge	13,643	14,127	14,305
Cicero	67,436	85,616	83,891
Country Club Hills	15,431	16,169	16,541
Countryside	5,716	5,991	5,895
Crestwood	10,823	11,251	10,950
Des Plaines	53,223	58,720	58,364
Dixmoor	3,647	3,934	3,644
Dolton	23,930	25,614	23,153
East Hazel Crest	1,570	1,607	1,543
Elk Grove Village	33,429	34,727	—
Elmwood Park	23,206	25,405	24,883

Evanston	73,233	74,239	74,486
Evergreen Park	20,874	20,821	19,852
Flossmoor	8,651	9,301	9,464
Ford Heights	4,259	3,456	2,763
Forest Park	14,918	15,688	14,167
Forest View	743	778	698
Franklin Park	18,485	19,434	18,333
Glencoe	8,499	8,762	8,723
Glenview	37,093	41,847	44,692
Glenwood	9,289	9,000	8,969
Golf	454	451	500
Hanover Park	32,895	38,278	—
Harvey	29,771	30,000	25,282
Harwood Heights	7,680	8,297	8,612
Hazel Crest	13,334	14,816	14,100
Hoffman Estates	13,021	13,926	—
Hickory Hills	7,672	8,155	14,049
Hillside	1,963	2,134	8,157
Hodgkins	46,561	49,495	1,897
Hometown	4,769	4,467	4,349
Homewood	19,278	19,543	19,323
Indian Head Park	3,503	3,685	3,809
Inverness	6,503	6,749	—
Justice	11,137	12,193	12,926
Kenilworth	2,402	2,494	2,513
La Grange	15,362	15,608	15,550
La Grange Park	12,861	13,295	13,579
Lansing	28,086	28,332	28,331
Lincolnwood	11,365	12,359	12,590
Lynwood	6,535	7,377	9,007
Lyons	9,828	10,255	10,729
Markham	13,136	12,620	12,508
Matteson	11,378	12,928	19,009
Maywood	27,139	26,987	24,090
McCook	235	254	228
Melrose Park	20,859	23,171	25,411
Merrionette Park	2,065	1,999	1,900
Midlothian	14,372	14,315	14,819
Morton Grove	22,408	22,451	23,270

Mount Prospect	53,170	56,265	54,167
Niles	28,284	30,068	29,803
Norridge	14,459	14,582	14,572
North Riverside	6,005	6,688	6,672
Northbrook	32,308	33,435	33,170
Northfield	—	—	5,420
Northlake	12,505	11,878	12,323
Oak Forest	26,203	28,051	27,962
Oak Lawn	56,182	55,245	56,690
Oak Park	53,648	52,524	51,878
Olympia Fields	4,248	4,732	4,988
Palos Heights	11,478	11,260	12,515
Palos Hills	17,803	17,665	17,484
Park Forest	24,656	23,462	—
Park Ridge	36,175	37,775	37,480
Phoenix	2,217	2,157	1,964
Posen	4,226	4,730	5,987
Prospect Heights	15,239	17,081	16,256
Richton Park	10,523	12,533	13,646
River Forest	13,671	15,055	11,172
River Grove	11,669	11,635	10,227
Riverdale	9,961	10,668	13,549
Riverside	8,774	8,895	8,875
Robbins	7,498	6,635	5,337
Rolling Meadows	22,591	24,604	24,099
Rosemont	3,995	4,224	4,202
Sauk Village	9,926	10,411	10,506
Schaumburg	68,586	75,386	74,227
Schiller Park	11,189	11,850	11,793
Skokie	59,432	63,348	64,784
South Chicago Heights	3,597	3,970	4,139
South Holland	22,105	22,147	22,030
Stickney	5,678	6,148	6,786
Stone Park	4,383	5,127	4,946
Streamwood	30,987	36,407	39,858
Summit	9,971	10,637	11,054
Thornton	2,778	2,582	2,338
Tinley Park	37,121	48,401	—
Westchester	17,301	16,824	16,718

Western Springs	11,984	12,493	12,975
Wheeling	29,911	34,496	—
Willow Springs	4,509	5,027	5,524
Wilmette	26,690	27,651	27,087
Winnetka	12,174	12,419	12,187
Worth	11,208	11,047	10,789
Unincorporated County	—	—	98,000
Cook County Total	**5,105,067**	**5,376,741**	**5,194,675**
Note: Municipalities with primary area in another county are not shown			

Income

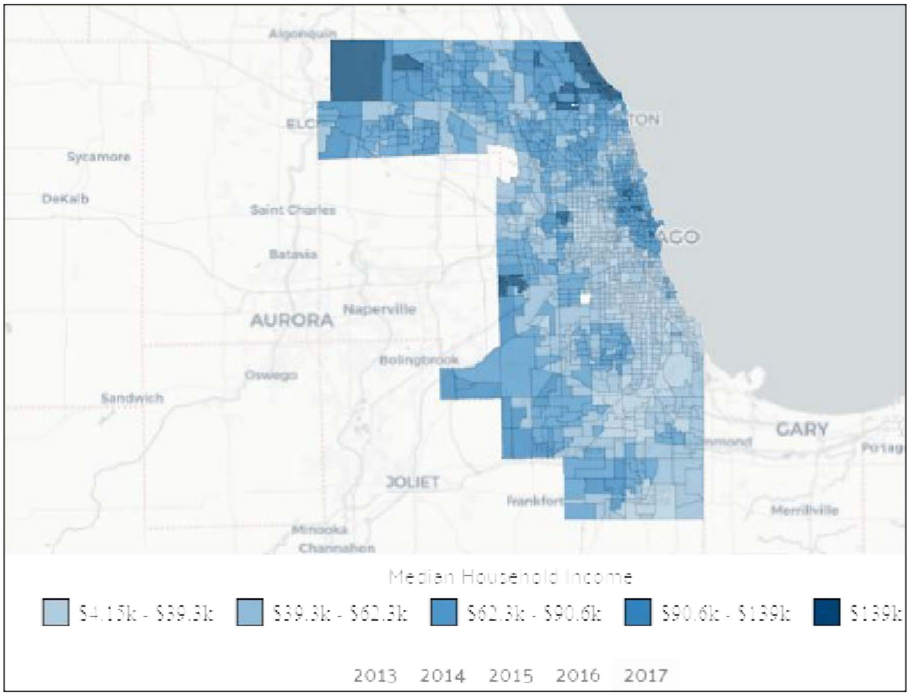
In the United States, individual households are expected to use private resources to prepare for, respond to, and recover from disasters to some extent. This means that households living in poverty are automatically disadvantaged when confronting hazards. Additionally, people lacking adequate resources are also typically living in older structures and inadequately maintained housing. Mobile or modular homes, for example, are more susceptible to damage in earthquakes and floods than other types of housing. In urban areas, the poor often live in older houses and apartment complexes, which are more likely to be made of unreinforced masonry, a building type that is particularly susceptible to damage during earthquakes. Furthermore, residents below the poverty level are less likely to have insurance to compensate for losses incurred from natural disasters. This means that residents below the poverty level have a great deal to lose during an event and are the least prepared to deal with potential losses. The events following Hurricane Katrina in 2005 illustrated that personal household economics significantly impact people's decisions on evacuation. Individuals who cannot afford gas for their cars will likely not have the means to evacuate.

Based on U.S. Census Bureau estimates, per capita income in the planning area in 2012 was $30,048 and has increased to $33,722 (in 2017 dollars) based on the ACS 2013-17. The median household income has also increased and is $59,426 (in 2017 dollars) based on the ACS 2013-17 (in comparison to the 2016 amount highlighted in the table below). In 2017, the average salary (full-time employee) for a male was $72,886 and the average salary for a female was $53,388 (1.37 times less). In 2017 the highest paid race/ethnicity of Cook County, IL workers was Asian. These workers were paid 1.19 times more than White workers, who made the second highest salary of any race/ethnicity. Income inequality in 2017 was 0.484 which showed a 0.488% decline from 2016 meaning wage distribution grew somewhat more evenly (Data USA).

TABLE: HOUSEHOLD INCOME, 2016		
Household Income, 2016	**Count**	**Percent**
Less than $25,000	456,075	23.4
$25,000 to $49,999	414,969	21.3
$50,000 to $74,999	325,112	16.7
$75,000 to $99,999	233,500	12.0
$100,000 to $149,999	269,196	13.8
$150,000 and Over	252,754	13.0
Median Household Income, 2016	**$56,902**	–

Source: CMAP

Just like population size, median household income varies widely across the County.



Map: Income by Location

Source: [Data USA]

The 2017 Small Area Income and Poverty Estimate (SAIPE) poverty estimates 14.6% of the population is in poverty and the Census Bureau ACS 5-year (2013-17) Estimate is higher at 15.9% of the population living below the poverty line. The Census Bureau ACS 5-year (2013-17) Estimate for the entire United States is 13.4% indicating a higher percentage of Cook County residents live below the poverty line than the average population for the entire county. The most common racial or ethnic group living below the poverty line in Cook County, IL is Black, followed by White and Hispanic. The largest age and gender demographic living in poverty are Females 25 - 34, followed by Females 18 - 24 and then Females 35 - 44.

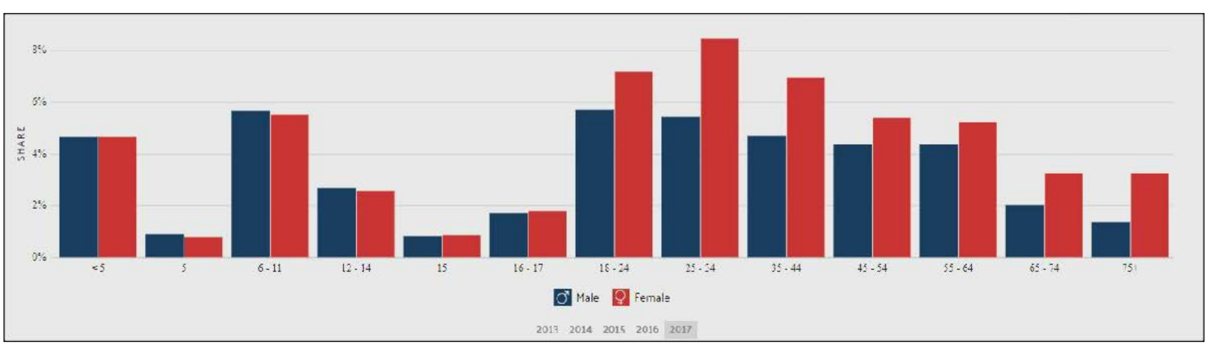
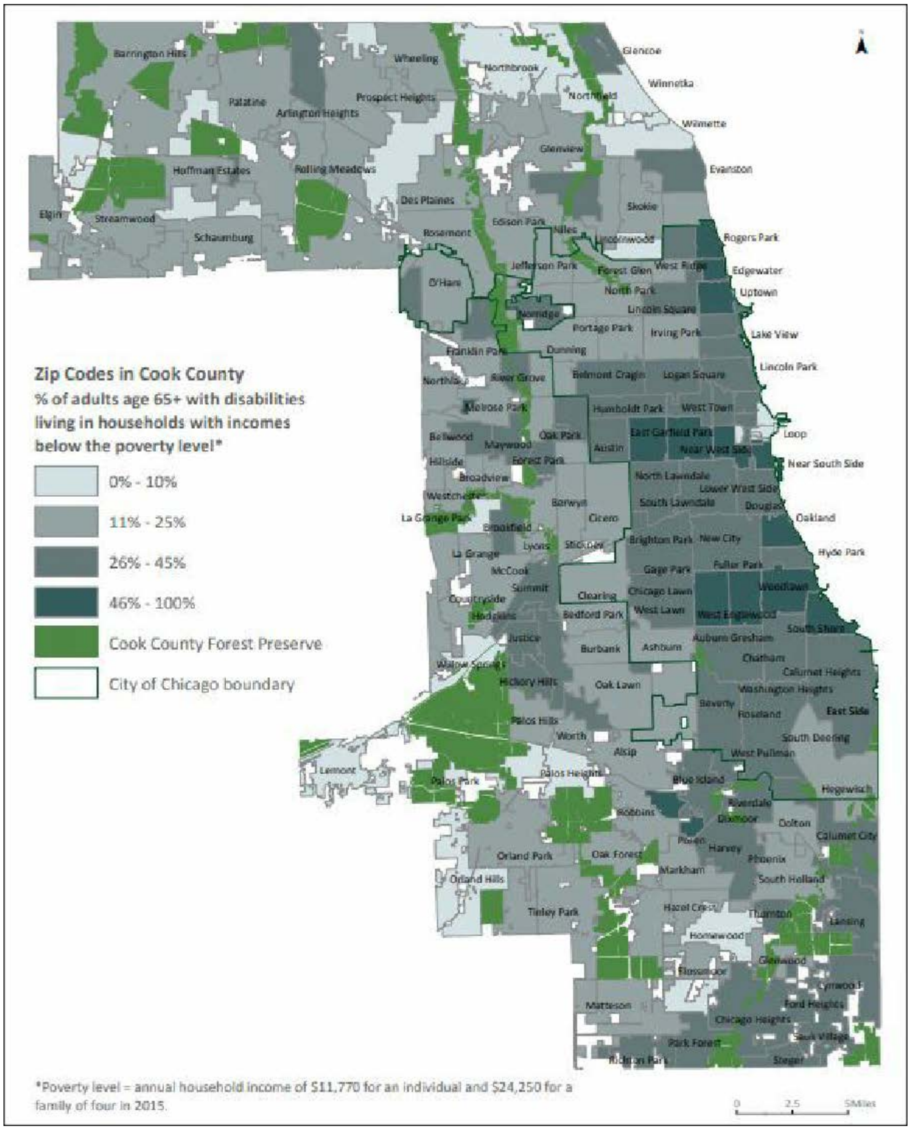


Chart: Poverty by Age and Gender

Source: Data USA

Like with median household income, social vulnerability will vary throughout the County. A multitude of factors determines vulnerability. In correlation to income, age, poverty, and disability are all factors that impact an individuals resilience.



Map: Percent of adults with disabilities age 65 living below the poverty level by Cook County Zip Code, 2015

Source: Chicago Food Bank

Homelessness

While statistics for Cook County do not exist, the total unduplicated count of people homeless in Chicago throughout 2016 is 80,384. 80% of them were living doubled-up.

- According to data from the American Communities Survey, 64,114 people were living doubled up in Chicago in 2016. Of those, 55.5% were black, 6.5% white, 33.1 Hispanic/Latino, and 4.9% other groups.
- According to 2016 HMIS data, 23,808 people were served in the shelter system. Of those, 7,538 had been living doubled-up with family or friends at some point that year. 76% of shelter residents were black,19% white, and 5% other. 11% reported being Hispanic/Latino.
- Of the 35,435 homeless people living in families with children, 90% (31,923) were doubled up.
- Of the 8,860 homeless family households, 88% (7,821) were doubled-up.
- Of the 44,757 homeless individuals, 72% (32,191) were doubled-up.
- Unaccompanied homeless youth ages 14-24 totaled 11,067. Of those, 85% (9,455) were doubled up.
    - Chicago Coalition for the Homeless

The most recent annual Homeless Point in Time Count, conducted in January 2018, found a total of 873 people (640 households) experiencing homelessness in Suburban Cook County. The data show that most of the homeless population in the community is sheltered, with 398 of counted households living in emergency shelters (62%), 134 (21%) living in transitional housing, and 24 households (4%) living in safe havens. There were 84 unsheltered households, comprising 13% of the total households counted. There were 131 people experiencing chronic homelessness and 50 veterans (Strategic Plan to End Homelessness in Suburban Cook County).

By school district in Cook County, the following districts had the highest number of students enrolled that were chronically homeless:

- Harvey District 152, 704 students; South Holland District 150, 307;
- Palatine District 15, 161; Wheeling District 21, 259; (Palatine) High School District 211, 236;
- (Arlington Heights) High School District 214, 201;
- Evanston Township District 202, 201. (Illinois Department of Education)
    - Chicago Coalition for the Homeless

Age Distribution

As a group, the elderly are more apt to lack the physical and economic resources necessary for response to hazard events and are more likely to suffer health-related consequences making recovery slower. They are more likely to be vision, hearing, and/or mobility impaired, and more likely to experience mental impairment or dementia. Additionally, the elderly are more likely to live in assisted-living facilities where emergency preparedness occurs at the discretion of facility operators. These facilities are typically identified as "critical facilities" by emergency managers because they require extra notice to implement evacuation. Elderly residents living in their own homes may have more difficulty evacuating their homes and could be stranded in dangerous situations. This population group is more likely to need special medical attention, which may not be readily available during natural disasters due to isolation caused by the event. Specific planning attention for the elderly is an important consideration given the current aging of the American population.

Children under 14 are particularly vulnerable to disaster events because of their young age and dependence on others for basic necessities. Very young children may additionally be vulnerable to injury or sickness; this vulnerability can be worsened during a natural disaster because they may not understand the measures that need to be taken to protect themselves from hazards.

The overall age distribution for the planning area is illustrated in the table below. In addition, according to the Vintage 2017 Population Estimates, 6.2% of the population is under 5 years and 14.3% of people are 65 and over (Census).

TABLE: AGE COHORTS, 2016		
Age Cohorts, 2016	**Count**	**Percent**
19 and under	1,316,810	25.2
20 to 34	1,214,796	23.2
35 to 49	1,046,126	20.0
50 to 64	972,184	18.6
65 to 74	377,451	7.2
75 to 84	205,204	3.9
85 and Older	95,004	1.8
Median Age	**36.1**	–

Source: CMAP

A multitude of factors in addition to age must be utilized to make fully-informed plans that include the whole community. Within the age demographics, the Census highlights some socioeconomic and disability factors that are key to understanding the needs of vulnerable population members. Based on 2012 U.S. Census data estimates, 12.4 percent of the planning area's population is 65 or older. Using the Vintage 2017 Population Estimate Program, the percentage has increased to 14.3%.

Race, Ethnicity and Language

Race, ethnicity, primary language, and class are factors that help explain social vulnerability. Planners need to not only look at the natural environment in the development of mitigation programs but also the social environment. The interaction between nature and society produces the vulnerability of places. Census data provides a snapshot of the community for a particular timeframe and often lacks information on the most vulnerable community members, such as residents that do not have legal status or the homeless population. To truly provide equitable disaster planning and relief, disaster planners need to understand the community beyond Census data. For an entire community to be prepared for a disaster, planners need to move beyond assessing the aggregate need of a population and understand the resources and vulnerabilities that exist within the community.

TABLE: VINTAGE 2017 POPULATION ESTIMATES	
Race and Hispanic Origin, 2017	**Percentage**
White alone	65.6
Black or African American alone	24
American Indian and Alaska Native alone	0.7
Asian along	7.7
Native Hawaiian and Other Pacific Islander alone	0.1
Two or More Races	1.9
Hispanic or Latino	25.5
White alone, not Hispanic or Latino	42.3

Source: Census

TABLE: RACE AND ETHNICITY OF COOK COUNTY, 2016		
Race and Ethnicity, 2016	**Count**	**Percent**
White non-Hispanic	2,241,001	42.9
Hispanic or Latino	1,300,843	24.9
Black non-Hispanic	1,232,816	23.6
Asian non-Hispanic	355,071	6.8
All other categories	97,844	1.9

Source: CMAP

The table below highlights the percentage of changes in race and ethnicity in Cook County.

TABLE: RACE AND ETHNICITY OF COOK COUNTY, 2000, 2010, AND 2016			
Race and Ethnicity	**2000, %**	**2010, %**	**2016, %**
White, non-Hispanic	47.6	44.4	42.9
Hispanic or Latino	19.9	23.3.	24.9
Black non-Hispanic	25.9	24.9	23.6
Asian non-Hispanic	4.8	6.1	6.8
All other categories	1.8	1.4	1.9

Source: CMAP - 2000 Census; 2010, 2016 American Community Survey five-year estimates.

According to the ACS 5-year Estimate, 15.9% of the population lives below the poverty line (822,000 people). In Cook County, the primary race (ethnicity) is White (alone) followed by Hispanic or Latino and then Black. A disappropriate number of individuals identifying as Black reside in poverty.

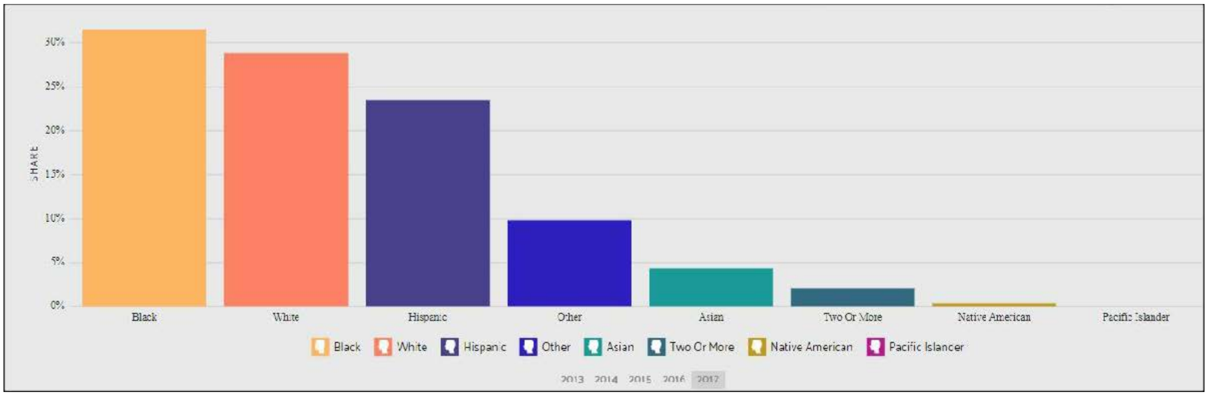


Chart: Poverty by Race and Ethnicity of Cook County, ACS 2013-2017

Source: [Data USA]

TABLE: POVERTY BY RACE AND ETHNICITY OF COOK COUNTY, ACS 2013-2017		
Poverty by Race and Ethnicity	**Count**	**Percent**
White non-Hispanic	309,454	28.9
Hispanic or Latino	250,972	23.4
Black non-Hispanic	337,304	31.4
Asian non-Hispanic	105,069	9.8
Native American	2,761	0.257
Two or More Races	21,321	1.99
All other categories	105,069	4.24
Total	**1,026,881**	–

Source: [Data USA]

The planning area has a 22.4% (1,095,636) foreign-born population. The census estimates 14.4% (704,337) of the residents speak English “less than very well.” The table below shows the primary language spoken at home.

TABLE: LANGUAGE SPOKEN AT HOME, 2016		
Language Spoken at Home, 2016	**Count**	**Percent**
English	3,183,874	65.1
Spanish	1,007,534	20.6
Slavic	209,746	4.3
Chinese	62,699	1.3
Tagalog	47,227	1.0
Arabic	44,364	0.9
Korean	27,129	0.6

Other Asian Languages	61,230	1.3
Other Indo-European Languages	202,944	4.1
Other/Unspecified Languages	45,979	0.9

Disabled Populations

The 2010 U.S. Census estimates that 54 million non-institutionalized Americans with disabilities live in the U.S. This equates to about one-in-five persons. People with disabilities are more likely to have difficulty responding to a hazard event than the general population. Local government is the first level of response to assist these individuals, and coordination of efforts to meet their access and functional needs is paramount to life safety efforts. It is important for emergency managers to distinguish between functional and medical needs in order to plan for incidents that require evacuation and sheltering. Knowing the percentage of the population with a disability will allow emergency management personnel and first responders to have personnel available who can provide services needed by those with access and functional needs. According to the 2012 Disability Stats Report Census, there are 551,169 individuals with some form of disability within the planning area.

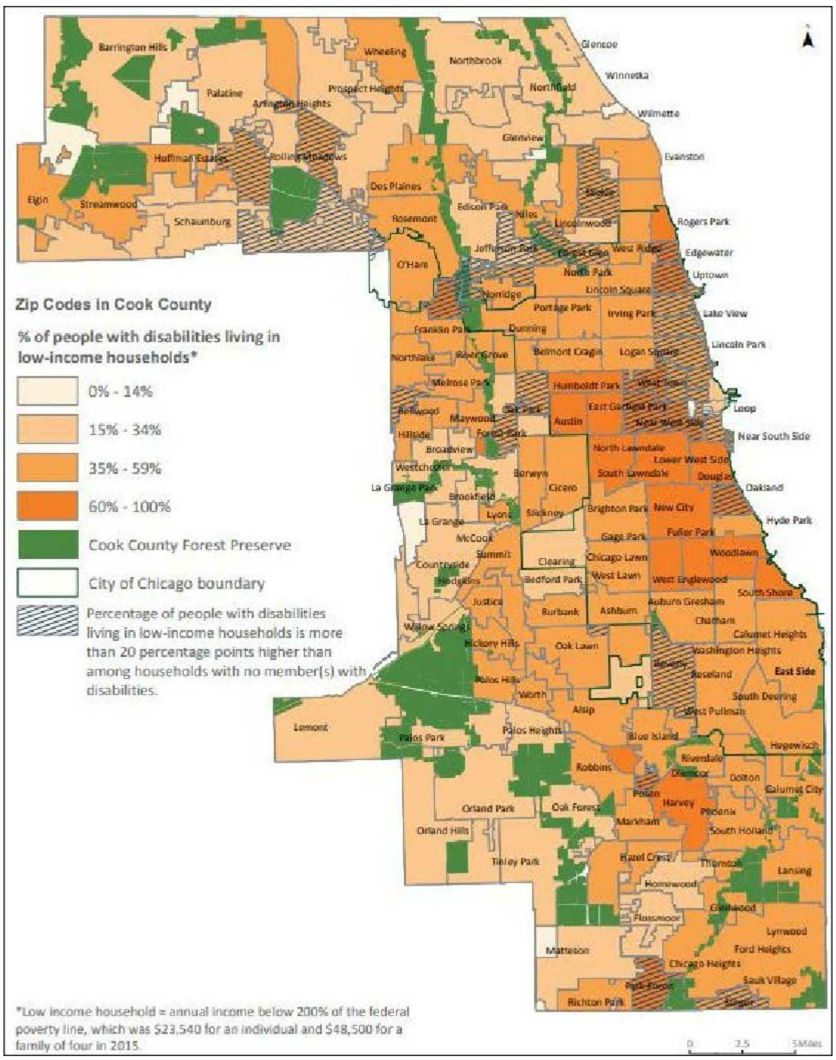
According to the ADA, the term disability means, with respect to an individual: (a) a physical or mental impairment that substantially limits one or more of the major life activities of such individual; (b) a record of such impairment; or (c) being regarded as having such an impairment. Based on the Disability Stats Report 2012, 551,169 (10.6%) in Cook County have at least one type of disability.

In 2013, a United States Department of Agriculture (USDA) Economic Research Service (ERS) report found that having a disability was among the strongest known risk factors for food insecurity. Food insecurity is disproportionately high among adults with disabilities in Cook County, especially among working-age adults. Food insecurity statistics can be correlated to individuals that will need assistance, particularly evacuation and recovery assistance, during and following an emergency.

Based on the 2015 U.S. Census Current Population Survey data, an estimated 49% of individuals with a disability in Cook County live at the 200% federal poverty line. Furthermore, 31% of households with a working-age member with a disability in the Chicago metro area are food insecure, compared to 8% of households with a working-age adult with no disabilities. Neighborhoods across Chicago and the suburbs show very high proportions of people with disabilities living in low-income households. While some areas mirror poverty patterns of the general population, several communities, particularly on the north side of Chicago, show considerably higher rates of low-income among adults with disabilities than among those with no disabilities. More than 12% of the county's current adult population has a disability and the Social Security Administration predicts that more than 1 in 4 of the current 20-year-olds will become disabled before they retire. In addition, demographers project the population over age 65 will increase by 55% by 2030 and more than double by 2060. These shifting dynamics indicate that the number of adults with disabilities will likely grow in the coming years, and food insecurity can thus also be expected to increase if focus and priority are not placed on the barriers to food access faced by this population (Chicago Food Bank).

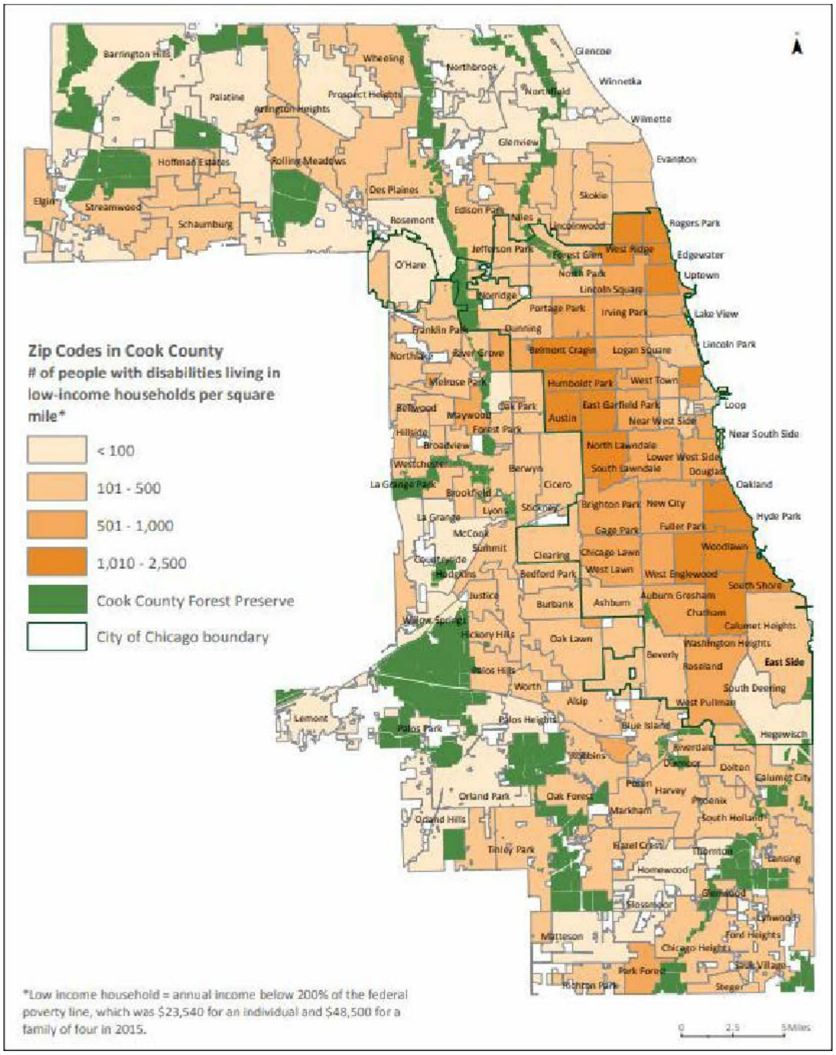
TABLE: NEED INDICATORS IN COOK COUNTY, 2015				
Need Indicators, 2015	**With a disability Age 18-64**	**With a disability Age 65**	**No Disability Age 18-64**	**No Disability Age 65**
Unemployment rate	19%	N/A	8%	N/A
Median earnings	$22,495	N/A	$35,452	N/A
Poverty rate	28%	14%	13%	10%

Source: [Chicago Food Bank]



Map: Percent of people with disabilities living in low-income households by Cook County Zip Code, 2015

Source: [Chicago Food Bank]



Map: Number of people with disabilities living in low-income households per square mile, by Cook County Zip Code, 2015

Source: [Chicago Food Bank]

TABLE: ZIP CODES WITH THE HIGHEST RATES OF LOW-INCOME AMONG PEOPLE WITH DISABILITIES				
Zip Code	**Community Areas in Zip Code**	**# of people with disabilities**	**# of people with disabilities with incomes below 200% FPL**	**% of people with disabilities with incomes below 200% FPL**
60469	Posen	577	40	78%
60612	Near West Side, East Garfield Park	4,654	3,516	76%
60624	West Garfield Park	6,577	4,913	75%

60653	Grand Boulevard, Oakland	5,122	3,809	74%
60621	Englewood	5,373	3,976	74%
60672	Robbins	1,186	862	73%
60649	South Shore	6,859	4,912	72%
60644	Austin	8,534	6,013	70%
60623	South Lawndale, North Lawndale	11,375	7,978	70%
60640	Uptown	7,244	5,067	70%
60609	New City, Fuller Park	7,013	4,776	68%
60636	West Englewood	5,737	3,866	67%
60637	Woodlawn, Washington Park	7,053	4,700	67%
60651	Humboldt Park	9,899	6,552	66%
60626	Rogers Park	4,860	3,216	66%

Source: *Chicago Food Bank*

Economy

This section describes the economic characteristics of Cook County, such as: the industries, businesses, institutions, and employment trends unique to the County.

Industry, Businesses and Institutions

The economy of Cook County, IL employs 2.56 million people. The largest industries in Cook County, IL are Health Care & Social Assistance (359,078 people), Manufacturing (251,042 people), and Professional, Scientific, & Technical Services (245,584 people), and the highest paying industries are Utilities ($80,566), Finance & Insurance ($75,265), and Mining, Quarrying, & Oil & Gas Extraction ($71,505).

From 2016 to 2017, employment in Cook County, IL grew at a rate of 0.355%, from 2.55 to 2.56 million employees.

The most common job groups, by the number of people living in Cook County, IL, are Other Management Occupations Except Farmers, Ranchers, & Other Agricultural Managers (153,934 people), Other Business Operations Specialists (75,696 people), and Building Cleaning & Pest Control Workers (73,834 people).

The most common jobs held by residents of Cook County, IL, by the number of employees, are Other Management Occupations Except Farmers, Ranchers, & Other Agricultural Managers (153,934 people), Other Business Operations Specialists (75,696 people), and Building Cleaning & Pest Control Workers (73,834 people).

TABLE: EMPLOYMENT BY OCCUPATIONS	
Occupation Categories	**Number of Employees**
Management, Business, Science, and Arts	955K

Production, Transportation, and Material Moving Occupation	338K
Sales and Office Occupation	583K
Service Occupation	459K
Natural Resources, Construction, and Maintainance	155K
Total Employed in 2017	**2.56M**

Source: *Data USA*

The most common employment sectors for those who live in Cook County, IL, are Health Care & Social Assistance (359,078 people), Manufacturing (251,042 people), and Professional, Scientific, & Technical Services (245,584 people). Agriculture, forestry, fishing, and mining make up the smallest source of the local economy. Compared to other counties, Cook County, IL has an unusually high number of residents working as Preschool & Kinder (2.84 times higher than expected), Motor Vehicle Operators Except for Bus & Truck Drivers (2.18 times), and Baggage Porters & Concierges, & Tour & Travel Guides (1.76 times).

TABLE: EMPLOYMENT BY INDUSTRIES	
Employment by Industries	**Number of Employees**
Education Services, Health Care, and Social Assistance	587K
Public Administration	85.5K
Other Service Except for Public Administration	127K
Agricultural, Forestry, Fishing, Hunting, and Mining	3.92K
Arts, Entertainment Recreations, Accommodation, and Food Services	261K
Construction	122K
Manufacturing	251K
Wholesale Trade	69.8K
Retail Trade	244K
Professional, Scientific, Technical Services, Administrative, Support, and Waste Management Services	368K
Transportation, Warehousing, and Utilities	180K
Information	54.6K
Finance, Insurance, Real Estate, Rental, and Leasing	209K

Source: *Data USA*

The planning area benefits from a variety of business activity. Major businesses include the U.S. Government; Jewel-Osco; United Airlines; Motorola; Abbott Laboratories; Target Corporation; Walgreens; The Boeing Company; Bank One; Boeing; and Sears, Roebuck, and Company.

Higher Education

In 2016, universities in Cook County, IL awarded 93,676 degrees. The student population of Cook County, IL is skewed towards women, with 143,431 male students and 192,578 female students.

The largest universities in Cook County, IL by a number of degrees awarded are Northwestern University(9,127 and 9.74%), the University of Illinois at Chicago(7,525 and 8.03%), and DePaul University (6,428 and 6.86%).

The most popular majors in Cook County, IL are General Business Administration & Management(8,120 and 8.67%), Liberal Arts & Sciences (5,213 and 5.56%), and Biological & Physical Sciences (2,564 and 2.74%). The median tuition costs in Cook County, IL is $27,200 for private four-year colleges, and $7,450 and $14,907 respectively, for public four-year colleges for in-state students and out-of-state students (Data USA).

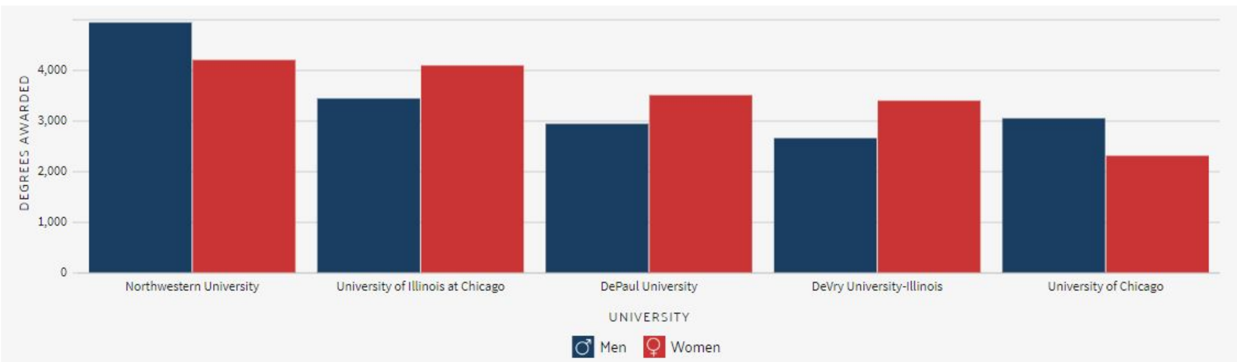


Chart: Student Gender by Top 5 Enrolled Institutions in Cook County

Source: Data USA

Employment Trends and Occupations

Cook County is the most racially, ethnically, and economically diverse workforce area in the state. More adults who live in the area have less than a high school diploma, yet a much higher percentage than the state average has a graduate or professional degree (Illinois Department of Economic Security).

TABLE: EDUCATION	
Education (2013-2017)	**Percent**
High School graduate or higher, percent of people over 25 years	86.2
Bachelor's degree or higher, percent of people over 25 years	37.2

Source: Census - ACS 2013-2017

From 2010 to 2014, Cook County ranked number 4 out of 73 counties that contributed to the largest increase in employment in the U.S. In total, employment increased by 165,680 with an employment growth rate of 7.6% and population growth of 1%. Additionally, Cook County was the only county in Illinois and the entire Midwest that contributed to half of the new business growth in the United States. In total, 20 counties contributed to generating half of the net new establishments. Cook County ranked

12 of 20 and had an estimated increase in establishing 2,980 new businesses (Economic Innovation Group).

According to the American Community Survey 2013-17, about 65.8 percent of Cook County's population over 16 years old. Of the population over 16 years old, 60.6 percent identify as women in the labor force (Census). From 2016 to 2017, employment in Cook County, IL grew at a rate of 0.355%, from 2.55M employees to 2.56M employees. CMAP data (2016) further breakdown the employment and unemployment statistics of individuals over 16 years olf in Cook County (CMAP).

TABLE: EMPLOYMENT STATUS, 2016		
Employment Status, 2016	**Count**	**Percent**
In Labor Force	2,759,566	66.1
Employed (1)*	2,492,088	90.3
Unemployed*	266,397	9.7
Not In Labor Force	1,413,506	33.9

Source: CMAP

The highest paying industries in Cook County, IL, by median earnings, are Utilities ($80,566), Finance & Insurance ($75,265), and Mining, Quarrying, & Oil & Gas Extraction ($71,505). The highest paid jobs held by residents of Cook County, IL, by median earnings, are Legal Occupations ($98,582), Law Enforcement Workers Including Supervisors ($81,659), and Management Occupations ($78,257). Additional Census Data on the economy and businesses in Cook County are highlighted below.

TABLE: BUSINESSES, COOK COUNTY	
Businesses	**Total/Percent**
Total employer establishments, 2016	133,150
Total employment, 2016	2,401,662
Total annual payroll, 2016 ($1,000)	145,680,137
Total employment, percent change, 2015-2016	1.70%
Total nonemployer establishments, 2016	483,757
All firms, 2012	549,686
Men-owned firms, 2012	291,278
Women-owned firms, 2012	216,929
Minority-owned firms, 2012	216,374
Nonminority-owned firms, 2012	319,115
Veteran-owned firms, 2012	38,665
Nonveteran-owned firms, 2012	495,450

Source: Census

TABLE: ECONOMY, COOK COUNTY

Economy	Total
Total accommodation and food services sales, 2012 ($1,000)	14,553,105
Total health care and social assistance receipts/revenue, 2012 ($1,000)	39,639,868
Total manufacturers shipments, 2012 ($1,000)	79,526,980
Total merchant wholesaler sales, 2012 ($1,000)	100,829,550
Total retail sales, 2012 ($1,000)	62,767,358
Total retail sales per capita, 2012	$11,998

Source: *Census*

Transportation

The U.S. Census estimates the mean travel time to work (minutes) for workers 16 years and older was 32.9 minutes (ACS 2013-17). In 2017, on average, most households owned 2 cars and the majority (60.8%) drive alone to work; 19.3% take public transit and 8.04% carpool (Data USA).

Future Trends in Development

Relevant to the Hazard Mitigation Program, Cook County FY2019 Expense Projections indicates $1,875,690 as the Executive 2019 estimate to the Emergency Management Agency. This number is up from 2018 approved and adopted ($1,311,501) amount. Overall, an anticipated budgetary surplus of $0.6 million in the General Fund and Health Fund (the two major operating funds for Cook County) was anticipated for FY2018 (FY2019 Preliminary Forecast). Cook County's General Fund is projected to end FY2018 with a $2.9 million surplus, while the Health Fund is projecting a $2.3 million shortfall, for a combined surplus of $.6 million in the County's major operating funds. The projected County FY2018 General Fund surplus is driven by greater than anticipated growth in Home Rule Sales Tax revenue. The FY2019 outlook includes a $52.3 million shortfall projected in the General Fund and a $29.5 million shortfall in the Health Fund, creating a total operating fund projected deficit of $81.8 million (Cook County Preliminary Forecast 2019).

Household Income

Looking at the entire population of Cook County, the median household income (in 2017 dollars) from 2013-2017 is $59,426 which is up from 2010 ($51,466) but lower than 1999 ($60,091) in 1999 (Census). to $53,406 in 2009 and to $51,466 in 2010. From 1999 to 2010, the median household income decreased 14 percent in 11 years, more than 1 percent per year. From 2016 to 2017, the median annual income increased by 2.26%. From 2013-2017, the annual median household income was above the annual median household income across the entire United States but below Illinois (Data USA). In 2017, the average male salary was 1.37 more than a female employee with the average male salary being $72,886 and the average female salary being $53,388.

Population

The CMAP Data Hub, a regional planning organization for northeastern Illinois, prepares data, analyses, and evaluations on land use, transportation, and environmental topics. One data set (CMAP Regional

Reference Forecast 2015) provides population and household predictions from 2015 to 2050. This data is not only for Cook County and includes Dupage, Kane, Kendall, Lake, McHenry, and Will Counties in addition to Cook County. The regional data indicates a 28% (positive) population growth from 2010 to 2050 (CMAP Data Hub). However, data just for Cook County shows a steady population decline. The Illinois Department of Public Health (IDPH) study called IDPH Population Projections For Illinois Counties 2010 To 2025 showed the 2025 population projection (5,078,297) down from the 2020 projection (5,132,412) and 2015 estimated population size (5,173,864). Cook County, however, still exceeded all other County population sizes in Illinois with the second highest population projection in 2025 being DuPage County with under 1 million (IDPH).

In the past year, Cook County had a -0.38% growth rate. The population decrease in Cook County is in-line with the majority of counties across Illinois, as 86 of the 102 counties in Illinois experienced population loss from July 2017-2018. Longer-term, 93 of the 102 counties in Illinois experienced population loss from July 2010 to July 2018. From July 2017-July 2018, Cook County was the top-ranked county in the US to decrease in population size. Birth rates still outpace death rates in Cook County correlating to the population decline stemming from domestic outmigration. The primary driver for outmigration has been correlated to the labor market and tax conditions (Illinois Policy).

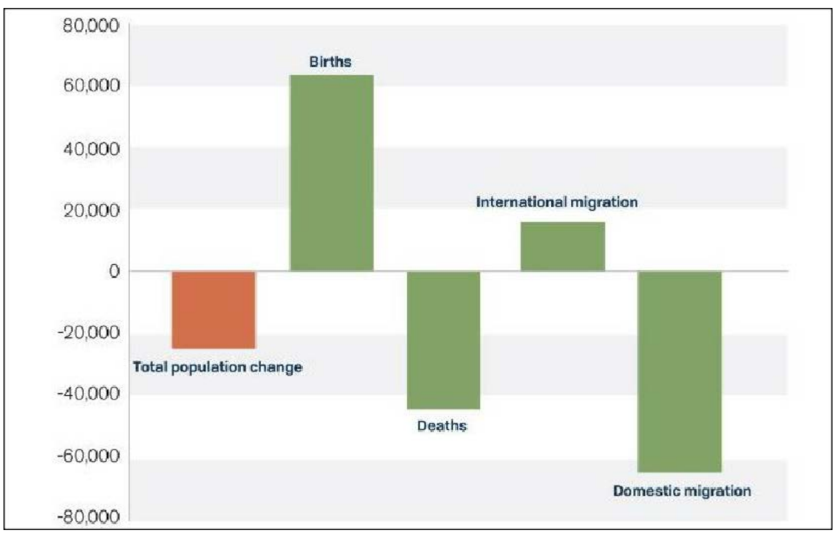


Figure: Outmigration Rates for Cook County from Illinois Policy

Housing

The 2014 Hazard Mitigation Plan highlighted the severity of Cook County's housing crisis and this trend has continued and may worsen. The New York Times cited RealtyTrac's report that metropolitan Chicago has the nation's largest inventory of foreclosed property, with more than 118,776 homes in May 2011 that were either owned by banks or were in foreclosure because the owners could no longer afford their monthly mortgage payments. According to RealtyTrac, 69,103 homes were in foreclosure in July 2012. By 2010, the median home value in Cook County had dropped 14 percent to $244,000 from $281,000 in 2007. The collapse of the homeownership market has produced a tighter rental environment for 41.8 percent of residents who do not own their home. A study done by relator.com projected Chicago-Naperville-Elgin Metropolitan Area to be the weakest of the 100 major housing markets in 2019. The report attributes Illinois having the highest overall tax burden and second highest property tax in the nation. Additionally, a population decline due to outmigration of the working-age (25-54 years old) is one of the primary drivers of the decrease in homebuyers (Illinois Policy)

Unemployment

Unemployment rates have significantly decreased from 11.8 percent in 2010 to 9.5 percent in 2012 to 3.7% in April 2019 (Illinois Department of Employment Security). Currently, the unemployment rate in Cook County is above the unemployment rate in the United States but below the unemployment rate in Illinois. Countywide job creation since 1990 has significantly lagged behind the Chicago metropolitan area and the nation. The State of Illinois Industry Employment Projections (Long-term) 2014-2024 demonstrate growth in projected employment (0.61) with a projected increase in 170,813 jobs from 2014 to 2024 (Illinois Department of Employment Security)

Incorporation of the HMP

The municipal planning partners use plans, codes, and ordinances to govern land use decision-making and policy-making within their jurisdictions. All municipal planning partners will incorporate this hazard mitigation plan in their land use plans and programs by reference. This will ensure that future development trends can be established with the benefits of the information on risk and vulnerability to natural hazards identified in this plan.

Laws, Ordinances, Programs, and Plans

Existing laws, ordinances, and plans at the federal, state, and local level can support or impact hazard mitigation actions identified in this plan. Hazard mitigation plans are required to include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information as part of the planning process (44 CFR, Section 201.6(b)(3)). Pertinent federal and state laws are described below. Each planning partner has individually reviewed existing local plans, studies, reports, and technical information in its jurisdictional annex, presented in Volume 2.

Federal

Disaster Mitigation Act of 2000

The DMA is the current federal legislation addressing hazard mitigation planning. It emphasizes the importance of strong state and local planning processes and program management in planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Grant Program funds are available to communities. This plan is designed to meet the requirements of DMA, improving the planning partners' eligibility for future hazard mitigation funds.

National Flood Insurance Program

The National Flood Insurance Program (NFIP) provides federally backed flood insurance in exchange for communities enacting floodplain regulations. Participation and good standing under NFIP are prerequisites to grant funding eligibility under the Robert T. Stafford Act. The County and most of the partner cities for this plan participate in the NFIP and have adopted regulations that meet the NFIP requirements. At the time of the preparation of this plan, all participating jurisdictions in the partnership were in good standing with NFIP requirements.

The Clean Water Act

The federal Clean Water Act (CWA) employs regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's surface waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."

Evolution of CWA programs over the last decade has included a shift from a program-by-program, source-by-source, pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach, equal emphasis is placed on protecting healthy waters and restoring impaired ones. A full array of issues is addressed, not just those subject to CWA regulatory authority. Involvement of stakeholder groups in the development and implementation of strategies for achieving and maintaining water quality and other environmental goals is a hallmark of this approach.

Endangered Species Act

The federal Endangered Species Act (ESA) was enacted in 1973 to conserve species facing depletion or extinction and the ecosystems that support them. The act sets forth a process for determining which species are threatened and endangered and requires the conservation of the critical habitat in which those species live. The ESA provides broad protection for species of fish, wildlife, and plants that are listed as threatened or endangered. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species and contains exceptions and exemptions. It is the enabling legislation for the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Criminal and civil penalties are provided for violations of the ESA and the Convention.

Federal agencies must seek to conserve endangered and threatened species and use their authorities in furtherance of the ESA's purposes. The ESA defines three fundamental terms:

- **Endangered** means that a species of fish, animal, or plant is "in danger of extinction throughout all or a significant portion of its range." (For salmon and other vertebrate species, this may include subspecies and distinct population segments.)
- **Threatened** means that a species "is likely to become endangered within the foreseeable future." Regulations may be less restrictive for threatened species than for endangered species.
- **Critical habitat** means "specific geographical areas that are…essential for the conservation and management of a listed species, whether occupied by the species or not."

Five sections of the ESA are of critical importance to understanding it:

- **Section 4: Listing of a Species**—The National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries) is responsible for listing marine species; the U.S. Fish and Wildlife Service is responsible for listing terrestrial and freshwater aquatic species. The agencies may initiate reviews for listings, or citizens may petition for them. A listing must be made "solely on the basis of the best scientific and commercial data available." After a listing has been proposed, agencies receive comment and conduct further scientific reviews for 12 to 18 months, after which they must decide if the listing is warranted. Economic impacts cannot be considered in this decision, but it may include an evaluation of the adequacy of local and state protections. Critical habitat for the species may be designated at the time of listing.

- **Section 7: Consultation**—Federal agencies must ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed or proposed species or adversely modify its critical habitat. This includes private and public actions that require a federal permit. Once a final listing is made, non-federal actions are subject to the same review, termed a "consultation." If the listing agency finds that an action will "take" a species, it must propose mitigations or "reasonable and prudent" alternatives to the action; if the proponent rejects these, the action cannot proceed.
- **Section 9: Prohibition of Take—**It is unlawful to "take" an endangered species, including killing or injuring it or modifying its habitat in a way that interferes with essential behavioral patterns, including breeding, feeding or sheltering.
- **Section 10: Permitted Take**—Through voluntary agreements with the federal government that provide protections to an endangered species, a non-federal applicant may commit a take that would otherwise be prohibited as long as it is incidental to an otherwise lawful activity (such as developing land or building a road). These agreements often take the form of a "Habitat Conservation Plan."
- **Section 11: Citizen Lawsuits**—Civil actions initiated by any citizen can require the listing agency to enforce the ESA's prohibition of taking or to meet the requirements of the consultation process.

With the listing of salmon and trout species as threatened or endangered, the ESA has impacted most of the Pacific Coast states. Although some of these areas have been more impacted by the ESA than others due to the known presence of listed species, the entire region has been impacted by mandates, programs and policies based on the presumption of the presence of listed species. Most West Coast jurisdictions must now take into account the impact of their programs on habitat.

FEMA Administered Grant Programs

Flood Mitigation Assistance Program

The Flood Mitigation Assistance (FMA) program is a cost-share program through which communities can receive grants to develop a comprehensive flood mitigation plan and implement flood mitigation projects. To be eligible for FMA funds, communities must participate in the NFIP and have an approved flood mitigation plan. The goals of FMA program are as follows:

- Fund measures that reduce or eliminate the long-term risk of flood damage to NFIP-insured buildings, manufactured homes, and other structures.
- Reduce the number of repetitively or substantially damaged structures and the associated claims on the NFIP.
- Encourage long-term, comprehensive mitigation planning.
- Respond to the needs of communities participating in the NFIP.

The Hazard Mitigation Grant Program

The Illinois Emergency Management Agency (IEMA) administers the Hazard Mitigation Grant Program (HMGP), making grants available to state and local governments as well as eligible private, non-profit organizations to implement cost-effective and long-term mitigation measures following a major disaster declaration. In order to receive HMGP funds, a community must be participating in and in good standing with the NFIP and have an approved hazard mitigation plan. Projects can protect public and/or private property.

Pre-Disaster Mitigation Program

The Pre-Disaster Mitigation (PDM) Program makes funding available to local governments and state governments to implement cost-effective hazard mitigation activities that complement a comprehensive mitigation program. Funding may be awarded for the development of a hazard mitigation plan or for a cost-effective hazard mitigation project. Local governments applying for PDM funds for local mitigation projects must first have an approved local mitigation plan. PDM applicants must be participating in and in good standing with the NFIP if a Flood Hazard Boundary Map or Flood Insurance Rate Map issued through the NFIP identifies them as having a Special Flood Hazard Area.

Flood Mitigation Grant Program

The Flood Mitigation Grant Program provides funding to reduce or eliminate the long-term risk of flood damage to NFIP-insured properties, including but not limited to FEMA-identified repetitive loss and severe repetitive loss properties. The Flood Mitigation Grant Program is a federal cost-share program with states, territories, or federally recognized Indian tribes that have FEMA-approved mitigation plans.

State

2018 Illinois Natural Hazard Mitigation Plan

The Illinois Natural Hazard Mitigation Plan approved by FEMA in 2018 establishes a process for identifying and mitigating the effects of natural hazards in the State of Illinois as required under the Disaster Mitigation Act of 2000 and further provides guidance for hazard mitigation throughout the state. The plan identifies hazard mitigation goals, objectives, and actions for state government to reduce injury and damage from natural hazards. By meeting federal requirements for an enhanced state plan (44 CFR parts 201.4 and 201.5), the plan allows the state to seek significantly higher funding from the Hazard Mitigation Grant Program following presidential declared disasters.

The Illinois Emergency Management Agency Act

The Illinois Emergency Management Agency Act (20 ILCS 3305/5 and 29 ILCS 301) created IEMA and its authority to develop, plan, analyze, conduct, provide, implement and maintain programs for disaster mitigation, preparedness, response and recovery. IEMA is further mandated under 29 Illinois Administrative Code 301 to prepare the State of Illinois to deal with disasters, preserve the lives and property of the people of the state, and protect health and safety in the event of a disaster.

Illinois State Building Code

Under Public Act 096-0704, all new commercial construction after July 1, 2001 must comply with the 2006 or later editions of the International Building Code, International Existing Building Code, and

International Property Maintenance Code, as well as the 2008 or later edition of the National Electrical Code (NFPA 70). This does not apply to any area that has adopted its own building code and registered that code adoption with the Capital Development Board in accordance with the Illinois Building Commission Act.

Public Act 096-0704 also requires that newly constructed commercial buildings pass an inspection conducted by an inspector meeting Capital Development Board qualification. The act grants local governments the right to enter agreements with other governmental units to enforce building codes as well as to hire third-party inspectors qualified under the act to provide inspection services.

Illinois Residential Real Property Disclosure Act

The Illinois Residential Real Property Disclosure Act requires home sellers to disclose whether the following are true, to the best of their knowledge:

- I am aware of flooding or recurring leakage problems in the crawl space or basement.
- I am aware that the property is located in a floodplain or that I currently have flood hazard insurance on the property.

Illinois State Floodway Standard

Illinois Administrative Code prohibits development in designated floodways unless the developed is considered an “appropriate use.” The floodway rules, administered by the Illinois Department of Natural Resources, Office of Water Resources also mandates a standard of a 0.10-foot allowable surcharge to delineate the floodway (Title 17, Chapter 1, Subchapter h, Part 3700, Sections 3700.60, 3700.70 and 3700.75; Construction in Floodways and Rivers, Lakes and Streams).

Local Programs

Each planning partner has prepared a jurisdiction-specific annex to this plan (see Volume 2). In preparing these annexes, each partner completed a capability assessment that looked at its regulatory, technical, and financial capability to carry out proactive hazard mitigation. Refer to these annexes for a review of regulatory codes and ordinances applicable to each planning partner. This section provides an overview of countywide programs that can support or enhance the actions identified in this plan.

Metropolitan Water Reclamation District of Greater Chicago

The Metropolitan Water Reclamation District of Greater Chicago (District) is located primarily within the boundaries of Cook County, Illinois. The District’s corporate limits encompass an area of 883.1 square miles which includes the City of Chicago and 128 suburban communities. The District also has authority for Stormwater Management for all of Cook County, including areas that lie outside the District’s corporate limits, but within Cook County. The District’s corporate limits are shown in the District’s annex section in Volume 2. The mission of the District is to protect the health and safety of the public in its service area, protect the quality of the water supply source (Lake Michigan), improve the quality of water in water courses in its service area, protect businesses and homes from flood damage, and manage water as a vital resource for its service area.

In the separate sewered area, stormwater is controlled by a number of stormwater detention reservoirs to reduce flood damage. In the combined sewer area, the District's tunnel and reservoir project reduces basement backup and overflows to local waterways. While exercising no direct control over wastewater collection systems owned and maintained by cities, villages, sewer districts and utilities, the District does control municipal sewer construction by permits outside the City of Chicago. It also owns a network of intercepting sewers to convey wastewater from local collection systems to water reclamation plants.

The District is governed by a nine-member Board of Commissioners. Commissioners are elected at large and serve on a salaried part-time basis. Three Commissioners are elected every two years for six-year terms. Biannually, the board elects from its membership a president, vice president, and chairman of the committee on finance. An executive director who reports directly to the board manages the District's day-to-day operations. Eight appointed department heads report to the executive director. General administration, management & budget, public affairs, and affirmative action are direct staff and support units reporting to the executive director. The treasurer of the District, its chief financial officer, is appointed by and reports directly to the board.

Stormwater Management Program and Cook County Stormwater Management Plan

The District's Board of Commissioners adopted the Cook County Stormwater Management Plan (CCSPM) by ordinance in February 2007, and the CCSMP was amended in July 2014. The Stormwater Management Plan is not a regulatory ordinance and does not set forth any rules, regulations, or standards that a municipality will be held to or be required to enforce. It is a high-level organizational plan wherein the overall framework for the countywide program is established. The District adopted the plan as a first step in establishing the District's countywide stormwater management program.

The mission of the countywide stormwater management program is to provide Cook County with rules, regulations, and projects to reduce the potential for stormwater damage to life, public health, safety, property and the environment. Nineteen stormwater management goals have been developed by the District. The goals extend from protecting new and existing development from flooding to preventing the loss of water quality and habitat.

Cook County Watershed Management Ordinance

The District's Board of Commissioners adopted the Watershed Management Ordinance (WMO) on October 3, 2013 and it became effective on May 1, 2014. The WMO was amended in May 2019. The WMO establishes uniform, minimum, countywide stormwater management regulations throughout Cook County. Components that are regulated under the ordinance include drainage and detention, volume control, floodplain management, isolated wetland protection, riparian environment protection, and soil erosion and sediment control.

The Cook County Consolidated Plan

Each year, Cook County receives Community Development Block Grant, Emergency Solutions Grant, and HOME Investment Partnerships Program funds from the U.S. Department of Housing and Urban Development (HUD). These funds are used to support community development, affordable housing, and economic development in suburban Cook County, primarily for the benefit of low- and moderate-income households. Past initiatives have included housing rehabilitation, down payment assistance, social services, infrastructure, and workforce development. The County must submit a consolidated plan for this funding to HUD every five years, assessing local assets, resources, needs, market conditions, and opportunities. A new plan for 2015 – 2019 must be submitted to HUD by August 2015.

Chapter 5. Climate Change

A direct sentence from the 2016 edition of the National Mitigation Framework is,

"Aiming toward the ultimate goal of sustainability and resilience, mitigation requires a process of continuous learning, adapting to change, managing risk, and evaluating progress" (Homeland Security, 2016).

Understanding shifting climatic patterns is a major contributor to adapting to change. The 2018 Illinois Hazard Mitigation Plan added a section called "Climate Change and Hazard Mitigation." The 2014 Cook County Plan highlighted Climate Change as a compounding factor to increased hazard risk and this Hazard Mitigation Plan will further investigate the impact of climate change on hazards. Important to hazard mitigation is understanding current and long-term climatic conditions that have the potential to increase hazard impact both in intensity and quantity. The Cook County Hazard Mitigation Plan update uses the best available science and data for all the hazard profile updates.

Additionally, as noted in the County Profile section, the Hazard Mitigation Plan and Mitigation Actions will need to focus on populations that are vulnerable and the increased impact hazardous events (compounded by climatic shifts) can have on these individuals. Climate adaptation strategies should include mitigation methods that account for the needs of the entire, specifically the most vulnerable, members of the population (National Climate Assessment, 2018).

Recent plans in the County have focused on climate adaption. In order for the Hazard Mitigation Plan to be effective, coordination between this plan and existing plans is needed. Further, just like any good plan, the discussion between key stakeholders will need to be ongoing to ensure the plan is inclusive and does not just sit on a shelf. Current plans include but are not limited to:

- In 2017, Cook County Green Leadership Team completed the Cook County Sustainability Report 2017.
- Forest Preserves of Cook County - Sustainability and Climate Resiliency Plan, September 2018
- City of Chicago Climate Action Plan
- Northeastern Illinois Resilience Partnership (2015 submission for the HUD National Disaster Resilience Competition)
- National Climate Assessment - Midwest

Climate includes patterns of temperature, precipitation, humidity, wind, and seasons. Climate plays a fundamental role in shaping natural ecosystems and the human economies and cultures that depend on them. “Climate change” refers to changes over a long period of time. It is generally perceived that climate change will have a measurable impact on the occurrence and severity of natural hazards around the world. Impacts are likely to include the following:

- An increase in the risk of drought and the frequency, intensity, and duration of heat waves
- More extreme precipitation, increasing the risk of flooding

- An overall increase in the world's average temperature.

Climate change will affect the planning area in a variety of ways. Impacts could include an increased risk for extreme events such as drought, storms, and flooding, as well as more heat-related stress. In many cases, communities are already facing these problems to some degree. Climate change changes the frequency, intensity, extent, and/or magnitude of the problems. This chapter summarizes current understandings about climate change in order to provide a context for the recommendations and implementation of hazard mitigation measures within Cook County.

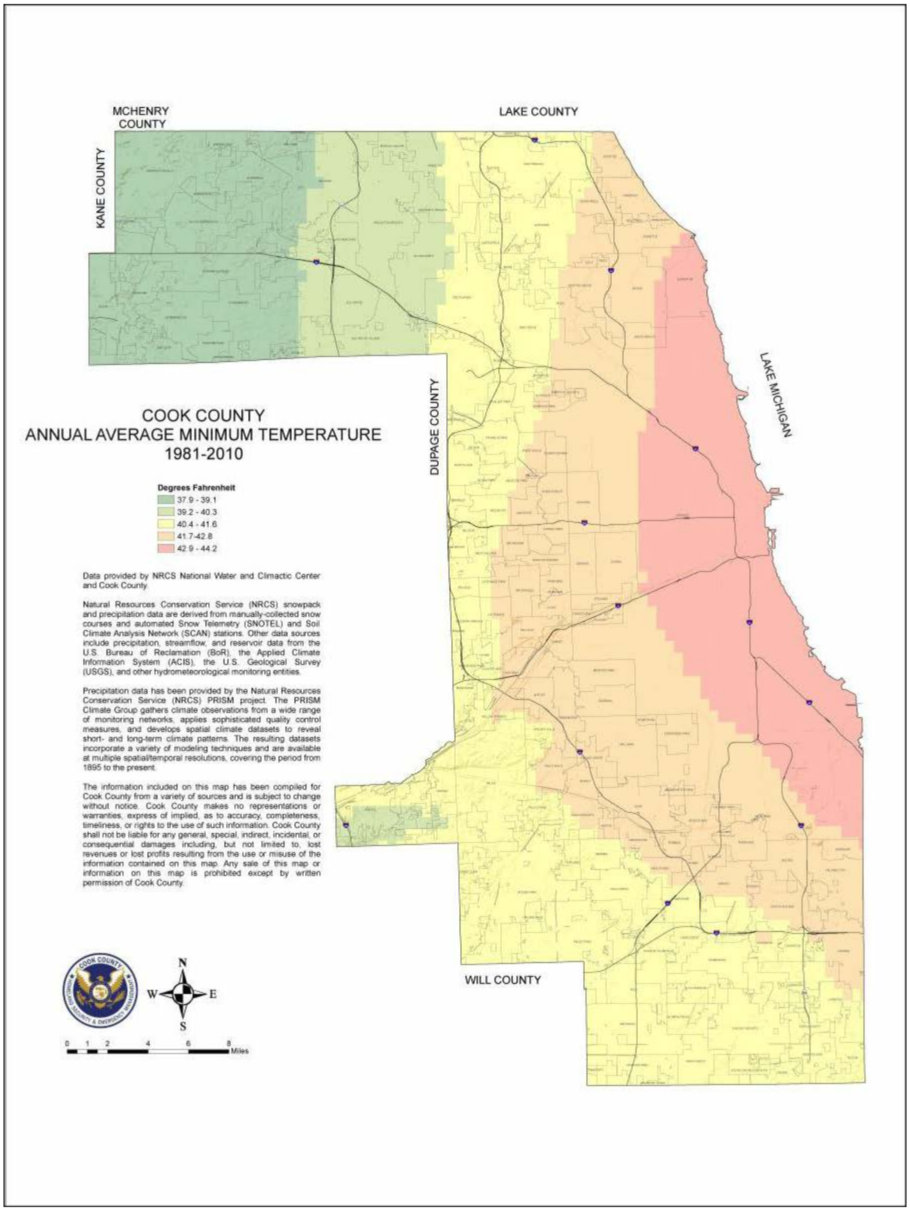
Trends relevant to climate change are best viewed at broad geographic scales and over long time periods rather than at localized scales or over a few years or a season. In line with the National Climate Assessment to focus on the entire US and regional data to fully understand the impacts of climate change, the Midwest data will be used for analysis. Extreme heat, heavy downpours, and flooding will affect infrastructure, health, agriculture, forestry, transportation, air and water quality, and more. Climate change will also exacerbate a range of risks to the Great Lakes (National Climate Assessment).

FEMA currently supports the following tools and data on climate change (all links can be accessed here):

- Hazard Mitigation Assistance and Sea Level Rise
- NFIP's Community Rating System (CRS) Guidance
- Threat and Hazard Identification and Risk Assessment
- Sea Level Rise Map Tool, and a Sea Level Rise Flood Elevation Calculator
- Climate.gov - A NOAA site that provides science and information for a climate-smart nation
- US Global Change Research Program - Established to assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change.
- USGS National Climate Change Viewer
- EPA Stormwater Calculator
- US Climate Resilience Toolkit
- NASA Climate Resources
- DOE Climate Change Science and Innovation
- HHS Sustainability
- Transportation and Climate Change Clearinghouse
- Climate Data at data.gov

While climate change encompasses all aspects of variability in climatic conditions, notably, changes in temperatures need to be tracked and changes must be considered when developing mitigation plans. Highlighted below is the annual average minimum temperature from 1981 to 2010 in Cook County.

Temperature change is further addressed in the upcoming section, [Projections for the State of Illinois and Cook County]



Map: Cook County Annual Average Minimum Temperature 1981-2010

How Climate Change Affects Hazard Mitigation

According to the National Centers for Environmental Information (NCEI), the United States has sustained over 200 weather and climate-based disasters from 1980 to 2016 totaling over $1.1 trillion in overall damages. In 2016 alone, 12 events have created losses of over $1 billion. During 2017, there were 15 weather and climate disaster events with losses exceeding $1 billion each (NCEI, 2017). The average number of events totaling more than $1 billion in overall damages from 1980-2015 was only 5.2 events. While the increase in infrastructure contributes to increasing property damage value, the increase in infrastructure quantity and value does not correlate to the spike in "billion-dollar" events. The National Climatic Data Center (NCDC) notes that each disaster and the resultant losses will carry a varying degree of uncertainty on the losses. Even with degrees of doubt, the increase in billion-dollar weather and climate disasters requires adaption and mitigation strategies (Hoople, 2013).

A recent anomaly of a temporary slowdown in the warming of the global average surface temperature between 1998 and 2013 concluded the phenomenon represented a redistribution of energy within the Earth system with the Earth's ocean absorbing the extra heat (NASA, 2016). This is a worrisome trend due to the catastrophic disasters that result from ocean temperature variability. Until more mitigation efforts are utilized to control climate variability, communities will not be fully resilient (Second Nature, 2016).

An essential aspect of hazard mitigation is predicting the likelihood of hazard events in a planning area. Typically, predictions are based on statistical projections from records of past events. This approach assumes that the likelihood of hazard events remains essentially unchanged over time. Thus, averages based on the past frequencies of, for example, floods are used to estimate future frequencies: if a river has flooded an average of once every five years for the past 100 years, then it can be expected to continue to flood an average of once every five years.

Natural and human-caused hazards can be impacted by climate. To increase the accuracy of hazard mitigation planning, future climate-based projections need to be calculated along with past events. Information about how climate patterns are changing provides insight into the reliability of future hazard projections used in mitigation analysis.

Climate Change Indications and Potential Impact

According to the fourth edition of the National Climate Assessment, Earth's climate is changing faster than at any point in the history of modern civilization. Climate change results in risks that impact everyday lives. In the Midwest, increasing heavy rains are leading to more soil erosion and nutrient loss on Midwestern cropland.

Observations from around the world show the widespread effects of increasing greenhouse gas concentrations on Earth's climate. High-temperature extremes and heavy precipitation events are increasing. Glaciers and snow cover are shrinking, and sea ice is retreating. Seas are warming, rising, and becoming more acidic, and marine species are moving to new locations toward cooler waters. Flooding is becoming more frequent along the U.S. coastline. Growing seasons are lengthening, and wildfires are increasing (National Climate Assessment, 2018).

The Environmental Protection Agency (EPA) produced the 2016 climate Change Indicators in the United States Report. **The report highlighted that trends relevant to climate change are best viewed at broad geographic scales and over long time periods rather than at localized scales or over a few years or a season.** Average temperatures have risen across the contiguous 48 states since 1901, with an increased rate of warming over the past 30 years. Eight of the top 10 warmest years on record have occurred since 1998. Average global temperatures show a similar trend, and all of the top 10 warmest years on record worldwide have occurred since 1998. Within the United States, temperatures in parts of the North, the West, and Alaska have increased the most. Additionally, many extreme temperature conditions are becoming more common. Total annual precipitation has increased over land areas in the United States and worldwide and in recent years, a higher percentage of precipitation in the United States has come in the form of intense single-day events (EPA, 2016).

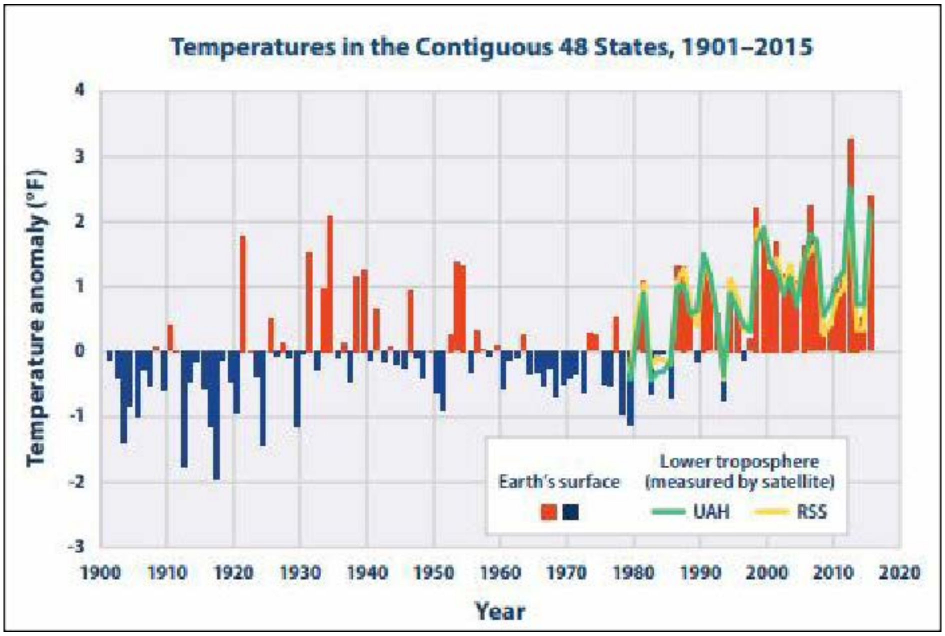


Figure: Temperatures in the Contiguous US, 1901-2015

Source: [EPA, 2016]

In addition to compounding impact from a changing climate on hazard intensity is the impact on human health. Changes in the Earth's climate can affect public health, agriculture, water supplies, energy production and use, land use and development, and recreation. The nature and extent of these effects, and whether they will be harmful or beneficial, will vary regionally and over time (EPA, 2016).

In summary and directly quoting the National Climate Assessment (2018) Summary Findings:

- **Communities:** Climate change creates new risks and exacerbates existing vulnerabilities in communities across the United States, presenting growing challenges to human health and safety, quality of life, and the rate of economic growth.
- **Economy:** Without substantial and sustained global mitigation and regional adaptation efforts, climate change is expected to cause growing losses to American infrastructure and property and impede the rate of economic growth over this century.
- **Interconnected Impacts:** Climate change affects the natural, built, and social systems we rely on individually and through their connections to one another. These interconnected systems are increasingly vulnerable to cascading impacts that are often difficult to predict, threatening essential services within and beyond the Nation's borders.
- **Actions to Reduce Risks:** Communities, governments, and businesses are working to reduce risks from and costs associated with climate change by taking action to lower greenhouse gas emissions and implement adaptation strategies. While mitigation and adaptation efforts have expanded substantially in the last four years, they do not yet approach the scale considered necessary to avoid substantial damages to the economy, environment, and human health over the coming decades.
- **Water:** The quality and quantity of water available for use by people and ecosystems across the country are being affected by climate change, increasing risks and costs to agriculture, energy

production, industry, recreation, and the environment.

- **Health:** Impacts from climate change on extreme weather and climate-related events, air quality, and the transmission of disease through insects and pests, food, and water increasingly threaten the health and well-being of the American people, particularly populations that are already vulnerable.
- **Indigenous Peoples:** Climate change increasingly threatens Indigenous communities' livelihoods, economies, health, and cultural identities by disrupting interconnected social, physical, and ecological systems.
- **Ecosystems & Services:** Ecosystems and the benefits they provide to society are being altered by climate change, and these impacts are projected to continue. Without substantial and sustained reductions in global greenhouse gas emissions, transformative impacts on some ecosystems will occur; some coral reef and sea ice ecosystems are already experiencing such transformational changes.
- **Agriculture:** Rising temperatures, extreme heat, drought, wildfire on rangelands, and heavy downpours are expected to increasingly disrupt agricultural productivity in the United States. Expected increases in challenges to livestock health, declines in crop yields and quality, and changes in extreme events in the United States and abroad threaten rural livelihoods, sustainable food security, and price stability.
- **Infrastructure:** Our Nation's aging and deteriorating infrastructure is further stressed by increases in heavy precipitation events, coastal flooding, heat, wildfires, and other extreme events, as well as changes to average precipitation and temperature. Without adaptation, climate change will continue to degrade infrastructure performance over the rest of the century, with the potential for cascading impacts that threaten our economy, national security, essential services, and health and well-being.
- **Oceans & Coasts:** Coastal communities and the ecosystems that support them are increasingly threatened by the impacts of climate change. Without significant reductions in global greenhouse gas emissions and regional adaptation measures, many coastal regions will be transformed by the latter part of this century, with impacts affecting other regions and sectors. Even in the future with lower greenhouse gas emissions, many communities are expected to suffer financial impacts as chronic high-tide flooding leads to higher costs and lower property values.
- **Tourism & Recreation:** Outdoor recreation, tourist economies, and quality of life are reliant on benefits provided by our natural environment that will be degraded by the impacts of climate change in many ways.

Projections for the State of Illinois and Cook County

According to the State Climatologist Office for Illinois, the climate in Illinois has changed due to natural forces (including variation in solar radiation, ocean circulation, and volcanic eruptions), human impacts (including increased greenhouse gas and aerosols emissions) and human land-use changes (including agricultural practices such as transforming a prairie to an agricultural site or a city). Climate change is the result of complex interactions between natural and human-induced forces, and understanding future climate change remains a challenge (State Climatologist Office for Illinois).

The NOAA National Centers for Environmental Information State Summary for Illinois (2017) noted that on average, the temperature in the 20th century increased 1-degree Fahrenheit with the average spring temperature increasing the most (2-degrees Fahrenheit). Precipitation in spring and summer has been above average the past two decades which impacts agriculture. Warming has been concentrated in winter and spring while summers have not warmed substantially in the state, a feature characteristic of much of the Midwest.

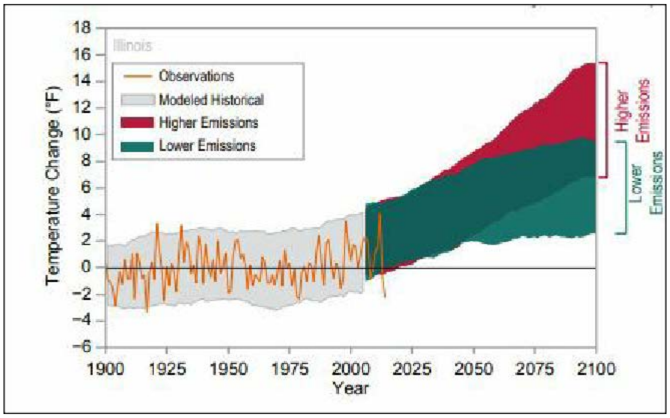
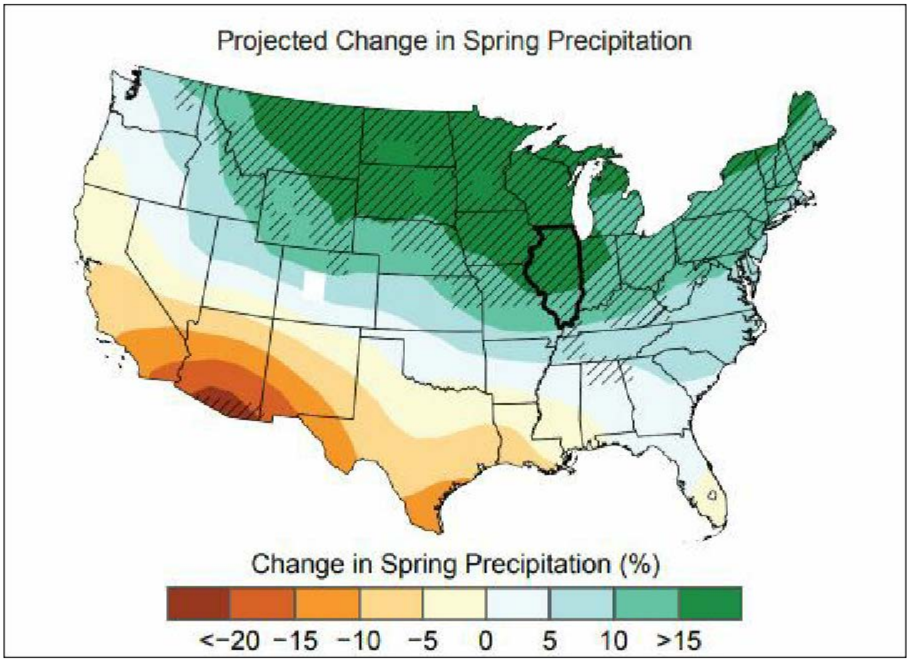


Figure: Observed (1900-2014) and Projected (2006-2100) Temperature Change in Illinois

Source: [NOAA Centers for Environmental Information Climate Assessment for each State, 2017]

Illinois has experienced a dramatic increase in the number of extreme precipitation events (more than 2 inches of precipitation), which can cause severe flooding in the state. Winter and spring precipitation are projected to increase and the intensity of future droughts is projected to increase (due to increased evaporation rates). A recent report, *Frequency Distributions of Heavy Precipitation in Illinois: Updated Bulletin 70*, highlights that the increase in heavy precipitation in Illinois presents a significant challenge for stormwater management. The change in precipitation and evaporation patterns will likely lead to more intense flooding and droughts, which have already been occurring periodically in recent years. Spring precipitation in Illinois is projected to increase in the range of 10–20% by 2050. Annual precipitation varies widely across the state, ranging from more than 48 inches in the south to less than 32 inches in the north. For snowfall, the pattern is reversed, with the northeastern part of the state averaging 40 inches of snowfall annually, compared to only 10 inches in the southernmost section. In the Chicago Metropolitan area, the proximity to Lake Michigan occasionally results in heavy winter precipitation from lake-effect snows.



Map: Project Change in Spring Precipitation for the middle of the 21st Century compared to late 20th Century

Source: [NOAA Centers for Environmental Information Climate Assessment for each State, 2017]()

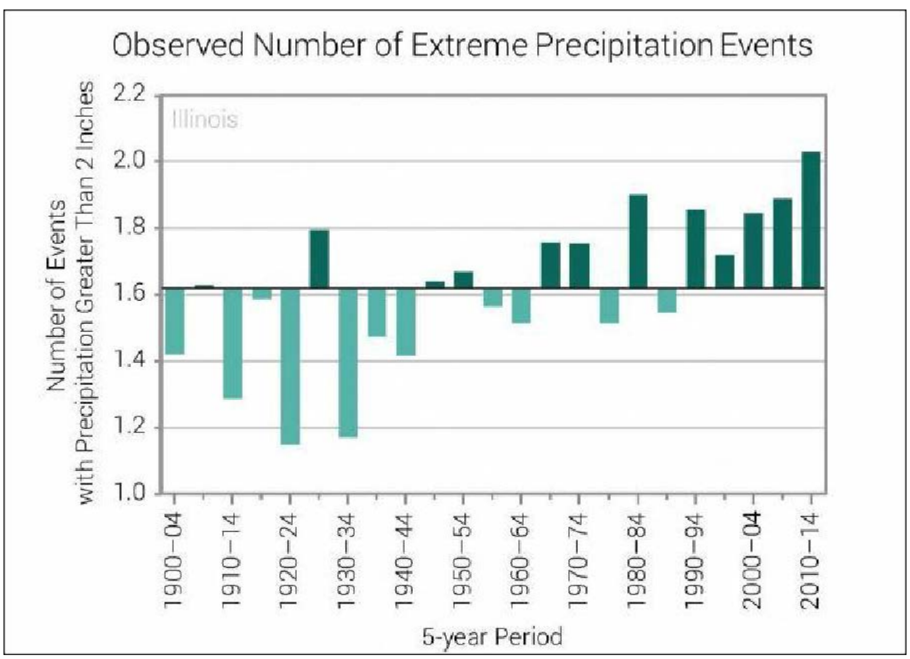


Table: Observed Annual Number of Days with Precipitation Greater Than 2 inches for 1900-2014 on Average Over 5-year periods

Source: Frequency Distributions of Heavy Precipitation in Illinois: Updated Bulletin 70, 2019

Qualitative Assessment of Climate Change Impact

Climate change data is primarily focused on global, national, and regional scale (Illinois Hazard Mitigation Plan - Climate Change and Hazard Mitigation, 2018). In accordance with the Intergovernmental Panel on Climate Change (IPCC)'s definition, 'vulnerability' should be understood as the degree to which a system is susceptible to, or unable to cope with, the adverse effects of environmental change. Currently, there is no consensus on how to measure vulnerability to climate change, as highlighted in the Approaches for Conducting Vulnerability Assessments in the Great Lakes Basin: A Review of the Literature, 2018. A key point from the Literature Review is that based on a vulnerability assessment done Lemieux et al. (2014), planners must engage communities, stakeholders, and experts substantively early on and continuously to ensure buy-in and to increase the likelihood that vulnerabilities and adaptation options identified were realistic and relevant to local social-ecological contexts. While specific quantitative measurements for climate change cannot be isolated to solely Cook County, the Midwest projection in the Fourth National Climate Assessment can reasonably be utilized to analyze climatic projections for Cook County.

- **Dam Failure**—Dams are constructed with safety features known as "spillways," which are put in place as a safety measure in the event of the reservoir filling too quickly. Spillway overflow events, often referred to as "design failures," result in increased discharges downstream and increased flooding potential. Spillway operation is designed partly based on assumptions about a river's flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. Increasing precipitation, especially heavy rain events, has increased the overall risk of floods. In turn, floods cause damage to infrastructure, such as dams. To lessen potential climate change impacts on dams, the use of green infrastructure (including nature-based approaches, such as wetland restoration, and innovations like permeable pavements) and better engineering practices should be explored as mitigation tactics.

- **Drought**—Higher temperatures, increasing variation in precipitation patterns, and changes in lake levels are likely to increase the vulnerability of cities to extreme events (including flooding, drought, heat waves, and more intense urban heat island effects), compounding already existing stressors. Drought has been identified as a slow-moving stressor that contributes to acute and chronic mental health impacts such as anxiety and depression. While drought pattern projections are still uncertain, various factors that contribute to drought have been analyzed. Future projections show that Midwest surface soil moisture likely will transition from excessive levels in spring due to increased precipitation to insufficient levels in summer driven by higher temperatures, causing more moisture to be lost through evaporation. Additionally, correlated to a changing climate, including an increased frequency of late-growing-season drought conditions, is the likely worsening effects of invasive species, insect pests, and plant disease as trees experience periodic moisture stress. Climatic shifts that impact floods and droughts yield compounding impacts. Transitions from extremes of drought to floods lead to an increase in nitrogen levels in rivers and lead to harmful algal blooms. As growing-season temperatures rise, rain patterns shift, and the frequency of drought stress increases from drier air (as a result of increases in vapor pressure deficit), reduced tree growth and widespread tree mortality are expected. Overall, the increasing stress on trees from rising temperatures, drought, and frost damage raises the susceptibility of individual trees to the negative impacts of invasive plants, insect pests, and disease agents. High rates of change in climate factors like changing air and water temperature and increasing drought risk likely will accelerate the rate of species declines and extinctions. A more detailed index (still under development to ensure comparison to historical patterns) developed recently shows that over the period from 2000 through 2015, roughly 20 to 70 percent of the U.S. land area experienced conditions that were at least abnormally dry at any given time (EPA, 2016).

The best advice to water resource managers regarding climate change is to start addressing current stresses on water supplies and build flexibility and robustness into any system. Flexibility helps to ensure a quick response to changing conditions, and robustness helps people prepare for and survive the worst conditions. With this approach to planning, water system managers will be better able to adapt to the impacts of climate change.

- **Earthquake**—The impacts of global climate change on earthquake probability are unknown. Some scientists say that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the earth's crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity according to research into prehistoric earthquakes and volcanic activity. NASA and USGS scientists found that retreating glaciers in southern Alaska may be opening the way for future earthquakes (NASA, 2004). Secondary impacts of earthquakes could be magnified by climate change. Soils saturated by repetitive storms could experience liquefaction during seismic activity due to the increased saturation. Dams storing increased volumes of water due to changes in the hydrograph could fail during seismic events.
- **Flood**—Increased flood risk is one of the highest noted impacts of climate change in the Midwest (see the map of precipitation patterns shifting in the Midwest in the previous section). Widespread heavy rains in recent years have led to flooding, soil erosion, and water quality issues from nutrient runoff into those systems. Human land use has influenced the structure and function of natural resources and when vegetation has been removed or undergoes a major change, runoff and flooding both tend to increase. The growth of agricultural lands and the loss of wetlands has created a highly altered environment that promotes flooding. Climate projections suggest an increased risk of inland flooding, even under low-range scenarios. Average annual damages from heightened flooding risk in the Midwest are projected to be in excess of $500 million (in 2015 dollars) by 2050. As hydrology changes in response to changing precipitation patterns, what is currently considered a 100-year flood may strike more often, leaving many communities at greater risk; and the magnitude of high-frequency flood events (e.g. 10-year floods) will likely increase. Greater storm intensity will result in more direct runoff and flooding. Changes in watershed vegetation and soil moisture conditions will likewise change runoff and recharge patterns. Historical hydrologic data are used to model floods. With

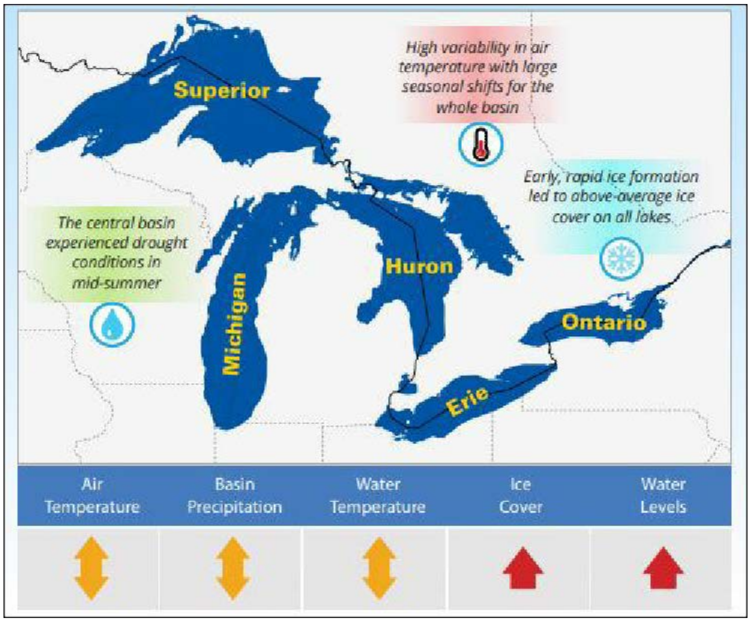
the climate changing, model calibration will be needed more frequently, new forecast-based tools will have to be developed, and a standard of practice that explicitly considers climate change should be adopted. Planners will need to factor a new level of safety into the design, operation, and regulation of flood protection facilities such as dams, floodways, bypass channels, and levees, as well as the design of local sewers and storm drains. Restoring systems like wetland and forested floodplains, utilizing open space preservation, and implementing agricultural best management strategies that increase vegetative cover (such as cover crops and riparian buffers) can help reduce flooding risks and protect water quality

- **Tornado**—Key ingredients for severe thunderstorms that lead to tornadoes include warm, moist air and winds that change with altitude (wind shear) to help organize a thunderstorm and create rotation. Large changes of wind with height are especially important for tornado formation. As the planet warms, the moisture content of the atmosphere will increase, as well as the energy available for producing storms. However, wind shear will likely decrease, due to a lower temperature contrast from pole to pole. Since increasing warmth and moisture will create an environment more conducive to severe thunderstorms and tornadoes but decreased wind shear will create a less conducive environment, it is difficult to determine how the tornado hazard will change with a changing climate. Some ingredients needed for tornadoes are tied to large-scale features on the planet, such as the presence of the Rocky Mountains and the Gulf of Mexico, which will not change with changes in climate. The regions where tornadoes occur are likely to be tied to their relationship to those two features.
- **Severe Weather**—Extreme weather heavily impacts infrastructure. The annual cost of adapting urban stormwater systems to more frequent and severe storms is projected to exceed $500 million for the Midwest by the end of the century. The EPA estimates that the annual cost of maintaining current levels of service on midwestern bridges in the face of increased scour damage from climate change could reach approximately $400 million in the year 2050 under either the lower or higher scenario climate change presents a significant challenge for risk management associated with severe weather. The frequency of severe weather events has increased steadily over the last century. The number of weather-related disasters during the 1990s was four times that of the 1950s and cost 14 times as much in economic losses. Historical data shows that the probability of severe weather events increases in a warmer climate. Total annual precipitation has increased over land areas in the United States and worldwide (EPA, 2016). Since 1901, precipitation has increased at an average rate of 0.08 inches per decade over land areas worldwide. The changing climate could include significant changes in the intensity, duration, and frequency of storm events.

  Unique to Cook County from many Counties in the Midwest is the County is bordered by the Great Lakes. The Great Lakes contain 20% of the world’s surface freshwater, provide drinking water and livelihood to more than 35 million people and allow for important economic and cultural services such as shipping and recreation. The Great Lakes influence regional weather and climate conditions and impact climate variability and change across the region. The lakes influence daily weather by 1) moderating maximum and minimum temperatures of the region in all seasons, 2) increasing cloud cover and precipitation over and just downwind of the lakes during winter, and 3) decreasing summertime convective clouds and rainfall over the lakes. In recent decades, the Great Lakes have exhibited notable changes that are impacting and will continue to impact people and the environment within the region. Ecological impacts of climate change in the Great Lakes occur in the context of multiple stressors, as these important ecosystems are under stress from pollution, nutrient and sediment inputs from agricultural systems, and invasive species. In particular, lake surface temperatures are increasing, lake ice cover is declining, the seasonal stratification of temperatures in the lakes is occurring earlier in the year, and summer evaporation rates are increasing. Additionally, the water levels in Lake Michigan are rising which has been correlated to higher and heavier spring rain events and can be viewed in the table at the end of this section (US Army Corps of Engineers).

- The 2018 Annual Climate Trends and Impacts Summary for the Great Lakes Basin highlight that periods of drought conditions, in addition to record-breaking annual precipitation which attributes to a rise in the water level in Lake Michigan occurred along with large swings in temperature. The highest temperature anemology occurred in April and May and precipitation anomalies occurred in July and August. In recent decades, climate change impacts across the GLB have generally consisted of higher temperatures, increased precipitation, reduced snow cover, decreased annual lake ice coverage, increased wind speeds and waves, and an increased amount of extreme events (e.g. snowstorms, ice storms, thunderstorms, hail storms, high wind speed events, etc.) (Assel et al. 2003; Austin and Colman 2007, 2008; Ghanbari and Bravo 2008; Gronewold et al. 2013; Hofmann et al. 2008; Sellinger et al. 2007; Wang et al. 2012; Wilcox et al. 2007; Wang et al. 2017). The major climatic events cited in the report included:
    - Winter 2017-2018
        - Rapid ice formation in late December, due to below-normal temperatures and strong winds, impacted the coastline of rivers and lakes across the Great Lakes basin.
        - This caused a sudden slow-down in shipping capabilities throughout the basin and additional ice breakers had to be utilized to open shipping lanes.
        - Strong winds and cold conditions forced large amounts of ice from Lake Erie onshore in late December, resulting in the formation of ice shoves that caused coastal damage.
        - By January 1st, the Great Lakes were already 20% covered in ice (compared to 2% the previous winter).
        - In late February, continuous, heavy rainfall caused widespread flooding across the southern and central basin, forcing counties to declare a state of emergency and call for evacuations. Unseasonably warm temperatures in late February broke records for many locations across the basin.

- Spring 2018
    - Four nor'easters in a three-week period in March brought above-average snowfall to much of the eastern basin.
    - In mid-April, a rapid drop in air temperature led to the formation of new ice in Lake Superior.
    - Anomalously cold conditions in March and April delayed the seeding and emergence of many crops, while above-normal temperatures in May made up for the delayed start
- Summer 2018
    - Agriculture around the Great Lakes experienced quick development during the early summer months as a result of above-normal temperatures.
    - Dry conditions began to develop and intensify through mid-to-late summer, primarily in eastern portions of the basin, resulting in increased stress on crops and livestock.
    - Heavy rain up to 18cm (7in) over a few hours led to severe flooding and road damage across the Keweenaw Peninsula of Northern Michigan. Areas of Northwest Wisconsin received up to 38cm (15in) of rainfall from this same storm system.
- Autumn 2018
    - Excessive rainfall across the Lake Superior basin from October 8-11 caused water levels to rise during a time of year when levels typically decrease.
    - A strong October storm with high winds on Lake Superior caused coastal erosion, localized flooding, and damage to popular tourist spots that amounted to over $18.4 million in damages.
    - Crop harvest in the Great Lakes region was slow due to wet conditions in October and early-season snow in November that delayed the ability to harvest crops.
    - The Harmful Algal Bloom (HAB) that occurred on Lake Erie this year ended earlier than normal in the first week of October and had a much weaker severity index than what was originally forecasted.
    - Cold conditions in late November led to an early start to the winter season across the basin.



Map: 2018 Climate Trends (red arrow indicates above the long-term average and yellow indicates variable to the long-term average

Source: [2018 Annual Climate Trends and Impacts Summary for the Great Lakes Basin]()

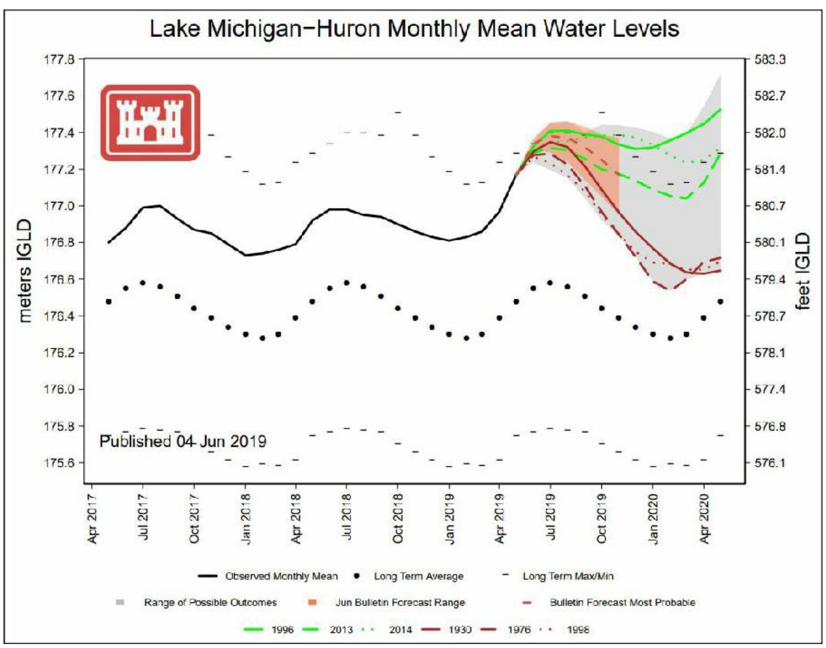


Table: Monthly Mean Water Levels in Lake Michigan 2017-2020

Source: [Army Corps of Engineers]()

Chapter 6. Dam and Levee Failure

DEFINITIONS

Dam—A barrier constructed across a watercourse in order to store, control, or divert water.

Dam Failure—The collapse, breach, or other failure of a dam that causes downstream flooding.

Emergency Action Plan—A document that identifies potential emergency conditions at a dam and specifies actions to be followed to minimize property damage and loss of life. The plan specifies actions the dam owner should take to alleviate problems at a dam. It contains procedures and information to assist the dam owner in issuing early warning and notification messages to responsible downstream emergency management authorities of the emergency situation. It also contains inundation maps to show emergency management authorities the critical areas for action in case of an emergency. (FEMA 64)

High Hazard Dam—Dams where failure or operational error will probably cause loss of human life. (FEMA 333)

Significant Hazard Dam—Dams where failure or operational error will result in no probable loss of human life but can cause economic loss, environmental damage or disruption of lifeline facilities, or can impact other concerns. Significant hazard dams are often located in rural or agricultural areas but could be located in areas with population and significant infrastructure. (FEMA 333)

General Background

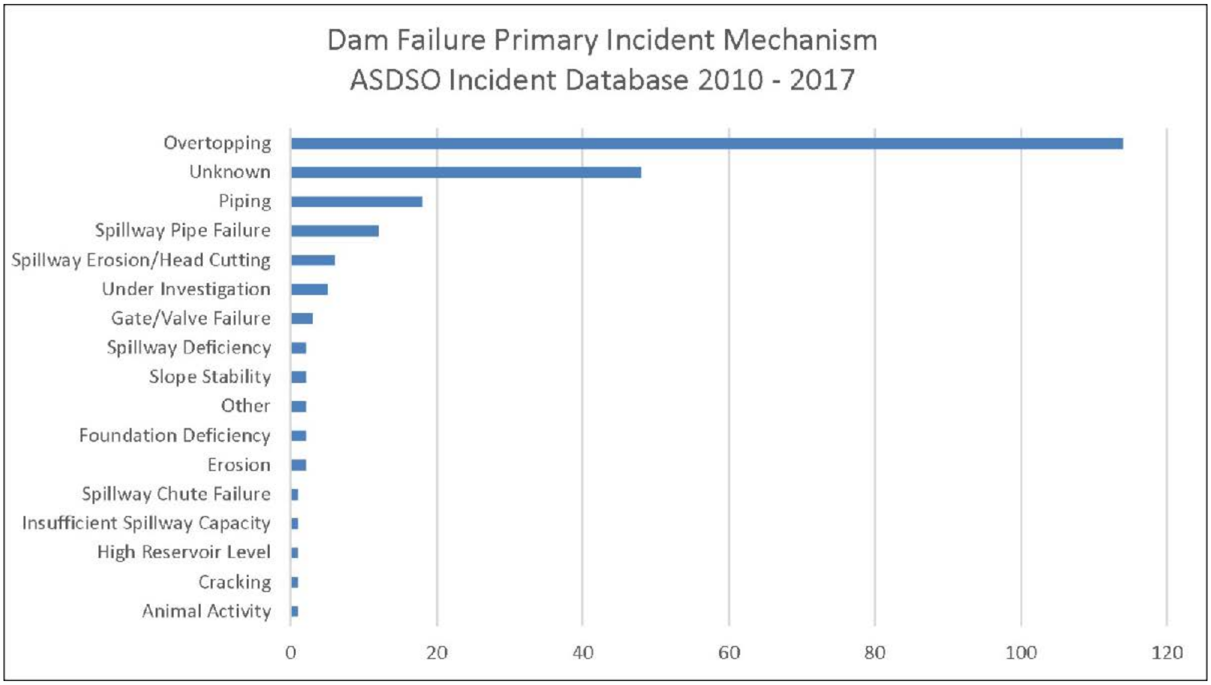
This section describes the cause of dam and levee failures and regulatory oversight.

Causes of Dam Failure

Dam failures in the United States typically occur in one of four ways:

- Overtopping of the primary dam structure due to inadequate spillway design, settlement of the dam crest, blockage of spillways, and other factors.
- Foundation defects due to differential settlement, slides, slope instability, uplift pressures, and foundation seepage.
- Internal erosion due to piping and seepage, erosion along hydraulic structures such as spillways, erosion due to animal burrows, and cracks in the dam structure.

- Problems with conduits and valves, typically caused by the piping of embankment material into conduits through joints or cracks.



Many U.S. dam failures are due to unknown or miscellaneous causes. Many dam failures in the United States have been secondary results of other disasters. The prominent causes are earthquakes, extreme storms, massive snowmelt, equipment malfunction, structural damage, foundation failures, and sabotage.

Poor construction, lack of maintenance and repair, and deficient operational procedures are preventable or correctable by a program of regular inspections. Terrorism and vandalism are serious concerns that all operators of public facilities must plan for; these threats are under continuous review by public safety agencies.

Causes of Levee Failure

Levees are man-made structures designed to protect specific areas from flooding. There are six types of levee failure:

- Bearing failure—Destabilization of the ground under the levee, most likely caused by seismic ground shaking
- Sliding failure—Parts of the levee sliding apart due to weak or brittle zones in the foundation soil
- Slumping and spreading—Changes in strain loading on the foundation due to seismic activity, high water levels, or seepage

- Seepage—Erosion of the foundation due to water seeping into the foundational layers; this may be due to boring animals or insects or tree roots, which create conduits for the water
- Slope erosion—Erosion of levee material by the water the levee is holding back
- Overtopping—Water flowing over the levee and eroding the base.

Regulatory Oversight

The potential for catastrophic flooding due to dam failures led to the passage of the National Dam Safety Act (Public Law 92-367). The National Dam Safety Program requires a periodic engineering analysis of every major dam in the country. The goal of this FEMA-monitored effort is to identify and mitigate the risk of dam failure so as to protect the lives and property of the public.

The National Levee Safety Act of 2007 established the National Committee on Levee Safety, which, recommended to Congress the establishment of a national levee safety program, but none currently exists. The recommended program is based on three core concepts (National Committee on Levee Safety, no date):

- National leadership via a national levee safety program that includes an inventory and assessment of all the nation's levees, development of national levee safety standards, comprehensive risk communication and education, and coordination of environmental and safety concerns
- Strong state levee safety programs that provide oversight, critical levee safety processes, and support for community levee safety activities
- A foundation of well-aligned federal agency programs and processes.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. The Corps has inventoried dams; surveyed each state and federal agency's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety (U.S. Army Corps of Engineers, no date).

The Corps of Engineers inspects and assesses approximately 2,500 levee systems across the country each year (U.S. Army Corps of Engineers, no date); however, that represents only about 10 percent of the nation's levees. None of the levees in the planning area are maintained by the Corps of Engineers; all are under the responsibility of state and local agencies.

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) cooperates with a large number of federal and state agencies to ensure and promote dam safety. More than 3,000 dams are part of regulated hydroelectric projects in the FERC program. Two-thirds of these are more than 50 years old. As dams age, concern about their safety and integrity grows, so oversight and regular inspection are important. FERC inspects hydroelectric projects on an unscheduled basis to investigate the following:

- Potential dam safety problems
- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with the terms and conditions of a license.

Every five years, an independent engineer approved by the FERC must inspect and evaluate projects with dams higher than 32.8 feet (10 meters), or with a total storage capacity of more than 2,000 acre-feet.

FERC monitors and evaluates seismic research and applies it in investigating and performing structural analyses of hydroelectric projects. FERC also evaluates the effects of potential and actual large floods on the safety of dams. During and following floods, FERC visits dams and licensed projects, determines the extent of damage, if any, and directs any necessary studies or remedial measures the licensee must undertake. The FERC publication *Engineering Guidelines for the Evaluation of Hydropower Projects* guides the FERC engineering staff and licensees in evaluating dam safety. The publication is frequently revised to reflect current information and methodologies.

FERC requires licensees to prepare emergency action plans and conducts training sessions on how to develop and test these plans. The plans outline an early warning system if there is an actual or potential sudden release of water from a dam due to failure. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that everyone knows what to do in emergency situations.

Illinois Department of Natural Resources

The Water Resources Division of the Illinois Department of Natural Resources (IDNR) issues permits for the construction of any structures in a floodway or floodplain (including levees); construction, operation and maintenance of new dams; and the modification, operation, and maintenance of existing dams. Dams are classified into one of three hazard classifications. All dams in the two higher classifications are required to have a permit. Dams in the lower hazard classification require a permit for construction or modification if they meet certain size criteria. Permits are also required for removing dams and transferring ownership of dams (IDNR, 2018). The Water Resources Division also has a Levee Safety Program, which is responsible for issuing permits regarding levees.

Levees Maintained by USACE - Chicago District	Levees Not Maintained by USACE in Cook County
1. Calumet City 2. Hammond Forest Ave 3. Lansing 4. Levee 37 5. Levee 50 6. Munster	1. Cook County Levee 1 2. Elmwood Park Flood Mitigation Project 3. Village of Westchester Unnamed Levee

Hazard Profile

This section provides specific information about this hazard, such as:

- Past Events
- Location
- Frequency and Future Hazard Events
- Extent
- Severity
- Warning Time

Past Events

There are no available records of dam or levee failures in the planning area. The State of Illinois experienced levee failures in 1993 and 2008, however. In 1993, 17 levee systems either failed, were overtopped, or were intentionally breached along the Mississippi River and the Illinois River just north of where it meets the Mississippi River. Over 237,000 acres along the rivers were flooded.

Location

There are 23 state-regulated dams in the planning area, as listed in the below table. Ten of these dams are classified as "high hazard" which means they have sufficient downstream populations to warrant the classification.

Future updates of the Plan will also describe the inundation area downstream of the dam. Although repeated efforts were made to obtain the EAPs and associated inundation maps, the data and information are not available for this update. Because DHSEM recognizes the importance of this data, County-wide Mitigation Action 31 was added during the update process to establish an action plan to better coordinate and collaborate with dam owners in Cook County so dam-specific risks can be better understood and mitigated in the future.

TABLE: DAMS IN THE PLANNING AREA											
Name	**National ID#**	**Water Course**	**City**	**Owner**	**Year Built**	**Dam Type a**	**Crest Length (feet)**	**Height (feet)**	**Storage Capacity (acre-feet)**	**Max Discharge**	**Hazard Class**
Buffalo Creek Reservoir	IL50013	Buffalo Creek	Buffalo Grove	Metropolitan Water Reclamation District	1983	RE	N/A	30-35	720	N/A	I
Upper Salt Creek Structure #2	IL50021	Tributary of Salt Creek	Palatine	Metropolitan Water Reclamation District	1984	RE	2400	23	297	9582	I
Touhy Reservoir	IL55104	Higgin's Creek	Chicago	City of Chicago/ Metropolitan Water Reclamation District	2004	RE	50	10	735	N/A	II
Upper Salt Creek Structure #3	IL50045	St. Michael's Cemetery Tributary	Rolling Meadows	Metropolitan Water Reclamation District	1985	RE	5500	26	407	13948	I
Upper Salt Creek Structure #4	IL50054	Salt Creek	Palatine	Metropolitan Water Reclamation District	1987	RE	3000	30	429	1300	I
Lake George Dam	IL01083	Tributary to Butterfield Creek	Matteson	Village of Richton	1969	RE	320	20	539	870	I

Midlothian Creek Dam	IL01002	Midlothian Creek	Oak Forest	IDNR	1975	RE	1,515	22	1,279	8031	I
Thornton Quarry Gap Dam	IL55136	Thornton Quarry	Thornton	Metropolitan Water Reclamation District	--	VA	240	116	9,900	N/A	I
Busse Woods Res. South Dam	IL01231	Salt Creek	Elk Grove	IDNR	1977	RE	1,381	23	17,621	24272	I
Richton Crossing Dam	IL01084	Tributary to Butterfield Creek	Matteson	Borg Warner Equity Corp.	1976	RE	490	16	53	920	I
Lower Elmhurst Dam	IL50304	Tributary to Addison Creek-off stream	Elmhurst	City of Elmhurst	1994	RE	2,200	15	93	N/A	I
Cornell Ave. Dam	IL55079	McDonald Creek	Wheeling	Village of Wheeling	1977	RE	--	8.5	--	N/A	I
Techny Reservoir Dam	IL01228	W. Fork, N. Branch Chicago River	Glenview	Society of the Divine Word	1979	RE	544	11	250	N/A	II
Saganashkee Slough 1 Dam	IL00870	Tributary to Calumet SAG Channel	Lemont	Forest Preserve District of Cook Co.	1948	RE	950	14	2,379	N/A	II
Bullfrog Lake Dam	IL00869	Tributary to Des Plaines River	Oak Forest	Forest Preserve District of Cook Co.	1958	RE	700	17	144	N/A	II
Maple Lake Dam	IL00878	Tributary to Des Plaines River	Lemont	Forest Preserve District of Cook Co.	1918	RE	110	25	765	N/A	II

Papoose Lake Dam	IL00867	Tributary to Mill Creek	Palos Park	Forest Preserve District of Cook Co.	1956	RE	750	12	143	N/A	II
Tampier Lake Dam	IL00866	Tributary to Long Run Creek	Lemont	Forest Preserve District of Cook Co.	1964	PG	240	9	859	N/A	II
Galvins Lake Dam	IL00862	Tributary to Spring Creek	Carpentersville	Marvin Duntemen	1938	RE	225	10	120	N/A	II
White Pine Ditch Dam	IL01227	White Pine Ditch	Arlington Heights	Arlington Club Condominium Association	1975	RE	500	13	65	N/A	II
Chicago Harbor Lock	IL55094	Chicago River	Chicago	U.S. Army Corps of Engineers	OT	--	--	9	--	N/A	II
Main St. Triangle Dam	IL55123	Mill Creek-off-stream	Orland Park	Village of Orland Park	--	CN	395	9	--	N/A	II
Saganashkee Slough 6 Dam	IL01216	Tributary to Calumet SAG Channel	Hastings	Forest Preserve District of Cook Co.	1948	RE	415	7	2,375	N/A	II

a. RE=Earth, VA=Arch, PG=Gravity, CN=Concrete

While no event has been recorded in Cook County, understanding the location and risk for the County associated with dams and levees is vital. In the broader U.S., the average age of a dam is 57 years and 74% of these dams are considered "High Hazard Potential Dams" and require an Emergency Action Plan. In Cook County, there are 40 dams with an average age of 51 years old and 24 (60%) of these dams are classified as having “high" (10) or "significant" (14) hazard risk – meaning they have significant downstream populations at risk if the dam should fail. In total, only 11 of the dams have an Emergency Action Plan, including 6 of the 10 "high" and 4 of the 14 "significant" hazard dams ([National Inventory of Dams Interactive Map]()).

Figure: Dams in Cook County

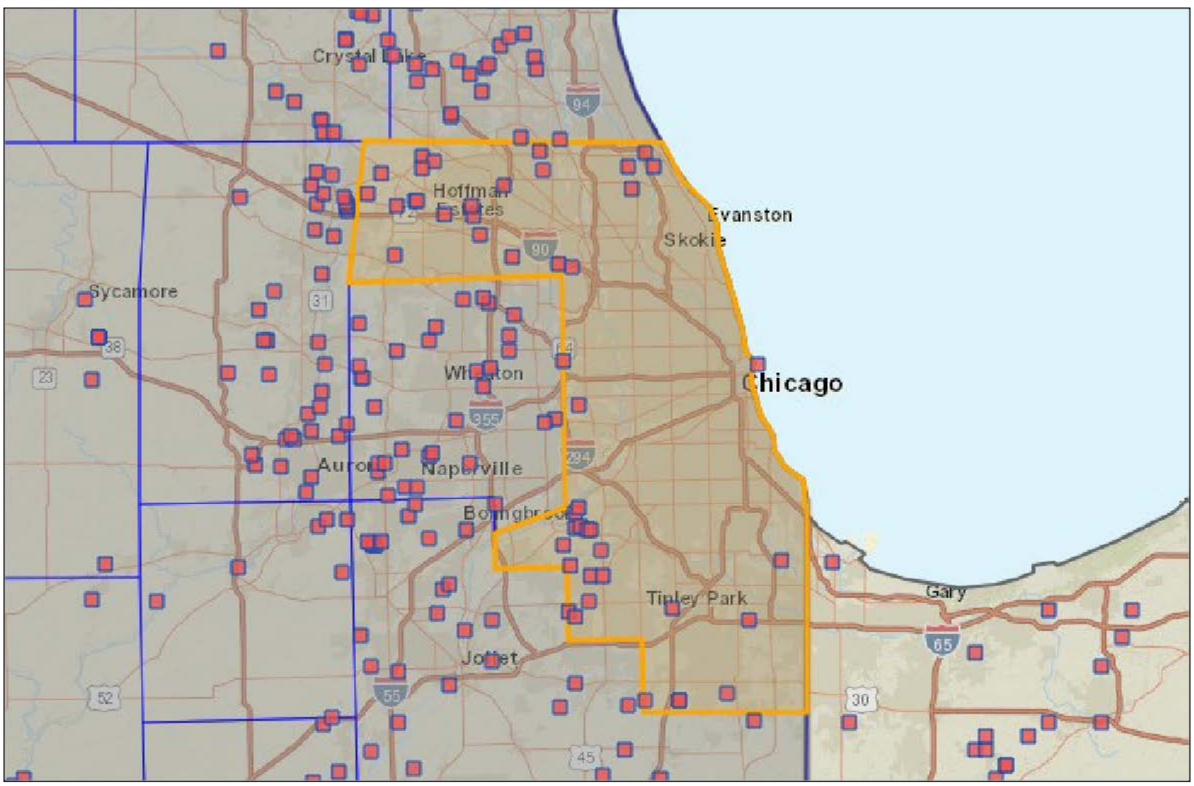


Figure: Dams in Cook County Map

Source: ([National Inventory of Dams Interactive Map]()).

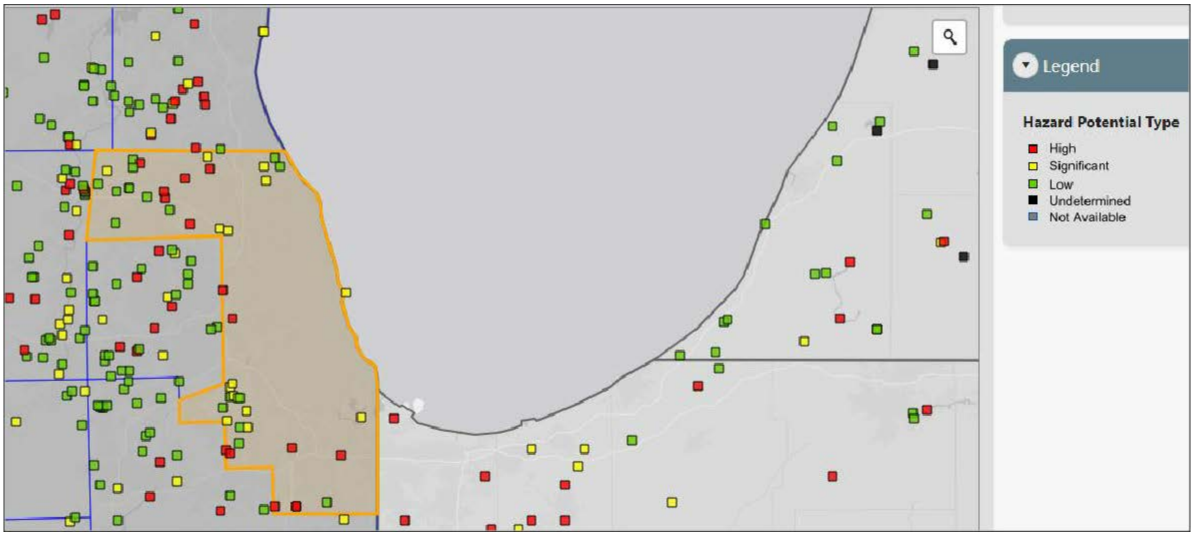


Figure: Hazard Potential of Dams in Cook County

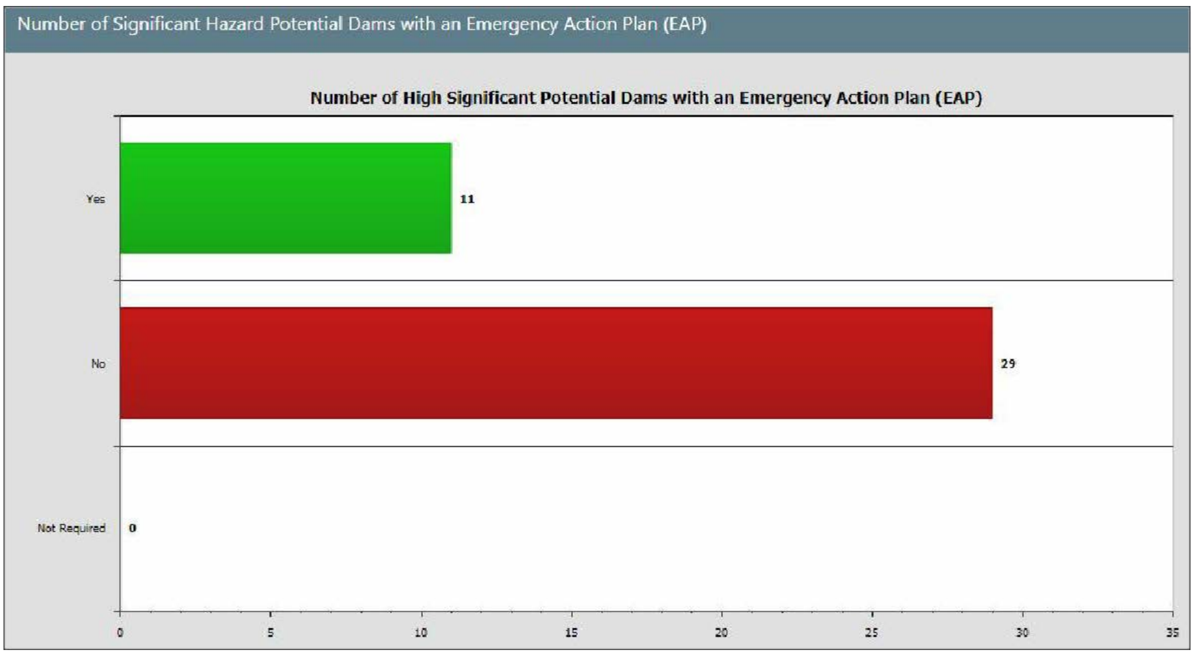


Figure: Dams in Cook County with an EAP

(Comprehensive Cook County dam data can be accessed in spreadsheet form here)

In Illinois, there are 2,923 levee structures and 576 levee systems totaling 1,951 miles of levees. The average age of levees in the U.S. is 55 years and in Illinois, the average age is 64. In Cook County, there are 9 Levee Systems totaling 8 miles of levees and 439 levee structures. The reported average age of the levee is relatively young, 21 years; however, the year of construction data was not available for 6 of the

9 levee systems which makes the data insufficient for a strong conclusion regarding the true the average age.

In total, 21,951 people are and 5,400 structures are protected by the levee. The property value of all 9 levee systems is $3,823,460,000.

One of the levee systems is classified as "moderate" and 2 as "low" under the levee safety action classification. According to the Levee Safety Action Classification Rating Definitions:

- Moderate means: Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in moderate risk.
- Low means; Likelihood of inundation due to breach and/or system component malfunction in combination with loss of life, economic, or environmental consequences results in low risk.

TABLE: LEVEES IN COOK COUNTY (National Levee Database)

Levee System	Location	Levee Safety Action Classification	People at Risk (protected by Levee)	Structures at Risk (protected by Levee)	Property Value	Total Miles	Length of Embankment (miles)	Length of Floodwall (miles)	Year Constructed
Calumet City	Calumet City, Cook County, Illinois	Not Screened	3,631	1,322	$462M	2.02	1.97	0.05	Not Reported
Cook County Levee 1	McCook, Cook County, Illinois	Not Screened	410	52	$195M	0.86	0.86	0	Not Reported
Elmwood Park Flood Mitigation Project	River Grove, Cook County, Illinois	Not Screened	500	158	$102M	0.32	0	0.32	Not Reported
Hammond Forest Ave*	Hammond, Lake County, Indiana; Chicago USACE District	Low (assessment date 7/8/16)	367	180	$49.8M	0.99	0.42	0.53 and 3 closure structures	1984
Lansing	Lansing, Cook County, Illinois	Not Screened	1,426	434	$211M	1.48	1.08	0.41	Not Reported
Levee 37**	Mount Prospect, Cook County, Illinois	Low (assessment date 2/21/2019)	5,603	622	$523M	2.12	0.16	1.7 (1 closure structure)	Not Reported
Levee 50***	Des Plaines, Cook	Moderate (assessment date	5,934	1,088	$1.46B	3.56	1.02	0.46 (2 closure structures)	2011

	County, Illinois	2/21/2019)							
Munster	Munster, Lak County, Indiana; Chicago USACE District	Not Screened	4,065	1,531	$815M	4.09	1.14	2.14 (5 closure structures)	2012
Village of Westchester Unnamed Levee	Westchester, Cook County, Illinois	Not Screened	15	13	$5.66M	0.06	0.06	0	Not Reported

*Risk Characterization Summary for Hammond Forest Ave: The LSOG considers the risk associated with the Hammond Forest Ave segment (LST ID 5331) to be Low (LSAC 4) for both prior to overtopping and with overtopping. The project was loaded to nearly 100% in 2008 prior to being brought into the USACE Rehabilitation and Inspection Program, the levee performed well during the 2008 event. The project is expected to perform well under a full range of loading conditions. The leveed area consists primarily of residential structures, the community has a high level of awareness of the project and its role in flood risk reduction. There are numerous short egress routes out of the leveed area.

**Risk Characterization Summary for Levee 37: The LSOG considers the risk associated with the Hammond Forest Ave segment (LST ID 5331) to be Low (LSAC 4) for both prior to overtopping and with overtopping. The project was loaded to nearly 100% in 2008 prior to being brought into the USACE Rehabilitation and Inspection Program, the levee performed well during the 2008 event. The project is expected to perform well under a full range of loading conditions. The leveed area consists primarily of residential structures, the community has a high level of awareness of the project and its role in flood risk reduction. There are numerous short egress routes out of the leveed area.

***Risk Characterization Summary for Levee 50: The Corps completed a risk assessment of the Levee 50 System in 2015. The levee has performed well since completion in 2011, including April 2013 when the system was loaded to within 3.5 feet of the levee top. Part of the reason for the successful operation of the levee is active local participation from the City of Des Plaines who operates and maintains the project features. The overall condition of Levee 50 is sufficient, but limitations for risk reduction remain. Any given year could result in a flood which the levee is not designed to handle. Also, since the area is heavily urban with I-294 partially dividing the leveed area, heavy congestion could be realized if an evacuation were necessary.

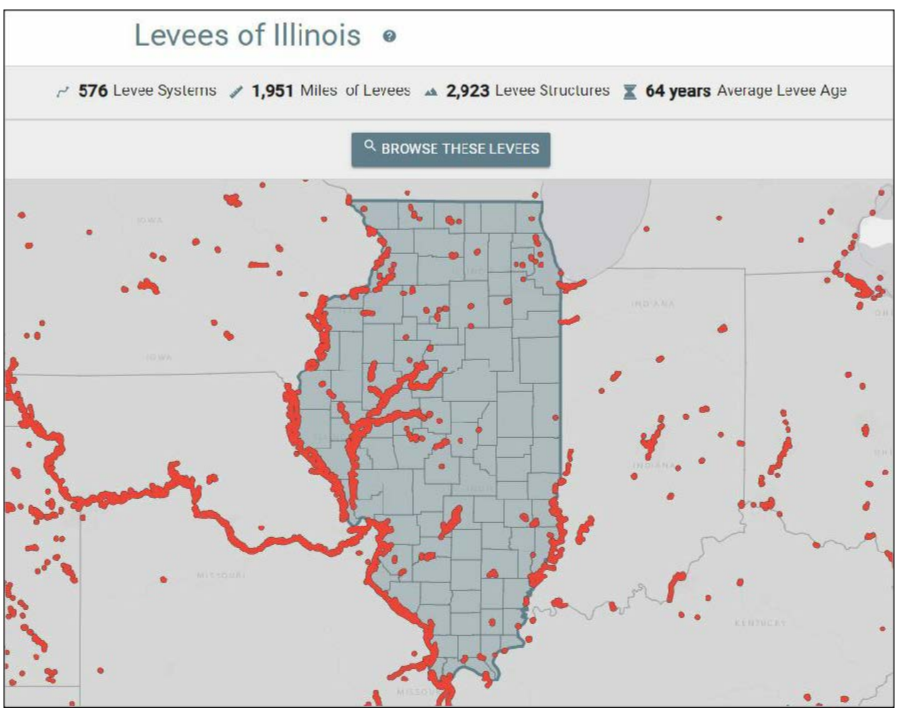


Figure: Levees in Illinois

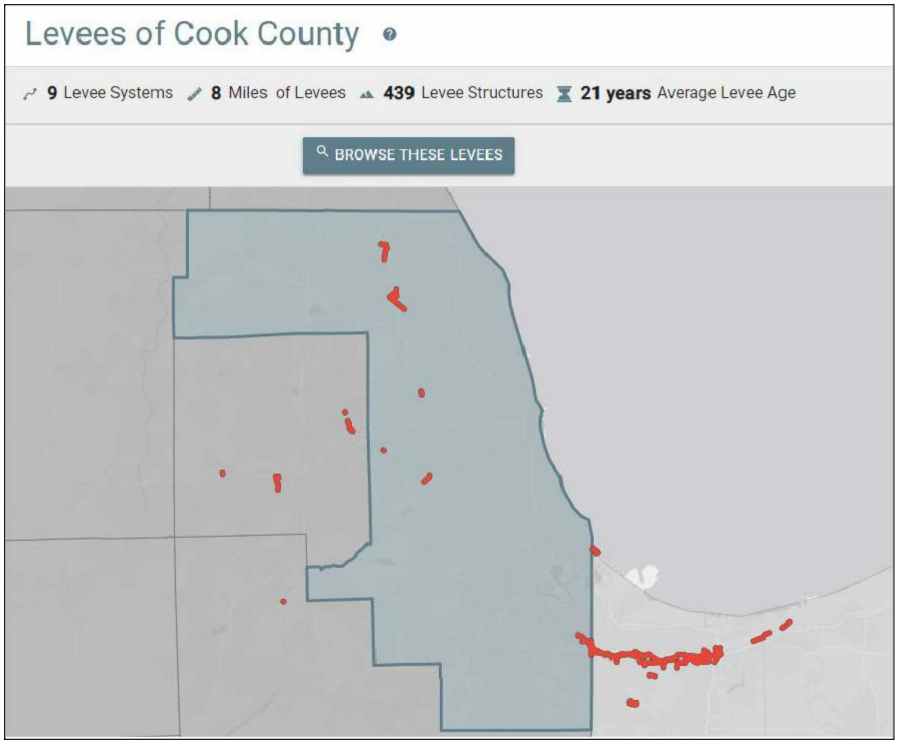


Figure: Levees in Cook County

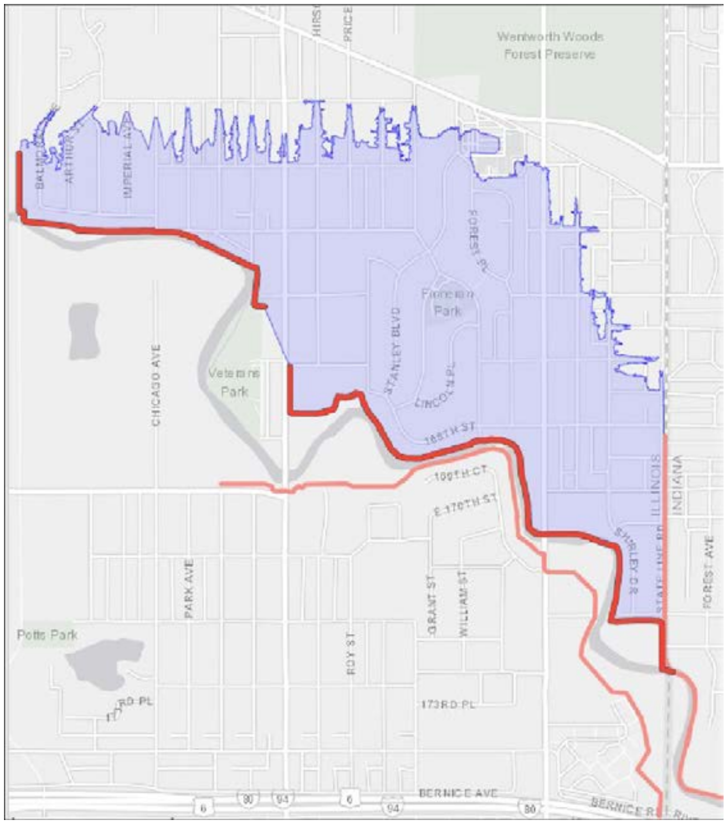


Figure: Calumet City, Classification Rating - Not Screened

Figure: Cook County Levee 1, Classification Rating - Not Screened

Figure: Elmwood Park Flood Mitigation Project, Classification Rating - Not Screened

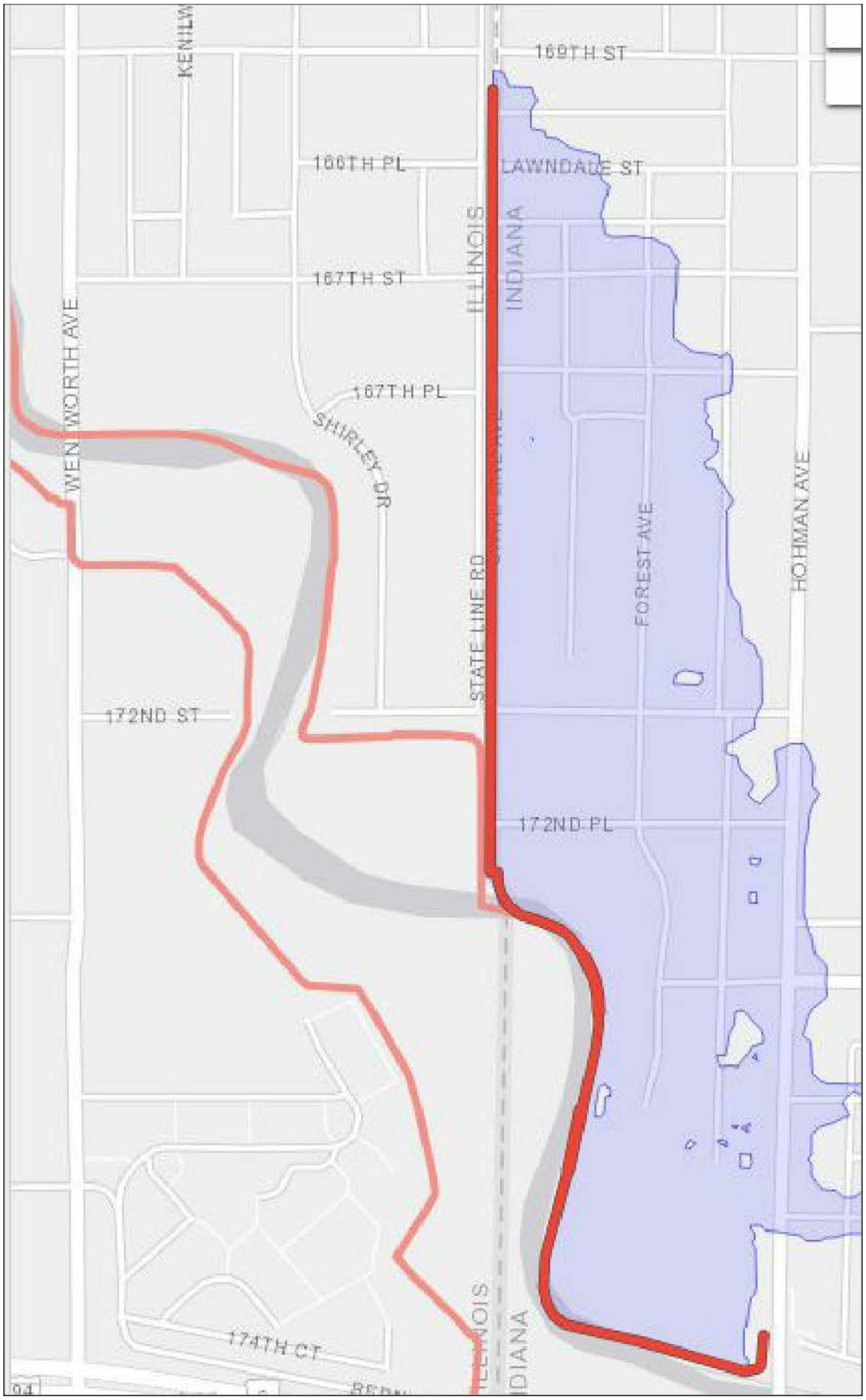


Figure: Hammond Forest Ave Levee Safety Action, Classification Rating - Low

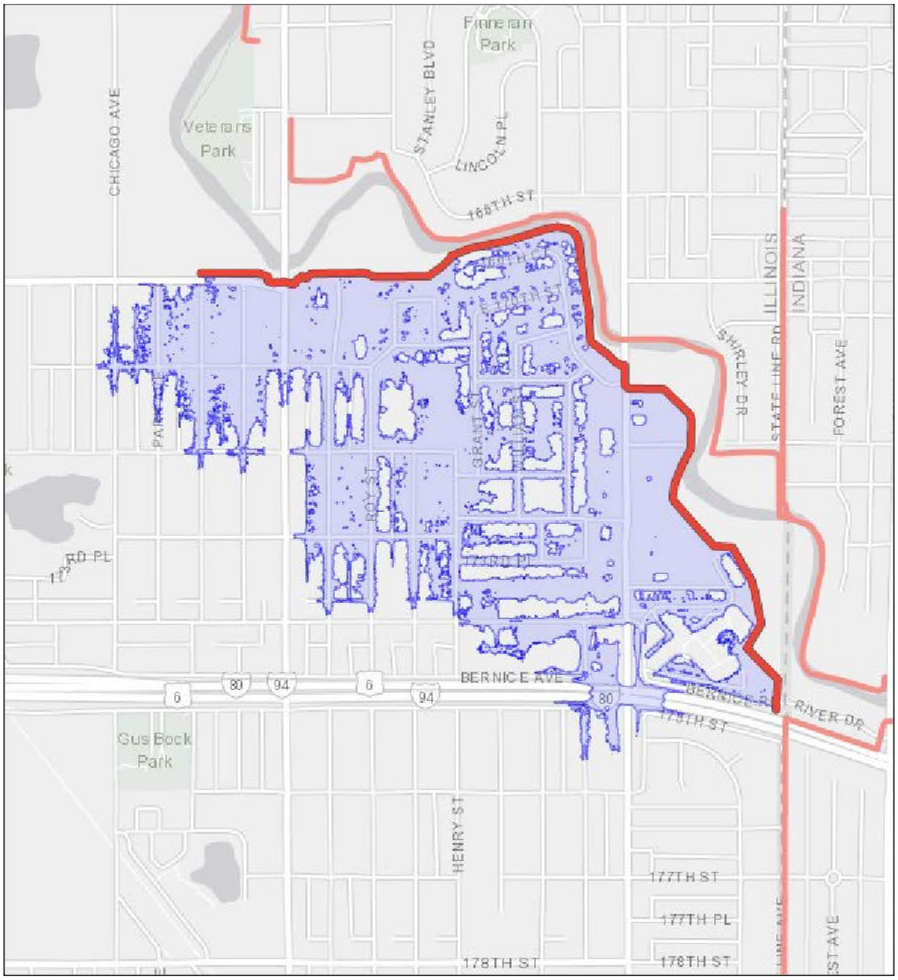


Figure: Lansing, Classification Rating - Not Screened

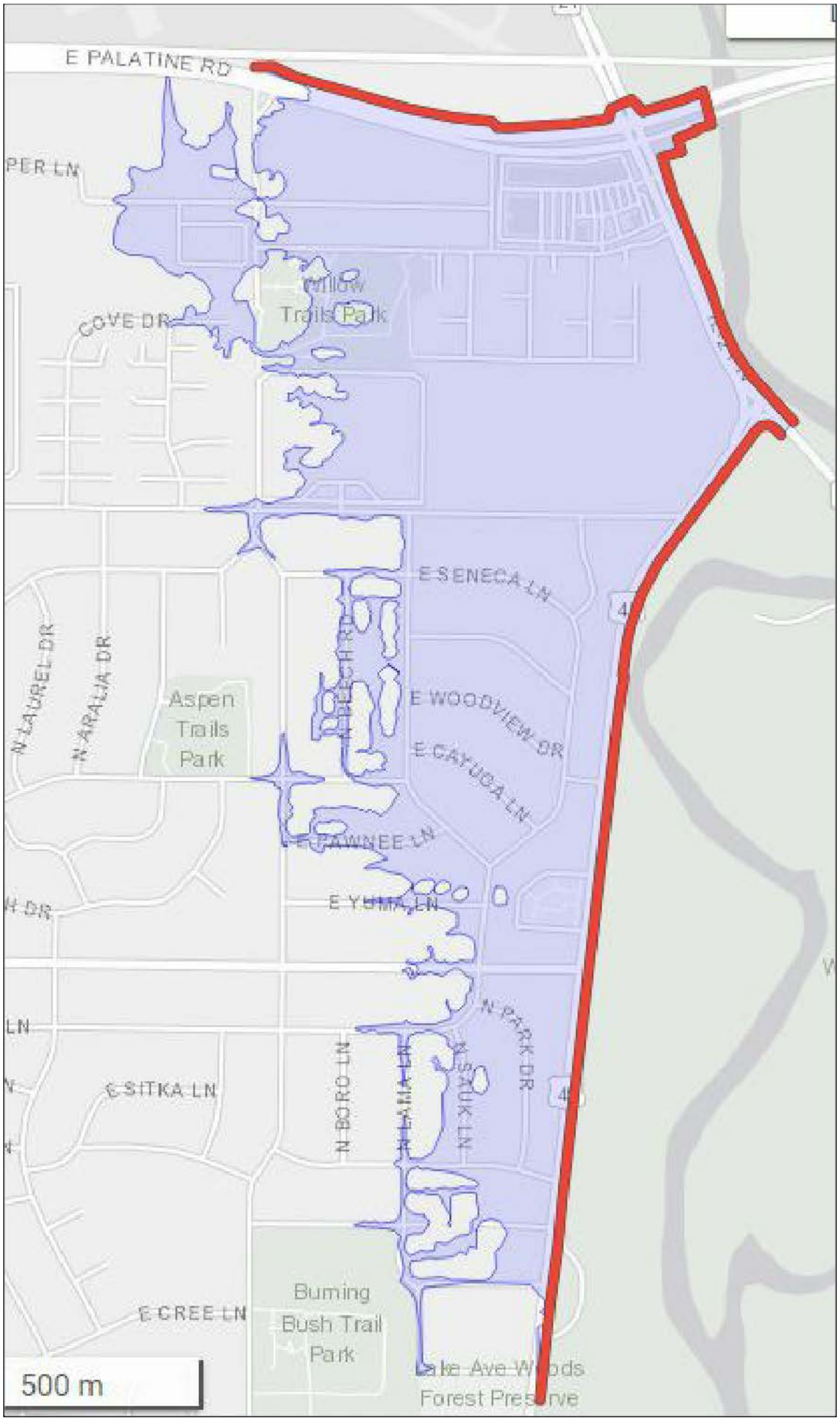


Figure: Levee 37 Levee Safety Action, Classification Rating - Low

Figure: Levee 50 Levee Safety Action, Classification Rating - Moderate

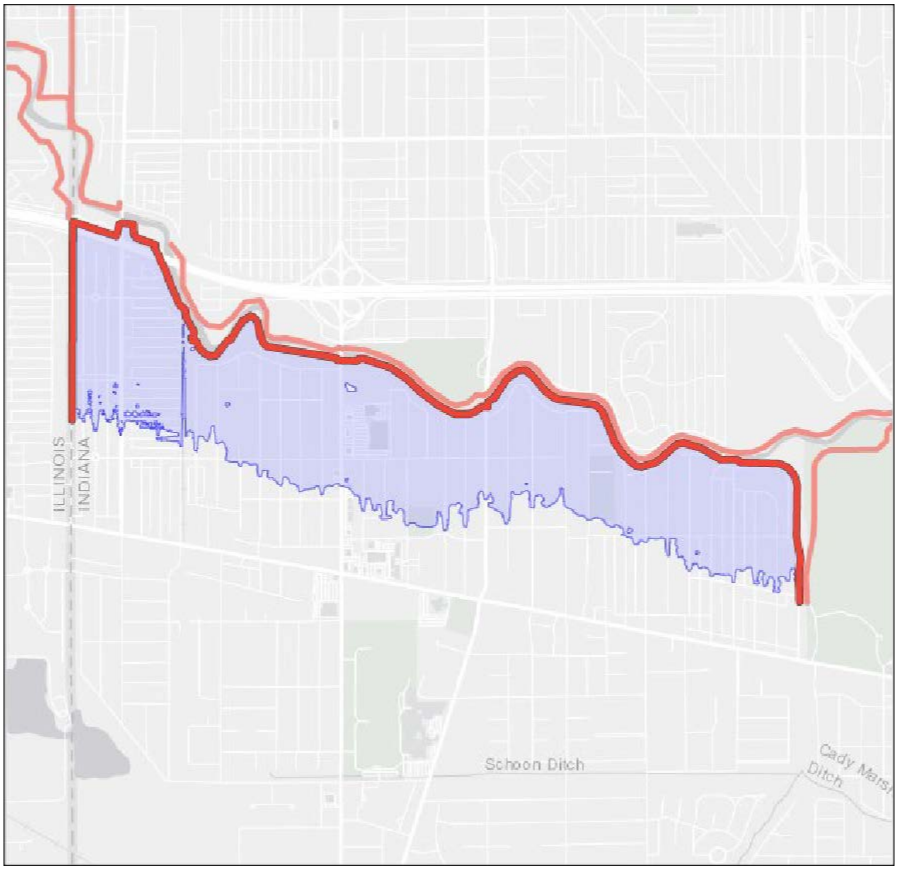


Figure: Munster, Classification Rating - Not Screened

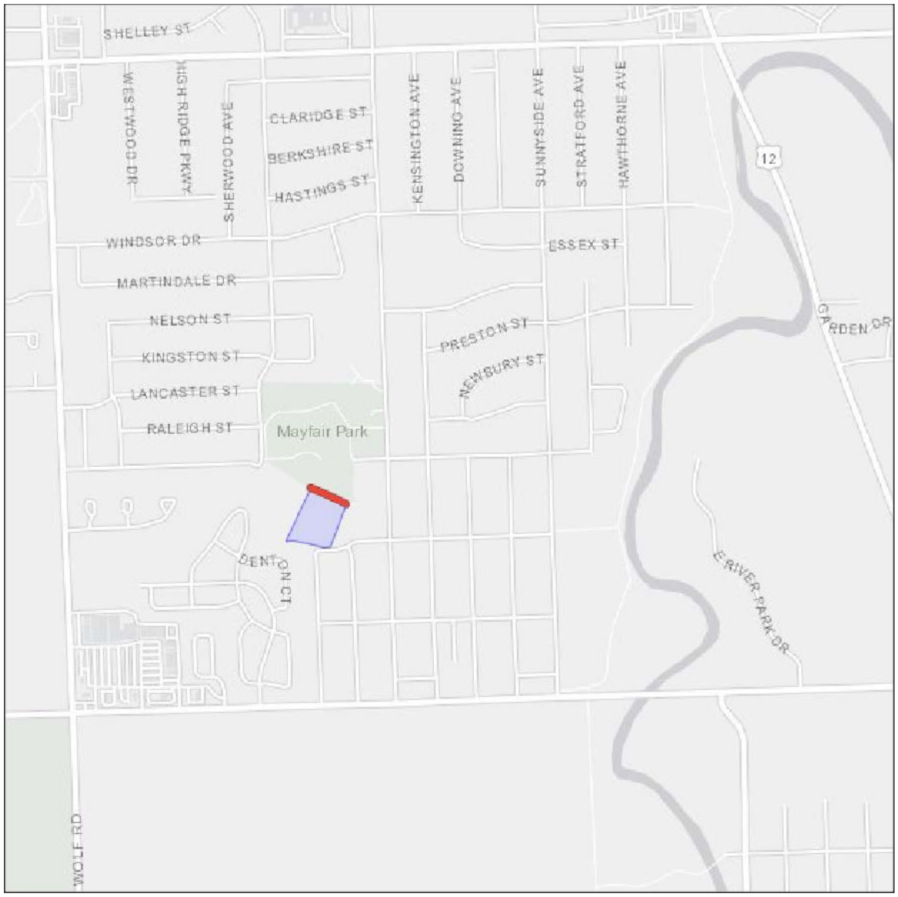


Figure: Village of Westchester Unnamed Levee, Classification Rating - Not Screened

Frequency and Future Hazard Events

Dam failure events are infrequent and usually coincide with events that cause them, such as earthquakes, flooding, excessive rainfall, and snowmelt. There is a “residual risk” associated with dams and levee failures. Residual risk is the risk that remains after safeguards have been implemented. For dams and levees, the residual risk is associated with events beyond those that the facility was designed to withstand. However, the probability of any type of dam or levee failure in the planning area is low in today’s regulatory environment because dam failure in Cook County has historically been extremely rare and there has been no documented history of significant occurrences or events in the past; and the likelihood of a significant event is that it may occur every 100 or more years.

Extent

Dams

Dam failure can be catastrophic to all life and property downstream. The IDNR Dam Safety Program classifies dams and reservoirs in a three-class hazard rating system based on the degree of threat to life and property that would result from a dam failure (State of Illinois, 2016). The following table illustrates the hazard extent of each dam in terms of Storage Capacity and Max Discharge if the data was available.

TABLE: DAMS IN THE PLANNING AREA					
Name	**Water Course**	**City**	**Storage Capacity (acre-feet)**	**Max Discharge**	**Hazard Class**
Buffalo Creek Reservoir	Buffalo Creek	Buffalo Grove	720	N/A	I
Upper Salt Creek Structure #2	Tributary of Salt Creek	Palatine	297	9582	I
Touhy Reservoir	Higgin's Creek	Chicago	735	N/A	II
Upper Salt Creek Structure #3	St. Michael's Cemetery Tributary	Rolling Meadows	407	13948	I
Upper Salt Creek Structure #4	Salt Creek	Palatine	429	1300	I
Lake George Dam	Tributary to Butterfield Creek	Matteson	539	870	I
Midlothian Creek Dam	Midlothian Creek	Oak Forest	1,279	8031	I
Thornton Quarry Gap Dam	Thornton Quarry	Thornton	9,900	N/A	I
Busse Woods Res. South Dam	Salt Creek	Elk Grove	17,621	24272	I
Richton Crossing Dam	Tributary to Butterfield Creek	Matteson	53	920	I
Lower Elmhurst Dam	Tributary to Addison Creek-off stream	Elmhurst	93	N/A	I
Cornell Ave. Dam	McDonald Creek	Wheeling	--	N/A	I
Techny Reservoir Dam	W. Fork, N. Branch Chicago River	Glenview	250	N/A	II

Saganashkee Slough 1 Dam	Tributary to Calumet SAG Channel	Lemont	2,379	N/A	II
Bullfrog Lake Dam	Tributary to Des Plaines River	Oak Forest	144	N/A	II
Maple Lake Dam	Tributary to Des Plaines River	Lemont	765	N/A	II
Papoose Lake Dam	Tributary to Mill Creek	Palos Park	143	N/A	II
Tampier Lake Dam	Tributary to Long Run Creek	Lemont	859	N/A	II
Galvins Lake Dam	Tributary to Spring Creek	Carpentersville	120	N/A	II
White Pine Ditch Dam	White Pine Ditch	Arlington Heights	65	N/A	II
Chicago Harbor Lock	Chicago River	Chicago	--	N/A	II
Main St. Triangle Dam	Mill Creek-off-stream	Orland Park	--	N/A	II
Saganashkee Slough 6 Dam	Tributary to Calumet SAG Channel	Hastings	2,375	N/A	II
a. RE=Earth, VA=Arch, PG=Gravity, CN=Concrete					

Based on the U.S. Army Corps of Engineers, when dams are assigned the low (L) hazard potential classification, it means that failure or incorrect operation of the dam will result in no human life losses and no economic or environmental losses. Losses are principally limited to the owner's property. Dams assigned the significant (S) hazard classification are those dams in which failure or incorrect operation results in no probable loss of human life; however, it can cause economic loss, environmental damage, and disruption of lifeline facilities. Dams classified as significant hazard potential dams are often located in predominantly rural or agricultural areas but could be located in populated areas with a significant amount of infrastructure. Dams assigned the high (H) hazard potential classification are those dams in which failure or incorrect operation has the highest risk to cause loss of human life and significant damage to buildings and infrastructure.

Levees

To determine extent of levee failure, additional data regarding the volume and velocity of water that breaches the levee is needed. The planning team and stakeholders were not able to obtain this data, and future efforts will ensure this information is obtained.

See Severity.

Severity

Dam failure can be catastrophic to all life and property downstream. The IDNR Dam Safety Program classifies dams and reservoirs in a three-class hazard rating system based on the degree of threat to life and property that would result from a dam failure (State of Illinois, 2016):

- Class I—Dams located where failure has a high probability for causing loss of life or substantial economic loss in excess of 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, a hospital, a nursing home, a highly traveled roadway, a shopping center, or similar type facilities where people are normally present downstream of the dam. This is similar to U.S. Army Corps of Engineers HIGH HAZARD POTENTIAL category as defined in the Corps Guidelines, and the U.S. Soil Conservation Service Class (c) dams as defined in Soil Conservation Service Technical Release No. 60.
- Class II—Dams located where failure has a moderate probability for causing loss of life or may cause substantial economic loss in excess of 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 facilities where people are downstream of the dam for only a portion of the day or on a more sporadic basis. This is similar to U.S. Army Corps of Engineers SIGNIFICANT HAZARD POTENTIAL category and the U.S. Soil Conservation Service Class (b) dams.
- 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 in excess of 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 seldom are present and where there are few structures. This corresponds to U.S. Army Corps of Engineers LOW HAZARD POTENTIAL category and U.S. Soil Conservation Service Class (a) dams.

The U.S. Army Corps of Engineers developed the classification system referenced in the definitions above and shown in *Table: Corps of Engineers Hazard Potential Classification* for the hazard potential of dam failures. The Illinois and Corps of Engineers hazard rating systems are both based only on the potential consequences of a dam failure; neither system takes into account the probability of such failures.

TABLE:
CORPS OF ENGINEERS HAZARD POTENTIAL CLASSIFICATION

Hazard Category (a)	**Direct Loss of Life** (b)	**Lifeline Losses** (c)	**Property Losses** (d)	**Environmental Losses** (e)
Low	None (rural location, no permanent structures for human habitation)	No disruption of services (cosmetic or rapidly repairable damage)	Private agricultural lands, equipment, and isolated buildings	Minimal incremental damage

Significant	Rural location, only transient or day- use facilities	Disruption of essential facilities and access	Major public and private facilities	Major mitigation required
High	Certain (one or more) extensive residential, commercial, or industrial development	Disruption of essential facilities and access	Extensive public and private facilities	Extensive mitigation cost or impossible to mitigate

a. Categories are assigned to overall projects, not individual structures at a project.
b. Loss of life potential based on inundation mapping of area downstream of the project. Analyses of loss of life potential should take into account the population at risk, time of flood wave travel, and warning time.
c. Indirect threats to life caused by the interruption of lifeline services due to project failure or operational disruption; for example, loss of critical medical facilities or access to them.
d. Damage to project facilities and downstream property and indirect impact due to loss of project services, such as impact due to loss of a dam and navigation pool, or impact due to loss of water or power supply.
e. Environmental impact downstream caused by the incremental flood wave produced by the project failure, beyond what would normally be expected for the magnitude flood event under which the failure occurs.

Source: U.S. Army Corps of Engineers, 1995

The severity of a levee failure depends on the area protected by the levee, the volume and velocity of water that breaches the levee, and the structures and population in the protected area. A levee breach will result in flooding of normally protected areas, resulting in impacts similar to those seen in areas that are within the floodplain and not normally protected by a levee, as described in Chapter 9.

Warning Time

Warning time for dam or levee failure varies depending on the cause of the failure. In events of extreme precipitation or massive snowmelt, evacuations can be planned with sufficient time. In the event of a structural failure due to an earthquake, there may be no warning time. The type of dam or levee also affects warning time. Earthen structures do not tend to fail completely or instantaneously. Once a breach is initiated, discharging water erodes the breach until either the water is depleted or the breach resists further erosion. Concrete structures also tend to have a partial breach as one or more monolith sections are forced apart by escaping water. The time of breach formation ranges from a few minutes to a few hours.

Cook County and its planning partners have established protocols for flood warning and response to imminent dam failure in the flood warning portion of its adopted emergency operations plan. These protocols are tied to the emergency action plans created by the dam owners.

Secondary Hazards

Dam failure can cause severe downstream flooding, depending on the magnitude of the failure. Other potential secondary hazards of dam failure are bank erosion on the rivers, and destruction of downstream habitat. Levee failure may cause severe flooding in the areas normally protected by the levee. Other hazards related to flooding are described in Chapter 9.

Exposure

In 2014, the flood module of Hazus-MH was used for a Level 2 assessment of dam failure. Hazus-MH uses census data at the block level and FEMA floodplain data, which has a level of accuracy acceptable for planning purposes. Where possible, the Hazus-MH data for the 2014 risk assessment was enhanced using GIS data from county, state, and federal sources. The exposure and vulnerability analyses focused on five dams for which inundation information is available: The Buffalo Creek Reservoir, Touhy Reservoir, and Upper Salt Creek Structures #2, #3 and #4. These are all Metropolitan Water Reclamation District facilities for which mapping exists to support emergency action planning. As stated in the methodology, during the 2019 update, the Planning Team, in coordination with Cook County GIS, reassessed data and the availability of data to determine if a more robust analysis would result in outputs representing a significant change from 2014. Analyses, using the same methodology were conducted, resulting in little to no major changes. It was determined that future analyses need to incorporate municipal-level GIS inputs and further coordination with local GIS databases, as available. New analyses were conducted for jurisdictions participating for the first time in the Cook County MJ-HMP. Future updates to this plan will strive to enhance this assessment with new data as that data becomes available.

Population

All populations in a dam failure inundation zone would be exposed to the risk of a dam failure. The potential for loss of life is affected by the capacity and number of evacuation routes available to populations living in areas of potential inundation. The estimated population living in the mapped inundation areas within the planning area is 30,135, or 0.57 percent of the planning area's population. The table below summarizes the at-risk population in the planning area by dam.

TABLE:
POPULATION WITHIN DAM FAILURE INUNDATION AREAS

Dam	Affected Population	% of Population
Buffalo Creek Reservoir	14,713	0.28%
Upper Salt Creek Structure #2	1,186	0.02%
Touhy Reservoir	1,593	0.03%
Upper Salt Creek Structure #3	5,987	0.11%
Upper Salt Creek Structure #4	6,656	0.13%
Total	**30,135**	**0.57%**

Property

Exposed Structures and Property Value

The Hazus-MH model estimated that there are 12,762 structures within the mapped dam failure inundation areas in the planning area. The value of exposed buildings in the planning area was generated using Hazus-MH and is summarized in *Table: Exposure And Value Of Structures In Dam Failure*

Inundation Areas. This methodology estimated $10.7 billion worth of building-and-contents exposure to dam failure inundation, representing 0.90 percent of the total building value of the planning area.

According to the Illinois Statewide Flood Hazard Assessment and the Illinois State Hazard Mitigation Plan, the value of buildings exposed to levee failures is just over $43.7 million (IEMA, 2013).

TABLE:
EXPOSURE AND VALUE OF STRUCTURES IN DAM FAILURE INUNDATION AREAS

Dam	Buildings Exposed	Value Exposed Building	Value Exposed Contents	Total	% of Total Assessed Value
Buffalo Creek Reservoir	4,527	$1,794,369,000	$1,252,212,000	$3,046,581,000	0.26 %
Upper Salt Creek Structure #2	3,855	$868,094,000	$658,159,000	$1,526,253,000	0.13 %
Touhy Reservoir	490	$765,949,000	$759,825,000	$1,525,774,000	0.13 %
Upper Salt Creek Structure #3	1,842	$1,295,532,000	$1,030,007,000	$2,325,539,000	0.19 %
Upper Salt Creek Structure #4	2,048	$1,293,667,000	$990,251,000	$2,283,918,000	0.19 %
Total	**12,762**	**$6,017,611,000**	**$4,690,454,000**	**$10,708,065,000**	**0.90 %**

Land Use in the Inundation Zones

Some land uses are more vulnerable to dam failure inundation, such as single-family homes, while others are less vulnerable, such as agricultural land or parks. *Table: Land Use In The Buffalo Creek Reservoir And Touhy Reservoir Dry-Weather Inundation Zones* and *Table: Land Use Within The Upper Salt Creek Dams Dry-Weather Inundation Zones* show the existing land use of all areas in the modeled dam failure inundation zones. The estimated portion of the inundation zone that contains vacant, developable land ranges from 8 to 17 percent for the five dams evaluated.

TABLE:
LAND USE IN THE BUFFALO CREEK RESERVOIR AND TOUHY RESERVOIR DRY-WEATHER INUNDATION ZONES

Land Use Classification	Buffalo Creek Reservoir		Touhy Reservoir	
	Area (acres)	% of total	Area (acres)	% of total
Agricultural	5	0.8	0	0.0
Commercial	67	10.1	12	6.3
Education	29	4.3	Less than 1	0.2
Industrial	50	7.4	13	7.2
Institutional	12	1.8	Less than 1	0.1
Open Space	126	18.8	12	6.4
Residential	228	34.2	21	11.3
Utility/Right of Way	34	5.2	103	56.2
Vacant	117	17.4	23	12.3
Total	**668**	**100.0**	**184**	**100.0**

Source: CMAP, 2005. Categories from the 2005 CMAP land-use inventory were aggregated; categories representing major water features were excluded.

TABLE:
LAND USE WITHIN THE UPPER SALT CREEK DAMS DRY-WEATHER INUNDATION ZONES

Land Use Classification	Upper Salt Creek Structure #2		Upper Salt Creek Structure #3		Upper Salt Creek Structure #4	
	Area (acres)	% of total	Area (acres)	% of total	Area (acres)	% of total
Agricultural	1	0.2	13	1.1	12	6.3
Commercial	8	2.2	160	14.5	0	0.2
Education	6	2.4	25	2.2	0	0
Industrial	0	0	5	0.5	`13	7.2
Institutional	0	0	2	0.2	0	0.1
Open Space	124	51.9	538	48.7	12	6.4
Residential	81	33.8	250	22.6	21	11.3
Utility/Right of Way	1	0.4	13	1.1	103	56.2
Vacant	19	8.0	99	9.0	23	12.3
Total	**240**	**100.0**	**1,105**	**100.0**	**184**	**100.0**

Source: CMAP, 2005. Categories from the 2005 CMAP land-use inventory were aggregated; categories representing major water features were excluded.

Critical Facilities

GIS analysis determined that 14 of the planning area’s critical facilities or critical infrastructure (0.07 percent) are in the mapped inundation areas.

Environment

Reservoirs held behind dams affect many ecological aspects of a river. River topography and dynamics depend on a wide range of flows, but rivers below dams often experience long periods of very stable flow conditions or saw-tooth flow patterns caused by releases followed by no releases. Water releases from dams usually contain very little suspended sediment; this can lead to scouring of river beds and banks. The environment would be exposed to a number of risks in the event of dam failure. The inundation could introduce many foreign elements into local waterways. This could result in the destruction of downstream habitat and could have detrimental effects on many species of animals, especially endangered species such as salmon.

Environmental impacts from levee failures would mirror the impacts due to flood events, as described in Chapter 9.

Vulnerability

This section provides specific information about the County's vulnerabilities to this hazard, such as:

- Population
- Property
- Critical Facilities
- Environment

Population

Vulnerable populations are all people downstream from dam failures or within areas normally protected by levees who are incapable of escaping the area within the allowable time frame. This includes the elderly and young who may be unable to get themselves out of the inundation area. The vulnerable population also includes those who would not have adequate warning from a television or radio emergency warning system.

The following tables list the approximate numbers of people at risk of dam and levee failure within Cook County.

Table: People at Risk of Dam Failure within Cook County

Dam	Affected Population	% of Population
Buffalo Creek Reservoir	14,713	0.28%
Upper Salt Creek Structure #2	1,186	0.02%
Touhy Reservoir	1,593	0.03%
Upper Salt Creek Structure #3	5,987	0.11%
Upper Salt Creek Structure #4	6,656	0.13%
Total:	**30,135**	**0.57%**

Table: People at Risk of Levee Failure within Cook County

Levee System	People at Risk
Calumet City	3,631
Cook County Levee 1	410
Elmwood Park Flood Mitigation Project	500
Hammond Forest Ave	367
Lansing	1,156
Levee 37	5,603
Levee 50	5,934
Munster	3,766
Village of Westchester Unnamed Levee	15
Total:	**21,382**

Property

Vulnerable properties are those closest to the dam inundation area and within areas normally protected by levees. These properties would experience the largest, most destructive surge of water. Low-lying areas are also vulnerable since they are where the waters would collect. Transportation routes are vulnerable to inundation and have the potential to be wiped out, creating isolation issues. This includes all roads, railroads, and bridges in the path of the dam inundation or in areas normally protected by levees. Those that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge. Utilities such as overhead power lines, cable and phone lines could also be vulnerable. Loss of these utilities could create additional isolation issues for the inundation areas.

The Hazus analysis indicated a total potential loss of $323,643,000 in the planning area for the five dam failures evaluated. This represents 3 percent of the total exposed property, or 0.03 percent of the total assessed value of the planning area. *Table: Loss Estimates For Dam Failure* summarizes the loss estimates for dam failure.

The Illinois State Hazard Mitigation Plan estimates potential losses from levee failures at $3.3 million (IEMA, 2013).

TABLE:
LOSS ESTIMATES FOR DAM FAILURE

Dam	Estimated Loss Associated with Dam Failure			% of Total Value
	Structure	Contents	Total	
Buffalo Creek Reservoir	$22,541,000	$42,767,000	$65,308,000	0.01%
Upper Salt Creek Structure #2	$7,581,000	$10,256,000	$17,837,000	0.00%
Touhy Reservoir	$6,107,000	$13,784,000	$19,891,000	0.00%
Upper Salt Creek Structure #3	$35,624,000	$71,118,000	$106,742,000	0.01%
Upper Salt Creek Structure #4	$40,286,000	$73,579,000	$113,865,000	0.01%
Total	**$112,139,000**	**$211,504,000**	**$323,643,000**	**0.03%**

Critical Facilities

On average, critical facilities would receive 7 percent damage to the structure and 26 percent damage to the contents during a dam failure event. The estimated time to restore these facilities to 100 percent of their functionality is 491 days.

TABLE:
CRITICAL FACILITIES IN DAM FAILURE INUNDATION AREAS

Dam	Medical & Health Services	Government Function	Protective Function	Schools	Hazardous Materials	Other Critical Function	Total
Buffalo Creek Reservoir	0	0	0	5	0	0	**5**
Upper Salt Creek Structure #2	0	0	0	0	0	0	**0**

Touhy Reservoir	0	0	0	0	0	0	**0**
Upper Salt Creek Structure #3	1	0	0	2	0	0	**3**
Upper Salt Creek Structure #4	1	0	0	2	0	0	**3**
Total	**2**	**0**	**0**	**9**	**0**	**0**	**11**

TABLE:
CRITICAL INFRASTRUCTURE IN DAM FAILURE INUNDATION AREAS

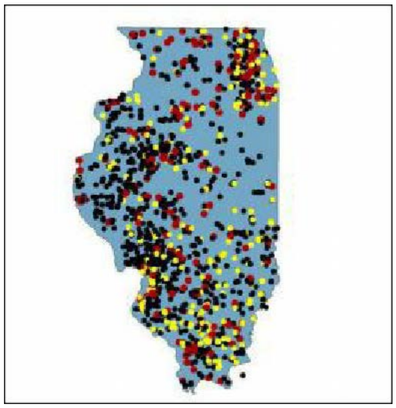
Dam	Bridges	Water Supply	Wastewater	Power	Communications	Other Infrastructure	Total
Buffalo Creek Reservoir	0	0	0	0	0	0	**0**
Upper Salt Creek Structure #2	0	0	0	0	0	0	**0**
Touhy Reservoir	1	0	0	0	0	0	**1**
Upper Salt Creek Structure #3	0	0	1	0	0	0	**1**
Upper Salt Creek Structure #4	0	0	1	0	0	0	**1**
Total	**1**	**0**	**2**	**0**	**0**	**0**	**3**

Environment

The environment would be vulnerable to a number of risks in the event of dam or levee failure. The inundation could introduce foreign elements into local waterways, resulting in destruction of downstream habitat and detrimental effects on many species of animals. The extent of the vulnerability of the environment is the same as the exposure of the environment.

Future Trends in Development

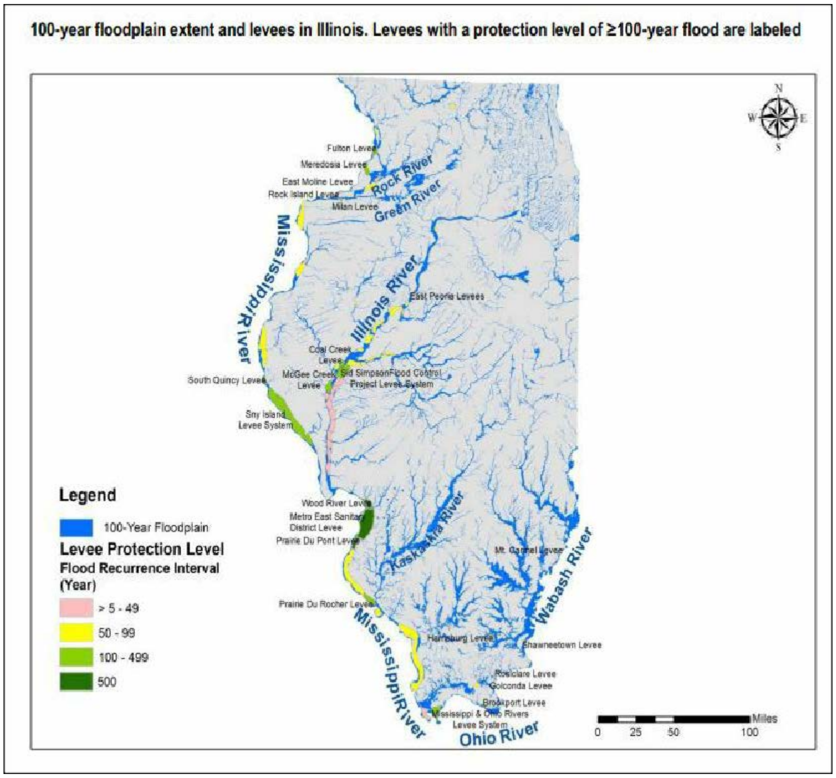
Levees and dams are designed to provide a specific level of protection. Levees can be overtopped or fail in larger flood events and without proper maintenance, can decay over time. Seepage is one of the most common failure mechanisms in levees. Dam failure is can result from an accidental or unintentional collapse of another structure that results in downstream flooding. Dams are man-made structures and



dam failures are usually considered technological hazards; however, these failures are usually caused by prolonged periods of rainfall and flooding.

Map: Dams in Illinois - Red Dot indicates High Hazard Potential if Dam Fails

Source: [Dam Safety Illinois]



Map: 100-year Floodplain in Illinois with Levee Protection

Source: [Illinois Mitigation Plan, 2018]

The county has experienced a slight decline in growth since 2015. Even with the decreased population size, the County still has the largest (and largest per capita) population in Illinois. Reliable infrastructure is crucial to protecting the population and attracting newcomers. Planners must continue to focus on redevelopment, versus expansion. This will provide the planning partnership the opportunity to address exposure and vulnerability of the existing building stock to the dam/levee failure hazard. There is an overlap between the dam/levee failure hazard and the flood hazard. The planning partners have established comprehensive policies regarding sound land use in identified flood hazard areas with the support of a strong state floodplain management program. Most of the areas vulnerable to the more severe impacts from dam or levee failure intersect the mapped flood hazard areas. Flood-related policies in the general plans will help to reduce the risk associated with the dam or levee failure hazard for all future development in the planning area.

Scenario

An earthquake, without warning during any time of the day, could lead to liquefaction of soils around a dam or levee. A human-caused failure such as a terrorist attack also could trigger a catastrophic failure of a dam or levee that impacts the planning area. While the probability of these failures is very low, the probability of flooding associated with changes to dam or levee operational parameters in response to climate change is higher. Dam and levee designs and operations are developed based on hydrographs from the historical record. If these hydrographs experience significant changes over time due to climate change, the design and operation may no longer be valid for the changed condition. This could have significant impacts on structures that provide flood control. Operational parameters (such as specified release rates and impound thresholds for dams) may have to be changed. This may result in increased discharges downstream of these facilities, thus increasing the probability and severity of flooding.

Issues

The most significant issue associated with dam and levee failure involves the properties and populations in the inundation zones. Flooding as a result of a dam and levee failure would significantly impact these areas. There is often limited warning time for dam and levee failure. These events are frequently associated with other natural hazard events such as earthquakes or severe weather, which limits their predictability and compounds the hazard. Important issues associated with dam and levee failure hazards include the following:

- Federally regulated dams have an adequate level of oversight and sophistication in the development of emergency action plans for public notification in the unlikely event of failure. However, the protocol for notification of downstream citizens of imminent failure needs to be tied to local emergency response planning.
- Mapping for federally regulated dams is already required and available; however, mapping for non-federal-regulated dams that estimates inundation depths is needed to better assess the risk associated with dam failure from these facilities.
- Most dam failure mapping required at federal levels requires determination of the probable maximum flood. While the probable maximum flood represents a worst-case scenario, it is generally the event with the lowest probability of occurrence. For non-federal-regulated dams, mapping of dam failure scenarios that are less extreme than the probable maximum flood but have a higher probability of occurrence can be valuable to emergency managers and community officials downstream of these facilities. This type of mapping can illustrate areas potentially impacted by more frequent events to support emergency response and preparedness.
- The concept of residual risk associated with structural flood control projects should be considered in the design of capital projects and the application of land use regulations.
- Addressing security concerns and the need to inform the public of the risk associated with dam failure is a challenge for public officials.
- Not all levees are reflected in the current DFIRMs, which makes delineation of the hazard area difficult.

Chapter 7. Drought

DEFINITIONS

Drought—The cumulative impacts of several dry years on water users. It can include deficiencies in surface and subsurface water supplies and generally impacts health, well-being, and quality of life.

Hydrological Drought—Deficiencies in surface and subsurface water supplies.

Socioeconomic Drought—Drought impacts on health, well-being, and quality of life.

General Background

Drought is a normal phase in the climatic cycle of most geographical regions. According to the National Drought Mitigation Center, drought originates from a deficiency of precipitation over an extended period of time, usually a season or more. This results in a water shortage for some activity, group, or environmental sector. Drought is the result of a significant decrease in water supply relative to what is "normal" in a given location. Unlike most disasters, droughts normally occur slowly but last a long time. They do not have clearly defined beginnings or ends. There are four generally accepted operational definitions of drought:

- **Meteorological drought** is an expression of precipitation's departure from normal over some period of time. Meteorological measurements are the first indicators of drought. Definitions are usually region-specific and based on an understanding of regional climatology. A definition of drought developed in one part of the world may not apply to another, given the wide range of meteorological definitions.
- **Agricultural drought** occurs when there is not enough soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought happens after meteorological drought but before hydrological drought. Agriculture is usually the first economic sector to be affected by drought.
- **Hydrological drought** refers to deficiencies in surface and subsurface water supplies. It is measured as stream flow and as a lake, reservoir, and groundwater levels. There is a time lag between lack of rain and less water in streams, rivers, lakes, and reservoirs, so hydrological measurements are not the earliest indicators of drought. After precipitation has been reduced or deficient over an extended period of time, this shortage is reflected in declining surface and subsurface water levels. Water supply is controlled not only by precipitation, but also by other factors, including evaporation (which is increased by higher than normal heat and winds), transpiration (the use of water by plants), and human use.
- **Socioeconomic drought** occurs when a physical water shortage starts to affect people, individually and collectively. Most socioeconomic definitions of drought associate it with the supply and demand of an economic good.

Defining when drought begins includes consideration of the supplies available to local water users as well as the stored water, they may have available in surface reservoirs or groundwater basins. Different local water agencies have different criteria for defining drought conditions in their jurisdictions. Some agencies issue drought watch or drought warning announcements to their customers. Determinations of regional or statewide drought conditions are usually based on a combination of hydrologic and water supply factors.

The State of Illinois Drought Preparedness and Response Plan defines drought as a long-lasting weather pattern consisting of dry conditions with very little or no precipitation, usually lasting one or more seasons. An operational definition of drought is often used to help identify the beginning, end, or severity of a drought. This is usually done by comparing reduced precipitation conditions to historical averages. Operation definitions specify the departure from the average over time and are used to analyze frequency, severity, and duration for a given period. This information is beneficial in the development of response and mitigation plans (State of Illinois Drought Preparedness and Response Plan, 2011).

Hazard Profile

Droughts originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time (a few weeks or a couple of months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months or years, the drought is considered to be long-term. It is possible for a region to experience a long-term circulation pattern that produces drought, and to have short-term changes in this long-term pattern that result in short- term wet spells. Likewise, it is possible for a long-term wet circulation pattern to be interrupted by short- term weather spells that result in short-term drought.

Drought is generally a weather condition that affects a large geographic area with similar weather patterns. Therefore, drought descriptions in this hazard profile are generally for the entire State of Illinois rather than the immediate planning area of Cook County.

The severity of a drought depends on location, duration, and geographical extent. Additionally, drought severity depends on the water supply, usage demands made by human activities, vegetation, and agricultural operations. Drought brings several different problems that must be addressed. The quality and quantity of crops, livestock, and other agricultural assets will be affected during a drought. Drought can adversely impact forested areas leading to an increased potential for extremely destructive forest and woodland fires that could threaten residential, commercial, and recreational structures.

Drought conditions are often accompanied by extreme heat, which is defined as temperatures that hover 10°F or more above the average high for the area and last for several weeks. Extreme heat can occur in humid conditions when high atmospheric pressure traps the damp air near the ground or in dry conditions, which often provoke dust storms.

The United States Drought Monitor has a map that identifies areas of drought and labels them by intensity. D1 is the least intense level and D4 the most intense. Drought is defined as a moisture deficit bad enough to have social, environmental or economic effects. D0 areas are not in a drought, but are experiencing abnormally dry conditions that could turn into drought or are recovering from drought but are not yet back to normal.

Category	Description	Possible Impacts	Ranges				
			Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: ▪ short-term dryness slowing planting, growth of crops or pastures Coming out of drought: ▪ some lingering water deficits ▪ pastures or crops not fully recovered	-1.0 to -1.9	21 to 30	21 to 30	-0.5 to -0.7	21 to 30
D1	Moderate Drought	▪ Some damage to crops, pastures ▪ Streams, reservoirs, or wells low, some water shortages developing or imminent ▪ Voluntary water-use restrictions requested	-2.0 to -2.9	11 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe Drought	▪ Crop or pasture losses likely ▪ Water shortages common ▪ Water restrictions imposed	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme Drought	▪ Major crop/pasture losses ▪ Widespread water shortages or restrictions	-4.0 to -4.9	3 to 5	3 to 5	-1.6 to -1.9	3 to 5
D4	Exceptional Drought	▪ Exceptional and widespread crop/pasture losses ▪ Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

https://droughtmonitor.unl.edu/AboutUSDM/AbouttheData/DroughtClassification.aspx

The Palmer Drought Severity Index (PDSI), developed by W.C. Palmer in 1965, is a soil moisture algorithm utilized by most federal and state government agencies to trigger drought relief programs and responses. The PDSI—shown in the table below—is based on the supply-and-demand concept of the water balance equation, taking into account more than just the precipitation deficit at specific locations. The objective of the PDSI is to provide standardized measurements of moisture so that comparisons can be made between locations and periods of time—usually months. The PDSI is designed so that a -4.0 in South Carolina has the same meaning in terms of the moisture departure from a climatological normal as a -4.0 does in Illinois.

TABLE: PALMER DROUGHT SEVERITY CLASSIFICATIONS

Classification Rating	Classification Description
4.0 or greater	Extremely Wet
3.0 to 3.99	Very Wet
2.0 to 2.99	Moderately Wet
1.0 to 1.99	Slightly Wet
0.5 to 0.99	Incipient Wet Spell
0.49 to -0.49	Near Normal
-0.5 to -0.99	Incipient Dry Spell
-1.0 to -1.99	Mild Drought
-2.0 to -2.99	Moderate Drought
-3.0 to -3.99	Severe Drought
-4.0 or less	Extreme Drought

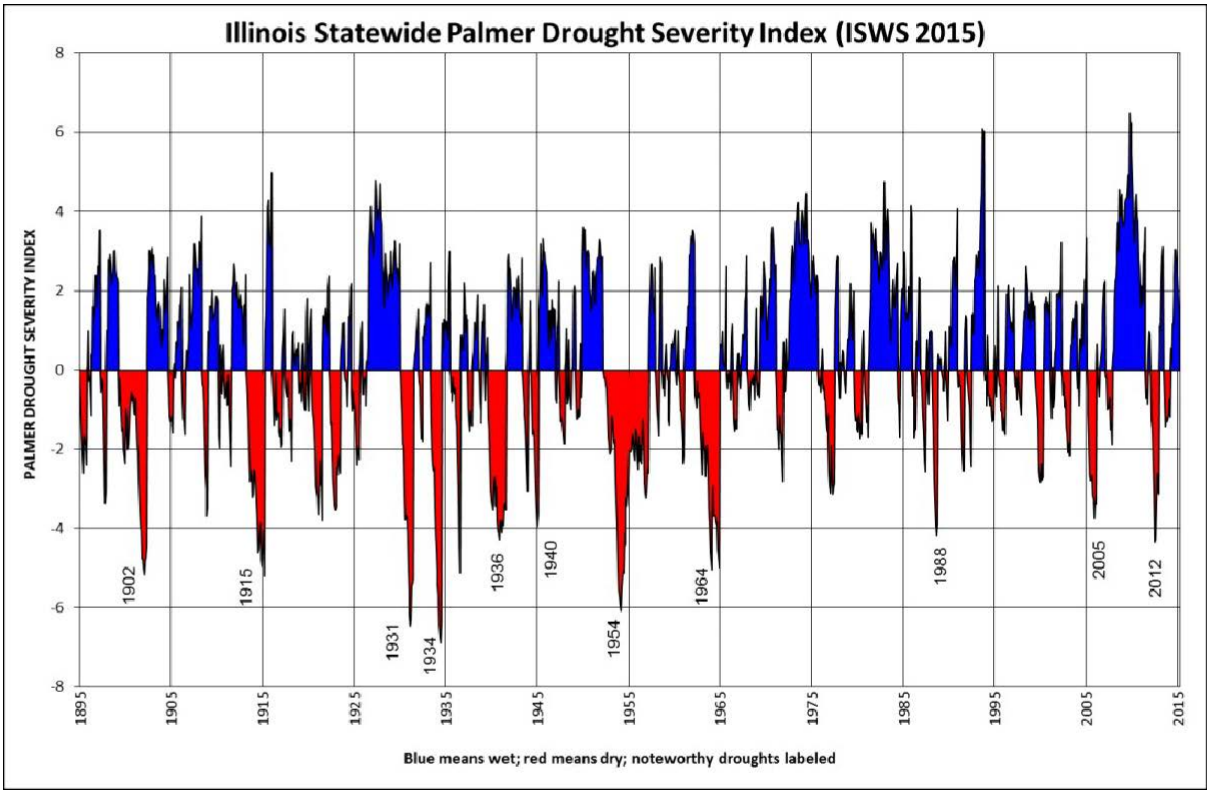
This section provides specific information about this hazard, such as:

- Past Events
- Location
- Frequency and Future Hazard Events
- Extent
- Severity
- Warning Time

Past Events

Droughts are fairly common in Illinois. In the past century, the state has experienced serious drought periods from 1902 to 1915, from 1931 to 1934, and in 1954, 1964, and 1988. The 1930s had the greatest frequency and severity of drought since drought recording using the Palmer Drought Severity Index (PDSI) began in 1895. The worst case was the summer of 1934, with a statewide PDSI of -6.48, followed by the summer of 1931 with -6.39 and 1954 with -6.09. All three of these events fall into the category of extreme drought.

Recent events include drought in 1983 and 1988. In September 1983, all 102 counties were declared state disaster areas because of high temperatures and insufficient precipitation during the summer. In 1988, 54 percent of the state was impacted by drought-like conditions, resulting in disaster relief payments to landowners and farmers exceeding $382 million; however, no state declaration was made.



Droughts in Cook County reported by NCDC - NOAA:

According to NCDC data, 9 events were reported between 01/01/1950 and 06/01/2019 (25354 days).

- 7 drought events occurred in 2005 and two in 2006.
    - No human, livestock, crop, or property loss has ever been recorded in Cook County due to drought.
- A more detailed spreadsheet can be accessed through this link.

TABLE: DROUGHT IN COOK COUNTY, ILLINOIS FROM 1950-2019

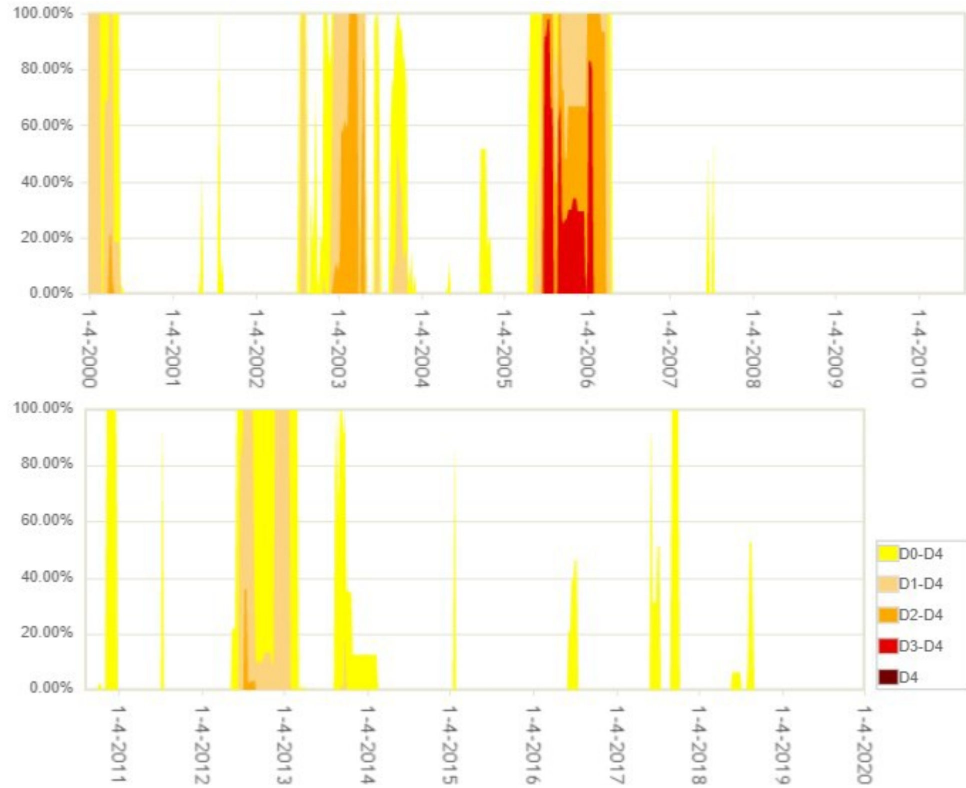
Source: www.ncdc.noaa.gov/stormevents

Number of County/Zone areas affected:	1
Number of Days with Event	9
Number of Days with Event	0
Number of Days with Event and Death or Injury	0
Number of Days with Event and Property Damage	0
Number of Days with Event and Crop Damage	0
Number of Event Types reported	1

Location

As previously stated, the United States Drought Monitor records and maintains data regarding drought severity throughout U.S. counties. In addition to severity, the percent of the county impacted by each drought event is also recorded. As can be seen from the figure below, any drought event, regardless of severity, is likely to impact most locations across Cook County and likely the entire region.

Figure: Cook County, IL, Percent Area Affected by Drought



Source: https://droughtmonitor.unl.edu/Data/Timeseries.aspx

The National Oceanic and Atmospheric Administration (NOAA) has also developed several indices to measure drought impacts and severity and to map their extent and locations. The maps below are arranged in chronological order so as to show the location of drought conditions, or lack thereof, throughout the Cook County region across time.

- The ***Palmer Drought Severity Index,*** known operationally as the Palmer Drought Index, provides measurements of standardized moisture conditions for comparisons between locations and months. The PDSI is calculated based on precipitation and temperature data, as well as the local Available Water Content of the soil. It was developed in 1965 and is the first comprehensive drought index developed in the United States (National Drought Mitigation Center). Negative index numbers indicate dry conditions, while values below -2 are considered some form of drought. *Figure: Palmer Drought Severity Index* shows the weekly PDSI map for various time periods for comparison.

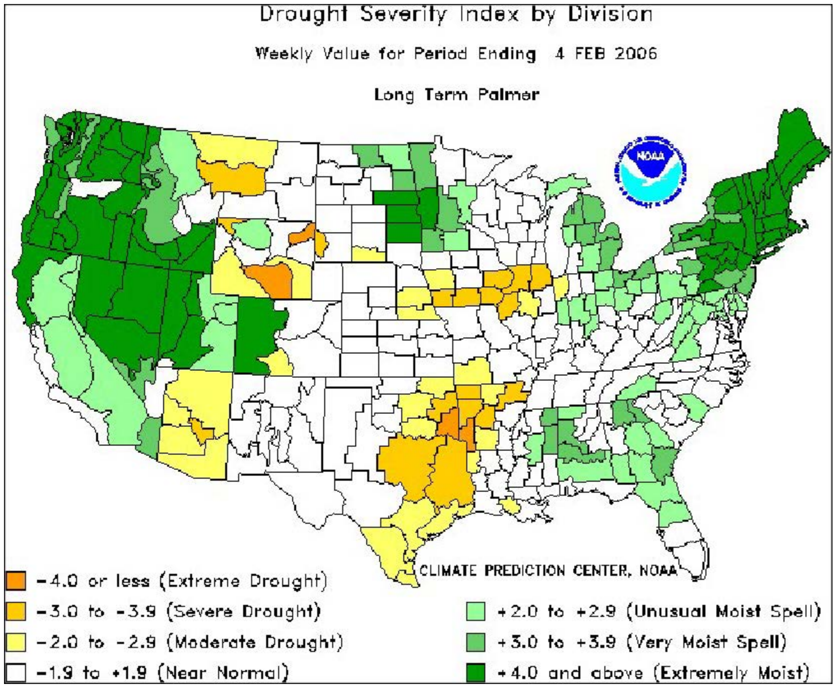


Figure: Drought Severity for Week Ending February 4, 2006

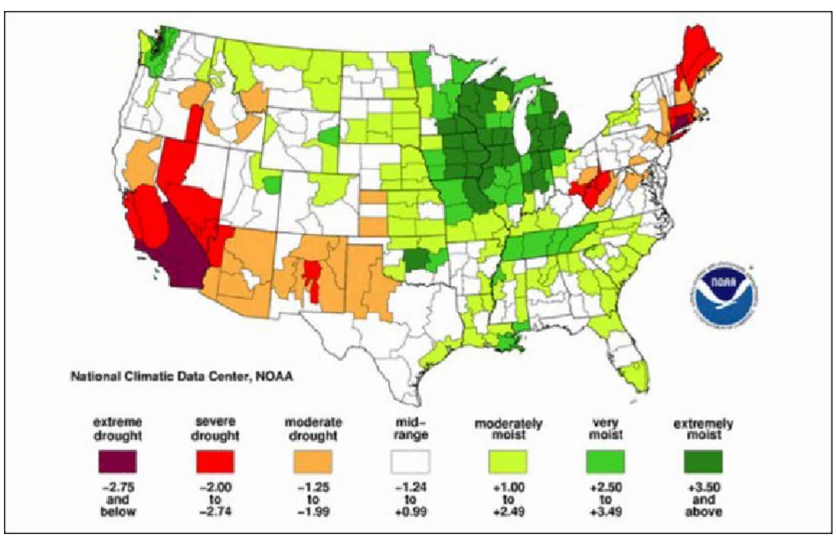


Figure: Palmer Z Index Short-Term Drought Conditions (April 2013)

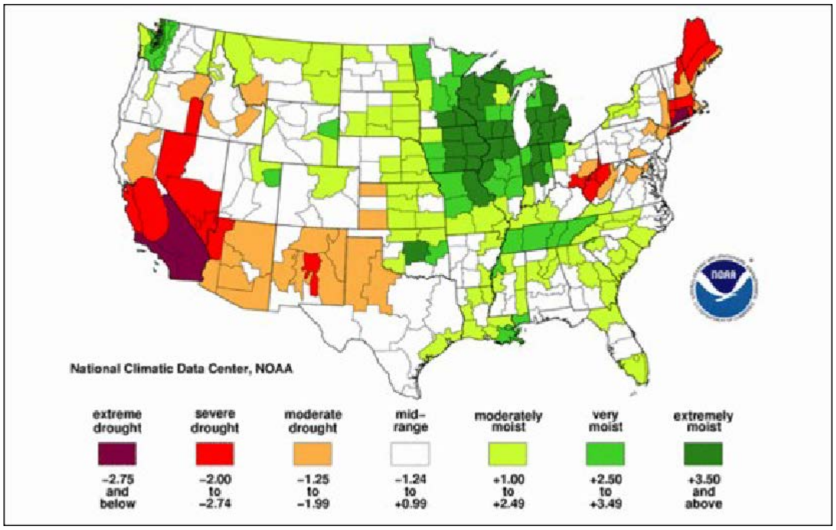


Figure: Palmer Hydrological Drought Index Long-Term Hydrologic Conditions (April 2013)

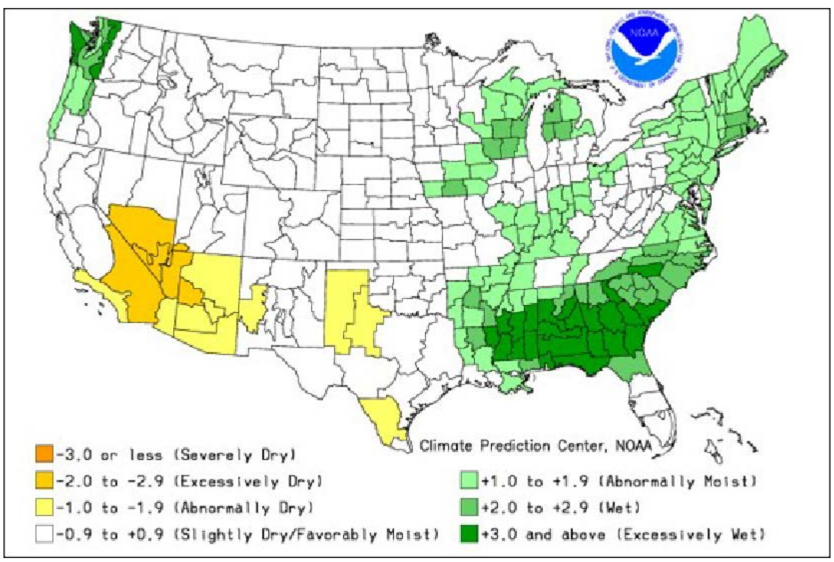


Figure: Crop Moisture Index for Week Ending April 19, 2014

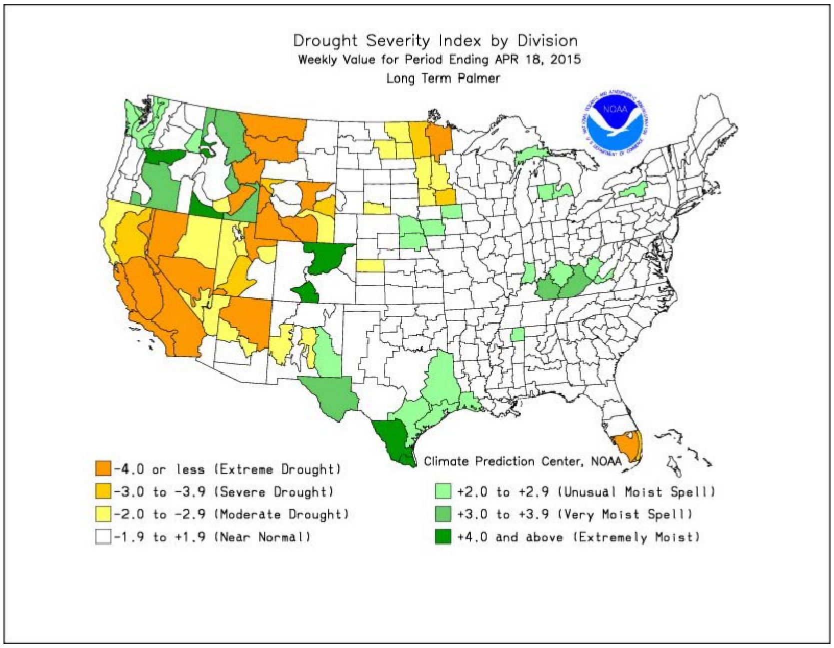


Figure: Drought Severity for Week Ending April 18, 2015

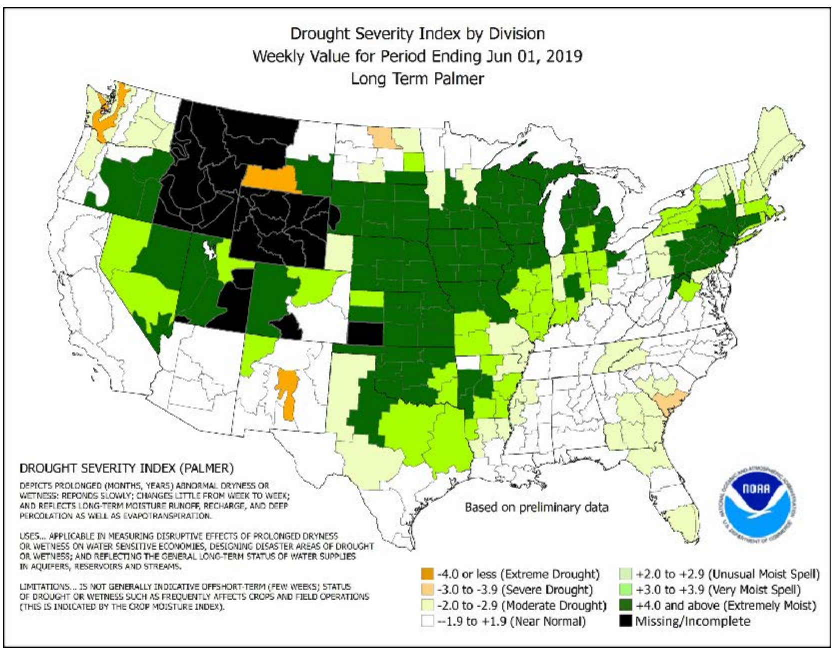


Figure: Drought Severity for Week Ending June 1, 2019

Frequency and Future Hazards

Historical drought data for the planning area indicate there have been 9 significant droughts from 1951 to 2017. Although many of these drought events were clustered in the around the mid-2000s, averaging the 9 events over 67 years yields approximately a 14% chance of a drought of some severity in any given year. Recent maps indicate Cook County has received high levels of precipitation, however.

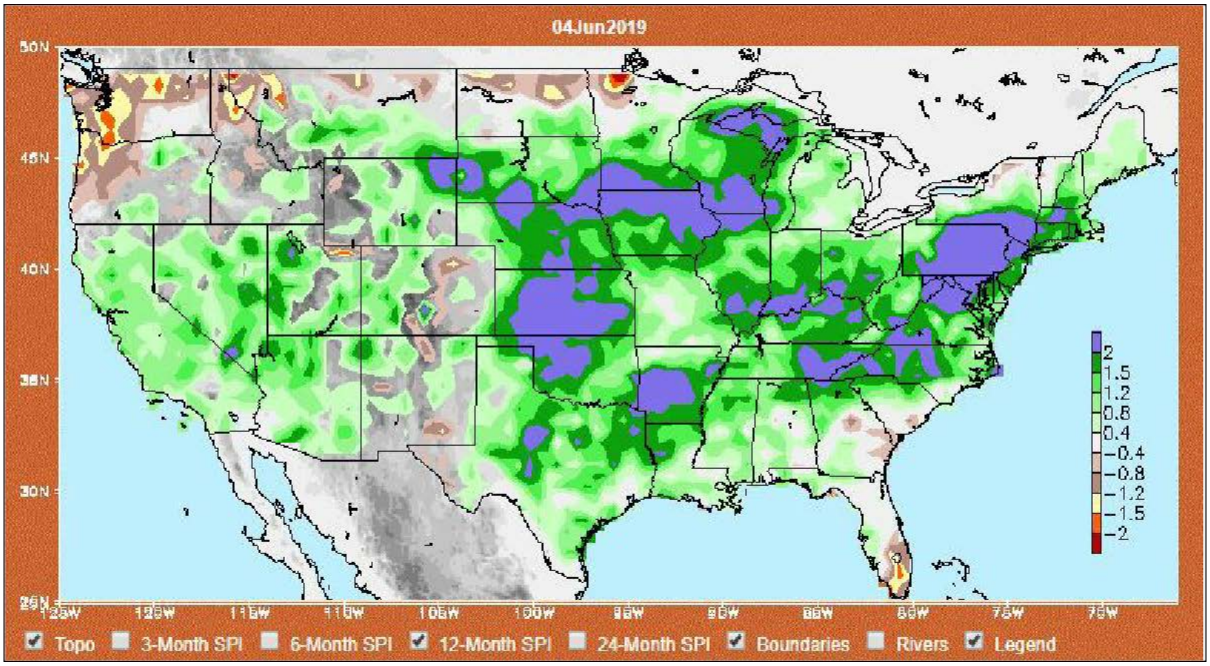


Figure: 12-Month Standardized Precipitation Index (June 1, 2018 - June 1, 2019)

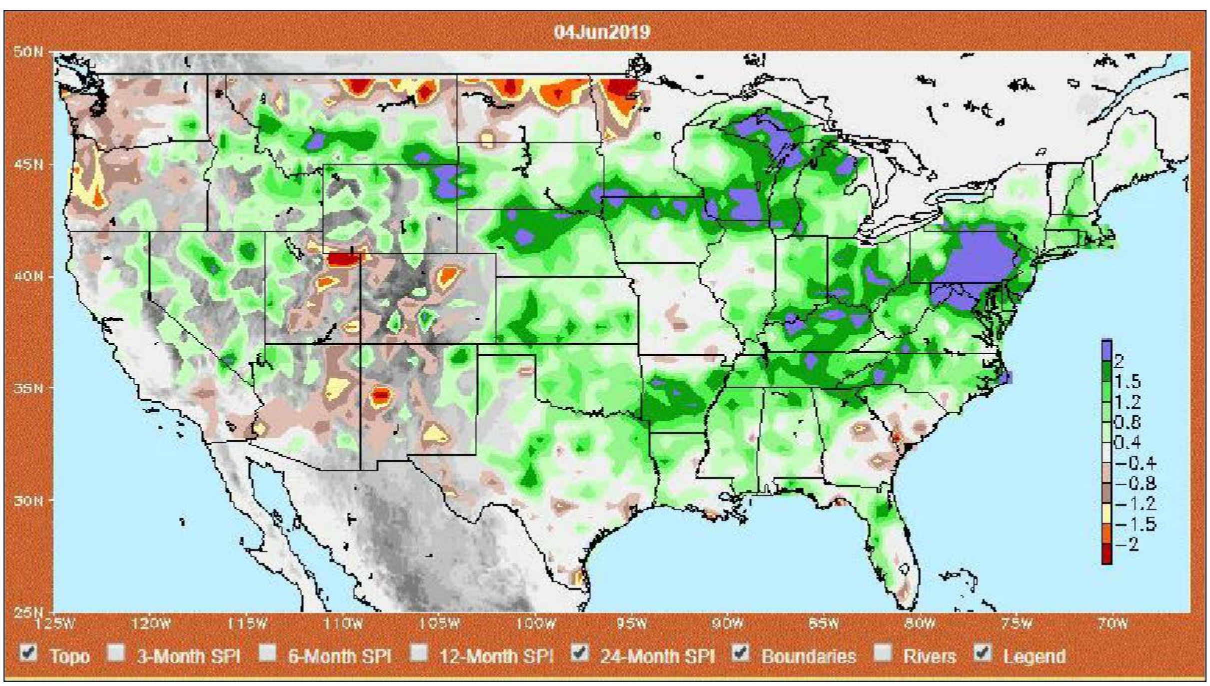


Figure: 24-Month Standardized Precipitation Index (June 1, 2017 - June 1, 2019)

Extent

Droughts can be widespread or localized events. The extent of droughts varies both in terms of the extent of the heat and range of precipitation.

Hazard Type	Affected Jurisdictions	Extent (based on historical events)	
		Minimum	Maximum
Drought	County-wide	0	D4 (Exceptional Drought)

Severity

Drought can have a widespread impact on the environment and the economy, depending upon its severity, although it typically does not result in loss of life or damage to property, as do other natural disasters. The National Drought Mitigation Center uses three categories to describe likely drought impacts:

- Agricultural—Drought threatens crops that rely on natural precipitation.
- Water supply—Drought threatens supplies of water for irrigated crops and for community use.
- Fire hazard—Drought increases the threat of wildfires from dry conditions in forest and rangelands.

Although no loss of life, livestock, crops, or property has ever been officially recorded within Cook County, on average, the nationwide annual impacts of drought are greater than the impacts of any other natural hazard. They are estimated to be between $6 billion and $8 billion annually in the United States and occur primarily in the agriculture, transportation, recreation and tourism, forestry, and energy sectors. Social and environmental impacts are also significant, although it is difficult to put a precise cost on these impacts.

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. Droughts are not usually associated with direct impacts on people or property, but they can have significant impacts on agriculture, which can impact people indirectly. In past Illinois state droughts, crops have been impacted the most from drought and yields were significantly reduced.

When measuring the severity of droughts, analysts typically look at economic impacts on a planning area. A drought directly or indirectly impacts all people in affected areas. All people could pay more for water if utilities increase their rates due to shortages. Agricultural impacts can result in loss of work for farmworkers and those in related food processing jobs. Additionally, drought may impact public water supplies. In cases where conservation measures are not enough to offset drought conditions, sanitation or fire protection may be affected. Other water- or electricity-dependent industries are commonly forced to shut down all or a portion of their facilities, resulting in further layoffs. A drought can harm recreational companies that use water (e.g., swimming pools, water parks, and river rafting companies) as well as landscape and nursery businesses because people will not invest in new plants if water is not available to sustain them. Illinois relies on nuclear power plants, using water cooling systems, to generate electricity for the stat. Severe drought may threaten the supply of electricity, with the potential to affect the cost of power.

A significant amount of shipping and industry relies on the Chicago Area Waterway System to connect to the Mississippi River basin. In Cook County, navigation may be adversely impacted by serious and extended drought when waterways are lowered to the point that ships are not able to safely navigate.

Drought generally does not affect groundwater sources as quickly as surface water supplies, but groundwater supplies generally take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams. Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when steam flows are lowest.

Warning Time

Droughts are climatic patterns that occur over long periods of time. Only generalized warning can take place due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions.

Empirical studies conducted over the past century have shown that meteorological drought is never the result of a single cause. It is the result of many causes, often synergistic in nature; these include global weather patterns that produce persistent, upper-level high-pressure systems along the West Coast with warm, dry air resulting in less precipitation.

Scientists at this time do not know how to predict drought more than a month in advance for most locations. Predicting drought depends on the ability to forecast precipitation and temperature. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depend on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on the global scale.

Secondary Hazards

The secondary hazard most commonly associated with drought is wildfire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. Loss of forests and trees increases erosion, causing severe damage to aquatic life, irrigation, and power development by heavy silting of streams, reservoirs, and rivers. Low stream flows have created high temperatures, oxygen depletion, disease, and lack of spawning areas for our fish resources. Often, drought is accompanied by extreme heat. When temperatures reach 90ºF and above, people are vulnerable to sunstroke, heat cramps, and heat exhaustion. Pets and livestock are also vulnerable to heat-related injuries. Crops can be vulnerable, as well.

Correlating low humidity and precipitation conditions and wildfire, the only wildfire that has occurred in Cook County since 1950 occurred on May 24, 2007. Strong winds to 45 mph combined with low relative humidity to create dangerous fire conditions on May 24th. A fire started at an RV business in Bolingbrook near Interstate 55. The fire spread to a camper nearby and produced thick, black smoke which was blown nearly horizontal across Interstate 55 by strong winds, causing it to be closed for an hour until the fire was brought under control. A one square mile area in Harvey was also leveled by fire. A brush fire started late in the morning near 156th Street and Lathrop Avenue. The fire quickly spread to buildings and was driven from rooftop to rooftop by winds as high as 45 mph. Again, a thick, black plume of smoke was produced and carried as far as 25 miles north of the fire. The fire also damaged some utility poles and power lines contributing to a total property damage figure of $2,000,000 (NOAA).

Exposure

All people, property, and environments in the planning area would be exposed to some degree to the impacts of moderate to extreme drought conditions.

Vulnerability

Drought produces a complex web of impacts that spans many sectors of the economy and reaches well beyond the area experiencing physical drought. This complexity exists because water is integral to the ability to produce goods and provide services. Drought can affect a wide range of economic, environmental, and social activities. The vulnerability of an activity to the effects of drought usually depends on its water demand, how the demand is met, and what water supplies are available to meet the demand.

The Illinois State Hazard Mitigation plan defines county vulnerability based on loss estimations. Since all counties within the state have been adversely affected by drought at some point in history, they are all considered at-risk. The actual risk is calculated from historical data compiled in the Storm Events Database. The total number of droughts (9) reported over a 67-year period (1951 – 2017) were divided by the number of years in the reporting period, to establish the probabilistic frequency of drought that each county would be expected to have. The expected number of droughts per county was then multiplied by the average historical damage reported for each event, to produce an estimate of annual dollar losses. Higher risks are associated with higher populations and residential growth. The National Climatic Data Center calculates total losses for each event including: property damage, crop damage, fatalities and injuries and divides the total number by the number of counties in the reporting region. Based on the 2018 Illinois State Hazard Mitigation Plan, the Cook County planning region was given a drought hazard rating of “Low” with a 14% probability of drought in any given year. As previously stated, no monetary estimated loss has yet been associated with the historical drought events in Cook County.

This section provides specific information about the County's vulnerabilities to this hazard, such as:

- Population
- Property
- Critical Facilities and Infrastructure
- Environment
- Economic Impact

Population

The planning partnership has the ability to minimize any impacts on residents and water consumers in the county should several consecutive dry years occur. Due to this, no significant life or health impacts are anticipated as a result of drought within the planning area. Drought does impact most humans and animals within its range to some degree, however. The following groups would be the most likely to be impacted.

- Population with functional needs and/or over the age of 65, because they may have more difficulty seeking shelter or dealing with many of the secondary effects of drought like heat, fire, or increased pollutant concentrations in surface water: 708,546 people over 65 years old, 534,813 with a disability, and 240,128 people who fall into both categories.
- Those working in the Agriculture, Forestry, Fishing, and Hunting Industry: 1,958,431

Property

No structures will be directly affected by drought conditions. Droughts can have significant impacts on landscapes, which could cause a financial burden to property owners. However, these impacts are not considered critical in planning for impacts from the drought hazard.

Critical Facilities

Critical facilities as defined for this plan will continue to be operational during a drought. Critical facility elements such as landscaping may not be maintained due to limited resources, but the risk to the planning area's critical facilities inventory will be largely aesthetic. For example, when water conservation measures are in place, landscaped areas will not be watered and may die. These aesthetic impacts are not considered significant.

Environment

Environmental losses from drought are associated with damage to plants, animals, wildlife habitat, and air and water quality; degradation of landscape quality; loss of biodiversity; and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. However, many species will eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects. Currently, the land use within Cook County for agricultural purposes is 98,588.5 acres (2.5%).

Economic Impact

The economic impact will be largely associated with industries that use water or depend on water for their business. For example, landscaping businesses were affected in the droughts of the past as the demand for service significantly declined because landscaping was not watered. Agricultural industries will be impacted if water usage is restricted for irrigation.

From 1980-2016, 23 drought events in the broader U.S. resulted in a total of $223.8 billion in damages with each event averaging $9.3 billion in damages. In 2016, droughts were noted as one of the 15 weather and climate events that resulted in over $1 billion in U.S. damages. In 2012, extreme drought across the U.S. resulted in $30 billion in damages (Smith, 2017). Fortunately, Cook County has never incurred a significant economic impact from droughts directly.

Future Trends in Development

The Illinois Hazard Mitigation Plan estimated that the annual probability of drought in Cook County is 14% with an estimated $0 annual loss in property or crop damage (Illinois HMP 2018). This estimation demonstrates a higher future probability based on historical records of 9 drought events occurring in the county from 1951 to 2017 and a climatic shift that would increase evaporation rates.

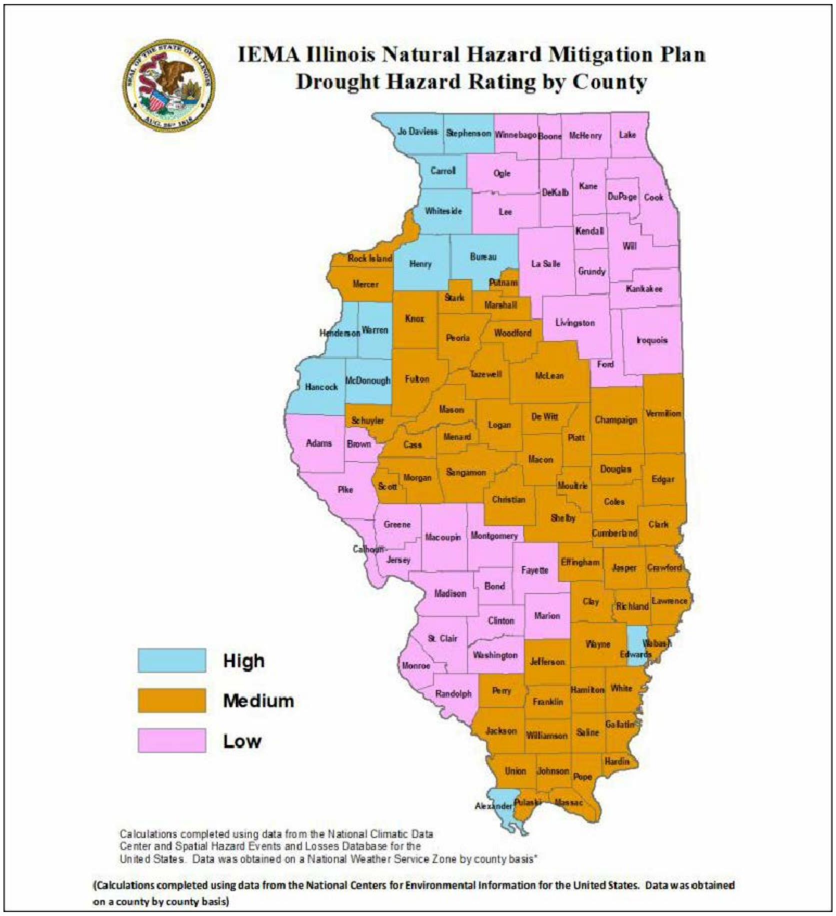
According to the USGS, the primary water use categories are:

- Public Supply
- Domestic
- Irrigation
- Thermoelectric Power
- Industrial
- Mining
- Livestock
- Aquaculture

The U.S. Geological Survey (USGS) collects and releases data every five years on water use. The USGS figures for Cook County show a substantial decrease in the public supply of self-supplied surface water withdrawals from 1985 (1113.29 mgal/d) to 2015 (824.87 mgal/d) even though population numbers in Cook County are similar in 1985 to 2015 (~2.5 million people). The decrease in industrial total self-supplied withdrawals of surface water demonstrates an even greater decline from 232.04 mgal/d in 1985 to 62.5 mgal/d in 2015. In line with the rest of the United States, only thermoelectric power total self-supplied withdrawals have increased and is only from freshwater. Data is not yet available for 2015 however the number increased from 409.18 mgal/d in 1995 to 749.35 mgal/d in 2010 (USGS).

Overall, national water use has declined over the last three decades and experienced a major drop between 2005 and 2010 despite overall national economic gains and an increase in the total population. Water requirements for thermoelectric power production are substantial, representing the single largest use of water — both fresh and saline — in the United States. Water use for agricultural irrigation continued its declining trend in 2010, while irrigated acres continue to increase. A report by Pacific Institute, Water Use Trends in the United States (2015), states that considerable progress has been made in managing the nation's water — but the current pace is not likely to counter the demands of continued population and economic growth, climate change, and increasing tensions over scarce water resources. While precipitation rates are predicted to increase (especially one-day heavy pour events), evaporation rates as temperature increases and green spaces decline are predicted to increase which would yield a higher frequency of drought events.

While drought is considered a low-risk hazard for Cook County, planners need to consider best practices for land use policies to support water supply sustainability and increase the protection of water resources. Utilizing these practices provide the capability at the local municipal level to protect future development from the impacts of drought.



Map: Drought Hazard Ranking in Illinois

Source: [IEMA HMP 2018]

Scenario

An extreme multi-year drought more intense than the droughts occurring in the 1930s could impact the region with little warning. Combinations of low precipitation and unusually high temperatures could occur over several consecutive years. Surrounding communities, also in drought conditions, could increase their demand for water supplies relied upon by the planning partnership, causing social and political conflicts. If such conditions persisted for several years, the economy of Cook County could experience setbacks, especially in water-dependent industries.

Issues

The planning team has identified the following drought-related issues:

- Identification and development of alternative water supplies
- Utilization of groundwater recharge techniques to stabilize the groundwater supply
- The probability of increased drought frequencies and durations due to climate change
- The promotion of active water conservation even during non-drought periods.

Chapter 8. Earthquake

DEFINITIONS

Earthquake—The shaking of the ground caused by an abrupt shift of rock along a fracture in the earth or a contact zone between tectonic plates.

Epicenter—The point on the earth's surface directly above the hypocenter of an earthquake. The location of an earthquake is commonly described by the geographic position of its epicenter and by its focal depth.

Fault—A fracture in the earth's crust along which two blocks of the

crust have slipped with respect to each other.

Focal Depth—The depth from the earth's surface to the hypocenter.

Hypocenter—The region underground where an earthquake's energy originates

Liquefaction—Loosely packed, water-logged sediments losing their strength in response to strong shaking, causing major damage during earthquakes.

General Background

An earthquake is a sudden, rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped Earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free, causing the ground to shake.

How Earthquakes Happen

An earthquake is the vibration of the earth's surface following a release of energy in the earth's crust. This energy can be generated by a sudden dislocation of the crust or by a volcanic eruption. Most destructive quakes are caused by dislocations of the crust. The crust may first bend and then, when the stress exceeds the strength of the rocks, break and snap to a new position. In the process of breaking, vibrations called "seismic waves" are generated. These waves travel outward from the source of the earthquake at varying speeds.

Earthquakes tend to reoccur along faults, which are zones of weakness in the crust. Even if a fault zone has recently experienced an earthquake, there is no guarantee that all the stress has been relieved. Another earthquake could still occur.

Geologists classify faults by their relative hazards. Active faults, which represent the highest hazard, are those that have ruptured to the ground surface during the Holocene period (about the last 11,000 years). Potentially active faults are those that displaced layers of rock from the Quaternary period (the last 1,800,000 years). Determining if a fault is "active" or "potentially active" depends on geologic evidence, which may not be available for every fault. Although there are probably still some unrecognized active faults, nearly all the movement between the two plates, and therefore the majority of the seismic hazards, are on the well-known active faults.

Faults are more likely to have earthquakes on them if they have more rapid rates of movement, have had recent earthquakes along them, experience greater total displacements, and are aligned so that movement can relieve accumulating tectonic stresses. A direct relationship exists between a fault's length and location and its ability to generate damaging ground motion at a given site. In some areas, smaller, local faults produce lower magnitude quakes, but ground shaking can be strong, and damage can be significant as a result of the fault's proximity to the area. In contrast, large regional faults can generate great magnitudes but, because of their distance and depth, may result in only moderate shaking in the area.

Earthquakes in Illinois and Surrounding Region

Earthquakes in Illinois originate within the crystalline basement rocks at depths of one to 25 miles, which is below the layers of sedimentary rock where coal, oil, and aggregate (gravel) are mined. They occur in the granitic rocks far below the sedimentary layers of rock where known faults are mapped. The earthquake vibrations move out away from the point of origin (hypocenter or focus) through the bedrock and then up though the overlying soils on top of the bedrock. In the central part of the U.S., the bedrock is flat-lying, old, intact, and strong. Earthquake vibrations travel very far through material such as this in comparison to the young, broken, weak bedrock of the west coast. Because of this difference, central U. S. earthquakes are felt and cause damage over an area 15 to 20 times larger than California earthquakes with similar magnitudes (Illinois State Hazard Mitigation Plan, 2018).

Earthquake Classifications

Earthquakes are typically classified in one of two ways: by the impact on people and structures, measured as intensity; or by the amount of energy released, measured as magnitude.

Intensity

Currently the most commonly used intensity scale is the modified Mercalli intensity scale, with ratings defined as follows (USGS, 1989):

> I. Not felt except by a very few under especially favorable conditions.
>
> II. Felt only by a few persons at rest, especially on upper floors of buildings.
>
> III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it is an earthquake. Standing cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
>
> IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like a heavy truck striking building. Standing cars rocked noticeably.
>
> V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
>
> VI. Felt by all; many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
>
> VII. Damage negligible in buildings of good design and construction; slight in well-built ordinary structures; considerable in poorly built or badly designed structures. Some chimneys broken.

VIII. Damage slight in specially designed structures; considerable damage in ordinary buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.

IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.

X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.

XII. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Magnitude

Currently the most commonly used magnitude scale is the moment magnitude (Mw) scale, with the following classifications of magnitude:

- Great—Mw $\geq$ 8
- Major—Mw = 7.0 - 7.9
- Strong—Mw = 6.0 - 6.9
- Moderate—Mw = 5.0 - 5.9
- Light—Mw = 4.0 - 4.9
- Minor—Mw = 3.0 - 3.9
- Micro—Mw < 3

Estimates of moment magnitude roughly match the local magnitude scale (ML) commonly called the Richter scale. One advantage of the moment magnitude scale is that, unlike other magnitude scales, it does not saturate at the upper end. That is, there is no value beyond which all large earthquakes have about the same magnitude. For this reason, moment magnitude is now the most often used estimate of large earthquake magnitudes.

Ground Motion

Earthquake hazard assessment is also based on expected ground motion. This involves determining the annual probability that certain ground motion accelerations will be exceeded, then summing the annual probabilities over the time period of interest. The most commonly mapped ground motion parameters are the horizontal and vertical peak ground accelerations (PGA) for a given soil or rock type. Instruments called accelerographs record levels of ground motion due to earthquakes at stations throughout a region. These readings are recorded by state and federal agencies that monitor and predict seismic activity.

Maps of PGA values form the basis of seismic zone maps that are included in building codes such as the International Building Code. Building codes that include seismic provisions specify the horizontal force due to lateral acceleration that a building should be able to withstand during an earthquake. PGA values are directly related to these lateral forces that could damage “short period structures” (e.g. single-family dwellings). Longer period response components determine the lateral forces that damage larger structures with longer natural periods (apartment buildings, factories, high-rises, bridges). *Table: Mercalli Scale And Peak Ground Acceleration Comparison* lists damage potential and perceived shaking by PGA factors, compared to the Mercalli scale.

TABLE:
MERCALLI SCALE AND PEAK GROUND ACCELERATION COMPARISON

Modified Mercalli Scale	Perceived Shaking	Potential Structure Damage		Estimated PGA *a* (%g)
		Resistant Buildings	Vulnerable Buildings	
I	Not Felt	None	None	<0.17%
II-III	Weak	None	None	0.17% - 1.4%
IV	Light	None	None	1.4% - 3.9%
V	Moderate	Very Light	Light	3.9% - 9.2%
VI	Strong	Light	Moderate	9.2% - 18%
VII	Very Strong	Moderate	Moderate/Heavy	18% - 34%
VIII	Severe	Moderate/Heavy	Heavy	34% - 65%
IX	Violent	Heavy	Very Heavy	65% - 124%
X - XII	Extreme	Very Heavy	Very Heavy	>124%

a. PGA measured in percent of g, where g is the acceleration of gravity
Sources: USGS, 2008; USGS, 2010

Effect of Soil Types

The impact of an earthquake on structures and infrastructure is largely a function of ground shaking, distance from the source of the quake, and liquefaction, a secondary effect of an earthquake in which soils lose their shear strength and flow or behave as liquid, thereby damaging structures that derive their support from the soil. Liquefaction generally occurs in soft, unconsolidated sedimentary soils. A program called the National Earthquake Hazard Reduction Program (NEHRP) creates maps based on soil characteristics to help identify locations subject to liquefaction. *Table: NEHRP Soil Classification System* summarizes NEHRP soil classifications. NEHRP Soils B and C typically can sustain ground shaking without much effect, dependent on the earthquake magnitude. The areas that are commonly most affected by ground shaking have NEHRP Soils D, E and F. In general, these areas are also most susceptible to liquefaction.

TABLE: NEHRP SOIL CLASSIFICATION SYSTEM		
NEHRP Soil Type	**Description**	**Mean Shear Velocity to 30m (m/s)**
A	Hard Rock	1,500
B	Firm to Hard Rock	760-1,500
C	Dense Soil/Soft Rock	360-760
D	Stiff Soil	180-360
E	Soft Clays	< 180
F	Special Study Soils (liquefiable soils, sensitive clays, organic soils, soft clays >36 m thick)	

Hazard Profile

Earthquakes can last from a few seconds to over five minutes; they may also occur as a series of tremors over several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties generally result from falling objects and debris, because the shocks shake, damage or demolish buildings and other structures. Disruption of communications, electrical power supplies and gas, sewer and water lines should be expected. Earthquakes may trigger fires, dam failures, or releases of hazardous material, compounding their disastrous effects.

Small, local faults produce lower magnitude quakes, but ground shaking can be strong and damage can be significant in areas close to the fault. In contrast, large regional faults can generate earthquakes of great magnitudes but, because of their distance and depth, they may result in only moderate shaking in an area.

This section provides specific information about this hazard, such as:

- Past Events
- Location
- Frequency and Future Hazard Events
- Extent
- Severity
- Warning Time

Past Events

Earthquakes occur throughout Illinois, with most in the southern third of the state. Over 360 earthquakes have occurred in Illinois during the past 20 years. Damage resulted from 32 of these earthquakes. Sixteen notable events have been recorded in Cook, DuPage, Kane, Kendall, and Will

Counties since 1804. Cook County has experienced three earthquakes ranging from a magnitude of 3 to 4.9. Since the 2014 Hazard Mitigation Plan, Cook County has not experienced any additional significant earthquakes. The table below lists examples of major past seismic events that have impacted Cook County.

TABLE: EARTHQUAKES THAT IMPACTED COOK COUNTY

Date	Magnitude	Location/Fault Line	Comments
August 1804	4.4	Fort Dearborn (Chicago)	Felt over 30,000 square miles
December 16, 1811	N/A	New Madrid	Earthquake was so severe that its awakened people in Pittsburgh, PA and Norfolk, VA.
1812	N/A	New Madrid	Aftershocks from the December 16, 1811 event
October 13, 1895	6.2	Charlestown, MO	No reference and/or no damage reported
1909	5.1	7 miles southwest of the Village of Lemont, IL	One of the largest earthquakes in Illinois; knocked over many chimneys in Aurora. It was felt over 500,000 square miles. Buildings swayed in Chicago.
1968	5.4	New Madrid Fault	Southern Illinois; damage occurred in south-central Illinois, southwest Indiana, and northwest Kentucky; felt over all or parts of 23 states
May 10, 1987	5.0	Near Lawrenceville, IL	No reference and/or no damage reported
April 27, 1989	4.7	15 miles SW of Caruthersville, MO	No reference and/or no damage reported
September 28, 1989	4.5	15 miles south of Cairo, IL	No reference and/or no damage reported
September 26, 1990	4.6	10 miles south of Cape Giradau, MO	No reference and/or no damage reported
May 3, 1991	4.6	10 miles west of New Madrid, MO	No reference and/or no damage reported
September 9, 1985	3.0	2 miles from Lombard, IL	No reference and/or no damage reported
February 5, 1994	4.2	Lick Creek-Goresville Area	No reference and/or no damage reported
September 2, 1999	3.5	8 miles from Dixon, IL	No reference and/or no damage reported
June 28, 2004	4.2	8 miles from Ot8 miles from Ottawa, ILawa, IL	Felt throughout Cook County and most of Illinois
April 18, 2008	5.2	7 miles from Mt. Carmel	Felt around the state, including the Chicago area; skyscrapers in downtown Chicago shook but damage was mostly seen downstate
February 11, 2010	3.8	1 mile southeast of Pingree Grove (40 miles northwest of Chicago)	Located 6 miles below the ground surface
2011	3.8	Central Indiana	Residents of Chicago, Naperville, and Buffalo Grove reported having felt the earthquake
January 31, 2012	2.3	East of McHenry, IL	Residents of McHenry County reported having felt this earthquake

March 11, 2013	2.7	Benton, IL – New Madrid Seismic Zone	Occurred around 5 a.m.; no injuries or damage reported

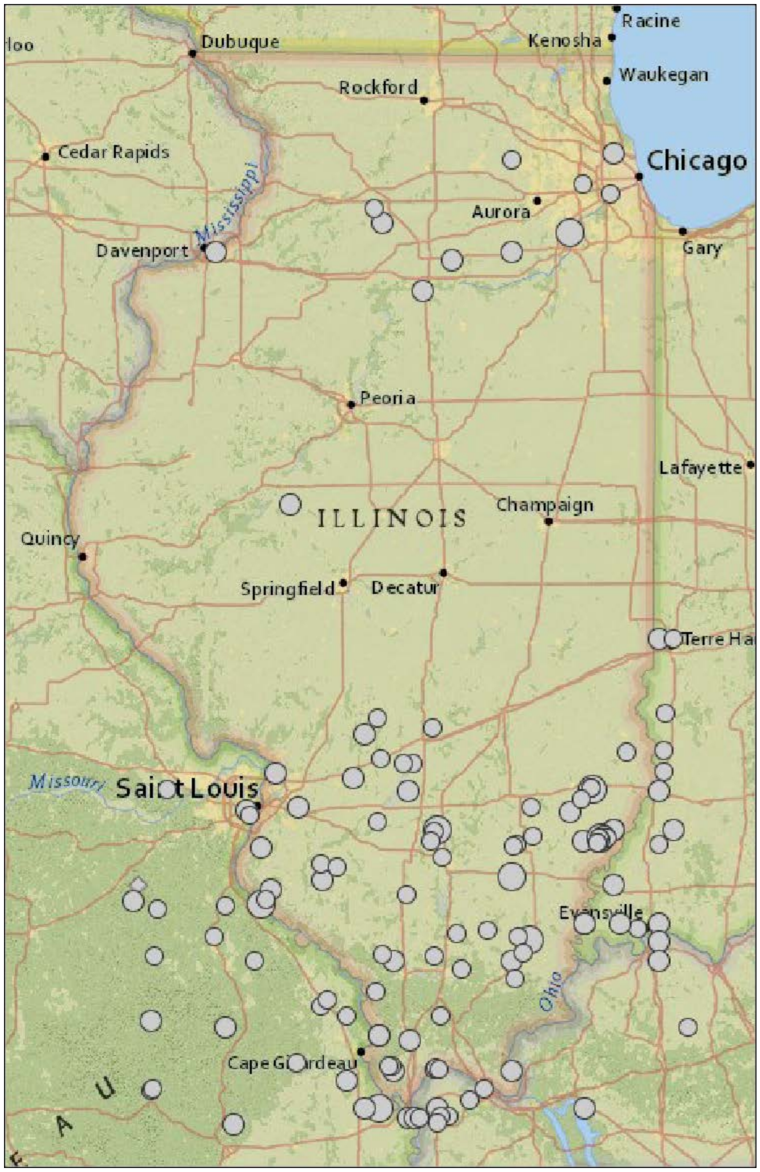


Figure: Illinois Region Earthquakes Magnitude 3.0, 1800–2018.

Location

The location of previous earthquakes is shown in *Table: Earthquakes That Impacted Cook County* in the previous section.

According to USGS, no fault zones are in Cook County; however, numerous reports highlight the fault activity of the Des Plaines Crater located beneath the populated Des Plaines suburb of Chicago.

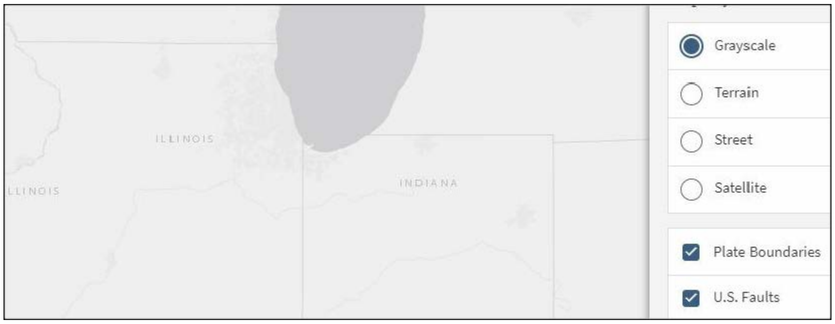


Figure: [USGS Interactive Map Shows]() No Fault Zones in Cook County

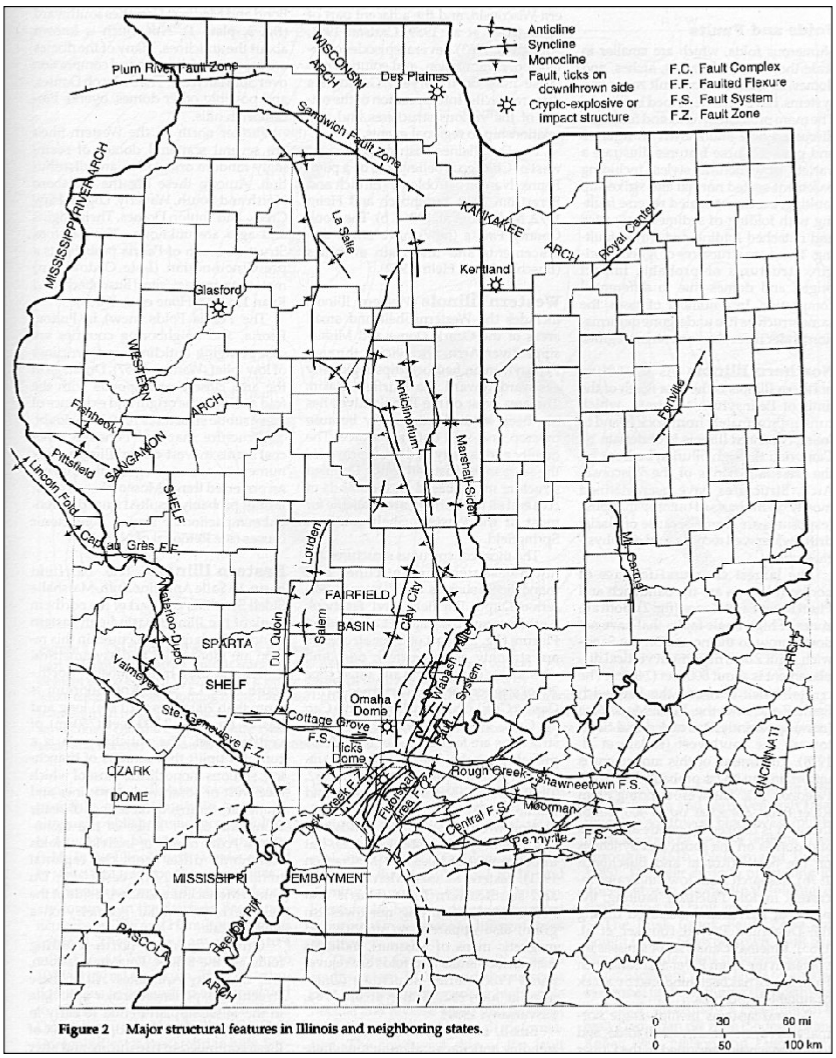


Figure 2 Major structural features in Illinois and neighboring states.

Figure: Highlights Faults in Illinois ([ISGS]())

As can be seen in the map below from the USGS, the hazard risk for earthquakes is much more prevalent in Southern Illinois closer to the New Madrid fault, whereas Cook County is located far enough North that the hazard risk is much less.

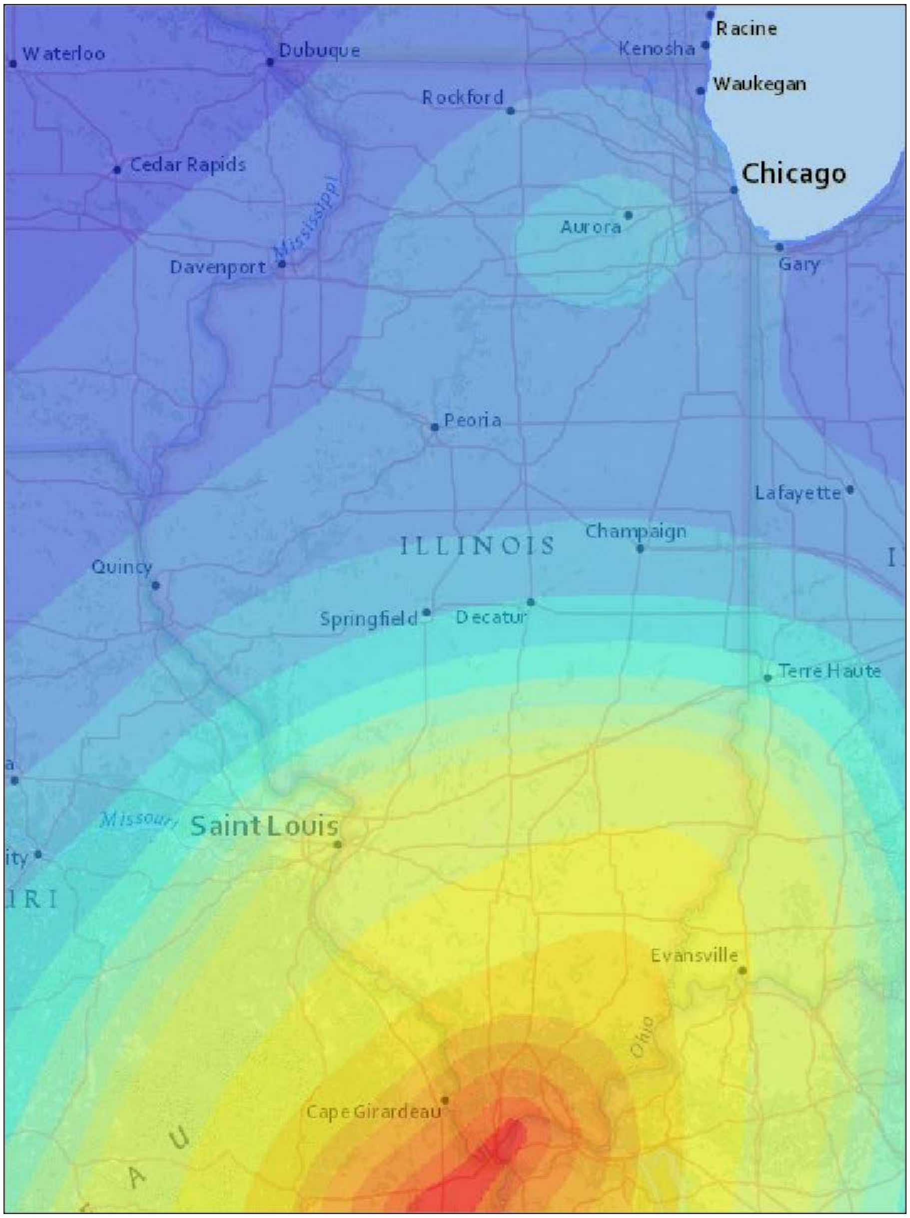


Figure: Earthquake Hazard Risk in Illinois

Identifying the extent and location of an earthquake, however, is not as simple as it is for other hazards such as floods. The impact of an earthquake is largely a function of the following components:

- Ground shaking (ground motion accelerations)
- Liquefaction (soil instability)
- Distance from the source (both horizontally and vertically).

Mapping that shows the impacts of these components was used to assess the risk of earthquakes within the planning area. While the impacts from each of these components can build upon each other during an earthquake event, the mapping looks at each component individually. The mapping used in this assessment is described below.

Shake Maps

A shake map is a representation of ground shaking produced by an earthquake. The information it presents is different from the earthquake magnitude and epicenter that are released after an earthquake because shake maps focus on the ground shaking resulting from the earthquake, rather than the parameters describing the earthquake source. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region, depending on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth’s crust. A shake map shows the extent and variation of ground shaking in a region immediately following significant earthquakes.

Ground motion and intensity maps are derived from peak ground motion amplitudes recorded on seismic sensors (accelerometers), with interpolation based on estimated amplitudes where data are lacking, and site amplification corrections. Color-coded instrumental intensity maps are derived from empirical relations between peak ground motions and Modified Mercalli intensity. Two types of shake map are typically generated from the data: probabilistic and scenario.

Probabilistic Earthquake Events

A probabilistic seismic hazard map shows the hazard from earthquakes that geologists and seismologists agree could occur. The maps are expressed in terms of probability of exceeding a certain ground motion, such as the 10-percent probability of exceedance in 50 years. This level of ground shaking has been used for designing buildings in high seismic areas. *Figure: PGA for 100-year Earthquake Event in Cook County* and *Figure: PGA for 500-year Earthquake Event in Cook County* show the estimated ground motion for the 1-percent-annual-chance and 0.2-percent-annual-chance probabilistic earthquakes in the planning area.

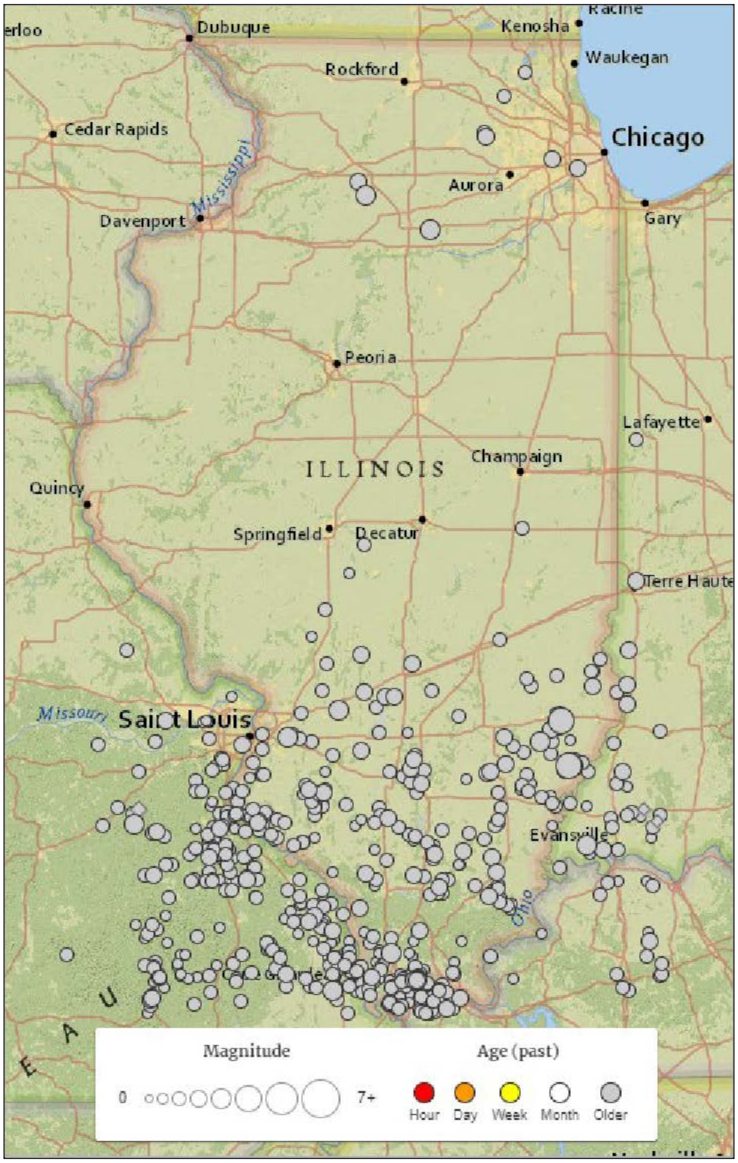


Figure: Earthquake Epicenters in Illinois, June 1970 - June 2019

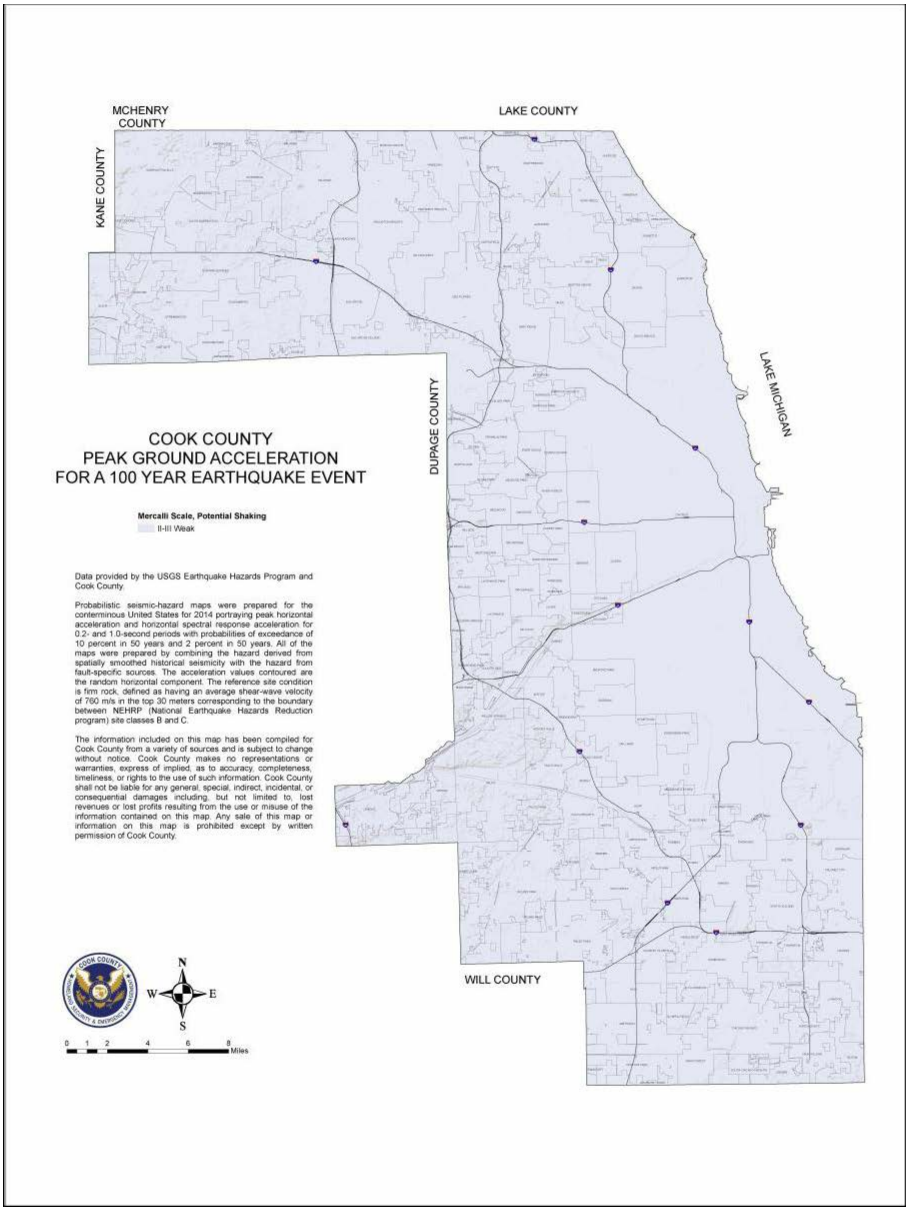


Figure: PGA for 100-year Earthquake Event in Cook County

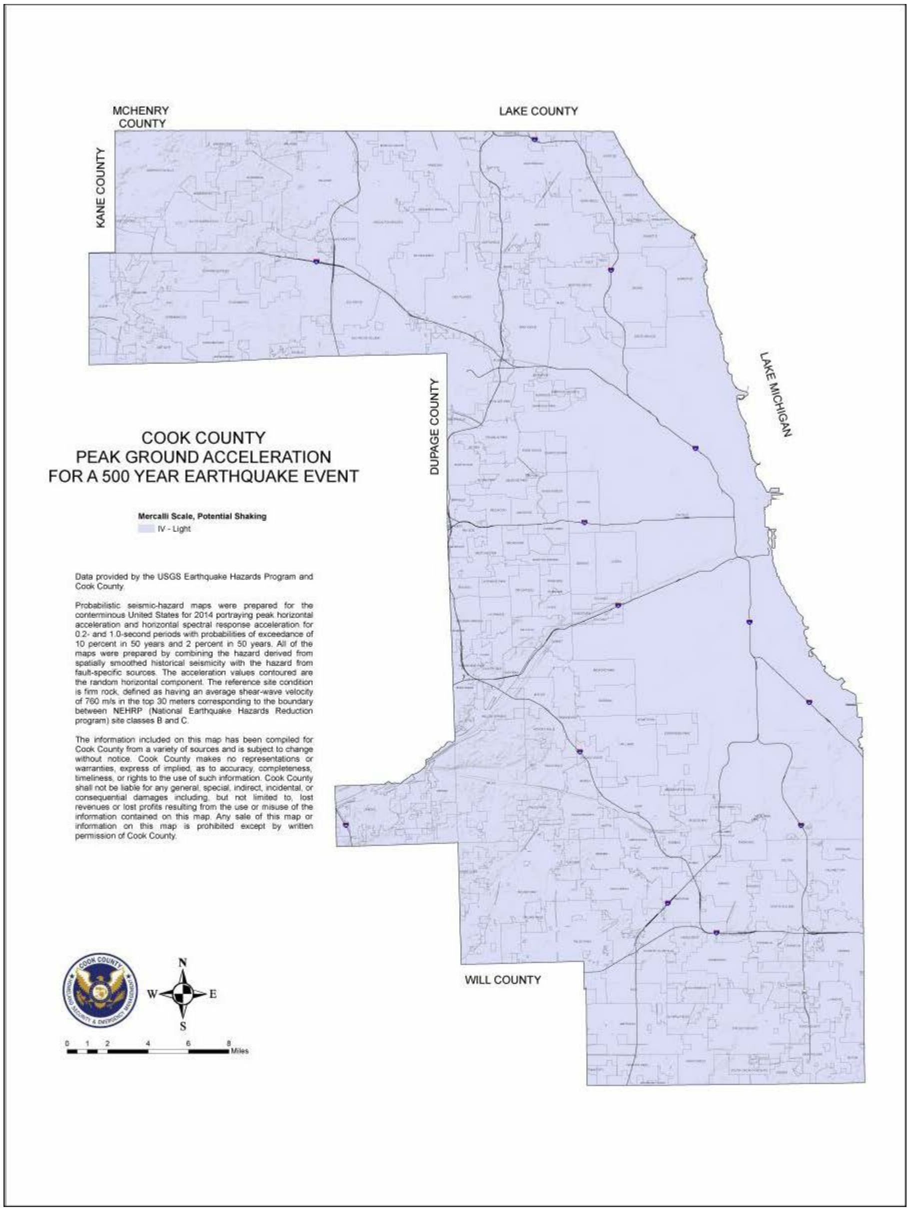


Figure: PGA for 500-year Earthquake Event in Cook County

Scenario Earthquake Events

Earthquake scenario maps describe the expected ground motions and effects of hypothetical large earthquakes for a region. Maps of these scenarios can be used to support all phases of emergency management. Two scenarios were chosen to analyze for this plan:

- 1909 Historical Earthquake Scenario—A Magnitude 6.2 event with a shallow depth and epicenter approximately 7 miles southwest of the Village of Lemont, IL. The basis for this map and analysis was the historical events database contained within the Hazus-MH model. For this assessment, the magnitude of the event was changed from 5.0 to 6.0, using the same focal depth and epicenter as the historical event. *Figure: PGA for 1909 Historical Earthquake Scenario in Cook County* shows the estimated ground motion for this event in the planning area.

- M 7.1 Wabash Fault Scenario—A shake map created by USGS represents an event with a magnitude of 7.1 and an epicenter in the southeastern portion of Illinois. *Figure: Shake Map for M7.1 Event on Wabash Fault* shows the estimated ground motion for this event in the planning area.

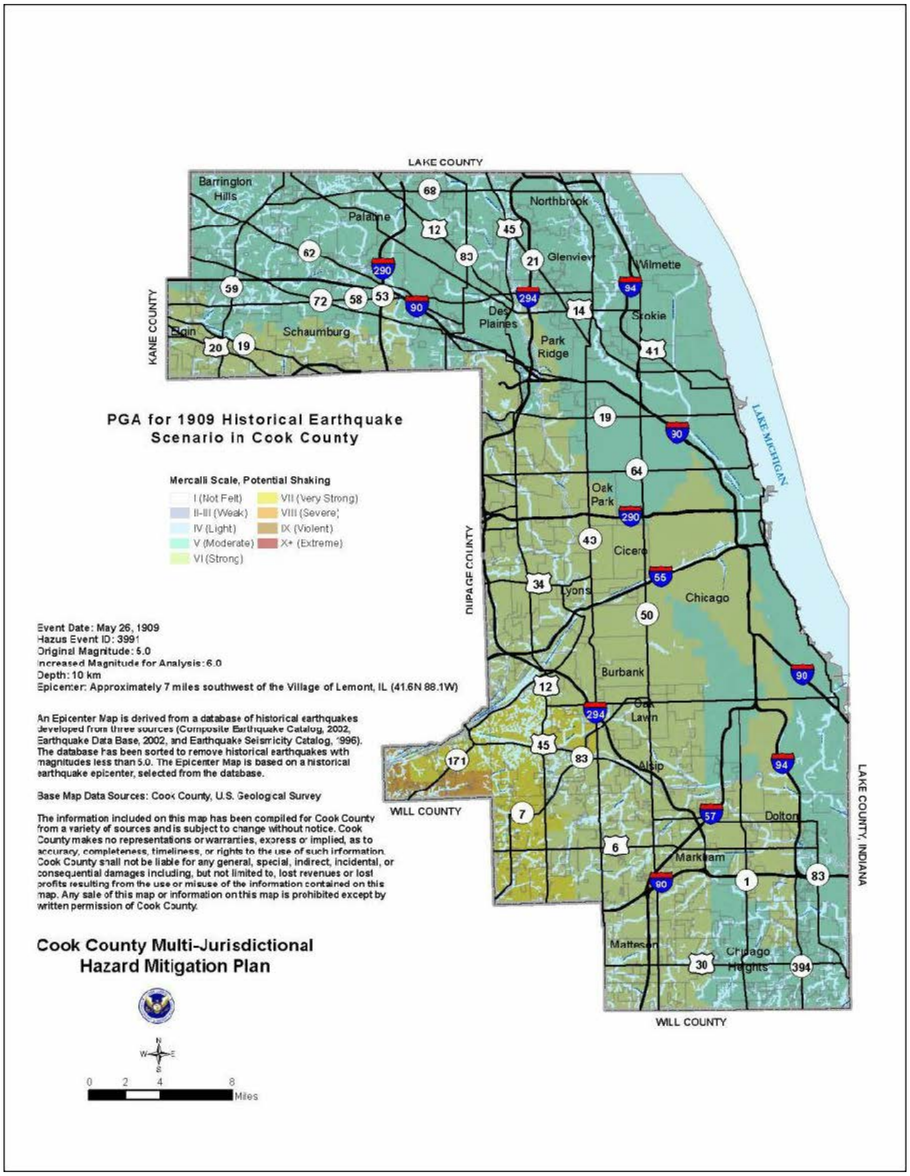


Figure: PGA for 1909 Historical Earthquake Scenario in Cook County

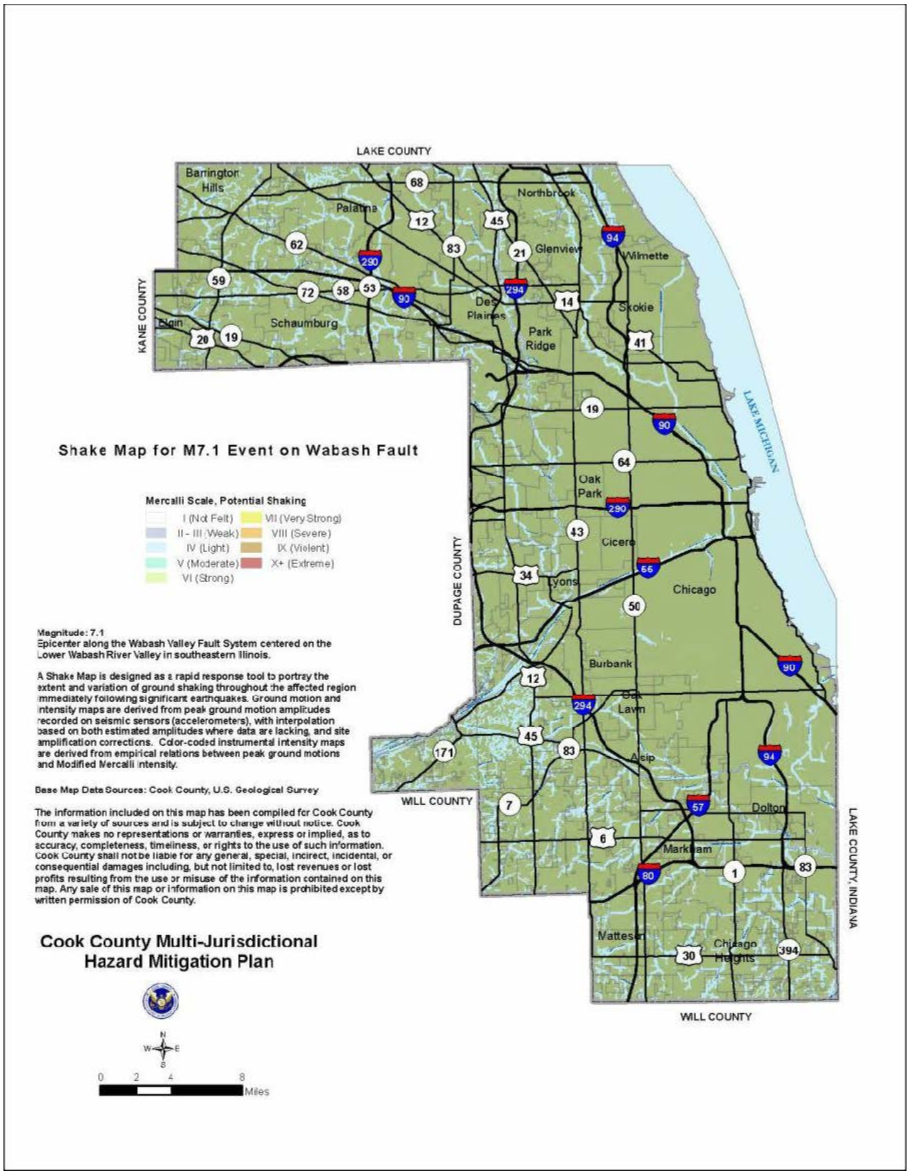


Figure: Shake Map for M7.1 Event on Wabash Fault

NEHRP Soil Maps

NEHRP soil types define the locations that will be significantly impacted by an earthquake. NEHRP Soils B and C typically can sustain low-magnitude ground shaking without much effect. The areas that are most commonly affected by ground shaking have NEHRP Soils D, E. *Figure: NEHRP Soil Classifications of Cook County* shows NEHRP soil classifications in the county.

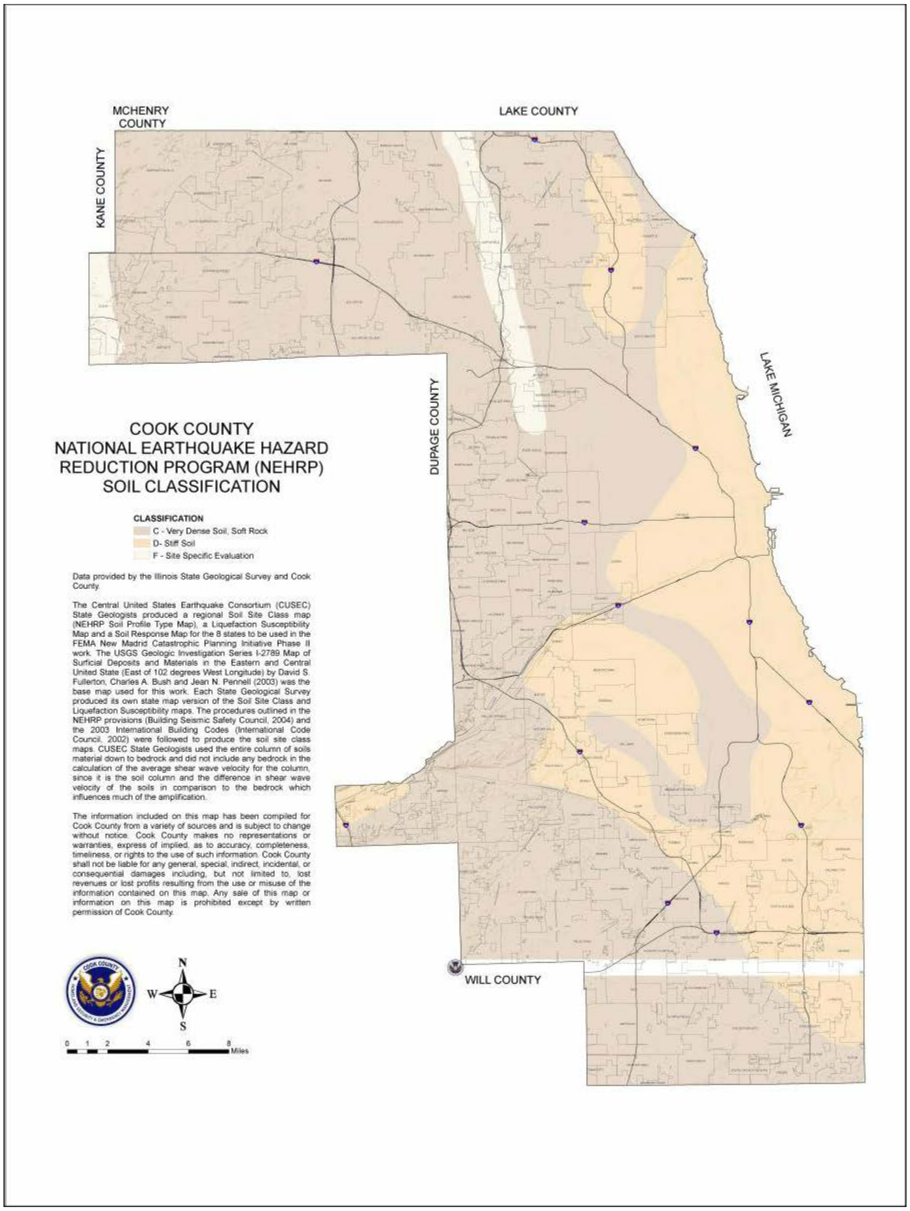


Figure: NEHRP Soil Classifications of Cook County

Liquefaction Maps

Soil liquefaction maps are useful tools to assess potential damage from earthquakes. When the ground liquefies, sandy or silty materials saturated with water behave like a liquid, causing pipes to leak, roads and airport runways to buckle, and building foundations to be damaged. In general, areas with NEHRP Soils D, E, and F are also susceptible to liquefaction. If there is a dry soil crust, excess water will sometimes come to the surface through cracks in the confining layer, bringing liquefied sand with it, creating sand boils. *Figure: Liquefaction Susceptibility of Cook County* shows the liquefaction susceptibility in the planning area.

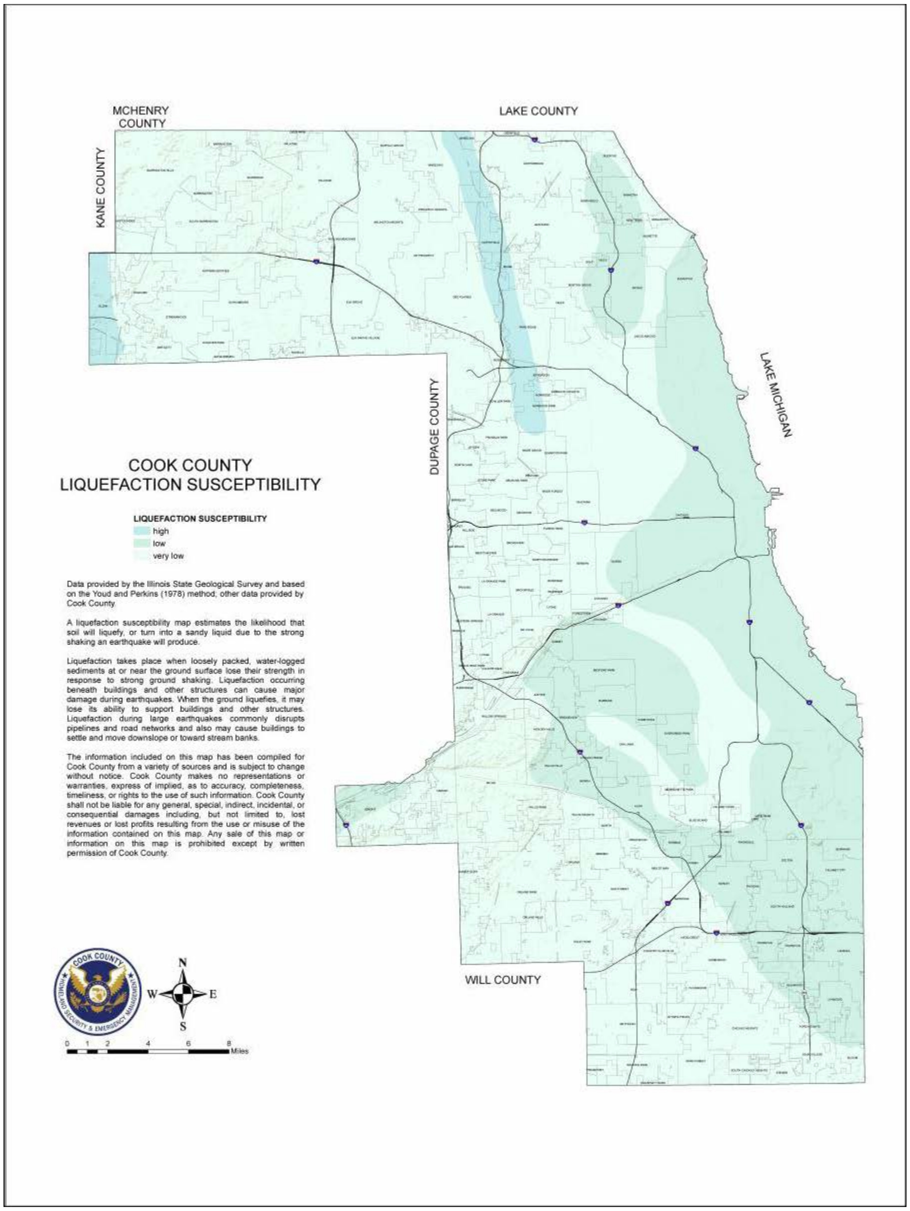


Figure: Liquefaction Susceptibility of Cook County

Seismic Zones

Figure: New Madrid and Wabash Valley Seismic Zones shows the location of the two seismic zones most likely to affect the planning area:

- The New Madrid Seismic Zone, in the central Mississippi Valley, extends from northeast Arkansas through southeast Missouri, western Tennessee, and western Kentucky to southern Illinois.
- The Wabash Valley Seismic Zone, in southeastern Illinois and southwest Indiana, is capable of producing earthquake events of magnitude similar to those of the New Madrid

Seismic Zone. People living in this area experience moderate-sized earthquakes, impacting Illinois, Indiana, and Kentucky. This fault system is about 55 miles long and 31 miles wide. It consists of a series of parallel, high-angle normal faults. The easternmost faults extend into Indiana.

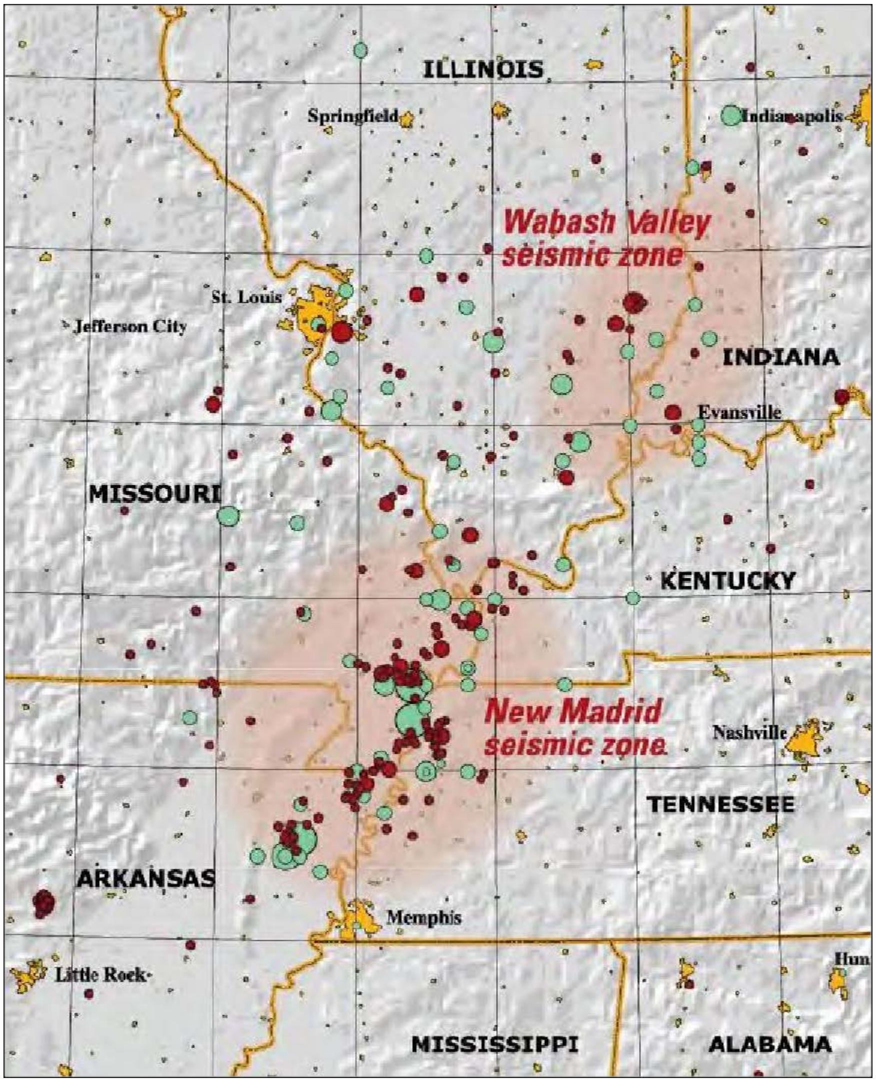


Figure: New Madrid and Wabash Valley Seismic Zones

Fault Lines

The figure below shows the major fault systems and other seismic structural features of Illinois and surrounding areas.

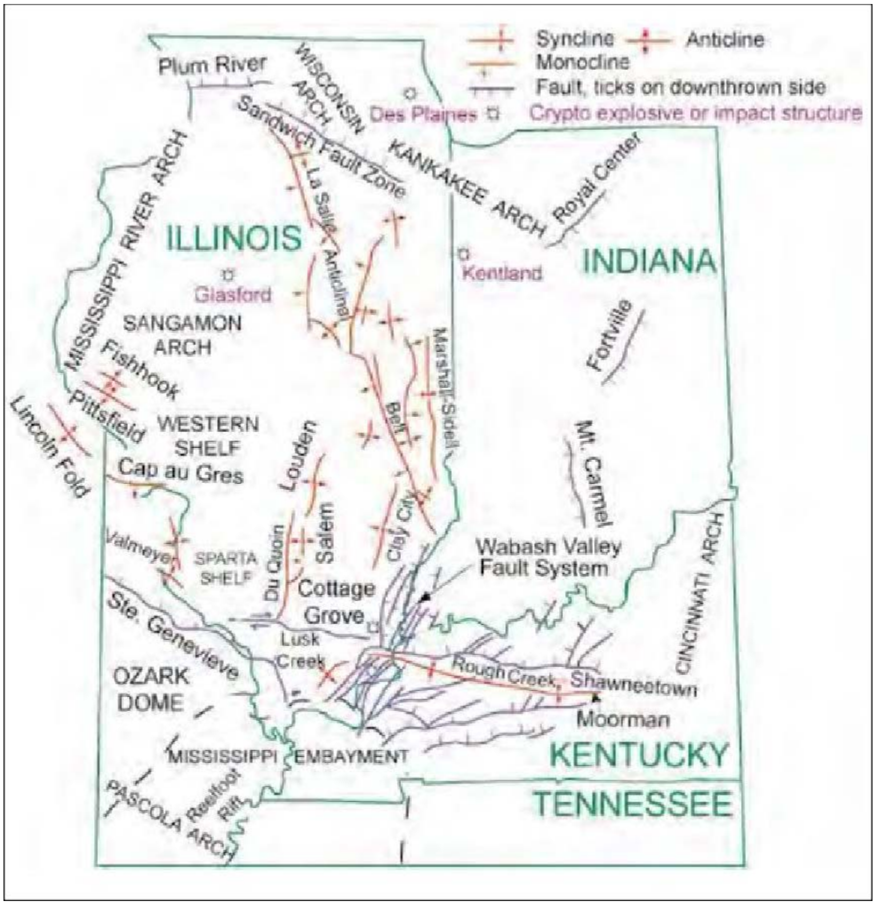


Figure: Major Fault Systems

Frequency and Future Hazard Events

Below are 100 and 500-year earthquake maps. Probabilistic seismic-hazard maps were prepared for the conterminous United States for 2014 portraying peak horizontal acceleration and horizontal spectral response acceleration for 0.2- and 1.0-second periods with probabilities of exceedance of 10 percent in 50 years and 2 percent in 50 years. All of the maps were prepared by combining the hazard derived from spatially smoothed historical seismicity with the hazard from fault-specific sources. The acceleration values contoured are the random horizontal component. The reference site condition is firm rock, defined as having an average shear-wave velocity of 760 m/s in the top 30 meters corresponding to the boundary between NEHRP (National Earthquake Hazards Reduction program) site classes B and C.

A liquefaction susceptibility map estimates the likelihood that soil will liquefy, or turn into a sandy liquid due to the strong shaking an earthquake will produce. Liquefaction takes place when loosely packed, water-logged sediments at or near the ground surface lose their strength in response to strong ground shaking. Liquefaction occurring beneath buildings and other structures can cause major damage during earthquakes. When the ground liquefies, it may lose its ability to support buildings and other structures. Liquefaction during large earthquakes commonly disrupts pipelines and road networks and also may cause buildings to settle and move downslope or toward stream banks. Data provided by the Illinois State Geological Survey and based on the Youd and Perkins (1978) method; other data provided by Cook County.

The New Madrid Seismic Zone is active, averaging more than 200 measured earthquake events every year. Tremors large enough to be felt (Magnitude 2.5 to 3.0) occur annually. About every 18 months, the fault releases a shock of 4.0 or greater, capable of causing local minor damage. Magnitudes of 5.0 or greater, which are capable of significant damage and being felt across several states, occur about once every 10 years.

In the short term, the probability of an earthquake, even a minor ground shake, in Cook County in 2018 had a probability rate of less than 1%. The USGS produced the 2018 one-year probabilistic seismic hazard forecast for the central and eastern United States from induced and natural earthquakes using the same probabilistic seismicity-based methodology as applied in the two previous forecasts. Rates of earthquakes across the U.S. grew rapidly between 2008 and 2015 but have steadily declined over the past three years.

The seismicity pattern in 2017 was complex with earthquakes more spatially dispersed than in previous years. Important to Cook County, the New Madrid seismic zone (11 earthquakes M ≥ 3) continues to be higher than historical levels. While the New Madrid fault line is located hundreds of miles away from Cook County, the County has sustained shaking from past high magnitude earthquakes from the 150-mile New Madrid seismic zone (USGS).

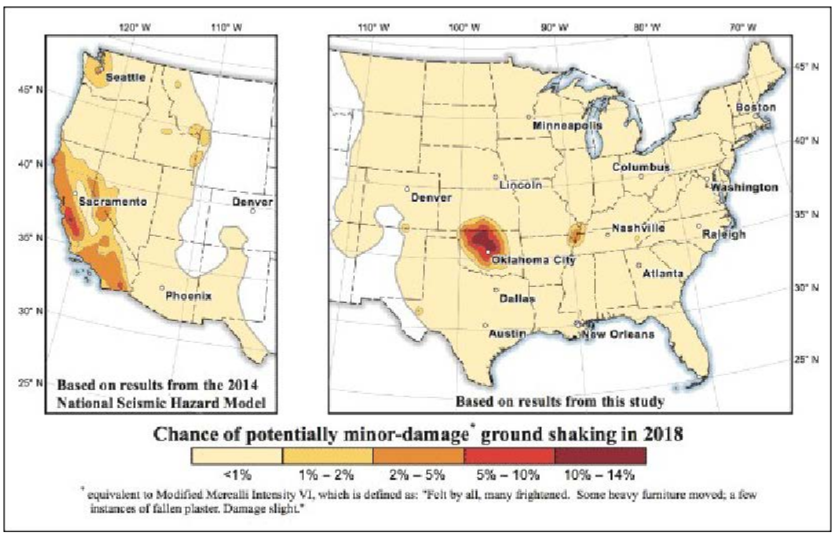


Figure: 2018 One-Year Probabilistic Seismic Hazard Forecast. (USGS).

Long-term probability mapping done by USGS shows, Cook County falls in the "light blue" zone for the expected number of occurrences of damaging earthquake shaking in 10,000 years. The light blue zone equates to 2-4 earthquakes per 10,000 years that yield damaging shaking.

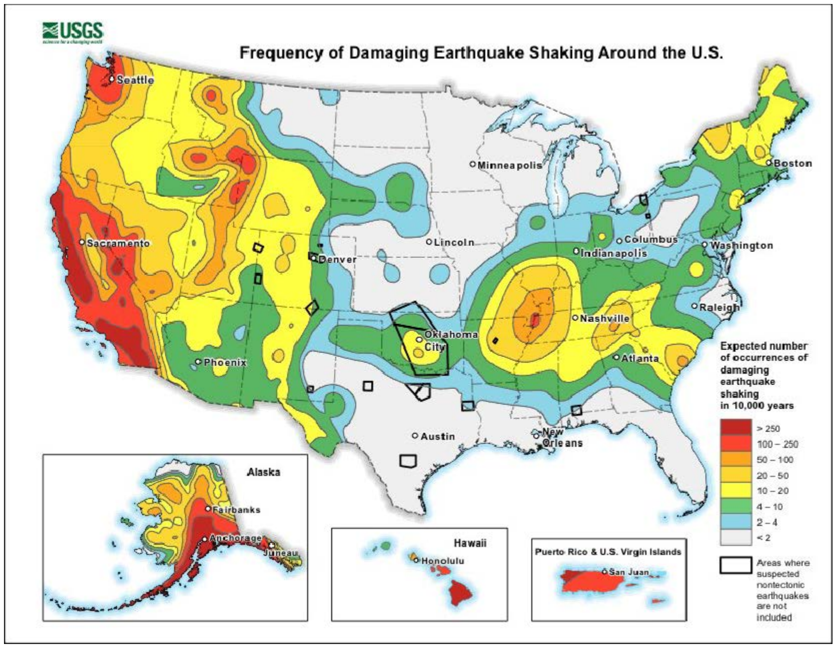


Figure: Frequency of Damaging Earthquake Shaking Around the U.S. ([USGS](#)).

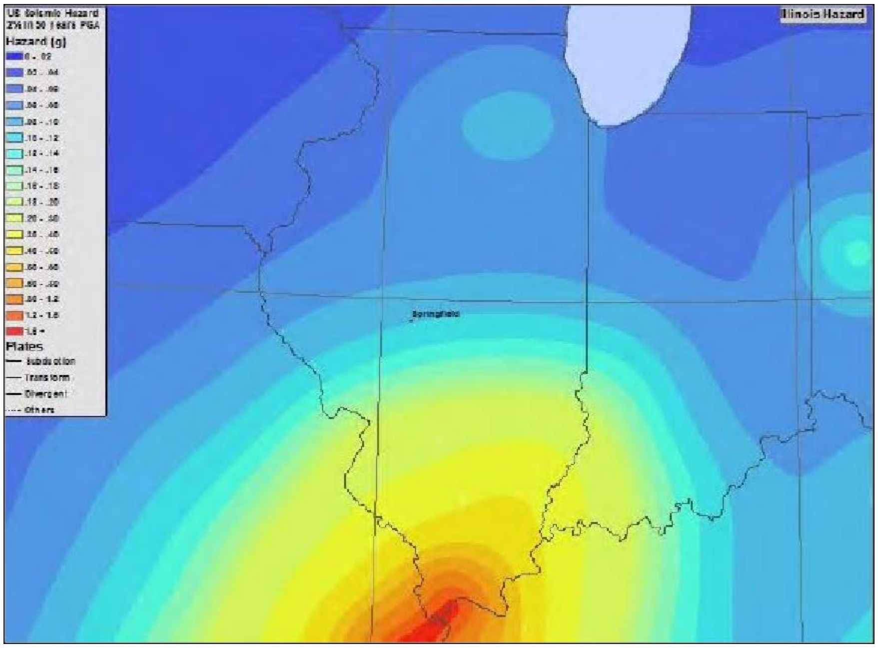
Extent

The extent of an earthquake is countywide. One of the most critical sources of information that is required for accurate assessment of earthquake risk is soils data. Soils along rivers and other bodies of water have higher water tables and higher sand content. As a result, these areas are more susceptible to liquefaction and land shaking. Liquefaction is a phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking as a result of water filling the space between individual soil particles. This can cause buildings to tilt or sink into the ground, slope failures, lateral spreading, surface subsidence, ground cracking, and sand blows.

Hazard Type	**Affected Jurisdictions**	**Extent (based on historical events)**		**Comments**
		Minimum	**Maximum**	
Earthquake	County-wide	0	4.9	Cook County has experienced three earthquakes ranging from a magnitude of 3 to 4.9. Since the 2014 Hazard Mitigation Plan, Cook County has not experienced any additional significant earthquakes.

Severity

The severity of an earthquake can be expressed in terms of intensity or magnitude. Intensity represents the observed effects of ground shaking on people, buildings, and natural features. The USGS has created



ground motion maps based on current information about several fault zones. These maps show the PGA that has a certain probability (2 percent or 10 percent) of being exceeded in a 50-year period. The PGA is measured in numbers of g's (the acceleration associated with gravity). *Figure: PGA with 2-Percent Probability of Exceedance in 50 Years, State of Illinois* shows the PGAs with a 2-percent exceedance chance in 50 years in Illinois.

Figure: PGA with 2-Percent Probability of Exceedance in 50 Years, State of Illinois

Magnitude is related to the amount of seismic energy released at the hypocenter of an earthquake. It is determined by the amplitude of the earthquake waves recorded on instruments. Whereas intensity varies depending on location with respect to the earthquake epicenter, magnitude is represented by a single, instrumentally determined value for each earthquake event.

In simplistic terms, the severity of an earthquake event can be measured in the following terms:

- How hard did the ground shake?
- How did the ground move? (Horizontally or vertically)
- How stable was the soil?
- What is the fragility of the built environment in the area of impact?

Warning Time

There is currently no reliable way to predict the day or month that an earthquake will occur at any given location. Research is being done with warning systems that use the low energy waves that precede major earthquakes. These potential warning systems give approximately 40 seconds notice that a major earthquake is about to occur. The warning time is very short but it could allow for someone to get under a desk, step away from a hazardous material they are working with, or shut down a computer system.

Secondary Hazards

During earthquakes, river valleys are vulnerable to slope failure, often as a result of loss of soil cohesion. Soil liquefaction occurs when water-saturated sands, silts, or gravelly soils are shaken so violently that the individual grains lose contact with one another and float freely in the water, turning the ground into a pudding-like liquid. Building and road foundations lose load-bearing strength and may sink into what was previously solid ground. Unless properly secured, hazardous materials can be released, causing significant damage to the environment and people. Earthen dams and levees are highly susceptible to seismic events and the impacts of their eventual failures can be considered secondary risks for earthquakes. Additionally, other underground critical infrastructure such as the extensive network of oil and gas pipelines which feed the supply chain and fiber optic communications cable are highly vulnerable.

Exposure

All people, property, and environments in the planning area would be exposed to some degree to the impacts of an earthquake.

Population

The entire population of Cook County is potentially exposed to direct and indirect impacts from earthquakes. The degree of exposure is dependent on many factors, including the age and construction type of the structures people live in, the soil types their homes are constructed on, their proximity to fault location, etc. Whether directly impacted or indirectly impact, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could keep people from working, road closures could isolate populations, and loss of functions of utilities could impact populations that suffered no direct damage from an event itself.

Property

According to County Assessor records, there are 1,214,337 buildings in the planning area, with a total assessed value of $1,193,571,135,889. Since all structures in the planning area are susceptible to earthquake impacts to varying degrees, this total represents the countywide property exposure to seismic events. Most of the buildings (85.1 percent) are residential.

Critical Facilities and Infrastructure

All critical facilities in the planning area are exposed to the earthquake hazard. *Table: Critical Facilities by Jurisdiction and Category* and *Table: Critical Infrastructure by Jurisdiction and Category* list the number of each type of facility by jurisdiction. Hazardous materials releases can occur during an earthquake. Transportation corridors can be disrupted during an earthquake, leading to the release of materials to the surrounding environment. Facilities holding hazardous materials are of particular concern because of possible isolation of neighborhoods surrounding them. During an earthquake, structures storing these materials could rupture and leak into the surrounding area or an adjacent waterway, having a disastrous effect on the environment.

Environment

Secondary hazards associated with earthquakes will likely have some of the most damaging effects on the environment. For example, it is possible for streams to be rerouted after an earthquake. This can change the water quality, possibly damaging habitat and feeding areas. There is a possibility of streams fed by groundwater drying up because of changes in underlying geology.

Vulnerability

In 2014, earthquake vulnerability data was generated using a Level 2 Hazus-MH analysis. Once the location and size of a hypothetical earthquake were identified, Hazus-MH estimated the intensity of the ground shaking, the number of buildings damaged, the number of casualties, the damage to transportation systems and utilities, the number of people displaced from their homes, and the estimated cost of repair and clean up. The probabilistic and scenario-event mapping developed for this hazard mitigation plan were the basis for these analyses in 2014. The model results for the 1%, 0.2% chance probabilistic events and the Wabash fault scenario showed little or no damage in the planning area. Therefore, the earthquake vulnerability analysis in 2014 focused on the 1909 Historical Earthquake scenario; a reoccurrence of this event within the planning area would be a worst-case scenario. During the 2019 update, the Planning Team, in coordination with Cook County GIS, reassessed data and the availability of data to determine if a more robust analysis would result in outputs representing a significant change from 2014. Analyses, mostly related to limitations in data, suggested little to no major changes. It was determined that future analyses need to incorporate municipal-level GIS inputs and further coordination with local GIS databases, as available. New analyses were conducted for jurisdictions participating for the first time in the Cook County MJ-HMP. Future updates to this plan will strive to enhance this assessment with new data as that data becomes available.

This section provides specific information about the County's vulnerabilities to this hazard, such as:

- Population
- Property
- Critical Facilities and Infrastructure
- Environment

Population

Three population groups are particularly vulnerable to earthquake hazards:

- **Linguistically Isolated Populations**—34.4 percent of residents in the planning area census blocks on NEHRP D and E soils do not speak English as their native language. Problems arise when there is an urgent need to inform non-English speaking residents of an earthquake event. They are vulnerable because of difficulties in understanding hazard-related information from predominantly English-speaking media and government agencies.
- **Population Below Poverty Level**—16.4 percent of households in the planning area census blocks on NEHRP D and E soils earn incomes below the poverty level. These households may lack

the resources to improve their homes to prevent or mitigate earthquake damage. They are also less likely to have insurance to compensate for earthquake losses.

- **Population Over 65 Years Old**—12.1 percent of residents in the planning area census blocks on NEHRP D and E soils are over 65 years old. This population group is vulnerable because they are more likely to need special medical attention, which may not be available due to isolation caused by earthquakes. Elderly residents also have more difficulty leaving their homes during earthquake events and could be stranded in dangerous situations.

Table: Estimated Earthquake Impact On Persons And Households, 1909 Historical Earthquake Scenario summarizes estimated impacts on persons and households in the planning area for the 1909 Historical Earthquake scenario, based on Hazus results.

TABLE:
ESTIMATED EARTHQUAKE IMPACT ON PERSONS AND HOUSEHOLDS, 1909 HISTORICAL EARTHQUAKE SCENARIO

Region	Number of Displaced Households	Number of Persons Requiring Short- Term Shelter
North	480	284
Central	5547	4694
South	1517	955
Total	**7,544**	**5,933**

Property

Building Age

The State of Illinois has no statewide mandatory residential building code in place. Building code adoption and enforcement are primarily the responsibility of local jurisdictions. The 2006 International Building Code or newer is required for all commercial buildings. The state's Capital Development Board oversees the design and construction of new buildings for schools, universities, and State-owned facilities. Seismic requirements for school construction are based on 2004 I-Codes.

Table: Age Of Structures In Planning Area identifies significant milestones in building and seismic code requirements that directly affect the structural integrity of the development. Using these time periods, the planning team used Hazus to identify the number of structures in the planning area by date of construction. Of all structures in the planning area, only 7.9 percent were constructed after the Uniform Building Code was amended in 1994 to include seismic safety provisions; 29.7 percent were built before 1933 when there were no building permits, inspections, or seismic standards. The number of structures does not reflect the number of total housing units, as many multi-family units and attached housing units are reported as one structure.

TABLE: AGE OF STRUCTURES IN PLANNING AREA		
Time Period	**Number of Current Planning Area Structures Built in Period**	**Significance of Time Frame**
Pre-1933	360,788	Before 1933, there were no explicit earthquake requirements in building codes. State law did not require local governments to have building officials or issue building permits.
1933-1940	18,202	In 1940, the first strong motion recording was made.
1941-1960	330,226	In 1960, the Structural Engineers Association of California published guidelines on recommended earthquake provisions.
1961-1975	254,839	In 1975, significant improvements were made to lateral force requirements in national codes
1976-1994	154,918	In 1994, the Uniform Building Code was amended to include provisions for seismic safety.
1995-Present	95,364	
Total	**1,214,337**	

Loss Potential

Property losses were estimated through the Level 2 Hazus-MH analysis for the 1909 Historical Earthquake scenario. *Table: Loss Estimates For 1909 Historical Earthquake Scenario* shows the results for two types of property loss:

- Structural loss, representing damage to building structures
- Non-structural loss, representing the value of lost contents and inventory, relocation, income loss, rental loss, and wage loss.

For the 1909 Historical Earthquake scenario, the estimated damage potential is $8,578,759,370, or 0.72 (%) percent of the total building value for the planning area.

TABLE: LOSS ESTIMATES FOR 1909 HISTORICAL EARTHQUAKE SCENARIO			
Region	**Estimated Loss Associated with 1909 Historical Earthquake Scenario**		
	Structure	**Contents**	**Total**
North	$562,074,920	$128,022,899	$690,097,818
Central	$3,821,088,331	$1,042,483,511	$4,863,571,841
South	$2,319,429,832	$705,659,878	$3,025,089,710
Total	**$6,702,593,083**	**$1,876,166,288**	**$8,578,759,369**

The Hazus-MH analysis also estimated the amount of earthquake-caused debris in the planning area for the 1909 Historical Earthquake scenario, as summarized in *Table: Estimated Earthquake-Caused Debris*.

TABLE: ESTIMATED EARTHQUAKE-CAUSED DEBRIS	
Region	**Debris to Be Removed (1,000 tons)**
North	738.53
Central	6325.56
South	3099.77
Total	**10,163.86**

Critical Facilities and Infrastructure

Level of Damage

Hazus-MH classifies the vulnerability of critical facilities to earthquake damage in five categories: no damage, slight damage, moderate damage, extensive damage, or complete damage. The model was used to assign a vulnerability category to each critical facility in the planning area except hazmat facilities and “other infrastructure” facilities, for which there are no established damage functions. The analysis was performed for the 1909 Historical Earthquake scenario, which would have the largest potential impact on the planning area. *Table: Estimated Damage To Critical Facilities From 1909 Historical Earthquake Scenario* summarizes the results.

**TABLE:
ESTIMATED DAMAGE TO CRITICAL FACILITIES FROM 1909 HISTORICAL EARTHQUAKE SCENARIO**

Category *a*	**No Damage**	**Slight Damage**	**Moderate Damage**	**Extensive Damage**	**Complete Damage**
Medical and Health	72	620	4	0	2
Government Functions	39	38	1	0	1
Protective Functions	447	43	4	0	1
Schools	148	2,394	2	0	7
Other Critical Functions	0	0	0	0	0
Bridges	1,500	0	0	0	1
Water supply	98	4	0	0	0
Wastewater	137	5	1	0	0
Power	240	1	2	0	1
Communications	198	9	2	0	0
Total	**2,879**	**3,114**	**16**	**0**	**13**

a. Vulnerability not estimated for hazmat facilities or for "other infrastructure" facilities due to lack of established damage functions for these type facilities.

Time to Return to Functionality

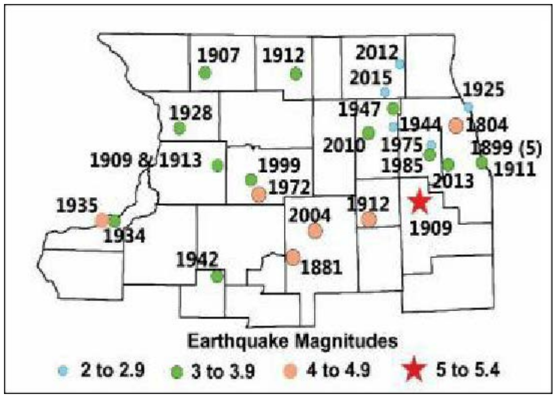
Hazus-MH estimates the time to restore critical facilities to fully functional use. Results are presented as probability of being functional at specified time increments: 1, 3, 7, 14, 30, and 90 days after the event. For example, Hazus-MH may estimate that a facility has a 5 percent chance of being fully functional at Day 3, and a 95-percent chance of being fully functional at Day 90. The analysis of critical facilities in the planning area was performed for the 1909 Historical Earthquake scenario.

Environment

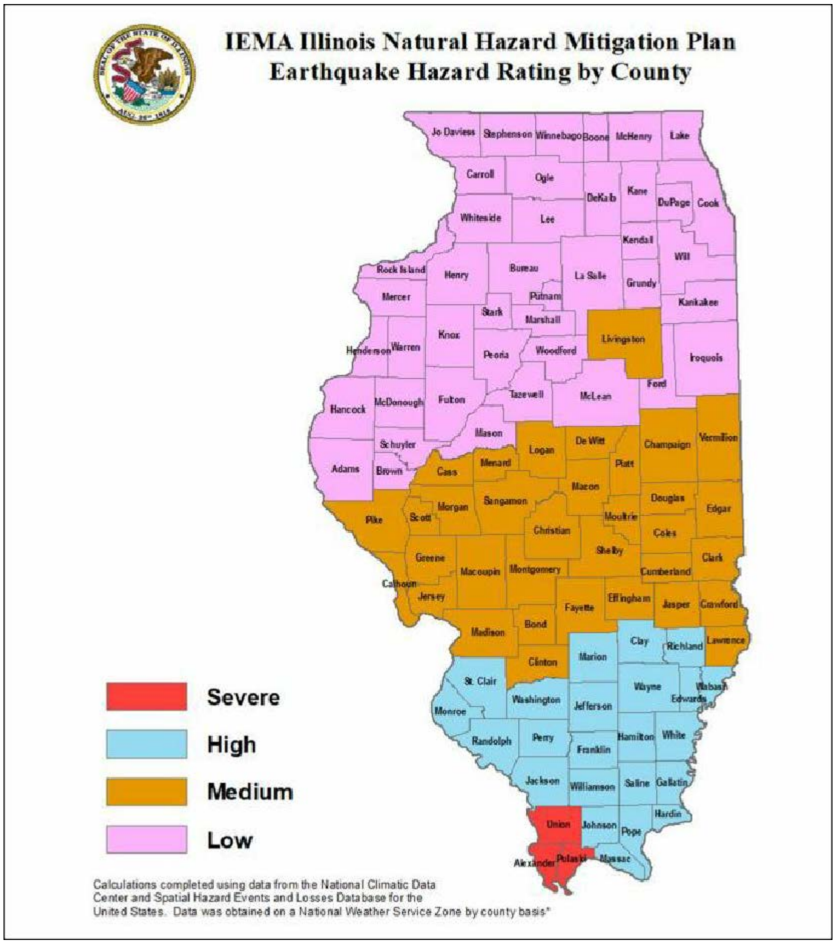
The environment vulnerable to earthquake hazard is the same as the environment exposed to the hazard.

Future Trends in Development

From 1795 to 2017 felt or damaging earthquakes in Cook County included one (1) earthquake with a magnitude ranging from 2 to 2.9, 3 ranging from 3 to 3.9, 1 ranging from 4 to 4.9, and none ranging from 5 to 5.4. Cook County is 1 of the 21 counties in Illinois to experience an earthquake with a magnitude of 4 to 4.9 (Illinois HMP, 2018).



Some states (Arkansas, Ohio, Kansas, and Oklahoma) contribute an increase in seismic activity to induced seismicity from wastewater disposal. While USGS has almost doubled wastewater activity in the last several years in Illinois, no seismicity increase has been associated with wastewater disposal wells in Illinois. Additionally, the Illinois Hazard Mitigation Plan ranks earthquakes as a low-ranking hazard for Cook County. The Illinois HMP attributes the lack of increase in seismicity due to differing practices in wastewater disposal. The continuation of practices that will not increase seismicity is needed.



Map: Earthquake Hazard Ranking in Illinois

Source: IEMA HMP 2018

Even with earthquakes being ranked a low hazard by the Illinois HMP, the damage from a singular earthquake is sizable. Land use in the planning area will be directed by plans and programs adopted at the local level. With no state-mandated building code, regulating new construction according to national/international standards will be a local decision. The regulatory capabilities of each planning partner are described in Volume 2 of this plan. As the planning area continues to recover from declining economic conditions, the focus will be on redevelopment, versus expansion. This will provide the planning partnership the opportunity to address risk exposure and vulnerability to earthquake hazard to the existing building stock.

TABLE: FUNCTIONALITY OF CRITICAL FACILITIES FOR 1909 HISTORICAL EARTHQUAKE SCENARIO							
	# of Critical Facilities	Probability of Being Fully Functional (%)					
		At Day 1	At Day 3	At Day 7	At Day 14	At Day 30	At Day 90
Medical and Health	698	30.29	31.61	86.96	88.30	97.11	98.22
Government Functions	79	46.49	47.37	84.27	85.17	95.40	96.99
Protective Functions	495	78.92	79.23	92.09	92.41	98.69	99.15
Schools	2,551	70.01	70.40	87.02	87.44	96.83	98.09
Other Critical Functions	0	0	0	0	0	0	0
Bridges	1,501	97.36	98.19	98.61	98.68	98.75	99.27
Water supply	102	87.75	98.62	99.55	99.58	99.66	99.88
Wastewater	143	83.77	95.98	99.10	99.44	99.49	99.82
Power	244	89.36	96.01	98.55	99.20	99.59	99.88
Communications	209	97.39	99.40	99.60	99.77	99.86	99.89
Total/Average	**6,022**	**75.7**	**79.7**	**94**	**94.4**	**98.4**	**99**

Scenario

Any seismic activity of 6.0 or greater on faults within the planning area would have significant impacts throughout the county. Potential warning systems could give approximately 40 seconds notice that a major earthquake is about to occur. This would not provide adequate time for preparation. Earthquakes of this magnitude or higher would lead to massive structural failure of property on NEHRP C, D, E, and F soils. Levees and revetments built on these poor soils would likely fail, representing a loss of critical infrastructure. These events could cause secondary hazards, including mudslides that would further damage structures. River valley hydraulic-fill sediment areas are also vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils. Soil liquefaction would occur in water-saturated sands, silts, or gravelly soils.

Issues

While Illinois is not typically associated with earthquake risk, there is seismicity in the region. The biggest risk for the planning area is the abundance of older building stock that was constructed without the influence of seismic code provisions. It is estimated that more than half of the existing building stock was constructed without any seismic provisions. Important issues associated with an earthquake include but are not limited to the following:

- The public perception of the earthquake risk within the planning area is low. It can be difficult to get the public to think about earthquake mitigation with little or no perceived risk.
- Most of the planning area's building stock was built prior to 1975, when seismic provisions became uniformly applied through building code applications.
- A building stock analysis that looks at the potential fragility of the older building stock constructed without building code influence would be beneficial in the identification of seismic mitigation

projects.

- More shake map, scenario-based mapping is needed for the planning area.
- Critical facility owners/operators should be encouraged to create or enhance continuity of operations plans using the information on risk and vulnerability contained in this plan.
- Geotechnical standards should be established that take into account the probable impacts from earthquakes in the design and construction of new or enhanced facilities.
- The County has over 6 miles of earthen levees and revetments on soft, unstable soil. These soils are prone to liquefaction, which would severely undermine the integrity of these facilities.
- There are a large number of earthen dams within the planning area. Dam failure warning and evacuation plans and procedures should be reviewed and updated to reflect the dams' risk potential associated with earthquake activity in the region.
- Earthquakes could trigger other natural hazard events such as dam failures, which could severely impact the county.
- A worst-case scenario would be the occurrence of a large seismic event during a flood or high-water event. Levee failures would happen at multiple locations, increasing the impacts of the individual events.

Chapter 9. Flood

DEFINITIONS

Base-Flood—The base flood has a 1%, or 1 out of 100 chance of occurring in any given year.

Flood—The inundation of normally dry land resulting from the rising and overflowing of a body of water.

Floodplain—The land area along the sides of a river that becomes inundated with water during a flood.

Floodway-—Typically the channel of a river or stream and the overbank areas adjacent to the channel. During a flood event, the floodway carries the bulk of the flood waters downstream and is the area where water velocities and forces are the greatest and most destructive.

100-Year Floodplain—The area flooded by a flood that has a 1- percent chance of being equaled or exceeded each year. This is a statistical average only; a 100- year flood can occur more than once in a short period of time.

The 1-percent annual chance flood is the standard used by most federal and state agencies.

Return Period—The average number of years between occurrences of a hazard (equal to the inverse of the annual likelihood of occurrence).

Riparian Zone—The area along the banks of a natural watercourse.

Special Flood Hazard Area—For purposes of the NFIP, the area that would be inundated by the base flood (1% annual chance flood)

General Background

A floodplain is the area adjacent to a river, creek, or lake that becomes inundated during a flood. Floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

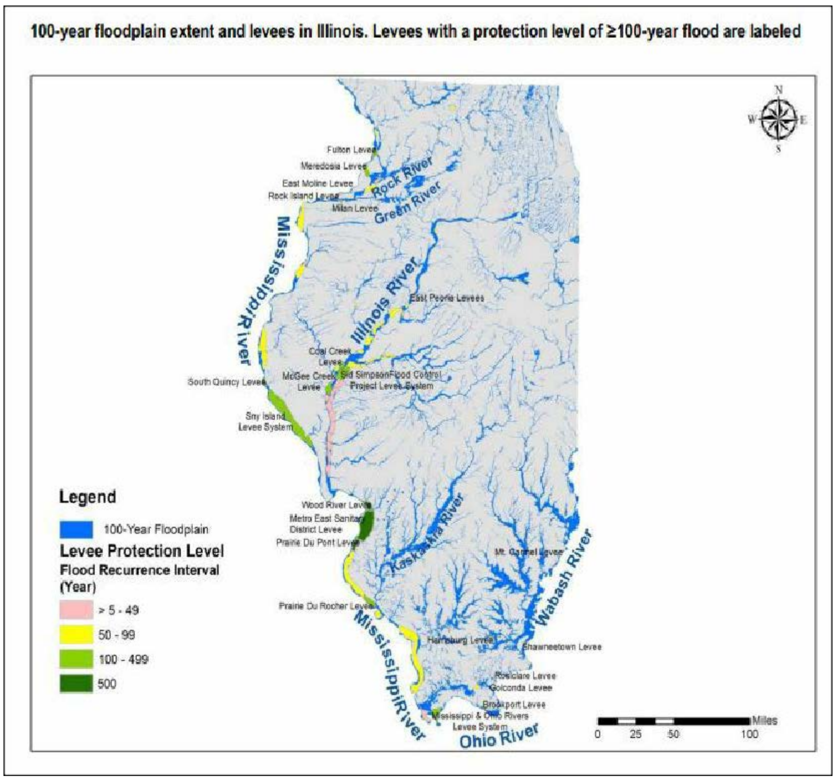
When floodwaters recede after a flood event, they leave behind layers of rock and mud. These gradually build up to create a new floor of the floodplain. Floodplains generally contain unconsolidated sediments (accumulations of sand, gravel, loam, silt, and/or clay), often extending below the bed of the stream. These sediments provide a natural filtering system, with water percolating back into the ground and replenishing groundwater. These are often important aquifers, the water drawn from them being filtered compared to the water in the stream. Fertile, flat reclaimed floodplain lands are commonly used for agriculture, commerce, and residential development.

Connections between a river and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

Measuring Floods and Floodplains

The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability. For example, the 100-year discharge has a 1-percent chance of being equaled or exceeded in any given year. The “annual flood” is the greatest flood event expected to occur in a typical year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-year or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river.

The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-year flood) is used as the regulatory boundary by many agencies. Also referred to as the special flood hazard area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the elevation of water that will result from a given discharge level, which is one of the most important factors used in estimating flood damage.



Map: 100-year floodplain extent and levees in Illinois

Source: IEMA HMP 2018

Floodplain Ecosystems

Floodplains can support ecosystems that are rich in plant and animal species. A floodplain can contain 100 or even 1,000 times as many species as a river. Wetting of the floodplain soil releases an immediate surge of nutrients: those left over from the last flood, and those that result from the rapid decomposition of organic matter that has accumulated since then. Microscopic organisms thrive and larger species enter a rapid breeding cycle. Opportunistic feeders (particularly birds) move in to take advantage. The production of nutrients peaks and falls away quickly, but the surge of new growth endures for some time. This makes floodplains valuable for agriculture. Species growing in floodplains are markedly different from those that grow outside floodplains. For instance, riparian trees (trees that grow in floodplains) tend to be very tolerant of root disturbance and very quick-growing compared to non-riparian trees.

Effects of Human Activities

Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate in floodplains for a number of reasons: water is readily available; the land is fertile and suitable for farming; transportation by water is easily accessible; and the land is flatter and easier to develop. But human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels. This increases flood potential in two ways: it reduces the stream's capacity to contain flows, and it increases flow rates or velocities downstream during all stages of a flood event. Human activities can interface effectively with a floodplain as long as steps are taken to mitigate the activities' adverse impacts on floodplain functions.

Federal Flood Programs

Repetitive Loss (RL): A RL property is a structure that has incurred flood-related damage on two occasions. Funding for the Repetitive Loss (RL) structures is available on an annual basis through FEMA FMA. The purpose of funding is to reduce or eliminate the long-term risk of flood damage to structures insured by the NFIP and identified by FEMA as RL structures. RL will operate under a 75% Federal/25% Local cost share.

Severe Repetitive Loss (SRL): Funding for the Severe Repetitive Loss (SRL) structures is available on an annual basis through FEMA FMA. The purpose of funding is to reduce or eliminate the long-term risk of flood damage to structures insured by the NFIP and identified by FEMA as SRL structures. Specifically, SRL structures are residential properties that have at least four NFIP claims over $5,000 each, at least two of which occur within ten years of each other, or that have had at least two structural claims within ten years of each other that cumulatively exceed the value of the structure. SRL will operate under a 75% Federal/25% Local cost share and FEMA may contribute up to 100% Federal Cost Share. Typical activities would be the acquisition and demolition of properties or elevation.

As of the publication of the IEMA HMP 2018, Cook County had:

- Community Repetitive Loss Listing: 377 property losses from flooding with 125 being repetitive loss properties. Insurance claims were $7,277,890.95 and average paid insurance claim was $19,304.75.
- County Repetitive Loss Listing: 4,539 property losses from flooding with 1,775 being repetitive loss properties. Insurance claims were $92,838,524.01 and average paid insurance claim was $1,673,616.85.

Hazard Profile

Floods in Cook County are caused by rainfall from large frontal storms, which may be in combination with some snowmelt, runoff, and ice jams. The principal contributor to flooding in the area is the inadequate capacity of some of the natural stream channels to contain runoff resulting from intense thunderstorm precipitation over the stream basins. Inundation of lands adjoining stream channels has been aggravated over the years by the gradual accumulation of silt. The buildup of sand bars and island channels has resulted in the loss of channel capacity. Another factor lending itself to the poor flow characteristics of some portions of channels is the excessive growth of brush, light timber, and aquatic vegetation. Two types of flooding are typical:

- Riverine Flooding—A flood typically seen as water flowing over a stream's banks. Riverine floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwater) and the related probability of occurrence (expressed as the percentage chance that a flood of a specific extent will occur in any given year).
- Stormwater/urban drainage floods—Floods that occur suddenly after a brief but intense downpour. These floods move rapidly, end suddenly, and can occur in areas not generally associated with flooding (such as subdivisions not adjacent to a water body and areas serviced by underground drainage systems). Although the duration of these events is usually brief, the damage they cause can be severe. In addition, they occur in similar geographic locations resulting in recurring repetitive damage. They cannot be predicted accurately and could potentially happen whenever there are heavy storms. Localized flooding not associated with stream overflow can occur where there are no drainage facilities to control flows or when runoff volumes exceed the design capacity of drainage facilities.

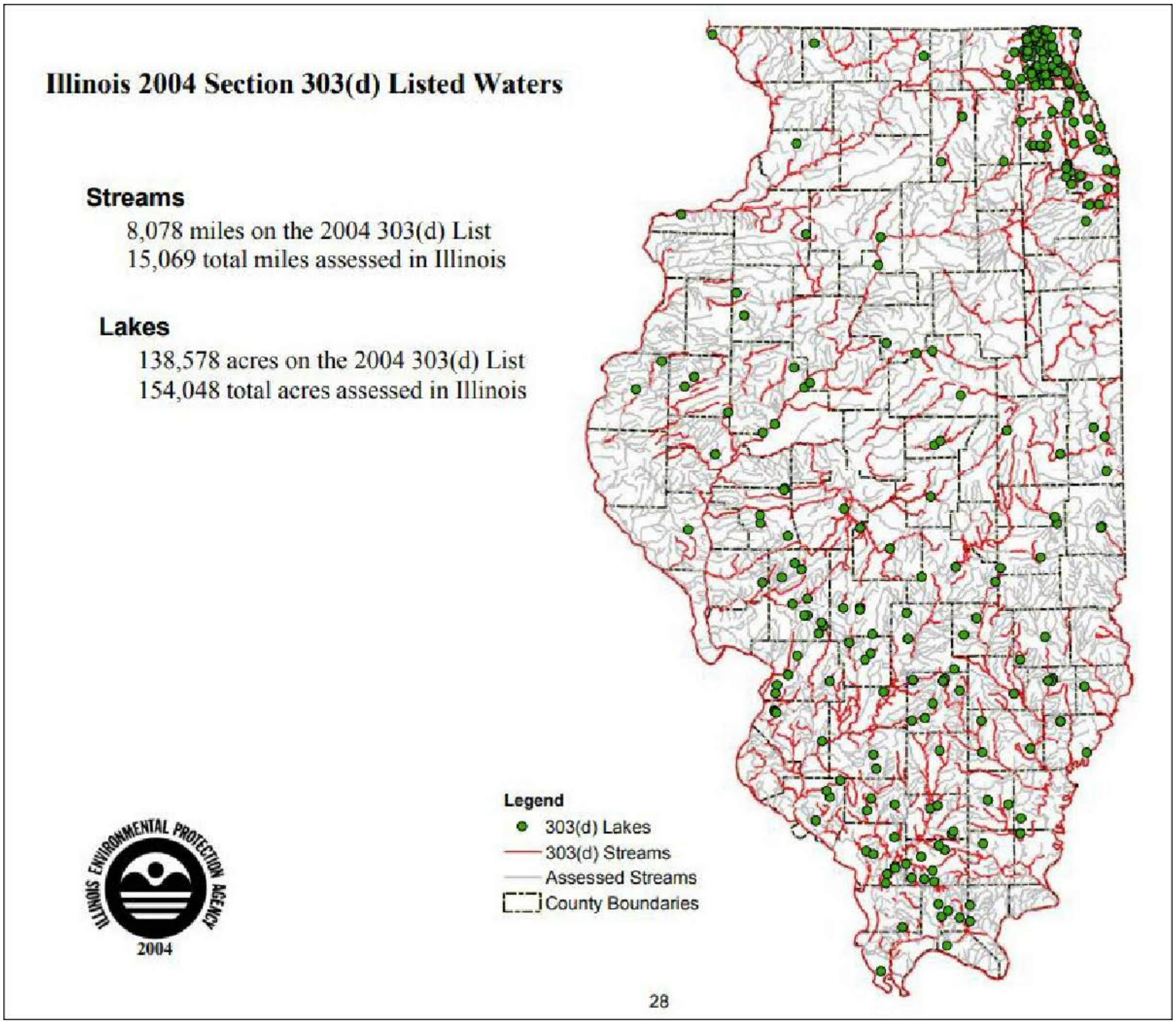
This section provides specific information about this hazard, such as:

- Principle Flooding Sources
- Past Events
- Location
- Frequency and Future Hazard Events
- Extent
- Severity

Principle Flooding Success

Riverine Flooding

Rivers and streams are part of nature's system for carrying water from high ground down to lakes and oceans. Floodplains are part of that system and carry unusually large amounts of water. The land areas adjacent to the streams, rivers, and lakes that are inundated when flooding occurs are floodplains. Flooding is a natural process and floodplains are a vital part of that process. The planning area is topographically dominated by the glacial Lake Chicago plain encompassing the Chicago River, Des Plaines River, and the Calumet River.



Map: Waterways in Illinois

Source: EPA Illinois

FEMA has mapped over 78 square miles of the 100-year floodplain and 99 square miles of 500-year floodplain along 172 water courses within the Cook County planning area. This includes floodplains within jurisdictions that intersect multiple counties. Whiles these maps do not cover all of the flood risks within the planning area, they do represent a large percentage of the risk. A brief description of some of these riverine flood sources is provided below.

Addison Creek

Addison Creek is a tributary to Salt Creek and the principal flood source for the Village of Bellwood. Addison Creek caused substantial flooding following a storm in March 1948. In 1951 and 1952, the channel was deepened and widened by IDNR from the mouth to Lake Street in Northlake. Flooding in the 1960s led to channel improvements in the reaches upstream from Bellwood in 1970. A peak stream flow of 1,120 cubic feet per second (cfs) with a river stage of 12.84 feet was observed on August 14, 1987.

North Branch of the Chicago River

Large magnitude floods occurred on the Chicago River, North Branch, West Fork in 1938, 1954, 1957, 1960, 1967, 1982, 1987, 1994 and 2001. Flood damage in the Chicago River, North Branch watershed have been most severe in the Chicago River, North Branch, West Fork because of relatively greater levels of floodplain development, such as that which has occurred along the 2.6-mile West Fork stream reach in Glenview. The 1967 flood, approximately a 5-percent-annual-chance flood event, caused damage along the entire Chicago River, North Branch, West Fork. A peak stream flow of 1,190 cfs, with a river stage of 10.10 feet, was observed on the West Fork of this riverine system on August 14, 1987.

The Chicago River, North Branch, West Fork flooded in the Village of Northbrook on July 22, 1982, when more than 7 inches of rain fell over 12 hours. The flood was the most extreme event recorded since the early 1950s when systematic streamflow records were first recorded on the West Fork. The peak discharge recorded at the Dundee Road gauge in Northbrook was 1,070 cfs, which had an estimated recurrence interval of 25 years. A major storm, which had been preceded by a very wet 30-day period, occurred on December 2, 1982. Rainfall amounts from 3 to 4 inches were recorded over a 1- to 2-day period. The peak discharge of 740 cfs was recorded at the Dundee Road gauge.

Flood damage is increasing in the Chicago River, North Branch watershed. The change can be attributed to a number of factors, the most notable of which is urbanization of upland areas, increasing the rate and volume of storm runoff. Another factor is floodplain development, which reduces natural floodplain storage and often obstructs conveyance of flood flows. Both urbanization and floodplain filling are expected to continue. In combination, these factors cause more frequent flooding and higher flood stages.

It should be noted that in July 2018, the Albany Park Stormwater Diversion Tunnel was completed in Chicago's Albany Park neighborhood. As of July 2019, the tunnel had successfully diverted stormwater during several heavy rainfall events that have historically created flooding issues in the immediate area.

Des Plaines River

Damaging floods in the primarily urban Des Plaines River watershed occurred in 1938, 1948, 1950, 1954, 1957, 1960, 1965, 1972, 1974, 1976, 1979, 1986, 1987, 2000, 2004, and 2013. Despite numerous flood control efforts, the Des Plaines River remains one of the most flood-prone waterways in the region. Two floods (September-October 1986 and August 1987) caused more than $100 million in damage to more than 10,000 residential, commercial or public structures. More than 15,000 residents were evacuated during the 1986 flood. Communities along the Des Plaines River that were affected include Gurnee, Lincolnshire, and Wadsworth, as well as the unincorporated areas of Cook County. Flooding in these communities has impacted the transportation network, homes, commercial/industrial sites, public/municipal sites, streets, golf courses, cemeteries, and recreation/open space areas. According to the National Weather Service, the Des Plaines River near Gurnee has a flood stage of 7 feet; at 11 feet the flood category becomes major. Major floods occurred in 1986 and 2004, with crests at 11.95 feet and 11.76 feet, respectively.

West Branch of the DuPage River

Flooding is frequent and severe along the DuPage River, West Branch in Hanover Park. Rapid urbanization in the drainage areas since 1960 has led to increasing stormwater runoff. At the same time, development in the floodplain in the north portion of the village has obstructed overbank flows during floods, raising water-surface elevations in the vicinity and generally worsening the damage. A major storm in October 1954 caused record flooding in the Chicago area, but Hanover Park was sparsely developed at that time. Other significant floods occurred on June 10, 1967, and on September 6, 1970, when an estimated 2.7 inches of rain fell in the drainage area. Peak discharges at the crest-stage gauge at Lake Street on the river reached 570 cfs in 1967 and 450 cfs in 1970. Damage in Hanover Park resulting from the 1970 flood was estimated at $470,000. In addition to flooding due to major storms, more frequent flooding occurs due to high waters in the river blocking storm sewer outlets and causing basement flooding. Data from the recording gauge on the river near North Avenue in the Village of Bartlett indicated that the June 1967 flood had a 1-percent-annual-chance probability.

Little Calumet River

The Little Calumet River in Calumet City, Illinois, has had severe flooding in June 1981, December 1982, November 1990, and July 1996. The highest flood of record occurred in November 1990 when the river reached a stage between 20 and 21 feet. This flood was below the 1-percent-annual-chance probability.

Flagg Creek

The most severe floods on Flagg Creek near Indian Head Park, and their approximate recurrence intervals can be documented from records for the USGS Flag Creek at Willow Springs gauge downstream of Indian Head Park. This gauge (No. 05533000, drainage area 16.5 square miles) was established in 1949.

A peak stream flow of 2,680 cfs with a river stage of 13.814 feet was observed on September 14, 1961. This peak was approached again on April 18, 2013, with a flow of 2,610 cfs and a stage of 10.57 feet.

Flint Creek

Flint Creek Tributary, in the Village of Barrington, can flood upstream of bridges, apparently due to restrictive culverts. The storm on December 2-3, 1982, resulted in Elm Road being covered by approximately 18 inches of water.

Midlothian Creek

One of the earliest recorded floods in Cook County occurred on Midlothian Creek in April 1947; it had a 2-percent-annual-chance recurrence probability. Other major floods of Midlothian Creek in the City of

Blue Island occurred in April 1973, October 1954, July 1957, September 1961, and July 1996. A peak stream flow of 627 cfs with a river stage of 7.67 feet was observed on April 22, 1973.

Salt Creek

Salt Creek, as measured by USGS Gauge No. 05531500, located approximately 4 miles upstream of the Village of Broadview at Western Springs, had a peak discharge for the period of record of 3,980 cfs on April 18, 2013. River stage for this event was 10.65 feet. Flooding on Salt Creek in the Village of Broadview creates backwater in the lower reaches of Addison Creek. Flooding on Salt Creek and other streams in the Village of Schaumburg is principally caused by inadequate sewers. The most common problem during a major storm is street flooding.

Stoney Creek (East)

Stony Creek (East) is formed by a confluence of local, natural, and sewered tributaries. Although low-lying areas in the vicinity of the channel in the Village of Alsip have a record of extensive flooding, the channel has been the recipient of varied state, county, and local improvements that have reduced most of the flooding problems. There are two prominent areas along Stony Creek (East) that still present a flood hazard in Alsip: one at Central Park Avenue, at the confluence of Merrionette Park Ditch, and the other downstream of Cicero Avenue. Major damage during these floods can be attributed to basement flooding by flow through windows or doors, wall seepage, and backup of combined sewers. The worst flood on record in Alsip prior to 1965 was in October 1954, which was estimated to be a 2-percent-annual-chance flood. Other floods of significance occurred in July 1957 and September 1961. All of these floods affected Stony Creek (East) and Merrionette Park Ditch. In 1977, improvements to the flow in the creek and discharge into the Calumet Sag Channel were completed.

Stormwater/Urban Drainage Flooding

Stormwater/urban drainage flooding occurs when severe storms cause runoff that exceeds the design capacity of the systems in place to convey stormwater to a receiving body. Stormwater issues are usually exacerbated by increased impervious area in a watershed, which decreases the watershed's ability to absorb rainfall, increasing the runoff. Unmanaged, stormwater runoff from new development throughout a watershed can affect floodplains by causing more frequent flooding, greater flood depths, and longer- lasting floods. As forests, fields, and farms are covered by impermeable surfaces, such as streets, rooftops, and parking lots, more of the rain runs off, and it runs off at a faster rate. When an area is urbanized, the rate and volume of runoff can increase five-fold or more. This problem is compounded by the following factors:

- Changes in the surface drainage system (stormwater runoff travels faster on streets and in storm drains than it did under predevelopment conditions)
- Armoring of channels, which can increase the velocity of flows and remove the habitat that is essential to many riparian species
- Sediment from disturbed ground, which can reduce the capacity of the drainage system, adversely affect water quality, and destroy habitat for many species of insects and the fish that depend on them.

People, buildings, and infrastructure are affected by these changed conditions. Communities are affected by development that takes place upstream in their watershed, and the community's own development, in turn, can have an impact on downstream communities. Consequently, watershed-based agencies have been created around the country to address these issues on a broader scale. Communities are encouraged to cooperate with adjacent communities to manage stormwater.

The frequency and the magnitude of stormwater/urban drainage flooding in Cook County dictated the assignment of stormwater management within the County to a single entity—the Metropolitan Water Reclamation District of Greater Chicago. The District's mission is to protect the health and safety of the public in its service area, protect the quality of the water supply source (Lake Michigan), improve the quality of water in watercourses in its service area, protect businesses and homes from flood damage, and manage water as a vital resource for its service area. The District has developed a stormwater management program that includes a detailed watershed plan (DWP) for the six principal watersheds that make up Cook County (see figures below). The purpose of each DWP was to identify the stormwater-related problems in a watershed, develop regional alternative solutions to those problems, and then evaluate the regional alternatives to determine the most effective alternative solutions in addressing the watershed's needs. Each DWP contains a summary of the watershed's areas of concern and a listing of proposed regional capital improvement projects to address those concerns. After DWPs were completed, the District again solicited information for its Phase II Program from each municipality, township and regional agency having jurisdiction in Cook County. Summary descriptions of each watershed are provided.

The Calumet-Sag Channel Watershed

The Calumet-Sag Channel Watershed in southwestern Cook County drains an area of 151 square miles that includes 27 communities. The watershed area north of the Calumet-Sag Channel is heavily developed and characterized by low relief. It is drained principally by the East and West branches of Stony Creek, which both discharge into the Calumet-Sag Channel.

Several smaller streams discharge westward into the I&M Canal or southward into the Calumet-Sag Channel. The watershed area south of the Calumet-Sag Channel is less intensely developed and characterized by greater topographic relief. Spring Creek, Long Run Creek, and Marley Creek all drain southwest into Will County and are tributary to Hickory Creek, which drains to the Lower Des Plaines River. These streams are included in the scope of the Calumet-Sag Channel DWP, along with tributaries that flow north to the Calumet-Sag Channel and several tributaries that flow west to the I&M Canal.

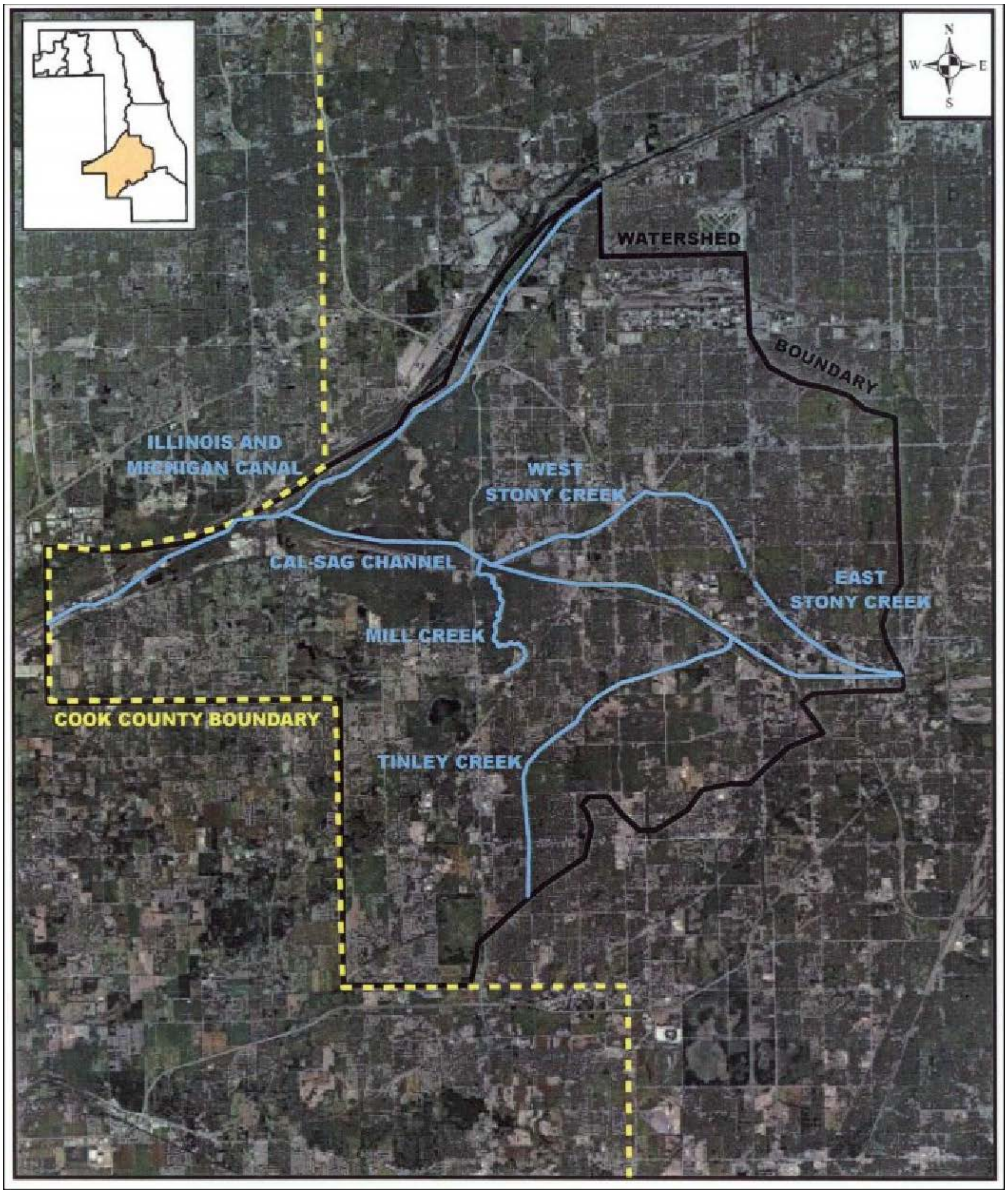


Figure: Calumet-Sag Channel Watershed (Cook County Stormwater Management Plan, 2014)

The Little Calumet River Watershed

The Little Calumet River Watershed is predominantly in the southeast portion of Cook County and has a total area of 264.6 square miles: 159.6 square miles in Cook County, 61.4 square miles in Will County, and 43.6 square miles in Lake County, Indiana. The watershed is bounded on the north by Blue Island, on the south by Monee, on the west by Tinley Park, and on the east by Gary, Indiana. The watershed includes nine sub watersheds: Butterfield Creek, Cady Marsh Ditch, Calumet Union Drainage Ditch, Deer Creek, Little Calumet River, Midlothian Creek, North Creek, Plum Creek/Hart Ditch, and Thorn Creek. The predominant land use in the watershed (Cook and Will Counties, Illinois) is residential (35 percent).

Approximately 20 percent of the watershed is undeveloped land (agriculture and vacant land) and 28 percent is classified as open space (parks, cemeteries, golf courses, wetlands, etc.). The remaining land is mostly classified as commercial, industrial, and institutional. Locations with historical flooding and stream bank erosion problems on regional waterways exist throughout the watershed.

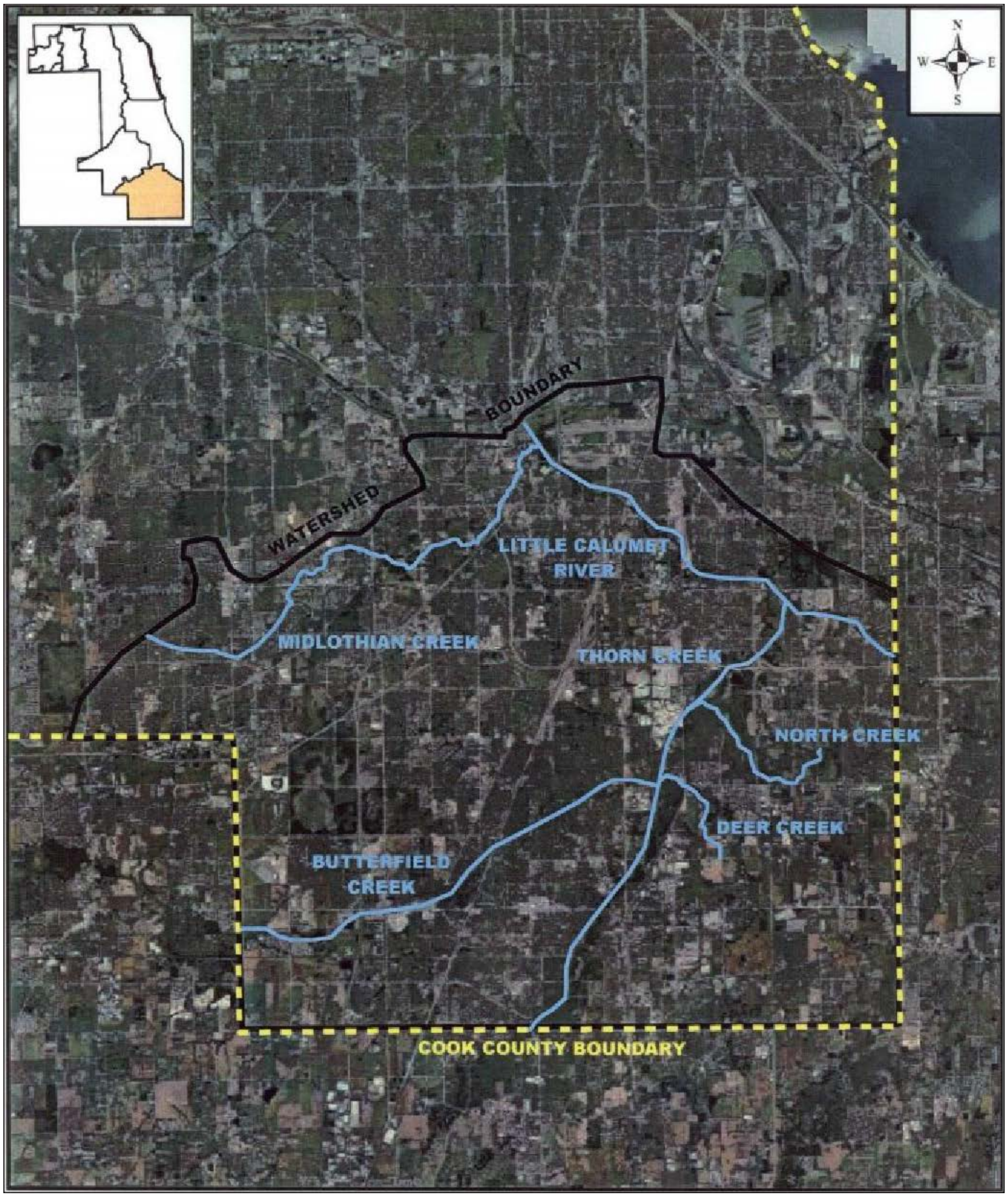


Figure: Little Calumet River Watershed (Cook County Stormwater Management Plan, 2014)

Lower Des Plaines River Watershed

The Des Plaines River Watershed is located in portions of Racine and Kenosha Counties in Wisconsin and Lake, Cook, DuPage, and Will Counties in Illinois. The majority of the watershed is an urban developed area within the Chicago metropolitan area, with most remaining agricultural lands in Lake and Will Counties. Approximately 680 square miles of the watershed area is a tributary to the Des Plaines River at the Cook-Will County border.

Tributary sub watersheds within the Lower Des Plaines River Watershed study area include 67th Street Ditch, Addison Creek, Buffalo Creek, Chicago Sanitary and Ship Canal, Crystal Creek, Des Plaines River Main Stem, Des Plaines River Tributary A, East Avenue Ditch, Farmers-Prairie Creek, Feehanville Ditch, Flagg Creek, Golf Course Tributary, McDonald Creek, Lower Salt Creek, Silver Creek, Weller Creek, and Willow Creek. The tributary sub watersheds are generally on the west side of the Lower Des Plaines River and flow east toward the Lower Des Plaines River main stem, except for the Farmers-Prairie Creek and Golf Course Tributary Sub watersheds, which are on the east side of the Lower Des Plaines River Main Stem. Locations with historical flooding and streambank erosion problems on regional waterways exist throughout the watershed.

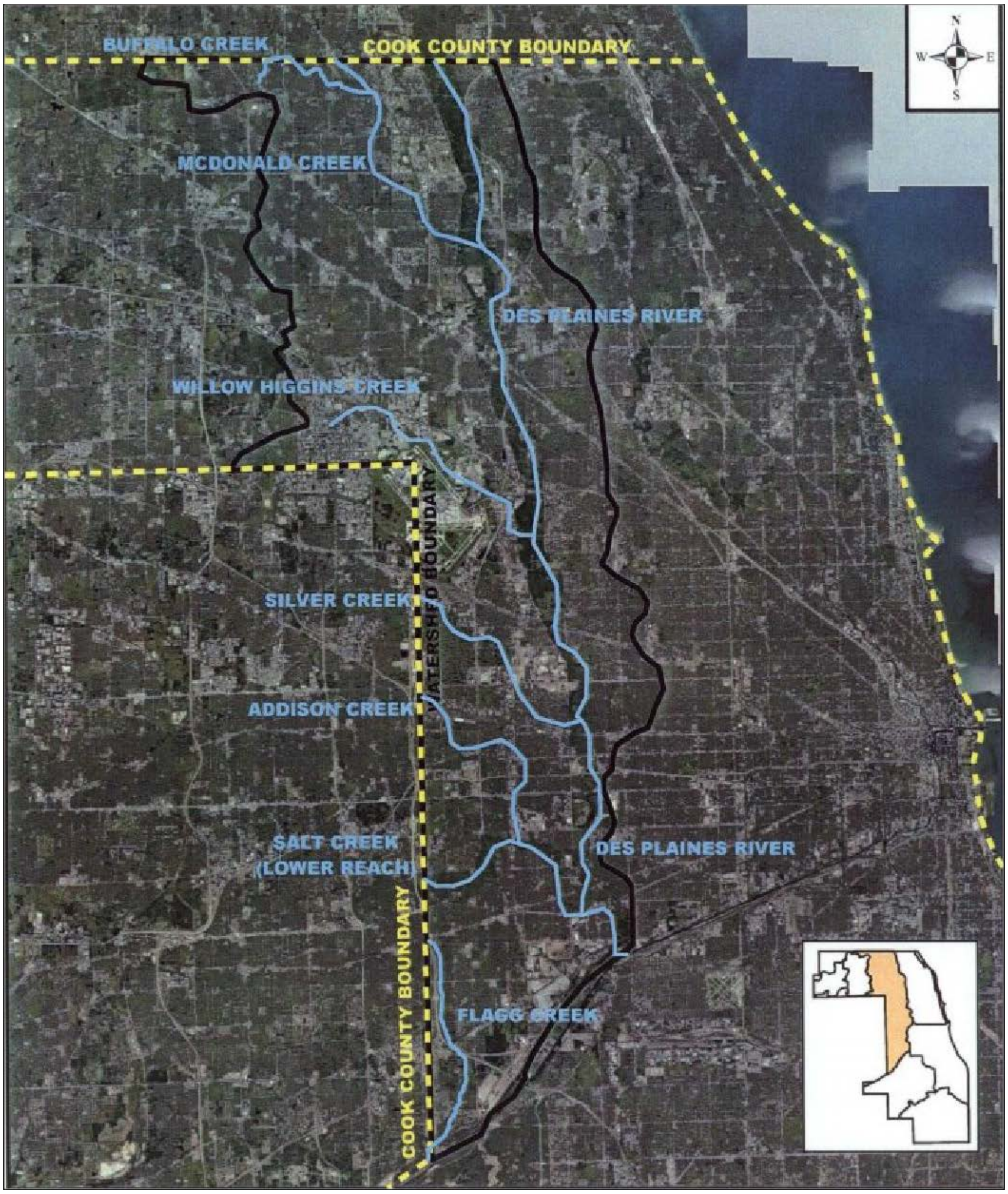


Figure: Lower Des Plaines River Watershed (Cook County Stormwater Management Plan, 2014)

Chicago River, North Branch Watershed

The Chicago River, North Branch watershed is located in northeastern Cook County. The headwaters of the three major tributaries—the West Fork, the Middle Fork, and the Skokie River—are located in Lake County. These tributaries flow south and combine with the Chicago River, North Branch at two separate confluence points. Another tributary, the NSC, enters the system near Albany Avenue in Chicago. Twenty municipalities are located entirely, or in part, in the watershed, and the entire watershed covers 141 square miles. The downstream limit of the Chicago River, North Branch is at the confluence with the Chicago River, South Branch near West Lake Street. This reach has been widened and dredged, with widths up to 300 feet and depths of 10 to 15 feet. For the next 7 miles upstream to the North Branch Dam, the river is about 90 feet wide with a depth of 10 feet. The Chicago River, North Branch watershed area is a heavily urbanized area, characterized by low relief, with small portions of forest preserve and park areas. Locations with historical flooding and stream bank erosion problems on regional waterways exist throughout the watershed.

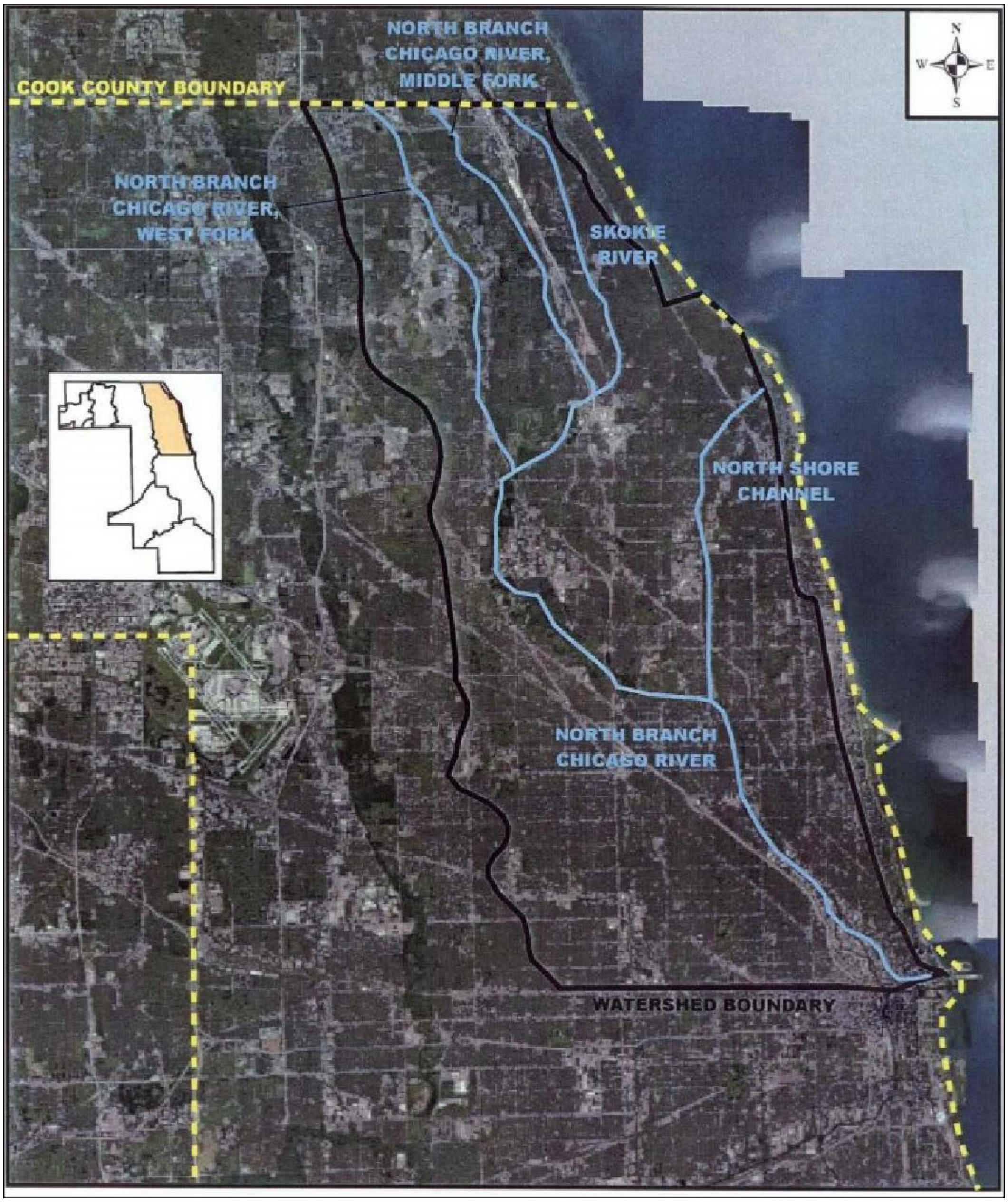


Figure: Chicago River, North Branch, Watershed (Cook County Stormwater Management Plan, 2014)

Poplar Creek Watershed

The Poplar Creek Watershed study area covers 83.5 square miles in northwestern Cook County and includes the Cook County portions of the Poplar Creek, Flint Creek, Spring Creek, Brewster Creek, and West Branch DuPage River watersheds. The District has established boundaries of the Poplar Creek Watershed study area for purposes of its stormwater management program. The main stem of Poplar Creek has six major tributaries: Tributary A, Poplar Creek East Branch, Poplar Creek Schaumburg Branch, Railroad Tributary, Poplar Creek South Branch, and Lord's Park Tributary. Flint Creek Tributary is tributary to Flint Creek, exiting Cook County upstream of its confluence with Flint Creek. Locations with historical flooding and stream bank erosion problems on regional waterways exist throughout the watershed.

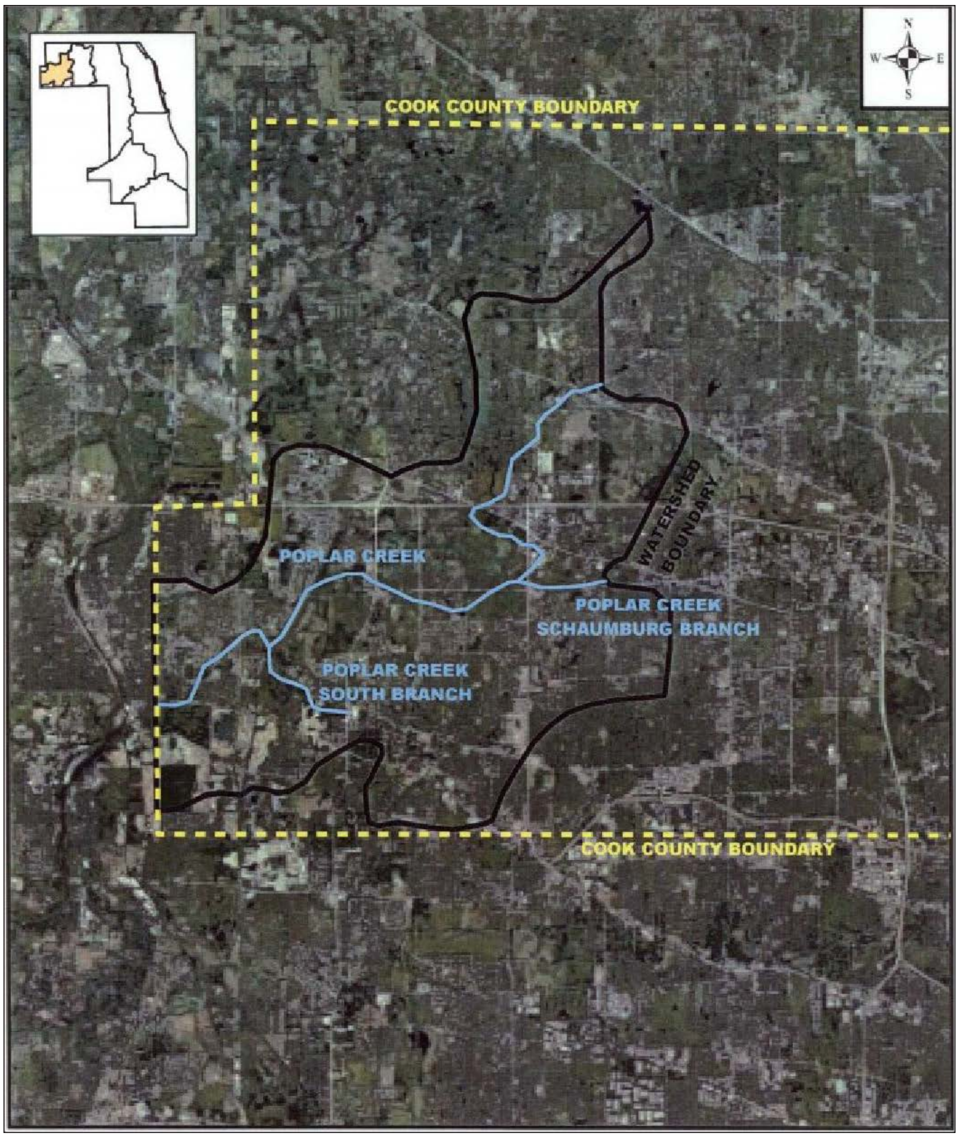


Figure: Poplar Creek Watershed (Cook County Stormwater Management Plan, 2014)

Upper Salt Creek Watershed

Salt Creek is divided into two hydrologic parts by Busse Woods Dam: Upper Salt Creek and Lower Salt Creek. In the DWP, "Upper Salt Creek" refers to the Salt Creek stream reaches and tributaries upstream of the DuPage County/Cook County border. The total watershed area is 55 square miles. Land use is predominantly residential, with concentrations of commercial, light manufacturing and trucking facilities. Several large forest preserves are also present, notably Ned Brown Preserve (also known as Busse Woods), Paul Douglas Forest Preserve and Deer Grove Forest Preserve.

The watershed is composed of three sub watersheds: the Arlington Heights branch, the Main Stem, and the West Branch. The Arlington Heights Branch sub watershed covers the north and northeast portion of the watershed and flows directly into the main stem upstream of Algonquin Road in the City of Rolling Meadows. The West Branch sub watershed covers the southwest portion of the watershed and joins the main stem at the Busse Woods Reservoir. Locations with historical flooding and stream bank erosion problems on regional waterways exist throughout the watershed.

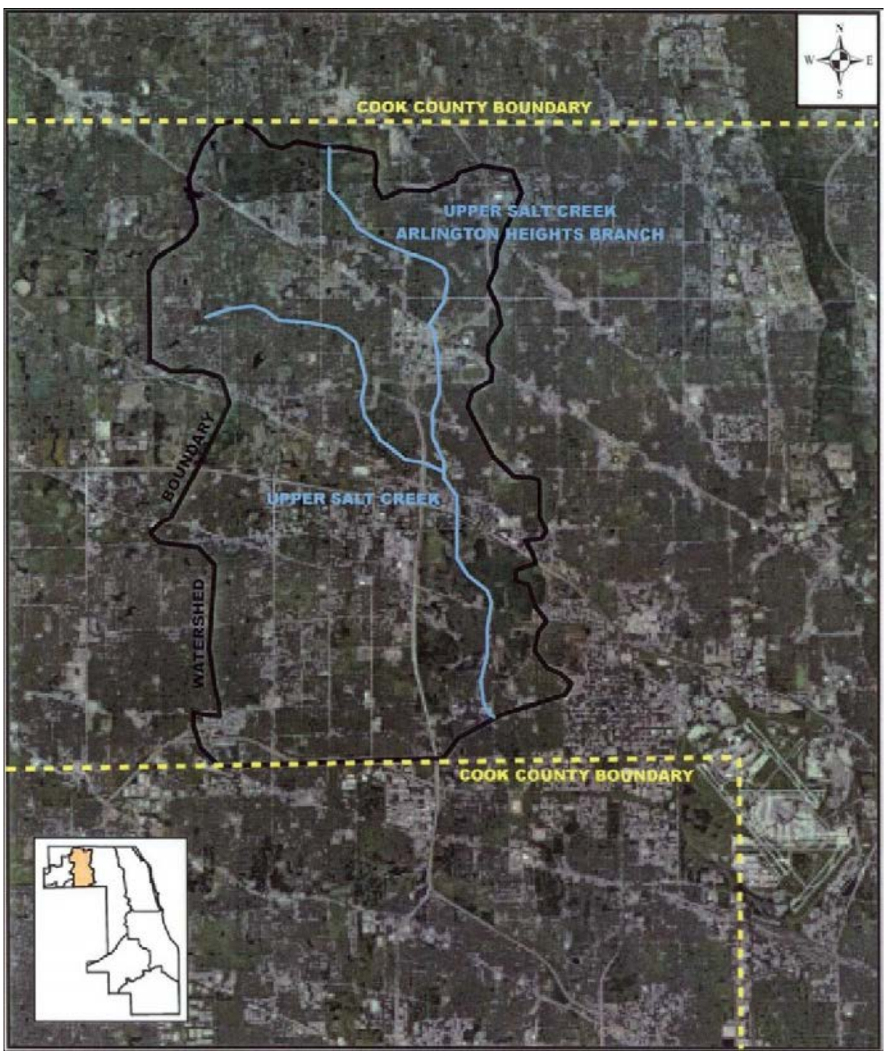


Figure: Upper Salt Creek Watershed (Cook County Stormwater Management Plan, 2014)

Combined Sewer Area

The combined sewer area is the conglomeration of all combined sewer areas within Cook County, rather than a geographical feature of the county as are the six watersheds listed above. The combined sewer area encompasses a significant portion of the City of Chicago and overlaps areas of four of the six primary watersheds listed above. Stormwater/urban drainage flooding issues are prevalent in this area, as indicated by a large number of individual assistance claims paid following the flooding in 2013 (see *Figure: Individual Assistance Claims for DR-4116*).

Overview of Existing Problems

During the development of the DWPs and Phase II Program, information on existing problem areas were solicited from Watershed Planning Council members, municipalities, townships, federal and state agencies, and other stakeholders. Responses were used to help identify locations of concern and where field assessment, surveys, and modeling were needed to support alternative solutions. A review of these identified problems found a consistent set of flooding issues across the watersheds:

- Undersized or restrictive sewers or culverts
- Undersized ditches
- Undersized detention basins
- Poorly managed stormwater facilities
  - Clogged sewers or culverts
  - Overgrowth in drainage ditches
  - Overgrowth at outfalls of storm sewers
- Overbank flooding
- Erosion
- Ponding or flooding in streets, alleys, parking lots, or yards
- Structural flooding from ponding or sheet flow
- No detention because the area was developed before detention requirements
- Basement backups and sanitary backups
- Sump pumps connected to sanitary sewers
- Depressional areas with no overland drainage routes
- Lack of inlets in low-lying areas
- No storm sewers or ditches.

Past Events

Floods in Cook County reported by NCDC - NOAA:

- 231 Flood, Flash Flood, Coastal Flood, or Heavy Rain weather events were reported between 1996 and 2018, an average of approximately 10 events per year.
    - All recorded events totaled $506,040,000 in property damage and 4 deaths.
        - Flash Flooding accounted for 112 events resulting in a total of $498,510,000 in property damage and indicating an average of approximately 5 flash flooding events per year.
        - Flooding accounted for 97 events resulting in a total of $7,200,000 in property damage and indicating an average of approximately 4 events each year.
        - Heavy Rain accounted for 18 events resulting in a total of resulted in $330,000 in property damage, indicating an average of approximately 1 event every year.
        - Coastal Flooding accounted for only one event (November 26, 2018) and was connected to a winter storm producing heavy wet snow. While property damage amount was noted as zero, significant damage did happen, including numerous trees and power lines were blown down with over 80 trees blown down in Chicago. Some of the trees fell onto houses and cars and some were blocking streets. At the height of the storm an estimated 361,000 customers lost power. More than 1,300 flights were canceled at O'Hare and Midway Airports. Hundreds of schools were closed and numerous car accidents were reported. Along the Lake Michigan shore, the bike path north of Downtown Chicago was flooded with several feet of water. High waves also caused flooding in the rightmost lane of northbound Lakeshore Drive which was closed.
- A more detailed spreadsheet can be accessed through this link.

TABLE:

FLOOD, FLASH FLOOD, HEAVY RAIN, AND COASTAL FLOOD EVENTS IN COOK COUNTY, ILLINOIS FROM 1996-2019

Source: www.ncdc.noaa.gov/stormevents

Number of County/Zone areas affected:	2
Number of Days with Event	124
Number of Days with Event	3
Number of Days with Event and Death or Injury	3
Number of Days with Event and Property Damage	33
Number of Days with Event and Crop Damage	0
Number of Event Types reported	4

Flood events of historical significance occurred in the Cook County region in 1849, 1855, 1885, 1938, 1952, 1954, 1957, 1961, 1973, 1979, 1986, 1987, 1996, 2001, 2004, 2008, 2010, 2011 and 2013.

Most record-setting flood stages and discharges in the region have been recorded since 1948. Table 10-3 summarizes flood events in the planning area since 1972. Since 1972, 13 presidential-declared flood events in the County have caused in excess of $628.5 million in property damage.

TABLE: HISTORY OF FLOOD EVENTS

Date	Declaration #	Type of event	Estimated Damage
4/26/2013	DR-4116	Severe Storms, Straight-Line Winds and Flooding	N/A
7/23/2011	- -	Flooding	$30 million *a*
7/19/2010	DR-1935	Severe Storms and Flooding	$253 million *a*
9/13/2008	DR-1800	Severe Storms and Flooding	$61 million *a*
2/17/2008	- -	Flash Flood	In excess of $2 million *b*
8/20/2007	DR-1729	Severe Storms and Flooding	N/A
4/17/2006	- -	Flash Flood	In excess of $1.5 million *b*
Jul-Aug 2003	- -	Flash Floods	In excess of $7 million *b*
8/02/2001	- -	Flash Flood	In excess of $37 million *b*
8/16/1997	DR-1188	Flooding	
7/17/1996	DR-1129	Flooding	In excess of $44 million *b*
4/13/1993	DR-997	Flooding, Severe Storms	In excess of $3 million *a*
8/13/1987	DR-798	Severe Storms, Flooding	In excess of $90.2 million *a*
9/21/1986	DR-776	Severe Storms, Flooding	In excess of $100 million *c*
6/30/1981	DR-643	Severe Storms, Tornados, Flooding	N/A
6/18/1976	DR-509	Severe Storms, Tornados, Flooding	N/A
4/26/1973	DR-373	Severe Storms, Flooding	N/A
9/4/1972	DR-351	Severe Storms, Flooding	N/A

a. Data from SHELDUS
b. Data from National Climatic Data Center
c. Data from FEMA Flood Insurance Study N/A = Information is not available

Historical Stormwater/Urban Drainage Flooding

Cook County has an extensive history of stormwater/urban drainage flooding that is not reflected in *Table: History of Flood Events* or in the flood hazard mapping used for this risk assessment. In the past 20 years, stormwater/urban drainage flooding has become the principal cause of flood losses in the Cook County planning area. The largest disasters in Cook County have been stormwater/urban drainage flooding events. After the flooding in August 2010, FEMA provided more than $435 million in disaster recovery, response, and mitigation in Cook and DuPage Counties. More than 75 percent of this went to individual homeowners, most of whom suffered sewer backups and basement flooding caused by stormwater/urban drainage flooding. In 2013, (DR-4116), a similar percentage of the claims for individual assistance (see *Figure: Individual Assistance Claims for DR-4116*) were for stormwater/urban drainage flooding issues

In 2013, the Center for Neighborhood Technology, an organization promoting sustainability in urban communities, performed a case study of Cook County stormwater/urban drainage flooding by looking at significant past flood events in the region. The study analyzed claims data for flood damage and sewer and drain backups in Cook County from 2007 to 2011, aggregated by ZIP code. Data was collected from private insurance companies, the NFIP, and FEMA's Disaster Relief Assistance Program. It also included 115 responses to an online survey of Cook County property owners who had experienced property flooding in the previous five years. Key findings of this study include the following:

- Stormwater/urban drainage flooding in Cook County is chronic and systemic, resulting in damage that is widespread, repetitive and costly. The analysis identified 176,980 claims made across 96 percent of Cook County ZIP codes, including claims in each of the five years studied. This is the equivalent of one in six properties in the County making a claim. Average payouts per claim were $3,733 across all types of claims, with total claims amounting to $660 million over the five years studied. Seventy percent of online survey respondents estimated that they had experienced flooding three or more times in the five years; 20 percent had experienced flooding 10 or more times.
- Eighty-four percent of online survey respondents reported that they suffered stress and 13 percent reported that they suffered ill health. Forty-one percent lost the use of part of their property, 63 percent lost valuables, and 74 percent lost hours of work to clean up.
- No correlation was found between damage payouts and mapped floodplains; some of the Cook County ZIP codes with the highest concentration of payouts (number and value) had no land area within federally designated floodplains.
- Claims were made across income groups, but 67 percent of the 27 ZIP codes with the highest concentrations of damage have below-average household income for Cook County.
- Flood insurance is not carrying the burden of damage payouts: claims via the NFIP—the only formal flood insurance program—represent only 10 percent of total payouts.

- Seventy-six percent of online survey respondents had invested in measures to prevent future flooding, such as downspout disconnection and pumps, but only 6 percent believed that the investment had solved their flooding problem.

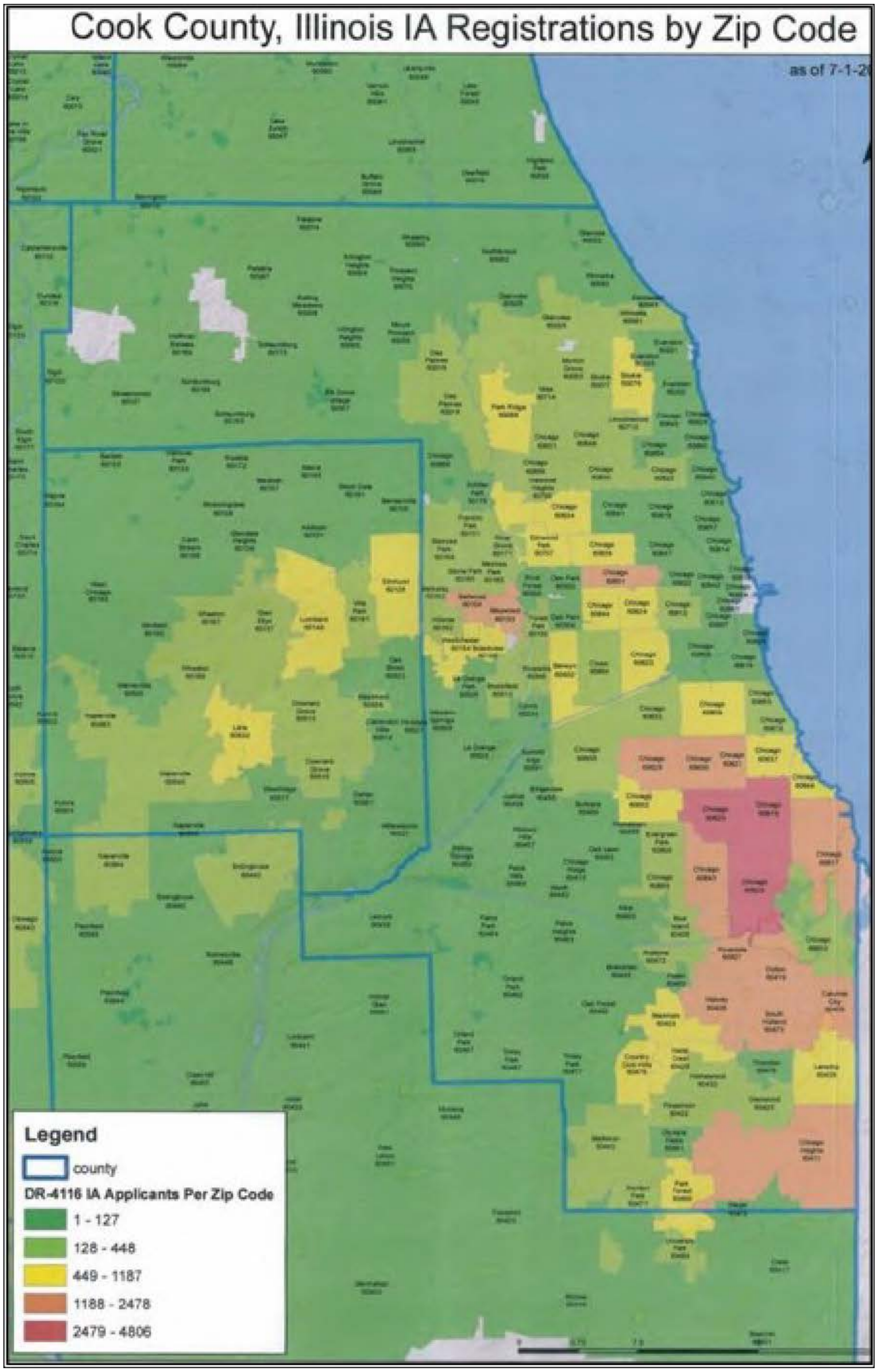


Figure: Individual Assistance Claims for DR-4116

Location

Approximately 8 percent of the County is located within mapped 1-percent-annual-chance floodplains. Flooding in Cook County has been documented by gauge records, high water marks, damage surveys, and personal accounts. This documentation was the basis for the August 19, 2008, Flood Insurance Study that is incorporated in the currently effective FIRMs. The FIRMs are the most detailed and consistent data source available for determining flood extent. The 2008 Flood Insurance Study is the sole source of data used in this risk assessment to map the extent and location of the flood hazard. The inundation mapping developed by MWRD for the DWPs was not used for the HAZUS-MH analysis of potential flood damage. The DWP computer modeling used to develop the District's inundation maps was not available in a format that could be used in the HAZUS-MH model. Other information provided by MWRD was used in the overall risk assessment for floods.

Future updates to this plan should look into ways to effectively map the extent and location of stormwater/urban drainage flooding. This could include recording of high-water marks for future events or tracking of damage data similar to the Center for Neighborhood Technology study described in *Past Events*. The Urban Flooding Susceptibility Index Chart (see Extent) also provides some indication of where urban flooding is an issue.

Additional flood risk areas in Cook County have been mapped by MWRD during the development of the DWPs. These areas include small tributaries not previously mapped by FEMA and more detailed floodplain mapping in areas with approximate studies done by FEMA.

There are also areas outside the SFHA that are subject to stormwater/urban drainage flooding. In general, these are areas where the topography is so flat that the runoff from major storms cannot be sufficiently conveyed to a channel or a sewer. While it is possible to map this type of flood risk, it is very costly and is usually done as part of a feasibility design for capital projects. Without mapping, assessment of this type of risk is limited. Mapped below is the annual average precipitation index for Cook County.

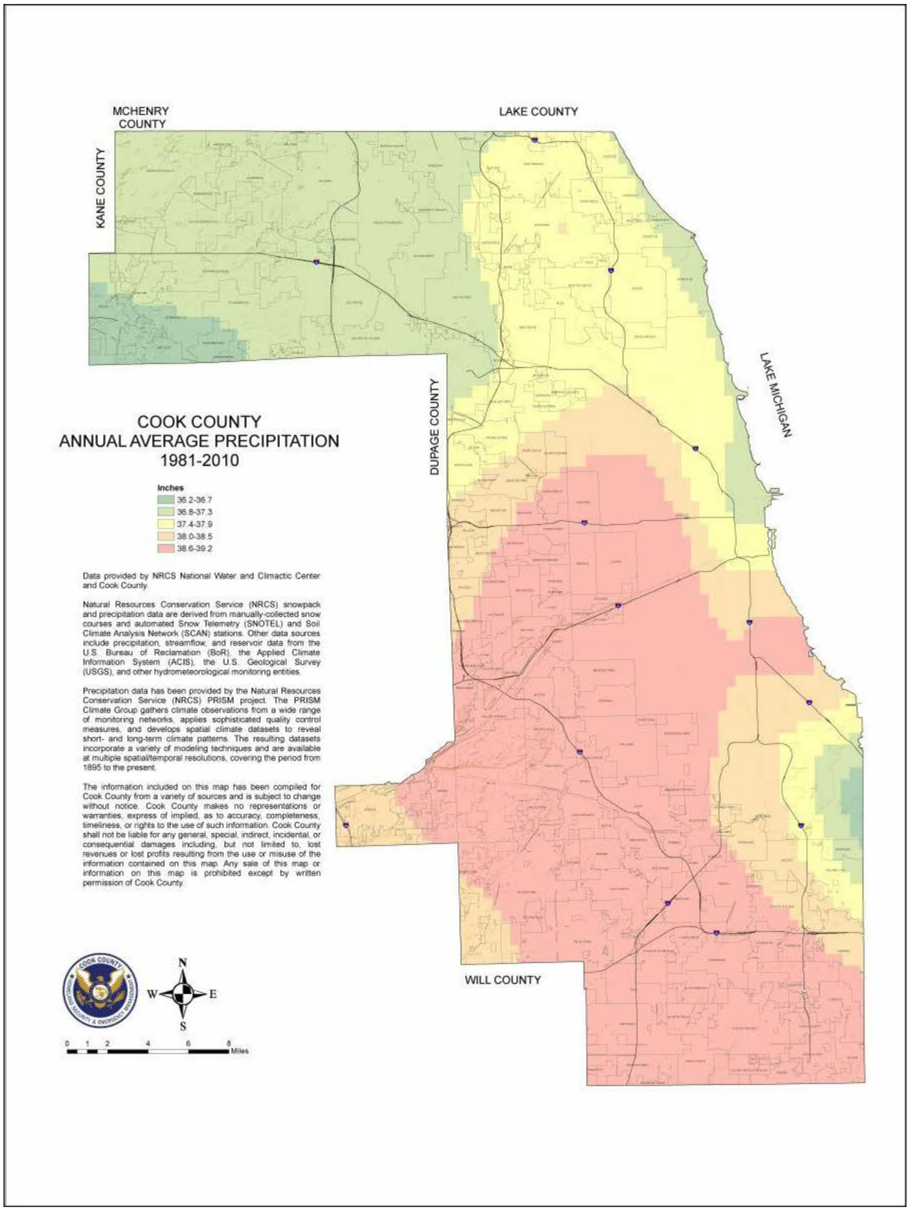


Figure: Cook County Annual Average Precipitation 1981-2010

Frequency and Future Hazard Events

As previously indicated, Cook County experiences an average of 10 flooding events every year. Certain portions of the County annually experience nuisance flooding related to drainage issues and these events can occur in any season. Large floods that can cause property damage typically occur every three to seven years. It is expected that these hazard events will only increase in frequency in the future, as well, due to the widespread effects of climate change.

Extent

The Hazus-MH flood model is designed to generate a flood depth grid and flood boundary polygon by deriving hydrologic and hydraulic information based on user-provided elevation data or by incorporating selected output from other flood models. Hazus-MH also has the ability to clip a Digital Elevation Model (DEM) with a user-provided flood boundary, thus creating a flood depth grid. For Cook County, Hazus-MH was used to extract flood depth by clipping the DEM with the DFIRMs Base Flood Elevation (BFE) boundary. The BFE is defined as the area that has a 1% chance of flooding in any given year.

Flood hazard scenarios were modeled using GIS analysis and Hazus-MH. The flood hazard modeling was based on historical occurrences and current threats. Existing flood maps were used to identify the areas of study. These digital files, although not official FIRMs, provided the boundary which was the basis for this analysis. Planning team input and a review of historical information provided additional information on specific flood events.

Table: Flooding Hazard Extent

Hazard Type	Affected Jurisdictions	Extent (based on historical events)		Comments
		Minimum	Maximum	
Flood (Riverine)	Jurisdictions near rivers, streams, and waterways	0-feet	See Peak Discharge Table below	
Flood (Flash)	County-wide	0 inches of rain	9.35 inches (24-hour)	August 13-14, 1987

The principal factors affecting flood damage are flood depth and velocity. The deeper and faster flood flows become, the more damage they can cause. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. This is especially true when a channel migrates over a broad floodplain, redirecting high-velocity flows and transporting debris and sediment. Flood severity is often evaluated by examining peak discharges; *Table: Summary Of Peak Discharges Within The Planning Area* lists some of the peak flows used by FEMA to map the floodplains of Cook County.

TABLE: SUMMARY OF PEAK DISCHARGES WITHIN THE PLANNING AREA				
Source/Location	**Discharge (cubic feet/second)**			
	10% Annual Chance	**2% Annual Chance**	**1% Annual Chance**	**0.2% Annual Chance**
79th Street Ditch				
At County Line Rd	91	141	165	226
Addison Creek				
At Confluence with Salt Creek	1,727	2,337	2,530	3,070
Approximately 650’ downstream of Tri-state Tollway	517	802	951	1,370
Belaire Creek				
At confluence with Dixie Creek	68	103	119	154
Boca Rio Ditch				
Just downstream of 147th Street	336	490	562	730
Buffalo Creek				
At Elmhurst Rd.	870	1,430	1,680	2,470
At Lake-Cook Road	715	1,187	1,430	2,088
Buffalo Creek Tributary A				
At confluence with Buffalo	370	580	690	940
Creek At Staples Road	0	0	40	110
Butterfield Creek				
At confluence with Thorn	1,720	--	2,740	3,725
Creek At I-57	345		470	540
Butterfield Creek East Branch		--		
At confluence with Thorn Creek	1,000		1,400	1,715
Butterfield Creek Tributary No. 3				
Just upstream of confluence with Butterfield Creek	196	281	317	402
Calumet Sag Channel Tributary A				
At State Route 83	230	365	425	595

Calumet Sag Channel Tributary B At confluence with Calumet Sag Channel	213	411	545	716
Calumet Union Drainage Ditch At Halsted Street At St. Louis Avenue	415 96	746 173	1,024 219	1,460 282
Calumet Union Drainage Ditch Southwest Branch At Central Park Avenue	360	660	920	1,330
Chicago River, North Branch At confluence of North Shore Channel Just upstream of Glenview Road	2,375 1,830	3,600 1,967	4,180 2,361	5,600 2,897
Chicago River, North Branch, Middle Fork At confluence with Skokie River At Lake-Cook Road	418 521	847 879	1,004 1,098	1,479 1,569

Table: Urban Flooding Susceptibility Index Chart

The below chart and map are based on the CMAP-developed urban flood susceptibility index (FSI). This was constructed with data from FEMA, counties, and the City of Chicago collected and put into an address-level database of documented flood locations. This database consisted of 165,000 unique locations, with the majority of these locations experiencing flooding between 2007 and 2017. The index is categorized into 10 risk levels based on the combined frequency ratio scores from the following flood-related factors: Topographic Wetness Index, combined sewer service areas, property elevation compared to nearest Base Flood Elevation, impervious coverage, age of first development, and precipitation variation. 1 is the lowest susceptibility and 10 is the highest.

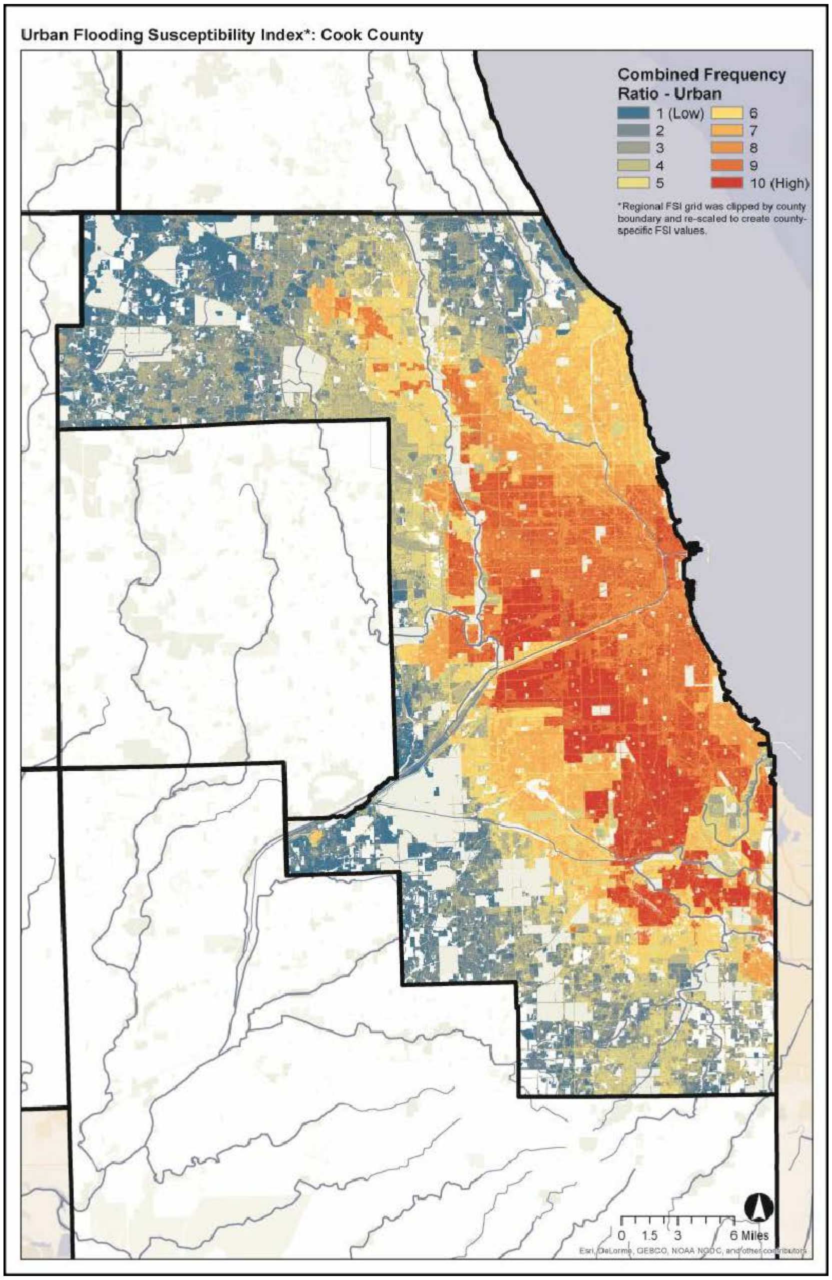
Note: Because depth has not been recorded for incidents of urban flooding, this is considered a data deficiency, and new mitigation actions have been created related to high water markings throughout this plan.

TABLE: URBAN FLOOD SUSCEPTIBILITY CHART			
Jurisdiction	**FSI**	**Jurisdiction**	**FSI**
Alsip	9	Lemont	5
Arlington Heights	7	Lincolnwood	9
Barrington	5	Lynwood	5
Barrington Hills	2	Lyons	10
Bartlett	4	Marionette Park	8
Bedford Park	9	Markham	7
Bellwood	8	Matteson	5
Bensenville	7	Maywood	10
Berkeley	7	McCook	8
Berwyn	10	Melrose Park	9
Blue Island	10	Midlothian	9
Bridgeview	9	Morton Grove	8
Broadview	9	Mount Prospect	8
Brookfield	10	Niles	9
Buffalo Grove	7	Norridge	8
Burbank	9	North Riverside	10
Burnham	8	Northbrook	4
Burr Ridge	N/A	Northfield	3
Calumet Park	10	Northlake	7
Chicago	10	Oak Brook	5
Chicago Heights	7	Oak Forest	7
Chicago Ridge	9	Oak Lawn	9
Cicero	10	Oak Park	10
Country Club Hills	6	Olympia Fields	5
Countryside	6	Orland Park	5

Crestwood	9	Orlando Hills	5
Deer Park	2	Palatine	5
Deerfield	3	Palos Heights	7
Des Plaines	8	Palos Hills	8
Dixmoor	10	Palos Park	4
Dolton	10	Park Forest	7
East Dundee	6	Park Ridge	10
East Hazel Crest	7	Phoenix	10
Elgin	6	Posen	10
Elk Grove Village	7	Prospect Heights	7
Elmhurst	6	Richton Park	5
Elmwood Park	10	River Forest	8
Evanston	8	River Grove	9
Evergreen Park	9	Riverdale	10
Flossmoor	5	Riverside	9
Ford Heights	4	Robbins	7
Forest Park	9	Rolling Meadows	6
Forest View	10	Roselle	5
Franklin Park	9	Rosemont	7
Glencoe	4	Sauk Village	7
Glenview	5	Schaumburg	6
Glenwood	7	Schiller Park	7
Golf	N/A	Skokie	9
Hanover Park	7	South Barrington	2
Harvey	10	South Chicago Heights	7
Harwood Heights	9	South Holland	9
Hazel Crest	8	Steger	3
Hickory Hills	8	Stickney	10
Hillside	7	Stone Park	7
Hinsdale	5	Streamwood	5
Hodgkins	7	Summit	9
Hoffman Estates	4	Thornton	5
Hometown	10	Tinley Park	6
Homewood	7	University Park	3
Indian Head	4	Westchester	7
Inverness	2	Western Springs	9
Justice	8	Wheeling	7
Kenilworth	8	Willow Springs	2
La Grange	9	Wilmette	7
La Grange Park	9	Winnetka	3
Lansing	9	Worth	9

Map: Urban Flooding Susceptibility Index

Below is the map showing the varying jurisdictional FSI throughout Cook County.



Source: [CMAP]

Severity

The principal factors affecting flood damage are flood depth and velocity. The deeper and faster flood flows become, the more damage they can cause. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. This is especially true when a channel migrates over a broad floodplain, redirecting high-velocity flows and transporting debris and sediment. Flood severity is often evaluated by examining peak discharges; *Table: Summary Of Peak Discharges Within The Planning Area* lists some of the peak flows used by FEMA to map the floodplains of Cook County.

TABLE: SUMMARY OF PEAK DISCHARGES WITHIN THE PLANNING AREA				
Source/Location	**Discharge (cubic feet/second)**			
	10% Annual Chance	**2% Annual Chance**	**1% Annual Chance**	**0.2% Annual Chance**
79th Street Ditch				
At County Line Rd	91	141	165	226
Addison Creek				
At Confluence with Salt Creek	1,727	2,337	2,530	3,070
Approximately 650' downstream of Tri-state Tollway	517	802	951	1,370
Belaire Creek				
At confluence with Dixie Creek	68	103	119	154
Boca Rio Ditch				
Just downstream of 147th Street	336	490	562	730
Buffalo Creek				
At Elmhurst Rd.	870	1,430	1,680	2,470
At Lake-Cook Road	715	1,187	1,430	2,088
Buffalo Creek Tributary A				
At confluence with Buffalo	370	580	690	940
Creek At Staples Road	0	0	40	110
Butterfield Creek				
At confluence with Thorn Creek	1,720	--	2,740	3,725
At I-57	345		470	540
Butterfield Creek East Branch		--		
At confluence with Thorn Creek	1,000		1,400	1,715
Butterfield Creek Tributary No. 3				
Just upstream of confluence with Butterfield Creek	196	281	317	402
Calumet Sag Channel Tributary A				
At State Route 83	230	365	425	595
Calumet Sag Channel Tributary B				
At confluence with Calumet Sag Channel	213	411	545	716

Calumet Union Drainage Ditch At Halsted Street At St. Louis Avenue	 415 96	 746 173	 1,024 219	 1,460 282
Calumet Union Drainage Ditch Southwest Branch At Central Park Avenue	 360	 660	 920	 1,330
Chicago River, North Branch At confluence of North Shore Channel Just upstream of Glenview Road	 2,375 1,830	 3,600 1,967	 4,180 2,361	 5,600 2,897
Chicago River, North Branch, Middle Fork At confluence with Skokie River At Lake-Cook Road	 418 521	 847 879	 1,004 1,098	 1,479 1,569
Chicago River, North Branch, West Fork At confluence with Chicago River, North Branch At confluence of Underwriters Tributary	 741 364	 1,295 509	 1,494 593	 2,341 1,199
Crestwood Drainage Ditch West At State Route 83	 242	 343	 384	 500
Crystal Creek At the confluence with the Des Plaines River Approximately 900 feet upstream of Mannheim Road	 333 17	 469 28	 502 34	 590 51
Crystal Creek Tributary At confluence with Crystal Creek Just upstream of confluence of Sexton Ditch	 194 72	 271 83	 321 89	 389 100
Deer Creek At Young Street	 1,195	 1,810	 2,079	 2,800
Des Plaines River At Interstate Route 55 Approximately 1,600 feet downstream of Dundee Road	 6,000 3,727	 7,500 5,367	 8,400 6,018	 9,300 7,511
Dixie Creek At Dixie Highway	 66	 100	 135	 250
DuPage River West Branch At Irving Park Road	 322	 594	 807	 1,150

Farmer's Creek At confluence with Des Plaines River	317	505	643	1,987
Flag Creek At the mouth At 47th Street	1,660 400	2,650 620	3,180 740	4,500 1,020
Grand Calumet River At CSX Transportation	415	460	470	500
Hickory Creek At Harlem Avenue	550	860	1,014	1,400
Higgins Creek At Old Mt. Prospect Road At upstream side of Wille Road	454 450	503 755	730 975	1,666 1,365
Little Calumet River At confluence with Calumet-Sag Channel At Illinois/Indiana State Line	3,090 1,010	4,290 1,250	4,670 1,290	6,110 1,551
Long Run At State Street	1,460	2,300	2,670	3,500
Marley Creek At 179th Street	530	830	976	1,370
McDonald Creek At confluence with the Des Plaines River At Cornell Avenue	535 115	800 129	913 141	1,240 473
McDonald Creek North Branch Just upstream of Windsor Drive	965	1,443	1,630	2,220
McDonald Creek South Branch Upstream of Buffalo Grove Road	902	1,190	1,261	1,502
Midlothian Creek At mouth At 84th Avenue	264 254	495 573	637 728	951 1,078
Midlothian Creek Western Branch At confluence with Midlothian Creek	155	225	255	335
Mill Creek At 119th Street At 131st Street	485	840	1,030	1,510

	242	355	406	535
Mill Creek West Branch At 123rd Street, approximately 1,000 feet east of U.S. Route 45	295	415	469	600
Natalie Creek At Crawford Avenue	187	313	450	763
Navajo Creek At confluence with Calumet-Sag Channel	516	741	836	1,080
North Creek At confluence with Thorn Creek At Wentworth Avenue	722 28	1,127 44	1,332 51	1,891 62
Plum Creek At Steger Road	1,152	1,594	1,800	2,370
Poplar Creek At the mouth At Stover Road	1,085 76	1,709 119	2,010 140	2,794 195
Prairie Creek At Kennedy Drive	137	210	269	1,336
Salt Creek (Lower Reach) At the mouth At Elk Grove Village	1,570 1,653	2,780 2,300	3,400 2,590	4,920 3,350
Salt Creek (Upper Reach) At Golf Road Just upstream of confluence of Salt Creek Tributary B	1,136 69	1,845 130	2,221 169	3,031 256
Salt Creek, Arlington Heights Branch At confluence with Salt Creek (Upper Reach) At Quentin Road	446 57	686 149	818 210	1,174 359
Salt Creek Middle Fork At the mouth	45	82	100	110
Salt Creek South Fork At the mouth	38	47	64	130
Salt Creek West Branch At Interstate Route 290 At Wiley Road	674	1,197	1,505	2,200

	50	94	122	185
Silver Creek At mouth at Des Plaines River At Railroad yard	465 350	712 535	842 640	1,125 850
Skokie River At Willow Road At Lake-Cook Road	429 1,084	1,202 1,559	1,624 1,844	2,197 2,401
Spring Creek At 118th Avenue	108	205	259	396
Stony Creek (East) At confluence with Calumet-Sag Channel At Cicero Avenue	260 50	395 75	459 100	620 150
Stony Creek (West) At the mouth At Norfolk & Western Railway	1,420 935	1,900 1,250	2,100 1,405	2,620 1,720
Third Creek Approximately 2,400 feet upstream of confluence with Deer Creek	98	172	221	325
Thorn Creek At the confluence with the Little Calumet River At Sauk Trail	1,156 525	2,020 880	2,870 1,100	5,450 1,520
Tinley Creek At confluence with Calumet-Sag Channel At 167th Street	1,368 127	1,665 204	1,770 253	2,005 360
Weller Creek Upstream entrance to diversion conduit	789	1,281	1,611	2,683
Willow Creek At confluence with the Des Plaines River Confluence of Willow Creek and Higgins Creek	1,337 1,348	1,670 1,960	1,800 2,206	3,055 3,180

Warning Time

Floods are generally classed as either slow-rise or flash floods. Due to the sequential pattern of meteorological conditions needed to cause serious slow-rise flooding, it is unusual for a slow-rise flood to occur without warning. Slow-rise floods may be preceded by a warning time from several hours, to days, to possibly weeks. Evacuation and sandbagging for a slow-rise flood may lessen flood damage.

Flash floods are more difficult to prepare for, due to the extremely short warning time given, if any. Flash flood warnings usually require evacuation within an hour. However, potential hazard areas can be warned in advanced of potential flash flooding danger.

Each watershed has unique qualities that affect its response to rainfall. Stream gauges are used to monitor stream levels or stages. Data collected from stream gauges are used to develop hydrograph models to help predict potential flood conditions and flood heights. A hydrograph is a graph or chart illustrating stream flow in relation to time (see *Figure: Des Plaines River Hydrograph*).

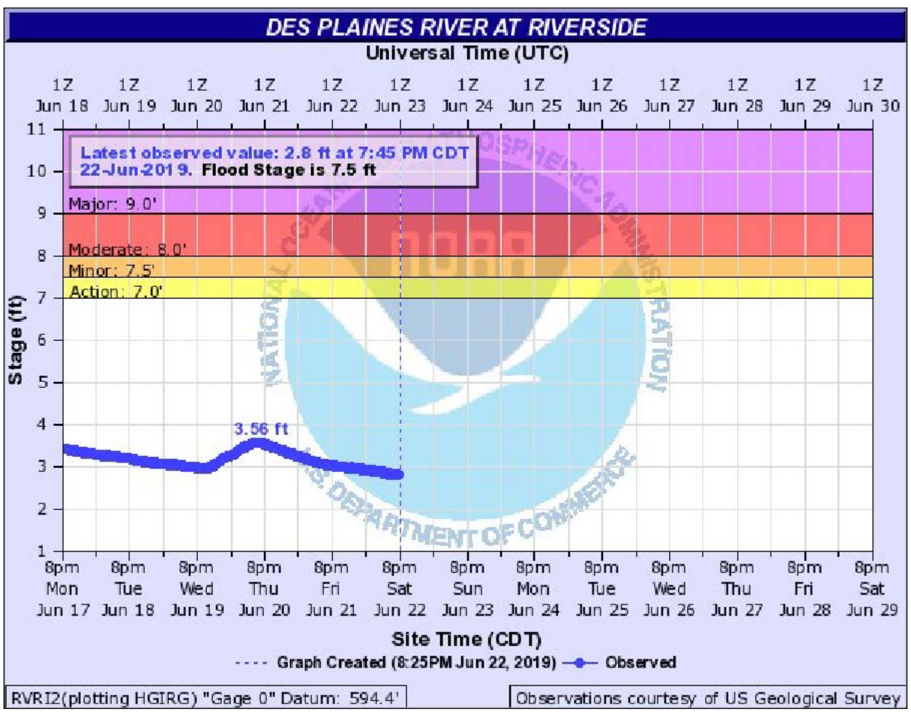


Figure: Des Plaines River Hydrograph

Once rainfall starts falling over a watershed, runoff begins and the stream begins to rise. Water depth in the stream channel (stage of flow) will continue to rise in response to runoff even after rainfall ends. Eventually, the runoff will reach a peak, and the stage of flow will crest. The flooding eventually subsides and the stream flow decreases to a level below flooding stage.

The potential warning time a community has to respond to a flooding threat is a function of the time between the first measurable rainfall and the first occurrence of flooding. The time it takes to recognize a flooding threat reduces the potential warning time that a community has to take actions to protect lives and property. Another element that characterizes a community's flood threat is the length of time floodwaters remain above flood stage.

The Cook County flood threat system consists of a network of precipitation gages throughout the watershed and stream gages at strategic locations that constantly monitor and report stream levels. Stream gage networks and hydrograph models are available on the major streams for Cook County, including the Des Plaines River, Salt Creek, Little Calumet River, Thorn Creek, Plum Creek, and the Chicago River, North Branch. This information is fed into USGS forecasting models that assess the flood threat based on the amount of flow in the stream (measured in cubic feet per second). In addition to this program, data and flood warning information are provided by the National Weather Service.

All of this information is analyzed to evaluate the flood threat and possible evacuation needs. It is monitored by agencies in the planning area such as Cook County DHSEM and Metropolitan Water Reclamation District. Data is used for the operation of flood control facilities in Cook County. The response to warnings from these systems is also dictated by emergency response plans developed by the County and municipalities.

Secondary Hazards

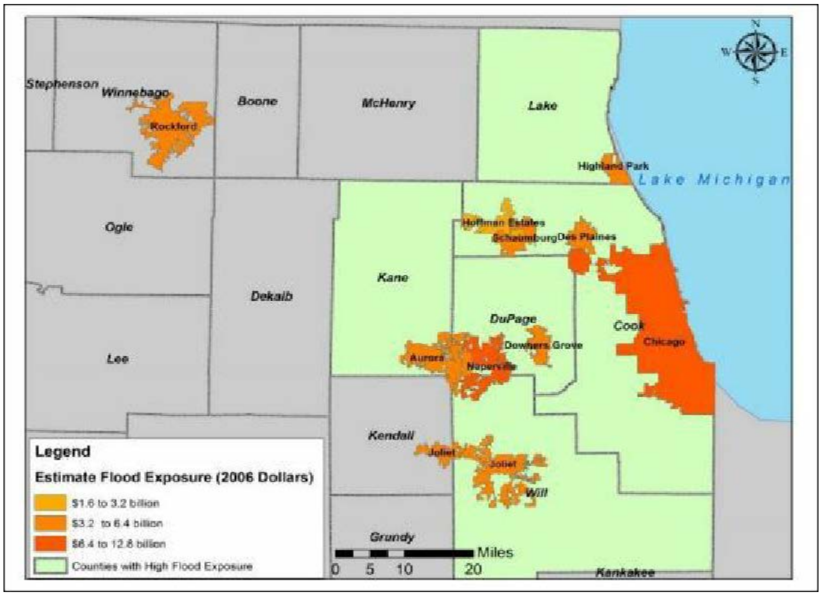
One of the most problematic secondary hazards for flooding is bank erosion, which in some cases can be more harmful than the actual flooding itself. This is especially true in the upper courses of rivers with steep gradients, where floodwaters may pass quickly and without much damage, but scour the banks, edging properties closer to the floodplain or causing them to fall in. This may also happen in areas with soft soils that are prone to erosion. Hazardous materials spills are also a secondary hazard of flooding if storage tanks rupture and spill into streams, rivers, or storm sewers.

Exposure

In 2014, a Level 2, user-defined Hazus-MH protocol was used to assess the risk and vulnerability to flooding in the planning area. The model used census data at the block level and FEMA floodplain data, which has a level of accuracy acceptable for planning purposes. Where possible, the Hazus-MH default data was enhanced using local GIS data from county, state, and federal sources. It should be noted that the focus of this analysis is based on mapped floodplains used as part regulatory floodplain management programs within the planning area. It is acknowledged by this risk assessment that this is not reflective of the total flood risk for the planning area. But until mapping becomes available that allows for assessment of risk in equal planes, that being flood depth/damage correlation, this level of detail shall be considered "best available data" for this initial planning efforts. During the 2019 update, the Planning Team, in coordination with Cook County GIS, reassessed data and the availability of data to determine if a more robust analysis would result in outputs representing a significant change from 2014. Analyses, using the same methodology were conducted, resulting in little to no major changes. It was determined that future analyses need to incorporate municipal-level GIS inputs and further coordination with local GIS databases, as available. New analyses were conducted for jurisdictions participating for the first time in the Cook County MJ-HMP. Future updates to this plan will strive to enhance this assessment with new data as that data becomes available.

The "Illinois Statewide Flood Hazard Assessment" completed by (NHRMG) highlighted that the estimated building-related-flood losses within Illinois' 100-year floodplains are $18.03 billion. Aggregated county-level losses ranged from a minimum of $2.4 million in Ford 2018 Illinois Hazard

Mitigation Plan III-65 County up to $3.4 billion in Cook County. At the jurisdictional level, flood losses ranged from less than a $1,000 in Bonneville up to $950 million in the City of Chicago. As with the flood exposure estimates, the largest flood losses generally were in and around the City of Chicago (IEMA HMP 2018).



Map: Absolute Highest Values of Flood Exposure in 100-year Floodplains, 2013

Source: IEMA HMP 2018

Population

Population counts of those living in the floodplain in the planning area were generated by analyzing census blocks that intersect with the 1-percent-annual-chance and 0.2-percent-annual-chance floodplains identified on FIRMs. Census blocks do not follow the boundaries of the floodplain. Therefore, the methodology used to generate these estimates counted census block groups whose centers are in the floodplain or where the majority of the population most likely lives in or near the floodplain. Hazus-MH estimated the number of buildings within the floodplain in each block, and then estimated the total population by multiplying the number of residential structures by the average Cook County household size of 2.60 persons per household.

Using this approach, it was estimated that the exposed population for the entire county is 64,396 within the 1-percent-annual-chance floodplain (1.22 percent of the total county population) and 140,293 within the 0.2-percent-annual-chance floodplain (2.66 percent of the total). This analysis is based on areas with mapped floodplains; it does not include areas subject to stormwater/urban drainage flooding, which is extensive.

Property

Structures in the Floodplain

Table: Area and Structures in The Floodplain summarizes the area and number of structures in the floodplain. Individual jurisdiction data is shown in jurisdictional annexes in Volume 2. The Hazus-MH model estimated 15,822 structures in the 1-percent-annual-chance floodplain and 37,953 structures in the 0.2-percent-annual-chance floodplain. Most are residential.

Exposed Value

Table: Value of Structures in 1-Percent-Annual-Chance Floodplain and *Table: Value of Structures in 0.2-Percent-Annual-Chance Floodplain* summarize the estimated value of exposed buildings in the planning area, by region. This methodology estimated $21.85 billion worth of building-and-contents exposure to the 1-percent-annual-chance flood, representing 2.37 percent of the total assessed value of the planning area, and $39.4 billion worth of building-and-contents exposure to the 0.2-percent-annual-chance flood, representing 3.30 percent of the total.

TABLE: AREA AND STRUCTURES IN THE FLOODPLAIN

	1-Percent-Annual Chance Floodplain	0.2-Percent-Annual Chance Floodplain
Area in Floodplain (acres)	50,280.14	63,802
Type and Number of Structures in Floodplain		
Residential	14,410	35,489
Commercial	943	1,621
Industrial	461	832
Agriculture	8	11
Religion	0	0
Government	0	0
Education	0	0
Total	**15,822**	**37,953**

TABLE: VALUE OF STRUCTURES IN 1-PERCENT-ANNUAL-CHANCE FLOODPLAIN

	Value Exposed		
Region	**Structure**	**Contents**	**Total**
North	$3,730,217,247	$2,993,476,126	$6,723,693,373
Central	$3,229,076,012	$2,847,459,825	$6,076,535,837
South	$4,843,181,147	$4,205,845,451	$9,049,026,597
Total	**$11,802,474,406**	**$10,046,781,402**	**$21,849,255,807**

TABLE: VALUE OF STRUCTURES IN 0.2-PERCENT-ANNUAL-CHANCE FLOODPLAIN			
	Value Exposed		
Region	**Structure**	**Contents**	**Total**
North	$7,498,405,987	$5,421,925,131	$12,920,331,117
Central	$4,692,899,110	$4,006,376,411	$8,699,275,520
South	$9,736,722,572	$8,089,213,876	$17,825,936,448
Total	**$21,928,027,669**	**$17,517,515,418**	**$39,445,543,085**

Land Use in the Floodplain

Some land uses are more vulnerable to flooding, such as single-family homes, while others are less vulnerable, such as agricultural land or parks. *Table: Land Use Within the Floodplain* shows the existing land use of areas in the 1-percent-annual-chance and 0.2-percent-annual-chance floodplains. More than 55 percent of the area in the 1-percent-annual-chance floodplain is currently open space or in agricultural uses, which are favorable, lower-risk uses for the floodplain. The amount of the floodplain that contains vacant, developable land is estimated to be 10 percent of the total land area in the floodplain.

TABLE: LAND USE WITHIN THE FLOODPLAIN				
Land Use Classification	**1%-Annual-Chance Floodplain**		**0.2%-Annual-Chance Floodplain**	
	Area (acres)	**% of total**	**Area (acres)**	**% of total**
Agricultural	2,499	6.7	3,058	6.1
Commercial	1,318	3.6	2,188	4.4
Education	556	1.5	858	1.7
Industrial	1,335	3.6	2,138	4.3
Institutional	496	1.3	785	1.6
Open Space	18,103	48.8	20,454	40.8
Residential	7,213	19.4	13,656	27.3
Utility/Right of Way	1,882	5.1	2,511	5.0
Vacant	3,710	10.0	4,456	8.9
Total	**37,112**	**100.0**	**50,104**	**100.0**
Source: CMAP, 2005. Categories from the 2005 CMAP land-use inventory were aggregated; categories representing major water features were excluded.				

Critical Facilities and Infrastructure

The tables below summarize the critical facilities and infrastructure in the 1-percent-annual- chance and 0.2-percent-annual-chance floodplains of the planning area. Details are provided in the following sections.

TABLE: CRITICAL FACILITIES IN THE 1-PERCENT-ANNUAL-CHANCE FLOODPLAIN							
Region	**Medical and Health Services**	**Government Function**	**Protective**	**Hazardous Materials**	**Schools**	**Other**	**Total**
North	2	0	2	17	7	6	**34**
Central	3	2	6	11	8	15	**45**
South	4	0	4	21	16	21	**66**
Total	**9**	**2**	**12**	**49**	**31**	**42**	**145**

TABLE: CRITICAL FACILITIES IN THE 0.2-PERCENT-ANNUAL-CHANCE FLOODPLAIN							
Region	**Medical and Health Services**	**Government Function**	**Protective**	**Hazardous Materials**	**Schools**	**Other**	**Total**
North	8	1	4	27	20	18	**78**
Central	6	3	12	70	18	34	**143**
South	12	0	13	39	33	23	**120**
Total	**26**	**4**	**29**	**136**	**71**	**75**	**341**

TABLE: CRITICAL INFRASTRUCTURE IN THE 1-PERCENT-ANNUAL-CHANCE FLOODPLAIN							
Region	**Bridges**	**Water Supply**	**Wastewater**	**Power**	**Communications**	**Other**	**Total**
North	108	1	13	4	1	15	**142**
Central	137	0	7	4	0	69	**217**
South	59	1	9	4	2	27	**102**
Total	**304**	**2**	**29**	**12**	**3**	**111**	**461**

TABLE: CRITICAL INFRASTRUCTURE IN THE 0.2-PERCENT-ANNUAL-CHANCE FLOODPLAIN							
Region	**Bridges**	**Water Supply**	**Wastewater**	**Power**	**Communications**	**Other**	**Total**
North	127	1	18	4	3	13	**166**
Central	149	0	7	4	3	75	**238**
South	77	2	11	5	3	33	**131**
Total	**353**	**3**	**36**	**13**	**9**	**121**	**535**

Tier II Facilities

Tier II facilities are those that use or store materials that can harm the environment if damaged by a flood. Forty-nine businesses in the 1-percent-annual-chance floodplain and 136 businesses in the 0.2-percent- annual-chance floodplain report having Tier II hazardous materials. During a flood event, containers holding these materials can rupture and leak into the surrounding area, having a disastrous effect on the environment as well as residents.

Utilities and Infrastructure

It is important to determine who may be at risk if infrastructure is damaged by flooding. Roads or railroads that are blocked or damaged can isolate residents and can prevent access throughout the county, including for emergency service providers needing to get to vulnerable populations or to make repairs. Bridges washed out or blocked by floods or debris also can cause isolation. Water and sewer systems can be flooded or backed up, causing health problems. Underground utilities can be damaged. Dikes can fail or be overtopped, inundating the land that they protect. The following sections describe specific types of critical infrastructure.

Roads

The following major roads pass through the 1-percent-annual-chance floodplain and thus are exposed to flooding:

- I-290
- IL171
- US 20
- Adlai Stevenson Expressway
- Calumet Expressway
- Dan Ryan Expressway
- Edens Expressway
- Eisenhower Expressway
- Kennedy Expressway
- Moline Expressway
- West Leg Dan Ryan Expressway
- Dixie Highway
- East Lincoln Highway
- Governors Highway
- Lincoln Highway
- Northwest Highway
- South Southwest Highway
- Southwest Highway
- West Diversey Parkway
- West Fullerton Parkway
- Northwest Tollway
- Tri-State Tollway

- Bishop Ford Freeway
- Busse Highway
- Veterans Memorial Tollway
- Midlothian Turnpike

Some of these roads are built above the flood level, and others function as levees to prevent flooding. Still, in severe flood events these roads can be blocked or damaged, preventing access to some areas.

Bridges

Flooding events can significantly impact road bridges. These are important because often they provide the only ingress and egress to some neighborhoods. An analysis showed that there are 28 bridges that are in or cross over the 1-percent-annual-chance floodplain and 34 bridges in the 0.2-percent-annual-chance floodplain.

Water and Sewer Infrastructure

Water and sewer systems can be affected by flooding. Floodwaters can back up drainage systems, causing localized flooding. Culverts can be blocked by debris from flood events, also causing localized stormwater/urban drainage flooding. Floodwaters can get into drinking water supplies, causing contamination. Sewer systems can be backed up, causing wastewater to spill into homes, neighborhoods, rivers, and streams.

Environment

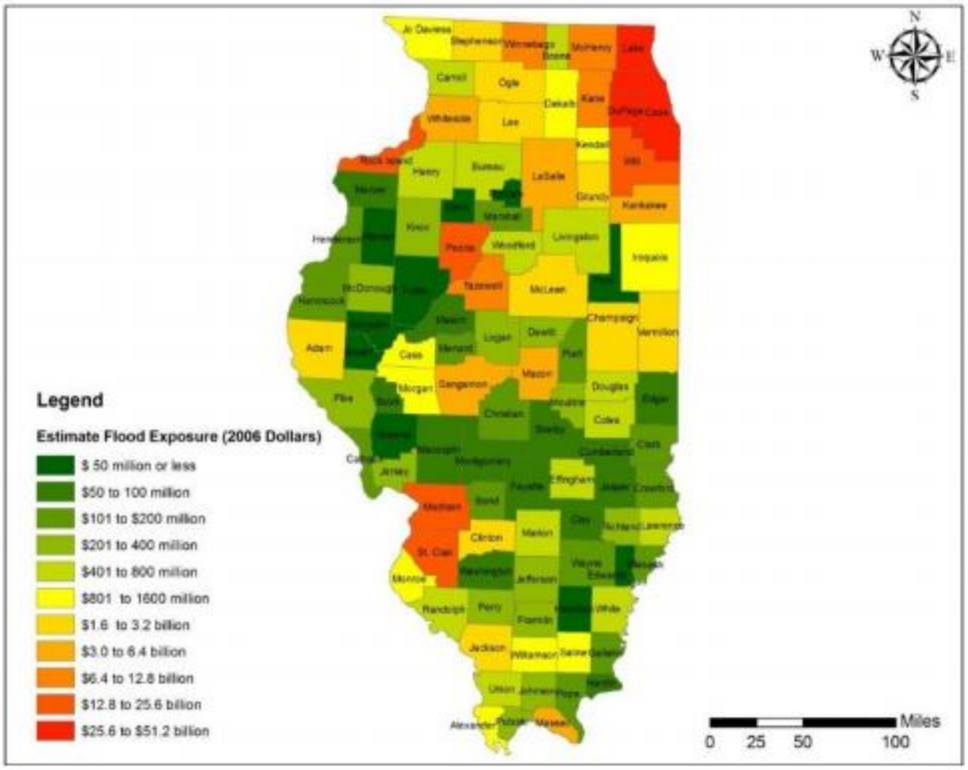
Flooding is a natural event, and floodplains provide many natural and beneficial functions. Nonetheless, with human development factored in, flooding can impact the environment in negative ways. Migrating fish can wash into roads or over dikes into flooded fields, with no possibility of escape. Pollution from roads, such as oil, and hazardous materials can wash into rivers and streams. During floods, these can settle onto normally dry soils, polluting them for agricultural uses. Human development such as bridge abutments and levees, and logjams from timber harvesting can increase stream bank erosion, causing rivers and streams to migrate into non-natural courses.

Vulnerability

Many of the areas exposed to flooding may not experience serious flooding or flood damage. This section describes vulnerabilities in terms of population, property, infrastructure, and environment.

The 2013 Illinois Natural Hazard Mitigation Plan (INHMP) used Hazard Mitigation Grant Program funds to have a state-wide Level 1.5 HAZUS Hazus-MH analysis conducted to develop a risk assessment focused on defining the potential flood exposure throughout the 102 counties in Illinois. The building-related-flood exposure within the 100-year floodplain in Illinois is estimated to be $190.25 billion. The greatest concentration of this flood exposure is located in Cook and adjacent five counties: DuPage, Kane, Lake, McHenry, and Will. These counties contain $120.92 billion or nearly 64% of the 100-year flood exposure in Illinois (IEMA HMP 2018).

Estimated flood exposure on 100-year floodplains aggregated by County



This section provides specific information about the County's vulnerabilities to this hazard, such as:

- Population
- Property
- Critical Facilities and Infrastructure
- Environment

Urban Flooding

Recognizing the significance of urban flooding to Cook County and the lack of data to better quantify vulnerability at the County and municipal levels, Cook County DHSEM will standardize and programmatically institute a process to collaborate with individual municipalities and stakeholders to educate, train, and support planning partner members to effectively collect and make available this information

Population

A geographic analysis of demographics using the Hazus-MH model identified populations vulnerable to the flood hazard as follows:

- **Economically Disadvantaged Populations**—It is estimated that 18 percent of the people within the 1-percent-annual-chance floodplain are economically disadvantaged, defined as having household incomes of $20,000 or less.
- **Population Over 65 Years Old**—It is estimated that 13 percent of the population in the census blocks that intersect the 1-percent-annual-chance floodplain are over 65 years old.
- **Population Under 16 Years Old**—It is estimated that 25 percent of the population within census blocks located in or near the 1-percent-annual-chance floodplain are under 16 years of age.

Impacts on persons and households in the planning area were estimated for the 1-percent-annual-chance and 1-percent-annual-chance flood events through the Level 2 Hazus-MH analysis. *Table: Estimated Flood Impact on Persons and Households* summarizes the results.

TABLE:
ESTIMATED FLOOD IMPACT ON PERSONS AND HOUSEHOLDS

Region	Number of Displaced Households		Number of Persons Requiring Short-Term Shelter	
	1% Annual Chance Floodplain	0.2% Annual Chance Floodplain	1% Annual Chance Floodplain	0.2% Annual Chance Floodplain
North	35,512	65,401	30,275	57,086
Central	24,933	38,469	21,794	34,509
South	40,095	74,052	30,687	62,571
Total	**100,540**	**177,922**	**82,756**	**154,166**

Public Health and Safety

Floods and their aftermath present threats to public health and safety. Floodwater is generally contaminated by pollutants such as sewage, human and animal feces, pesticides and insecticides, fertilizers, oil, asbestos, and rusting building materials. Health and environmental tests carried out on floodwaters in New Orleans during and after Hurricane Katrina revealed bacteria and other health hazards. The following health and safety risks can be associated with flood events:

- **Unsafe food**—Floodwaters contain disease-causing bacteria, dirt, oil, human and animal wastes, and farm and industrial chemicals. They carry away whatever lies on the ground and upstream. Their contact with food items, including food crops in agricultural lands, can make that food unsafe to eat and hazardous to human health. Power failures caused by floods damage stored food. Refrigerated and frozen foods are affected during the outage periods, and must be carefully monitored and examined prior to consumption. Foods kept inside cardboard, plastic bags, jars, bottles, and paper packaging are subject to contamination by floodwaters. Even packages that do not appear to be wet may have mold contamination.

- **Contaminated drinking and washing water and poor sanitation**—Flooding impairs clean water sources with pollutants. Contact with the contaminants—whether through direct food intake, vector insects such as flies, unclean hands, or dirty plates and utensils—can result in waterborne illnesses and life-threatening infectious diseases. The pollutants also saturate into the groundwater or can infiltrate into sanitary sewer lines through the ground. Wastewater treatment plants, if flooded and caused to malfunction, can be overloaded with polluted runoff waters and sewage beyond their disposal capacity, resulting in backflows of raw sewage to homes and low-lying grounds. Private wells can be contaminated or damaged severely by floodwaters, while private sewage disposal systems can become a cause of infection if they are broken or overflow. Unclean drinking and washing water and sanitation, coupled with lack of adequate sewage treatment, can lead to disease outbreaks.

- **Mosquitoes and animals**—Prolonged rainfall and floods provide new breeding grounds for mosquitoes—wet areas and stagnant pools—and can lead to an increase in the number of mosquito-borne diseases such as dengue and West Nile fevers. Rats and other rodents and wild animals also can carry viruses and diseases. The public should avoid such animals and should dispose of dead animals in accordance with guidelines issued by local animal control authorities. Leptospirosis—a bacterial disease associated predominantly with rats—often accompanies floods in developing countries; the risk is low in industrialized regions unless wounds have direct contact with disease-contaminated waters or animals.

- **Mold and mildew**—Excessive exposure to mold and mildew can cause flood victims—especially those with allergies and asthma—to contract upper respiratory diseases, triggering cold-like symptoms. Molds grow in as little as 24 to 48 hours in damp areas of buildings that have not been cleaned after flooding, such as water-infiltrated walls, floors, carpets, toilets and bathrooms. Very small mold spores can be easily inhaled by humans and, in large enough quantities, cause allergic reactions, asthma episodes, and other respiratory problems. Infants, children, elderly people, and pregnant women are most vulnerable to mold-induced problems.

- **Carbon monoxide poisoning**—Carbon monoxide poisoning is as a potential hazard after major floods. Carbon monoxide can be found in combustion fumes, such as those generated by small gasoline engines, stoves, generators, lanterns and gas ranges, or by burning charcoal or wood. In the event of power outages following floods, flood victims tend to use alternative sources of fuels for heating, cooling, or cooking inside enclosed or partly enclosed houses, garages, or buildings without an adequate level of air ventilation. Carbon monoxide builds up from these sources and poisons the people and animals inside.

- **Hazards when re-entering and cleaning flooded homes and buildings**—Flooded buildings can pose significant health hazards after floodwaters recede. Electrical power systems, including fallen power lines, can become hazardous. Gas leaks from pipelines or propane tanks can pose fire and explosion risks to those cleaning damaged buildings or working to restore utility service. Flood debris—such as broken bottles, wood, stones, and walls—may cause injuries to those cleaning damaged buildings. Containers of hazardous chemicals, including pesticides, insecticides, fertilizers, car batteries, propane tanks, and other chemicals, may be hidden or buried under flood debris. A health hazard can also occur when hazardous dust and mold in ducts, fans, and ventilators of air-conditioning and heating equipment are circulated through a building and inhaled by those engaged in cleanup and restoration.

- **Mental stress and fatigue**—Having experienced a devastating flood and seen loved ones lost or injured and homes damaged or destroyed, flood victims can experience long-term psychological impact. The expense and effort required to repair flood-damaged homes places severe financial and psychological burdens on flood victims, in particular, the unprepared and uninsured. Post-flood recovery—especially when it is prolonged—can cause anxiety, anger, depression, lethargy, hyperactivity, sleeplessness, or suicide. Behavior changes may occur in children, such as an increase in bed-wetting and aggression. There is also a long-term concern among the affected that their homes can be flooded again in the future.

Documentation of these types of impacts in the planning area is limited. Current loss estimation models such as Hazus are not equipped to measure public health impacts. The best level of mitigation for these impacts is to be aware that they can occur, educate the public on prevention, and be prepared to deal with them in responding to flood events.

Property

*Please note that a request for Repetitive Loss Data (RL/SRL) was submitted, including the types of SRL/RL properties (residential, commercial, industrial). While the individual municipal annexes identify the number of SRL and RL properties in those jurisdictions, the aggregated totals by type will be updated upon receipt of the requested information.

Hazus-MH calculates losses to structures from flooding by looking at depth of flooding and type of structure. Using historical flood insurance claim data, Hazus-MH estimates the percentage of damage to structures and their contents by applying established damage functions to an inventory. For this analysis, local data on facilities was used instead of the default inventory data provided with Hazus-MH.

The analysis is summarized in *Table: Loss Estimates for 10-Percent-Annual-Chance Flood Event*, *Table: Loss Estimates for 1-Percent-Annual-Chance Flood Event*, and *Table: Loss Estimates for 0.2-Percent-Annual-Chance Flood Event* for the 10-percent-annual-chance, 1-percent-annual-chance, and 0.2-percent-annual-chance events, respectively. It is estimated that there would be up to $386.2 million of flood loss from a 10-percent-annual-chance flood event in the planning area. This represents 1.77 percent of the total exposure to the 10-percent annual-chance flood and 0.03 percent of the total assessed value for the planning area. It is estimated that there would be $1.903 billion of flood loss from a 1-percent-annual-chance flood event, representing 8.71 percent of the total exposure to a 1-percent-annual-chance flood event and 0.16 percent of the total assessed value. It is estimated that there would be $4.148 billion of flood loss from a 0.2-percent-annual-chance flood event, representing 10.52 percent of the total exposure to a 0.2-percent-annual-chance flood event and 1.35 percent of the total assessed value.

TABLE:
LOSS ESTIMATES FOR 10-PERCENT-ANNUAL-CHANCE FLOOD EVENT

	Estimated Loss Associated with Flood			
	Structures Impacted (a)	**Structures**	**Contents**	**Total**
North	457	$21,793,740	$37,990,894	$61,420,453
Central	870	$72,843,556	$143,353,670	$216,197,227
South	455	$33,595,431	$75,001,010	$108,596,441
Total	**1782**	**$128,232,727**	**$256,345,574**	**$386,214,121**

a. Impacted structures are those structures with finished floor elevations below the 10-year water surface elevation. These structures are the most likely to receive significant damage in a 10-year flood event

TABLE:
LOSS ESTIMATES FOR 1-PERCENT-ANNUAL-CHANCE FLOOD EVENT

	Estimated Loss Associated with Flood			
	Structures Impacted (a)	**Structures**	**Contents**	**Total**
North	2,451	$202,636,644	$357,535,763	$628,040,403
Central	3,755	$297,001,406	$502,085,980	$799,087,386
South	3,272	$183,979,597	$292,720,459	$476,700,056
Total	**9,478**	**$683,617,647**	**$1,152,342,202**	**$1,903,827,845**

a. Impacted structures are those structures with finished floor elevations below the 10-year water surface elevation. These structures are the most likely to receive significant damage in a 10-year flood event

TABLE:
LOSS ESTIMATES FOR 0.2-PERCENT-ANNUAL-CHANCE FLOOD EVENT

	Estimated Loss Associated with Flood			
	Structures Impacted (a)	**Structures**	**Contents**	**Total**
North	7,733	$651,950,004	$870,752,821	$1,522,702,826
Central	6,347	$487,725,107	$746,186,517	$1,233,911,623
South	9,147	$561,316,273	$830,111,165	$1,391,427,129
Total	**23,227**	**$1,700,991,384**	**$2,447,050,503**	**$4,148,041,578**

a. Impacted structures are those structures with finished floor elevations below the 10-year water surface elevation. These structures are the most likely to receive significant damage in a 10-year flood event

Repetitive Loss

A repetitive loss property is defined by FEMA as an NFIP-insured property that has experienced any of the following since 1978, regardless of any changes in ownership:

- Four or more paid losses in excess of $1,000
- Two paid losses in excess of $1,000 within any rolling 10-year period
- Three or more paid losses that equal or exceed the current value of the insured property.

Repetitive loss properties make up only 1 to 2 percent of flood insurance policies in force nationally, yet they account for 40 percent of the nation's flood insurance claim payments. In 1998, FEMA reported that the NFIP's 75,000 repetitive loss structures have already cost $2.8 billion in flood insurance payments and that numerous other flood-prone structures remain in the floodplain at high risk. The government has instituted programs encouraging communities to identify and mitigate the causes of repetitive losses. A recent report on repetitive losses by the National Wildlife Federation found that 20 percent of these properties are outside any mapped 1-percent-annual-chance floodplain. The key identifiers for repetitive loss properties are the existence of flood insurance policies and claims paid by the policies.

FEMA-sponsored programs, such as the CRS, require participating communities to identify repetitive loss areas. A repetitive loss area is the portion of a floodplain holding structures that FEMA has identified as meeting the definition of repetitive loss. Identifying repetitive loss areas helps to identify structures that are at risk but are not on FEMA's list of repetitive loss structures because no flood insurance policy was in force at the time of loss. FEMA's list of repetitive loss properties identifies 1,571 such properties in the planning area as of January 31, 2014. The breakdown of the properties by jurisdiction is presented in *Table: Repetitive Loss Properties*. A request was made to receive a more up-to-date breakdown of repetitive loss information, but at the time of publication, this data has not been made available. A review of the data indicated the following key findings:

TABLE: REPETITIVE LOSS PROPERTIES

Jurisdiction	Repetitive Loss Properties	Severe Repetitive Loss Properties	Number of Properties Mitigated	Corrected Number of Repetitive Loss Properties
Arlington Heights	3	0	0	3
Bellwood	214	1	0	214
Bensenville	15	1	1	14
Bridgeview	1	0	0	1
Broadview	3	1	0	3
Brookfield	13	1	0	13
Buffalo Grove	1	0	0	1

Burbank	2	0	0	2
Bur Ridge	1	0	0	1
Calumet City	28	1	17	11
Chicago Heights	3	0	1	2
Chicago	49	0	0	49
Cook County	121	12	1	120
Country Club Hills	1	0	0	1
Crestwood	1	0	0	1
Deerfield	14	0	6	8
Des Plaines	271	14	2	269
Dixmoor	3	0	0	3
Dolton	28	1	0	28
Elgin	19	2	1	18
Elk Grove Village	6	0	0	6
Elmhurst	18	0	3	15
Elmwood Park	10	0	0	10
Flossmoor	8	0	0	8
Ford Heights	8	0	0	8
Franklin Park	34	0	5	29
Glencoe	2	0	0	2
Glenview	41	5	2	39
Glenwood	3	0	0	3
Hanover Park	1	0	0	1
Harvey	24	0	0	24
Hazel Crest	2	0	0	2
Hinsdale	10	0	0	10
Homewood	5	0	0	5
Inverness	5	0	0	5
Justice	1	0	0	1
LaGrange	1	0	0	1
Lansing	33	0	12	21
Lincolnwood	2	0	0	2
Lynwood	1	0	0	1
Lyons	12	1	0	12
Markham	21	0	0	21
Matteson	1	0	0	1
Maywood	3	0	0	3
Melrose Park	74	2	7	67
Midlothian	7	0	2	5

Morton Grove	4	0	1	3
Mount Prospect	14	0	0	14
Niles	13	0	0	13
North Riverside	2	0	0	2
Northbrook	8	1	1	7
Northfield	20	0	0	20
Northlake	38	0	0	38
Oak Forest	9	1	0	9
Oak Lawn	1	0	0	1
Olympia Fields	1	0	0	1
Orland Park	7	0	2	5
Palatine	3	0	1	2
Palos Hills	6	0	3	3
Palos Park	1	0	0	1
Park Ridge	12	0	0	12
Posen	4	0	0	4
Prospect Heights	4	0	1	3
Richton Park	1	0	0	1
River Grove	25	1	0	25
Riverside	36	2	0	36
Robbins	4	0	0	4
Rolling Meadows	1	0	0	1
Rosemont	5	0	1	4
Schaumburg	1	0	0	1
Schiller Park	24	3	0	24
Skokie	21	0	0	21
South Holland	22	0	4	18
Steger	1	0	0	1
Stone Park	86	9	0	86
Summit	1	0	0	1
Westchester	98	0	1	97
Western Springs	1	0	0	1
Wheeling	17	1	2	15
Wilmette	15	0	0	15
Winnetka	18	0	0	18
Total	**1648**	**60**	**77**	**1571**

Based on FEMA Report of Repetitive Losses, 01/31/2014

- Of all identified repetitive loss properties, 67 percent are within a 1-percent-annual-chance or 0.2-percent-annual-chance flood zone, based on FEMA's current effective FIRM for the planning area. Of these properties, 44 percent are within the SFHA. Of the properties within the SFHA:
  - 39 percent intersect a FEMA-mapped floodway
  - 10 percent are in flood zones with shallow flooding, mapped as AH zones on FEMA's effective FIRM.
- Of all identified repetitive loss properties, 33 percent are outside a FEMA-mapped flood zone. Of the structures on these properties, 82 percent have basements below the average 1-percent-annual-chance flood depth, based on Hazus-MH modeling of 3 to 6 feet.
- The average flood insurance claim paid for all the identified repetitive loss properties was $12,630, which amounts to 3.77 percent of the average value of these properties. Using the Corps of Engineers' generic flood depth-damage curves for structures with a basement, this represents an average of about 5 feet of flood water in each basement. For structures without a basement, this correlates to about a half-foot of floodwater. Based on that analysis and current flood mapping, the typical repetitive damage appears to have been caused by less than 1-percent-annual-chance flood events. The numbers are typical of damage resulting from stormwater/urban drainage flooding. This conclusion is also supported by the Metropolitan Water Reclamation District's DWP program and Phase II Program (see Section 10.2.1).

Because the repetitive loss list does not include all properties subject to repetitive flooding, the planning partners established the following criteria for repetitive loss areas within the planning area:

- Any area mapped as either 1-percent-annual-chance or 0.2-percent-annual-chance floodplain by FEMA or the Metropolitan Water Reclamation District
- Any area identified with a drainage system need or issue by the Metropolitan Water Reclamation District DWP program or Phase II Program.

For communities participating in the CRS program, these parameters will be the basis for determining targeted properties for the repetitive loss area outreach required of repetitive loss Category B and C communities. Actions to address the repetitive flooding issues are being addressed by the District's Stormwater Management Program, through the DWPs and Phase II Program.

Critical Facilities and Infrastructure *Hazus-MH was used to estimate the flood loss potential to critical facilities exposed to the flood risk. Using depth/damage function curves to estimate the percent of damage to the building and contents of critical facilities, Hazus-MH correlates these estimates into an estimate of functional down-time (the estimated time it will take to restore a facility to 100 percent of its functionality). This helps to gauge how long the planning area could have limited usage of facilities deemed critical to flood response and recovery.*

The Hazus critical facility results are as follows:

- **1-percent-annual-chance flood event**—On average, critical facilities would receive 5.25 percent damage to the structure and 23 percent damage to the contents during a 1-

percent-annual-chance flood event. The estimated time to restore these facilities to 100 percent of their functionality is 470 days.

- **0.2-percent-annual-chance flood event**—A 0.2-percent-annual-chance flood event would damage the structures an average of 9.45 percent and the contents an average 32.3 percent. The estimated time to restore these facilities to 100 percent of their functionality after a 0.2-percent-annual-chance event is 502 days.

For urban flooding, the following critical infrastructure and facilities could potentially be vulnerable. The FSI scores were developed by CMAP urban flood susceptibility index (FSI). This was constructed with data from FEMA, counties, and the City of Chicago collected and put into an address-level database of documented flood locations. The index is categorized into 10 risk levels based on the combined frequency ratio scores from the following flood-related factors: Topographic Wetness Index, combined sewer service areas, property elevation compared to nearest Base Flood Elevation, impervious coverage, age of first development, and precipitation variation. 1 is the lowest susceptibility and 10 is the highest.

TABLE: CRITICAL INFRASTRUCTURE AND FACILITIES BY TYPE AT RISK OF URBAN FLOODING												
	FSI	Medical and Health	Government Functions	Protective Functions	Schools	Hazmat (Tier II)	Other Critical Functions	Water Supply	Wastewater	Power	Communication	Transportation
Alsip	9	2	0	3	10	47	0	0	2	9	4	0
Arlington Heights (a)	7	12	0	5	30	18	0	0	1	5	8	4
Barrington (a)	5	3	0	3	8	3	0	0	1	0	0	1
Barrington Hills	2	0	0	2	0	0	0	0	0	0	0	0
Bartlett	4	3	0	3	7	6	0	0	1	0	1	1
Bedford Park	9	0	0	3	3	54	2	6	3	8	0	3
Bellwood	8	1	1	2	9	18	0	0	0	4	1	1
Bensenville	7	0	0	0	0	1	0	0	0	0	0	0
Berkeley	7	0	1	1	3	4	0	0	0	1	1	1
Berwyn	10	5	1	4	19	10	0	0	0	3	0	3
Blue Island	10	4	0	2	15	13	0	0	1	3	1	8
Bridgeview	9	4	0	4	5	30	5	1	0	1	0	0
Broadview	9	0	0	2	4	19	0	1	0	3	2	0
Brookfield	10	1	1	3	10	1	4	3	0	3	0	3
Buffalo Grove (a)	7	0	0	3	14	3	0	0	0	0	2	1
Burbank	9	4	0	3	13	5	3	1	2	0	0	0
Burnham	8	2	0	2	2	3	0	0	0	1	2	0
Calumet City*	N/A	4	2	3	29	15	11	3	1	3	1	3
Calumet Park	10	3	0	1	5	1	0	0	0	0	0	2
Chicago	10	277	1	140	1227	947	1	16	21	2	56	373
Chicago Heights	7	7	1	6	25	38	0	0	1	5	2	2
Chicago Ridge	9	1	0	3	7	7	0	0	0	0	0	2
Cicero	10	3	0	5	29	30	2	2	0	8	1	8
Country Club Hills	6	7	0	3	7	1	0	0	0	1	0	0

Countryside	6	4	1	1	3	16	12	2	0	0	0	0
Crestwood	9	4	1	2	7	8	1	0	0	3	0	0
Deer Park	2	0	0	0	0	0	0	0	0	0	0	0
Deerfield	3	3	0	0	0	1	0	0	1	1	0	0
Des Plaines	8	3	0	0	0	1	0	1	1	9	5	6
Dixmoor	10	0	0	1	2	2	1	1	0	0	0	0
Dolton	10	5	1	3	11	10	0	0	0	2	0	2
East Dundee	6	0	0	0	0	0	0	0	0	0	0	0
East Hazel Crest	7	0	1	2	0	1	0	0	0	0	0	1
Elgin	6	4	0	1	5	10	1	0	1	0	1	0
Elk Grove Village (a)	7	8	0	9	14	133	0	0	0	3	3	1
Elmhurst	6	0	0	0	0	0	0	0	0	0	0	0
Elmwood Park	10	1	1	3	7	0	0	0	0	3	0	1
Evanston	8	24	1	7	86	19	1	2	1	10	3	14
Evergreen Park	9	3	1	2	14	4	0	0	0	2	0	0
Flossmoor	5	2	0	2	9	0	0	0	0	2	1	1
Ford Heights	4	0	0	2	3	1	0	0	0	0	1	0
Forest Park	9	4	0	2	12	8	9	4	0	1	0	4
Forest View	10	0	0	2	0	7	0	0	0	1	0	7
Franklin Park	9	2	3	4	9	58	7	6	6	8	1	4
Glencoe	4	0	1	2	4	3	0	2	1	2	1	1
Glenview	5	12	0	6	21	15	0	0	1	4	4	5
Glenwood	7	2	2	3	5	9	1	0	0	2	1	0
Hanover Park (a)	7	2	0	2	11	4	2	0	2	0	0	0
Harvey	10	10	0	5	20	21	0	1	0	4	2	3
Harwood Heights	9	1	0	5	4	4	1	0	0	0	0	0
Hazel Crest	8	8	0	2	6	3	0	0	1	0	0	1
Hickory Hills	8	2	1	1	5	8	3	2	1	0	1	0
Hillside	7	3	1	2	6	17	0	0	1	2	1	1
Hinsdale	5	1	0	0	1	0	0	0	1	0	0	0

Hodgkins	7	0	0	2	1	15	1	0	1	1	0	1
Hoffman Estates (a)	4	6	0	2	21	13	0	0	0	0	3	1
Hometown	10	0	1	2	2	0	0	0	0	0	0	0
Homewood	7	4	1	2	7	9	3	6	13	2	2	4
Indian Head Park	4	0	0	1	0	0	1	1	0	0	0	0
Inverness	2	1	1	2	2	0	2	0	0	0	0	0
Justice	8	1	0	3	5	1	3	1	1	1	0	0
Kenilworth	8	0	0	1	3	0	1	1	0	0	0	1
La Grange	9	5	1	2	19	5	4	3	0	0	2	3
La Grange Park	9	4	1	3	6	4	8	1	0	2	0	0
Lansing	9	3	1	5	16	15	0	0	0	2	2	4
Lemont (a)	5	4	2	3	8	20	0	0	1	3	2	19
Lincolnwood	9	6	1	2	5	6	9	0	0	2	0	1
Lynwood	5	1	1	2	1	1	1	0	1	1	0	1
Lyons	10	2	1	2	6	6	2	2	1	4	1	0
Markham	7	4	2	3	8	6	0	0	2	1	2	3
Matteson	5	3	0	3	11	10	0	0	0	0	0	2
Maywood	10	0	0	3	11	7	0	0	0	4	1	2
McCook	8	0	1	2	0	13	1	2	2	0	0	0
Melrose Park	9	3	1	3	11	46	0	0	0	4	1	3
Merrionette Park	8	0	0	2	2	0	0	0	0	0	0	0
Midlothian	9	2	0	3	13	3	11	0	0	0	0	1
Morton Grove	8	3	1	4	15	13	4	3	0	3	2	1
Mount Prospect	8	0	1	4	19	34	1	1	2	6	2	2
Niles	9	11	1	3	17	26	4	2	0	3	2	2
Norridge	8	2	0	1	11	0	0	0	0	0	0	0
North Riverside	10	1	0	2	3	1	0	0	0	0	0	2
Northbrook	4	8	2	4	29	26	5	1	20	5	6	2
Northfield	3	1	1	2	5	3	0	0	0	0	1	0
Northlake	7	3	0	3	8	23	0	0	1	2	0	1

Oak Forest	7	6	0	3	18	3	0	0	0	0	3	1
Oak Lawn	9	8	1	4	24	19	0	0	1	6	2	3
Oak Park	10	5	1	4	25	4	0	0	0	4	2	7
Olympia Fields	5	6	1	1	3	2	1	0	0	1	0	4
Orland Hills	5	0	0	1	3	1	0	0	0	0	1	0
Orland Park	5	5	1	8	28	11	0	0	0	1	5	4
Palatine	5	4	1	6	29	17	0	0	4	3	5	2
Palos Heights	7	5	0	3	9	1	0	0	0	1	2	1
Palos Hills	8	4	1	4	11	2	14	0	0	1	2	1
Palos Park	4	2	0	2	2	4	0	0	1	1	1	1
Park Forest (a)	7	3	0	2	11	3	0	1	1	3	1	1
Park Ridge	10	11	1	4	21	4	0	0	0	5	2	5
Phoenix	10	1	0	2	2	0	0	0	0	0	0	0
Posen	10	0	0	2	5	3	0	0	0	0	0	0
Prospect Heights	7	3	1	3	7	5	13	2	2	1	0	4
Richton Park	5	2	1	2	3	2	0	0	0	1	0	3
River Forest	8	0	2	2	11	1	3	0	1	1	1	1
River Grove	9	0	1	1	11	4	0	1	0	1	2	3
Riverdale	10	0	0	2	9	17	0	0	0	2	2	6
Riverside	9	1	1	3	12	1	2	2	0	2	0	1
Robbins	7	2	1	2	6	0	0	0	0	0	0	1
Rolling Meadows	6	4	1	3	12	27	2	0	0	3	5	0
Roselle	5	0	0	0	1	0	0	0	0	1	0	0
Rosemont	7	1	0	3	1	15	5	0	0	0	2	5
Sauk Village (a)	7	5	0	2	8	10	5	1	1	0	0	0
Schaumburg (a)	6	7	1	6	26	52	1	0	0	2	9	6
Schiller Park	7	1	1	3	4	17	8	4	3	2	1	3
Skokie	9	18	1	4	28	31	0	0	2	12	5	6
South Barrington	2	1	1	1	1	1	0	0	0	0	0	0

South Chicago Heights	7	1	0	2	3	3	0	0	0	1	0	0
South Holland	9	9	1	5	16	27	1	0	0	2	1	3
Steger (a)	3	0	2	4	5	1	2	0	0	1	0	0
Stickney	10	1	1	2	2	5	0	0	1	1	0	5
Stone Park	7	0	0	2	1	2	0	0	0	1	0	0
Streamwood	5	4	0	4	13	6	5	0	3	0	1	0
Summit	9	2	1	2	10	17	1	1	1	0	2	5
Thornton	5	1	0	2	2	3	0	0	3	0	0	0
Tinley Park (a)	6	5	1	4	24	16	1	0	1	1	3	2
University Park (a)	3	0	0	2	4	1	0	0	1	0	0	1
Westchester	7	1	2	3	9	3	5	1	2	0	0	0
Western Springs	9	3	1	3	10	1	3	3	0	0	0	1
Wheeling (a)	7	4	2	4	13	58	3	0	2	3	3	3
Willow Springs	2	0	0	2	4	7	2	0	2	0	0	5
Wilmette	7	3	0	3	18	6	5	2	4	5	3	3
Winnetka	3	0	1	2	10	1	4	2	0	0	2	4
Worth	9	1	1	2	5	3	0	0	2	1	0	1
Unincorporated County Areas*	N/A	17	2	5	27	48	6	4	7	9	5	11
Total		**696**	**79**	**495**	**2,551**	**2,476**	**221**	**102**	**143**	**244**	**209**	**639**

a. Municipality is partially located in another county; for planning purposes all facilities are included.
*Municipality included in spite of no FSI, because the jurisdiction discussed urban or flash flooding in mitigation actions or jurisdiction-specific hazards.

Environment

The environment vulnerable to flood hazard is the same as the environment exposed to the hazard. Loss estimation platforms such as Hazus-MH are not currently equipped to measure environmental impacts of flood hazards. The best gauge of vulnerability of the environment would be a review of damage from past flood events. Loss data that segregates damage to the environment was not available at the time of this plan. Capturing this data from future events could be beneficial in measuring the vulnerability of the environment for future updates.

National Flood Insurance Program (NFIP)

National Flood Insurance Program

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. For most participating communities, FEMA has prepared a detailed Flood Insurance Study. The study presents water surface elevations for floods of various magnitudes, including the 1-percent annual chance flood and the 0.2-percent annual chance flood (the 500-year flood). Base flood elevations and the boundaries of the 100- and 500-year floodplains are shown on Flood Insurance Rate Maps (FIRMs), which are the principal tool for identifying the extent and location of the flood hazard. FIRMs are the most detailed and consistent data source available, and for many communities, they represent the minimum area of oversight under their floodplain management program.

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 100-year flood.
- New floodplain development must not aggravate existing flood problems or increase damage to other properties.

As of the publication of the IEMA HMP 2018, Cook County had:

- Community Repetitive Loss Listing: 377 property losses from flooding with 125 being repetitive loss properties. Insurance claims were $7,277,890.95 and average paid insurance claim was $19,304.75.
- County Repetitive Loss Listing: 4539 property losses from flooding with 1775 being repetitive loss properties. Insurance claims were $92,838,524.01 and average paid insurance claim was $1,673,616.85.

According to the IEMA HMP 2018, the Loss Estimation according to Hazus-MH for Floods 2015 was:

County	Total Exposure ($1,000s)	Total Loss ($1,000s)	Flood Loss Ratio	SV Score	SV Index	FL Score	FL Index	FV Score	FV Index	Z Score	Flood Vulnerability Rating
Cook County	$65,830,820	$3,311,723	0.05	-0.08	0.55	0.05	0.24	0.79	0.36	0.07	Average

From 1993 to December 2015, 64 properties were part of the Floodplain Mitigation Acquisition Buy-Out Project from 5 jurisdictions in Cook County (IEMA HMP 2018):

- Glenwood - 9
- Palos Hill - 3
- Des Plaines - 33
- Glenview - 16
- Wood Dale (also in DuPage County) - 3

It should be noted that additional FEMA funded buyouts occurred in the county prior to 1993, including twelve homes in Calumet City in the 1980s. The Illinois Department of Natural Resources has also funded recent acquisitions in Des Plaines.

Currently, Cook County is "Pending a Physical Map Review" and pending maps that will become effective November 1, 2019 can be viewed at illinoisfloodmaps.org. While not confirmed, the pending data is showing changes in flood zones, as depicted in the map below.

CSLF for Physical Map Revision on Mill and Tinley Creek within Cook County, IL

Map: Preliminary Changes Since Last FIRM (CSLF)

Source: Illinois Flood Maps

Not all flooding claims are made through the National Flood Insurance Program. In a study completed that utilized data from 2007-2011, over $773 million in total damage claims were made. Over half the claims were made through the FEMA Disaster Relief fund (see the following charts)

	Total Number of Claims	Total Dollars	Average Payout
Private Insurance	20,461	$185,104,184	$9,047
FEMA National Flood Insurance Program	3,872	$63,907,684	$16,505
FEMA Disaster Relief Data	152,864	$415,322,894	$2,716
FEMA Public Assistance Grant Program	206	$28,396,689	$137,848
SBA Disaster Loan Program	3,691	$80,980,700	$21,940
Total	*181,094*	*$773,772,151*	*$4,272*

TABLE 1
Number of claims, claims amount, and average payout according to payer

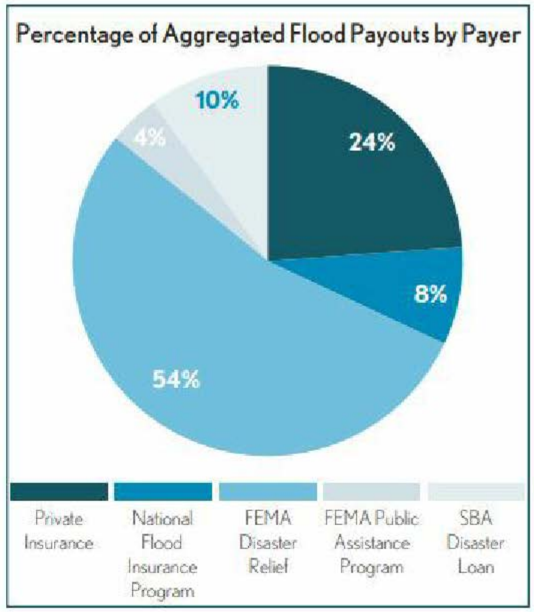


TABLE 2
Percentage of aggregated flood payouts by payer

* *Some households may have made multiple claims.*

Charts: Flood Claims and Payouts in Cook County, 2007-2011

Source: Center for Neighborhood Technology

All have had their compliance status evaluated by the Illinois Department of Natural Resources via a Community Assistance Visit. IDNR identified compliance issues for a few of these communities, but most are in full compliance and good standing with the provisions of the NFIP. Communities with compliance issues have identified actions to resolve those issues within their action plans, contained in Volume 2 of this hazard mitigation plan. Maintaining compliance under the NFIP is an important component of flood risk reduction. All planning partners that participate in the NFIP have identified actions to maintain their compliance and good standing. Cook County entered the NFIP on April 15, 1981. Structures permitted or built in the County before then are called “pre-FIRM” structures, and structures built afterwards are called “post-FIRM.” The insurance rate is different for the two types of structures. The effective date for the current countywide FIRM is August 19, 2008. This map is a DFIRM (digital flood insurance rate map). The communities in Cook County that participate in the NFIP are shown in *Table: NFIP Participating Communities in Cook County*.

TABLE:
NFIP PARTICIPATING COMMUNITIES IN COOK COUNTY

CID	Community Name	County	Initial FIRM Identified
170055#	Alsip, Village Of	Cook County	09/17/80
170056#	Arlington Heights, Village Of	Lake County/Cook County	05/01/78
170058#	Barrington Hills, Village Of	Mchenry County/Lake County/Kane County/Cook County	08/10/79
170057#	Barrington, Village Of	Lake County/Cook County	10/16/1984
170059#	Bartlett, Village Of	Kane County/Dupage County/Cook County	06/15/81
171007#	Bedford Park, Village Of	Cook County	01/31/83
170061#	Bellwood, Village Of	Cook County	12/4/1979
170200#	Bensenville, Village Of	Dupage County/Cook County	02/04/81
171039#	Berkeley, Village Of	Cook County	08/17/09
171036#	Berwyn, City Of	Cook County	10/27/2017
170064#	Blue Island, City Of	Cook County	07/02/80
170065#	Bridgeview, Village Of	Cook County	02/04/81
170067#	Broadview, Village Of	Cook County	01/16/81
170066#	Brookfield, Village Of	Cook County	12/16/1980
170068#	Buffalo Grove, Village Of	Lake County/Cook County	09/14/79
170069#	Burbank, City Of	Cook County	02/09/79
170070#	Burnham, Village Of	Cook County	06/01/81
170071#	Burr Ridge, Village Of	Cook County/Dupage County	10/15/1981
170072#	Calumet City, City Of	Cook County	04/01/80
170073#	Calumet Park, Village Of	Cook County	02/16/79
170075#	Chicago Heights, City Of	Cook County	11/15/1979
170076#	Chicago Ridge, Village Of	Cook County	11/19/1980
170074#	Chicago, City Of	Dupage County/Cook County	06/01/81
170077#	Cicero, Town Of	Cook County	11/6/2000
170054#	Cook County*	Cook County	04/15/81
170078#	Country Club Hills, City Of	Cook County	07/16/80
170079#	Countryside, City Of	Cook County	09/03/80
170080#	Crestwood, Village Of	Cook County	02/18/81
171028#	Deer Park, Village Of	Cook County/Lake County	09/03/97
170361#	Deerfield, Village Of	Cook County/Lake County	09/30/77
170081#	Des Plaines, City Of	Cook County	06/15/81
170082#	Dixmoor, Village Of	Cook County	06/04/80
170083#	Dolton, Village Of	Cook County	07/16/80

170323#	East Dundee, Village Of	Cook County/Kane County	03/16/81
170085#	East Hazel Crest, Village Of	Cook County	09/22/78
170087E	Elgin, City Of	Kane County/Cook	03/01/82
170088#	Elk Grove Village, Village Of	Dupage County/Cook County	06/15/79
170205#	Elmhurst, City Of	Cook County/Dupage County	02/04/81
170089#	Elmwood Park, Village Of	Cook County	08/15/80
170090#	Evanston, City Of	Cook County	11/26/1982
170733#	Evergreen Park, Village Of	Cook County	05/25/78
170091#	Flossmoor, Village Of	Cook County	11/5/1980
170084#	Ford Heights, Village Of	Cook County	09/29/78
170092#	Forest Park, Village Of	Cook County	09/22/78
170093#	Forest View, Village Of	Cook County	02/11/83
170701B	Frankfort, Village Of	Cook County/Will County	11/1/1979
170094#	Franklin Park, Village Of	Cook County	09/15/78
170095#	Glencoe, Village Of	Cook County	12/16/1980
170096#	Glenview, Village Of	Cook County	06/15/79
170097#	Glenwood, Village Of	Cook County	06/15/78
170098#	Golf, Village Of	Cook County	11/15/1979
170099#	Hanover Park, Village Of	Dupage County/Cook County	11/15/1978
170100#	Harvey, City Of	Cook County	04/17/78
170101#	Harwood Heights, Village Of	Cook County	02/29/80
170102#	Hazel Crest, Village Of	Cook County	12/2/1980
170103#	Hickory Hills, City Of	Cook County	07/16/80
170104#	Hillside, Village Of	Cook County	06/11/76
170105#	Hinsdale, Village Of	Dupage County/Cook County	01/16/81
170106#	Hodgkins, Village Of	Cook County	09/14/79
170107#	Hoffman Estates, Village Of	Kane County/Cook County	05/19/81
171080B	Homer Glen, Village Of	Cook County/Will County	09/06/02
170109#	Homewood, Village Of	Cook County	08/15/77
170110#	Indian Head Park, Village Of	Cook County	12/4/1979
170111#	Inverness, Village Of	Cook County	06/01/81
170112#	Justice, Village Of	Cook County	05/19/81
170113#	Kenilworth, Village Of	Cook County	08/19/83
170115#	La Grange Park, Village Of	Cook County	11/15/1978
170114#	La Grange, Village Of	Cook County	11/9/1979
170116#	Lansing, Village Of	Cook County	06/01/81
170117B	Lemont, Village Of	Will County/Dupage County/Cook County	06/30/76
171001#	Lincolnwood, Village Of	Cook County	04/24/79

170119#	Lynwood, Village Of	Cook County	08/03/81
170120#	Lyons, Village Of	Cook County	11/1/1979
175169#	Markham, City Of	Cook County	07/27/73
170123#	Matteson, Village Of	Cook County	08/16/82
170124#	Maywood, Village Of	Cook County	08/11/78
170121#	Mccook, Village Of	Cook County	07/16/91
170125#	Melrose Park, Village Of	Cook County	01/02/81
170126#	Merrionette Park, Village Of	Cook County	09/04/85
170127#	Midlothian, Village Of	Cook County	08/01/79
170128#	Morton Grove, Village Of	Cook County	06/15/79
170129#	Mount Prospect, Village Of	Cook County	08/02/82
170130#	Niles, Village Of	Cook County	06/15/79
170131#	Norridge, Village Of	Cook County	05/25/78
170135#	North Riverside, Village Of	Cook County	12/16/1980
170132#	Northbrook, Village Of	Lake County/Cook County	01/17/79
170133#	Northfield, Village Of	Cook County	12/18/1979
170134#	Northlake, City Of	Cook County	01/03/86
170214#	Oak Brook, Village Of	Cook County/Dupage County	02/18/81
170136#	Oak Forest, City Of	Cook County	12/4/1979
170137#	Oak Lawn, Village Of	Cook County	01/02/81
170139#	Olympia Fields, Village Of	Cook County	08/01/80
170172#	Orland Hills, Village Of	Cook County	03/15/82
170140B	Orland Park, Village Of	Will County/Cook County	02/04/81
175170#	Palatine, Village Of	Cook County	02/16/73
170142#	Palos Heights, City Of	Cook County	07/16/80
170143#	Palos Hills, City Of	Cook County	01/16/81
170144#	Palos Park, Village Of	Cook County	07/16/80
170145B	Park Forest, Village Of	Will County/Cook County	07/16/80
170146#	Park Ridge, City Of	Cook County	01/31/79
170147#	Phoenix, Village Of	Cook County	06/01/95
170148#	Posen, Village Of	Cook County	02/27/84
170919#	Prospect Heights, City Of	Cook County	08/01/79
170149#	Richton Park, Village Of	Cook County	01/16/81
170151#	River Forest, City Of	Cook County	08/11/78
170152#	River Grove, Village Of	Cook County	12/16/1980
170150#	Riverdale, Village Of	Cook County	09/29/78
170153#	Riverside, Village Of	Cook County	12/16/1980
170154#	Robbins, Village Of	Cook County	09/29/78
170155#	Rolling Meadows, City Of	Cook County	10/17/1978

170216#	Roselle, Village Of	Dupage County/Cook County	05/19/81
170156#	Rosemont, Village Of	Cook County	11/15/1979
170157B	Sauk Village, Village Of	Will County/Cook County	05/05/81
170158#	Schaumburg, Village Of	Dupage County/Cook County	02/15/79
170159#	Schiller Park, Village Of	Cook County	09/15/78
171000#	Skokie, Village Of	Cook County	02/14/79
170161#	South Barrington, Village Of	Cook County	07/16/81
170162#	South Chicago Heights, Village Of	Cook County	05/02/80
170163#	South Holland, Village Of	Cook County	08/01/80
170713B	Steger, Village Of	Will County/Cook County	02/18/83
170164#	Stickney, Village Of	Cook County	02/11/83
170165#	Stone Park, Village Of	Cook County	07/16/80
170166#	Streamwood, Village Of	Cook County	11/19/1980
170167#	Summit, Village Of	Cook County	05/01/94
170168#	Thornton, Village Of	Cook County	08/01/80
170169B	Tinley Park, Village Of	Will County/Cook County	12/4/1979
170708B	University Park, Village Of	Cook County/Will County	07/16/80
170170#	Westchester, Village Of	Cook County	06/04/80
170171#	Western Springs, Village Of	Cook County	01/02/81
170173#	Wheeling, Village Of	Lake County/Cook County	09/15/78
170174#	Willow Springs, Village Of	Cook County	07/16/79
170175#	Wilmette, Village Of	Cook County	01/14/83
170176#	Winnetka, Village Of	Cook County	11/19/1980
170737B	Woodridge, Village Of	Will County/Cook County/Dupage County	06/15/79
170177#	Worth, Village Of	Cook County	07/07/78

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. Cook County entered the NFIP on April 15, 1981. The effective date for the current countywide Flood Insurance Rate Map is August 19, 2008. In addition to the County, most Cook County municipalities participate in the NFIP. As of October, 2018, Cook County had 14,790 flood insurance policies providing $3.092 billion in insurance coverage. According to FEMA statistics, in the State of Illinois, there were 51,246 total losses (claims) between January 1, 1978 and January 31, 2019, for a total of approximately $545.36 million, an average of roughly $10,642 per claim.

TABLE:
COOK COUNTY FLOOD INSURANCE POLICIES

Community Name	Policies in Force	Insurance in force	Written Premium In-Force
Alsip, Village Of	16	$4,392,000	$33,013
Arlington Heights, Village	98	$25,274,700	$39,695

Of			
Barrington Hills, Village Of	10	$3,076,600	$11,391
Barrington, Village Of	30	$9,167,000	$14,343
Bartlett, Village Of	26	$7,426,000	$10,306
Bellwood, Village Of	589	$103,340,400	$1,240,804
Bensenville, Village Of	35	$11,560,400	$85,564
Berkeley, Village Of	4	$588,000	$1,133
Berwyn, City Of	1	$350,000	$373
Blue Island, City Of	3	$1,175,500	$1,434
Bridgeview, Village Of	6	$1,807,800	$5,039
Broadview, Village Of	31	$11,797,700	$51,472
Brookfield, Village Of	66	$23,590,800	$97,075
Buffalo Grove, Village Of	69	$18,136,800	$50,271
Burbank, City Of	17	$3,299,700	$7,243
Burnham, Village Of	3	$835,600	$2,434
Burr Ridge, Village Of	38	$10,975,000	$30,675
Calumet City, City Of	490	$66,680,700	$367,870
Calumet Park, Village Of	3	$420,000	$735
Chicago Heights, City Of	18	$4,169,800	$22,601
Chicago Ridge, Village Of	26	$5,930,600	$29,616
Chicago, City Of	1,052	$255,187,900	$606,033
Cicero, Town Of	4	$812,300	$3,142
Country Club Hills, City Of	34	$5,726,800	$34,114
Countryside, City Of	8	$1,747,000	$11,015
Crestwood, Village Of	110	$11,151,000	$71,401
Deer Park, Village Of	7	$2,025,000	$2,654
Deerfield, Village Of	174	$55,576,000	$140,909
Des Plaines, City Of	1,868	$401,612,300	$1,669,828
Dixmoor, Village Of	51	$7,322,300	$61,931
Dolton, Village Of	34	$7,421,800	$25,762
East Dundee, Village Of	41	$9,067,100	$63,778
East Hazel Crest, Village Of	1	$350,000	$415
Elgin, City Of	204	$49,829,400	$207,737
Elk Grove Village, Village Of	44	$20,796,600	$70,456
Elmhurst, City Of	252	$65,516,000	$161,359
Elmwood Park, Village Of	20	$3,627,900	$12,759
Evanston, City Of	67	$18,058,000	$24,318
Evergreen Park, Village Of	4	$750,000	$1,085

Flossmoor, Village Of	89	$23,127,200	$123,047
Ford Heights, Village Of	4	$375,200	$1,102
Forest Park, Village Of	8	$1,966,000	$4,467
Forest View, Village Of	21	$5,540,000	$8,539
Frankfort, Village Of	41	$8,893,200	$43,746
Franklin Park, Village Of	429	$82,857,500	$911,810
Glencoe, Village Of	58	$18,411,000	$24,913
Glenview, Village Of	246	$66,183,100	$203,702
Glenwood, Village Of	11	$2,666,500	$8,342
Hanover Park, Village Of	15	$2,754,300	$8,409
Harvey, City Of	161	$19,601,100	$172,567
Harwood Heights, Village Of	1	$350,000	$415
Hazel Crest, Village Of	27	$5,285,400	$36,210
Hickory Hills, City Of	8	$3,252,600	$25,738
Hillside, Village Of	16	$5,107,000	$9,153
Hinsdale, Village Of	314	$80,659,300	$159,173
Hoffman Estates, Village Of	60	$12,320,900	$52,701
Homer Glen, Village Of	3	$750,000	$1,366
Homewood, Village Of	33	$7,026,200	$47,160
Indian Head Park, Village Of	7	$1,800,000	$4,528
Inverness, Village Of	21	$5,985,000	$9,635
Justice, Village Of	126	$21,886,900	$172,043
Kenilworth, Village Of	12	$3,642,000	$13,527
La Grange Park, Village Of	16	$4,376,400	$6,982
La Grange, Village Of	29	$8,785,000	$11,280
Lansing, Village Of	188	$35,618,100	$195,413
Lemont, Village Of	6	$2,135,000	$20,890
Lincolnwood, Village Of	24	$6,549,900	$10,072
Lynwood, Village Of	21	$4,634,400	$16,335
Lyons, Village Of	25	$5,181,500	$44,012
Markham, City Of	19	$2,406,600	$11,650
Matteson, Village Of	62	$14,259,700	$103,577
Maywood, Village Of	21	$3,754,100	$11,118
Mccook, Village Of	2	$1,000,000	$6,786
Melrose Park, Village Of	267	$59,854,800	$621,703
Merrionette Park, Village Of	1	$210,000	$320
Midlothian, Village Of	179	$28,011,300	$242,851

Morton Grove, Village Of	21	$5,946,000	$9,177
Mount Prospect, Village Of	150	$36,400,200	$159,578
Niles, Village Of	42	$13,061,900	$39,342
Norridge, Village Of	7	$1,400,000	$2,373
North Riverside, Village Of	7	$2,292,400	$4,550
Northbrook, Village Of	146	$41,093,600	$75,040
Northfield, Village Of	167	$44,609,400	$230,652
Northlake, City Of	177	$32,397,300	$341,711
Oak Forest, City Of	74	$12,578,000	$96,651
Oak Lawn, Village Of	493	$77,076,000	$390,834
Olympia Fields, Village Of	26	$6,433,800	$36,237
Orland Hills, Village Of	19	$3,961,200	$16,405
Orland Park, Village Of	66	$20,132,800	$60,227
Palatine, Village Of	107	$24,004,500	$51,131
Palos Heights, City Of	61	$14,941,100	$96,877
Palos Hills, City Of	87	$17,817,500	$85,307
Palos Park, Village Of	20	$5,854,000	$10,550
Park Forest, Village Of	4	$567,000	$1,036
Park Ridge, City Of	133	$35,119,400	$59,831
Phoenix, Village Of	1	$175,000	$332
Posen, Village Of	83	$12,500,600	$136,324
Prospect Heights, City Of	1,113	$140,716,900	$684,981
Richton Park, Village Of	22	$4,978,400	$27,879
River Forest, City Of	44	$13,293,400	$24,981
River Grove, Village Of	68	$15,389,400	$158,817
Riverdale, Village Of	3	$351,800	$1,608
Riverside, Village Of	116	$26,577,300	$137,457
Robbins, Village Of	30	$3,988,200	$39,892
Rolling Meadows, City Of	568	$66,786,400	$204,359
Roselle, Village Of	28	$8,552,200	$35,354
Rosemont, Village Of	17	$5,315,000	$14,121
Sauk Village, Village Of	14	$4,501,200	$18,276
Schaumburg, Village Of	54	$17,171,000	$49,577
Schiller Park, Village Of	170	$28,665,300	$325,819
Skokie, Village Of	83	$19,563,000	$33,870
South Barrington, Village Of	8	$2,555,000	$3,193
South Holland, Village Of	97	$25,184,900	$60,246
Steger, Village Of	11	$2,919,100	$25,786

Stickney, Village Of	3	$650,000	$2,985
Stone Park, Village Of	134	$22,046,500	$268,546
Streamwood, Village Of	18	$5,215,000	$8,168
Summit, Village Of	2	$182,000	$506
Thornton, Village Of	2	$252,000	$541
Tinley Park, Village Of	170	$29,298,300	$159,201
Unincorporated Cook County *	446	$92,792,600	$689,426
University Park, Village Of	3	$928,000	$2,161
Westchester, Village Of	383	$73,013,600	$731,953
Western Springs, Village Of	38	$11,565,500	$20,330
Wheeling, Village Of	616	$131,237,900	$962,305
Willow Springs, Village Of	20	$4,763,600	$23,186
Wilmette, Village Of	130	$33,414,500	$75,402
Winnetka, Village Of	337	$96,837,100	$622,448
Woodridge, Village Of	24	$7,664,800	$23,531
Worth, Village Of	2	$392,000	$605
Total	**14790**	**$3,092,913,300**	**$15,958,740**

The Community Rating System

The CRS is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions meeting the following three goals of the CRS:

- Reduce flood losses.
- Facilitate accurate insurance rating.
- Promote awareness of flood insurance.

For participating communities, flood insurance premium rates are discounted in increments of 5 percent. For example, a Class 1 community would receive a 45 percent premium discount, and a Class 9 community would receive a 5 percent discount. (Class 10 communities are those that do not participate in the CRS; they receive no discount.) The CRS classes for local communities are based on 18 creditable activities in the following categories:

- Public information
- Mapping and regulations
- Flood damage reduction
- Flood preparedness.

Although CRS communities represent only a small minority of the communities participating in the NFIP, more than 67 percent of all flood insurance policies are written in CRS communities. CRS activities can help to save lives and reduce property damage. Communities participating in the CRS range from small to large and represent a broad mixture of flood risks, including both coastal and riverine flood risks.

Communities participating in the CRS represent a significant portion of the nation's flood risk; over 66 percent of the NFIP's policy base is located in these communities. Communities receiving premium discounts through the CRS range from small to large and represent a broad mixture of flood risks, including both coastal and riverine flood risks.

There are 24 communities currently participating in CRS within the planning area. Their CRS status as of October 2016, is summarized in *Table: CRS Community Status in the Planning Area*. Many of the mitigation actions identified in Volume 2 of this plan are creditable activities under the CRS program. Therefore, successful implementation of this plan offers the potential for these communities to enhance their CRS classifications and for currently non-participating communities to join the program.

TABLE:
CRS COMMUNITY STATUS IN THE PLANNING AREA

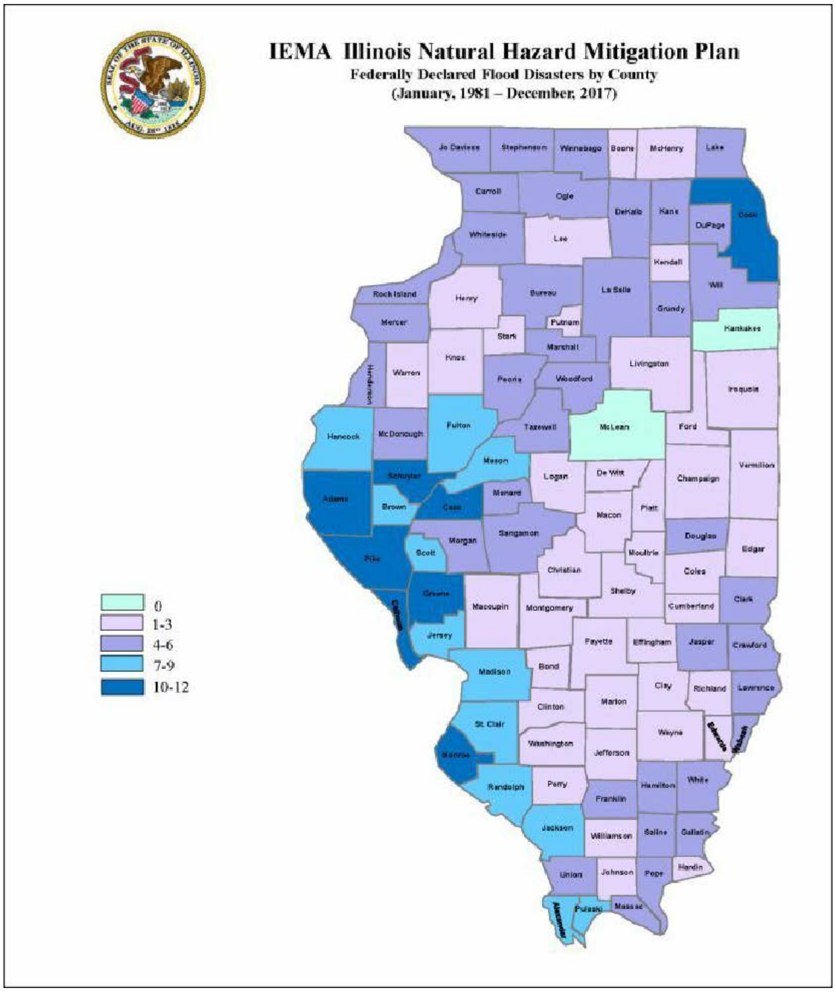
Community	NFIP Community #	CRS Entry Date	Current Effective Date	Current CRS Classification	% Premium Discount, SFHA/non-SFHA	Status
Bartlett	170059	10/01/1991	10/1/2018	6	20/10	Current
Calumet City	170072	10/01/2000	05/01/2003	6	20/10	Current
Country Club Hill	170078	10/01/1993	10/01/1994	8	10/5	Current
Deerfield	170361	10/01/1995	05/01/2008	6	20/10	Current
Des Plaines	170081	10/01/1993	10/01/2003	7	15/5	Current
Flossmoor	170091	10/01/1993	05/01/13	7	15/5	Current
Glenview	170096	10/01/2011	10/01/2017	5	25/10	Current
Hoffman Estates	170107	10/01/1992	5/1/2018	6	20/10	Current
Lansing	170116	10/01/1993	10/01/2001	7	15/5	Current
Melrose Park	170125	10/01/2015	10/01/2015	8	10/5	Current
Midlothian	170127	5/1/2018	5/1/2018	7	15/5	Current
Mount Prospect	170129	10/01/1991	10/1/2017	6	20/10	Current
Niles	170130	10/01/201	10/01/201	6	20/1	Curren

		3	3		0	t
Northbrook	170132	10/01/1994	05/01/2004	7	15/5	Current
Northfield	170133	10/01/2016	10/01/2016	7	15/5	Current
Oak Brook	170214	10/01/1992	10/01/1997	7	15/5	Current
Orland Hills	170172	10/01/1996	10/01/2002	5	25/10	Current
Palatine	175170	10/01/1994	05/01/2004	7	15/5	Current
Prospect Heights	170919	10/01/1994	10/01/2015	7	15/5	Current
River Forest	170151	05/01/2012	05/01/2012	7	15/5	Current
South Holland	170163	10/01/1992	10/01/2002	5	25/10	Current
Tinley Park	170169	10/01/2005	10/01/2016	7	15/5	Current
Westchester	170170	10/01/2012	10/01/2012	8	10/5	Current
Wheeling	170173	10/01/1991	05/01/2014	6	20/10	Current
Winnetka	170176	15/01/2015	05/01/2015	6	20/10	Current

Future Trends

Next to fires, floods are the most commonly occurring hazard in the United States. Since 1965 all but one county in Illinois had been declared at least once by the President as major disaster areas due to flooding. According to the Illinois Department of Natural Resources/Office of Water Resources (IDNR/OWR), Illinois has one of the largest inland systems of rivers, lakes, and streams in the United States. Nearly 15% of our total land area (or 7,400 square miles) is subject to flooding. Floods are an inevitable natural event. Floods are by far the most common natural disaster in Illinois, accounting for well over 90% of the declared disasters. Since 1965, flooding was the either the main or a significant contributing factor for 32 out of the 52 presidential disaster declarations issued in Illinois. It is estimated that over 250,000 buildings are located in floodplains of Illinois (Illinois HMP, 2018).

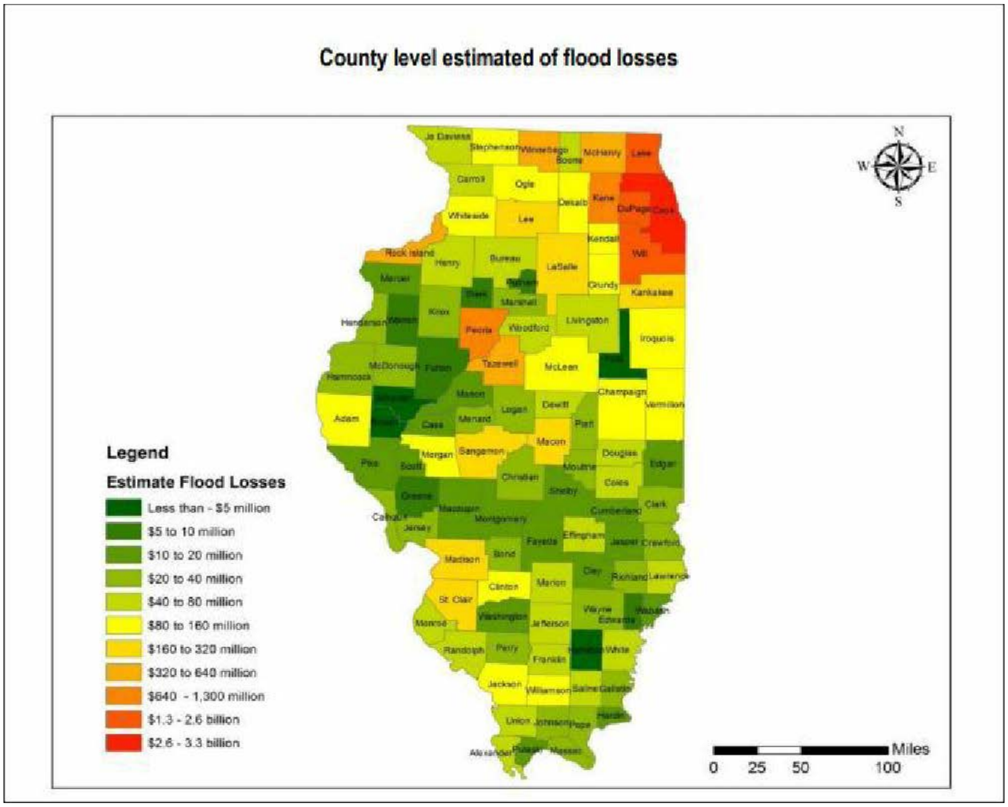
Cook County has had 11 Declared Floods from January 1981 to December 2017 with only one county (Calhoun) in Illinois having more declared floods (12) and two other counties also having 11 declared floods (Adams and Greene). Cook County is impacted by two major watersheds: Great Lakes/Calumet River Watershed and Des Plaines River Watershed (EPA Illinois).



Map: Federally Declared Flood Disasters by Numbers in Illinois

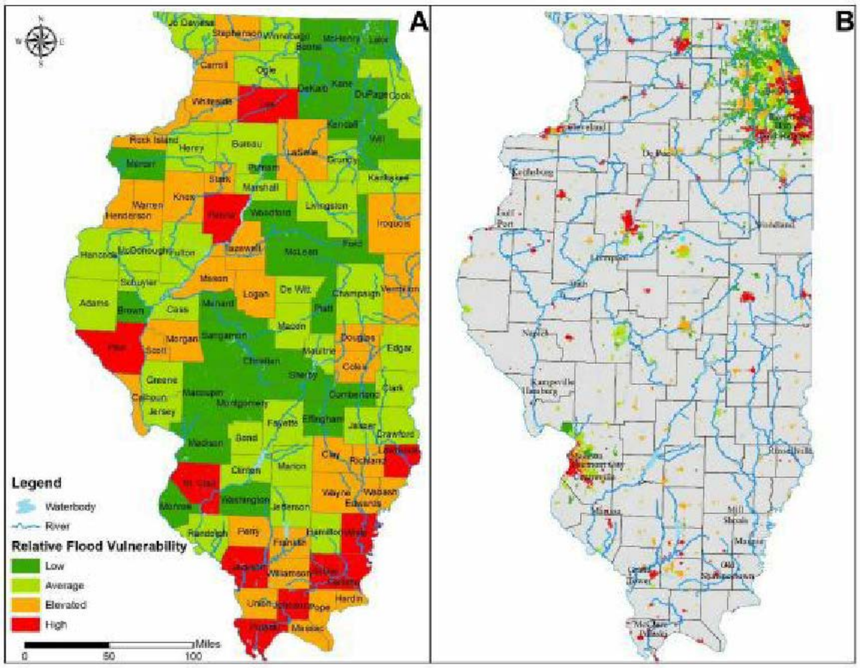
Source: [IEMA HMP 2018]

Flooding is a recurring problem in Cook County. Northeastern Illinois has already experienced and is projected to see even greater changes in temperature and precipitation from climate change which can result in increases in flooding due to increased frequency and intensity of storm events, reduced soil capacity from drought, and increases in winter rain and denser, heavier snow. While flooding cannot be prevented, the impacts of flooding can be ameliorated (Remo et al., 2015). The building-related-flood exposure within the 100-year floodplain in Illinois is estimated to be $190.25 billion. The greatest concentration of this flood exposure is located in Cook and adjacent five counties. Aggregated county-level losses ranged from a minimum of $2.4 million in Ford 2018 Illinois Hazard Mitigation Plan III-65 County up to $3.4 billion in Cook County. At the jurisdictional level, flood losses ranged from less than a $1,000 in Bonneville up to $950 million in the City of Chicago. As with the flood exposure estimates, the largest flood losses generally were in and around the City of Chicago.

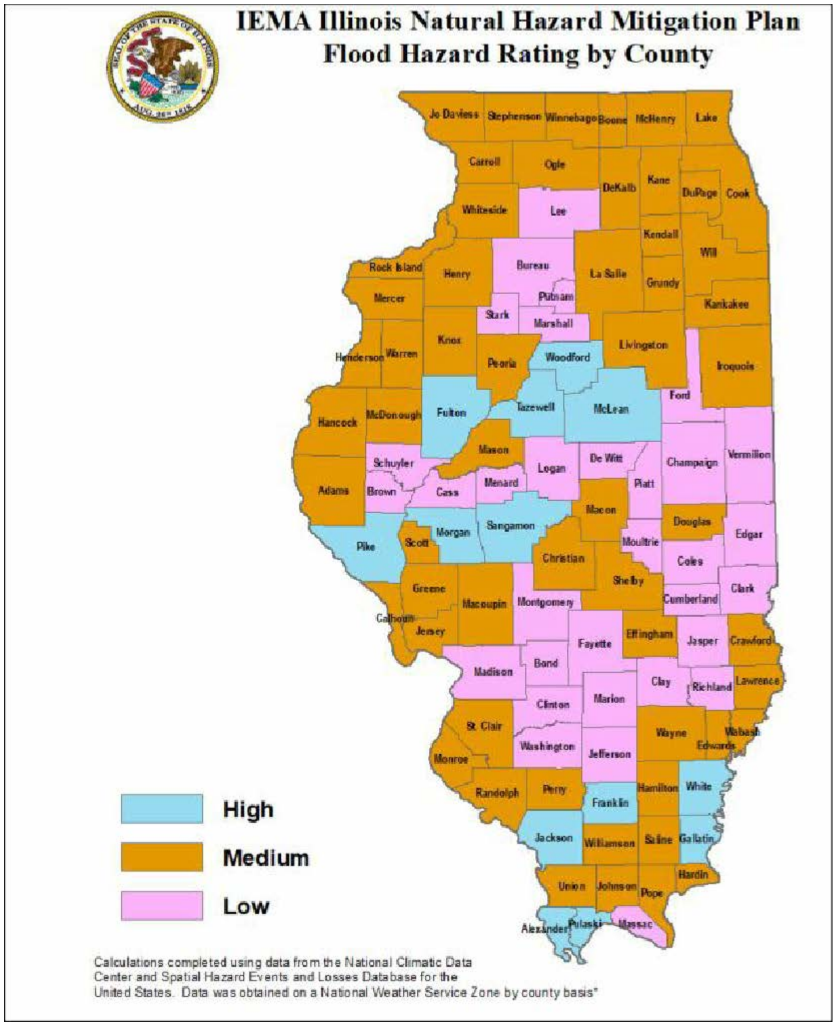


Further breaking down County data, certain jurisdictions in Cook County, located closest to Lake Michigan, have a higher vulnerability to flooding.

Relative flood vulnerability by county and (B) relative flood vulnerability by jurisdiction



In the 2018 Illinois Hazard Mitigation Plan, Cook County received a "medium" hazard ranking for flooding. Important to note is the above point that certain jurisdictions in the County have a much higher vulnerability to flooding. Also of importance is the information on the levee and dam system in Cook County (Chapter 6).



Map: Flood Hazard Ranking in Illinois

Source: IEMA HMP 2018

A recent CMAP Report highlights that parts of the region are more susceptible to flooding.

These are largely locations that predate modern stormwater and floodplain management design standards and/or have been impacted by increased development within the watershed or sewer shed. When flooding does occur, some populations and communities struggle to recover from flooding damages and may lack the capacity or financial resources to reduce their exposure in the future. The extent of development and the transformation of the landscape has increased stormwater runoff and contributes to downstream flooding and demands on the drainage system. Wetlands and other permeable landscapes have provided storage and infiltration for rainwater volumes. Agriculture and urbanization have led to large-scale removal of natural habitat and subsequent alteration of drainage patterns through the creation of impervious surface. Much of the Chicago region was constructed before the advent of modern stormwater management principles. The designs of this earlier development focused on conveying runoff from impervious surfaces as quickly as possible and eliminated natural drainage and infiltration capacity. Given this drainage structure – without a focus on managing the stormwater onsite – storm events that overwhelm a portion of the system often lead to flooding elsewhere. Development and infrastructure decisions in one location can have downstream impacts, yet those impacts are not always properly understood or evaluated during the development process, especially across jurisdictional boundaries. In recent years, the loss of storage volume provided by some of these resources have been mitigated for via county stormwater and floodplain management regulations; yet large areas lack proper stormwater management facilities or are impacted by upstream actions.

The report further articulates the recommended actions and implementation strategies for stormwater and flooding:

Recommended actions	Implementation strategies
Identify and communicate flooding risk and exposure	Update precipitation data and floodplain maps Continue advancing watershed and sewer modeling efforts Enhance understanding of urban flooding risk Assess impacts to vulnerable populations, communities, and critical assets Communicate risk and exposure to residents, businesses
Advance planning efforts to reduce current and future risk	Continue advancing stormwater management ordinances Update municipal plans and ordinances to better manage stormwater Coordinate flood reduction and water quality improvement efforts Enhance floodplain management compliance Prepare for future floods
Invest and maintain grey and green infrastructure	Enhance maintenance of grey and green infrastructure Protect and expand open spaces to enhance stormwater management Encourage coordinated investments with green infrastructure Establish dedicated revenue streams for stormwater management
Increase the resiliency of the transportation system	Conduct vulnerability assessments to transportation planning Integrate stormwater management in transportation planning and investments Develop and enhance operational strategies to maintain performance
Improve state and regional coordination	Enhance regional coordination and information sharing Review state agency coordination

To increase community resilience from flooding, land use planning techniques, land acquisition and restoration, educational programs, and warning systems and emergency plans once flooding is happening are all recommended tools to meet NFIP criteria. Communities not currently participating in the Community Rating System (CRS) should take steps to join the program to increase insurance rate discounts and flooding preparedness (CMAP). All municipal planning partners must have and use plans that address frequently flooded areas. All partners have committed to linking those land use plans to this hazard mitigation plan. This will create an opportunity for wise land use decisions as future growth impacts flood hazard areas.

Additionally, all municipal planning partners are participants in the NFIP and have adopted flood damage prevention ordinances in response to its requirements. With 24 communities in the county (approximately 18%) participating in the CRS program, there is an incentive to adopt consistent, appropriate, higher regulatory standards in communities with the highest degree of flood risk. All municipal planning partners have committed to maintaining their good standing under the NFIP through actions identified in this plan. Communities participating or considering participation in the CRS program will be able to refine this commitment using CRS programs and templates as a guide.

Scenario

The worst-case scenarios flood damage in the planning area include:

- Heavy rainfall, similar to the 1986, 2010, or 2013 events, over the region when streams are already at flood stage due to previous rainfall.
- Heavy rainfall during the winter months when the planning area is frozen and 100 percent of the rainfall becomes runoff.

These scenarios would lead to both riverine and stormwater/urban drainage flooding. These types of events could overwhelm the response and floodplain management capability within the planning area. Major roads could be blocked, preventing critical access for many residents and critical functions. High in-channel flows could cause water courses to scour, possibly washing out roads and creating more isolation problems. In the case of multi-basin flooding, the County would not be able to make repairs quickly enough to restore critical facilities and infrastructure.

Issues

The planning team has identified the following flood-related issues relevant to the planning area:

- The risk reflected on FEMA's flood hazard mapping is not considered the best available data. The 2-D, unsteady state modeling performed by the Metropolitan Water Reclamation District is considered to be the best available data. However, this data is not the basis of the current effective FIRM.
- The District's flood hazard data should be formatted so that it can be used to support risk assessment and thus validate best available data.
- The planning area has a large percentage of policies and losses outside a mapped hazard area.
- Basement flooding is a common problem.
- The lack of consistent data on extent, location, frequency and depths of stormwater/urban drainage flooding make it difficult to quantitatively assess the risk to this type of flooding.

- Future flood risk assessments for the planning area would benefit greatly from the implementation of a “high-water-mark” campaign following flood events.
- The stormwater/urban drainage flooding risk is not mapped, which makes it difficult to assess this hazard, other than looking at historical loss data.
- The risk associated with the flood hazard overlaps the risk associated with other hazards such as earthquake. This provides an opportunity to seek mitigation alternatives with multiple objectives that can reduce risk for multiple hazards.
- There is no degree of consistency of land-use practices and regulatory floodplain management scope within the planning area.
- It is unclear how potential climate change may impact flood conditions in the planning area.
- The concept of residual risk should be considered in the design of future capital flood control projects and should be communicated with residents living in the floodplain.
- More information is needed on flood risk to support the concept of risk-based analysis of capital projects.
- There needs to be a sustained effort to gather historical damage data, such as high-water marks on structures and damage reports, to measure the cost-effectiveness of future mitigation projects.
- Ongoing flood hazard mitigation will require funding from multiple sources.
- There needs to be a coordinated hazard mitigation effort between jurisdictions affected by flood hazards in the county.
- Floodplain residents need to continue to be educated about flood preparedness and the resources available during and after floods.
- The promotion of flood insurance as a means of protecting private property owners from the economic impacts of frequent flood events should continue.
- The economy affects a jurisdiction’s ability to manage its floodplains. Budget cuts and personnel losses can strain resources needed to support floodplain management.
- Consider developing flood stage warning for all USGS gages within Cook County.
- A comprehensive data set on land use in the entire planning area would significantly enhance future revisions to the risk assessment.

Chapter 10. Severe Weather

DEFINITIONS

Severe Local Storm—Small-scale atmospheric systems, including tornadoes, thunderstorms and windstorms. These storms may cause a great deal of destruction and even death, but their impact is generally confined to a small area. Typical impacts are on transportation infrastructure and utilities.

Thunderstorm—A storm featuring heavy rains, strong winds, thunder and lightning, typically about 15 miles in diameter and lasting about 30 minutes. Hail and tornadoes are also dangers associated with thunderstorms. Lightning is a serious threat to human life. Heavy rains over a small area in a short time can lead to flash flooding.

Windstorm—A storm featuring violent winds. Southwesterly winds are associated with strong storms moving onto the coast from the Pacific Ocean. Southern winds parallel to the coastal mountains are the strongest and most destructive winds. Windstorms tend to damage ridgelines that face into the winds.

General Background

Severe weather refers to any dangerous meteorological phenomena with the potential to cause damage, serious social disruption, or loss of human life. It includes hail, heat, excessive heat, lightning, hail, fog, and high, strong, and thunderstorm winds.

Extreme Heat

Excessive heat events are defined by the U.S. Environmental Protection Agency (EPA) as "summertime weather that is substantially hotter and/or more humid than average for a location at that time of year" (U.S. EPA, 2006). Extreme heat is relative to the usual weather in a region. Temperatures 10ºF or more above the average high temperature for a region that last for several hours are defined as extreme heat. Three or more consecutive days of extreme heat generally are considered to be a heat wave. A heat wave is an extended period of unusually high atmosphere-related heat stress that causes temporary modifications in lifestyle and that may have adverse health consequences for the affected population.

Heat Index

Excessive heat events are often a result of more than just ambient air temperature. Heat index tables (see *Figure: Heat Index Table*) are commonly used to provide information about how hot it feels, which is based on the interactions between several meteorological conditions. Since heat index values were devised for shady, light wind conditions, exposure to full sunshine can increase heat index values by up to 15°F. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

Temperature (°F)

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

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution   Extreme Caution   Danger   Extreme Danger

Figure: Heat Index Table

Heat Islands

Excessive heat events may be exacerbated in urban areas, where reduced air flow, reduced vegetation and increased generation of waste heat can contribute to temperatures that are several degrees higher than in surrounding rural or less urbanized areas. When urban buildings, roads and other infrastructure replace open land and vegetation, surfaces that were once permeable and moist become impermeable and dry. These changes cause urban areas to become warmer than the surrounding areas, serving as contiguous regions of higher temperatures. This phenomenon is known as urban heat island effect. Heat islands can affect communities by increasing peak energy demand during the summer, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and death, and water quality degradation. Heat islands occur both on the surface and in the atmosphere. The annual mean air temperature of a city with more than a million people can be between 1.8ºF and 5.4ºF warmer than surrounding areas. In the evening, the difference in air temperatures can be as high as 22ºF. On a hot, sunny day, the sun can heat dry, exposed urban surfaces to temperatures 50ºF to 90ºF hotter than the air.

Lightning

Lightning is a discharge of atmospheric electricity from a thunderstorm. It can travel at speed up to 140,000 mph and reach temperatures approaching 54,000 degrees. Lightning is often perceived as a minor hazard; in reality, lightning can cause damage to many structures, severely injure, or even kill humans. There are two main types of lightning: intra-cloud lightning and cloud-to-ground lightning. Cloud-to-ground lightning consists of at least one leader and at least one return stroke. The leader initiates the first phase of the lightning discharge; a return stroke moves upward along a lightning channel from the ground to the cloud.

Hail

Hail occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice. Recent studies suggest that super-cooled water may accumulate on frozen particles near the back-side of a storm as they are pushed forward across and above the updraft by the prevailing winds near the top of the storm. Eventually, the hailstones encounter downdraft air and fall to the ground.

Hailstones grow two ways: by wet growth or dry growth. In wet growth, a tiny piece of ice is in an area where the air temperature is below freezing, but not super cold. When the tiny piece of ice collides with a super-cooled drop, the water does not freeze on the ice immediately. Instead, liquid water spreads across tumbling hailstones and slowly freezes. Since the process is slow, air bubbles can escape, resulting in a layer of clear ice. Dry growth hailstones grow when the air temperature is well below freezing and the water droplet freezes immediately as it collides with the ice particle. The air bubbles are "frozen" in place, leaving cloudy ice. Hailstones can have layers like an onion if they travel up and down in an updraft, or they can have few or no layers if they are "balanced" in an updraft. One can tell how many times a hailstone traveled to the top of the storm by counting its layers. Hailstones can begin to melt and then re-freeze together, forming large and very irregularly shaped hail.

Fog

Fog, a layer of water droplets suspended just above the ground (NWS, 2009), can reduce visibility to less than a quarter-mile, making driving hazardous. There are several types of fog (NWS, 2007):

- Radiation fog forms when a layer of moist air near the ground cools to the point that water vapor condenses.
- Advection fog forms when moist air moves over a cool surface, such as when warm, moist air from a large body of water moves over the relatively cool land.
- Upslope fog forms when moist air is pushed up a mountain or hill to the point where condensation occurs.
- Evaporation fog forms when evaporating water mixes with cool air.

High Winds

Damaging winds are classified as those exceeding 60 mph. Damage from such winds accounts for half of all severe weather reports in the lower 48 states and is more common than damage from tornadoes. Wind speeds can reach up to 100 mph and can produce a damage path extending for hundreds of miles. There are seven types of damaging winds:

- **Straight-line winds**—Any thunderstorm wind that is not associated with rotation; this term is used mainly to differentiate from tornado winds. Most thunderstorms produce some straight-line winds as a result of outflow generated by the thunderstorm downdraft.
- **Downdrafts**—A small-scale column of air that rapidly sinks toward the ground.
- **Downbursts**—A strong downdraft with horizontal dimensions larger than 2.5 miles resulting in an outward burst or damaging winds on or near the ground. Downburst winds may begin as a microburst and spread out over a wider area, sometimes producing damage similar to a strong tornado. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder.
- **Microbursts**—A small concentrated downburst that produces an outward burst of damaging winds at the surface. Microbursts are generally less than 2.5 miles across and short-lived, lasting

only 5 to 10 minutes, with maximum wind speeds up to 168 mph. There are two kinds of microbursts: wet and dry. A wet microburst is accompanied by heavy precipitation at the surface. Dry microbursts, common in places like the high plains and the intermountain west, occur with little or no precipitation reaching the ground.

- **Gust front—**A gust front is the leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Sometimes the winds push up air above them, forming a shelf cloud or detached roll cloud.
- **Derecho**—A derecho is a widespread thunderstorm wind caused when new thunderstorms form along the leading edge of an outflow boundary (the boundary formed by horizontal spreading of thunderstorm-cooled air). The word “derecho” is of Spanish origin and means “straight ahead.” Thunderstorms feed on the boundary and continue to reproduce. Derechos typically occur in summer when complexes of thunderstorms form over plains, producing heavy rain and severe wind. The damaging winds can last a long time and cover a large area.
- **Bow Echo**—A bow echo is a linear wind front bent outward in a bow shape. Damaging straight-line winds often occur near the center of a bow echo. Bow echoes can be 200 miles long, last for several hours, and produce extensive wind damage at the ground.

Windstorms have the ability to cause damage over 100 miles from the center of storm activity. Winds impacting walls, doors, windows, and roofs, may cause structural components to fail. Wind pressure can create a direct and frontal assault on a structure, pushing walls, doors, and windows inward. Conversely, passing currents can create lift and suction forces that act to pull building components and surfaces outward. The effects of winds are magnified in the upper levels of multi-story structures. As positive and negative forces impact the building’s protective envelope (doors, windows, and walls), the result can be roof or building component failures and considerable structural damage.

Debris carried along by extreme winds can contribute directly to loss of life and indirectly to the failure of protective building envelopes, siding, or walls of buildings. When severe windstorms strike a community, downed trees, power lines, and damaged property can be major hindrances to emergency response and disaster recovery. Storm winds can also cause damage buildings, power lines, and other property and infrastructure due to falling trees and branches. During wet winters, saturated soils cause trees to become less stable and more vulnerable to uprooting from high winds. Windstorms can result in collapsed or damaged buildings, damaged or blocked roads and bridges, damaged traffic signals, streetlights, and parks, among others. Roads blocked by fallen trees during a windstorm may have severe consequences to people who need access to emergency services. Emergency response operations can be complicated when roads are blocked or when power supplies are interrupted. Industry and commerce can suffer losses from interruptions in electric service and from extended road closures. They can also sustain direct losses to buildings, personnel, and other vital equipment. There are direct consequences to the local economy resulting from windstorms related to both physical damage and interrupted services.

Hazard Profile

This section provides specific information about this hazard, such as:

- Past Events
- Location
- Frequency and Future Hazard Events
- Extent
- Severity
- Warning Time

Past Events

Within the category of severe weather, heat, excessive heat, lightning, hail, high wind, and thunderstorm wind were all analyzed. Below are overviews of each event type; more detailed spreadsheets can be accessed through:

- Hail Spreadsheet
- Heat and Excessive Heat
- High and Strong Wind
- Lightning
- Thunderstorm Wind

In total, all **1,386** recorded severe weather events (1950 to 2018; excluding heat and excessive heat) and **57** heat/excessive heat events amassed to **$44,820,600** in recorded property damages, **371** deaths (direct), **122** injuries (direct), **2** deaths (indirect), and **0** injuries (indirect). There were no significant fog events recorded for Cook County in the NCDC - NOAA data.

Frequency of Event Occurrence	Highest Direct Death Toll	Highest Direct Injury Toll	Highest Property Damage
782 (Thunderstorm Wind)	339 (Heat and Excessive Heat)	90 (Thunderstorm Wind)	$18,839,000 (Hail)
495 (Hail)	17 (Lightning)	24 (High and Strong Wind)	$17,168,600 (Thunderstorm Wind)
57 (Heat and Excessive Heat) *Recorded from 1996 - 2018*	11 (Thunderstorm Wind)	8 (Heat and Excessive Heat)	$6,537,000 (Lightning)
55 (Lightning)	4 (High and Strong Wind)		$1,501,000 (High and Strong Wind)
54 (High and Strong Wind)	0 (Hail)	0 (Hail) & 0 (Lightning)	$775,000 (Heat and Excessive Heat)
TOTAL: 1,443 events	**371 Direct Deaths**	**122 Direct Injuries**	**$44,820,600 in Property Damages**

Hail Events in Cook County reported by NCDC - NOAA:

- 495 hail weather events were reported between 01/01/1950 and 06/01/2019 (25354 days)
    - All hail events totaled $18,839,000 in property damages.
        - 17 hail events had hail 2 inches in diameter or larger
        - 281 hail events had hail at least 1 inch in diameter but less than 2 inches in diameter.
    - The hail events (all stemming from thunderstorm events) that caused the most property damage are as follows:
        - 6/30/2011 - $17,000,000 in damages. Hail 2.0 inches in diameter fell across the City of Chicago and shattered thousands of glass panes at the Garfield Park Conservatory. Clean up costs were estimated at $2 million while repair and replacement costs were estimated at $15 million. Thousands of trees were blown down in eastern Lake County Illinois
        - 4/5/2010 - $868,000 in property damages. Hail was 1.5 inches in diameter (size of baseballs in Des Plaines). The roof of the All-State Arena was damaged by hail and had to be replaced.
        - 6/30/2011 - $750,000 in property damages. Hail was reported as 2.75 inches in diameter. Thousands of trees were blown down in eastern Lake County Illinois. Hail as large as baseballs fell across many areas of the city of Chicago. Hundreds of vehicles were damaged including at least 130 police cars that suffered broken windshields and smashed rooftop lights.
        - 7/13/2015 - $100,000 in damages. Tennis ball size (2.5 inches in diameter) hail fell resulting in minor roof and tree damage. The hail also broke house windows.

TABLE: HAIL EVENTS IN COOK COUNTY, ILLINOIS FROM 1950-2019

Source: www.ncdc.noaa.gov/stormevents

Number of County/Zone areas affected:	1
Number of Days with Event	204
Number of Days with Event	0
Number of Days with Event and Death or Injury	0
Number of Days with Event and Property Damage	6
Number of Days with Event and Crop Damage	0
Number of Event Types reported	1

High and Strong Wind Events in Cook County reported by NCDC - NOAA:

- 54 high (50 mph and above) and strong wind (below 50 mph) weather events were reported between 01/01/1950 and 06/01/2019 (25354 days)
    - All events totaled $1,501,000 in property damages, 4 deaths (direct), and 24 injuries (direct).
        - High Winds accounted for 41 events and resulted in $1,303,000 in property damage, 4 deaths, and 13 injuries

      - One event (3/9/2002) caused the 4 deaths and resulted in $200,000 in property damage. Trees, branches, utility poles and wires were blown down across all of north central and northeast Illinois.
      - 3 events (2005, 2006, and 2016) caused $100,000 (each) in property damage. As a result of the 2005 event, more than 130,000 customers lost power during the high winds. The 2006 event resulted in the City of Chicago reporting 107 trees or tree limbs blown into roads and 35 damaged utility poles.
      - 1 event (2010) caused $500,000 in damage - The high winds caused around 200,000 Commonwealth Edison customers to lose power. Five hundred flights were canceled at O'Hare Airport. There were 448 reports of trees damaged in Chicago as well as damage to many traffic lights, street lights, and poles.
    - Strong Winds accounted for 12 events and resulted in $198,000 in property damage and 11 injuries

TABLE: HIGH AND STRONG WIND EVENTS IN COOK COUNTY, ILLINOIS FROM 1950-2019

Source: www.ncdc.noaa.gov/stormevents

Number of County/Zone areas affected:	1
Number of Days with Event	48
Number of Days with Event	1
Number of Days with Event and Death or Injury	11
Number of Days with Event and Property Damage	29
Number of Days with Event and Crop Damage	0
Number of Event Types reported	2

Heat and Excessive Heat Events in Cook County reported by NCDC - NOAA:

- 57 heat and excessive heat weather events were reported between 1996 and 2018.
  - All events totaled $775,000 in property damages, 339 deaths (direct), 8 injuries (direct), and 2 deaths (indirect).
    - Excessive heat accounted for 10 events and resulted in $750,00 in property damage, 36 deaths (direct), and 2 deaths (indirect).
      - 1 event (7/4/2012) caused the full $750,000 in property damage from excessive heat along with 23 deaths (direct) and 2 deaths (indirect). Northern Illinois experienced an intense heat wave during the first week of July. High temperatures at Chicago O'Hare Airport reached 102 on the 4th, 103 on the 5th and 6th and 98 on the 7th. Low temperatures remained in the upper 70s to lower 80s during much of the heat wave with a low temperature of just 82 degrees on the morning of the 6th. Maximum heat index values were mostly in the range of 105 to 115 each day across northeast Illinois. Between July 4th and July 11th, the intense heat was a direct or contributing factor to at

least 23 deaths in Cook County. On July 4th, heat caused Columbus Drive, just north of Roosevelt Road, to buckle. The damage stretched across the entire street, just above an underground pedestrian walkway. On July 4th, heat caused the railroad lines on a bridge over Shermer Road in Glenview to expand leading to a train derailment. A total of 28 freight cars piled up leading to a collapse of the bridge. Two people in a car driving under the bridge were killed.

- Heat accounted for 46 events and resulted in $25,00 in property damage, 303 deaths (direct), and 8 injuries (direct)
    - One event (7/16/2013) caused 1 death and resulted in the full $25,000 in property damage. Trees, branches, utility poles and wires were blown down across all of north central and northeast Illinois. From July 14th through the 21st, temperatures climbed into the upper 80s to mid 90s while overnight lows stayed in the 70s. The warmest stretch ran from the 17th through the 19th. On July 16th, the pavement buckled on the two eastbound lanes of Joe Orr Road two blocks west of Cottage Grove Avenue. Between July 18th and July 21st, the heat was a contributing factor in the deaths of six people across Will and Cook Counties.
- The heat events that caused 10 or more direct deaths included:
    - 7/28/1999 - 93 direct deaths. Of the 99 fatalities directly connected to this weather event, 93 were in Cook County, 3 were in Will County and 3 were in Lake County.
    - 8/1/2006 - 24 direct deaths.
    - 6/21/1997 - 16 direct deaths.
    - 7/17/2011 - 16 direct deaths.
    - 8/6/2001 - 14 direct deaths.
    - 7/21/1999 - 12 direct deaths.
    - 7/1/2002 - 12 direct deaths.
    - 7/15/2002 - 11 direct deaths.
    - 6/24/1998 - 10 direct deaths.
    - 7/21/2001 - 10 direct deaths.

TABLE: HEAT AND EXCESSIVE HEAT EVENTS IN COOK COUNTY, ILLINOIS FROM 1996-2019

Source: www.ncdc.noaa.gov/stormevents

Number of County/Zone areas affected:	1
Number of Days with Event	57
Number of Days with Event	53
Number of Days with Event and Death or Injury	53
Number of Days with Event and Property Damage	2
Number of Days with Event and Crop Damage	0
Number of Event Types reported	2

Although not recorded in NCDC data, the heat wave of July 1995 was one of the worst disasters in Illinois history, with over 700 deaths statewide over five-days. Numerous factors contributed to the high number of fatalities (Angel, 2009):

- Temperatures—The daily high temperatures at Midway airport from July 12 through July 16 ranged from 94ºF to 106ºF. The July 13 temperature of 106ºF during that heat wave was the highest July temperature on record at Midway. Night-time temperatures around 80ºF were also high during the event
- Humidity—Record humidity levels accompanied the high temperatures.
- Heat island—Urban heat islands absorb more heat than rural areas during the day and radiate it at night, so that these areas heat up more during the day and cool off less at night.
- Demographics—Most victims of the heat wave were the elderly, who are physically more at risk, and low-income persons unable to afford functioning air conditioning.
- Safety concerns—Many older citizens were reluctant to leave doors and windows open overnight for cooling, out of concern about crime. By contrast, during heat waves in the 1930s, many residents slept outside in parks or near Lake Michigan.
- Belated warning—Chicago officials did not release a heat emergency warning until July 15, when the heat wave was almost over. Emergency measures such as the city's five cooling centers were not fully used.

Lightning Events in Cook County reported by NCDC - NOAA:

- 55 lightning weather events were reported between 01/01/1950 and 06/01/2019 (25354 days)
    - All lightning events totaled $6,537,000 in property damages.

TABLE: LIGHTNING EVENTS IN COOK COUNTY, ILLINOIS FROM 1950-2019

Source: www.ncdc.noaa.gov/stormevents

Number of County/Zone areas affected:	1
Number of Days with Event	204
Number of Days with Event	0
Number of Days with Event and Death or Injury	0
Number of Days with Event and Property Damage	6
Number of Days with Event and Crop Damage	0
Number of Event Types reported	1

Thunderstorm Wind Events in Cook County reported by NCDC - NOAA:

- 782 thunderstorm wind weather events were reported between 01/01/1950 and 06/01/2019 (25354 days)
    - All thunderstorm wind events totaled $17,168,600 in property damages, 11 deaths (direct), and 90 injuries.

- On average, reported wind speeds are 56.38 MPH with the highest magnitude wind event occurring in June 1990 where thunderstorm wind speeds reached 130 MPH.
- The month thunderstorm wind events most frequently occurred (mode) was June.
- One event caused 37 direct injuries (7/2/1992).
- The events that caused the most property damage include:
    - **7/5/2003: $5,000,000 in property damage.** A long-lived line of severe thunderstorms, known as a derecho, moved from Iowa into northern Illinois early in the morning of Saturday July. High winds and tree damage were reported in Kane, DuPage, and Cook Counties. In Kane County a retired meteorologist reported 70 mph winds in St. Charles. In DuPage County trees were damaged in Lisle, Downers Grove, and Clarendon Hills. The storm hit hard on the southwest side of Chicago from 44th and Marshfield, through Washington Park to Jackson Park at 63rd and the Lakefront. Large trees were blown down and buildings were damaged. Chicago emergency management officials reported nearly 500 trees downed or damaged, and 68 homes and businesses damaged, 8 of them uninhabitable. The roof was taken off a Park District building and a brick commercial building was destroyed. Stackable containers at a railroad yard were blown over. Damages to this area were estimated to be at least 5 million dollars. Winds were likely 90 mph or more. A wind gust to 88 mph was measured in Chicago Lawn with handheld equipment. Trees were also damaged in south suburban Midlothian. A 90 foot tall, 3-foot diameter Oak tree that was estimated to be 273 years old, possibly the oldest tree in Chicago, was blown down.
    - **7/26/2007: $2,000,000 in property damage.** Roof damage to two large commercial buildings. Numerous large limbs were blown down. Damage concentrated near County Line Road and Interstate 55.
    - **3/13/2006: $1,500,000 in property damage.** A downburst caused extensive damage from 79th Street about 300 yards west of Harlem to just north of 77th and Harlem. Several evergreen trees were uprooted and tree limbs were downed. A few garages collapsed or had roofs torn off. A large section of an apartment roof was torn off and debris damaged other nearby apartments and other buildings. About 40 cars were damaged by flying debris. Two police officers were injured by flying glass. About 1/2 mile further northeast the roof was damaged at a FedEx facility.
    - **10/2/2006: $1,000,000 in property damage.** The roof of a junior high school was blown off in Hickory Hills near the intersection of 97th Street and Roberts Road. The roof landed on a service van in a parking lot next to the school. Two occupants in the van were trapped and injured. Numerous trees, tree limbs, and power lines were blown down. Several homes along 97th Street received damage from falling trees and tree limbs. In Bridgeview, structural damage was noted to warehouse buildings in an industrial park along 100th place, west of Harlem Avenue. A building of cinder block construction partially collapsed when

the north and east walls were blown down. Additional minor damage was noted at Bridgeview Fire Station number 2. Winds were estimated between 80 and 110 mph.

- **7/21/2017: $1,000,000 in property damage.** Many trees were blown down with some snapped at their base. Based on radar and damage photos, it appears a microburst occurred with wind speeds estimated between 70 mph and 90 mph. A 48 multi-unit building complex suffered significant wind damage.
- **9/21/2010: $1,000,000 in property damage.** Roofs were blown off three industrial buildings on Glenn Avenue between Chaddick Drive and Shepard Avenue. Vehicle windows were smashed and some trees were completely snapped off.
- **6/18/2010: $750,000 in property damage.** Wind gusts to 81 mph were measured at Chicago Executive Airport. Roof damage was reported to three hangers. Four airplanes were damaged, with two of them flipped over. Approximately 1,000 feet of fencing was destroyed. A willow tree was uprooted on Wolf Road in Wheeling.
- Additional events that caused $150,000 or more in property damage include: 1 event caused $350,000 (6/2010), 1 event caused $300,000 (8/2007), 1 event caused $250,000 (7/2007), 2 events caused $200,000 (8/2006 & 6/2008), and 2 events caused $150,000 (6/2011 & 7/2011).

TABLE: THUNDERSTORM WIND EVENTS IN COOK COUNTY, ILLINOIS FROM 1950-2019

Source: www.ncdc.noaa.gov/stormevents

Number of County/Zone areas affected:	1
Number of Days with Event	204
Number of Days with Event	0
Number of Days with Event and Death or Injury	0
Number of Days with Event and Property Damage	6
Number of Days with Event and Crop Damage	0
Number of Event Types reported	1

Location

Location	Date of Event	Wind Type	Death	Injury	Total Damage
(Cgx) Meigs Fld Chica	7/5/2012	Thunderstorm Wind	0	0	$0
(Cgx) Meigs Fld Chica	10/2/2006	Thunderstorm Wind	0	0	$0
(Mdw) Midway Arpt Chi	6/30/2014	Thunderstorm Wind	0	0	$0
(Mdw) Midway Arpt Chi	6/24/2013	Thunderstorm Wind	0	0	$0
(Mdw) Midway Arpt Chi	8/4/2012	Thunderstorm Wind	0	0	$0
(Mdw) Midway Arpt Chi	7/24/2012	Thunderstorm Wind	0	0	$0
(Mdw) Midway Arpt Chi	7/24/2012	Thunderstorm Wind	0	0	$0
(Mdw) Midway Arpt Chi	7/18/2010	Thunderstorm Wind	0	0	$0
(Mdw) Midway Arpt Chi	6/23/2010	Thunderstorm Wind	0	0	$0
(Mdw) Midway Arpt Chi	6/23/2010	Thunderstorm Wind	0	0	$0
(Mdw) Midway Arpt Chi	6/23/2010	Thunderstorm Wind	0	0	$0
(Mdw) Midway Arpt Chi	6/23/2010	Thunderstorm Wind	0	0	$0
(Mdw) Midway Arpt Chi	6/24/2009	Thunderstorm Wind	0	0	$10,000
(Mdw) Midway Arpt Chi	6/24/2009	Thunderstorm Wind	0	0	$0
(Mdw) Midway Arpt Chi	6/19/2009	Thunderstorm Wind	0	0	$0
(Mdw) Midway Arpt Chi	6/19/2009	Thunderstorm Wind	0	0	$0
(Mdw) Midway Arpt Chi	8/4/2008	Thunderstorm Wind	0	0	$0
(Mdw) Midway Arpt Chi	12/23/2007	Thunderstorm Wind	0	0	$0
(Ord) O'Hare Intl Arp	7/26/2012	Thunderstorm Wind	0	0	$10,000
(Ord) O'Hare Intl Arp	7/24/2012	Thunderstorm Wind	0	0	$0
(Ord) O'Hare Intl Arp	7/1/2012	Thunderstorm Wind	0	0	$0
(Ord) O'Hare Intl Arp	7/11/2011	Thunderstorm Wind	0	0	$0
(Ord) O'Hare Intl Arp	6/21/2011	Thunderstorm Wind	0	0	$0
(Ord) O'Hare Intl Arp	6/21/2010	Thunderstorm Wind	0	0	$0
(Ord) O'Hare Intl Arp	6/18/2010	Thunderstorm Wind	0	0	$0
(Ord) O'Hare Intl Arp	4/5/2010	Thunderstorm Wind	0	0	$0
(Ord) O'Hare Intl Arp	12/23/2007	Thunderstorm Wind	0	0	$0
(Ord) O'Hare Intl Arp	8/23/2007	Thunderstorm Wind	0	0	$0

(Ord) O'Hare Intl Arp	7/25/2005	Thunderstorm Wind	0	0	$0
Alpine	5/11/2014	Thunderstorm Wind	0	0	$0
Alsip	7/6/2016	Thunderstorm Wind	0	0	$0
Alsip	7/21/2004	Thunderstorm Wind	0	0	$0
Alsip	7/3/2004	Thunderstorm Wind	0	0	$0
Alsip	7/7/2003	Thunderstorm Wind	0	0	$0
Alsip	8/23/1993	Thunderstorm Wind	0	0	$0
Argo	7/11/2011	Thunderstorm Wind	0	0	$50,000
Argo	6/19/2009	Thunderstorm Wind	0	0	$0
Arlington Hgts	8/28/2018	Thunderstorm Wind	0	0	$10,000
Arlington Hgts	5/12/2014	Thunderstorm Wind	0	0	$0
Arlington Hgts	7/19/2013	Thunderstorm Wind	0	0	$0
Arlington Hgts	7/11/2011	Thunderstorm Wind	0	0	$2,000
Arlington Hgts	7/11/2011	Thunderstorm Wind	0	0	$0
Arlington Hgts	7/11/2011	Thunderstorm Wind	0	0	$0
Arlington Hgts	6/21/2011	Thunderstorm Wind	0	0	$1,000
Arlington Hgts	9/21/2010	Thunderstorm Wind	0	0	$0
Arlington Hgts	9/25/2007	Thunderstorm Wind	0	0	$5,000
Arlington Hgts	8/23/2007	Thunderstorm Wind	0	0	$50,000
Arlington Hgts	7/18/2007	Thunderstorm Wind	0	0	$0
Arlington Hgts	7/9/2007	Thunderstorm Wind	0	0	$0
Arlington Hgts	7/20/2006	Thunderstorm Wind	0	0	$0
Arlington Hgts	6/4/2005	Thunderstorm Wind	0	0	$0
Arlington Hgts	5/18/2000	Thunderstorm Wind	1	0	$0
Arlington Hgts	5/28/1998	Thunderstorm Wind	0	0	$0
Ashburn	7/11/2011	Thunderstorm Wind	0	0	$0
Austin Park	6/15/2008	Thunderstorm Wind	0	0	$0
Avondale	9/3/2018	Thunderstorm Wind	0	0	$0
Avondale	9/3/2018	Thunderstorm Wind	0	0	$0
Avondale	6/21/2011	Thunderstorm Wind	0	2	$10,000
Avondale	6/19/2009	Thunderstorm Wind	0	0	$0

Avondale	6/19/2009	Thunderstorm Wind	0	0	$0
Avondale	6/19/2009	Thunderstorm Wind	0	0	$0
Avondale	7/12/2008	Thunderstorm Wind	0	0	$0
Barrington	6/18/2010	Thunderstorm Wind	0	0	$0
Barrington	8/22/2007	Thunderstorm Wind	0	0	$3,000
Barrington	7/20/2006	Thunderstorm Wind	0	0	$0
Barrington	9/22/2005	Thunderstorm Wind	0	0	$0
Barrington	8/9/2001	Thunderstorm Wind	0	0	$0
Barrington	7/22/2001	Thunderstorm Wind	0	0	$0
Barrington	6/11/2001	Thunderstorm Wind	0	0	$15,000
Barrington Hills	9/4/2012	Thunderstorm Wind	0	0	$0
Barrington Hills	6/18/2010	Thunderstorm Wind	0	0	$0
Barrington Hills	6/18/2010	Thunderstorm Wind	0	0	$0
Barrington Woods	7/21/2013	Thunderstorm Wind	0	0	$0
Bartlett	8/4/2008	Thunderstorm Wind	0	0	$50,000
Bedford Park	7/23/2010	Thunderstorm Wind	0	0	$3,000
Bedford Park	7/23/2010	Thunderstorm Wind	0	0	$1,000
Bedford Park	7/18/2010	Thunderstorm Wind	0	0	$0
Bedford Park	6/19/2009	Thunderstorm Wind	0	0	$0
Bedford Park	8/23/2007	Thunderstorm Wind	0	0	$0
Bellwood	7/17/2006	Thunderstorm Wind	0	0	$0
Berwyn	8/1/2017	Thunderstorm Wind	0	0	$0
Berwyn	6/27/2013	Thunderstorm Wind	0	0	$0
Berwyn	8/4/2008	Thunderstorm Wind	0	0	$10,000
Berwyn	6/15/2008	Thunderstorm Wind	0	0	$0
Berwyn	9/7/2007	Thunderstorm Wind	0	0	$0
Beverly Hills	7/11/2011	Thunderstorm Wind	0	0	$25,000
Beverly Hills	6/9/2011	Thunderstorm Wind	0	0	$0
Blue Is	7/24/2016	Thunderstorm Wind	0	0	$0
Blue Is	5/29/2006	Thunderstorm Wind	0	0	$10,000
Bridgeview	6/24/2013	Thunderstorm Wind	0	0	$0

Bridgeview	3/13/2006	Thunderstorm Wind	0	2	$1,500,000
Bridgeview	7/21/2004	Thunderstorm Wind	0	0	$0
Brighton Park	7/11/2011	Thunderstorm Wind	0	0	$5,000
Brighton Park	7/11/2011	Thunderstorm Wind	1	0	$4,000
Brighton Park	6/23/2010	Thunderstorm Wind	0	0	$10,000
Broadview	6/21/2011	Thunderstorm Wind	0	0	$5,000
Broadview	6/15/2008	Thunderstorm Wind	0	0	$0
Brookfield	7/28/2011	Thunderstorm Wind	0	0	$5,000
Brookfield	7/11/2011	Thunderstorm Wind	0	0	$5,000
Brookfield	6/9/2011	Thunderstorm Wind	0	0	$0
Brookfield	8/2/2006	Thunderstorm Wind	0	0	$200,000
Brookfield	5/18/1997	Thunderstorm Wind	0	0	$0
Bryn Mawr	10/3/2013	Thunderstorm Wind	0	0	$5,000
Burbank	6/30/2014	Thunderstorm Wind	0	0	$0
Burbank	6/4/2011	Thunderstorm Wind	0	0	$1,000
Burbank	7/21/2004	Thunderstorm Wind	0	0	$0
Burbank	7/20/2003	Thunderstorm Wind	0	0	$0
Burbank	8/6/2000	Thunderstorm Wind	0	0	$0
Burr Ridge	7/26/2007	Thunderstorm Wind	0	0	$2,000,000
Calumet	2/28/2017	Thunderstorm Wind	0	0	$500
Calumet	9/21/2010	Thunderstorm Wind	0	0	$0
Calumet City	5/18/2000	Thunderstorm Wind	0	0	$0
Chicago	7/24/2016	Thunderstorm Wind	0	0	$0
Chicago	6/22/2016	Thunderstorm Wind	0	0	$0
Chicago	6/21/2011	Thunderstorm Wind	0	0	$0
Chicago	6/21/2010	Thunderstorm Wind	0	0	$10,000
Chicago	6/28/2008	Thunderstorm Wind	0	0	$3,000
Chicago	6/15/2008	Thunderstorm Wind	0	0	$25,000
Chicago	6/8/2008	Thunderstorm Wind	0	0	$10,000
Chicago	10/18/2007	Thunderstorm Wind	0	1	$10,000
Chicago	10/18/2007	Thunderstorm Wind	0	0	$0

Chicago	8/23/2007	Thunderstorm Wind	0	0	$0
Chicago	8/23/2007	Thunderstorm Wind	0	0	$0
Chicago	8/23/2007	Thunderstorm Wind	1	0	$100,000
Chicago	8/23/2007	Thunderstorm Wind	0	0	$0
Chicago	8/23/2007	Thunderstorm Wind	0	0	$10,000
Chicago	6/26/2007	Thunderstorm Wind	0	0	$0
Chicago	6/18/2007	Thunderstorm Wind	0	0	$0
Chicago	9/22/2006	Thunderstorm Wind	0	0	$50,000
Chicago	8/3/2006	Thunderstorm Wind	0	0	$0
Chicago	7/27/2006	Thunderstorm Wind	0	0	$0
Chicago	7/20/2006	Thunderstorm Wind	0	0	$0
Chicago	7/17/2006	Thunderstorm Wind	0	0	$0
Chicago	7/17/2006	Thunderstorm Wind	0	0	$0
Chicago	3/13/2006	Thunderstorm Wind	0	0	$0
Chicago	3/13/2006	Thunderstorm Wind	0	0	$0
Chicago	6/10/2005	Thunderstorm Wind	0	0	$0
Chicago	6/4/2005	Thunderstorm Wind	0	0	$0
Chicago	5/30/2004	Thunderstorm Wind	0	0	$0
Chicago	5/21/2004	Thunderstorm Wind	0	0	$0
Chicago	5/20/2004	Thunderstorm Wind	0	0	$0
Chicago	5/20/2004	Thunderstorm Wind	0	0	$0
Chicago	5/12/2004	Thunderstorm Wind	0	0	$0
Chicago	5/12/2004	Thunderstorm Wind	0	0	$0
Chicago	8/1/2003	Thunderstorm Wind	0	0	$0
Chicago	7/15/2003	Thunderstorm Wind	0	0	$0
Chicago	7/15/2003	Thunderstorm Wind	0	0	$0
Chicago	5/30/2003	Thunderstorm Wind	0	0	$0
Chicago	6/4/2002	Thunderstorm Wind	0	0	$0
Chicago	8/6/2000	Thunderstorm Wind	0	0	$0
Chicago	8/6/2000	Thunderstorm Wind	0	0	$0
Chicago	5/18/2000	Thunderstorm Wind	0	0	$0

Chicago	4/20/2000	Thunderstorm Wind	0	0	$0
Chicago	6/18/1998	Thunderstorm Wind	0	1	$0
Chicago	8/16/1997	Thunderstorm Wind	0	0	$0
Chicago	5/18/1997	Thunderstorm Wind	0	0	$0
Chicago	5/18/1997	Thunderstorm Wind	0	0	$0
Chicago	6/7/1995	Thunderstorm Wind	0	0	$0
Chicago	8/23/1993	Thunderstorm Wind	0	0	$0
Chicago Hammond Arpt	7/24/2012	Thunderstorm Wind	0	0	$0
Chicago Hgts	5/30/2013	Thunderstorm Wind	0	0	$0
Chicago Hgts	7/21/2004	Thunderstorm Wind	0	0	$0
Chicago Hgts	8/6/2000	Thunderstorm Wind	0	0	$0
Chicago Lawn	6/27/2013	Thunderstorm Wind	0	0	$10,000
Chicago Lawn	5/11/2011	Thunderstorm Wind	0	0	$0
Chicago Lawn	7/21/2004	Thunderstorm Wind	0	0	$0
Chicago Midway Arpt	8/6/2000	Thunderstorm Wind	0	0	$0
Chicago Midway Arpt	8/24/1998	Thunderstorm Wind	0	1	$0
Chicago Midway Arpt	7/19/1998	Thunderstorm Wind	0	0	$0
Chicago Ridge	6/30/2014	Thunderstorm Wind	0	0	$0
Chicago Ridge	9/3/2011	Thunderstorm Wind	0	0	$0
Chicago Ridge	8/2/2011	Thunderstorm Wind	0	0	$0
Chicago Ridge	7/31/2008	Thunderstorm Wind	0	0	$0
Chicago Ridge	10/18/2007	Thunderstorm Wind	0	0	$0
Cicero	6/24/2009	Thunderstorm Wind	0	0	$0
Cicero	8/4/2008	Thunderstorm Wind	0	0	$0
Cicero	6/15/2008	Thunderstorm Wind	0	0	$0
Claburn	9/21/2010	Thunderstorm Wind	0	0	$25,000
Clybourn	7/13/2012	Thunderstorm Wind	0	0	$0
Clybourn	7/11/2011	Thunderstorm Wind	0	0	$0
Clybourn	7/11/2011	Thunderstorm Wind	0	0	$0
Congress Park	6/23/2010	Thunderstorm Wind	0	0	$5,000
Congress Park	6/19/2009	Thunderstorm Wind	0	0	$2,000

Congress Park	10/2/2006	Thunderstorm Wind	0	0	$0
Corwith	6/15/2008	Thunderstorm Wind	0	0	$10,000
Country Club Hills	5/17/1999	Thunderstorm Wind	0	0	$0
Countywide	10/29/1996	Thunderstorm Wind	0	0	$0
Cragin Jct	8/30/2013	Thunderstorm Wind	0	0	$0
Crestwood	8/4/2008	Thunderstorm Wind	0	0	$0
Crestwood	8/4/2008	Thunderstorm Wind	0	0	$0
Cumberland	6/21/2011	Thunderstorm Wind	0	0	$0
Cumberland	6/21/2011	Thunderstorm Wind	0	0	$0
Cumberland	6/21/2011	Thunderstorm Wind	0	0	$50,000
Deerfield	8/4/2010	Thunderstorm Wind	0	0	$0
Deering	8/4/2012	Thunderstorm Wind	0	0	$0
Deering	7/5/2012	Thunderstorm Wind	0	0	$0
Des Plaines	7/18/2015	Thunderstorm Wind	0	0	$0
Des Plaines	9/5/2014	Thunderstorm Wind	0	4	$75,000
Des Plaines	7/26/2012	Thunderstorm Wind	0	0	$5,000
Des Plaines	6/21/2011	Thunderstorm Wind	0	0	$50,000
Des Plaines	8/23/2007	Thunderstorm Wind	0	0	$300,000
Des Plaines	8/23/2007	Thunderstorm Wind	0	0	$0
Des Plaines	6/18/2007	Thunderstorm Wind	0	0	$0
Des Plaines	7/25/2005	Thunderstorm Wind	0	0	$0
Des Plaines	6/4/2005	Thunderstorm Wind	0	0	$0
Des Plaines	5/21/2004	Thunderstorm Wind	0	0	$0
Des Plaines	8/1/2003	Thunderstorm Wind	0	0	$0
Dolton	7/20/2006	Thunderstorm Wind	0	0	$25,000
Dunhurst	9/21/2010	Thunderstorm Wind	0	0	$1,000,000
Dunning	5/2/2008	Thunderstorm Wind	0	0	$0
East Hazel Crest	6/24/2013	Thunderstorm Wind	0	0	$0
East Hazel Crest	8/4/2008	Thunderstorm Wind	0	0	$15,000
Edgebrook	7/1/2012	Thunderstorm Wind	0	0	$5,000
Edison Park	6/19/2009	Thunderstorm Wind	0	0	$0

Elk Grove	7/22/2001	Thunderstorm Wind	0	0	$0
Elk Grove Vlg	7/21/2017	Thunderstorm Wind	0	0	$1,000,000
Elk Grove Vlg	6/21/2011	Thunderstorm Wind	0	0	$1,000
Elk Grove Vlg	6/18/2010	Thunderstorm Wind	0	0	$0
Elk Grove Vlg	8/23/2007	Thunderstorm Wind	0	0	$25,000
Elk Grove Vlg	7/20/2006	Thunderstorm Wind	0	0	$0
Elmwood Park	9/25/2018	Thunderstorm Wind	0	0	$0
Elmwood Park	8/4/2008	Thunderstorm Wind	0	0	$0
Elmwood Park	7/17/2006	Thunderstorm Wind	0	0	$0
Englewood	11/17/2013	Thunderstorm Wind	0	0	$0
Evanston	5/9/2018	Thunderstorm Wind	0	0	$0
Evanston	7/23/2016	Thunderstorm Wind	0	0	$0
Evanston	7/23/2016	Thunderstorm Wind	0	0	$0
Evanston	7/23/2016	Thunderstorm Wind	0	0	$0
Evanston	7/6/2016	Thunderstorm Wind	0	0	$0
Evanston	8/2/2015	Thunderstorm Wind	0	1	$0
Evanston	7/18/2015	Thunderstorm Wind	0	0	$1,000
Evanston	7/11/2011	Thunderstorm Wind	0	0	$0
Evanston	7/11/2011	Thunderstorm Wind	0	0	$0
Evanston	6/28/2008	Thunderstorm Wind	0	0	$0
Evanston	6/28/2008	Thunderstorm Wind	0	6	$5,000
Evanston	6/15/2008	Thunderstorm Wind	0	0	$0
Evanston	6/4/2005	Thunderstorm Wind	0	0	$0
Evanston	6/4/2005	Thunderstorm Wind	0	0	$0
Evanston	5/21/2004	Thunderstorm Wind	0	0	$0
Evanston	5/12/2004	Thunderstorm Wind	0	0	$0
Evanston	6/10/2002	Thunderstorm Wind	0	0	$0
Evanston	5/8/2000	Thunderstorm Wind	0	0	$0
Evergreen Park	6/30/2011	Thunderstorm Wind	0	0	$500
Evergreen Park	6/24/2009	Thunderstorm Wind	0	0	$0
Evergreen Park	8/4/2008	Thunderstorm Wind	0	0	$0

Evergreen Park	12/23/2007	Thunderstorm Wind	0	0	$3,000
Evergreen Park	8/23/2007	Thunderstorm Wind	0	0	$0
Evergreen Park	7/20/2003	Thunderstorm Wind	0	0	$0
Flossmoor	9/21/2010	Thunderstorm Wind	0	0	$2,000
Forest Glen	8/30/2013	Thunderstorm Wind	0	0	$0
Forest Glen	7/11/2011	Thunderstorm Wind	0	0	$30,000
Forest Glen	6/19/2009	Thunderstorm Wind	0	0	$10,000
Forest Park	6/23/2010	Thunderstorm Wind	0	0	$2,000
Forest Park	8/23/2007	Thunderstorm Wind	0	0	$25,000
Forest View	6/23/2010	Thunderstorm Wind	0	0	$0
Franklin Park	9/1/2018	Thunderstorm Wind	0	0	$5,000
Franklin Park	7/11/2011	Thunderstorm Wind	0	0	$5,000
Franklin Park	6/21/2011	Thunderstorm Wind	0	0	$100,000
Franklin Park	7/10/2007	Thunderstorm Wind	0	0	$250,000
Franklin Park	7/10/2007	Thunderstorm Wind	0	0	$100,000
Franklin Park	7/15/2003	Thunderstorm Wind	0	0	$0
Franklin Park	6/14/2001	Thunderstorm Wind	0	0	$0
Glencoe	6/21/2011	Thunderstorm Wind	0	0	$50,000
Glenview	8/23/2007	Thunderstorm Wind	0	1	$50,000
Glenview	9/22/2006	Thunderstorm Wind	0	0	$0
Glenview Countryside	6/8/2015	Thunderstorm Wind	0	0	$0
Glenwood	7/17/2003	Thunderstorm Wind	0	0	$0
Goeselville	8/28/2018	Thunderstorm Wind	0	0	$10,000
Goeselville	7/18/2012	Thunderstorm Wind	0	0	$0
Golden Acres	9/21/2010	Thunderstorm Wind	0	0	$0
Grayland	8/2/2015	Thunderstorm Wind	0	0	$0
Grayland	8/4/2008	Thunderstorm Wind	0	0	$0
Hanover Park	6/18/2010	Thunderstorm Wind	0	0	$0
Hanover Park	3/31/2007	Thunderstorm Wind	0	0	$0
Hanover Park	7/25/2005	Thunderstorm Wind	0	0	$0
Hanover Park	8/6/2000	Thunderstorm Wind	0	0	$0

Hanson Park	7/22/2011	Thunderstorm Wind	0	0	$150,000
Hanson Park	6/21/2011	Thunderstorm Wind	0	0	$50,000
Hanson Park	6/21/2010	Thunderstorm Wind	0	0	$0
Harvey	6/30/2014	Thunderstorm Wind	0	0	$0
Harvey	10/26/2010	Thunderstorm Wind	0	0	$0
Harvey	8/6/2000	Thunderstorm Wind	0	0	$0
Harwood Hgts	7/11/2011	Thunderstorm Wind	0	0	$10,000
Harwood Hgts	9/22/2006	Thunderstorm Wind	0	0	$0
Hastings	9/11/2013	Thunderstorm Wind	0	0	$0
Hawthorne	6/30/2014	Thunderstorm Wind	0	0	$0
Hawthorne	7/24/2012	Thunderstorm Wind	0	0	$0
Hawthorne	8/4/2008	Thunderstorm Wind	0	0	$0
Hazel Crest	7/13/2016	Thunderstorm Wind	0	0	$0
Hazel Crest	7/20/2006	Thunderstorm Wind	0	0	$0
Hermosa	6/15/2008	Thunderstorm Wind	0	0	$0
Hickory Hills	10/2/2006	Thunderstorm Wind	0	2	$1,000,000
Hickory Hills	6/11/1997	Thunderstorm Wind	0	0	$0
Hillside	6/19/2009	Thunderstorm Wind	0	0	$0
Hoffman Estates	5/2/2018	Thunderstorm Wind	0	0	$0
Hoffman Estates	7/19/2013	Thunderstorm Wind	0	0	$0
Hoffman Estates	7/11/2011	Thunderstorm Wind	0	0	$0
Hoffman Estates	6/21/2011	Thunderstorm Wind	0	0	$0
Hoffman Estates	6/19/2009	Thunderstorm Wind	0	0	$0
Hoffman Estates	8/23/2007	Thunderstorm Wind	0	0	$0
Hometown	5/28/2013	Thunderstorm Wind	0	0	$0
Hometown	5/28/2013	Thunderstorm Wind	0	0	$0
Hometown	8/2/2011	Thunderstorm Wind	0	0	$0
Hometown	6/30/2011	Thunderstorm Wind	0	0	$0
Hometown	6/9/2011	Thunderstorm Wind	0	0	$0
Hometown	5/11/2011	Thunderstorm Wind	0	0	$0
Hometown	6/23/2010	Thunderstorm Wind	0	0	$0

Hometown	3/24/2009	Thunderstorm Wind	0	0	$2,000
Hometown	7/20/2003	Thunderstorm Wind	0	0	$0
Homewood	7/2/2017	Thunderstorm Wind	0	0	$0
Homewood	2/28/2017	Thunderstorm Wind	0	0	$0
Homewood	6/30/2014	Thunderstorm Wind	0	0	$0
Homewood	7/24/2012	Thunderstorm Wind	0	0	$0
Homewood	5/29/2006	Thunderstorm Wind	0	0	$0
Homewood	5/24/2006	Thunderstorm Wind	0	0	$0
Homewood	10/2/2005	Thunderstorm Wind	0	0	$0
Homewood	5/30/2004	Thunderstorm Wind	0	0	$0
Homewood	5/30/2004	Thunderstorm Wind	0	0	$0
Inverness	7/18/2012	Thunderstorm Wind	0	0	$0
Inverness	8/2/2011	Thunderstorm Wind	0	0	$0
Justice	5/20/2014	Thunderstorm Wind	0	0	$50,000
Justice	10/2/2006	Thunderstorm Wind	0	0	$10,000
Kedzie	7/24/2016	Thunderstorm Wind	0	0	$0
Kedzie	7/24/2012	Thunderstorm Wind	0	0	$0
Kedzie	8/4/2008	Thunderstorm Wind	0	0	$10,000
Kedzie	5/2/2008	Thunderstorm Wind	0	0	$0
Kimberly Hgts	6/30/2014	Thunderstorm Wind	0	0	$5,000
Kimberly Hgts	8/4/2012	Thunderstorm Wind	0	0	$0
La Grange	6/21/2011	Thunderstorm Wind	0	0	$150,000
La Grange	8/4/2008	Thunderstorm Wind	0	0	$3,000
La Grange	6/15/2008	Thunderstorm Wind	0	0	$3,000
La Grange	8/6/2000	Thunderstorm Wind	0	0	$0
La Grange Park	7/17/2006	Thunderstorm Wind	0	0	$0
La Grange Park	7/5/2003	Thunderstorm Wind	0	0	$5,000,000
Lambert	7/11/2011	Thunderstorm Wind	0	6	$0
Lansing	6/30/2014	Thunderstorm Wind	0	0	$0
Lansing	3/31/2007	Thunderstorm Wind	0	0	$0
Lansing	10/2/2006	Thunderstorm Wind	0	0	$50,000

Lansing	8/1/2003	Thunderstorm Wind	0	0	$0
Lansing	7/17/2003	Thunderstorm Wind	0	0	$0
Lemont	5/17/2017	Thunderstorm Wind	0	0	$0
Lemont	6/21/2011	Thunderstorm Wind	0	0	$1,000
Lemont	7/21/2004	Thunderstorm Wind	0	0	$0
Lemont	7/6/2003	Thunderstorm Wind	0	0	$0
Lemont	8/3/1997	Thunderstorm Wind	0	0	$0
Lemont	7/18/1997	Thunderstorm Wind	0	0	$0
Lincolnwood	6/21/2011	Thunderstorm Wind	0	0	$15,000
Lincolnwood	6/26/2007	Thunderstorm Wind	0	0	$0
Lincolnwood	9/22/2006	Thunderstorm Wind	0	0	$0
Lynwood	5/30/2013	Thunderstorm Wind	0	0	$0
Lynwood	8/4/2008	Thunderstorm Wind	0	0	$0
Lyons	7/11/2011	Thunderstorm Wind	0	0	$0
Lyons	6/15/2008	Thunderstorm Wind	0	0	$200,000
Lyons	8/2/2006	Thunderstorm Wind	0	0	$20,000
Lyons	7/3/2004	Thunderstorm Wind	0	0	$0
Mannheim	7/1/2012	Thunderstorm Wind	0	0	$0
Matteson	6/30/2014	Thunderstorm Wind	0	0	$0
Matteson	6/23/2010	Thunderstorm Wind	0	0	$0
Matteson	6/23/2010	Thunderstorm Wind	0	0	$100,000
Matteson	8/23/2007	Thunderstorm Wind	0	0	$15,000
Matteson	8/23/2007	Thunderstorm Wind	0	0	$10,000
Matteson	8/2/2006	Thunderstorm Wind	0	0	$5,000
Matteson	10/2/2005	Thunderstorm Wind	0	0	$0
Maywood	7/18/2015	Thunderstorm Wind	0	0	$0
Maywood	8/4/2008	Thunderstorm Wind	0	0	$0
Mc Cook	5/2/2018	Thunderstorm Wind	0	0	$100,000
Mc Cook	7/29/2011	Thunderstorm Wind	0	0	$5,000
Mc Cook	6/18/2010	Thunderstorm Wind	0	0	$0
Mc Cook	6/18/2010	Thunderstorm Wind	1	2	$0

Mc Cook	8/4/2008	Thunderstorm Wind	0	0	$25,000
Melrose Park	5/9/2018	Thunderstorm Wind	0	0	$0
Melrose Park	7/11/2011	Thunderstorm Wind	0	0	$0
Melrose Park	3/13/2006	Thunderstorm Wind	0	0	$0
Melrose Park	5/21/2004	Thunderstorm Wind	0	0	$0
Merrionette Park	6/23/2010	Thunderstorm Wind	0	0	$75,000
Merrionette Park	6/15/2008	Thunderstorm Wind	0	0	$3,000
Midlothian	6/30/2014	Thunderstorm Wind	0	0	$0
Midlothian	10/18/2007	Thunderstorm Wind	0	0	$0
Midlothian	8/23/2007	Thunderstorm Wind	0	0	$0
Midlothian	8/23/2007	Thunderstorm Wind	0	0	$0
Midlothian	7/18/1997	Thunderstorm Wind	0	0	$0
Midway Airport	4/5/1997	Thunderstorm Wind	0	0	$0
Morton Grove	6/21/2011	Thunderstorm Wind	0	0	$2,000
Morton Grove	6/21/2011	Thunderstorm Wind	0	0	$10,000
Morton Grove	6/19/2009	Thunderstorm Wind	0	0	$0
Morton Grove	8/23/2007	Thunderstorm Wind	0	0	$0
Morton Grove	7/25/2005	Thunderstorm Wind	0	0	$0
Morton Grove	8/22/2001	Thunderstorm Wind	0	0	$0
Mt Prospect	6/22/2016	Thunderstorm Wind	0	0	$0
Mt Prospect	6/21/2011	Thunderstorm Wind	0	0	$10,000
Mt Prospect	6/18/2010	Thunderstorm Wind	0	0	$100,000
Mt Prospect	8/23/2007	Thunderstorm Wind	0	0	$100,000
Mt Prospect	7/18/2007	Thunderstorm Wind	0	0	$0
Mt Prospect	7/4/2005	Thunderstorm Wind	0	0	$0
Mt Prospect	7/20/2003	Thunderstorm Wind	0	0	$0
Niles	8/30/2013	Thunderstorm Wind	0	0	$0
Niles	6/21/2011	Thunderstorm Wind	0	0	$50,000
Niles	6/19/2009	Thunderstorm Wind	0	0	$0
Niles	8/4/2008	Thunderstorm Wind	0	0	$5,000
Niles	9/22/2006	Thunderstorm Wind	0	0	$0

Niles	10/13/2001	Thunderstorm Wind	1	6	$5,000
Norridge	6/21/2011	Thunderstorm Wind	0	0	$50,000
North Northfield	9/5/2014	Thunderstorm Wind	1	0	$0
North Northfield	11/17/2013	Thunderstorm Wind	0	0	$0
North Northfield	9/21/2010	Thunderstorm Wind	0	0	$0
North Riverside	8/2/2011	Thunderstorm Wind	0	0	$1,000
North Riverside	6/23/2010	Thunderstorm Wind	0	0	$0
North Riverside	8/2/2006	Thunderstorm Wind	0	0	$20,000
Northbrook	9/5/2014	Thunderstorm Wind	0	0	$25,000
Northbrook	9/21/2010	Thunderstorm Wind	0	0	$0
Northbrook	9/25/2007	Thunderstorm Wind	0	0	$0
Northbrook	8/23/2007	Thunderstorm Wind	0	0	$0
Northbrook	8/23/2007	Thunderstorm Wind	0	0	$0
Northbrook	8/28/1995	Thunderstorm Wind	0	0	$0
Northfield	5/22/2004	Thunderstorm Wind	0	0	$0
Nottingham Park	7/5/2018	Thunderstorm Wind	0	0	$0
O Hare Intl Arpt	8/6/2000	Thunderstorm Wind	0	0	$0
O Hare Intl Arpt	8/6/2000	Thunderstorm Wind	0	0	$0
Oak Forest	6/24/2013	Thunderstorm Wind	0	0	$0
Oak Forest	8/4/2008	Thunderstorm Wind	0	0	$0
Oak Forest	8/23/2007	Thunderstorm Wind	0	0	$30,000
Oak Lawn	5/18/2017	Thunderstorm Wind	0	0	$0
Oak Lawn	11/17/2013	Thunderstorm Wind	0	0	$50,000
Oak Lawn	6/24/2013	Thunderstorm Wind	0	0	$0
Oak Lawn	6/4/2011	Thunderstorm Wind	0	0	$0
Oak Lawn	6/23/2010	Thunderstorm Wind	0	0	$0
Oak Lawn	6/18/2010	Thunderstorm Wind	0	3	$0
Oak Lawn	6/24/2009	Thunderstorm Wind	0	2	$5,000
Oak Lawn	6/4/2005	Thunderstorm Wind	0	0	$0
Oak Lawn	7/21/1999	Thunderstorm Wind	0	0	$0
Oak Park	6/21/2010	Thunderstorm Wind	0	0	$1,000

Oak Park	8/4/2008	Thunderstorm Wind	0	0	$3,000
Oak Park	8/23/2007	Thunderstorm Wind	0	0	$0
Olympia Fields	8/23/2007	Thunderstorm Wind	0	0	$20,000
Olympia Fields	10/2/2005	Thunderstorm Wind	0	0	$0
Orchard Place	6/21/2011	Thunderstorm Wind	0	0	$100
Orland Park	8/4/2008	Thunderstorm Wind	0	0	$50,000
Orland Park	8/23/2007	Thunderstorm Wind	0	0	$0
Orland Park	7/6/2003	Thunderstorm Wind	0	0	$0
Orland Park	7/21/2001	Thunderstorm Wind	0	0	$0
Orland Park	5/8/2000	Thunderstorm Wind	0	0	$0
Orland Park	9/30/1998	Thunderstorm Wind	0	0	$0
Orland Park	9/7/1998	Thunderstorm Wind	0	0	$0
Orland Park	5/18/1997	Thunderstorm Wind	0	0	$0
Palatine	9/5/2014	Thunderstorm Wind	0	0	$0
Palatine	7/11/2011	Thunderstorm Wind	0	0	$0
Palatine	6/21/2011	Thunderstorm Wind	0	0	$1,000
Palatine	9/21/2010	Thunderstorm Wind	0	0	$0
Palatine	6/18/2010	Thunderstorm Wind	0	0	$0
Palatine	6/19/2009	Thunderstorm Wind	0	0	$0
Palatine	9/22/2005	Thunderstorm Wind	0	0	$0
Palos Gardens	6/9/2011	Thunderstorm Wind	0	0	$0
Palos Gardens	6/9/2011	Thunderstorm Wind	0	0	$0
Palos Hgts	8/23/2007	Thunderstorm Wind	0	0	$0
Palos Hills	9/11/2013	Thunderstorm Wind	0	0	$1,000
Palos Hills	8/6/2000	Thunderstorm Wind	0	0	$0
Palos Hills	6/26/1998	Thunderstorm Wind	0	0	$0
Palos Park	12/23/2007	Thunderstorm Wind	0	0	$2,000
Palwaukee Airport	1/18/1996	Thunderstorm Wind	0	0	$0
Park Forest	6/30/2014	Thunderstorm Wind	0	0	$0
Park Forest	7/5/1994	Thunderstorm Wind	0	0	$0
Park Ridge	9/18/2013	Thunderstorm Wind	0	0	$0

Park Ridge	6/24/2013	Thunderstorm Wind	0	0	$0
Park Ridge	6/21/2011	Thunderstorm Wind	0	0	$25,000
Park Ridge	6/24/2009	Thunderstorm Wind	0	0	$10,000
Park Ridge	6/19/2009	Thunderstorm Wind	0	0	$0
Park Ridge	9/22/2006	Thunderstorm Wind	0	0	$25,000
Park Ridge	6/11/1999	Thunderstorm Wind	0	0	$0
Phoenix	6/30/2014	Thunderstorm Wind	0	0	$0
Plum Grove Estates	7/24/2012	Thunderstorm Wind	0	0	$500
Plum Grove Estates	6/28/2008	Thunderstorm Wind	0	0	$0
Posen	6/22/2016	Thunderstorm Wind	0	0	$0
Prospect Hgts	9/5/2014	Thunderstorm Wind	0	0	$0
Prospect Hgts	7/11/2011	Thunderstorm Wind	0	0	$25,000
Prospect Hgts	7/11/2011	Thunderstorm Wind	0	0	$5,000
Prospect Hgts	6/21/2011	Thunderstorm Wind	0	0	$40,000
Richton Park	6/20/2017	Thunderstorm Wind	0	0	$500
Richton Park	8/4/2012	Thunderstorm Wind	0	0	$0
River Forest	6/27/2013	Thunderstorm Wind	0	0	$0
River Forest	7/11/2011	Thunderstorm Wind	0	0	$0
River Forest	6/15/2008	Thunderstorm Wind	0	0	$10,000
River Grove	7/1/2012	Thunderstorm Wind	0	0	$0
River Grove	8/4/2008	Thunderstorm Wind	0	0	$0
River Grove	7/10/2007	Thunderstorm Wind	0	0	$0
Riverside	6/15/2008	Thunderstorm Wind	0	0	$10,000
Riverside	8/2/2006	Thunderstorm Wind	0	0	$20,000
Rolling Meadows	6/21/2011	Thunderstorm Wind	0	0	$1,000
Rolling Meadows	7/25/2005	Thunderstorm Wind	0	0	$0
Roselle	8/6/2000	Thunderstorm Wind	0	0	$0
Rosemont	8/2/2015	Thunderstorm Wind	0	0	$25,000
Rosemont	6/18/2010	Thunderstorm Wind	0	0	$350,000
Rosemont	9/22/2006	Thunderstorm Wind	0	0	$0
Rosemont	7/17/2006	Thunderstorm Wind	0	0	$0

Sag Bridge	5/28/2013	Thunderstorm Wind	0	0	$500
Sauk Vlg	6/24/2009	Thunderstorm Wind	0	0	$0
Schaumburg	11/17/2013	Thunderstorm Wind	0	0	$0
Schaumburg	10/14/2012	Thunderstorm Wind	0	0	$0
Schaumburg	10/14/2012	Thunderstorm Wind	0	0	$5,000
Schaumburg	8/2/2011	Thunderstorm Wind	0	0	$0
Schaumburg	6/21/2011	Thunderstorm Wind	0	0	$0
Schaumburg	6/21/2011	Thunderstorm Wind	0	0	$0
Schaumburg	8/23/2007	Thunderstorm Wind	0	0	$50,000
Schaumburg	5/16/2007	Thunderstorm Wind	0	0	$25,000
Schaumburg	5/13/2004	Thunderstorm Wind	0	0	$0
Schaumburg	5/10/2003	Thunderstorm Wind	0	0	$0
Schaumburg	7/26/1997	Thunderstorm Wind	0	0	$0
Schiller Park	9/22/2006	Thunderstorm Wind	0	0	$20,000
Skokie	8/25/2014	Thunderstorm Wind	0	0	$0
Skokie	8/30/2013	Thunderstorm Wind	0	0	$30,000
Skokie	7/11/2011	Thunderstorm Wind	0	0	$0
Skokie	6/21/2011	Thunderstorm Wind	0	0	$50,000
South Holland	6/30/2014	Thunderstorm Wind	0	0	$0
Steger	7/17/2003	Thunderstorm Wind	0	0	$0
Stickney	9/7/2007	Thunderstorm Wind	0	0	$0
Stickney And Berwyn	8/28/1995	Thunderstorm Wind	0	0	$5,000
Stone Park	7/18/2015	Thunderstorm Wind	0	0	$0
Streamwood	9/5/2014	Thunderstorm Wind	0	0	$75,000
Streamwood	7/18/2012	Thunderstorm Wind	0	0	$0
Streamwood	8/2/2011	Thunderstorm Wind	0	0	$10,000
Streamwood	8/23/2007	Thunderstorm Wind	0	0	$0
Streamwood	8/23/2007	Thunderstorm Wind	0	0	$100,000
Streamwood	5/16/2007	Thunderstorm Wind	0	0	$0
Streamwood	7/17/2006	Thunderstorm Wind	0	0	$15,000
Streamwood	5/30/2004	Thunderstorm Wind	0	0	$0

Streamwood	5/21/2004	Thunderstorm Wind	0	0	$0
Streamwood	8/23/1993	Thunderstorm Wind	0	0	$0
Summit	7/11/2011	Thunderstorm Wind	0	0	$0
Sutton	7/24/2016	Thunderstorm Wind	0	0	$0
Sutton	9/5/2014	Thunderstorm Wind	0	0	$0
Sutton	8/4/2012	Thunderstorm Wind	0	0	$0
The Greens	7/11/2011	Thunderstorm Wind	0	0	$30,000
The Greens	6/21/2011	Thunderstorm Wind	0	0	$15,000
Tinley Park	7/21/2016	Thunderstorm Wind	0	0	$0
Tinley Park	9/27/2009	Thunderstorm Wind	0	0	$0
West Dale	8/4/2008	Thunderstorm Wind	0	0	$0
Western Spgs	6/24/2013	Thunderstorm Wind	0	0	$0
Western Spgs	7/11/2011	Thunderstorm Wind	0	0	$50,000
Wheeling	9/5/2014	Thunderstorm Wind	0	0	$0
Wheeling	6/21/2011	Thunderstorm Wind	0	0	$750,000
Wheeling	6/21/2011	Thunderstorm Wind	0	0	$0
Wheeling	3/24/2009	Thunderstorm Wind	0	0	$50,000
Wheeling	7/10/2008	Thunderstorm Wind	0	0	$0
Wheeling	7/4/2005	Thunderstorm Wind	0	0	$0
Wheeling	5/20/2004	Thunderstorm Wind	0	0	$0
Wheeling	5/28/2003	Thunderstorm Wind	0	0	$0
Willow Spgs	5/11/2011	Thunderstorm Wind	0	0	$0
Wilmette	6/14/2017	Thunderstorm Wind	0	0	$0
Wilmette	6/14/2017	Thunderstorm Wind	0	0	$100,000
Wilmette	7/24/2012	Thunderstorm Wind	0	0	$0
Wilmette	8/13/2011	Thunderstorm Wind	0	0	$2,000
Wilmette	7/11/2011	Thunderstorm Wind	0	0	$0
Wilmette	8/23/2007	Thunderstorm Wind	0	0	$0
Wilmette	9/22/2006	Thunderstorm Wind	0	0	$30,000
Wilmette	5/12/2004	Thunderstorm Wind	0	0	$0
Winnetka	7/1/2012	Thunderstorm Wind	0	0	$10,000

Winnetka	6/21/2011	Thunderstorm Wind	0	0	$0
Worth	9/3/2011	Thunderstorm Wind	0	0	$0
Worth	8/16/2009	Thunderstorm Wind	0	0	$0
Worth	12/23/2007	Thunderstorm Wind	0	0	$0
Worth	8/1/2003	Thunderstorm Wind	0	0	$0

NCDC data for the locations of significant hail events within Cook County are contained in the table below.

Table: Hail Event Locations Within Cook County, NCDC

Date of Event	Location	Deaths	Injuries	Damage Amount
10/2/2006	(Cgx) Meigs Fld Chica	0	0	$0
5/2/2018	(Mdw) Midway Arpt Chi	0	0	$0
7/17/2003	(Mdw) Midway Arpt Chi	0	0	$0
8/3/2003	(Ord) O'Hare Intl Arp	0	0	$0
8/1/2003	(Ord) O'Hare Intl Arp	0	0	$0
4/12/1996	(Ord) O'Hare Intl Arp	0	0	$0
2/28/2017	Alsip	0	0	$0
2/28/2017	Alsip	0	0	$0
6/28/2012	Alsip	0	0	$0
10/18/2007	Alsip	0	0	$0
5/23/2004	Alsip	0	0	$0
6/14/2002	Alsip	0	0	$0
4/10/2017	Arlington Hgts	0	0	$0
4/19/2011	Arlington Hgts	0	0	$0
4/5/2010	Arlington Hgts	0	0	$0
10/2/2006	Arlington Hgts	0	0	$0
9/22/2005	Arlington Hgts	0	0	$0
3/1/2004	Arlington Hgts	0	0	$0
3/1/2004	Arlington Hgts	0	0	$0

8/1/2003	Arlington Hgts	0	0	$0
8/1/2003	Arlington Hgts	0	0	$0
8/1/2003	Arlington Hgts	0	0	$0
7/20/2003	Arlington Hgts	0	0	$0
7/17/2003	Arlington Hgts	0	0	$0
7/6/2003	Arlington Hgts	0	0	$0
6/9/1999	Arlington Hgts	0	0	$0
8/2/2015	Arlington Park	0	0	$0
4/12/2014	Arlington Park	0	0	$0
8/4/2008	Arlington Park	0	0	$0
6/30/2011	Austin	0	0	$17,000,000
6/30/2011	Austin	0	0	$0
7/17/2003	Austin	0	0	$0
7/24/2016	Avondale	0	0	$0
8/2/2015	Avondale	0	0	$0
8/30/2013	Avondale	0	0	$0
5/3/2012	Avondale	0	0	$0
6/30/2011	Avondale	0	0	$0
6/30/2011	Avondale	0	0	$0
6/19/2009	Avondale	0	0	$0
6/19/2009	Avondale	0	0	$0
6/22/2008	Avondale	0	0	$0
8/2/2015	Barrington	0	0	$0
4/12/2014	Barrington	0	0	$0
6/19/2009	Barrington	0	0	$0
6/19/2009	Barrington	0	0	$0
9/22/2005	Barrington	0	0	$0
5/19/2005	Barrington	0	0	$0
3/8/2000	Barrington Hills	0	0	$0
8/2/2015	Barrington Woods	0	0	$0
6/28/2012	Bartlett	0	0	$0

3/1/2004	Bartlett	0	0	$0
8/1/2003	Bartlett	0	0	$0
6/28/2012	Berger	0	0	$0
7/17/2003	Berwyn	0	0	$0
5/20/2014	Beverly Hills	0	0	$0
10/18/2007	Blue Is	0	0	$0
10/18/2007	Blue Is	0	0	$0
6/25/2002	Blue Is	0	0	$0
6/8/2015	Bridgeview	0	0	$0
11/17/2013	Bridgeview	0	0	$0
10/2/2006	Bridgeview	0	0	$0
4/2/2006	Bridgeview	0	0	$0
6/30/2011	Brighton Park	0	0	$750,000
7/1/2012	Brookfield	0	0	$0
6/21/2008	Burbank	0	0	$0
5/23/2004	Burbank	0	0	$0
7/13/2015	Burnham	0	0	$0
5/11/2014	Burnham	0	0	$0
6/28/2012	Burnham	0	0	$0
5/20/2014	Calumet	0	0	$0
1/28/2013	Calumet City	0	0	$0
5/18/2000	Calumet City	0	0	$0
6/27/2013	Chatham	0	0	$0
5/20/2014	Chesterfield	0	0	$0
4/25/2016	Chicago	0	0	$0
10/18/2007	Chicago	0	0	$0
10/18/2007	Chicago	0	0	$0
6/26/2006	Chicago	0	0	$0
5/17/2006	Chicago	0	0	$0
5/17/2006	Chicago	0	0	$0
4/2/2006	Chicago	0	0	$0

7/21/2004	Chicago	0	0	$0
5/23/2004	Chicago	0	0	$0
4/17/2004	Chicago	0	0	$0
3/13/2004	Chicago	0	0	$0
8/3/2003	Chicago	0	0	$0
8/3/2003	Chicago	0	0	$0
7/17/2003	Chicago	0	0	$0
7/15/2003	Chicago	0	0	$0
7/6/2003	Chicago	0	0	$0
10/24/2001	Chicago	0	0	$0
6/11/2001	Chicago	0	0	$0
4/20/2000	Chicago	0	0	$0
7/18/1997	Chicago	0	0	$0
4/12/1996	Chicago	0	0	$0
4/10/1995	Chicago	0	0	$0
2/28/2017	Chicago Hammond Arpt	0	0	$0
8/12/2013	Chicago Hgts	0	0	$0
1/28/2013	Chicago Hgts	0	0	$0
6/4/2008	Chicago Hgts	0	0	$0
6/28/2012	Chicago Howell Arpt	0	0	$0
10/18/2007	Chicago Ridge	0	0	$0
10/18/2007	Chicago Ridge	0	0	$0
10/2/2006	Chicago Ridge	0	0	$0
5/23/2004	Chicago Ridge	0	0	$0
8/4/2008	Cicero	0	0	$0
6/15/2008	Cicero	0	0	$0
5/17/2006	Cicero	0	0	$0
6/4/2005	Cicero	0	0	$0
8/1/2003	Cicero	0	0	$0
7/17/2003	Cicero	0	0	$0
7/6/2003	Cicero	0	0	$0

8/15/1995	Cicero	0	0	$0
7/13/2015	Claburn	0	0	$100,000
8/13/2011	Clybourn	0	0	$0
6/30/2011	Clybourn	0	0	$0
6/30/2011	Corwith	0	0	$0
5/20/2014	Country Club Hills	0	0	$0
6/30/2011	Cragin	0	0	$0
8/30/2013	Cragin Jct	0	0	$0
4/5/2010	Cumberland	0	0	$5,000
5/20/2014	Dearborn Hgts	0	0	$0
9/18/2013	Deering	0	0	$0
6/30/2011	Deering	0	0	$0
5/3/2012	Des Plaines	0	0	$0
4/5/2010	Des Plaines	0	0	$0
6/19/2009	Des Plaines	0	0	$0
9/22/2006	Des Plaines	0	0	$0
6/28/2006	Des Plaines	0	0	$0
5/17/2006	Des Plaines	0	0	$0
5/21/2004	Des Plaines	0	0	$0
8/1/2003	Des Plaines	0	0	$0
8/1/2003	Des Plaines	0	0	$0
7/20/2003	Des Plaines	0	0	$0
7/17/2003	Des Plaines	0	0	$0
5/18/2000	Des Plaines	0	0	$0
4/26/1994	Dixmoor	0	0	$0
7/2/2008	Dunhurst	0	0	$0
6/12/2013	Dunning	0	0	$0
5/3/2012	Dunning	0	0	$0
5/30/2013	East Chicago Hgts	0	0	$0
8/30/2013	Edison Park	0	0	$0

3/20/2017	Elgin	0	0	$0
7/17/2015	Elgin	0	0	$0
12/1/2018	Elk Grove Vlg	0	0	$0
7/21/2017	Elk Grove Vlg	0	0	$0
7/21/2017	Elk Grove Vlg	0	0	$0
7/12/2017	Elk Grove Vlg	0	0	$0
4/29/2014	Elk Grove Vlg	0	0	$0
8/1/2003	Elk Grove Vlg	0	0	$0
7/17/2003	Elsdon	0	0	$0
2/24/2017	Evanston	0	0	$0
8/2/2015	Evanston	0	0	$0
8/2/2015	Evanston	0	0	$0
11/17/2013	Evanston	0	0	$0
11/17/2013	Evanston	0	0	$0
5/3/2012	Evanston	0	0	$0
8/13/2011	Evanston	0	0	$0
4/5/2010	Evanston	0	0	$0
4/5/2010	Evanston	0	0	$0
4/5/2010	Evanston	0	0	$0
6/28/2008	Evanston	0	0	$0
10/2/2006	Evanston	0	0	$0
9/22/2006	Evanston	0	0	$0
6/30/2011	Evergreen Park	0	0	$0
10/24/2010	Evergreen Park	0	0	$0
4/17/2004	Evergreen Park	0	0	$0
8/1/2003	Evergreen Park	0	0	$0
7/13/2015	Fernway	0	0	$0
5/20/2014	Fernway	0	0	$0
4/4/2010	Fernway	0	0	$0
2/28/2017	Flossmoor	0	0	$0
6/12/2013	Flossmoor	0	0	$0

4/25/2016	Forest Glen	0	0	$0
4/5/2010	Forest Glen	0	0	$0
6/5/2008	Forest Glen	0	0	$0
8/3/2003	Franklin Park	0	0	$0
8/1/2003	Franklin Park	0	0	$0
7/12/2017	Glenview	0	0	$0
4/25/2016	Glenview	0	0	$0
5/17/2006	Glenview	0	0	$0
5/20/2014	Glenwood	0	0	$0
5/20/2014	Goeselville	0	0	$0
5/22/2011	Golden Acres	0	0	$0
6/19/2009	Grayland	0	0	$0
3/22/2007	Hanover Park	0	0	$50,000
3/21/2007	Hanover Park	0	0	$0
8/1/2003	Hanover Park	0	0	$0
8/1/2003	Hanover Park	0	0	$0
4/12/1996	Hanover Park	0	0	$0
8/13/2011	Hanson Park	0	0	$0
6/30/2011	Harvey	0	0	$0
4/25/2016	Harwood Hgts	0	0	$0
6/12/2013	Harwood Hgts	0	0	$0
7/23/2009	Harwood Hgts	0	0	$0
7/20/2006	Hazel Crest	0	0	$0
6/26/1998	Hazel Crest	0	0	$0
4/26/1994	Hazel Crest	0	0	$0
6/24/2009	Hermosa	0	0	$0
6/15/2008	Hermosa	0	0	$0
4/20/2004	Hickory Hills	0	0	$0
7/23/2017	Hoffman Estates	0	0	$0
4/10/2017	Hoffman Estates	0	0	$0
7/17/2015	Hoffman Estates	0	0	$0

4/12/2014	Hoffman Estates	0	0	$0
4/5/2010	Hoffman Estates	0	0	$0
4/5/2010	Hoffman Estates	0	0	$50,000
6/1/2009	Hoffman Estates	0	0	$0
5/11/2011	Hometown	0	0	$0
10/24/2010	Hometown	0	0	$0
6/28/2012	Homewood	0	0	$0
5/24/2006	Homewood	0	0	$0
4/17/2004	Homewood	0	0	$0
4/9/2015	Inverness	0	0	$0
10/2/2006	Justice	0	0	$0
5/6/2012	Kedzie	0	0	$0
5/20/2014	Kimberly Hgts	0	0	$0
6/23/2010	La Grange	0	0	$0
3/1/2004	La Grange	0	0	$0
4/26/1994	Lake Calumet	0	0	$0
3/20/2017	Lambert	0	0	$0
9/3/2011	Lambert	0	0	$0
5/20/2014	Lansing	0	0	$0
6/28/2012	Lansing	0	0	$0
7/20/2003	Lansing	0	0	$0
7/17/2003	Lansing	0	0	$0
5/14/2018	Lemont	0	0	$0
4/8/2015	Lemont	0	0	$0
10/3/2013	Lemont	0	0	$0
7/9/2007	Lemont	0	0	$0
10/2/2006	Lemont	0	0	$0
3/30/2005	Lemont	0	0	$0
3/30/2005	Lemont	0	0	$0
6/11/2004	Lemont	0	0	$0
5/28/2003	Lemont	0	0	$0

6/1/1999	Lemont	0	0	$0
8/2/2015	Lincolnwood	0	0	$0
6/19/2009	Lincolnwood	0	0	$0
6/22/2008	Lincolnwood	0	0	$0
5/17/2006	Lincolnwood	0	0	$0
7/20/2003	Lincolnwood	0	0	$0
7/8/2003	Lincolnwood	0	0	$0
4/12/1996	Lincolnwood	0	0	$0
5/30/2013	Lynwood	0	0	$0
6/4/2011	Lyons	0	0	$0
10/2/2006	Mannheim	0	0	$0
9/11/2000	Markham	0	0	$0
4/26/1994	Markham	0	0	$0
6/1/2007	Matteson	0	0	$0
5/24/2006	Matteson	0	0	$0
10/2/2006	Maywood	0	0	$0
5/19/2005	Maywood	0	0	$0
5/2/2018	Mc Cook	0	0	$0
6/4/2011	Melrose Park	0	0	$0
10/2/2005	Melrose Park	0	0	$0
10/18/2007	Midlothian	0	0	$0
4/12/1996	Midlothian	0	0	$0
7/7/2017	Morton Grove	0	0	$0
11/17/2013	Morton Grove	0	0	$0
5/22/2011	Morton Grove	0	0	$0
4/5/2010	Morton Grove	0	0	$0
8/4/2008	Morton Grove	0	0	$0
6/22/2008	Morton Grove	0	0	$0
3/30/2005	Morton Grove	0	0	$0
4/17/2004	Morton Grove	0	0	$0
8/22/2001	Morton Grove	0	0	$0

5/18/2000	Morton Grove	0	0	$0
6/20/1997	Morton Grove	0	0	$0
7/7/2017	Mt Prospect	0	0	$0
8/1/2003	Mt Prospect	0	0	$0
7/17/2003	Mt Prospect	0	0	$0
7/26/1997	Mt Prospect	0	0	$0
7/7/2017	Niles	0	0	$0
5/3/2012	Niles	0	0	$0
5/3/2012	Niles	0	0	$0
4/5/2010	Niles	0	0	$0
4/5/2010	Niles	0	0	$0
4/5/2010	Niles	0	0	$0
5/17/2006	Niles	0	0	$0
8/3/2003	Niles	0	0	$0
8/3/2003	Niles	0	0	$0
7/17/2003	Niles	0	0	$0
5/18/2000	Niles	0	0	$0
4/25/2016	Norridge	0	0	$0
5/3/2012	Norridge	0	0	$0
7/17/2003	Norridge	0	0	$0
6/4/2011	North Riverside	0	0	$0
5/12/2014	Northbrook	0	0	$0
5/12/2014	Northbrook	0	0	$0
4/12/2014	Northbrook	0	0	$0
5/11/2011	Northbrook	0	0	$0
7/17/2003	Northbrook	0	0	$0
4/17/2004	Northfield	0	0	$0
10/18/2007	Oak Forest	0	0	$0
6/22/2006	Oak Forest	0	0	$0
4/20/2004	Oak Forest	0	0	$0
4/20/2004	Oak Forest	0	0	$0

4/10/2017	Oak Lawn	0	0	$0
3/20/2017	Oak Lawn	0	0	$0
5/3/2012	Oak Lawn	0	0	$0
6/7/1995	O'Hare Airport	0	0	$0
2/28/2017	Olympia Fields	0	0	$0
10/2/2006	Olympia Fields	0	0	$0
2/28/2017	Orland Park	0	0	$0
7/13/2015	Orland Park	0	0	$0
6/28/2012	Orland Park	0	0	$0
4/19/2011	Orland Park	0	0	$0
5/29/2006	Orland Park	0	0	$0
3/30/2005	Orland Park	0	0	$0
5/5/1997	Orland Park	0	0	$0
4/19/1996	Orland Park	0	0	$0
4/12/1996	Orland Park	0	0	$0
5/12/2014	Palatine	0	0	$0
4/12/2014	Palatine	0	0	$0
8/4/2012	Palatine	0	0	$0
8/13/2011	Palatine	0	0	$0
4/25/2008	Palatine	0	0	$0
5/16/2007	Palatine	0	0	$0
10/2/2006	Palatine	0	0	$0
10/2/2006	Palatine	0	0	$0
10/2/2006	Palatine	0	0	$0
10/2/2006	Palatine	0	0	$0
5/24/2006	Palatine	0	0	$0
9/22/2005	Palatine	0	0	$0
6/10/2005	Palatine	0	0	$0
7/20/2003	Palatine	0	0	$0
6/28/2012	Palos Gardens	0	0	$0
5/20/2014	Palos Hgts	0	0	$0

8/2/2015	Palos Hills	0	0	$0
6/28/2014	Palos Hills	0	0	$0
1/28/2013	Park Forest	0	0	$0
5/6/2012	Park Forest	0	0	$0
4/10/1999	Park Forest	0	0	$0
4/19/1996	Park Forest	0	0	$0
4/19/1996	Park Forest	0	0	$0
4/26/1994	Park Forest	0	0	$0
4/5/2010	Park Ridge	0	0	$0
6/27/2007	Park Ridge	0	0	$0
5/29/2006	Posen	0	0	$1,000
6/4/2011	Richton Park	0	0	$0
5/25/2011	Richton Park	0	0	$0
8/1/2014	River Forest	0	0	$0
6/28/2006	River Forest	0	0	$15,000
6/28/2006	River Forest	0	0	$0
7/17/2003	River Forest	0	0	$0
10/2/2006	River Grove	0	0	$0
1/28/2013	Riverdale	0	0	$0
4/5/2010	Rolling Meadows	0	0	$0
8/1/2003	Rolling Meadows	0	0	$0
8/2/2015	Rosemont	0	0	$0
4/5/2010	Rosemont	0	0	$868,000
7/7/2017	Sauk Vlg	0	0	$0
6/12/2013	Sauk Vlg	0	0	$0
6/4/2008	Sauk Vlg	0	0	$0
7/21/2017	Schaumburg	0	0	$0
3/20/2017	Schaumburg	0	0	$0
7/17/2015	Schaumburg	0	0	$0
6/12/2013	Schaumburg	0	0	$0
4/17/2013	Schaumburg	0	0	$0

10/14/2012	Schaumburg	0	0	$0
4/19/2011	Schaumburg	0	0	$0
4/5/2010	Schaumburg	0	0	$0
7/18/2007	Schaumburg	0	0	$0
5/21/2004	Schaumburg	0	0	$0
5/20/2004	Schaumburg	0	0	$0
5/9/2004	Schaumburg	0	0	$0
3/1/2004	Schaumburg	0	0	$0
3/1/2004	Schaumburg	0	0	$0
8/1/2003	Schaumburg	0	0	$0
8/1/2003	Schaumburg	0	0	$0
8/1/2003	Schaumburg	0	0	$0
7/15/2003	Schaumburg	0	0	$0
4/30/2003	Schaumburg	0	0	$0
9/11/2000	Schaumburg	0	0	$0
5/17/1999	Schaumburg	0	0	$0
4/21/1999	Schaumburg	0	0	$0
3/30/2005	Schiller Park	0	0	$0
4/5/2010	Skokie	0	0	$0
10/2/2006	Skokie	0	0	$0
5/12/2000	Skokie	0	0	$0
4/12/1996	Skokie	0	0	$0
6/29/2012	South Holland	0	0	$0
7/17/2015	Spaulding	0	0	$0
4/5/2010	Streamwood	0	0	$0
4/5/2010	Streamwood	0	0	$0
4/5/2010	Streamwood	0	0	$0
9/22/2006	Streamwood	0	0	$0
5/9/2004	Streamwood	0	0	$0
8/1/2003	Streamwood	0	0	$0
8/1/2003	Streamwood	0	0	$0

8/1/2003	Streamwood	0	0	$0
8/1/2003	Streamwood	0	0	$0
8/1/2003	Streamwood	0	0	$0
5/10/2003	Streamwood	0	0	$0
5/9/2003	Streamwood	0	0	$0
5/18/2000	Streamwood	0	0	$0
6/4/2011	Tinley Park	0	0	$0
3/8/2009	Tinley Park	0	0	$0
4/17/2004	Tinley Park	0	0	$0
9/11/2000	Tinley Park	0	0	$0
4/19/1996	Tinley Park	0	0	$0
5/3/2012	West Glenview	0	0	$0
10/2/2006	West Glenview	0	0	$0
10/2/2006	West Glenview	0	0	$0
7/1/2012	Westchester	0	0	$0
4/2/2006	Westchester	0	0	$0
4/12/2014	Wheeling	0	0	$0
7/23/2009	Wheeling	0	0	$0
9/22/2005	Wheeling	0	0	$0
5/20/2004	Wheeling	0	0	$0
10/2/2006	Willow Spgs	0	0	$0
4/30/2003	Willow Spgs	0	0	$0
9/22/2006	Wilmette	0	0	$0
9/22/2006	Winnetka	0	0	$0
7/22/2001	Winnetka	0	0	$0
5/20/2014	Worth	0	0	$0
5/20/2014	Worth	0	0	$0
5/3/2012	Worth	0	0	$0
9/3/2011	Worth	0	0	$0
4/4/2010	Worth	0	0	$0

NCDC data for the locations of significant lightning events within Cook County are contained in the table below.

Table: Lightning Event Locations Within Cook County, NCDC

Date of Event	Location	Deaths	Injuries	Damage Amount	Narrative
7/4/2018	(CGX) Meigs Fld Chica	0	1	$0	An adult female was struck by lightning and seriously injured at Maggie Daley Park near South Lake Shore Drive and East Monroe Drive.
4/4/2003	(ORD) O'Hare Intl Arp	0	1	$0	
5/26/2010	Barrington	0	0	$200,000	A house in Barrington was struck by lightning. A fire started in the attic and caused significant damage. Two people in the home at the time got out safely with no injuries reported.
4/5/2010	Bartlett	0	0	$5,000	Power lines were blown down onto a house on Cedar Avenue which started a small fire. The fire damage to the house was minimal but the house sustained smoke damage throughout.
5/2/2008	Bartlett	0	0	$10,000	Lightning struck a high voltage transmission line near the intersection of Stearns Road and Route 59 which knocked out two distribution substations which caused 45,000 customers to lose power.
9/3/2018	Brookfield	0	0	$5,000	Lightning struck a parapet brick wall on a two-story apartment building producing only minor damage.
7/28/2011	Brookfield	0	0	$250,000	Lightning struck a park district building in Phillips Park.
7/23/2001	Calumet City	0	1	$0	
8/2/2006	Chicago	0	1	$25,000	A house was struck by lightning on the northwest side of Chicago. A young girl was watching TV and was taken to the hospital with numbness in her arm. A few blocks away, another bolt of lightning

					struck a hair salon and knocked down part of the facade.
8/2/2006	Chicago	0	0	$10,000	A house was struck by lightning on the west side of Chicago. The surge blew out some appliances.
5/11/2005	Chicago	0	1	$0	A 27-year-old man was struck by lightning and suffered burns and internal injuries.
6/11/1999	Chicago	0	2	$0	Lightning struck a tree, causing a limb to fall on a car on the southwest side of Chicago.
9/19/1997	Chicago	0	1	$0	A 13-year-old boy was critically injured when he was struck by lightning while playing soccer at Gage Park on 55th Street on the southwest side of Chicago. It was not raining and there were no signs of lightning before he was struck.
9/7/1996	Chicago	0	1	$0	
5/24/1996	Chicago	0	1	$0	
5/24/1996	Chicago Ridge	0	1	$0	
6/20/2011	Congress Park	0	0	$10,000	Lightning struck the chimney of a brick building near La Grange Road and Burlington Avenue. Bricks and debris were scattered across the street and on sidewalks.
7/24/2009	Cragin	0	0	$20,000	Lightning struck a three-story apartment building on West Palmer causing a fire in one apartment. The lightning also caused bricks to explode off the building and onto the street below, damaging at least two cars.
7/4/2018	Deering	0	1	$0	A man suffered lightning related injuries while watching fireworks at Belmont Harbor.

9/3/2018	Dunning	0	0	$10,000	A house was struck by lightning and was damaged in the southern part of the Portage Park neighborhood.
7/23/2011	Elk Grove Vlg	0	0	$3,500,000	Lightning struck a 39-unit apartment building in Mt. Prospect. The fire quickly consumed the attic and 3rd floor. Fire departments were delayed by flooded roads. The building was a total loss and would be demolished with all 75 residents having to find a new place to live. Many of the residents lost all their belongings.
7/20/2003	Elk Grove Vlg	0	0	$25,000	
7/23/2011	Glencoe	0	0	$1,000,000	Lightning struck a large house on Lincoln Avenue and started a fire in the attic which spread to the second floor. The house and its contents were a total loss. No one was home at the time of the fire.
7/25/2005	Hanover Park	0	0	$0	A few house fires were started by lightning strikes. One house had damage to the attic from a fire.
7/11/2011	Hanson Park	0	0	$10,000	Lightning struck a large tree which then fell onto a storage building, shifting the roof and making it unsafe to enter.
6/30/2014	Hawthorne	0	1	$50,000	A home on the 15700 block of Peggy Lane was struck by lightning sparking a fire. The building was not occupied because it had been struck by lightning earlier in the year; however, a worker inside the building was shocked and had to be transported to the hospital.
5/20/2014	Hawthorne	0	0	$500,000	Lightning struck the roof of an apartment complex sparking a fire.
8/4/2008	Healy	0	0	$10,000	Lightning struck a tree on N. Ridgeland Avenue, then jumped to electrical wires and into a house. Several electrical appliances were destroyed and a fire was started in the basement.
6/30/2014	Inverness	0	0	$50,000	A home on the 1900 block of Durham Drive caught fire after lightning blew a small hole in the roof.
5/12/2011	Inverness	0	0	$15,000	A house was struck by lightning in the 200 block of South Clyde Avenue in Palatine. Most of the damage to the house was confined to the exterior.

7/23/2010	La Grange Park	0	0	$30,000	Lightning apparently struck a pole at a bank on Burlington Avenue. This pole then fell onto a chimney and then the chimney fell over, damaging a roof. Several pieces of electronic equipment were no longer working after the strike, including credit card readers.
8/17/2015	Maywood	0	0	$2,000	Multiple utility poles were down due to lightning.
7/22/2001	Maywood	1	0	$0	
10/18/2007	Mc Cook	0	1	$0	A 14-year-old boy was struck by lightning while riding his bike in an alley near the 6600 block of Archer Avenue. The boy only suffered minor injuries, including a welt on his back. Doctors believe he suffered an indirect lightning strike after the bolt hit something near him.
4/9/2015	Mt Prospect	0	0	$50,000	Lightning struck a multi-family home on the 400 block of East Lincoln Street causing a fire.
1/22/2002	Mt Prospect	0	1	$5,000	
6/9/2011	North Riverside	0	0	$15,000	Lightning struck the chimney of a house on Herrick Road. The chimney was destroyed. The lightning apparently started a fire on the opposite side of the house, causing minimal additional damage.
5/9/1996	Northbrook	1	0	$0	
5/9/2003	Orland Park	0	0	$0	
6/30/2014	Palatine	0	0	$25,000	A home on the 1600 block of Balmoral Lane was struck by lightning but did not catch fire.
8/20/2011	Palatine	0	0	$150,000	A townhome was struck by lightning and was declared uninhabitable due to extensive smoke and water damage. Minor

					damage was reported to the two adjacent units.
7/29/2011	Palatine	0	0	$5,000	Lightning struck the roof of an apartment near Dundee Road and Route 53. There was smoke in the attic but no fire.
5/12/2011	Palatine	0	0	$35,000	Lightning struck a house in the 800 block of Fremont Avenue, which started a fire in the attic.
6/21/2000	Palos Hgts	0	1	$0	
10/13/2010	Park Ridge	0	0	$2,000	Lightning struck the chimney of a two-story office building, causing bricks to collapse and shoot across the highway. A piece of brick shattered a window at another building. Busse Highway was shut down until debris could be removed.
6/17/1996	Park Ridge	1	0	$0	
6/19/2014	Schaumburg	0	0	$50,000	Lightning struck a home on East Weathersfield Way resulting in a fire that caused moderate damage. No injuries were reported.
9/22/2006	Schiller Park	0	0	$3,000	Lightning struck a utility pole.
5/22/2011	Techny	0	0	$250,000	Lightning struck a four-story apartment building on Summit Drive causing damage to the roof and attic.
8/2/2006	Tinley Park	0	1	$50,000	A house was struck by lightning which started a fire in the attic. The lightning struck the chimney, knocking part of it down. A woman washing her face felt a shock in her arm but suffered no serious injuries.
7/21/2001	Tinley Park	0	0	$20,000	

7/24/2011	Villa West	0	0	$20,000	Lightning ignited a fire in the attic of a home at 84th and Country Club Lane.
7/18/2015	Wilmette	0	0	$15,000	A garage was struck by lightning on Sheridan Road resulting in damage to the bricks and chimney.
8/3/2003	Worth	0	0	$5,000	

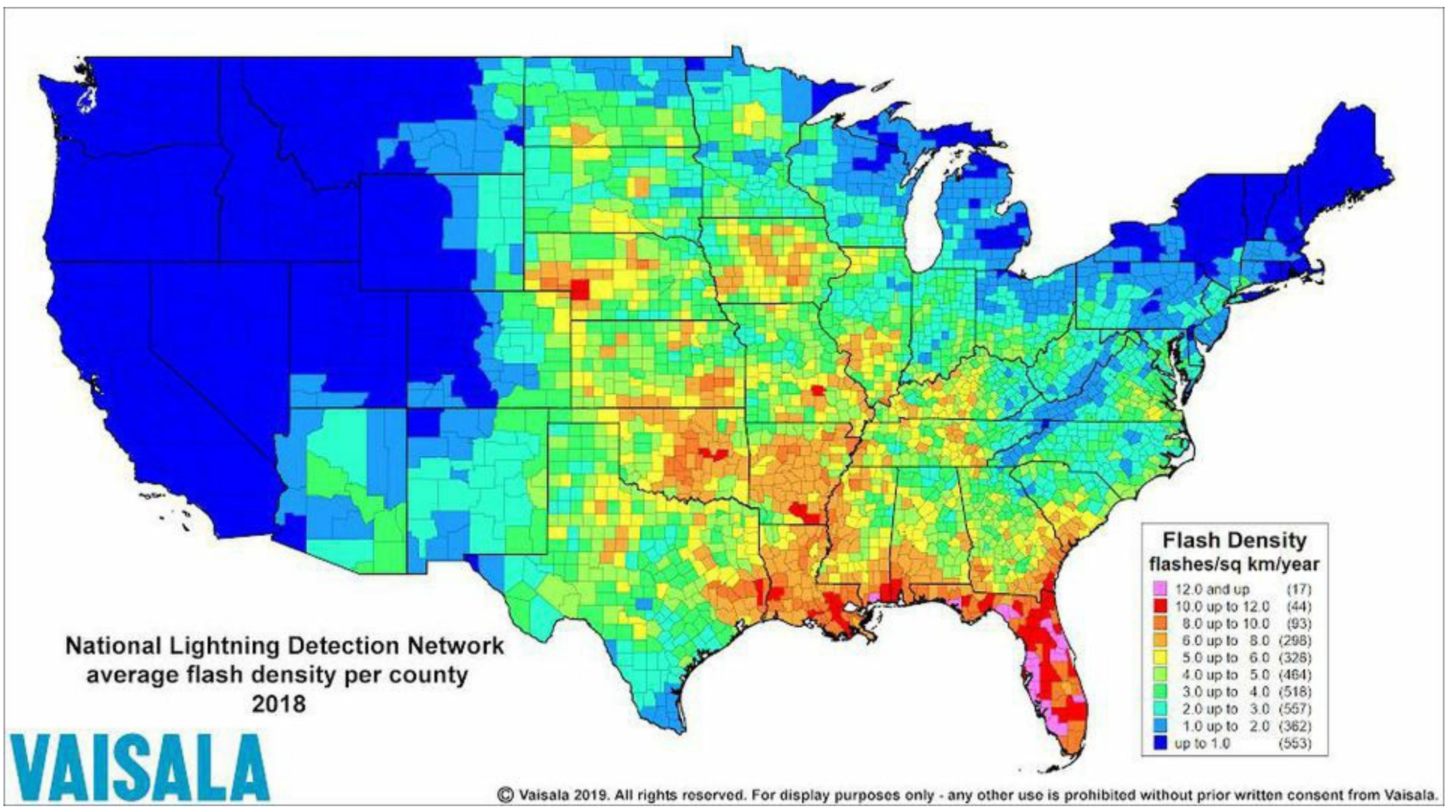
Frequency and Future Hazard Events

Records from the National Climatic Data Center indicate approximately 1,386 severe weather events (not including heat and extreme heat events) in the planning area between 1950 and 2018 occurring between 503 separate days. NCDC data from 1996 to 2018 also records 57 heat or excessive heat events. This means that Cook County can expect approximately 9 days every year where at least one severe weather event is occurring. More specifically, this represents an average of approximately 11 thunderstorm wind, 7 hail, 3 heat or excessive heat, 1 lightning, and 1 high or strong wind event every year. According to the 2018 Illinois Natural Hazard Mitigation Plan, the planning area is designated as severely vulnerable to severe storms, with a high vulnerability to extreme heat as well.

Extent

- **Extreme Heat:** Excessive heat events typically occur in the summer months. The extent of Extreme Heat Events varies in terms of the Heat Index and duration of the event.
- **High Winds:** The extent of the hazard varies in terms of the extent of the path and the wind speed. Extent is addressed at the county level due to the nature of the hazard.
- **Thunderstorms, Lightning, and Hail:** The extent of the historical thunderstorms varies in terms of the size of the storm, the wind speed, and the size of hailstones. Thunderstorms can occur at any location within the county.

Below is a map depicting the average lightning flash density per county in the United States. Flash density defined as the number of flashes of a specific type occurring on or over unit area in unit time. Cook County is between a 4.0 and 5.0 in flashes/sq.km/year



Severity

The most common problems associated with severe storms are immobility and loss of utilities. Fatalities are uncommon, but can occur. Roads may become impassable due to flooding and downed trees. Power lines may be downed due to high winds, and services such as water or phone may not be able to operate without power. Lightning can cause severe damage and injury.

Windstorms can be a frequent problem in the planning area and have been known to cause damage to utilities. The predicted wind speed given in wind warnings issued by the National Weather Service is for a one-minute average; gusts may be 25 to 30 percent higher. Lower wind speeds typical in the lower valleys are still high enough to knock down trees and power lines, and cause other property damage. The planning area, like the rest of the State of Illinois, is located in Wind Zone IV, with speeds up to 250 miles per hour.

Excessive heat events are also typical in the planning area. The severity of such events is likely to be a factor of how early the event occurs in the summer and the number of consecutive days for which the area experiences excessive heat.

Warning Time

Meteorologists can often predict the likelihood of a severe storm or other severe weather event. This can give several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of the storm. Some storms may come on more quickly and have only a few hours of warning time. The Chicago Office of the National Weather Service issues severe storm watches and warnings when appropriate to alert government agencies and the public of possible or impending weather events. The watches and warnings are broadcast over NOAA weather radio and are forwarded to the local media for retransmission using the Emergency Alert System.

In the planning area, heat warnings are issued by the NWS Chicago Forecast Office as follows (National Weather Service, 2014):

- Excessive Heat Advisory—Maximum heat index is expected to exceed 105°F
- Excessive Heat Watch—Upcoming potential for three consecutive days with a peak heat index expected to reach 100ºF to 105°F or two consecutive days with a forecast peak heat index of 105°F to 110ºF or one day with an expected peak heat index forecast at 110ºF or higher
- Excessive Heat Warning—Three consecutive days with a peak heat index expected to reach 100ºF to 105°F or two consecutive days with a forecast peak heat index 105°F to 110ºF or one day with an expected peak heat index forecast at 110ºF or higher.

Secondary Hazards

The most significant secondary hazards associated with severe local storms are floods, falling and downed trees, and downed power lines and associated power outages. Rapidly melting snow combined with heavy rain can overwhelm both natural and man-made drainage systems, causing overflow and property destruction. Excessive heat events can cause failure of motorized systems such as ventilation systems used to control temperatures inside buildings. Fires can occur as a result of lightning strikes.

Power Outages

According to the Commonwealth Edison (ComEd), "Weather-related events cause 70 percent of all power outages." Power outages usually last anywhere from a few minutes to a few hours. In some extreme cases, power outages have lasted a few days or even a few weeks. Severe weather induced power failures can come from the following sources:

- Storms: Thunderstorms increase the chance of lightning striking a vital part of the power grid. In addition, simple things like rain or freezing rain may damage insulators and other components vital for maintaining a functioning circuit. Snow storms with wet snow have the same effect. Insulators keep the flow of electricity moving and not shorting out on buildings and other structures so large amounts of moisture entering the insulators cause a fuse to blow.
- Wind: High and moderate winds lead to power outages by blowing objects into power lines and other components, causing them to break. Momentary outages may occur if an object, such as a tree limb, is blown on to a power line and then falls off. Areas near oceans and other large bodies of salt water may also experience power outages if the wind creates enough salt spray to reach nearby system components vulnerable to damage from sea water. Both high winds (more than 55 mph) and moderate winds (35 to 55 mph) may be sufficient to cause power outages.

Air Quality

Air quality is susceptible to impacts of extreme heat events. The daily air quality index (AQI) indicates how clean or polluted the air is and what associated health effects might be a concern. The AQI focuses on health effects that may be experienced within a few hours or days after breathing polluted air. The U.S. EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. For each of these pollutants, the EPA has established national air quality standards to protect public health. Ground-level ozone and airborne particles are the two pollutants that pose the greatest threat to human health in this country and typically trigger air quality alerts during periods of extreme heat.

Daily AQI values range from 0 to 500. The higher the AQI value, the greater the level of air pollution and the greater the health concern. For example, an AQI value of 50 represents good air quality with little potential to affect public health, while an AQI value over 300 represents hazardous air quality. An AQI value of 100 generally corresponds to the national air quality standard for the pollutant, which is the level the EPA has set to protect public health. AQI values below 100 are generally thought of as satisfactory. When AQI values exceed 100, air quality is considered to be unhealthy, first for sensitive groups of people then for everyone as values get higher. National Weather Service forecast offices issue air quality alerts for public notification and provide recommendations for reducing risks associated with poor air quality as needed.

Exposure

This section provides specific information about the County's exposure to this hazard, such as:

- Population
- Property

- Critical Facilities and Infrastructure
- Environment

Population

The lack of a nationally accepted model to estimate exposure and vulnerability to severe weather hazards prevented the level of a detailed analysis that was done for dam failure, earthquake and flood. However, it can be assumed that the entire planning area is exposed to some extent to severe storm events. Certain areas are more exposed due to geographic location and local weather patterns. Populations living at higher elevations with large stands of trees or power lines may be more susceptible to wind damage and blackout, while populations in low-lying areas are at risk for possible flooding. Populations living in densely populated urban areas are likely to be more exposed to extreme heat events.

Property

The Hazus-MH model shows that there are 1,190,135 buildings within the census tracts that define the planning area. Most of these buildings are residential. Most of the residential structures were built without the influence of a structure building code with provisions for wind loads. All of these buildings are considered to be exposed to the severe weather hazard, but structures in poor condition or in particularly vulnerable locations (located on hilltops or exposed open areas) may risk the most damage. The frequency and degree of damage will depend on specific locations.

Critical Facilities and Infrastructure

All critical facilities exposed to flooding (Chapter 9) are also likely exposed to severe weather. Additional facilities on higher ground may also be exposed to wind damage or damage from falling trees. The most common problems associated with severe weather are loss of utilities. Downed power lines can cause blackouts, leaving large areas isolated. Phone, water and sewer systems may not function. Roads may become impassable due secondary hazards.

Environment

The environment is highly exposed to severe weather events. Natural habitats such as streams and trees are exposed to the elements during a severe storm and risk major damage and destruction. Prolonged rains can saturate soils and lead to slope failure. Flooding events caused by severe weather can produce river channel migration or damage riparian habitat.

Vulnerability

This section provides specific information about the County's vulnerabilities to this hazard, such as:

- Population
- Property
- Critical Facilities and Infrastructure
- Environment

Recognizing the significance of severe weather to Cook County and the lack of meaningful and standardized municipal-level data to better quantify vulnerability at the municipal levels, Cook County DHSEM will standardize and programmatically institute a process to collaborate with individual municipalities and stakeholders to educate, train, and support planning partner members to effectively collect and make available this information.

Whereas many of the severe weather risks affect the entire planning area, and vulnerabilities are described, as a result, at the county level, Cook County DHSEM recognizes the need for greater specificity and data.

Population

The following populations are most vulnerable to a severe weather event, face isolation and exposure during severe storms, and could suffer more secondary effects of the hazard. The following chart provides a breakdown of vulnerable populations by jurisdiction.

Although data is not currently available to give a precise number, any population or communities with no early warning system or an ineffective early warning system would also be vulnerable.

The majority of injuries and deaths associated with lighting strikes occur when people are outdoors; however, almost one-third of lightning related injuries occur indoors. Males are five times more likely than females to be struck by lightning, and people between the ages of 15 and 34 account for 41 percent of all lightning strike victims (CDC, 2013).

Young children, the elderly, those who are sick, overweight or have alcohol problems, and men in general (because they sweat more and become more quickly dehydrated) are more susceptible to extreme heat. The chronically ill and elderly are often taking prescription medications that interfere with the body’s ability to dissipate heat. However, even young and healthy individuals can succumb to heat if they participate in strenuous physical activities during hot weather. Some behaviors also put people at greater risk: drinking alcohol; taking part in strenuous outdoor physical activities in hot weather; and taking medications that impair the body’s ability to regulate its temperature or that inhibit perspiration. Victims of extreme heat events generally have been overexposed to heat or have over-exercised for their age and physical condition (IEMA, 2013). In past studies, extreme heat most strongly affected adults age 50 or older. Additionally, many more males than females were killed by heat than females, due to the higher rate of dehydration men experience.

TABLE:
VULNERABLE POPULATION BY JURISDICTION AND CATEGORY

	Population Under 5	Population Under 18	Population Over 65	Foreign Born	Language other than English Spoken at Home	Access and Functional Needs	No Health Insurance	Population in Poverty	Population in Mobile Homes *By Occupied Housing Units*	Population without vehicles available *By Occupied Housing Units*
Alsip	1,076	4,154	2,851	2,020	3,889	1,643	1,529	191	0	617
Arlington Heights	4,063	15,953	14,523	13,545	17,985	3,838	4,891	3,311	0	1,977
Barrington	503	2,671	2,106	750	1,120	380	483	380	0	212
Barrington Hills	NA	NA	NA	559	NA	NA	NA	338	0	34
Bartlett	2,374	10,273	4,421	7,900	12,034	1,555	2,538	1,883	388	420
Bedford Park	NA	NA	NA	79	NA	NA	NA	68	0	16
Bellwood	1,187	4,333	2,487	1,601	3,335	1,187	2,148	2,204	87	640
Bensenville	1,203	4,137	2,241	6,379	10,680	1,002	3,354	2,096	9	539
Berkeley	223	1,086	690	786	1,715	441	624	380	0	81
Berwyn	3,789	13,894	5,821	14,882	32,730	3,350	7,908	7,029	0	1,842
Blue Island	1,317	5,385	2,704	4,900	9,360	1,733	3,166	4,438	339	1,328

Bridgeview	1,117	3,804	2,282	4,694	7,770	1,457	2,396	3,027	937	440
Broadview	323	1,269	1,438	223	508	608	1,169	600	26	447
Brookfield	1,350	4,494	2,367	1,701	3,883	1,202	1,017	1,498	5	261
Buffalo Grove	2,165	9,192	5,760	13,073	15,688	1,716	1,512	1,879	0	650
Burbank	1,940	6,848	4,109	7,875	14,296	2,397	4,280	3,082	16	0
Burnham	NA	NA	NA	451	NA	NA	NA	973	46	160
Burr Ridge	281	1,620	2,938	2,268	2,506	432	475	421	0	109
Calumet City	2,392	9,096	4,530	3,334	5,472	3,080	5,001	7,792	458	1,933
Calumet Park	284	1,534	1,135	406	552	751	1,120	1,419	123	345
Chicago	178,596	581,789	316,601	560,141	974,158	192,126	384,251	557,435	2,213	279,603
Chicago Heights	2,129	7,836	3,874	3,667	8,487	2,070	4,170	7,807	170	1,409
Chicago Ridge	1,869	4,117	1,728	3,386	6,407	717	1,461	3,611	0	237
Cicero	6,365	24,887	5,875	34,271	68,052	3,672	18,604	16,156	131	2,365
Country Club Hills	991	3,897	2,146	479	1,007	908	1,948	1,767	0	243
Countryside	322	1,352	965	917	1,702	625	530	655	275	205
Crestwood	517	1,616	2,671	495	872	1,163	883	1,001	76	434
Deer Park	NA	NA	NA	456	NA	NA	NA	88	0	13

Deerfield	846	5,296	2,986	1,709	2,028	601	357	319	7	305
Des Plaines	3,184	11,674	10,996	18,749	26,296	3,184	5,601	5,247	621	1,306
Dixmoor	NA	NA	NA	437	NA	NA	666	1,200	614	130
Dolton	1,330	5,614	2,931	902	1,240	2,232	3,292	5,998	81	901
East Dundee	NA	NA	NA	188	NA	NA	NA	NA	0	172
East Hazel Crest	NA	NA	NA	105	NA	NA	NA	238	0	49
Elgin	9,381	30,378	12,397	29,596	51,263	6,701	16,082	14,742	850	1,799
Elk Grove Village	1,688	5,972	5,615	7,043	9,218	1,980	2,077	1,493	17	724
Elmhurst	2,979	12,338	7,077	4,423	6,658	1,862	1,862	1,769	8	650
Elmwood Park	1,334	4,925	4,052	6,599	11,283	1,723	2,960	3,057	0	782
Evanston	4,002	14,821	10,597	14,302	17,860	3,779	4,446	9,856	11	4,981
Evergreen Park	1,140	4,831	2,628	1,275	1,952	1,256	1,082	1,372	14	398
Flossmoor	628	2,207	2,041	628	1,164	462	434	859	0	261
Ford Heights	NA	NA	NA	20	NA	NA	NA	1,252	0	357
Forest Park	677	2,016	2,057	1,671	2,306	1,105	1,450	1,395	0	863
Forest View	NA	NA	NA	110	NA	NA	NA	27	0	15
Frankfort	690	5,197	2,934	921	1,170	844	307	863	0	68

Franklin Park	1,104	3,740	2,404	5,610	10,382	837	2,511	1,371	0	507
Glencoe	461	2,625	1,463	887	1,020	239	204	266	0	147
Glenview	2,457	11,814	10,066	10,444	14,461	1,654	2,363	1,796	208	1,058
Glenwood	501	1,987	1,345	519	668	897	1,029	1,081	0	149
Golf	NA	NA	NA	72	NA	NA	NA	10	0	1
Hanover Park	2,605	10,418	3,426	12,004	18,855	2,529	5,549	4,039	70	366
Harvey	1,380	7,072	3,326	2,376	5,569	1,971	4,411	8,772	298	1,777
Harwood Heights	302	1,346	1,749	3,996	1,304	606	1,304	917	0	456
Hazel Crest	616	3,410	2,287	329	465	712	1,315	1,972	42	553
Hickory Hills	913	3,071	2,241	3,777	5,893	927	1,605	415	0	227
Hillside	127	1,472	1,082	1,249	2,570	573	859	907	18	242
Hinsdale	1,059	5,613	2,489	1,959	2,224	618	600	741	0	101
Hodgkins	NA	NA	NA	580	NA	NA	NA	209	373	51
Hoffman Estates	3,482	12,134	5,990	16,434	23,068	3,021	4,199	2,253	24	597
Hometown	NA	NA	NA	427	NA	NA	NA	113	0	101
Homewood	850	4,589	3,135	1,265	1,719	1,076	1,360	1,190	22	300
Indian Head Park	NA	NA	NA	466	NA	NA	NA	106	0	82

Inverness	164	1,569	1,5010	1,324	1,741	350	171	52	0	57
Justice	1,169	3,457	1,182	3,317	5,732	826	2,326	2,173	151	335
Kenilworth	NA	NA	NA	311	NA	NA	NA	43	0	19
La Grange	1,065	4,617	2,192	1,142	1,837	618	108	664	0	222
La Grange Park	917	3,484	2,407	1,303	2,220	611	651	758	0	405
Lansing	1,272	6,057	4,480	2,710	4,674	1,632	3,291	4,149	14	594
Lemont	703	4,117	3,002	2,556	3,668	789	635	909	0	247
Lincolnwood	531	2,630	2,939	4,483	7,125	716	976	667	10	315
Lynwood	682	2,183	1,188	829	1,382	700	829	976	898	66
Lyons	858	2,565	1,466	2,073	4,742	660	1,665	1,497	0	336
Markham	820	3,291	1,888	509	1,056	1,116	1,205	3,129	0	716
Matteson	914	4,185	2,705	584	1,187	934	2,453	2,277	426	461
Maywood	1,519	5,678	3,155	2,828	6,707	2,056	3,295	4,463	0	893
McCook	NA	NA	NA	21	NA	NA	NA	20	0	12
Melrose Park	2,144	7,278	2,468	8,400	17,722	1,471	5,035	4,761	452	714
Merrionette Park	NA	NA	NA	90	NA	NA	NA	102	167	101
Midlothian	796	3,170	1,838	1,230	2,707	926	1,404	1,057	0	374

Morton Grove	1,009	4,267	5,345	9,338	12,642	1,193	1,721	1,652	34	425
Mount Prospect	4,065	13,170	8,834	16,639	23,414	2,493	5,962	3,035	75	942
Niles	1,693	4,786	7,354	12,199	16,839	1,721	3,998	2,889	27	1,204
Norridge	643	2,456	3,170	4,527	7,440	914	1,400	1,242	9	536
North Riverside	350	1,512	1,136	3,148	720	324	493	701	29	180
Northbrook	1,725	7,396	8,756	6,500	7,827	1,327	730	962	8	691
Northfield	217	1,215	1,431	802	1,014	211	211	347	0	50
Northlake	954	3,389	1,701	3,389	7,072	893	1,750	1,750	5	366
Oak Brook	97	1,203	2,923	2,188	2,462	291	525	275	0	119
Oak Forest	1,096	5,426	3,864	3,124	4,577	1,535	2,631	1,946	23	471
Oak Lawn	3,320	11,713	9,714	9,159	16,098	4,441	5,218	5,496	333	1,724
Oak Park	3,345	12,909	7,108	4,965	6,429	2,875	2,770	4,338	85	2,965
Olympia Fields	NA	NA	NA	172	NA	NA	NA	137	0	121
Orland Hills	467	1,863	538	999	1,714	382	319	857	18	112
Orland Park	2,624	11,721	12,595	8,514	14,461	2,974	3,265	2,507	20	832
Palatine	4,491	16,197	8,575	18,170	24,431	3,062	8,234	6,873	37	1,151
Palos Heights	467	2,071	3,813	1,187	2020	985	694	505	11	85

Palos Hills	1,169	3,473	3,284	5,021	7,789	1,066	2,562	2,063	15	385
Palos Park	NA	NA	NA	440	NA	NA	NA	203	0	169
Park Forest	921	5,592	3,107	879	1,650	2,143	1,886	3,429	36	750
Park Ridge	2,421	9,422	7,038	5,437	8,044	1,452	1,489	1,639	0	767
Phoenix	NA	NA	NA	84	NA	NA	NA	575	5	97
Posen	450	1,925	369	1,445	2,428	328	696	1,609	0	95
Prospect Heights	1,169	3,763	2,626	6,742	9,192	817	3,251	1,569	14	265
Richton Park	603	3,004	1,502	577	711	818	1,891	2,708	8	457
River Forest	621	2,736	1,723	1,036	1,483	534	283	502	15	150
River Grove	868	2,116	1,497	3,123	5,119	659	1,786	1,237	8	168
Riverdale	1,321	3,750	1,109	158	277	1,069	1,281	3,790	11	1,044
Riverside	536	2,213	1,254	942	1,625	571	666	450	0	120
Robbins	317	1,218	885	66	186	1,153	732	2,038	21	391
Rolling Meadows	1,543	5,296	3,420	6,269	9262	1,615	2,802	1,829	0	431
Roselle	1,269	5,256	2,628	3,897	6,004	906	1,155	997	96	302
Rosemont	NA	NA	NA	1,909	NA	NA	NA	979	0	90
Sauk Village	786	3,062	973	435	1,055	1,024	1,366	2,400	196	169
Schaumburg	4,705	15,069	11,026	21,391	27,786	4,411	4,705	4,925	32	1,539

Schiller Park	587	2,522	1,347	4,756	7,404	7,600	1,716	1,578	0	291
Skokie	3,733	13,352	12,529	25,375	33,792	3,227	6,771	6,265	18	1,806
South Barrington	NA	NA	NA	1215	NA	NA	NA	303	0	55
South Chicago Heights	NA	NA	NA	1,039	NA	NA	NA	821	47	107
South Holland	882	5,225	3,354	1,096	1,677	1,591	1,957	2,473	8	276
Steger	429	1,801	1,400	616	1,138	643	980	1,502	0	205
Stickney	490	1,781	841	1,013	2,694	523	933	4,700	0	184
Stone Park	NA	NA	NA	2,284	NA	NA	NA	954	186	155
Streamwood	2,216	8,824	4,392	11,515	18,321	2,770	4,590	2,256	8	360
Summit	1,085	3,636	660	4,117	8,167	660	2,249	2,204	0	263
Thornton	NA	NA	NA	160	NA	NA	NA	296	0	52
Tinley Park	3,091	12,365	8,768	6,407	10,061	3,147	3,709	4,440	27	887
University Park	584	2,031	633	146	431	814	334	897	0	309
Westchester	1,140	3,288	3,744	2,247	4,151	912	1,367	863	0	289
Western Springs	1,126	4,262	2,104	469	791	469	121	295	0	79
Wheeling	2,566	8,514	5,171	16,251	22,783	2,061	6,298	4,471	289	868

Willow Springs	289	1,037	1,179	743	1,111	300	493	266	0	18
Wilmette	1,609	7,934	5,099	4,553	4,635	1,009	709	900	10	508
Winnetka	916	4,087	1,746	954	1,127	409	260	396	15	69
Worth	539	2,208	1,511	2,229	3,084	824	1,732	1,141	134	273

Property

All property is vulnerable during severe storm events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Those in higher elevations and on ridges may be more prone to wind damage.

Loss estimations for the severe storm hazard are not based on damage functions, because no such damage functions have been generated. Instead, loss estimates were developed representing 10 percent, 30 percent and 50 percent of the value of exposed structures. This allows emergency managers to select a range of potential economic impact based on an estimate of the percent of damage to the general building stock. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure. *Table: Loss Potential for Severe Weather* lists the loss estimates.

TABLE:
LOSS POTENTIAL FOR SEVERE WEATHER

	Exposed Value	Loss Potential from Severe Weather		
		10% Damage	30% Damage	50% Damage
North	$206,627,953,798	$20,662,795,380	$61,988,386,140	$103,313,976,898
Central	$725,657,496,175	$72,565,749,618	$217,697,248,852	$362,828,748,087
South	$261,285,685,917	$26,128,568,591	$78,385,705,775	$130,642,842,959
Total	**$1,193,571,135,890**	**$119,357,113,589**	**$358,071,340,767**	**$596,785,567,944**

Critical Facilities and Infrastructure

Severe windstorms and downed trees can create serious impacts on power and above-ground communication lines. Loss of electricity and phone connection would leave certain populations isolated because residents would be unable to call for assistance.

Incapacity and loss of roads (1,426 miles of paved roadways in Cook County) are also primary transportation failures resulting from severe weather, mostly associated with secondary hazards. High winds can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating population, and disrupting ingress and egress. Of particular concern are roads providing access to isolated areas and to the elderly. Prolonged obstruction of major routes due to debris or floodwaters can also disrupt the shipment of goods and other commerce. As a result, large, prolonged storms can have negative economic impacts for an entire region.

Environment

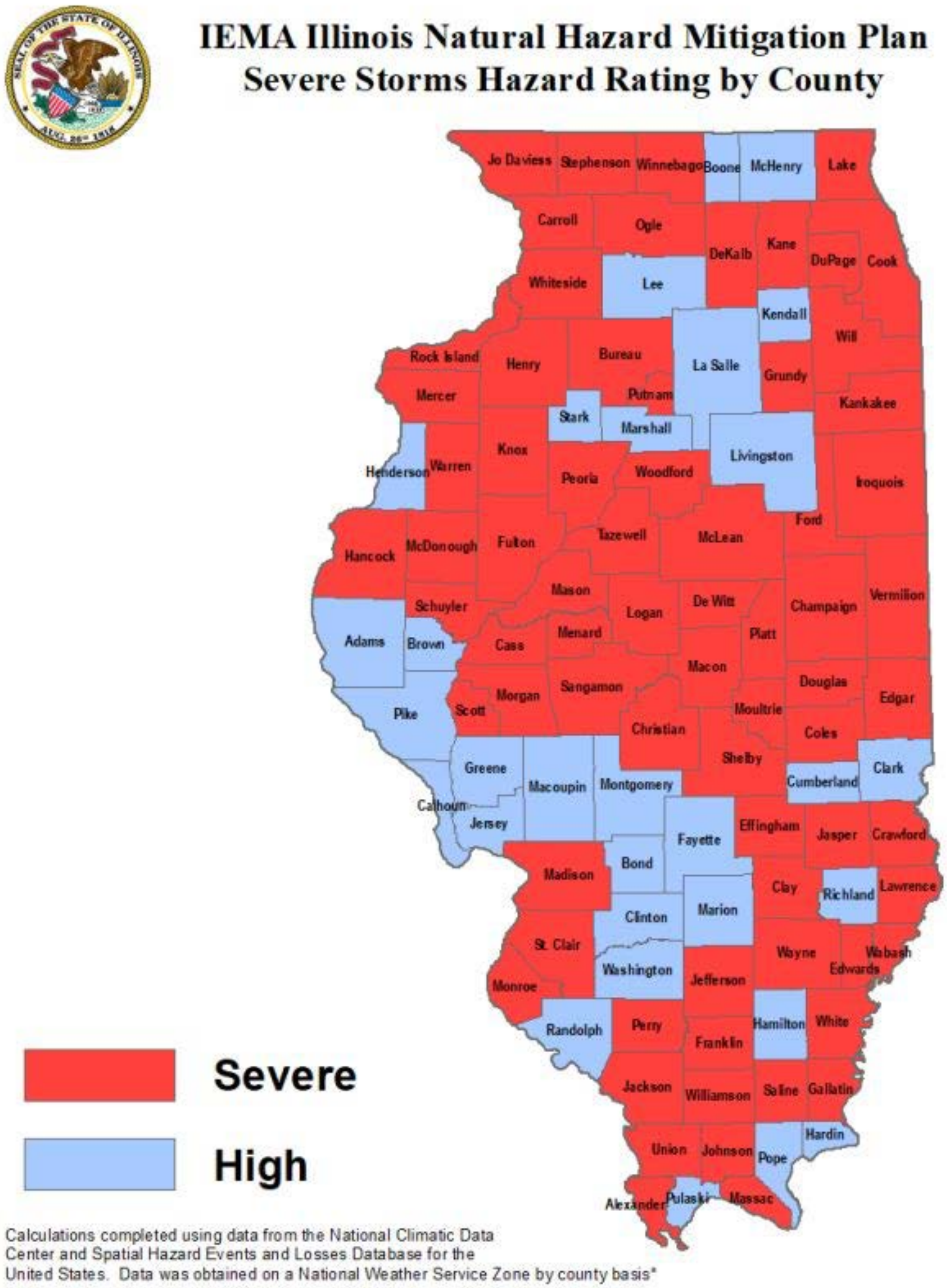
The vulnerability of the environment to severe weather is the same as the exposure.

Future Trends in Development

Annually, Cook County losses an estimated $261,242 and the annual probability of a severe storm occurring is very high (IEMA HMP 2018).

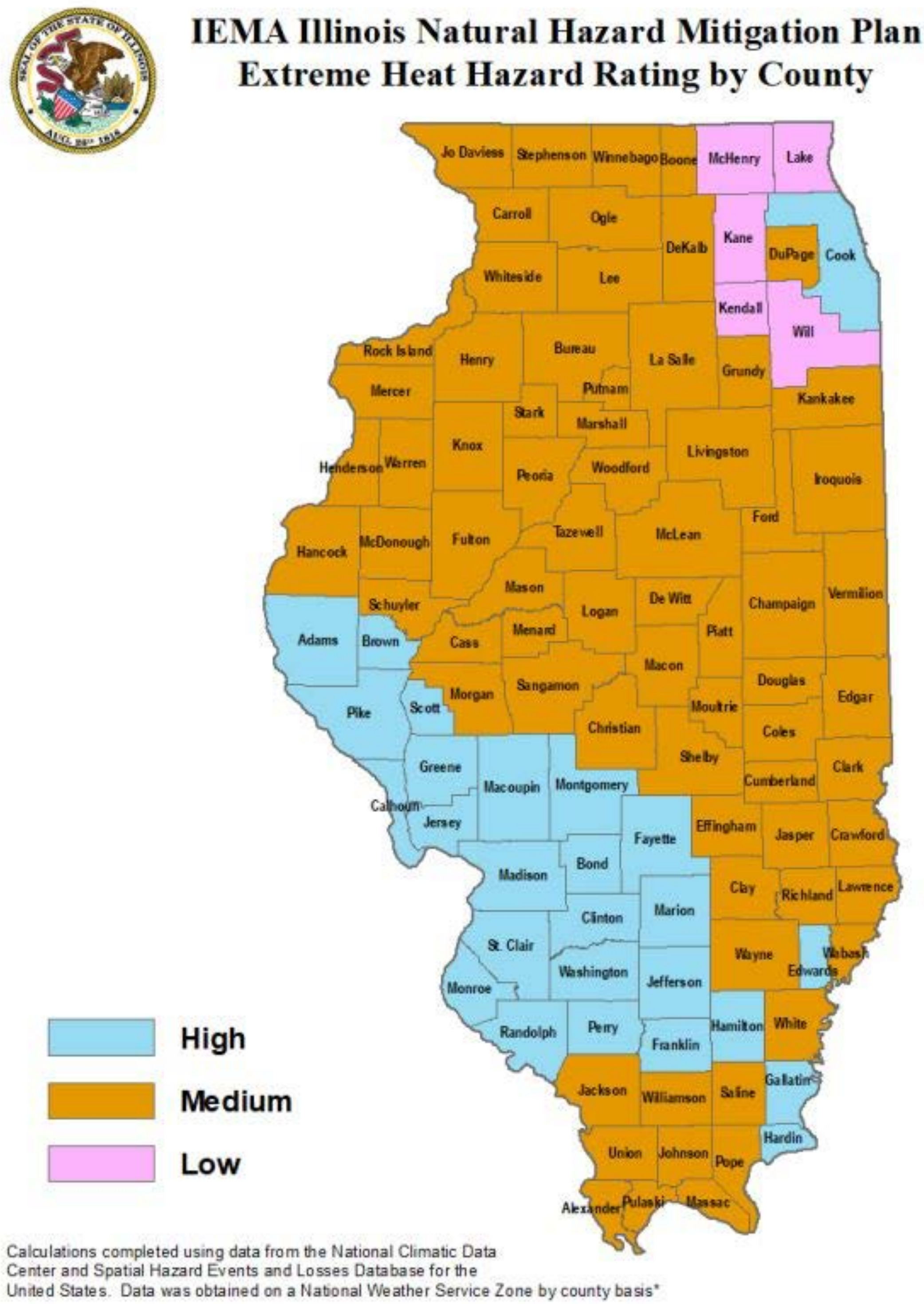
All future development will be affected by severe storms. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. Construction within the unincorporated areas of Cook County is governed by the Cook County Building and Environmental Ordinance. This code is equipped to deal with the impacts of severe weather events. Land use policies identified in comprehensive plans within the planning area also address many of the secondary impacts (e.g. flooding) of the severe weather hazard. To combat the effects of urban heat island effect, communities can implement design standards and urban planning principles that reduce the impacts of excessive heat events. With these tools, the planning partnership is well equipped to deal with future growth and the associated impacts of severe weather.

The IEMA HMP 2018 highlights that the hazard level for severe storms is "Severe" and "High" for extreme heat in Cook County. Both of these ratings are in line with the growing intensity of severe weather patterns that have impacted Cook County.



Map: Severe Storm Hazard Rating

Source: [IEMA HMP 2018]

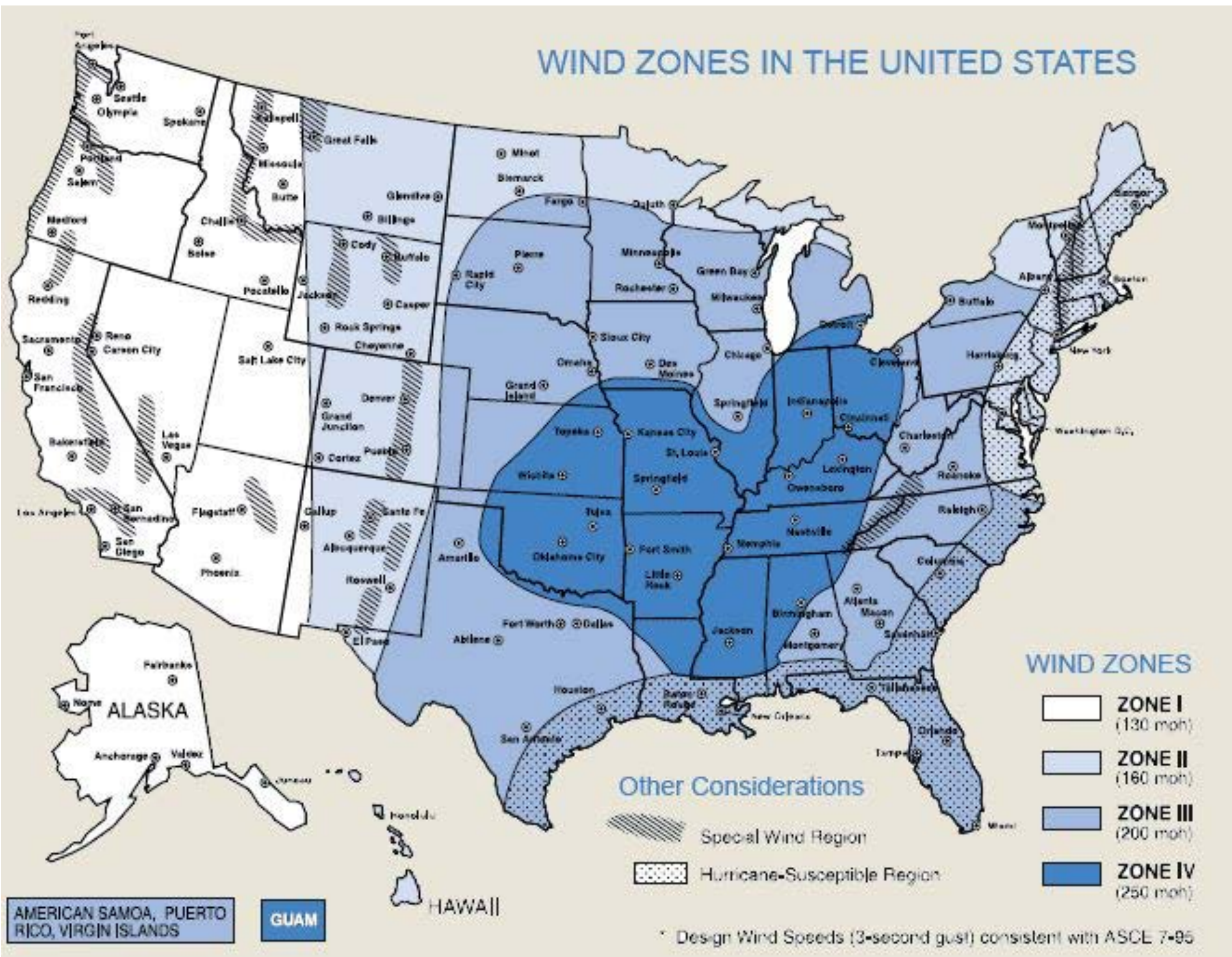


Map: Heat Hazard Rating

Source: [IEMA HMP 2018]

Severe heat waves have caused catastrophic crop failures, thousands of deaths, and widespread power outages due to increased use of air conditioning. In 1995, Chicago experienced a heat wave that contributed to roughly 700 direct and indirect deaths. A similar heat wave occurred in 1999; however, death rates dropped to 100. Chicago has proactively taken steps to mitigate deaths related to heat waves. Further mitigation actions will be needed as temperatures rise and the change in temperature impacts other weather patterns, particularly storm severity.

Although they do not receive as much recognition as tornado events, thunderstorm winds cause more damage year-to-year than tornadoes. Cook County reported damages of $17 million from 784 thunderstorms and strong winds between 1951 -2017. Cook County is located in wind Zone III but very close to Wind Zone IV. Additionally, the closeness of the County to the Lake increases winds, amongst other weather events.



Map: Wind Zones in the US

Source: [IEMA HMP 2018](#) - https://icfresource.com/lg-wndmap.html

Ultimately, severe storms, tornadoes, winds, lightning, and hail all occur separately and together in various combinations in Cook County. The historical data supports the fact that severe storms and tornadoes can and do happen frequently and the County must prepare for increased frequency and intensity,

Scenario

Severe weather impacts can be significant, particularly when secondary hazards occur. A worst-case event would involve prolonged high winds during a thunderstorm. Such an event would have both short-term and longer-term effects. Initially, schools and roads would be closed due to power outages caused by high winds and downed tree obstructions. In more rural areas, some subdivisions could experience limited ingress and egress. Prolonged rain could produce flooding and overtopped culverts with ponded water on roads. Flooding could further obstruct roads and bridges, further isolating residents.

Issues

Severe local storms are probably the most common widespread hazard. They affect large numbers of people throughout Cook County and the surrounding region when they occur. These types of storms can quickly overwhelm resources. Citizens should be prepared for these types of storms: family plans should be developed, disaster kits should be put in homes, workplaces, schools and cars, and every family member should be taught how to shut off household utilities. Initiating early dismissal from schools and businesses is an effective mitigation measure and should be encouraged.

Severe weather cannot be prevented, but measures can be taken to mitigate the effects. Critical infrastructure and utilities can be hardened to prevent damage during an event. The secondary effect of flooding can be addressed through decreasing runoff and water velocity. Important issues associated with a severe weather in the Cook County planning area include the following:

- Redundancy of power supply throughout the planning area must be evaluated.
- The capacity for backup power generation is limited.
- Public education on dealing with the impacts of severe weather needs to be provided.
- Debris management (downed trees, etc.) must be addressed.
- The effects of climate change may result in an increase in frequency of extreme heat events.

Chapter 11. Severe Winter Weather

DEFINITIONS

Freezing Rain—The result of rain occurring when the temperature is below the freezing point. The rain freezes on impact, resulting in a layer of glaze ice up to an inch thick. In a severe ice storm, an evergreen tree 60 feet high and 30 feet wide can be burdened with up to six tons of ice, creating a threat to power and telephone lines and transportation routes.

Winter Storm—A storm having significant snowfall, ice, and/or freezing rain; the quantity of precipitation varies by elevation.

General Background

This section provides specific information about the severe winter weather hazards that affect Cook County. They include:

- Snow
- Blizzards
- Ice Storms
- Extreme Cold and Wind Chill

This section also details information about the Regional Snowfall Index.

Snow

Snow is frozen precipitation in the form of ice crystals. Snow formation requires temperatures to be below freezing in all or most of the atmosphere from the surface up to cloud level. Snow can fall when surface temperatures are above freezing in a relatively shallow layer because it does not have enough time to melt before reaching the ground; such snow is wet with large flakes formed by the wet snowflakes sticking to one another.

Generally, 10 inches of snow will melt into 1 inch of water. Sometimes the snow-liquid ratio may be higher—on the order of 20:1 or 30:1—when snow falls into a very cold air mass, with temperatures of 20ºF or less at ground level.

Blizzards

A blizzard is a winter snowstorm with sustained or frequent wind gusts to 35 mph or more, accompanied by falling or blowing snow reducing visibility to a quarter-mile or less. These conditions must be the predominant condition over a 3-hour period. Extremely cold temperatures are often associated with blizzard conditions, but are not a formal part of the definition. However, the hazard created by the combination of snow, wind and low visibility increases significantly with temperatures below 20ºF. A severe blizzard is categorized as having temperatures near or below 10ºF, winds exceeding 45 mph, and visibility reduced by snow to near zero.

Storm systems powerful enough to cause blizzards usually form when the jet stream dips far to the south, allowing cold air from the north to clash with warm air from the south. Blizzard conditions often develop on the northwest side of an intense storm system. The difference between the lower pressure in the storm and the higher pressure to the west creates a tight pressure gradient, resulting in strong winds and extreme blowing snow.

Ice Storms

Ice storm conditions are defined by liquid rain falling and freezing on contact with cold objects creating ice build-ups of 1/4th inch or more that can cause severe damage. An ice storm warning, now included in the criteria for a winter storm warning, is for severe icing. This is issued when 1/2 inch or more of accretion of freezing rain is expected. This may lead to dangerous walking or driving conditions and the pulling down of power lines and trees. A warning is used for winter weather conditions posing a threat to life and property.

Another form of freezing precipitation is ice pellets, which occur when snowflakes melt into raindrops as they pass through a thin layer of warmer air. The raindrops then refreeze into particles of ice when they fall into a layer of sub-freezing air near the surface of the earth.

Sleet occurs when raindrops fall into subfreezing air thick enough that the raindrops refreeze into ice before hitting the ground. Sleet is different from hail. Sleet is a wintertime phenomenon; hail falls from convective clouds (usually thunderstorms) under completely different atmospheric conditions - and often during the warm spring and summer months

Extreme Cold and Wind Chill

According to the U.S. Centers for Disease Control and Prevention, what constitutes extreme cold and its effects varies in different areas of the country; in regions unaccustomed to winter weather, near freezing temperatures are considered extreme cold. Extreme cold can often accompany severe winter storms. Wind can exacerbate the effects of cold temperatures by carrying heat away from the body more quickly, thus making it feel colder than is indicated by the temperature. This phenomenon is known as wind chill. Wind chill is the temperature that your body feels when the air temperature is combined with wind speed. *Figure: Wind Chill Chart s*hows the value of wind chill based on ambient temperature and wind speed.

Temperature (ºF)

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

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

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

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

Effective 11/01/01

Figure: Windchill Chart

Regional Snowfall Index

NOAA's National Climatic Data Center calculates the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the U.S. A separate index is produced for each of six NCDC climate regions. The planning area is within the Ohio Valley (Central) region. NCDC calculates the index value for each snow storm and each region based on the area of the storm, the total snowfall depth and the affected population. The agency assigns a rating of 1 to 5 for storm severity in the region based on the calculated index:

- RSI = 1 – 3: Category 1 snowstorm (notable)
- RSI = 3 – 6: Category 2 snowstorm (significant)
- RSI = 6 – 10: Category 3 snowstorm (major)
- RSI = 10 – 18: Category 4 snowstorm (crippling)
- RSI > 18: Category 5 snowstorm (extreme).

Hazard Profile

This section provides specific information about this hazard, such as:

- Past Events
- Location
- Frequency and Future Hazard Events
- Extent
- Severity
- Warning Time

Past Events

Severe Winter Weather in Cook County reported by NCDC - NOAA:

- 178 severe winter weather events were reported between 01/01/1950 and 06/01/2019 (25354 days), although Cold/Windchill and Extreme Cold/Windchill were not recorded in available data sets until 1997 and 2006, respectively. There have been many more of these events before 1997 that were not recorded by NCDC data.
    - All events totaled **$700,000** in property damage, **156** direct deaths and **8** indirect deaths, and **5** direct injuries and **3** indirect injuries.
        - Blizzard accounted for 4 events. The most recent blizzard (2011) was the only blizzard event to cause property damage ($200,000), direct death (1), and indirect death (4).
        - Cold/Wind Chill accounted for 91 events; 115 direct deaths were the result of these events. The first recorded event was in 1997.
        - Extreme Cold/Wind Chill accounted for 15 events; 34 direct deaths were the result of these events. No extreme cold/wind chill events were recorded before 2006.
        - Frost/Freeze accounted for 1 event. The May 2004 event yielded record low temperatures at O'Hare airport.
        - Heavy Snow accounted for 24 events. The majority of the events yielded high accumulation of snow on the ground and some events resulted in downed power lines and power outages and traffic accidents.
        - Ice Storm accounted for 2 events.
        - Lake-Effect Snow accounted for 4 events. The two 2014 events and one 2017 event all produced close to a foot or more in certain communities.
        - Sleet accounted for 1 event on December 28, 2015. A record was set at the O'Hare Airport for the amount of sleet in one day.
        - Winter Storm accounted for 30 events. There were 5 direct deaths as the result of the January 15, 2017 event.
        - Winter Weather accounted for 6 events amounting to 4 indirect deaths and 3 indirect injuries. The January 2018 event caused $500,000 in property damage and several hundred car accidents were reported.
- A more detailed spreadsheet can be accessed through this link.

TABLE: BLIZZARD, COLD/WIND CHILL, EXTREME COLD/WIND CHILL, FROST/FREEZE, HEAVY SNOW, ICE STORM, LAKE-EFFECT SNOW, SLEET, WINTER STORM, WINTER WEATHER IN COOK COUNTY, ILLINOIS FROM 1950-2019

Source: www.ncdc.noaa.gov/stormevents

Number of County/Zone areas affected:	1
Number of Days with Event	163
Number of Days with Event	98
Number of Days with Event and Death or Injury	98
Number of Days with Event and Property Damage	1
Number of Days with Event and Crop Damage	0
Number of Event Types reported	9

Location

Severe winter weather events have the potential to happen anywhere in the planning area. Most severe winter events can be somewhat regional in nature, impacting all of the County, or large portions of it.

Frequency and Future Hazard Events

As previously stated, there have been numerous Blizzard (4 events), Frost/Freeze (1), Heavy Snow (24), Ice Storm (2), Lake-Effect Snow (4), Sleet (1), Winter Storm (30), and Winter Weather (6) events from 1950 to June, 2019 (25,354 days). From 1997 through 2018 (22 years) there have been 91 Cold/Wind Chill events and from 2006 to 2018 (13 years) there have been 15 Extreme Cold/Wind Chill Events.

This means that from the recorded history of events until roughly 2018, Cook County has experienced approximately **6** Severe Winter Weather events per year. The fact that cold/windchill and extreme cold/wind chill data was not recorded until 1997 and 2006, respectively, has been factored into this number.

It is likely that the current level of severe winter weather events will continue, likely even at an increasing intensity and frequency, as the impacts of climate change exacerbate the extremes of annual climate cycles across the region.

Extent

- **Extreme Cold**: Extreme cold events typically occur in the winter months. The extent of extreme cold varies in terms of the Wind Chill Temperature and duration of the event.
- **Severe Winter Storms**: The extent of the historical winter storms varies in terms of storm location, temperature, and ice or snowfall. A severe winter storm can occur anywhere in Cook County.

Severity

The most common problems associated with severe winter weather are threats to life safety, immobility, and loss of utilities. Many of the severe winter weather events in the planning area have resulted in numerous losses of life and injuries. Roads may also become hazardous or impassable due to ice or snow. Power lines may be downed due to high winds or ice accumulation, and services such as water or phone may not be able to operate without power. Physical damage to homes and facilities can occur from wind damage or accumulation of snow or ice. Even a small accumulation of snow can cause havoc on transportation systems partly due to lack of snow clearing equipment, inexperienced drivers, and hills.

While sleet and hail can create hazards for motorists when it accumulates, freezing rain can cause the most dangerous conditions. Rain can fall on frozen streets, cars, and other sub-freezing surfaces, creating dangerous conditions. Ice buildup can bring down trees, communication towers, and wires, creating hazards for property owners, motorists, and pedestrians alike. Ice storms accompanied by high winds can have especially destructive impacts, especially on trees, power lines, and utility services.

The planning area typically receives 34 inches of snow each year. Snowfall records, measured in Chicago, are as follows (NWS, 2018):

- The one-day record is 18.6 inches on January 2, 1999
- The one-month record is 42.5 inches during January, 1918
- The winter-long record is 89.7 inches during the winter of 1978-1979.

As recorded in the State of Illinois, 2018, Natural Hazard Mitigation Plan. One of the worst winter storms to impact the state was on January 26-27, 1967, when as much as 23 inches of snow fell on Moline (Rock Island County) and the Chicago area, paralyzing the O'Hare International Airport. Travel throughout northern Illinois was curtailed and areas to the south experienced a glaze of ice which made travel virtually impossible until January 29, 1967. Fifty deaths were directly attributed to this storm.

In 1994, the first winter storm of the season brought 6 to 10 inches of snow. The ice storm caused thousands of tree limbs to break, taking power lines with them. The damage to lines, poles and equipment was extensive; approximately $1,000,000 in damages were recorded and nearly 300,000 residents lost power.

A Category 5 storm in the Ohio Valley Region occurred in 1996 - one of the worst storms ever witnessed in the urban corridor. The slow-moving nature of this storm allowed snow to pile up throughout the urban corridor. The huge amount of snow and the enormous area affected made cleanup efforts slow, leaving the urban corridor paralyzed for a week and causing 3 billion dollars of loss.

On January 24, 2018, freezing rain quickly led to dangerously icy conditions on the roads throughout much of Cook County - many of the southern and western Chicago suburbs, in particular. Several hundred accidents were reported, many vehicles spun off the pavement into ditches, and many motorists abandoned their vehicles. Three of the accidents resulted in fatalities. One person died in Tinley Park when a semi-tractor trailer came across the median and struck a car on LaGrange Road south of 175th Street. A second person was killed when a pick-up truck lost control onto the right shoulder and struck a semi-trailer on southbound Interstate 294 near Burr Ridge. A 20-car pileup involving a semi occurred on Interstate 57 near 159th Street and was spread out over a quarter of a mile. A crash involving two semi-trucks was also reported on southbound Interstate 294 near Interstate 57. Numerous sections of interstates and roadways were closed while accidents were cleared. In Hickory Hills, a car pulling into a gas station slid uncontrollably into a pump, knocking it onto another car, causing a small fire. Total recorded damage was approximately $500,000.

Warning Time

Meteorologists can often predict likely severe winter weather, giving several days of warning time. However, meteorologists cannot predict the exact time of onset or severity of the storm. Some storms may come on more quickly and have only a few hours of warning time. The National Weather Service provides public warnings on storm, snow and ice events as appropriate to alert government agencies and the public of possible or impending weather events. Watches and warnings are broadcast over NOAA weather radio and are forwarded to local media for retransmission using the Emergency Alert System.

Secondary Hazards

The most significant secondary hazards associated with severe winter weather are structural damage from snow loads, wind damage, impacts on life safety, disruption of traffic, economic impact, loss of ability to evacuate, taxing first responder capabilities, service disruption (power, water, etc.), and communication disruption.

Freezing temperatures and extreme cold may cause insulators to fail and conductors to break. Extreme cold has the added effect of making people turn up their heaters, which causes circuit overload and the resulting power outage. People turning on their lights and heaters in anticipation of the power being restored may extend an outage. It creates a high-power demand on fusing that may not be able to handle the stress of the load. Consumers should turn on items that demand electricity slowly and one at a time once power is restored to avoid a new outage from system overload.

Exposure

This section provides specific information about the County's exposure to this hazard, such as:

- Population
- Property
- Critical Facilities and Infrastructure
- Environment

Population

The lack of a nationally accepted model to estimate exposure and vulnerability to severe winter weather hazards prevented the level of detailed analysis that was done for dam failure, earthquake and flood. However, it can be assumed that the entire planning area is exposed to some extent to severe winter weather events. Certain areas are more exposed due to geographic location and local weather patterns. According to the NOAA National Severe Storms Laboratory, winter weather indirectly and deceptively kills hundreds of people in the U.S. every year, primarily from automobile accidents, overexertion, and exposure. Winter storms are often accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, drifting snow, and extreme cold temperatures and dangerous wind chill. They are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. Injuries and fatalities may occur due to traffic accidents on icy roads, heart attacks while shoveling snow, or hypothermia from prolonged exposure to cold. Heavy snow can immobilize a region and paralyze a city, shutting down air and rail transportation, stopping the flow of supplies, and disrupting medical and emergency services.

Property

The Hazus-MH model shows that there are 1,190,135 buildings within the census tracts that define the planning area. Most of these buildings are residential. Most of the residential structures were built without the influence of a structure building code with provisions for wind loads. All of these buildings are considered to be exposed to the severe winter weather hazard, but structures in poor condition or in particularly vulnerable locations (located on hilltops or exposed open areas) may risk the most damage. The frequency and degree of damage will depend on specific locations.

Critical Facilities and Infrastructure

All critical facilities and infrastructure in the planning area are exposed to the severe winter weather hazard. The most common problems associated with severe winter weather are loss of utilities. Downed power lines can cause blackouts, leaving large areas isolated. Phone, water and sewer systems may not function. Roads may become impassable due to ice or snow. Full functionality of critical facilities such as police, fire and medical facilities is essential for response during and after a winter storm event. Because power interruption can occur, backup power is recommended for critical facilities and infrastructure. Infrastructure at risk for this hazard includes roadways that could be damaged due to the application of salt and intermittent freezing and warming conditions that can damage roads over time.

Environment

The environment is highly exposed to severe winter weather events. Natural habitats such as streams and trees are exposed to the elements and risk damage from snow and ice. Flooding events caused by snowmelt can produce river channel migration or damage riparian habitat. Lots of snowfall can lead to flooding in the local ecosystems, impacting the local food chain and potentially spreading pollution. Extended periods of wet/damp conditions can encourage the spread of mold and fungi. It is also possible that frozen tree’s branches can break off under their own weight and damage the tree. Winter conditions may make it harder for animals to obtain food and water, causing a drop off in local populations; livestock may also be impacted.

Vulnerability

This section provides specific information about the County's vulnerabilities to this hazard, such as:

- Population
- Property
- Critical Facilities and Infrastructure
- Environment

Recognizing the significance of severe winter weather to Cook County and the lack of meaningful and standardized municipal-level data to better quantify vulnerability at the municipal levels, Cook County DHSEM will standardize and programmatically institute a process to collaborate with individual municipalities and stakeholders to educate, train, and support planning partner members to effectively collect and make available this information.

Whereas many of the severe winter weather risks affect the entire planning area, and vulnerabilities are described, as a result, at the county level, Cook County DHSEM recognizes the need for greater specificity and data.

Population

Similarly, to severe weather vulnerability, all residents in the planning area are vulnerable to severe winter weather, but the elderly, low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads or without adequate shelter may be especially vulnerable. Power outages can be life threatening to those dependent on electricity for life support. Power outages can also cause life-threatening situations if residents use alternative means to heat their homes without the use of proper ventilation. Isolation of these populations is a significant concern. These populations face isolation and exposure during severe winter weather events and could suffer more secondary effects of the hazard.

- Population without vehicles available who may face isolation or mobility issues: 346,996
- Population with functional needs and/or over the age of 65, because they may have more difficulty evacuating or seeking shelter, and power outages can be life threatening to those dependent on electricity for life support: 708,546 people over 65 years old, 534,813 with a disability, and 240,128 people who fall into both categories.
- Economically disadvantaged populations because they are likely to evaluate their risk and make decisions based on the major economic impact to their family and may not have funds to evacuate: 438,544 people within households with an income of less than $25,000 and 313,048,563 for whom poverty status is determined.
- Population with a language barrier that possibly would be unable to follow warning messages: 696,597
- Population in mobile homes: 14,550

Property

All property is vulnerable during severe winter weather events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Those at higher elevations may be more prone to wind damage. Those that are located under or near overhead lines or near large trees may be vulnerable to falling ice or may be damaged in the event of a collapse.

Loss estimations for the severe winter weather hazard are not based on damage functions, because no such damage functions have been generated. Instead, loss estimates were developed representing 10 percent, 30 percent and 50 percent of the value of exposed structures. This allows emergency managers to select a range of potential economic impact based on an estimate of the percent of damage to the general building stock. Damage in excess of 50 percent is considered to be substantial by most building codes and typically requires total reconstruction of the structure. *Table: Loss Potential for Severe Winter Weather* lists the loss estimates.

TABLE: LOSS POTENTIAL FOR SEVERE WINTER WEATHER				
	Exposed Value	**Loss Potential from Severe Weather**		
		10% Damage	**30% Damage**	**50% Damage**
North	$206,627,953,798	$20,662,795,380	$61,988,386,140	$103,313,976,898
Central	$725,657,496,175	$72,565,749,618	$217,697,248,852	$362,828,748,087
South	$261,285,685,917	$26,128,568,591	$78,385,705,775	$130,642,842,959
Total	**$1,193,571,135,890**	**$119,357,113,589**	**$358,071,340,767**	**$596,785,567,944**

Critical Facilities and Infrastructure

Incapacity and loss of roads (1,426 miles of paved roadways in Cook County) are the primary transportation failures resulting from severe winter weather, mostly associated with secondary hazards. High winds can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating population, and disrupting ingress and egress. Snowstorms can significantly impact the transportation system and the availability of public safety services. Of particular concern are roads providing access to isolated areas and to the elderly.

Prolonged obstruction of major routes due to snow can disrupt the shipment of goods and other commerce. Large, prolonged storms can have negative economic impacts for an entire region.

Severe windstorms, downed trees, and ice can create serious impacts on power and above-ground communication lines. Freezing of power and communication lines can cause them to break, disrupting electricity and communication. Loss of electricity and phone connection would leave certain populations isolated because residents would be unable to call for assistance.

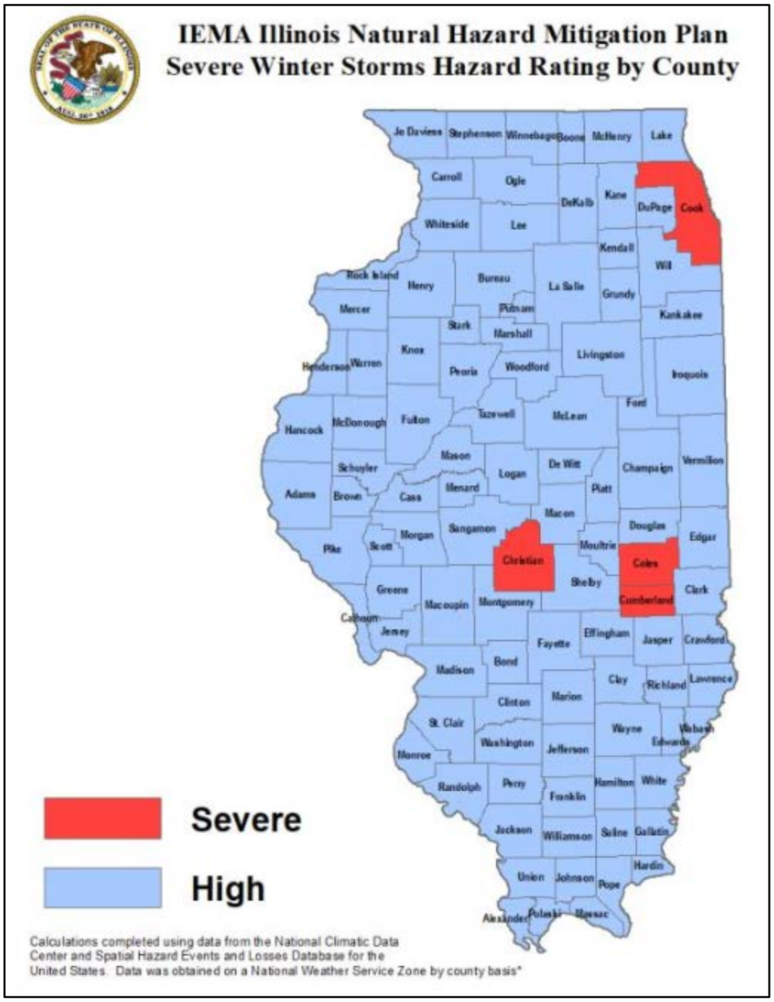
Environment

The vulnerability of the environment to severe winter weather is the same as the exposure.

Future Trends in Development

All future development will be affected by severe winter weather. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. Construction within the unincorporated areas of Cook County is governed by the Cook County Building and Environmental Ordinance. This code is equipped to deal with the impacts of severe winter weather events. Land use policies identified in general plans within the planning area also address many of the secondary impacts of the severe winter weather hazard. With these tools, the planning partnership is well equipped to deal with future growth and the associated impacts of severe winter weather.

Like severe weather, Severe Winter Storms are ranked as "Severe" in Cook County for the hazard analysis done for the IEMA HMP 2018.



Map: Severe Winter Storms Ranking in Illinois

Source: IEMA HMP 2018

Since 1900, there have only been five years in which the state did not record a temperature below zero. This further identifies extreme cold as a common occurrence statewide. The most vulnerable groups are mainly in urban areas, mostly middle-aged or elderly, and often homeless. The National Center for Environmental Information (NCEI) calculates that the annual probability of a severe winter storm happening at 41%.

Building codes and construction must consider snow loads, low temperatures (as well as high temperatures), and ice storms. While buildings are typically not impacted by winter storms, extreme damage can be caused to utilities and roadways and bridges. Proper planning and warning are needed to protect Cook County communities.

Scenario

Severe winter weather impacts can be significant, particularly when secondary hazards occur. A worst-case event would involve prolonged high winds, drifting snow, and whiteout conditions during a winter storm accompanied by thunderstorms. Such an event would have both short-term and longer-term effects. Initially, schools and roads would be closed or unpassable due to drifting snow and whiteout conditions as well as to power outages caused by high winds and downed tree obstructions. Some subdivisions could experience limited ingress and egress.

Issues

Important issues associated with a severe winter weather in the planning area include the following:

- Older building stock in the planning area is built to low code standards or none at all. These structures could be highly vulnerable to severe winter weather events such as windstorms.
- Redundancy of power supply must be evaluated.
- The capacity for backup power generation is limited.
- Isolated population centers.

Chapter 12: Tornado

All of Illinois is susceptible to tornadoes, including Cook County. The peak tornado season runs March through August; however, a tornado can occur in the state at any time.

DEFINITIONS

Tornado—Funnel clouds that generate winds up to 500 miles per hour. They can affect an area up to three-quarters of a mile wide, with a path of varying length. Tornadoes can come from lines of cumulonimbus clouds or from a single storm cloud.
Fujita Scale—Categorizes a tornado by intensity and area.

General Background

A tornado is a narrow, violently rotating column of air that extends from the base of a cumulonimbus cloud to the ground. The visible sign of a tornado is the dust and debris that is caught in the rotating column made up of water droplets. Tornadoes are the most violent of all atmospheric storms. The following are common ingredients for tornado formation:

- Very strong winds in the mid and upper levels of the atmosphere
- Clockwise turning of the wind with height (i.e., from southeast at the surface to west aloft)
- Increasing wind speed in the lowest 10,000 feet of the atmosphere (i.e., 20 mph at the surface and 50 mph at 7,000 feet.)
- Very warm, moist air near the ground with unusually cooler air aloft
- A forcing mechanism such as a cold front or leftover weather boundary from previous shower or thunderstorm activity.

Tornadoes can form from individual cells within severe thunderstorm squall lines. They can form from an isolated super-cell thunderstorm. Weak tornadoes can sometimes occur from air that is converging and spinning upward, with little more than a rain shower occurring in the vicinity. The most extreme tornadoes can attain wind speeds of more than 300 miles per hour, stretch more than two miles across, and stay on the ground for dozens of miles.

Types of tornadoes include land spouts, multiple vortex tornadoes, and waterspouts. Other tornado-like phenomena that exist in nature include dust devils, fire whirls, and steam devils; downbursts are frequently confused with tornadoes, though their action is dissimilar.

Measuring Tornadoes

Tornadoes were originally categorized using the Fujita Scale (F-Scale) or Pearson Fujita Scale, introduced in 1971, based on a relationship between the Beaufort Wind Scales (B-Scales) (measure of wind intensity) and the Mach number scale (measure of relative speed). The Fujita Scale is used to rate the intensity of a tornado by examining the damage caused by the tornado after it has passed over a man-made structure (Tornado Project, Date Unknown). The F-Scale categorizes each tornado by intensity and area. The scale is divided into six categories, F0 (Gale) to F5 (Incredible). *Table: Fujita Damage Scale* explains each of the six F-Scale categories.

TABLE: FUJITA DAMAGE SCALE		
Scale	**Wind Speed (mph)**	**Typical Damage**
F0	< 73	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
F1	73-112	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113-157	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light- object missiles generated; cars lifted off ground.
F3	158-206	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207-260	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5	261-318	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena occur.

The primary limitations of the F-Scale rating system are a lack of damage indicators, no account of construction quality and variability, and no definitive correlation between damage and wind speed. These limitations have led to the inconsistent rating of tornadoes and, in some cases, an overestimate of tornado wind speeds. These limitations led to the development of the Enhanced Fujita Scale (EF-Scale) by the Texas Tech University Wind Science and Engineering Center and a national forum of meteorologists and wind engineers (NOAA 2008). The EF-Scale takes into account more variables than the original F-Scale did when assigning a wind speed rating to a tornado. The EF-Scale became operational on February 1, 2007.

Because the EF-Scale was revised from the original F-Scale to better reflect examinations of tornado damage, it considers how most structures are designed (NOAA 2008). Tornado ratings are assigned based on estimated wind speeds and related damage. When tornado-related damage is surveyed, it is compared to a list of Damage Indicators (DI) and Degree of Damage (DOD), which help better estimate the range of wind speeds produced by the tornado. From that, a rating is assigned, with six categories from EF0 to EF5, representing increasing degrees of damage. *Table: Enhanced Fujita Damage Scale* lists six categories of the EF-Scale.

The EF-Scale offers a set of wind estimates (not measurements) based on damage. Its uses three-second gusts estimated at the point of damage based on a judgment of eight levels of damage to the 28 indicators listed in *Table: Enhanced Fujita Scale Damage Indicators*. These estimates vary with height and exposure. Standard measurements are taken by weather stations in open exposures. *Table: The EF-Scale Ratings* describes the EF-scale ratings.

TABLE: ENHANCED FUJITA DAMAGE SCALE			
EF-Scale Number	**Intensity Phrase**	**Wind Speed (mph)**	**Type of Damage Done**
EF0	Light tornado	65–85	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	Moderate tornado	86-110	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	Significant tornado	111-135	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	Severe tornado	136-165	Severe damage. 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	Devastating tornado	166-200	Devastating damage. Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	Incredible tornado	>200	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); high-rise buildings have significant structural deformation; incredible phenomena occur.

TABLE: **ENHANCED FUJITA SCALE DAMAGE INDICATORS**

No.	Damage Indicator	No.	Damage Indicator
1	Small barns, frames outbuildings	15	School – 1-story elementary (interior or exterior halls)
2	One or two-family residences	16	School – junior or senior high school
3	Single-wide mobile home	17	Low-rise (1-4 story) building
4	Double-wide mobile home	18	Mid-rise (5-20) building
5	Apt, Condo, townhouse (3 stories or less)	19	High-rise (over 20 stories
6	Motel	20	Institutional bldg. (hospital, govt. or university)
7	Masonry Apt. or motel	21	Metal building system
8	Small retail building (fast food)	22	Service station canopy
9	Small professional (Doctor office, Bank)	23	Warehouse (tilt-up walls or heavy timber)
10	Strip Mall	24	Transmission line tower
11	Large shopping mall	25	Free-standing tower
12	Large, isolated (big box) retail building	26	Free standing pole (light, flag, luminary)
13	Automobile showroom	27	Tree – hardwood
14	Automobile service building	28	Tree – softwood

TABLE: THE EF-SCALE RATINGS						
Fujita Scale			Derived		Operational EF Scale	
F Number	Fastest ¼ mile (mph)	3-second gust (mph)	EF Number	3-second gust (mph)	EF Number	3-second gusts (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over -200

Tornado Types

Multiple Vortex Tornadoes

A multiple-vortex tornado is a tornado that contains several vortices rotating around, inside of, and as part of the main vortex. The only times multiple vortices may be visible are when the tornado is first forming or when condensation and debris are balanced enough so that sub-vortices are apparent without being obscured. They are responsible for most (if not all) cases where narrow arcs of extreme destruction lie right next to weak damage within tornado paths. Multi-vortex tornadoes should not be confused with cyclically tornadic super-cells, which are systems that produce many, separate tornadoes at the same time or in succession.

Suction vortices are substructures of many, perhaps all, tornadoes but are not always easily visible. They usually occur where the tornado makes contact with the surface. Sub-vortices tend to form after vortex breakdown reaches the surface and result from the ratio of cyclonically incoming and rising air motions. Multi-vortex structure is not unique to tornadoes, occurring in other circulations such as dust devils; it is a natural result of the physics of vortex dynamics.

The largest tornado ever documented was a multiple-vortex tornado; it struck near the town of El Reno, Oklahoma on May 31, 2013. This storm had a maximum width of 2.6 miles and a maximum recorded wind speed of 295 miles per hour, rating it an EF3 on the Enhanced Fujita scale, second only to the 1999 Bridge Creek–Moore tornado (another multiple-vortex tornado) in terms of maximum recorded wind speed. The May 2011 destructive EF5 Joplin tornado is another example of a multiple-vortex tornado.

A phenomenon similar to multiple vortices is the satellite tornado. It is different from a multiple-vortex tornado in that it exists outside of the main tornado and forms via a different mechanism.

Water Spouts

Waterspouts are characterized by a spiraling funnel-shaped wind current, connecting to a large cumulus or cumulonimbus cloud. They are generally classified as non-super cellular tornadoes that develop over bodies of water, but there is disagreement over whether to classify them as true tornadoes. These spiraling columns of air frequently develop in tropical areas close to the equator, and are less common at high latitudes. There are two methods of water spout formation:

- Waterspouts can form on a clear day with the right amount of instability and wind shear. These can have wind speeds of 60 to 100 mph, but since they do not move very far, they can often be navigated around. They can become a threat to land if they drift onshore.
- A tornadic waterspout is a true tornado that is moving over water at the time that it forms. These form from the same processes that cause tornadoes (see section above). The National Weather Service issues a Special Marine Warning for waterspouts over the coastal waters. The Service issues a Tornado Warning if a waterspout shows signs of moving toward land.

Land spout

A land spout is a colloquial term for a kind of tornado not associated with the mesocyclone of a thunderstorm. Land spouts are considered tornadoes since a rotating column of air is in contact with both the surface and a cumuliform cloud. The Glossary of Meteorology defines land spouts as follows:

> …tornadoes occurring with a parent cloud in its growth stage and with its vorticity originating in the boundary layer. The parent cloud does not contain a preexisting midlevel mesocyclone. The land spout was so named because it looks like a weak Florida Keys waterspout over land.

Land spouts form during the growth stage of convective clouds by stretching boundary layer vorticity upward and into the cumuliform tower's updraft. They generally are smaller and weaker than super-cellular tornadoes and do not contain a mesocyclone or pre-existing rotation in the cloud. Because of this, land spouts are rarely detected by Doppler weather radar. Land spouts develop similarly to waterspouts and bear a strong resemblance to them, usually taking the form of a translucent and highly laminar helical tube. Not all land spouts are visible, and many are first sighted as debris swirling at the surface before eventually filling in with condensation and dust. Land spouts are most common in semi-arid climates characterized by high cloud bases and considerable low-level instability. These conditions tend to favor the High Plains of the United States from spring through summer.

Hazard Profile

This section provides specific information about this hazard, such as:

- Past Events
- Location
- Frequency and Future Hazard Events
- Extent
- Severity
- Warning Time

Past Events

Tornadoes in Cook County reported by NCDC - NOAA:

- 57 tornado and funnel cloud events were reported between 01/01/1950 and 06/01/2019 (25354 days)
    - All events totaled $118,337,750 in property damage, 39 deaths, and 770 injuries.
        - Tornadoes were listed as the event type for 54 of the events resulting in a total of caused $118,337,750 in property damage.
            - 2 tornadoes (1967 and 1976) were rated as F4 and caused $27,500,000 of the damage, along with 35 of the deaths and 523 of the injuries
            - 1 (1991) tornado was rated as F3 and caused $25,000,000 of the damages and 7 of the injuries
            - 13 (1956, 1961, 1962, 3 in 1965, 2 in 1966, 1970, 1972, 1973, 1975,1976, and 2008) tornadoes were rated as F2 and caused $60,075,000 in damages, 4 deaths, and 209 injuries.
            - 18 (1954, 1955, 1956, 1958, 2 in 1959, 1965, 1967, 2 in 1972, 1973, 1977, 1978, 1983, 1985, 1986, 2008, 2010, and 2011) tornadoes were rated as F1 and caused $5,350,000 in damages and 29 injuries.
            - 14 (1966, 1973, 1974, 1980, 1983, 1991, 2003, 2006, 2007, 2008, 2011, 2015, 2016, and 2018) tornadoes were rated as F0 and caused $162,500 in damages and 2 injuries.
            - 3 (1959, 1974, and 1979) tornadoes were not rated and caused $250,250 in damages.
        - Funnel Cloud was listed as the event type for 3 of the events resulting in no damage, deaths, or injuries.
        - The only F5 recorded in the immediate area occurred on August 28, 1990, in nearby Will and Kendall Counties. In total, 29 direct deaths, 350 injuries, and 250 million in property damage was recorded.
- A more detailed spreadsheet can be accessed through this link.

TABLE: TORNADO AND FUNNEL CLOUDS EVENTS IN COOK COUNTY, ILLINOIS FROM 1950-2019

Source: www.ncdc.noaa.gov/stormevents

Number of County/Zone areas affected:	1
Number of Days with Event	49
Number of Days with Event	5
Number of Days with Event and Death or Injury	15
Number of Days with Event and Property Damage	37
Number of Days with Event and Crop Damage	0
Number of Event Types reported	2

Many sources provided historical information regarding previous occurrences and losses associated with tornado events in Illinois and Cook County. With so many sources reviewed, loss and impact information vary, depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the information identified during research for this hazard mitigation plan.

Location

The peak of the tornado season is April through June, with the highest concentration of tornadoes in the central U.S. Illinois is considered to be on the North East edge of "tornado alley." According to the 2018 Illinois Natural Hazard Mitigation Plan, most of the counties in Illinois have a medium hazard rating for tornadoes; the North East corner of the State, including Cook County, are ranked as high, however. Therefore, a tornado event is possible anywhere within or immediately around the entire planning region.

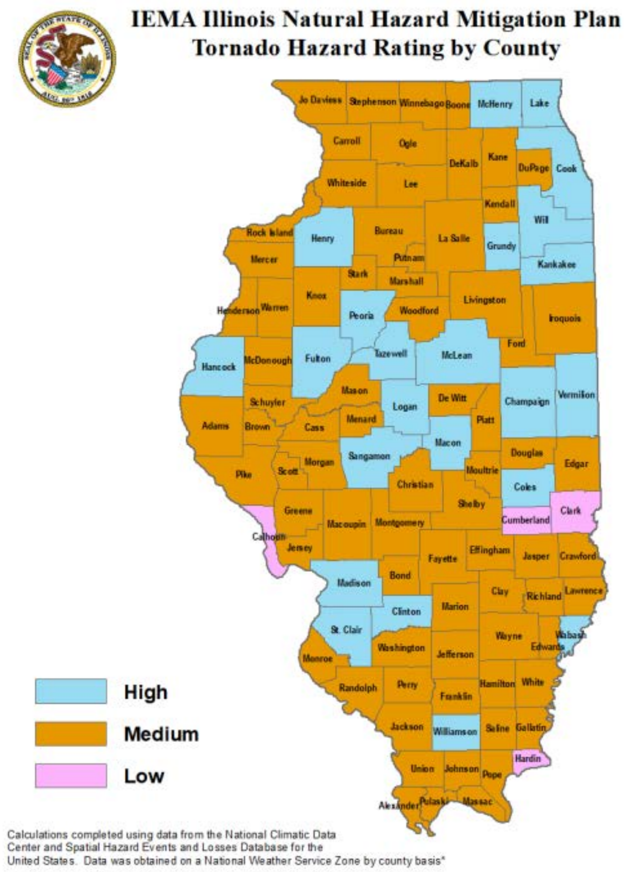


Figure: Illinois Tornado Hazard Rating by County

Frequency and Future Hazard Events

According to the tornado rankings by county from 1950 to 2017 recorded in the 2018 Illinois Natural Hazard Mitigation Plan, Cook County ranked 29th out of 102 counties. Because the counties vary in size, tornado frequency was calculated per hundred square miles; Cook County experiences approximately 5.60 tornadoes per 100 sq. miles. As previously stated, the County experienced 54 tornadoes and 3 funnel cloud events from 1954 to 2018 (65 years) - an average of approximately 1 per year. The average annual frequency of tornadoes in Illinois is increasing, however, as can be seen in the figure below.

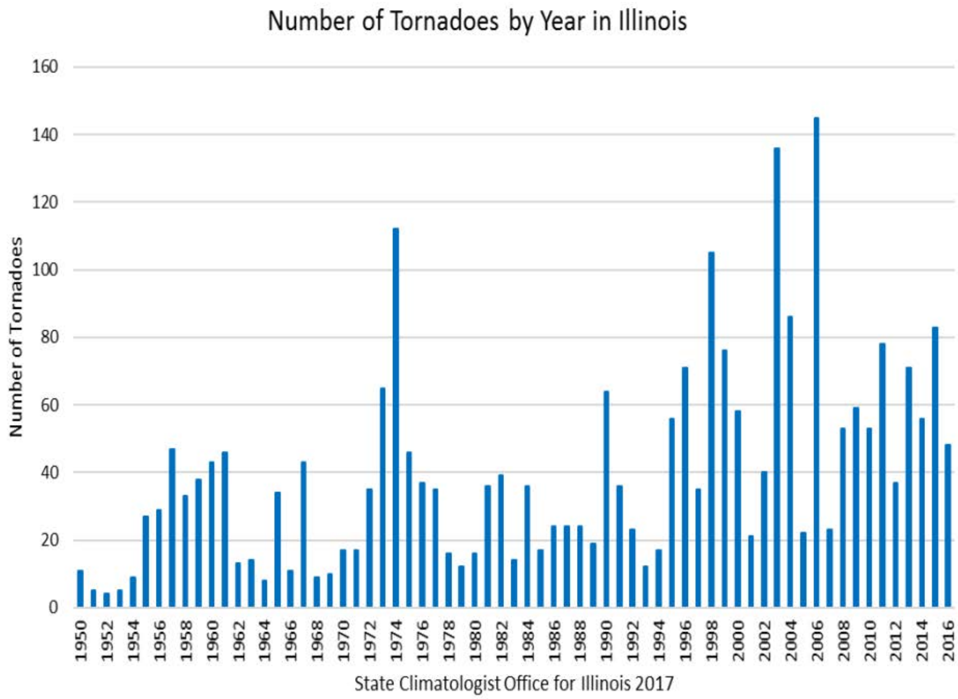


Figure: Number of Tornadoes by Year in Illinois

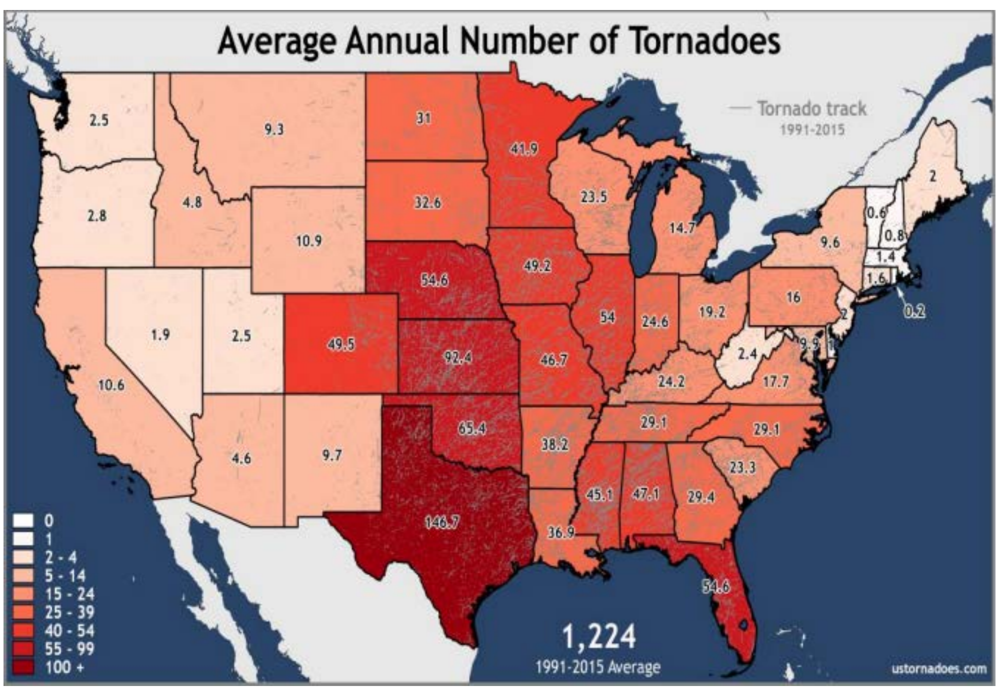


Figure: Annual Average Number of Tornadoes in the U.S., 1991 to 2015

Extent

The extent of the hazard varies in terms of the extent of the path and the wind speed. Extent is addressed at the county level due to the nature of the hazard.

Hazard Type	Affected Jurisdictions	Extent (based on historical events)		Comments
		Minimum	Maximum	
Tornado	County-wide	EF0	EF4	Two (2) F4 tornados have occurred in the county. An F5 was recorded in the immediate area on August 28, 1990, in nearby Will and Kendall Counties

Severity

Tornadoes are one nature's most violent storms. They are almost always spawned from severe storms, can cause fatalities, and even devastate an entire neighborhood in seconds. Winds can reach 300 mph and damage paths can be more than a mile wide and 50 miles long (FEMA 2013). If a major tornado were to strike within the populated areas of Cook County, damage could be widespread. Businesses could be forced to close for an extended period or permanently, fatalities and injuries could be high, as occurred in nearby Will and Kendall counties in August 1990. Impacts on transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting) transportation needs as roads may become impassable. Utility infrastructure (power lines, gas lines, electrical systems) could suffer damage, resulting in a loss of power, which can impact business operations and heating or cooling provision to citizens (including the young and elderly, who are particularly vulnerable to temperature-related health impacts), or leave large areas isolated. Post-event, there is a risk of fire, electrocution or an explosion. Phone, water and sewer systems may not function. Many buildings may be damaged or destroyed completely. Direct wind-induced damage (wind pressures and windborne debris) to buildings is dependent upon the performance of components and cladding, including roof covering (shingles, tiles, membrane), roof sheathing (wood frame construction only), windows and doors and is modeled as such. Structural wall failures can occur for masonry and wood frame walls and uplift of whole roof systems due to failure at the roof/wall connections. Foundation failures (i.e., sliding, overturning and uplift) can potentially take place for manufactured homes.

Warning Time

Tornado watches and warnings are issued by the local NWS office. A tornado watch is released when tornadoes are possible in an area. A tornado warning means a tornado has been sighted or indicated by weather radar. The current average lead time for tornado warnings is 13 minutes, although the NWS is constantly researching ways to improve this number. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible.

Secondary Hazards

Tornadoes have the potential to lead to widespread utility failure, thus exposing vulnerable populations to extreme temperatures. Tornado events may also be accompanied by strong thunderstorms, straight line winds, and hail, which can cause significant property damage on their own right.

Exposure

Using the methodology described, an exposure analysis using Hazus-MH was conducted for the 1-percent-annual-chance and 0.2-percent-annual-chance probabilistic tornado events.

Population

The impact of the tornado hazard on life, health, and safety is dependent upon several factors, including the severity of the event and whether or not adequate warning time was provided to residents. The entire population of Cook County is considered to be exposed to the tornado hazard.

Property

Exposed Value in the Tornado Zone

The value of exposed buildings in the planning area was generated using Hazus-MH and is summarized in *Table: Value of Exposed Buildings Within 1-Percent-Annual-Chance Tornado Zone* and *Table: Value of Exposed Buildings Within 0.2-Percent-Annual-Chance Tornado Zone*. This methodology estimated $121.5 billion worth of building-and-contents exposure to a 1-percent-annual-chance probabilistic tornado, representing 10.18 percent of the total building value of the planning area. The model estimated $253.5 billion worth of building-and-contents exposure to a 0.2-percent-annual-chance probabilistic tornado, representing 21.24 percent of the total building value of the planning area.

TABLE: VALUE OF EXPOSED BUILDINGS WITHIN 1-PERCENT-ANNUAL-CHANCE TORNADO ZONE

	Estimated Tornado Exposure		
Region	**Structure**	**Contents**	**Total**
North	$28,718,358,870	$20,735,229,800	$49,453,588,680
Central	$16,381,576,290	$12,532,519,960	$28,914,096,250
South	$24,416,017,470	$18,768,909,680	$43,184,927,140
Total	**$69,515,952,630**	**$52,036,659,440**	**$121,552,612,070**

TABLE: VALUE OF EXPOSED BUILDINGS WITHIN 0.2-PERCENT-ANNUAL-CHANCE TORNADO ZONE

	Estimated Tornado Exposure		
Region	**Structure**	**Contents**	**Total**
North	$34,287,936,200	$22,550,531,540	$56,838,467,750
Central	$49,486,953,450	$39,822,658,210	$89,309,611,660

South	$60,881,328,540	$46,489,729,090	$107,371,057,620
Total	**$144,656,218,190**	**$108,862,918,840**	**$253,519,137,030**

Land Use in the Tornado Zone

Some land uses are more vulnerable to tornadoes, such as single-family homes, while others are less vulnerable, such as agricultural land or parks. *Table: Land Use Within The Tornado Zone* shows the existing land use of all areas directly in the 1-percent-annual-chance and 0.2-percent-annual-chance tornado zones.

TABLE: LAND USE WITHIN THE TORNADO ZONE

Land Use Classification	1-Percent-Annual-Chance Tornado Zone 0.2		0,2-Percent-Annual-Chance Tornado Zone	
	Area (acres)	**% of total**	**Area (acres)**	**% of total**
Agricultural	0	0.0	6	0.1
Commercial	329	9.9	430	8.5
Education	126	3.8	307	6.1
Industrial	651	19.6	630	12.5
Institutional	12	0.4	353	7.0
Open Space	161	4.8	98	1.9
Residential	1,665	50.1	2,802	55.4
Utility/Right of Way	278	8.4	308	6.1
Vacant	105	3.2	125	2.5
Total	**3,327**	**100.0**	**5,059**	**100.0**

Source: CMAP, 2005. Categories from the 2005 CMAP land-use inventory were aggregated; categories representing major water features were excluded.

Critical Facilities and Infrastructure

Table: Critical Facilities in the 1-Percent-Annual-Chance and 0.2-Percent-Annual-Chance Tornado Zones and *Table: Critical Infrastructure in the 1-Percent-Annual-Chance and 0.2-Percent-Annual-Chance Tornado Zones* summarize the critical facilities and infrastructure in the 1-percent-annual- chance and 0.2-percent-annual-chance tornado zones of the planning area. All critical facilities are likely exposed to tornadoes. Additional facilities on higher ground may also be exposed to wind damage or damage from falling trees.

TABLE: CRITICAL FACILITIES IN THE 1-PERCENT-ANNUAL-CHANCE AND 0.2-PERCENT-ANNUAL-CHANCE TORNADO ZONES

Event	Medical and Health Services	Government Function	Protective	Hazardous Materials	Schools	Other	Total
100-year	5	0	2	26	20	31	**84**
500-year	2	0	5	38	30	38	**113**

TABLE: CRITICAL INFRASTRUCTURE IN THE 1-PERCENT-ANNUAL-CHANCE AND 0.2-PERCENT-ANNUAL-CHANCE TORNADO ZONES							
Event	**Bridges**	**Water Supply**	**Wastewater**	**Power**	**Communications**	**Other**	**Total**
100-year	17	0	0	0	0	17	**34**
500-year	4	0	1	1	2	11	**19**

Environment

The environmental impacts of tornadoes are consistent with impacts of other hazards discussed in this plan. The debris accumulated with tornado events can overwhelm a planning area's ability to manage. A tornado's area of impact tends to be smaller than that of a thunderstorm or other severe storm, but its higher wind speeds can cause much more destruction.

Vulnerability

This section provides specific information about the County's vulnerabilities to this hazard, such as:

- Population
- Property
- Critical Facilities and Infrastructure
- Environment

Population

The following populations face isolation and exposure during tornado events and could suffer more secondary effects of the hazard:

- The elderly and functional needs populations are considered most vulnerable because they require extra time or outside assistance to seek shelter and are more likely to seek or need medical attention, which may not be available due to isolation during or after an event: 708,546 people over 65 years old, 534,813 with a disability, and 240,128 people who fall into both categories.
- Population with a language barrier that possibly would be unable to follow warning messages: 696,597
- Population in mobile homes: 14,550
- People in automobiles at the time of a tornado: 1,725,128 (number of people who travel to work by driving alone or carpooling)

Although data is not currently available to give a precise number, any population or communities with no early warning system or an ineffective early warning system would also be vulnerable.

Property

All property is vulnerable during tornado events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Those in higher elevations and on ridges may be more prone to wind damage.

Damage to buildings is dependent upon several factors including wind speed and duration, and building construction. A probabilistic scenario was run for the planning area for the 1-percent-annual-chance and 0.2-percent-annual-chance probabilistic tornado events. Table: Estimated Damage Within 1-Percent-Annual-Chance Tornado Zone and Table: Estimated Damage Within 0.2-Percent-Annual-Chance Tornado Zone list the estimated losses. The analysis estimated $12.155 billion worth of building-and-contents damage from a 1-percent- annual-chance probabilistic tornado, representing 1.02 percent of the total building value of the planning area, and $37.013 billion worth of building-and-contents damage from a 0.2-percent-annual-chance probabilistic tornado, representing 3.10 percent of the total building value of the planning area.

Critical Facilities and Infrastructure

Incapacity and loss of roads are the primary transportation failures resulting from severe storms, mostly associated with secondary hazards. High winds can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating population, and disrupting ingress and egress. Of particular concern are roads providing access to isolated areas and to the elderly.

Prolonged obstruction of major routes due to debris or floodwaters can disrupt the shipment of goods and other commerce. Large, prolonged storms can have negative economic impacts for an entire region.

Severe winds and downed trees can create serious impacts on power and above-ground communication lines. Loss of electricity and phone connection would leave certain populations isolated because residents would be unable to call for assistance.

TABLE: ESTIMATED DAMAGE WITHIN 1-PERCENT-ANNUAL-CHANCE TORNADO ZONE

	Estimated Tornado Damage		
	Structure	**Contents**	**Total**
North	$1,636,256,580	$1,058,032,100	$2,694,288,680
Central	$2,873,736,930	$2,268,742,870	$5,142,479,820
South	$2,441,601,740	$1,876,890,970	$4,318,492,710
Total	**$6,951,595,250**	**$5,203,665,940**	**$12,155,261,210**

TABLE: ESTIMATED DAMAGE WITHIN 0.2-PERCENT-ANNUAL-CHANCE TORNADO ZONE

	Estimated Tornado Damage		
	Structure	**Contents**	**Total**
North	$5,006,038,680	$3,292,377,610	$8,298,416,290
Central	$7,225,095,210	$5,814,108,100	$13,039,203,300
South	$8,888,673,960	$6,787,500,450	$15,676,174,410
Total	**$21,119,807,850**	**$15,893,986,160**	**$37,013,794,000**

Environment

The vulnerability of the environment to severe storms is the same as the exposure.

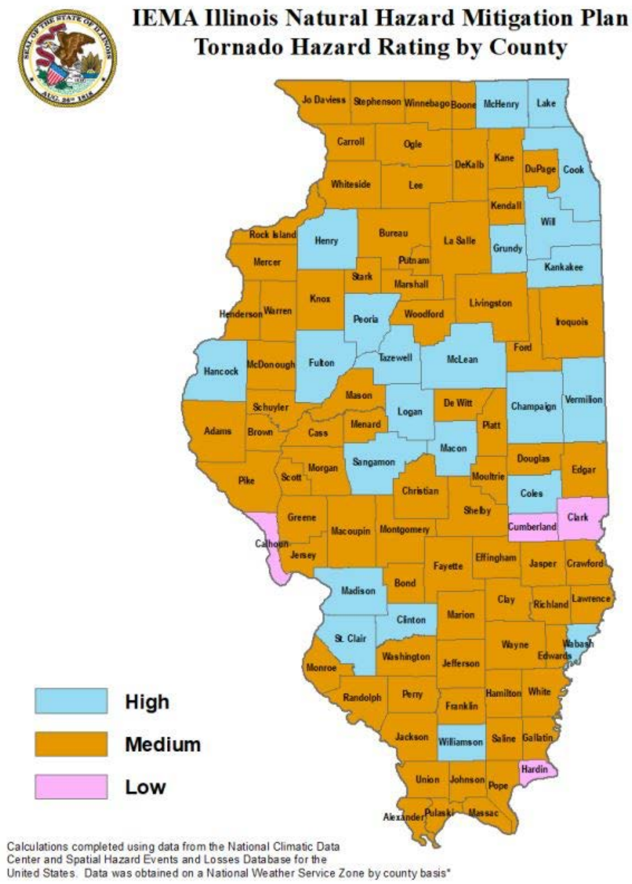
Future Trends in Development

The estimated annual loss from tornadoes in Cook County is $1,792,848 and the annual probability of a tornado occurring is 80% (IEMA HMP 2018*)*.

All future development will be affected by tornadoes. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. The planning partners have adopted the International Building Code. This code is equipped to deal with the impacts of severe storm events, including tornadoes. Land use policies identified in general plans within the planning area also address many of the secondary impacts of the tornado hazard. With these tools, the planning partnership is well equipped to deal with future growth and the associated impacts of tornadoes.

Since 1950, Illinois has averaged 46 tornadoes per year; however, in some years, this average was greatly exceeded. Illinois has one of the higher tornado death tolls of the 50 states due to rare, intense tornadoes that have directly struck towns or cities. Cook County is rated as a "High" risk for tornadoes in the IEMA HMP 2018. The IEMA HMP 2018 additionally calculated the difference in cost between tornadoes and severe storms. Tornadoes caused sustainability more property damage ($2.9 billion versus $738 billion statewide for a 66-year period using NCDC data). The plan also notes that "higher risks are associated with areas with increased populations as well as residential growth," meaning that Cook County is at much greater risk than much of Illinois.

While a growing population is correlated to higher damage potential, Cook County already has a large population. Precaution needs to be taken, especially given the northern location of the county which geographically increases the risk to tornadoes and severe weather.



Map: Tornado Hazard Rating

Source: IEMA HMP 2018

Scenario

Tornadoes are potentially the most dangerous of local storms. If a major tornado were to strike within the populated areas of the planning area, damage could be widespread. Businesses could be forced to close for an extended period or permanently, fatalities could be high, many people could be homeless for an extended period, and routine services such as telephone or power could be disrupted. Buildings may be damaged or destroyed. The State of Illinois is located in the area of the U.S. that has the highest percentage of tornado activity. Illinois ranked eighth in the country for tornado frequency and first in tornado deaths. The true worst-case scenario for the planning area would be an F4 – F5 tornado in the urban core of the planning area, striking during a peak time during the work week.

Issues

Important issues associated with a tornado in the planning area include the following:

- Older building stock in the planning area is built to low code standards or none at all. These structures could be highly vulnerable to severe storm events such as windstorms.
- Redundancy of power supply must be evaluated.
- The capacity for backup power generation is limited, which may adversely impact vulnerable populations and key resources such as assisted living facilities.
- The amount of the tornado zone that contains vacant, developable land is not known. This would be valuable information for gauging the future development potential of the tornado zone.
- Declining growth rate makes it difficult for code standards to have impacts on new development.
- The planning area has insufficient suitable tornado shelters.
- Public awareness of tornado response protocols is a concern, given the large non-resident population.

Chapter 13. Hazards of Interest

The hazards of concern that are assessed in Chapter 6 through Chapter 12 and rated and ranked in Chapter 14 are those that present significant risks in Cook County. Additional hazards were identified by the Steering Committee as having some potential to impact the planning area, but at a much lower risk level.

This chapter presents a short profile of each of these additional hazards of interest, including a qualitative discussion of its potential to impact Cook County. No formal risk assessment of these hazards was performed, as they are more thoroughly addressed in other emergency management planning efforts. However, planning partners and residents should be aware of these hazards and should take steps to reduce the risks they present wherever it is practical to do so. The following hazards are discussed:

- Epidemic or Pandemic
- Nuclear Power Plant Incidents
- Secondary Impacts from Incoming Evacuees
- Widespread Power Outage
- Hazardous Material Incident
- Coastal Erosion

Epidemic or Pandemic

Health hazards that affect the residents of Cook County may arise in a variety of situations, such as during a communicable disease outbreak, after a natural disaster, or as the result of a bioterrorism incident. Communicable diseases may lead to a localized epidemic or wider-reaching pandemic under the right conditions. All populations in Cook County are susceptible to bioterrorism or pandemic events. Populations who are young, elderly, or have compromised immune systems are likely to be more vulnerable and are considered at-risk population. However local plans should consider all populations, as disease may target a wide range of populations under a variety of conditions.

The U.S. Centers for Disease Control and Prevention define an outbreak as the occurrence of more cases of disease than normally expected within a specific place or group of people over a given period. State and local regulations require immediate reporting of any known or suspected outbreaks by health care providers, health care facilities, laboratories, veterinarians, schools, child day care facilities, and food service establishments. An epidemic is a localized outbreak that spreads rapidly and affects a large number of people or animals in a community. A pandemic is an epidemic that occurs worldwide or over a very large area and affects a large number of people or animals.

A variety of factors contribute to the spread and emergence of infectious diseases. Rapid population growth, increasing poverty, increasing urban migration, increased rates of people with impaired immunity, poor sanitary conditions, unavailability of health care to people of certain socioeconomic groups, and frequent travel across state and international boundaries by tourists, workers, immigrants, and refugees can facilitate rapid spread of disease among humans within a country and internationally. Diseases can also be spread by humans’ alteration of the habitats of animals that transmit disease, should the alteration increase proximity of infected animals to human populations.

Pandemic influenza has been classified at the State level as having a low probability of occurring and being difficult to predict. However, recent occurrences have made it a concern of note. According to the Centers for Disease Control and Prevention and the Illinois Department of Public Health, the seasonal influenza, a viral infection, results in approximately 36,000 deaths in the United States, including 2,000 in Illinois, and 200,000 hospitalizations annually. However, the genetic make-up of the virus allows it to quickly change and introduce new strains into human populations where no prior immunity exists. Such was the case of past outbreaks of H5N1 and H7N9 Influenza A, which were previously only found in birds but changed to be able to infect humans.

According to national projections by the Centers for Disease Control and Prevention, a pandemic flu with a 15- to 35-percent attack rate could cause 2 to 4.5 million cases in Illinois with up to 9,000 deaths.

The *Illinois Pandemic Preparedness and Response Plan* was produced by the Illinois Department of Public Health to provide a framework for state, local, and federal public health and medical officials to work together to reduce morbidity, mortality, and social disruption that would result from a pandemic influenza outbreak. Local jurisdictions should consult this framework in the development of local plans for pandemic response.

Based on their characteristics and capacity to spread, the following human diseases could also contribute to a serious epidemic in the area and should be noted:

- Methicillin-resistant staphylococcus
- West Nile virus
- Influenza
- H1N1 influenza
- Severe acute respiratory syndrome
- Measles
- Hepatitis
- Tuberculosis
- E. coli
- Lye disease
- Hantavirus
- Leptospirosis

An epidemic or pandemic would likely last longer than most incidents in that it would take time for a community to build an immunity for a disease in the event that vaccinations were not available prior to the outbreak. Additionally, it is likely that first responders and health care providers would be affected by disease at the same rate or higher, thus reducing their numbers and capacity to provide care to the general population. Cascading events caused by an major disease outbreak may include disruption of utilities, law enforcement, and essential fire, government, and other services; shortages of medical supplies, vaccine, equipment (ventilators, etc.), hospital beds, and health-care workers; high absenteeism at schools, businesses, and government facilities; reduced transportation system capacity due to illness of employees; and post-pandemic, long-term convalescence needs. Outbreaks can also require isolation of large populations to reduce spread, including closure of large gathering places, businesses, etc.

Nuclear Power Plant Incidents

There are currently six nuclear power plants in operation within the State of Illinois, providing nearly 50 percent of the electric power to the state. There are no such plants within the borders of Cook County. According to the United States Nuclear Regulatory Commission, the three sites nearest to Cook County and still in operation are in Will County, Grundy County, and LaSalle County. These sites are approximately 55 miles, 40 miles, and 70 miles from Cook County, respectively. Nuclear plants have an Emergency Planning Zone (EPZ) requirement of 10 miles and 50 miles as set by the Nuclear Regulatory Commission. The 10-mile EPZ correlates to the plume pathway for inhalation exposure and airborne contamination exposure. The 50-mile EPZ correlates to potential ingestion pathway exposure. The only site within 50 miles of Cook County is the Dresden Nuclear Power Plant located in Grundy County. Locations within the 50-Mile EPZ are not projected to be at risk for any direct radiological contamination, even in the most severe event. They would only possibly be impacted by residual/indirect contamination, which could enter the region (50-mile EPZ) via waterways, vegetation, or animals originating from within the 10-mile EPZ.

According to 2010 U.S. Census data, there were 7,305,482 people within 50 miles of the Dresden Facility. Chicago is included in this 50-mile area. The Nuclear Regulatory Commission's estimate of the risk each year of an earthquake intense enough to cause core damage to the reactor at Dresden is 1 in 52,632 (Nuclear Regulatory Commission, 2010).

FEMA regulates all offsite activities in the vicinity of nuclear facilities through the Radiological Emergency Preparedness Program. The purpose of the program is to ensure that the health and safety of citizens living around commercial nuclear power plants would be adequately protected in the event of a nuclear power plant accident and to inform and educate the public about radiological emergency preparedness.

Secondary Impacts from Incoming Evacuees

People evacuated from an outside area can have great impacts if local receiving jurisdictions are not prepared and lack the capacity to handle the amount of people and their belongings. Under certain conditions, the effects of a large influx of people can lead to a secondary disaster of sorts for a receiving jurisdiction ill-equipped to provide services to evacuees. For Cook County evacuees from the earthquake hazard along the New Madrid Fault line in southern Illinois and other Central U.S. Earthquake Consortium (CUSEC) states, this represents a very significant potential exposure.

In general, evacuees have undergone a traumatic event; most likely they have lost most of their belongings. In addition to needing mass basic care services, evacuees may be separated from family, pets, and all that is familiar to them, necessitating evacuee tracking and some type of emotional or psychological support services. Additionally, evacuees will likely have medical needs based on incident-related injuries or because they were evacuated without medications, equipment, etc.

The effects of this were most visible following Hurricane Katrina in 2005, when over 200,000 residents of the area around New Orleans were evacuees. Evacuees were scattered around the country, with most taken to the City of Houston. During the month of September immediately following the hurricane, Houston emergency departments reported treating 4,518 evacuees, with an additional 20,000 cared for at medical clinics set up in area shelters (Med Care, 2008). The top three cities that took in evacuees reported increases in crime in the months following the influx of people, though there is not proof that the crime was caused by evacuees. Once provided with long-term shelter, many evacuees chose not to return to the impacted area and to establish themselves in the host city.

In 2012, the IL-IN-WI Regional Catastrophic Grant Program's Regional Hub Reception Center (RHRC) Plan was created to address a large influx of evacuees from within or outside of the planning area. This regional plan, which includes Cook County and its local jurisdictions, provides a regional and local concept of operation to process, track, and care for evacuees and further spread them out to a much larger area for long-term shelter. The RHRC concept is meant to alleviate the burden to a receiving jurisdiction's existing infrastructure by providing the short-term services needed by evacuees in an ad-hoc setting and then distributing evacuees out of that initial receiving jurisdiction. Services anticipated within an RHRC include the following:

- Evacuee tracking via the National Mass Evacuation Tracking System
- Mass care services
- Pet tracking, support, and care
- Basic medical needs/triage
- Decontamination (as needed)
- Functional and access needs and support services
- Translation services
- Social services for unaccompanied minors
- Emotional/spiritual support services
- Transportation coordination
- Site security.

It is important for the planning partners to develop plans for evacuees, as this will help increase their capabilities for both internal and external evacuees. The following should be considered in the planning process to address the issues:

- **Duration Variability**—Jurisdictions need to ask how long the displacement is expected and whether their resources can sustain evacuees for the anticipated time:
    - Short term (< 4 weeks)—Shelters with health and medical support will most likely be adequate.
    - Mid-term (4 weeks to 6 months)—Apartments, schooling, financial support will start to be a planning factor.
    - Long term to permanent (> 6 months e.g. catastrophic earthquake, tsunami)—Complete integration into community is needed such as jobs, increased capacity for schools, hospitals, law enforcement, etc.
- **Coordination**—The U.S. Department of Homeland Security is the lead for identifying and soliciting states and local jurisdiction to accept evacuees, coordinating transportation to reception area, and staffing support to the receiving jurisdiction.
    - Receiving jurisdictions should immediately request and receive a federal disaster declaration for inclusion with an existing declaration for the incident to ensure:
        - Actions by receiving jurisdiction will be reimbursed (if properly documented)
        - Displaced persons will receive Individual Assistance
    - State or receiving jurisdiction should ask for Disaster Case Management from FEMA.
    - State and local emergency management should act as lead coordination for receiving jurisdiction with full emergency operation center activation.

    - State should request a FEMA Type 1 Incident Management Team to assist with coordination as needed.
- **Evacuee Reception**—One or more reception centers as discussed above should be established prior to evacuee arrive and it must be appropriately sized and equipped to handle the anticipated number of evacuees. The reception center should offer all necessary services for evacuee processing as discussed above.
- **Joint Information Center**—A joint information center should be set up immediately within the receiving jurisdiction or at the reception center to ensure clear messaging to the public (both general public and incoming evacuees) and to ensure protection of evacuees from media intrusion during the traumatic time.
- **Capacity of Local Jurisdiction**—Receiving jurisdictions need to consider their existing capacity to care for their citizens and the extent to which they can provide services to incoming evacuees. A census of the local surge capacity for hospitals, shelters, hotels, law enforcement, etc. may be necessary, and then jurisdictions can begin to consider where additional resources can be brought from to support the effort.

Widespread Power Outage

A blackout is generally defined as a period of disrupted delivery of electricity due to the failure of some component of the electric power system. The most severe utility interruptions are regional power outages. In general, utilities that employ aboveground wiring (e.g., power and data/telecommunications) are vulnerable to the effects of hazards such as high wind, heavy snow, ice, rain, and vehicular accidents. Electric power is a critical resource for operations of diverse infrastructure and provision of services.

Most often, power disruption results from damage to or electrical hazards within an electric power system. System components include power generation plants, substations, circuits, switches, transformers, power lines, and power poles. Because of the variation in causes of power outages that range from vehicle accidents to severe weather, utility interruptions can occur at any time.

Uncontrolled blackouts result from imbalances among load, generation, and transmission system flows and can occur when one or more elements of the electrical grid (generator or transmission line) fails or trips out of service. If a blackout remains within a localized area, it is considered an “unplanned interruption.” However, sometimes an unplanned interruption in one area can lead to successive power disruptions over a wide area of the grid. This disruption is known as a “cascading blackout” and cannot be restrained, resulting in massive power outages over an entire region. An example of a cascading blackout is the blackout of 2003, during which large portions of the eastern United States and Canada experienced power disruptions for several days.

A qualitative analysis was conducted as part of the IL-IN-WI Combined Statistical Area Regional Catastrophic Grant Program’s Regional Risk Assessment to determine potential dollar losses, impacts, and historical occurrence intervals within areas of the United States. Data sources included NOAA, the Nuclear Regulatory Commission, the U.S. Department of Transportation, and the U.S. Energy Information Administration.

Cascading events caused by a widespread blackout can impact health and safety and lead to service disruptions, transportation disruptions (air, water, and roadways), communication disruptions, water distribution disruptions, sewer disruptions, vandalism, looting, arson, psychological impacts, loss of productivity, and economic loss. Economic impacts resulting from a power outage can be severe. All facilities considered critical infrastructure are vulnerable to utility interruptions, especially loss of power. Establishment of reliable backup power at these facilities is extremely important to continue to provide for the health, safety, and well-being of the population.

Hazardous Material Incident

Given the number of hazardous materials facilities and shipment of hazardous chemicals throughout Cook County, a hazardous material incident is of concern to the planning partners. A hazardous material is any substance that can adversely affect the safety and health of humans, animals, or the environment. Materials that are generally of concern for exposure in a hazardous material incident include, but are not limited to the following:

- Ammonia
- Sulfuric acid
- Nitric acid
- Hydrofluoric acid
- Bromine
- Chlorine
- Cyanide solutions.

Many hazardous-material facilities have specific reporting and emergency planning guidelines mandated by the Emergency Planning and Community Right-to-Know Act and regulated by the state emergency response agency. These reporting requirements are known as Tier II reporting requirements. The Illinois Emergency Management Agency maintains Tier II reports for the state, so IEMA has a clear understanding of the materials located within its jurisdiction. Reports are also generally required to be on file with local emergency planning committees or fire departments.

In 2013, the City of Chicago undertook a risk assessment of hazardous material transportation routes to better inform planners on the risks to the city and its inhabitants in the shipment of hazardous materials through its borders by road, water, and rail. *Table: Chemical Buffer Zone And Spill Size* describes the recommended buffer zone for various hazardous chemicals and spills of a certain size.

In planning for hazardous materials incidents, local jurisdictions should consider conducting a risk assessment to profile the potential hazardous concerns within their jurisdiction and to further assess health and safety impacts on their population, potential economic impacts, consequences, and the overall probably or frequency of incident.

TABLE: CHEMICAL BUFFER ZONE AND SPILL SIZE

Hazardous Material	Amount (gallons)	Buffer Zone Distance
Ammonia	800	2,640 feet
Hydrofluoric Acid Solution (12%)	700	4,752 feet
Sulfuric Acid	800	9,504 feet
Ammonia	2,000	2,640 feet
Ammonia	600	2,640 feet

Sodium Cyanide	833	1,056 feet
Ammonia	100	528 feet
Nitric Acid	3,781	1,584 feet
Sulfuric Acid	2,594	9,504 feet
Ethylenediamine	4,000	2,640 feet
Hydrofluoric Acid Solutions	4,000	4,752 feet
Ammonia	1,000	2,640 feet
Bromine	115	9,504 feet
Epichlorohydrin	420	2,640 feet
Ammonia, Solution (27%)	4,000	2,640 feet
Ammonia, Solution (27%)	4,000	2,640 feet
Anhydrous Ammonia	600	2,640 feet
Nitric Acid	142	1,584 feet
Sulfuric Acid	311	9,504 feet
Anhydrous Ammonia	1,200	2,640 feet
Sodium Cyanide	500	1,056 feet

Coastal Erosion

Fluctuating water levels in the Great Lakes have caused hundreds of millions of dollars in losses by the 40 million people and many industries in the Great Lakes Basin. About 15 percent of the United States' population and 50 percent of Canada's population live along or near the coastline of the Great Lakes. About 83 percent of the shoreline is privately owned, with property values as high as $10,000 per foot of lakefront.

During high lake levels, rates of bluff erosion increase, beachfront property is lost, and structures and beaches are submerged. During intervening periods of low lake levels, navigation channels and harbors require extensive dredging of sediments that commonly are polluted. Also, hydroelectric output decreases, the load on freshwater pumping facilities increases, and sewage disposal become more difficult.

The adverse effects of erosion are harmful not only to shoreline property of humans but also to habitats along the Great Lakes, which depend on the natural shoreline transport of sediments. Disruption of this transport disrupts the habitats and species inhabiting them. Often the loss of sediment increases the exposure of the shoreline, which is home to many fish and other aquatic animals, forcing them to relocate.

There are further impacts of an intensified erosion process: sand dunes are lost, resulting from a lack of sand being replaced, and coastal wetlands disappear as a result of hardening of the land. *The State of the Great Lakes*, an assessment of the overall condition of the five lakes, reports, "shoreline hardening is generally not reversible, so once a section of shoreline has been hardened it can be considered a permanent feature."

The USGS studies the geologic processes at work in the Great Lakes region because they have a direct bearing on the use, management, development, and preservation of the shoreline. The USGS, together with Illinois and Indiana state agencies and numerous academic institutions, initiated a 5-year study to document the timing and magnitude of prehistoric lake-level fluctuations and to assess the important geologic processes responsible for severe erosion of the Illinois-Indiana shoreline. The study drew the following conclusions:

- Prehistoric variations in lake levels have exceeded 3 meters—twice the 1.6-meter fluctuation recorded between low levels in 1964 and high levels in 1985-87.
- Greater lake-level fluctuations related to future climate change are probable, though the impact of any future climate change on the magnitude and frequency of water-level cycles remains uncertain.
- Ice ridges along the lakeshore, sometimes as high as 7 meters, do not protect the shoreline from winter erosion, as previously thought.
- In the last 12,000 years, the lake has experienced dramatic change due to changing outlets and isostatic tilting.
- For the past 5,000 years, climatically controlled fluctuations have been superimposed on a generally falling trend.
- For the last 160 years, the lake level has fluctuated, but each peak has been higher than the last. The scales of lake level change are shown in *Figure: Scales of Lake Level Change*.
- Bluff retreat between Wilmette and Waukegan, Illinois, varies from 10 to 75 centimeters per year and averages 20 to 25 centimeters per year. Erosion rates north of Waukegan, however, approach 300 centimeters per year. Sediment eroding from bluffs provides most of the sand to the nearshore zone. As more structures are erected to protect the bluffs, less sand is available to the system. Consequently, the nearshore sand reservoir has shown a dramatic decrease in volume over the past 20 years. As this sand supply dwindles, the finer-textured lakebed sediments are exposed to wave attack, inevitably accelerating coastal retreat.
- Side-scan sonar shows conclusively how, where, and why revetments designed to protect Chicago's lakeshore are failing; remedial designs based on these studies are being implemented.

As referenced in Chapter 5. Climate Change, the water level in Lake Michigan continues to increase. The increased water level, mainly resulting from climatic shifts that increase heavy rainfall events, exacerbates coastal erosion (USACE).

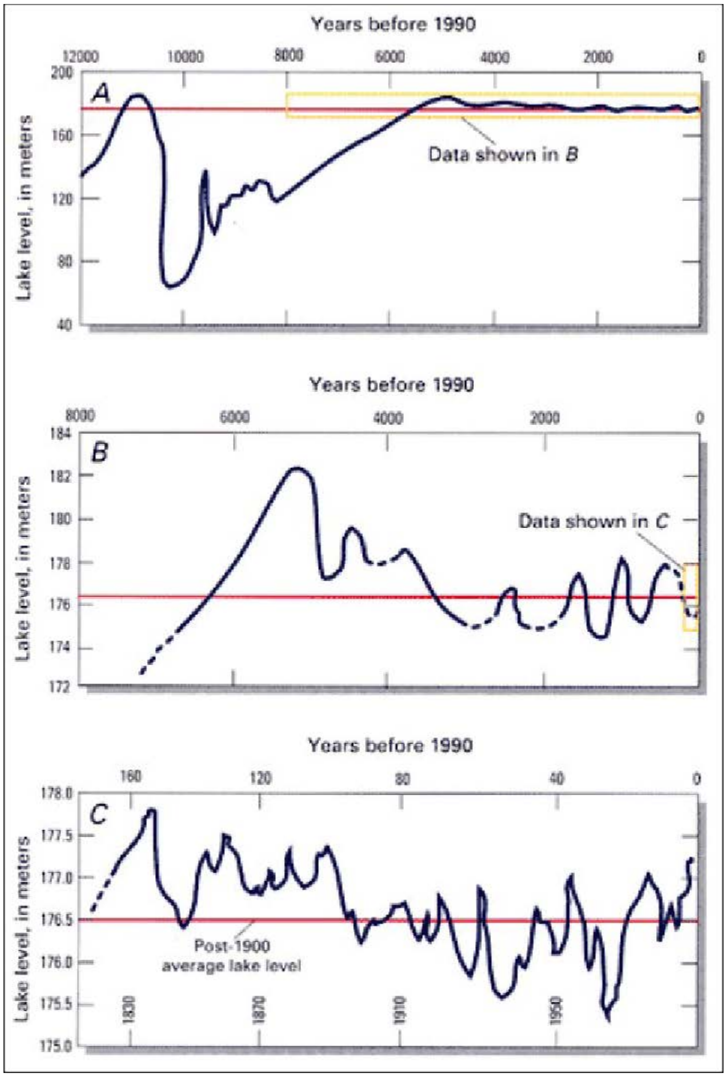


Figure: Scales of Lake Level Change Source: USGS, 2014

Chapter 14. Planning Area Risk Ranking

A risk ranking was performed to compare the probable impacts of the identified hazards of concern on each planning partner. The risk ranking assessed the probability of each hazard's occurrence as well as its likely impact on people, property, and the economy. This process was a critical component in selecting mitigation actions for this plan update. The ranking is not intended to focus all actions on the single hazard with the highest rank, but to ensure that attention is given to all hazards that have a significant impact. At the same time, the ranking allows communities to identify hazards with little or no impact so that those hazards can be eliminated from consideration for actions.

The ranking process was deployed by each planning partner, as described in detail in the jurisdictional annex instructions of Volume 2 of this plan. Assessments of risk were generated with data from Hazus-MH using methodologies promoted by FEMA. A separate ranking to assess probable impacts countywide was approved by the Steering Committee. The results of the countywide ranking, presented in this chapter, are used in establishing mitigation action and priorities presented in Chapter 17.

Probability of Occurrence

The probability of occurrence of a hazard is indicated by a probability factor based on the likelihood of annual occurrence:

- High—Hazard event is likely to occur within 25 years (Probability Factor = 3)
- Medium—Hazard event is likely to occur within 100 years (Probability Factor = 2)
- Low—Hazard event is not likely to occur within 100 years (Probability Factor = 1)
- No exposure—There is no probability of occurrence (Probability Factor = 0)

The assessment of hazard frequency is generally based on past hazard events in the area. *Table: Probability of Hazards* summarizes the probability assessment for each hazard of concern for this plan.

TABLE: PROBABILITY OF HAZARDS

Hazard Event	Probability (High, Medium, Low)	Probability Factor
Dam/Levee Failure	Low	1
Drought	Medium	2
Earthquake	Medium	2
Flood (including urban flooding)	High	3
Severe Weather	High	3
Severe Winter Weather	High	3
Tornado	High	3

Impact

Hazard impacts were assessed in three categories: impacts on people, impacts on property and impacts on the local economy. Numerical impact factors were assigned as follows:

- **People**—Values were assigned based on the percentage of the total ***population exposed*** to the hazard event. The degree of impact on individuals will vary and is not measurable, so the calculation assumes for simplicity and consistency that all people exposed to a hazard because they live in a hazard zone will be equally impacted when a hazard event occurs. It should be noted that planners can use an element of subjectivity when assigning values for impacts on people. Impact factors were assigned as follows:

- High—30 percent or more of the population is exposed to a hazard (Impact Factor = 3)
- Medium—15 percent to 29 percent of the population is exposed to a hazard (Impact Factor = 2)
- Low—14 percent or less of the population is exposed to the hazard (Impact Factor = 1)
- No impact—None of the population is exposed to a hazard (Impact Factor = 0)

- **Property**—Values were assigned based on the percentage of the total ***property value exposed*** *to the hazard event:*
  - High—25 percent or more of the total assessed property value is exposed to a hazard (Impact Factor = 3)
  - Medium—10 percent to 24 percent of the total assessed property value is exposed to a hazard (Impact Factor = 2)
  - Low—9 percent or less of the total assessed property value is exposed to the hazard (Impact Factor = 1)
  - No impact—None of the total assessed property value is exposed to a hazard (Impact Factor = 0)
- **Economy**—Values were assigned based on the percentage of the total ***property value vulnerable*** to the hazard event. Values represent estimates of the loss from a major event of each hazard in comparison to the total assessed value of the property exposed to the hazard. For some hazards, such as severe weather, vulnerability was considered to be the same as exposure due to the lack of loss estimation tools specific to those hazards. Loss estimates separate from the exposure estimates were generated for the earthquake and flood hazards using Hazus-MH.
  - High—Estimated loss from the hazard is 15 percent or more of the total assessed property value (Impact Factor = 3)
  - Medium—Estimated loss from the hazard is 5 percent to 14 percent of the total assessed property value (Impact Factor = 2)
  - Low—Estimated loss from the hazard is 4 percent or less of the total assessed property value (Impact Factor = 1)
  - No impact—No loss is estimated from the hazard (Impact Factor = 0)

Each category was assigned a weighting factor to reflect its significance, consistent with those typically used for measuring the benefits of hazard mitigation actions: a weighting factor of 3 for impact on people; a weighting factor of 2 for impact on property; and a weighting factor of 1 for impact on the economy. *Table: Impact on People from Hazards*, *Table: Impact On Property From Hazards* and T*able: Impact On Economy From Hazards* summarize the impacts for each hazard.

TABLE: IMPACT ON PEOPLE FROM HAZARDS			
Hazard Event	**Impact (High, Medium, Low)**	**Impact Factor**	**Multiplied by Weighting Factor (3)**
Dam/Levee Failure	Low	1	1x3=3
Drought	Low	1	1x3=3
Earthquake	High	3	3x3=9
Flood (including urban flooding)	Medium	2	2x3=6
Severe Weather	High	3	3x3=9
Severe Winter Weather	High	3	3x3=9
Tornado	Low	1	1x3=3

TABLE: IMPACT ON PROPERTY FROM HAZARDS			
Hazard Event	**Impact (High, Medium, Low)**	**Impact Factor**	**Multiplied by Weighting Factor (2)**
Dam/Levee Failure	Low	1	1x2=2
Drought	None	0	0x2=0
Earthquake	High	3	3x2=6
Flood (including urban flooding)	Medium	2	2x2=4
Severe Weather	Medium	2	2x2=4
Severe Winter Weather	High	3	3x2=6
Tornado	Low	1	1x2=2

TABLE: IMPACT ON ECONOMY FROM HAZARDS			
Hazard Event	**Impact (High, Medium, Low)**	**Impact Factor**	**Multiplied by Weighting Factor (1)**
Dam/Levee Failure	Low	1	1x1=1
Drought	Low	1	1x1=1
Earthquake	Low	1	1x1=1
Flood (including urban flooding)	High	3	3x1=3
Severe Weather	Medium	2	2x1=2
Severe Winter Weather	Medium	2	2x1=2
Tornado	High	3	3x1=3

Risk Rating and Ranking

The risk rating for each hazard was determined by multiplying the probability factor by the sum of the weighted impact factors for people, property and the economy, as summarized in Table: Hazard Risk Ranking Analysis.

TABLE: Hazard Risk Ranking Summary

Hazard Ranking	Hazard Event	Category
1	Severe Winter Weather	High
2	Severe Weather	High
3	Flood (including urban flooding)	High
4	Earthquake	Medium
5	Tornado	Medium
6	Drought	Low
7	Dam Failure	Low

Based on these ratings, a priority of high, medium or low was assigned to each hazard. The hazards ranked as being of highest concern for the 2019 MJ-HMP are severe winter weather, severe weather, and flood. Earthquake and tornado are ranked as being of medium concern. The hazards ranked as being of lowest concern are drought and dam/levee failure. Table: Hazard Risk Ranking Summary shows the final hazard risk ranking for the 2019 MJ-HMP update.

TABLE: Hazard Risk Ranking Analysis

Hazard Event	Probability Factor	Sum of Weighted Impact Factors	Total (Probability x Impact)
Severe Winter Weather	3	9 6 2=17	51
Severe Weather	3	9 4 2=15	45
Flood (including urban flooding)	3	6 4 3=13	39
Earthquake	2	9 6 1=16	32
Tornado	3	3 2 3=8	24
Drought	2	3 0 1=4	8
Dam Failure	1	3 2 1=6	6

Part 3. Mitigation Strategy

The heart of the mitigation plan is the mitigation strategy, which serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The mitigation strategy describes how the community will accomplish the overall purpose, or mission, of the planning process. In this section, mitigation goals and objectives were reevaluated and updated; and mitigation actions/projects were updated/amended, identified, evaluated, and prioritized.

Chapter 15. Mission, Goals, and Objectives

Hazard mitigation plans must identify goals for reducing long-term vulnerabilities to identified hazards (44 CFR Section 201.6(c)(3)(i)). The Steering Committee established a mission, a set of goals, and measurable objectives for this plan update, based on data from the preliminary risk assessment and the results of the public involvement strategy. The mission, goals, objectives, and actions in this plan all support each other. Goals were updated to support the mission. Objectives were selected that met multiple goals. Actions were prioritized based on the action addressing multiple goals and objectives.

Mission

A mission focuses the range of objectives and actions to be considered. This is not a goal because it does not describe a hazard mitigation outcome, and it is broader than a hazard-specific objective. The mission for the 2019 Cook County Multi-Jurisdictional Hazard Mitigation Plan is as follows:

> Identify risks and sustainable cost-effective actions to mitigate the impact of natural hazards in order to protect the life, health, safety, welfare, and economy of the communities of Cook County.

Goals

The following are the mitigation goals for this plan:

1. Develop and implement sustainable, cost-effective, and environmentally sound risk-reduction (mitigation) projects.
2. Protect the lives, health, safety, and property of the citizens of Cook County from the impacts of natural hazards.
3. Protect public services and critical facilities, including infrastructure, from loss of use during natural hazard events and potential damage from such events.
4. Involve stakeholders to enhance the local capacity to mitigate, prepare for, and respond to the impacts of natural hazards.
5. Develop, promote, and integrate mitigation action plans.
6. Promote public understanding of and support for hazard mitigation.

The effectiveness of a mitigation strategy is assessed by determining how well these goals are achieved.

Objectives

Each selected objective meets multiple goals, serving as a stand-alone measurement of the effectiveness of a mitigation action, rather than as a subset of a goal. The objectives also are used to help establish priorities. The objectives are as follows:

1. Eliminate or minimize disruption of local government operations caused by natural hazards through all phases of emergency management.
2. Increase resilience of (or protect and maintain) infrastructure and critical facilities.
3. Consider the impacts of natural hazards on future land uses in the planning area, including possible impacts from climate change.
4. Integrate hazard mitigation policies into land use plans in the planning area.
5. Develop, improve, and protect systems that provide early warnings, emergency response communications, and evacuation procedures.
6. Use the best available data, science and technologies to educate the public and to improve understanding of the location and potential impacts of natural hazards, the vulnerability of building types and community development patterns, and the measures needed to protect life safety.
7. Retrofit, purchase, or relocate structures in high hazard areas, including those known to be repetitively damaged.
8. Establish partnerships among all levels of local government, the private sector, and/or nongovernmental organizations to improve and implement methods to protect people and property.
9. Provide or improve flood protection on a watershed basis with flood control structures and drainage maintenance plans.
10. Strengthen codes and land use planning and their enforcement, so that new construction or redevelopment can avoid or withstand the impacts of natural hazards.
11. Encourage mitigation through incentive-based programs, such as the Community Rating System, Firewise, and StormReady programs.
12. Reduce natural hazard-related risks and vulnerability to potentially isolated populations within the planning area.
13. Encourage hazard mitigation measures that result in the least adverse effect on the natural environment and that use natural processes.

Chapter 16. Mitigation Action Plan

The action plan helps to prioritize mitigation initiatives according to a benefit/cost analysis of the proposed projects and their associated costs (44 CFR, Section 201.6(c)(3)(iii)). The action plan also provides the framework for how the proposed projects and initiatives will be implemented and administered over the next 5 years. It is also meant to programmatically guide the annual updates and progress for each mitigation initiative.

Each **new** mitigation project identified during the 2019 plan update has been organized based on the following table below.

TABLE: NEW MITIGATION ACTION FORM

Mitigation Action	[NEW MITIGATION ACTION]
Year Initiated	2019
Applicable Jurisdiction	
Lead Agency/Organization	
Supporting Agencies/Organizations	
Applicable Goal	
Applicable Objective	
Potential Funding Source	
Estimated Cost	
Benefits (loss avoided)	
Projected Completion Date	
Priority and Level of Importance (Low, Medium, High)	
Benefit Analysis (Low, Medium, High)	
Cost Analysis (Low, Medium, High)	
Actual Completion Date	

Recommended Mitigation Action/Implementation Plan and Project Description	
Action/Implementation Plan and Project Description:	[ADDITIONAL NARRATIVE ABOUT THE PROJECT AND ITS IMPLEMENTATION]

Mitigation Action and Project Maintenance		
Year	**Status**	**Comments**
2019	NEW	
2020		

2021		
2022		
2023		

Mitigated Hazards	
	All Hazards
	Dam/Levee Failure
	Drought
	Earthquake
	Flood
	Extreme Heat
	Lightning
	Hail
	Fog
	High Wind
	Snow
	Blizzard
	Extreme Cold
	Ice Storms
	Tornado
	Epidemic or pandemic
	Nuclear Power Plant Incident
	Widespread Power Outage
	Coastal Erosion
	Secondary Impacts from Mass Influx of Evacuees
	Hazardous Materials Incident

Mitigation Strategy/Action Timeline Parameters

While the preference is to provide definitive project completion dates, this is not possible for every mitigation strategy/action. Therefore, the parameters for the timeline (**Projected Completion Date**) are as follows:

- **Short Term** = to be completed in 1 to 5 years
- **Long Term** = to be completed in greater than 5 years
- **Ongoing** = currently being funded and implemented under existing programs.

Mitigation Strategy/Action Benefit Parameters

Benefit ratings were defined as follows:

- **High**—Project will provide an immediate reduction of risk exposure for life and property.
- **Medium**—Project will have a long-term impact on the reduction of risk exposure for life and property, or project will provide an immediate reduction in the risk exposure for property.
- **Low**—Long-term benefits of the project are difficult to quantify in the short term.

Mitigation Strategy/Action Estimated Cost Parameters

While the preference is to provide definitive costs (dollar figures) for each mitigation strategy/action, this is not possible for every mitigation strategy/action. Therefore, the estimated costs for the mitigation initiatives identified in this Plan were identified as high, medium, or low, using the following ranges:

- **High**—Existing funding will not cover the cost of the project; implementation would require new revenue through an alternative source (for example, bonds, grants, and fee increases).
- **Medium**—The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
- **Low**—The project could be funded under the existing budget. The project is part of or can be part of an ongoing existing program.

Mitigation Strategy/Action Prioritization Process

The action plan must be prioritized according to a benefit/cost analysis of the proposed projects and their associated costs (44 CFR, Section 201.6(c)(3)(iii)). The benefits of proposed projects were weighed against estimated costs as part of the project prioritization process. The benefit/cost analysis was not of the detailed variety required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) grant program. A less formal approach was used because some projects may not be implemented for up to 10 years, and associated costs and benefits could change dramatically in that time. Therefore, a review of the apparent benefits versus the apparent cost of each project was performed. Parameters were established for assigning subjective ratings (high, medium, and low) to the costs and benefits of these projects.

The priorities are defined as follows:

- **High Priority**—A project that meets multiple objectives (i.e., multiple hazards), has benefits that exceed cost, has funding secured or is an ongoing project and meets eligibility requirements for the HMGP or PDM grant program. High priority projects can be completed in the short term (1 to 5 years).
- **Medium Priority**—A project that meets goals and objectives, that has benefits that exceed costs, and for which funding has not been secured but that is grant eligible under HMGP, PDM or other grant programs. The project can be completed in the short term, once funding is secured. Medium priority projects will become high priority projects once funding is secured.
- **Low Priority**—A project that will mitigate the risk of a hazard, that has benefits that do not exceed the costs or are difficult to quantify, for which funding has not been secured, that is not eligible for HMGP or PDM grant funding, and for which the timeline for completion is long term

(1 to 10 years). Low priority projects may be eligible for other sources of grant funding from other programs.

For many of the strategies identified in this action plan, the partners may seek financial assistance under the HMGP or HMA programs, both of which require detailed benefit/cost analyses. These analyses will be performed on projects at the time of application using the FEMA benefit-cost model. For projects not seeking financial assistance from grant programs that require detailed analysis, the partners reserve the right to define “benefits” according to parameters that meet the goals and objectives of this plan.

Chapter 17. Mitigation Alternatives and Strategies

Plan participants assessed and included a comprehensive range of hazard mitigation strategies/actions, including strategies from FEMA documents, strategies from the 2014 Cook County Multi-Hazard Mitigation Plan and suggestions from participating communities and their respective stakeholders during a series of workshops that took place throughout the County in May and June of 2019.

Each of the participating communities, including Cook County, were invited to participate in a series of workshops in which goals, objectives, and strategies were discussed, identified, updated and prioritized. Each participant in this session was provided with a number of resources to help them identify relevant mitigation strategies. These include the following documents:

- FEMA Mitigation Ideas Handout (see Appendix B. Plan Process and Development Documentation)
- Cook County Mitigation Examples Handout (see Appendix B. Plan Process and Development Documentation)

All potential strategies that arose through this process are included in this Plan. A final draft of the Plan was presented to all stakeholders to allow them to provide final edits and approval of the strategies and their priority.

One of the benefits of using the Online Planning System, and organizing jurisdictions by North, Central and South regions, was to ensure neighboring communities had full visibility of each other's mitigation initiatives. This was done to ensure synergies were identified, when applicable, and that mitigation actions in one community would not adversely impact another nearby community.

Mitigation Strategies by County or Regional Agencies/Departments

The mitigation strategies and actions from county departments/agencies are included in **Volume 2**. Mitigation strategies that are applicable for **all participating jurisdictions** are also included in **Volume 2**. They include:

- Cook County - Unincorporated 2019 MJ-HMP Jurisdictional Annex: Mitigation Strategies and Actions
- MWRD 2019 MJ-HMP Jurisdictional Annex: Mitigation Strategies and Actions
- Countywide Mitigation Actions

Each entities' Mitigation Strategies & Actions are organized as follows:

- **New Mitigation Actions**—New actions identified during this 2019 update process
- **Ongoing Mitigation Actions**—These ongoing actions were included in the previous update and have yet to be completed. Some of these actions have no definitive end. During the 2019 update, these "ongoing" mitigation strategies/actions were modified and/or amended, as needed, to better define the strategy/action.
- **Completed Mitigation Actions**—Completed actions since 2014. Completed actions also included a brief description of the "Resulting Reduction or Limitation of Hazard Impact(s) Achieved" in order to show the resulting benefits of implementing the mitigation initiative.

Mitigation Strategies by Community

The mitigation strategies and actions from the participating jurisdictions are included in **Volume 2**. They include:

- North Region

- Central Region
- South Region
- Chicago 2019 MJ-HMP Jurisdictional Annex

Each entities' Mitigation Strategies & Actions are organized as follows:

- **New Mitigation Actions**—New actions identified during this 2019 update process
- **Ongoing Mitigation Actions**—These ongoing actions were included in the previous update and have yet to be completed. Some of these actions have no definitive end. During the 2019 update, these "ongoing" mitigation strategies/actions were modified and/or amended, as needed, to better define the strategy/action.
- **Completed Mitigation Actions**—Completed actions since 2014. Completed actions also included a brief description of the "Resulting Reduction or Limitation of Hazard Impact(s) Achieved" in order to show the resulting benefits of implementing the mitigation initiative.

NFIP-Specific Mitigation Actions and Implementation

The following mitigation strategies demonstrate Cook County and its participating jurisdictions' continued support and compliance with NFIP requirements, as appropriate. Only those actions that demonstrate specific support and compliance to the program are included. Other flood-related projects were not included in this section.

- **Countywide Action 15**—Identify and promote local, state, and federal funding sources for local flood mitigation projects.
- **Countywide Action 19**—Support planning partner education by requesting mobile training courses covering the National Flood Insurance Program and Community Rating System information during the period of this plan.

Other priorities within the county related to NFIP include: 1) Increased CRS participation throughout the county; 2) Increase in the number of flood insurance policies; 3) Increased number of CFMs throughout the county; 4) Post-flood damage estimate training for county and municipal staff; 5) Acquisition of severe repetitive loss and repetitive loss properties; 6) Higher regulatory standards including higher freeboard, cumulative substantial damage and substantial improvement threshold, and enforcing floodplain regulations in areas of known urban, typically shallow depth, flooding.

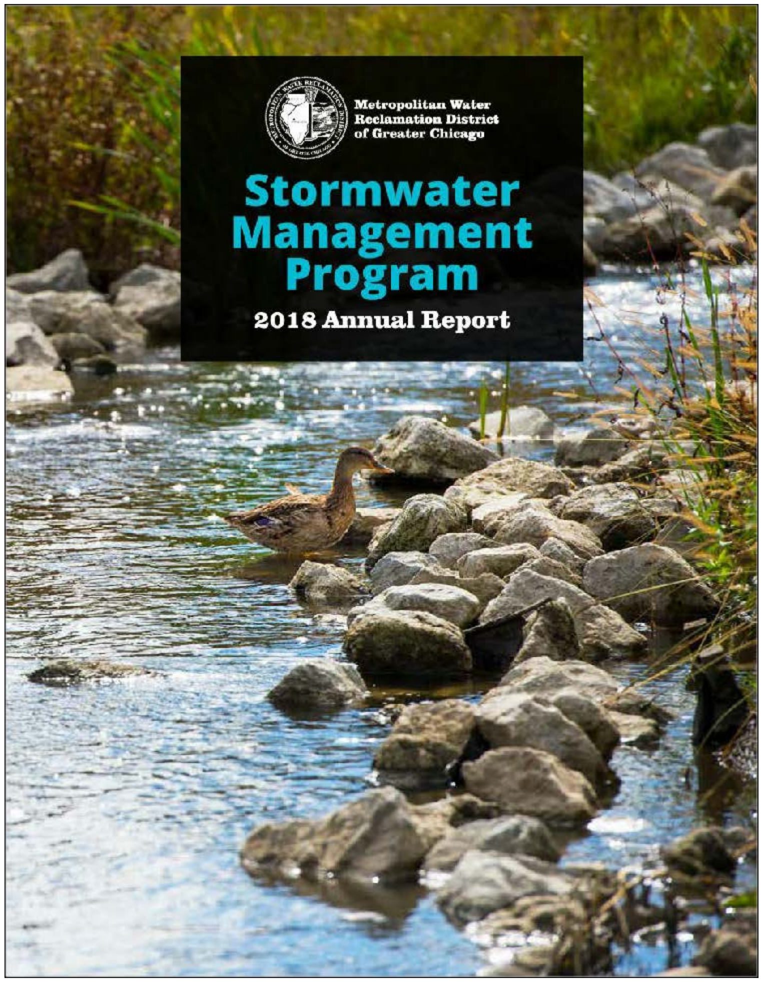
Chapter 18. Plan Integration Strategy

Plan integration is the process by which communities look critically at their existing planning framework and align efforts with the goal of building a safer, smarter community. Plan integration involves a two-way exchange of information and incorporation of ideas and concepts between the Cook County Multi-Jurisdictional Multi-Hazard Mitigation Plan and other community plans. Specifically, plan integration involves the incorporation of hazard mitigation principles and actions into community plans and community planning mechanisms.

The following demonstrates Cook County's and its participating jurisdictions' continued effort to integrate mitigation into other community plans and efforts:

- Goal #5: Develop, promote, and integrate mitigation action plans.
- Objective #4: Integrate hazard mitigation policies into land use plans in the planning area.
- In 2014, Cook County committed to the "Develop of a countywide hazards task force to create a collective approach to natural hazard mitigation through the unification of plans, actions, and data" (Countywide Action #14). This task force is now the Cook County Hazard Mitigation Steering Committee and has been tasked with ensuring the integration of mitigation strategies across all plans and actions throughout the County.
- In 2019, Cook County committed to the "Implementation of the Cook County Multi-Jurisdictional Hazard Mitigation Plan to more effectively establish a "programmatic" approach that integrates new and existing mitigation initiatives throughout the County by maximizing regional coordination and two-way information sharing of stakeholders" (Countywide Action #23). This action will ensure the County proactively enhances their information-sharing networks, meetings, and outreach efforts among key stakeholders to ensure mitigation initiatives are considered in all planning engagements.

An example of this effort to continue integrating across all plans can be found in the most recent MWRD Stormwater Management Program: 2018 Annual Report.



COOK COUNTY HAZARD MITIGATION PLAN (page 35)

The Cook County Hazard Mitigation Plan is the use of long-term and short-term policies, programs, projects, and other activities to alleviate the death, injury, and property damage that can result from a disaster. Cook County, MWRD, and a coalition of planning partners prepared the Cook County Multi-Jurisdictional Hazard Mitigation Plan in order to identify the risks posed by hazards and find ways to reduce their impacts. The plan reduces risk for those who live in, work in, and visit the County. MWRD continues to work closely with Cook County and our other planning partners to mitigate against flooding through projects identified in our annual report. A list of stormwater management press releases issued in 2018 can be found on the next page.

MWRD Engineer Michael "Mick" Cosme at Watershed Planning Council Meeting

PARTNERSHIPS AND PUBLIC OUTREACH

JOINT FUNDING AGREEMENT WITH THE UNITED STATES GEOLOGICAL SURVEY FOR STREAM GAGING STATION IN COOK COUNTY

MWRD entered into a Joint Funding Agreement with the United States Geological Survey beginning in 2006 and has since renewed the agreement annually to fund the continued maintenance and operation of various stream gages and rain gages within Cook County. Under the 2018–2019 agreement, MWRD is funding the following seven stream gages:

- Salt Creek at Rolling Meadows
- Salt Creek near Elk Grove Village
- Salt Creek at Western Springs
- Des Plaines River at Lyons
- North Branch of the Chicago River at Deerfield
- Natalie Creek at Midlothian
- Tinley Creek near Palos Park

MWRD is also funding two rain gages located on Salt Creek near Rolling Meadows and on Natalie Creek at Midlothian. The data from the streamflow gaging stations has proven useful for MWRD with calibration of the hydrologic and hydraulic models in the Detailed Watershed Plan development, and MWRD will continue to use data from these stations in ongoing and future planning and design of stormwater improvements. Real time data from the stream gages are available on the United States Geological Survey's website at **https://waterdata.usgs.gov/nwis**. Precipitation data is available at **https://il.water.usgs.gov/gmaps/precip/index.php**.

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WATERSHED PLANNING COUNCILS

The Watershed Planning Councils were formed in 2005 to serve as advisory bodies to MWRD for its stormwater management program. Municipalities and townships are represented in the councils by their chief elected officials or designees. Unincorporated areas are represented by the Cook County Board President or his or her designee. Councils meet at least quarterly for the watersheds of the North Branch of the Chicago River, the Lower Des Plaines River, the Calumet-Sag Channel, the Little Calumet River, Poplar Creek, and Upper Salt Creek. Watershed Planning Council meetings serve as a mechanism for representatives of municipalities and townships to be updated on MWRD's stormwater management program as well as to communicate concerns of the public to MWRD.

The following Councils of Government are responsible for coordination of the WPCs:

- Northwest Municipal Conference
- West Central Municipal Conference
- South Suburban Mayors and Managers Association
- Southwest Conference of Mayors

MWRD negotiated agreements with each of the Councils of Government to provide administrative assistance related to coordination of the Watershed Planning Councils; the current agreement was renewed for 2018 and 2019. The Councils of Government assist MWRD by arranging meeting schedules, drafting and distributing meeting agendas, distributing information from MWRD to council members, assembling contact information for council representatives, and forwarding information about stormwater management concerns from the council members to MWRD. Visit **https://mwrd.org/irj/portal/anonymous/meetingschedule** to view the current Watershed Planning Council meeting schedule.

PUBLIC AFFAIRS

In 2018, MWRD staff provided information about MWRD and the Stormwater Management Program at various public events in communities throughout the region and at various technical conferences. MWRD attends all Watershed Planning Council meetings to provide updates on watershed planning efforts, changes to the WMO, and stream maintenance activities. These meetings are open to the public and provide an opportunity for concerns of the public to be communicated to MWRD. The Space to Grow projects in partnership with Chicago Public Schools and the Chicago Department of Water Management also have a large public affairs component, including community meetings to recommend design elements, community planting days and ribbon cutting ceremonies, where the value of green infrastructure is demonstrated. MWRD also worked to educate the general public on their water footprint by attending numerous community and environmental fairs throughout Cook County.

MWRD Staff will continue to participate in community outreach events in 2019. MWRD will also continue to participate in Watershed Planning Council meetings, and continue to promote MWRD stormwater management efforts using press releases and other media outlets.

COOK COUNTY HAZARD MITIGATION PLAN

The Cook County Hazard Mitigation Plan is the use of long-term and short-term policies, programs, projects, and other activities to alleviate the death, injury, and property damage that can result from a disaster. Cook County, MWRD, and a coalition of planning partners prepared the Cook County Multi-Jurisdictional Hazard Mitigation Plan in order to identify the risks posed by hazards and find ways to reduce their impacts. The plan reduces risk for those who live in, work in, and visit the County. MWRD continues to work closely with Cook County and our other planning partners to mitigate against flooding through projects identified in our annual report.

A list of stormwater management press releases issued in 2018 can be found on the next page.

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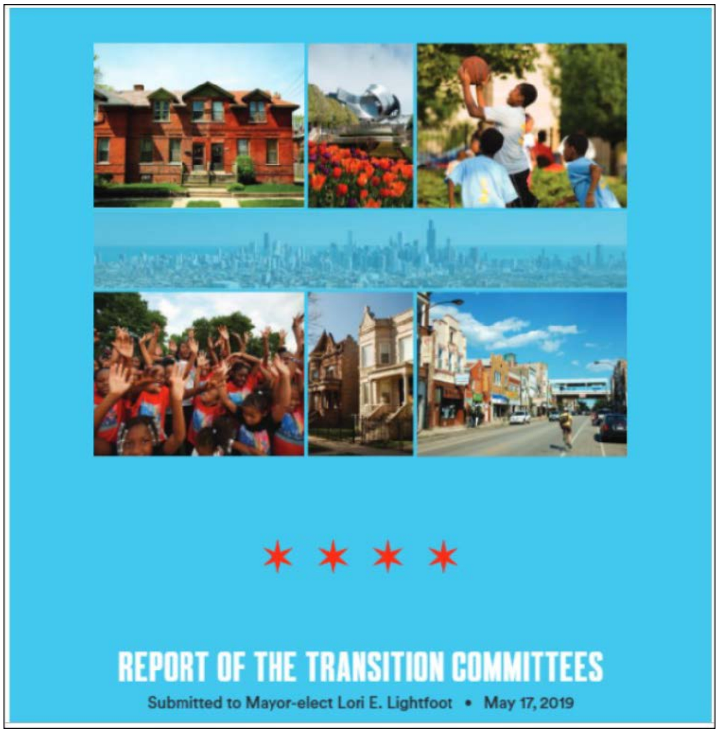
Another example is the integration of Mayor Lori E. Lightfoot's 2019 Transition Report. The City of Chicago considered these key initiatives as they reviewed existing mitigation actions and identified new mitigation strategies.



New Mitigation Strategy Description for the City of Chicago	Alignment w/ Mayor's Transition Report
Aviation - Notification Systems	Public Safety and Accountability
Senior Housing Retro-fits	Business, Economic and Neighborhood Development
Re-enroll in ILWARN notifications	Public Safety and Accountability
Backup generator for Jardine	Business, Economic and Neighborhood Development
CHA - Bio infiltration systems	Environmental
CHA - Installation of solar PV system	Environmental
CFD - Deployable portable generators	Business, Economic and Neighborhood Development
CFD - Portable High Capacity Air Conditioners	Public Safety and Accountability
CFD - High capacity portable heaters	Public Safety and Accountability
CFD - Mass Decontamination Apparatus	Public Safety and Accountability

Part 4. Plan Maintenance Strategy

A hazard mitigation plan must present a plan maintenance process that includes the following (44 CFR Section 201.6(c)(4)):

- A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan over a five-year cycle
- A process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate
- A discussion on how the community will continue public participation in the plan maintenance process.

This section details the formal process that will ensure that the Cook County Multi-Jurisdictional Hazard Mitigation Plan remains an active and relevant document and that the planning partners maintain their eligibility for applicable funding sources. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant.

Chapter 19. Plan Implementation

The effectiveness of the hazard mitigation plan depends on its implementation and incorporation of its action items into partner jurisdictions' existing plans, policies, and programs. Together, the action items in the plan provide a framework for activities that the partnership can implement over the next five years. The planning team and the Steering Committee have established goals and objectives and have prioritized mitigation actions that will be implemented through existing plans, policies, and programs.

Cook County Department of Homeland Security and Emergency Management (DHSEM) will assume lead responsibility for **implementation** and **monitoring** of this plan maintenance strategy. Although DHSEM will have primary responsibility, plan implementation and **evaluation** will be a shared responsibility among all planning partners and agencies identified as lead agencies in the mitigation action plans. Completion of this strategy is the responsibility of each planning partner. This was conveyed to each planning partner as an expectation at the beginning of the planning process.

Chapter 20. Steering Committee

The steering committee is a volunteer body that oversaw the update of the plan and made recommendations on key elements of the plan, including the maintenance strategy. The steering committee will have an active role in the plan maintenance strategy. The steering committee will remain a viable body involved in key elements of the plan maintenance strategy. The steering committee should strive to include representation from the planning partners, as well as other stakeholders in the planning area.

The steering committee will convene to perform annual reviews at a place and time to be determined. The make-up of this committee will be dynamic, allowing differing views to have a say in the implementation of the plan. DHSEM will strive for diverse stakeholder representation on this committee. Current Steering Committee members, planning partners and other stakeholders involved in this planning process will be contacted and given the option to remain involved in the process.

Chapter 21. Annual Progress Report

An annual progress report will be prepared for the Cook County Multi-Jurisdiction Hazard Mitigation Plan. The purpose of the annual progress report is to enhance the opportunities for the implementation of action items and opportunities for funding. The annual progress report will include the following:

- A summary of any hazard events that occurred during the prior year and their impact on the planning area
- A review of mitigation actions identified in the plan. Each newly identified mitigation action/strategy in the 2019 Cook County MJ-HMP includes the following table (Mitigation Action and Project Maintenance) to track annual updates and progress for each mitigation action. Lead agencies/organizations will be tasked to provide an annual status update for each action. In addition to utilizing the Annual Progress Report (Appendix E) to track the status of each of the actions, the Online Planning System, of which each planning partner has their own system, can be utilized to allow planning partners to comment and provide the status of each mitigation action. The comments tool can be used to encourage collaboration and transparency. Comments for each of the actions are visible to all administrators and users who have editing privileges for a given page. To make a comment, users click on the Comment link on the bottom of the content page and a pop-up box appears. The person uses the drop-down box to designate whether the comment is a Feedback or an Observation. After entering the comment, they click the Send Comments button to submit. The comment appears after the page refreshes (if user is allowed to view comments). An email notification is sent to users who are designated to receive comment notifications.

Mitigation Action and Project Maintenance		
Year	**Status**	**Comments**
2019	**N = New** Indicates a mitigation project/action that has not previously been identified in the annex/plan. **O = Action Ongoing toward Completion** Indicates a mitigation project/action that has **initiated** and that steps have been taken toward completion. This also applies to projects that have made **progress** but do not necessarily have a definitive end (i.e. some projects, like educating the public, are always ongoing and do not have a definitive completion date). **R = Want Removed from Annex** Indicates a mitigation project/action that is no longer relevant and can be **removed** from the annex/plan.	A detailed comment and status report will accompany the "Status" (i.e. N, O, R, X, C)

	X = **No Action Taken** Indicates a mitigation project/action in which **no substantial actions** have been taken. For example, this would apply to projects that are dependent on a funding source in order to initiate. **C** = **Project Completed** Indicates a mitigation project/action that has been **completed/finished** and no additional mitigation measures are needed.	
2020	Repeat for each year	A detailed comment and status report will accompany the "Status" (i.e. N, O, R, X, C)
2021	Repeat for each year	A detailed comment and status report will accompany the "Status" (i.e. N, O, R, X, C)
2022	Repeat for each year	A detailed comment and status report will accompany the "Status" (i.e. N, O, R, X, C)
2023	Repeat for each year	A detailed comment and status report will accompany the "Status" (i.e. N, O, R, X, C)

As stated above, the annual progress report will include:

- A re-evaluation of the action plans to determine if the timeline for identified projects needs to be amended (for example, changing a long-term project to a short-term project because of funding availability)
- A list of recommendations for new projects
- A summary of changes in or potential for new funding options (grant opportunities)
- A brief discussion of the impact of any other planning programs or actions within the planning partnership that involve hazard mitigation.
- A brief discussion about why targeted strategies were not completed.

DHSEM will assume the responsibility of initiating the annual progress reporting process. A template to guide planning partners in preparing a progress report is included in Appendix E. The plan maintenance steering committee will provide feedback to the planning team on items included in the template. DHSEM will then prepare a formal annual report on the progress of the plan. The framework for the annual report is as follows:

- The reporting period shall cover January through December of each reporting year (one calendar year).
- The timeframe for Steering Committee review of the annual progress report will be June to August of each reporting period.
- A final annual progress report will be produced no later than October 1 of each reporting year.
- The annual progress report will be posted on the Cook County Hazard Mitigation Plan website.
- Notice of the annual progress report will be provided to the local media through a press release.
- The annual progress report will be provided to all planning partners to inform them of the actions implemented during the reporting period.
- For planning partners that participate in the Community Rating System, the report can be provided as part of the CRS annual re-certification package. The CRS requires an annual recertification to be submitted by October 1 of every calendar year for which the community has not received a formal audit.
- For planning partners that participate in the Community Rating System, the report can be provided as part of the CRS annual re-certification package. The CRS requires an annual recertification to be submitted by October 1 of every calendar year for which the community has not received a formal audit.

Each planning partner will have discretion in how to use the annual progress report. Annual progress reporting is not a requirement specified under 44 CFR, but it may enhance the planning partnership's opportunities for funding. While failure to implement this component of the plan maintenance strategy will not jeopardize a planning partner's compliance under the DMA, it may jeopardize its opportunity to partner and leverage funding opportunities with the other planning partners. Each planning partner was informed of these protocols at the beginning of this planning process and acknowledged these expectations by submitting a letter of intent to participate in this process.

Chapter 22. Plan Update Process

Local hazard mitigation plans must be reviewed, revised if appropriate, and resubmitted for approval in order to remain eligible for benefits under the DMA (44 CFR, Section 201.6(d)(3)). The planning partnership intends to update the hazard mitigation plan on a five-year cycle from the date of initial plan adoption. This cycle may be accelerated to less than five years based on the following triggers:

- A Presidential Disaster Declaration that impacts the planning area
- A hazard event that causes loss of life
- A comprehensive update of the County or participating municipality's comprehensive plan

It will not be the intent of future updates to develop a completely new hazard mitigation plan for the planning area. The update will, at a minimum, include the following elements:

- The update process will be convened through a steering committee.
- The hazard risk assessment will be reviewed and, if necessary, updated using best available information and technologies.
- The action plans will be reviewed and revised to account for any actions completed, dropped, or changed and to account for changes in the risk assessment or new partnership policies identified under other planning mechanisms (such as the comprehensive plan).
- The draft update will be sent to appropriate agencies and organizations for comment.
- The public will be given an opportunity to comment on the update prior to adoption.
- The partnership governing bodies will adopt their respective portions of the updated plan.

Chapter 23. Continuing Public Involvement

The public will continue to be apprised of the plan's progress through the Cook County hazard mitigation website and by copies of annual progress reports provided to the media. Each planning partner has agreed to provide links to the County hazard mitigation plan website on their individual jurisdictional websites to increase avenues of public access to the plan. DHSEM has agreed to maintain the hazard mitigation plan website. This site will not only house the final plan, it will also become the one-stop shop for information regarding the plan, the partnership, and plan implementation. DHSEM will make copies of the plan for the Cook County Library system.

Upon initiation of future update processes, a new public involvement strategy will be initiated based on guidance from a new steering committee. This strategy will be based on the needs and capabilities of the planning partnership at the time of the update. At a minimum, this strategy will include the use of local media outlets within the planning area.

Chapter 24. Incorporation into Other Planning Mechanisms

The information on hazard, risk, vulnerability, and mitigation contained in this plan is based on the best science and technology available at the time this plan was prepared. The Cook County Comprehensive Plan and the comprehensive plans of the planning partners are considered to be integral parts of this plan. The County and partner municipalities, through adoption of comprehensive plans and zoning ordinances, have planned for the impact of natural hazards. The plan development process provided the County and the municipalities with the opportunity to review and expand on policies contained within these planning mechanisms. The planning partners used their comprehensive plans and the hazard mitigation plan as complementary documents that work together to achieve the goal of reducing risk exposure to the citizens of the planning area. An update to a comprehensive plan may trigger an update to the hazard mitigation plan.

All municipal planning partners are committed to creating a linkage between the hazard mitigation plan and their individual comprehensive plans by identifying a mitigation action as such and giving that action a high priority. Other planning processes and programs to be coordinated with the recommendations of the hazard mitigation plan include the following:

- Partners' emergency response plans
- Capital improvement programs
- Municipal codes
- Community design guidelines
- Water-efficient landscape design guidelines
- Stormwater management programs
- Water system vulnerability assessments

Some action items do not need to be implemented through regulation. Instead, they be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation. As information becomes available from other planning mechanisms that can enhance this plan, that information will be incorporated via the update process.

Part 5. Plan Adoption

A hazard mitigation plan must document that it has been formally adopted by the governing body of the jurisdiction requesting federal approval of the plan (44 CFR Section 201.6(c)(5)). For multi-jurisdictional plans, each jurisdiction requesting approval must document that is has been formally adopted. This plan will be submitted for a pre-adoption review to the Illinois Emergency Management Agency (IEMA) and FEMA prior to adoption. Once pre-adoption approval has been provided, all planning partners will formally adopt the plan. All partners understand that DMA compliance and its benefits cannot be achieved until the plan is adopted.

After a thorough review, the Cook County Board of Commissioners adopted the plan on September 26, 2019. Copies of the resolutions adopting this plan for all planning partners can be found in Appendix G of this volume.

Appendices

Appendix A: Acronyms and Definitions

Acronyms

44 CFR—Title 44 of the Code of Federal Regulations

AQI—Air quality index

CCSPM—Cook County Stormwater Management Plan

CFR—Code of Federal Regulations

cfs—Cubic feet per second

CIP—Capital Improvement Plan

CMAP—Chicago Metropolitan Agency for Planning

CRS—Community Rating System

CWA—Clean Water Act

DFIRM—Digital Flood Insurance Rate Maps

DHSEM— Cook County Department of Homeland Security and Emergency Management

DMA —Disaster Mitigation Act

DWP—Detailed watershed plan

EF—Enhanced Fujita (tornado rating scale)

EPA—U.S. Environmental Protection Agency

EPZ—Emergency planning zone

ESA—Endangered Species Act

FEMA—Federal Emergency Management Agency

FERC—Federal Energy Regulatory Commission

FIRM—Flood Insurance Rate Map

FMA—Flood Mitigation Assistance program

GIS—Geographic Information System

Hazus-MH—Hazards, United States-Multi Hazard

HUD—U.S. Department of Housing and Urban Development

HMGP—Hazard Mitigation Grant Program

IBC—International Building Code

IDNR—Illinois Department of Natural Resources

IEMA—Illinois Emergency Management Agency

ILCS—Illinois Compiled Statutes

IPCC—Intergovernmental Panel on Climate Change

IRC—International Residential Code

ISGS—Illinois State Geological Survey

MABAS— Mutual Aid Box Alarm System

MM—Modified Mercalli Scale

MWRD—Metropolitan Water Reclamation District of Greater Chicago

NASA—National Aeronautics and Space Administration

NCDC—National Climatic Data Center

NEHRP—National Earthquake Hazards Reduction Program

NFIP—National Flood Insurance Program

NFPA—National Fire Protection Association

NOAA—National Oceanic and Atmospheric Administration

NRC—National Research Council

NWS—National Weather Service

OTA—Congressional Office of Technology Assessment

PDM—Pre-Disaster Mitigation Grant Program

PDSI—Palmer Drought Severity Index

PGA—Peak Ground Acceleration

RHRC—Regional Hub Reception Center

RSI—Regional Snowfall Index

SFHA—Special Flood Hazard Area

SHELDUS—Spatial Hazard Events and Losses Database for the U.S.

SPI—Standardized Precipitation Index

USACE—United States Army Corps of Engineers

USGCRP—United States Global Change Research Program

USGS—U.S. Geological Survey

Definitions

100- Year Flood: The term “100-year flood” can be misleading. The 100-year flood does not necessarily occur once every 100 years. Rather, it is the flood that has a 1 percent chance of being equaled or exceeded in any given year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The Federal Emergency Management Agency (FEMA) defines it as the 1 percent annual chance flood, which is now the standard definition used by most federal and state agencies and by the National Flood Insurance Program (NFIP).

Acre-Foot: An acre-foot is the amount of water it takes to cover 1 acre to a depth of 1 foot. This measure is used to describe the quantity of storage in a water reservoir. An acre-foot is a unit of volume. One acre foot equals 7,758 barrels; 325,829 gallons; or 43,560 cubic feet. An average household of four will use approximately 1 acre-foot of water per year.

Asset: An asset is any man-made or natural feature that has value, including, but not limited to, people; buildings; infrastructure, such as bridges, roads, sewers, and water systems; lifelines, such as electricity and communication resources; and environmental, cultural, or recreational features such as parks, wetlands, and landmarks.

Base Flood: The flood having a 1% chance of being equaled or exceeded in any given year, also known as the “100-year” or “1-percent-annual-chance” flood. The base flood is a statistical concept used to ensure that all properties subject to the National Flood Insurance Program (NFIP) are protected to the same degree against flooding.

Basin: A basin is the area within which all surface water—whether from rainfall, snowmelt, springs, or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Basins are also referred to as “watersheds” and “drainage basins.”

Benefit: A benefit is a net project outcome and is usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of benefit-cost analysis of proposed mitigation measures, benefits are limited to specific, measurable, risk reduction factors, including reduction in expected property losses (buildings, contents, and functions) and protection of human life.

Benefit/Cost Analysis: A benefit/cost analysis is a systematic, quantitative method of comparing projected benefits to projected costs of a project or policy. It is used as a measure of cost-effectiveness.

Building: A building is defined as a structure that is walled and roofed, principally aboveground, and permanently fixed to a site. The term includes manufactured homes on permanent foundations on which the wheels and axles carry no weight.

Capability Assessment: A capability assessment provides a description and analysis of a community’s current capacity to address threats associated with hazards. The assessment includes two components: an inventory of an agency’s mission, programs, and policies, and an analysis of its capacity to carry them out. A capability assessment is an integral part of the planning process in which a community’s actions to reduce losses are identified, reviewed, and analyzed, and the framework for implementation is identified. The following capabilities were reviewed under this assessment:

Legal and regulatory capability

Administrative and technical capability

Fiscal capability

Community Rating System (CRS): The CRS is a voluntary program under the NFIP that rewards participating communities (provides incentives) for exceeding the minimum requirements of the NFIP and completing activities that reduce flood hazard risk by providing flood insurance premium discounts.

Critical Area: An area defined by state or local regulations as deserving special protection because of unique natural features or its value as habitat for a wide range of species of flora and fauna. A sensitive/critical area is usually subject to more restrictive development regulations.

Critical Facility: Facilities and infrastructure that are critical to the health and welfare of the population. These become especially important after any hazard event occurs. For the purposes of this plan, critical facilities include:

Structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic and/or water-reactive materials;

Hospitals, nursing homes, and housing likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a hazard event.

Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for disaster response before, during, and after hazard events, and

Public and private utilities, facilities and infrastructure that are vital to maintaining or restoring normal services to areas damaged by hazard events.

Government facilities.

Dam: Any artificial barrier or controlling mechanism that can or does impound 10 acre-feet or more of water.

Dam Failure: Dam failure refers to a partial or complete breach in a dam (or levee) that impacts its integrity. Dam failures occur for a number of reasons, such as flash flooding, inadequate spillway size, mechanical failure of valves or other equipment, freezing and thawing cycles, earthquakes, and intentional destruction.

Debris Slide: Debris slides consist of unconsolidated rock or soil that has moved rapidly down slope. They occur on slopes greater than 65 percent.

Disaster Mitigation Act of 2000 (DMA): The DMA is Public Law 106-390 and is the latest federal legislation enacted to encourage and promote proactive, pre-disaster planning as a condition of receiving financial assistance under the Robert T. Stafford Act. The DMA emphasizes planning for disasters before they occur. Under the DMA, a pre-disaster hazard mitigation program and new requirements for the national post-disaster hazard mitigation grant program (HMGP) were established.

Drainage Basin: A basin is the area within which all surface water- whether from rainfall, snowmelt, springs or other sources- flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains and ridges. Drainage basins are also referred to as **watersheds** or **basins**.

Drought: Drought is a period of time without substantial rainfall or snowfall from one year to the next. Drought can also be defined as the cumulative impacts of several dry years or a deficiency of precipitation over an extended period of time, which in turn results in water shortages for some activity, group, or environmental function. A hydrological drought is caused by deficiencies in surface and subsurface water supplies. A socioeconomic drought impacts the health, well-being, and quality of life or starts to have an adverse impact on a region. Drought is a normal, recurrent feature of climate and occurs almost everywhere.

Earthquake: An earthquake is defined as a sudden slip on a fault, volcanic or magmatic activity, and sudden stress changes in the earth that result in ground shaking and radiated seismic energy. Earthquakes can last from a few seconds to over 5 minutes, and have been known to occur as a series of tremors over a period of several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties may result from falling objects and debris as shocks shake, damage, or demolish buildings and other structures.

Enhanced Fujita Scale: The Enhanced Fujita Scale or EF Scale, which became operational on February 1, 2007, is used to assign a tornado a 'rating' based on estimated wind speeds and related damage. When tornado-related damage is surveyed, it is compared to a list of Damage Indicators (DIs) and Degrees of Damage (DoD) which help estimate better the range of wind speeds the tornado likely produced. From that, a rating (from EF0 to EF5) is assigned.

The EF Scale was revised from the original Fujita Scale to reflect better examinations of tornado damage surveys so as to align wind speeds more closely with associated storm damage. The new scale has to do with how most structures are designed.

Exposure: Exposure is defined as the number and dollar value of assets considered to be at risk during the occurrence of a specific hazard.

Extent: The extent is the size of an area affected by a hazard.

Firewise Communities Program: A program of the National Fire Protection Association that encourages local solutions for safety by involving homeowners in taking individual responsibility for preparing their homes from the risk of wildfire. Firewise is a key component of Fire Adapted Communities – a collaborative approach that connects all those who play a role in wildfire education, planning and action with comprehensive resources to help reduce risk. The program is co-sponsored by the USDA Forest Service, the US Department of the Interior, and the National Association of State Foresters.

Flash Flood: A flash flood occurs with little or no warning when water levels rise at an extremely fast rate

Flood Insurance Rate Map (FIRM): FIRMs are the official maps on which the Federal Emergency Management Agency (FEMA) has delineated the Special Flood Hazard Area (SFHA).

Flood Insurance Study: A report published by the Federal Insurance and Mitigation Administration for a community in conjunction with the community's Flood Insurance rate Map. The study contains such background data as the base flood discharges and water surface elevations that were used to prepare the FIRM. In most cases, a community FIRM with detailed mapping will have a corresponding flood insurance study.

Floodplain: Any land area susceptible to being inundated by flood waters from any source. A flood insurance rate map identifies most, but not necessarily all, of a community's floodplain as the Special Flood Hazard Area (SFHA).

Floodway: Floodways are areas within a floodplain that are reserved for the purpose of conveying flood discharge without increasing the base flood elevation more than 1 foot. Generally speaking, no development is allowed in floodways, as any structures located there would block the flow of floodwaters.

Floodway Fringe: Floodway fringe areas are located in the floodplain but outside of the floodway. Some development is generally allowed in these areas, with a variety of restrictions. On maps that have identified and delineated a floodway, this would be the area beyond the floodway boundary that can be subject to different regulations.

Fog: Fog refers to a cloud (or condensed water droplets) near the ground. Fog forms when air close to the ground can no longer hold all the moisture it contains. Fog occurs either when air is cooled to its dew point or the amount of moisture in the air increases. Heavy fog is particularly hazardous because it can restrict surface visibility. Severe fog incidents can close roads, cause vehicle accidents, cause airport delays, and impair the effectiveness of emergency response. Financial losses associated with transportation delays caused by fog have not been calculated in the United States but are known to be substantial.

Freeboard: Freeboard is the margin of safety added to the base flood elevation.

Frequency: For the purposes of this plan, frequency refers to how often a hazard of specific magnitude, duration, and/or extent is expected to occur on average. Statistically, a hazard with a 100-year frequency is expected to occur about once every 100 years on average and has a 1 percent chance of occurring any given year. Frequency reliability varies depending on the type of hazard considered.

Goal: A goal is a general guideline that explains what is to be achieved. Goals are usually broad-based, long-term, policy-type statements and represent global visions. Goals help define the benefits that a plan is trying to achieve. The success of a hazard mitigation plan is measured by the degree to which its goals have been met (that is, by the actual benefits in terms of actual hazard mitigation).

Geographic Information System (GIS): GIS is a computer software application that relates data regarding physical and other features on the earth to a database for mapping and analysis.

Hazard: A hazard is a source of potential danger or adverse condition that could harm people and/or cause property damage.

Hazard Mitigation Grant Program (HMGP): Authorized under Section 202 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, the HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster.

Hazards U.S. Multi-Hazard (Hazus-MH) Loss Estimation Program: Hazus-MH is a GIS-based program used to support the development of risk assessments as required under the DMA. The Hazus- MH software program assesses risk in a quantitative manner to estimate damage and losses associated with natural hazards. Hazus-MH is FEMA's nationally applicable, standardized methodology and software program and contains modules for estimating potential losses from earthquakes, floods, and wind hazards. Hazus-MH has also been used to assess vulnerability (exposure) for other hazards.

Hydraulics: Hydraulics is the branch of science or engineering that addresses fluids (especially water) in motion in rivers or canals, works and machinery for conducting or raising water, the use of water as a prime mover, and other fluid-related areas.

Hydrology: Hydrology is the analysis of waters of the earth. For example, a flood discharge estimate is developed by conducting a hydrologic study.

Intensity: For the purposes of this plan, intensity refers to the measure of the effects of a hazard.

Inventory: The assets identified in a study region comprise an inventory. Inventories include assets that could be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

Landspout: Tornado occurring with a parent cloud in its growth stage and with its vorticity originating in the boundary layer. The parent cloud does not contain a preexisting midlevel mesocyclone. The land spout was so named because it looks like a weak Florida Keys waterspout over land.

Lightning: Lightning is an electrical discharge resulting from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt," usually within or between clouds and the ground. A bolt of lightning instantaneously reaches temperatures approaching 50,000ºF. The rapid heating and cooling of air near lightning causes thunder. Lightning is a major threat during thunderstorms. In the United States, 75 to 100 Americans are struck and killed by lightning each year (see http://www.fema.gov/hazard/thunderstorms/thunder.shtm).

Liquefaction: Liquefaction is the complete failure of soils, occurring when soils lose shear strength and flow horizontally. It is most likely to occur in fine grain sands and silts, which behave like viscous fluids when liquefaction occurs. This situation is extremely hazardous to development on the soils that liquefy, and generally results in extreme property damage and threats to life and safety.

Local Government: Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

Magnitude: Magnitude is the measure of the strength of an earthquake, and is typically measured by the Richter scale. As an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Mitigation: A preventive action that can be taken in advance of an event that will reduce or eliminate the risk to life or property.

Mitigation Actions: Mitigation actions are specific actions to achieve goals and objectives that minimize the effects from a disaster and reduce the loss of life and property.

Objective: For the purposes of this plan, an objective is defined as a short-term aim that, when combined with other objectives, forms a strategy or course of action to meet a goal. Unlike goals, objectives are specific and measurable.

Peak Ground Acceleration: Peak Ground Acceleration (PGA) is a measure of the highest amplitude of ground shaking that accompanies an earthquake, based on a percentage of the force of gravity.

Preparedness: Preparedness refers to actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Presidential Disaster Declaration: These declarations are typically made for events that cause more damage than state and local governments and resources can handle without federal government assistance. Generally, no specific dollar loss threshold has been established for such declarations. A Presidential Disaster Declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, designed to help disaster victims, businesses, and public entities.

Probability of Occurrence: The probability of occurrence is a statistical measure or estimate of the likelihood that a hazard will occur. This probability is generally based on past hazard events in the area and a forecast of events that could occur in the future. A probability factor based on yearly values of occurrence is used to estimate probability of occurrence.

Repetitive Loss Property: Any NFIP-insured property that, since 1978 and regardless of any changes of ownership during that period, has experienced:

Four or more paid flood losses in excess of $1000.00; or

Two paid flood losses in excess of $1000.00 within any 10-year period since 1978 or

Three or more paid losses that equal or exceed the current value of the insured property.

Return Period (or Mean Return Period): This term refers to the average period of time in years between occurrences of a particular hazard (equal to the inverse of the annual frequency of occurrence).

Riverine: Of or produced by a river. Riverine floodplains have readily identifiable channels. Floodway maps can only be prepared for riverine floodplains.

Risk: Risk is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. Risk measures the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment: Risk assessment is the process of measuring potential loss of life, personal injury, economic injury, and property damage resulting from hazards. This process assesses the vulnerability of people, buildings, and infrastructure to hazards and focuses on (1) hazard identification; (2) impacts of hazards on physical, social, and economic assets; (3) vulnerability identification; and (4) estimates of the cost of damage or costs that could be avoided through mitigation.

Risk Ranking: This ranking serves two purposes, first to describe the probability that a hazard will occur, and second to describe the impact a hazard will have on people, property, and the economy. Risk estimates for the City are based on the methodology that the City used to prepare the risk assessment for this plan. The following equation shows the risk ranking calculation:

Risk Ranking = Probability Impact (people property economy)

Robert T. Stafford Act: The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 100-107, was signed into law on November 23, 1988. This law amended the Disaster Relief Act of 1974, Public Law 93-288. The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

Sinkhole: A collapse depression in the ground with no visible outlet. Its drainage is subterranean. It is commonly vertical-sided or funnel-shaped.

Special Flood Hazard Area: The base floodplain delineated on a Flood Insurance Rate Map. The SFHA is mapped as a Zone A in riverine situations and zone V in coastal situations. The SFHA may or may not encompass all of a community's flood problems

Stakeholder: Business leaders, civic groups, academia, non-profit organizations, major employers, managers of critical facilities, farmers, developers, special purpose districts, and others whose actions could impact hazard mitigation.

StormReady Program: A program of the National Weather Service that helps arm America's communities with the communication and safety skills needed to save lives and property--before and during a storm event. StormReady helps community leaders and emergency managers strengthen local safety programs. StormReady communities are better prepared to save lives from the onslaught of severe weather through advanced planning, education and awareness.

Stream Bank Erosion: Stream bank erosion is common along rivers, streams and drains where banks have been eroded, sloughed or undercut. However, it is important to remember that a stream is a dynamic and constantly changing system. It is natural for a stream to want to meander, so not all eroding banks are "bad" and in need of repair. Generally, stream bank erosion becomes a problem where development has limited the meandering nature of streams, where streams have been channelized, or where stream bank structures (like bridges, culverts, etc.) are located in places where they can actually cause damage to downstream areas. Stabilizing these areas can help protect watercourses from continued sedimentation, damage to adjacent land uses, control unwanted meander, and improvement of habitat for fish and wildlife.

Steep Slope: Different communities and agencies define it differently, depending on what it is being applied to, but generally a steep slope is a slope in which the percent slope equals or exceeds 25%. For this study, steep slope is defined as slopes greater than 33%.

Sustainable Hazard Mitigation: This concept includes the sound management of natural resources, local economic and social resiliency, and the recognition that hazards and mitigation must be understood in the largest possible social and economic context.

Thunderstorm: A thunderstorm is a storm with lightning and thunder produced by cumulonimbus clouds. Thunderstorms usually produce gusty winds, heavy rains, and sometimes hail. Thunderstorms are usually short in duration (seldom more than 2 hours). Heavy rains associated with thunderstorms can lead to flash flooding during the wet or dry seasons.

Tornado: A tornado is a violently rotating column of air extending between and in contact with a cloud and the surface of the earth. Tornadoes are often (but not always) visible as funnel clouds. On a local scale, tornadoes are the most intense of all atmospheric circulations, and winds can reach destructive speeds of more than 300 mph. A tornado's vortex is typically a few hundred meters in diameter, and damage paths can be up to 1 mile wide and 50 miles long.

Vulnerability: Vulnerability describes how exposed or susceptible an asset is to damage. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damage, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. Flooding of an electric substation would affect not only the substation itself but businesses as well. Often, indirect effects can be much more widespread and damaging than direct effects.

Watershed: A watershed is an area that drains downgradient from areas of higher land to areas of lower land to the lowest point, a common drainage basin.

Windstorm: Windstorms are generally short-duration events involving straight-line winds or gusts exceeding 50 mph. These gusts can produce winds of sufficient strength to cause property damage. Windstorms are especially dangerous in areas with significant tree stands, exposed property, poorly constructed buildings, mobile homes (manufactured housing units), major infrastructure, and aboveground utility lines. A windstorm can topple trees and power lines; cause damage to residential, commercial, critical facilities; and leave tons of debris in its wake.

Zoning Ordinance: The zoning ordinance designates allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.

Appendix B: Plan Process and Development Documentation

This section details plan participation validation for local jurisdictions. In accordance with best practices as outlined in CPG 101, Cook County DHSEM and its partners embraced the whole community approach throughout the 2019 MJ-HMP Update process, involving civic leaders, community representatives and organizations, and the general public. Understanding that critical infrastructure and key resources (CIKR), as well as public opinion and hazard likeliness, can dramatically change in a five-year period, the DHSEM and its partners leveraged in-person, on-site outreach opportunities to educate stakeholders and collect and validate the information. To support the 2019 MJ-HMP Update process, the following were facilitated for jurisdiction leaders and Point of Contacts (POC):

- Local Government Meetings
- Webinars
- Hazard Mitigation Planning Workshops

Further information about plan participation validation is included below.

2014 Cook County HMP Participation

Local jurisdiction plan participation takes into account whether or not each jurisdiction participated in the 2014 Cook County HMP. If the jurisdiction participated, the 2019 MJ-HMP Update is a straightforward process, maintaining access to 2014 jurisdictional annexes and other critical documents—including jurisdiction profiles, capability assessments, Hazus Risk Assessment results, etc.

A number of jurisdictions within Cook County are bordering municipalities that are geographically shared by more than one county. For example, nine (9) local jurisdictions in the northern region of the County did not participate in the 2014 HMP:

1. Barrington
2. Barrington Hills
3. Bartlett
4. Buffalo Grove
5. Deerfield
6. Deer Park
7. East Dundee
8. Elgin
9. Roselle

Though specific reasons for non-participation may vary across jurisdictions, the key reason for these jurisdictions' non-participation is federal guidance. Previous guidance shared by FEMA in 2014 limited jurisdictions to participate in only one HMP. Although only Bartlett and Roselle cite participation in the 2018 DuPage County HMP, it is likely that the other non-participating northern jurisdictions opted to participate in the bordering county's (Kane, Lake, and/or McHenry) HMPs or opted to develop their own jurisdictional HMP. Information about the central and south region participation in the 2014 HMP can be found in the tables under sections 3.2.2.7.2 Central Region Participation and 3.2.2.7.3 South Region Participation.

2016 HMP Update

Annual updates were conducted to maintain up-to-date data and vital information for participating jurisdiction, increase the number of participating jurisdictions in the overall HMP and increase Cook County's resilience. Regardless of previous participation in the 2014 HMP, some municipalities opted to not participate in the 2016 HMP Update. For example, the following jurisdictions in the central region of Cook County participated in the 2014 HMP, but did not submit annual reports for the 2016 HMP Update:

1. Brookfield
2. City of Chicago
3. Schiller Park

2018 HMP Update

During the 2018 HMP Update, a few jurisdictions decided to either join or opt out of the 2018 HMP Update. For example, the following jurisdictions in the southern region of the County who did not participate in the 2016 HMP Update, submitted a 2018 annual report:

1. Chicago Ridge
2. Country Club Hills
3. Orland Hills

2019 Letter of Intent

A Letter of Intent (LOI) is a legally binding agreement that outlines and confirms a jurisdiction's participation in the 2019 MJ-HMP Update with the County. For 2019, one hundred and eight (108) out of one hundred and thirty-six (136) LOIs were received by Cook County DHSEM (see here). In the case of bordering jurisdictions, DHSEM personnel and their partners formally reached out to each of the bordering jurisdictions' POC. Out of the fourteen (14) border jurisdictions, three (3) (Hanover Park, Barrington, and University Park) joined the 2019 MJ-HMP Update.

Cook County DHSEM personnel reached out to FEMA and IEMA for guidance to increase participation in the 2019 MJ-HMP Update. FEMA, with IEMA’s concurrence, provided the following guidance and example:

- The general rule is that the community should participate in the HMP of the county that the majority of the community is located in.
- However, if a county is a sub-applicant for HMA grants, and the work was occurring in the community, the community will need to participate and adopt the HMP of the county that is the sub-applicant.

For example, if municipality X has a majority of its municipality located in Cook County and is a sub-applicant and participant of the Cook County HMP with a current plan, municipality X would meet the planning requirement even if it is a part of Cook, DuPage, and Kane counties. If Kane County is a sub-applicant for a mitigation project located in municipality x, municipality x will need to participate and adopt the Kane County HMP.

It is Cook County's recommendation to have municipalities located in more than one county, participate in both the Cook County HMP, as well as the other county's HMP to increase funding opportunities for the municipality.

Cook County Hazard Mitigation Webinar Series

Description

The webinar provides an overview of the steps involved in mitigation planning and the actions required by a jurisdiction to meet the planning requirements.

After Action Review

An After-Action Review (AAR) was completed after each webinar to review the format, execution, and lessons learned in preparation for the next presentation.

- **Webinar Power Point PPT Presentation**
- **Webinar Training Audio and Video Recording - Cook County DHSEM KMS Index - 7. Reference Section > 7.8 Cook County Reference Section > Section 7.8.1 Hazard Mitigation Assistance Materials**

Webinar 1:

- **Date:** 17-May-19, Friday
- **Scheduled Time:** 1000-1130 Hours CDT
- **Training ID:** 961-677-260
- **Registrants:** 87
- **Registration Report:** Cook County Hazard Mitigation Webinar Series 051719 Webinar Registration Report (MS Excel)
- **Actual Time:** 1 Hour 46 Minutes
- **Attendees:** 71
- **Attendee Report:** Cook County Hazard Mitigation Webinar Series 051719 Webinar Attendee Report (MS Excel)

Webinar 2:

- **Date:** 18-May-19, Saturday
- **Time:** 1000-1130 Hours CDT
- **Training ID:** 965-563-180
- **Registrants:** 10
- **Registration Report:** Cook County Hazard Mitigation Webinar Series 051819 Webinar Registration Report (MS Excel)

- **Actual Time:** 1 Hour 46 Minutes
- **Attendees:** 4
- **Attendee Report:** Cook County Hazard Mitigation Webinar Series 051819 Webinar Attendee Report (MS Excel)

Webinar 3:

- **Date:** 20-May-19, Monday
- **Time:** 1800-1930 Hours CDT
- **Training ID:** 970-400-172
- **Registrants:** 20
- **Registration Report:** Cook County Hazard Mitigation Webinar Series 052019 Webinar Registration Report (MS Excel)
- **Actual Time:** 1 Hour 43 Minutes
- **Attendees:** 16
- **Attendee Report:** Cook County Hazard Mitigation Webinar Series 052019 Webinar Attendee Report (MS Excel)

Webinar 4:

- **Date:** 21-May-19, Tuesday
- **Time:** 1000-1130 Hours CDT
- **Training ID:** 971-038-220
- **Registrants:** 88
- **Registration Report:** Cook County Hazard Mitigation Webinar Series 052119 Webinar Registration Report (MS Excel)
- **Actual Time:** 2 Hours 2 Minutes
- **Attendees:** 72
- **Attendee Report:** Cook County Hazard Mitigation Webinar Series 052119 Webinar Attendee Report (MS Excel)

Webinar 5:

- **Date:** 22-May-19, Wednesday
- **Time:** 1800-1930 Hours CDT
- **Training ID:** 974-153-388
- **Registrants:** 54
- **Registration Report:** Cook County Hazard Mitigation Webinar Series 052219 Webinar Registration Report (MS Excel)
- **Actual Time:** 1 Hour 52 Minutes

- **Attendees:** 38
- **Attendee Report:** Cook County Hazard Mitigation Webinar Series 052219 Webinar Attendee Report (MS Excel)

Webinar Series Statistics:

- **Days:** 5
- **Time:** 9 Hours and 15 Minutes
- **Registrants:** 259
- **Attendees:** 201

Local Government Meetings

Cook County DHSEM engaged stakeholders for the 2019 MJ-HMP Update by attending public meetings. Regional Planner, Kimberly Nowicki and Chief Planner, Eugene Ryan, led this effort by participating in the following meetings throughout the County:

- April 05, 2019 — Calumet Storm Water Collaborative
- April 17, 2019 — Upper Salt Creek and Poplar Creek Watershed Planning Council (HMP Presentation)
- April 18, 2019 — NEIL COAD Meeting
- April 24, 2019 — West Central Municipal Conference (HMP Presentation)
- April 24, 2019 — Addison Creek Groundbreaking Ceremony
- April 29, 2019 — Cal-Sag Watershed Planning Council (HMP Presentation)
- May 01, 2019 — Cook County Department of Homeland Security and Emergency Management Town Hall Meeting (South) Oak Forest, IL (HMP Presentation)
- May 02, 2019 — Cook County Department of Homeland Security and Emergency Management Town Hall Meeting (North) Schaumburg, IL (HMP Presentation)
- May 03, 2019 — Calumet Storm Water Collaborative
- May 06, 2019 — South Barrington Emergency Management Committee Meeting (HMP Presentation)
- May 09, 2019 — Little Calumet Watershed Planning Council
- May 23, 2019 — Lower Des Plaines River Watershed Planning Council (HMP Presentation)
- June 07, 2019 — Metro-County Emergency Management Coordinators Monthly Meeting
- July 10, 2019 — Steger Multi-County Flood Response Meeting

Metro-County Emergency Management Coordinators Monthly Meeting

- On June 7, 2019, Cook County DHSEM, Executive Director William Barnes and Gene Ryan attended the Metro-County Emergency Management Coordinators Monthly Meeting. Director Barnes reviewed and discussed the importance of Hazard Mitigation Planning (HMP) and recommended to request municipalities in more than one county participate in Cook County's

HMP, as well as the other county's HMP in which they are located. They asked for support by explaining that it will provide the municipalities with additional and simplified funding opportunities while the process may require more effort in the HMP update and annual review process. A meeting agenda, DHSEM handout on HMP multi-jurisdictional coordination, and a sign-in roster (PDF) were used to document the meeting.

Steger Multi-County Flood Response Meeting

- On July 10, 2019, Cook County DHSEM partnered with Will County to support the citizens of the Village of Steger with facilitating a needs assessment following recent flooding. Village stakeholders were given access to both counties as part of this multi-county hazard mitigation effort.

Figure (top) and (bottom): Key Cook County DHSEM and WIll County personnel discuss facilitating a needs assessment for the Village

Regional Hazard Mitigation Planning Workshops

A series of Regional Hazard Mitigation Planning Workshop Meetings were facilitated throughout the County, engaging key stakeholders throughout the North, South, and Central Regions, as well as the City of Chicago. The objective of these workshops was straightforward: educate stakeholders about mitigation and the mitigation process, collect and verify jurisdiction-specific information, and collect contact information for POCs for further outreach and follow-up activities. The following provides information and pictures documenting each of these workshops. In addition to these meetings, it is important to note that another component of the public involvement strategy included Hazard Mitigation Planning Webinars--an important engagement and educational tool referenced earlier in the plan.

North Region Hazard Mitigation Planning Workshop

May 29, 2019; 9am-12pm

MABAS 233 West Hintz Road

Wheeling, IL

See here for sign-in sheet.

Figure: Mr. Earl Zuelke Jr., former officer with the City of Chicago Police Department and the project team's Subject Matter Expert addressing stakeholders at the Northern Region Hazard Mitigation Planning Workshop

Figure: ISC Consultant and Project Manager for the 2019 Cook County MJ-HMP Update, Mr. Daiko Abe, facilitating the Northern Region Hazard Mitigation Planning Workshop

Figure: Prospect Heights stakeholders working together on developing new mitigation actions for their jurisdiction

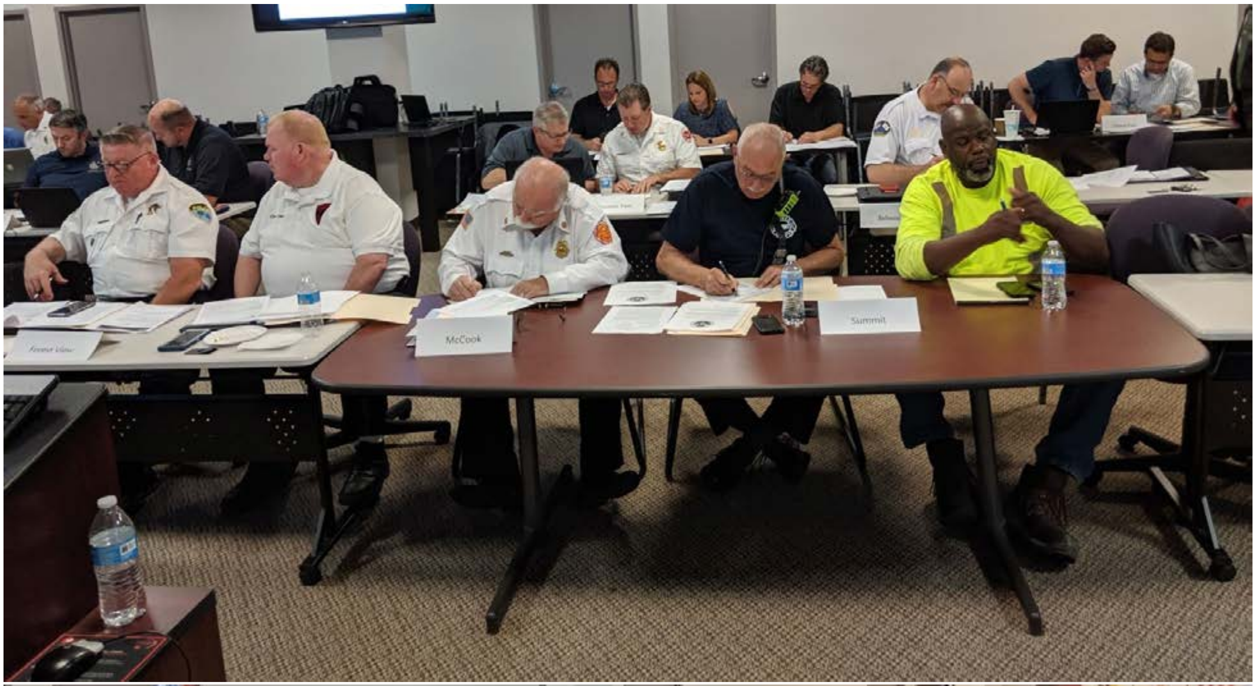
Central Region Hazard Mitigation Planning Workshop

May 30, 2019; 10am-1pm

7501 West Cermak Road

North Riverside, IL

See here for sign-in sheet.



Figures (top) and (bottom): Central Region Hazard Mitigation Planning Workshop participants drafting new jurisdictional hazard mitigation actions

City of Chicago Region Hazard Mitigation Planning Workshop

May 30, 2019; 1pm-4pm

1411 West Madison Street

Chicago, IL

[See here for sign-in sheet.]

Figures (top) and (bottom): Participants review educational hazard mitigation materials during workshop

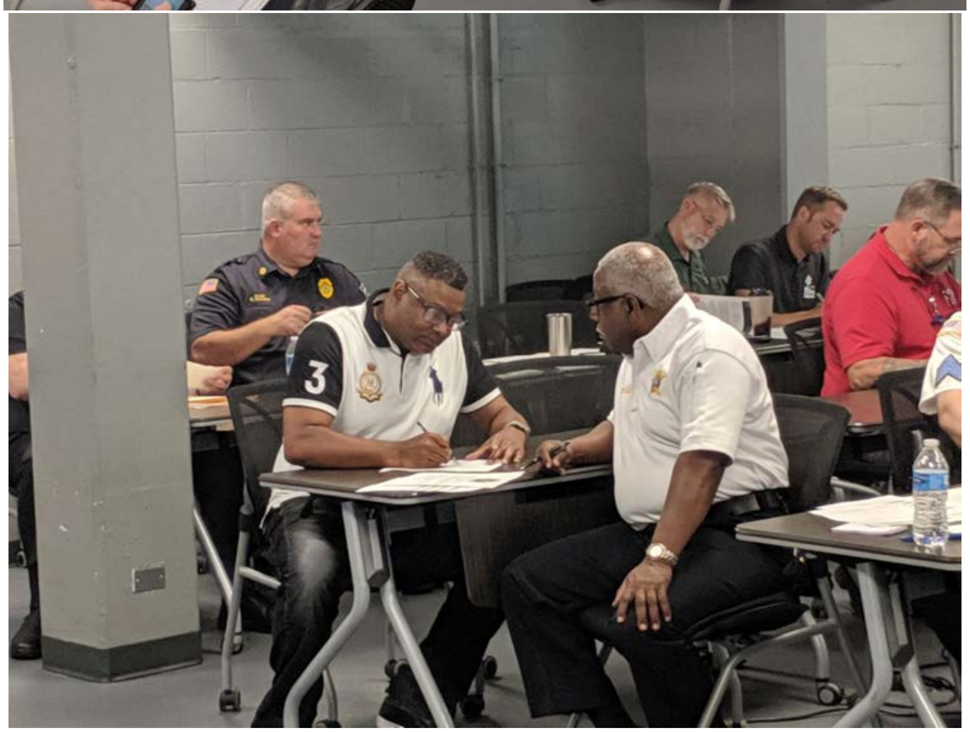
South Region Hazard Mitigation Planning Workshop

May 31, 2019; 9am-12pm

15900 South Cicero Avenue

Oak Forest, IL

See here for sign-in sheet.



Figures (top) and (bottom): Participants collaborate with one another and follow the presentation to develop new mitigation strategies

Figures (top) and (bottom): Mr. Abe and Metropolitan Water Reclamation District (MWRD) Senior Civil Engineer, Mr. Michael "Mick" Cosme, working directly with stakeholders on developing new mitigation strategies for their jurisdictions

Cook County Departments and Agencies Hazard Mitigation Planning Workshop

June 3, 2019

69 West Washington Street

Chicago, IL 60602

See here for sign-in sheet.

Figure: Meeting place on the 26th floor of the George Dunne Cook County building

Watershed Planning Council (WPC) Meetings (attended by Gene Ryan, DHSEM Chief of Planning and Kim Nowicki, DHSEM Regional Planner):

- Upper Salt Creek and plar Creek WPC Meeting on 4/17/19
- Lower Des Plaines River WPC Meeting on 5/23/19
- Cal-Sag WPC Meeting on 4/29/19
- Little Calumet WPC on 5/9/19
- North Branch of the Chicago River WPC 6/4/19 (handout presentation provided by MWRD)

Appendix C: Public Participation Documentation

In accordance with best practices as outlined in CPG 101, this public-private effort engaged the whole community, reaching citizens and key stakeholders across all 135 jurisdictions. Elements of virtual public outreach included the 2019 Cook County Preparedness Survey, webinars, and social media such as Twitter and Nextdoor. The physical component of the outreach efforts focused on maximizing attendance at hazard mitigation meetings.

The remainder of this section provides an overview as well as outreach documentation for:

- 2019 Cook County Community Preparedness Survey,
- Local Government Meetings,
- Hazard Mitigation Plan Public Meetings, and
- Hazard Mitigation Plan Draft Review Meetings

2019 Cook County Community Preparedness Survey

An integral component of the 2014 MJ-HMP public involvement strategy was the use of a questionnaire. To engage the whole community in the 2019 MJ-HMP Update process, DHSEM and ISC developed the 2019 Cook County Community Preparedness Survey to engage the general public by providing information on the update process while collecting and validating information from citizens throughout all 135 jurisdictions. The 37-question web-based tool was used to gauge household preparedness for natural hazards and the public's knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. The results of the survey were used by the Steering Committee guide them in developing objectives and mitigation strategies.

The survey was accessible to the public from May 20, 2019 to June 21, 2019 via multiple websites, including the City of Chicago Office of Emergency Management and Communications (OEMC) website. In addition, a link to the survey was disseminated through various social media platforms, local government websites, and press releases (see Survey Outreach). As emphasized in the National Response Framework (NRF), resilient communities are borne out of prepared individuals and strong leadership across governments, agencies, and businesses. Accordingly, the survey gauged the community's overall resiliency by collecting thousands of responses from respondents that represent the diverse backgrounds of the County.

Over 6,532 responses were collected during the 2019 MJ-HMP Update, more than tripling the previous response rate of over 1,800 from the 2014 MJ-HMP survey. A copy of the survey, as well as a summary of results, is presented in 2019 Cook County Community Preparedness Survey Results.

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2019 Cook County Community Preparedness Survey

Instructions

To Whom It May Concern:

Cook County is conducting a study to better understand the preparedness needs and risk perceptions of its residents as part of the County's Multi-Jurisdictional 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.

Survey Completion Date
Please complete the survey by June 21, 2019.

CONTACT US
If you have any questions, please contact:

Kimberly Nowicki, MScTRM, IPEM
Regional Planner
Cook County Department of Homeland Security & Emergency Management
Email: kimberly.nowicki@cookcountyil.gov

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.
Thank you for your participation.

Figure: 2019 Cook County Community Preparedness Survey

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June 4, 2019

Community Preparedness Public Survey

As part of the 2019 Cook County Hazard Mitigation Plan, OEMC's partners at Cook County Department of Homeland Security & Emergency Management have released a Community Preparedness Survey for public feedback. Please take a few minutes to provide your input!

https://www.surveygizmo.com/s3/4967666/2019-Cook-County-Community-Preparedness-Survey-copy?fbclid=IwAR19nhKQH5fSo3L85ZAOH_tV5grZEGY07jHDS9S3L5L5P9dA4fuPj51cm30

Figure: *City of Chicago OEMC - June 4, 2019 Community Preparedness Survey (Survey Page)*

2019 Cook County Community Preparedness Survey Outreach Efforts

As previously noted, the survey was disseminated across multiple platforms, including social media and online press releases by DHSEM as well as the participating municipalities. The following provides chronological documentation of survey outreach efforts with a brief summary of the activities categorized as Press Releases or Multimedia Outreach. It is important to note that the survey advertisements included references to the public meeting series. The citations have been also provided in the Press Releases - Public Meetings section, as well as a separate document.

Press Releases - Community Preparedness Survey Outreach

Summary of Press Releases

- May 31, 2019 - Village of Flossmoor
- June 2019 - Village of Harwood Heights
- June 6, 2019 - Village of Elmwood Park
- June 7, 2019 - Village of Schiller Park
- June 11, 2019 - Illinois Law Enforcement Alarm System (ILEAS)
- June 17, 2019 - Cook County DHSEM

May 31, 2019

Flossmoor Asks Residents To Take Survey For Disaster Grants

Flossmoor is asking residents to take a county survey that could help with grants that can be used when disasters strike

By Erika Hobbs, Patch Staff | May 31, 2019 3:16 pm ET

Like 3 Share Reply

Figure: Village of Flossmoor advertises the Cook County DHSEM 2019 MJ-MHP Update survey.

June 2019

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Cook County Dept of Homeland Security Survey

Print

Per their website, "The Cook County Department of Homeland Security and Emergency Management (DHSEM) works for the more than five million residents of the second largest county in the United States. Cook County is vulnerable to many hazards from extreme weather to terrorist attacks. We have a fundamental responsibility to do all we can to ensure the safety of our community." In summer 2019, DHSEM is completing a Multi-Jurisdictional Hazard Mitigation Plan Update and they are requesting input from the public. For the latest information on public meetings and to take their survey, please visit their website by clicking **here**.

Figure: Harwood Heights advertises the Public Meeting Series and Survey.

June 6, 2019

Figure: Village of Elmwood Park advertises the Public Meeting Series and the Survey

June 7, 2019

Figure: Village of Schiller Park advertise the Public Meeting Series and Survey

June 11, 2019

ILEAS About Training Programs Transparency Media Contact Mutual Aid Request Agency Login

Hazard Mitigation Meetings in Cook County

ILEAS has been asked to reach out to its members in Cook County to let everyone know about an important series of meeting regarding Hazard Mitigation.

"On behalf of Cook County Department of Homeland Security and Emergency Management (DHSEM), we are respectfully asking you to participate in our public meetings and survey. Cook County DHSEM is conducting a series of public meetings to better understand the preparedness needs and risk perceptions of its residents as part of the County's Multi-Jurisdictional Hazard Mitigation Plan update process. The later meetings will allow DHSEM to present the public with these findings, as well as the Draft Hazard Mitigation Plan update. In addition, a questionnaire has been distributed throughout the County. Your attendance and feedback are greatly needed and appreciated!" Please click below for a list of the meeting dates, times and locations.

DHSEM North Public Meeting I: Hazard Mitigation Plan Process

Monday, June 10, 2019 from 7:00 p.m. to 8:00 p.m.

Skokie Public Library

5215 Oakton Street

Skokie, IL 60077

DHSEM South Public Meeting I: Hazard Mitigation Plan Process

Thursday, June 13, 2019 from 6:30 p.m. to 7:30 p.m.

Orland Fire Protection District Station 1

9790 W 151st Street

Figure: ILEAS advertises both the Cook County DHSEM Public Meeting Series and Survey

June 17, 2019

Figure: Cook County DHSEM releases an article detailing information about the HMP update as well as information for the Public Meeting series and survey

Multimedia - Community Preparedness Survey Outreach

Social media platforms such as Twitter and Nextdoor were leveraged to increase survey participation. In addition, flyers for the Public Meeting Series provided access to the survey via Quick Response (QR) Codes - a machine-readable barcode containing data that links a user to a website. The following provides chronological documentation of multimedia-based survey outreach efforts.

May 31, 2019

Figure: @CCDHSEM advertises the Cook County Community Preparedness Survey.

June 4, 2019

Figure: @CCDHSEM advertises the Cook County Community Preparedness Survey.

June 5, 2019

Figure: @CCDHSEM advertises the Cook County Community Preparedness Survey.

June 7, 2019

CCDHSEM @ccdhsem · Jun 7

#CookCounty residents, we need your feedback! Just 10 minutes of your time can impact safety in your community. Please participate in this important hazard mitigation survey: bit.ly/2JQ5KM1

Figure: @CCDHSEM advertises the Cook County Community Preparedness Survey

Cook County Community Preparedness Survey

Assistant Village Manager Charles Meyer from Village of Lincolnwood · 4d ago

The Cook County Department of Homeland Security and Emergency is conducting a study to better understand the preparedness needs and risk perceptions of our residents as part of the County's Multi-Jurisdictional Hazard Mitigation Plan update process. We have reached out to residents throughout the County to encourage them to participate in the survey and we are asking you to participate as well.

The questionnaire should only take about 10 minutes to complete. All responses will be kept confidential, and your participation is strictly voluntary. Your feedback is critical as we plan for projects and funding to help secure Cook County.

Please click on this link to take the survey:
https://www.surveygizmo.com/s3/4967666/c...

Please complete the survey by June 21, 2019.

2019 Cook County Community Preparedness Survey
2019 Cook County Community Preparedness Survey.
SURVEYGIZMO.COM

4d ago · Subscribers of Village of Lincolnwood in Crime & Safety

Figure: Assistant Village Manager of the Village of Lincolnwood, Charles Meyer, encourages his constituents to take the survey through the smartphone application, Nextdoor.

June 13, 2019

Figure: Cook County DHSEM Regional Planner, Kimberly Nowicki, advertises the survey on Nextdoor, reaching over 34,000 views

2019 Hazard Mitigation Plan Meetings

Collaborating with ISC and MWRD, Cook County DHSEM facilitated four successful public meetings across the North, South, and Central regions of the county. These public meetings were divided into two series: The Hazard Mitigation Plan Process and the 2019 Cook County MJ-HMP Update Draft Review. The following provides documentation for each of the Hazard Mitigation Plan Public Meetings, including information and pictures.

Hazard Mitigation Plan Public Meetings, Series I

The first series of public meetings focused on educating the public on what hazard mitigation is, what it means, and how to work together to create a more resilient community. This included formal presentations, interactive group discussions, and defining new mitigation actions within each participants' respective jurisdiction. The remainder of this section provides documentation of the first series of public meetings, including pictures and descriptions.

June 5, 2019

255 Augusta Street

Oak Park, IL 60302

See here for sign-in sheet.

Figure: Oak Park Public Library Dole Branch Meeting Room

June 10, 2019

5215 Oakton Street

Skokie, IL 60077

See here for sign-in sheet.

Figures: ISC Consultant and 2019 Cook County MJ-MHP Update Lead Planner, Ms. Sabeen Shamsi, providing an educational presentation to Northern Cook County participants

June 13, 2019

9790 151st Street

Orland Park, IL 6062

See here for sign-in sheet.

Figure: Orland Park Fire Protection District personnel advertised the public meeting on the signs of each of their stations

Figure: Cook County DHSEM Chief Planner, Mr. Eugene "Gene" Ryan, addressing meeting attendees

Figure: The meeting welcomed community members from law enforcement, emergency medical services, fire protection, healthcare, and the general public to engage in a discussion about hazard mitigation

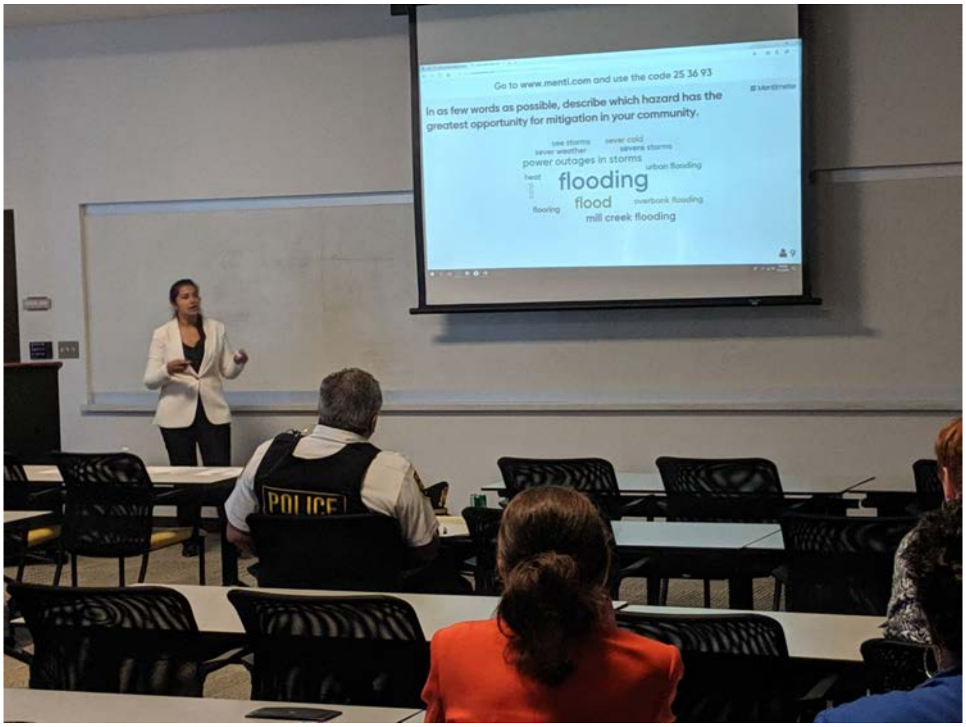

Figure: Ms. Shamsi leading meeting participants in an interactive online survey about hazards in Cook County's southern region

Ms. Shamsi leading the discussion about the goals of hazard mitigation planning (left) and the top five mitigation projects in 2018

Figure: MWRD Senior Civil Engineer, Michael "Mick" Cosme, presenting on the over 130 past projects the MWRD has completed

Press Releases - Hazard Mitigation Plan Public Meetings Outreach

Public outreach efforts for the Hazard Mitigation Plan Public Meetings was robust, marshaling engagement from local governments throughout Cook County. Below is a chronological documentation of press releases advertising the meetings.

Summary of Press Releases

- May 31, 2019 - Village of Flossmoor
- June 1, 2019 - *Nadig Newspapers*
- June 2019 - Cook County Government
- June 2019 - Morton Grove
- June 2019 - Village of Harwood Heights
- June 5, 2019 - Village of Brookfield
- June 5, 2019 - Village of Western Springs
- June 6, 2019 - Village of Crestwood
- June 6, 2019 - Village of Elmwood Park
- June 7, 2019 - Village of Maywood
- June 7, 2019 - Village of Schiller Park
- June 7, 2019 - City of Hickory Hills
- June 11, 2019 - Illinois Law Enforcement Alarm System (ILEAS)
- June 17, 2019 - Cook County DHSEM

May 30, 2019

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YOU ARE HERE: HOME › LOCAL NEWS › COUNTY RESIDENTS INVITED TO PARTICIPATE IN UPDATE TO PREPARATION PLAN FOR IMPACTS OF — JUNE 11, 2019 12:06 PM

NATURAL HAZARDS

County Residents Invited to Participate in Update to Preparation Plan for Impacts of Natural Hazards

Posted by Editor on May 30, 2019 in Local News | Comments Off on County Residents Invited to Participate in Update to Preparation Plan for Impacts of Natural Hazards

This week's storms along with severe weather forecasted in the coming days is a reminder to area residents of the kind of damage a weather event can cause. A number of natural hazards like flooding, snowstorms and even tornadoes impact Cook County. That is why the County's Department of Homeland Security and Emergency Management (DHSEM) is updating the Cook County Multi-Jurisdictional Hazard Mitigation Plan (HMP) to prepare for natural disasters and their impacts. And they want residents' input. DHSEM is hosting a series of public meetings to share details about the planning process with residents. The meetings will be held:

Tuesday, June 4
6:30 p.m. – 8:30 p.m.

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JUNE 6, 2019

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JUNE 6, 2019

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JUNE 6, 2019

MCA Hires New Latinx Curator
JUNE 6, 2019

Mayor Lightfoot Announces New Chief Engagement Officer
JUNE 6, 2019

June Home-Ownership Campaign Targets First Time Homebuyers
JUNE 6, 2019

FRIEND US ON FACEBOOK!

Figure: Lawndale News advertises the Southern Region Hazard Mitigation Plan Public Meeting

June 1, 2019

Nadig Newspapers Saturday, June 1, 2019

Resident input sought on natural disasters

The Cook County Department of Homeland Security and Emergency Management is seeking residents' input via survey and public meetings to update the Cook County Multi-Jurisdictional Hazard Mitigation Plan to prepare for natural disasters.

A public meeting will be held from 7 to 9 p.m. Monday, June 10, at the Skokie Library, 5215 W. Oakton St. Department staff will share details about the planning process, and participants will help identify and prioritize services, disaster-related projects, and capabilities the community may need during an emergency.

Additional meetings will be held at different times and locations.

The department is collecting survey responses through June 10 to identify hazards that are of concern to residents and businesses, and which services the community may need during an emergency.

For the survey, visit https://www.surveygizmo.com/s3/4967666/2019-Cook-County-Community-Preparedness-Survey-copy.

For more information, visit www.cookcountyhomelandsecurity.org/hazard-mitigation-plan.

Des Plaines receives funds for stormwall

The Federal Emergency Management Agency has released $1,477,241 in Pre-Disaster Mitigation funds for the construction of a floodwall to protect a fire station in Des Plaines.

"The Pre-Disaster Mitigation program enables communities to implement critical mitigation measures to reduce or eliminate the risk of loss of life and property," FEMA Region V administrator James Joseph said. "This floodwall will protect the fire station from flood damage, lessening the financial impact on individuals and the community when future flooding occurs ... tion program provides grants to state and local governments to implement long-term hazard mitigation measures. Through the program FEMA will pay 75 percent of the $1,969,655 eligible project cost, with the remaining 25 percent of the funds, or $492,414, provided by Des Plaines.

"This is a project several years in the making," Illinois Emergency Management Agency director Alicia Tate-Nadeau said. "The agency's mission is to help local governments identify mitigation projects that will reduce or eliminate long-term risks from

HOCUS-FOCUS

Find at least six differences in details between panels.

Figure: Nadig Newspapers advertises the June 10, 2019 North Region Public Meeting.

June 2019

Hazard Mitigation Plan Public Meeting - Skokie

Location: 5215 Oakton Street
Skokie Public Library
Skokie, IL 60077

When: June 10, 2019
7:00pm to 9:00pm

Category: Public Forum

The Cook County Department of Homeland Security and Emergency Management is hosting a series of public meetings in June 2019 to share details with residents about the planning process for our Multi-Jurisdictional Hazard Mitigation Plan Update (HMP).

The HMP details Cook County's plan to prepare for natural disasters and their impacts, with a comprehensive update required for our existing Hazard Mitigation Plan.

For more information:

- Press Release (May 29, 2019) - **County Residents Invited to Participate in Update to Preparation Plan for Impacts of Natural Hazards**
- Cook County Department of Homeland Security and Emergency Management

Figure: Cook County Government includes the Northern Regional Hazard Mitigation Plan Public Meeting on its calendar

MORTON GROVE
Incredibly Close ✤ Amazingly Open
Daniel P. DiMaria, Mayor

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ome / Events / Hazard Mitigation Plan Public Meeting

SHARE

Events

VIEW: summary | month | week | day | details

month calendar

FILTER BY: -- select cate

Like 0 | Share | Tweet

Hazard Mitigation Plan Public Meeting

Export to Outlook

Monday, June 10, 2019
07:00 PM - 09:00 PM

The Cook County Department of Homeland Security and Emergency Management (CCDHSEM) is hosting a series of public meetings in June 2019 to share details with residents about the planning process for our Multi-Jurisdictional Hazard Mitigation Plan Update (HMP).
The Cook County Department of Homeland Security and Emergency Management (CCDHSEM) is hosting a series of public meetings in June 2019 to share details with residents about the planning process for our Multi-Jurisdictional Hazard Mitigation Plan Update (HMP).

The HMP details Cook County's plan to prepare for natural disasters and their impacts, with a comprehensive update required for our existing Hazard Mitigation Plan.

The next HMP Public Meeting in our area will be held at the **Skokie Public Library**

Figure: Morton Grove advertises the Northern Region Hazard Mitigation Plan Public Meeting on its website.

Figure: Harwood Heights advertises the Public Meeting Series and Survey.

June 5, 2019

Figure: The Village of Brookfield advertises the Public Meeting series on their website

Figure: The Village of Western Springs advertises the Public Meeting series,

June 6, 2019

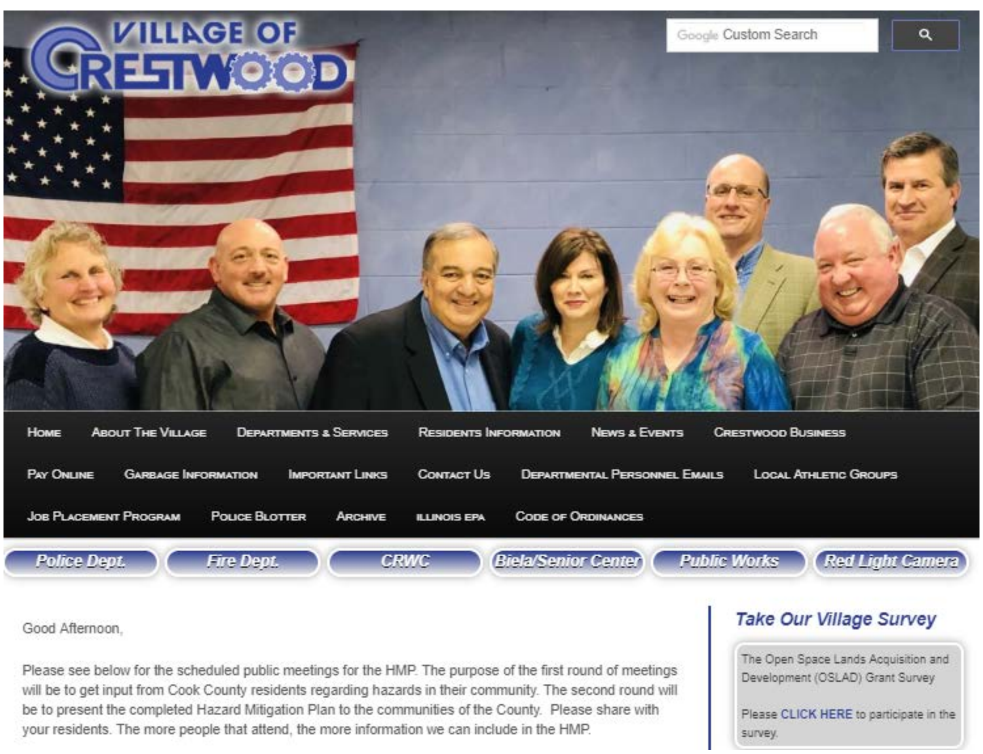


Figure: Village of Crestwood advertises the Public Meeting Series

Figure: Village of Elmwood Park advertises the Public Meeting Series and the Survey.

June 7, 2019

Figure: Village of Maywood advertises the Public Meeting series

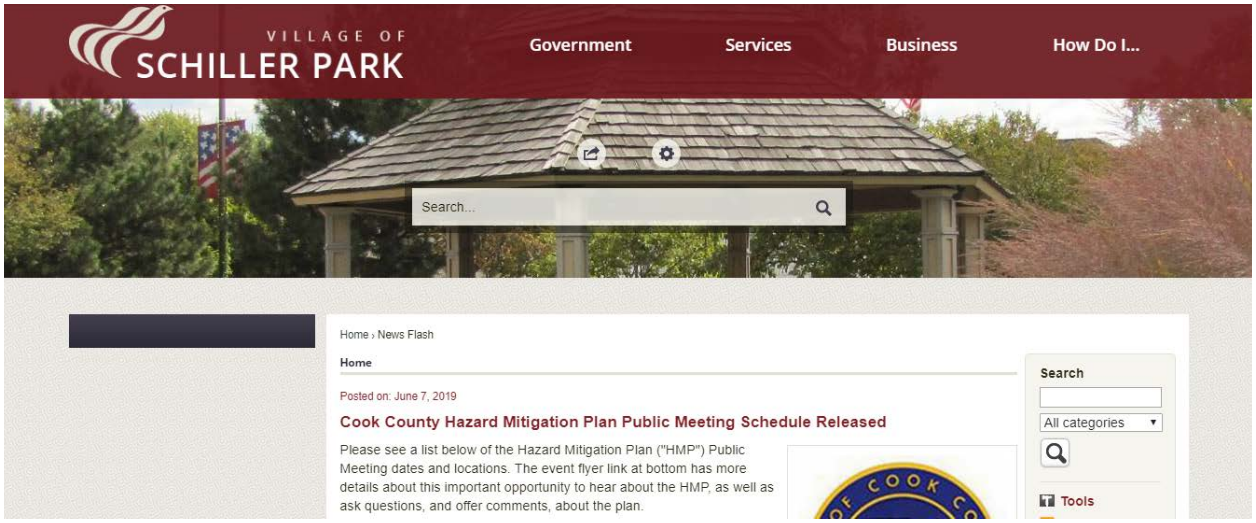
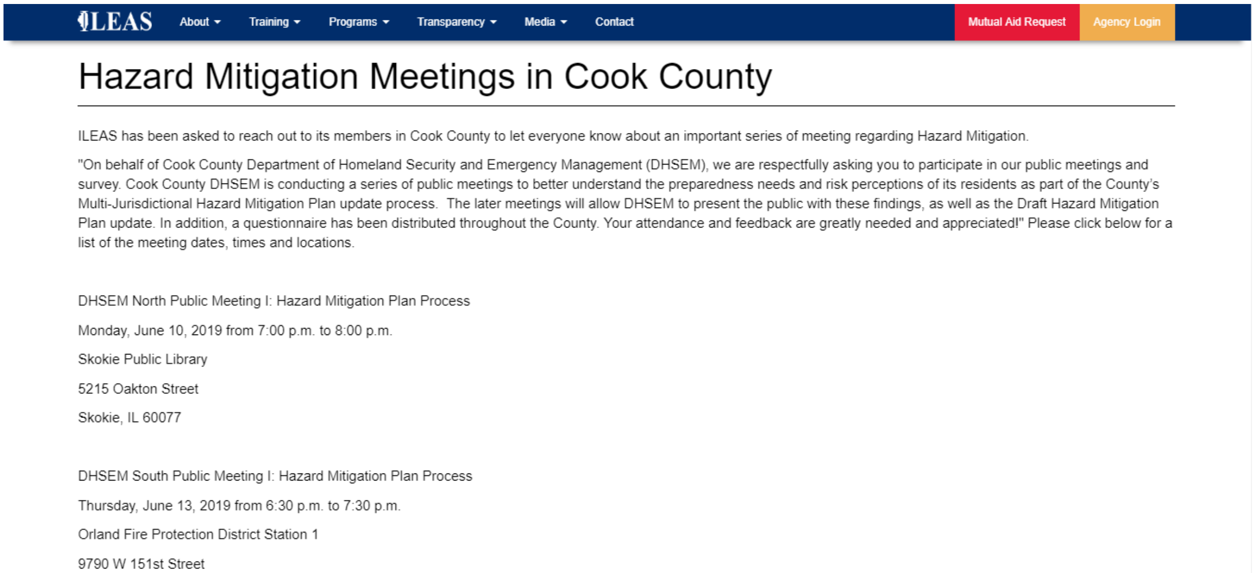


Figure: Village of Schiller Park advertise the Public Meeting series and survey

Figure: The City of Hickory Hills advertises the Public Meeting Series

June 11, 2019



ILEAS About Training Programs Transparency Media Contact Mutual Aid Request Agency Login

Hazard Mitigation Meetings in Cook County

ILEAS has been asked to reach out to its members in Cook County to let everyone know about an important series of meeting regarding Hazard Mitigation.

"On behalf of Cook County Department of Homeland Security and Emergency Management (DHSEM), we are respectfully asking you to participate in our public meetings and survey. Cook County DHSEM is conducting a series of public meetings to better understand the preparedness needs and risk perceptions of its residents as part of the County's Multi-Jurisdictional Hazard Mitigation Plan update process. The later meetings will allow DHSEM to present the public with these findings, as well as the Draft Hazard Mitigation Plan update. In addition, a questionnaire has been distributed throughout the County. Your attendance and feedback are greatly needed and appreciated!" Please click below for a list of the meeting dates, times and locations.

DHSEM North Public Meeting I: Hazard Mitigation Plan Process

Monday, June 10, 2019 from 7:00 p.m. to 8:00 p.m.

Skokie Public Library

5215 Oakton Street

Skokie, IL 60077

DHSEM South Public Meeting I: Hazard Mitigation Plan Process

Thursday, June 13, 2019 from 6:30 p.m. to 7:30 p.m.

Orland Fire Protection District Station 1

9790 W 151st Street

Figure: ILEAS advertises both the Cook County DHSEM Public Meeting series and survey link.

June 12, 2019

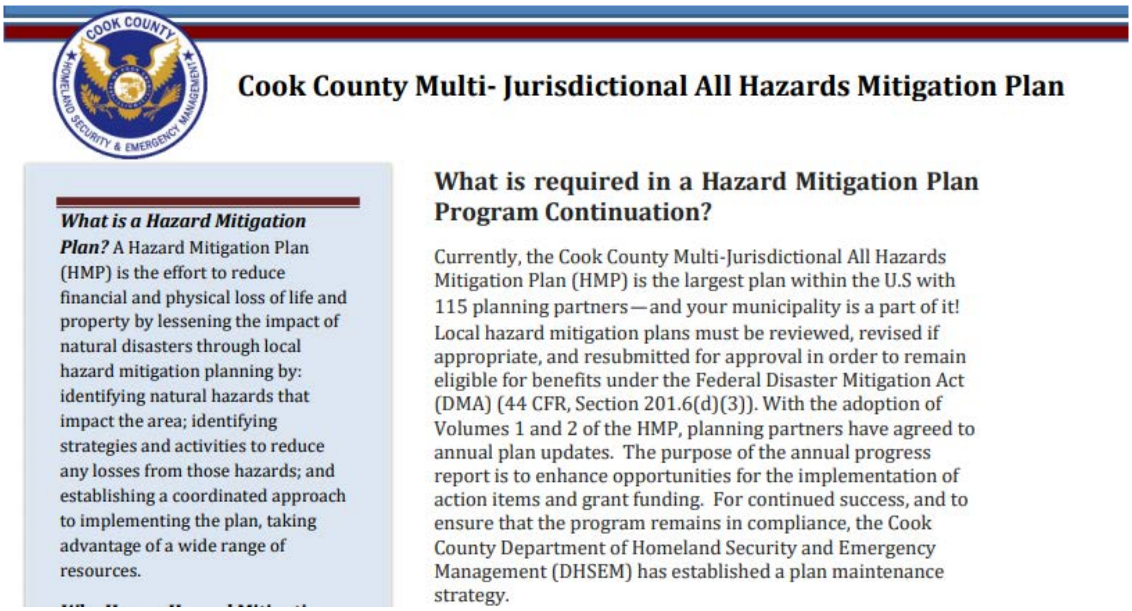
- Gene Ryan - ILEAS, MABAS and the Region 7 Health Care Coalition send the flyer to all their contacts.

June 17, 2019

Figure: Cook County DHSEM releases an article detailing information about the HMP update as well as information for the Public Meeting series and survey

Promotional Materials and Bulletins - Hazard Mitigation Plan Public Meetings Outreach

July 12, 2018



Cook County Multi- Jurisdictional All Hazards Mitigation Plan

What is a Hazard Mitigation Plan? A Hazard Mitigation Plan (HMP) is the effort to reduce financial and physical loss of life and property by lessening the impact of natural disasters through local hazard mitigation planning by: identifying natural hazards that impact the area; identifying strategies and activities to reduce any losses from those hazards; and establishing a coordinated approach to implementing the plan, taking advantage of a wide range of resources.

What is required in a Hazard Mitigation Plan Program Continuation?

Currently, the Cook County Multi-Jurisdictional All Hazards Mitigation Plan (HMP) is the largest plan within the U.S with 115 planning partners—and your municipality is a part of it! Local hazard mitigation plans must be reviewed, revised if appropriate, and resubmitted for approval in order to remain eligible for benefits under the Federal Disaster Mitigation Act (DMA) (44 CFR, Section 201.6(d)(3)). With the adoption of Volumes 1 and 2 of the HMP, planning partners have agreed to annual plan updates. The purpose of the annual progress report is to enhance opportunities for the implementation of action items and grant funding. For continued success, and to ensure that the program remains in compliance, the Cook County Department of Homeland Security and Emergency Management (DHSEM) has established a plan maintenance strategy.

Figure: Kimberly Nowicki kicked off outreach efforts in July 2018 with the following bulletin sent to the POCs of each of the County's municipalities (see here).

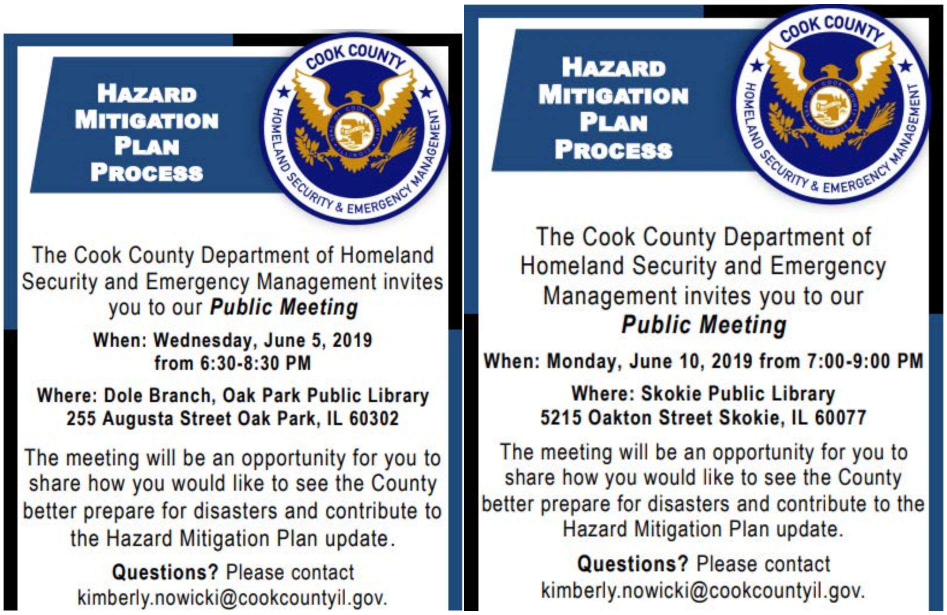


Figure: Example of Public Meeting Series posters

Figure: Chief Ryan designed hundreds of Cook County Department of Homeland Security promotional first aid kits to freely distribute at each meeting

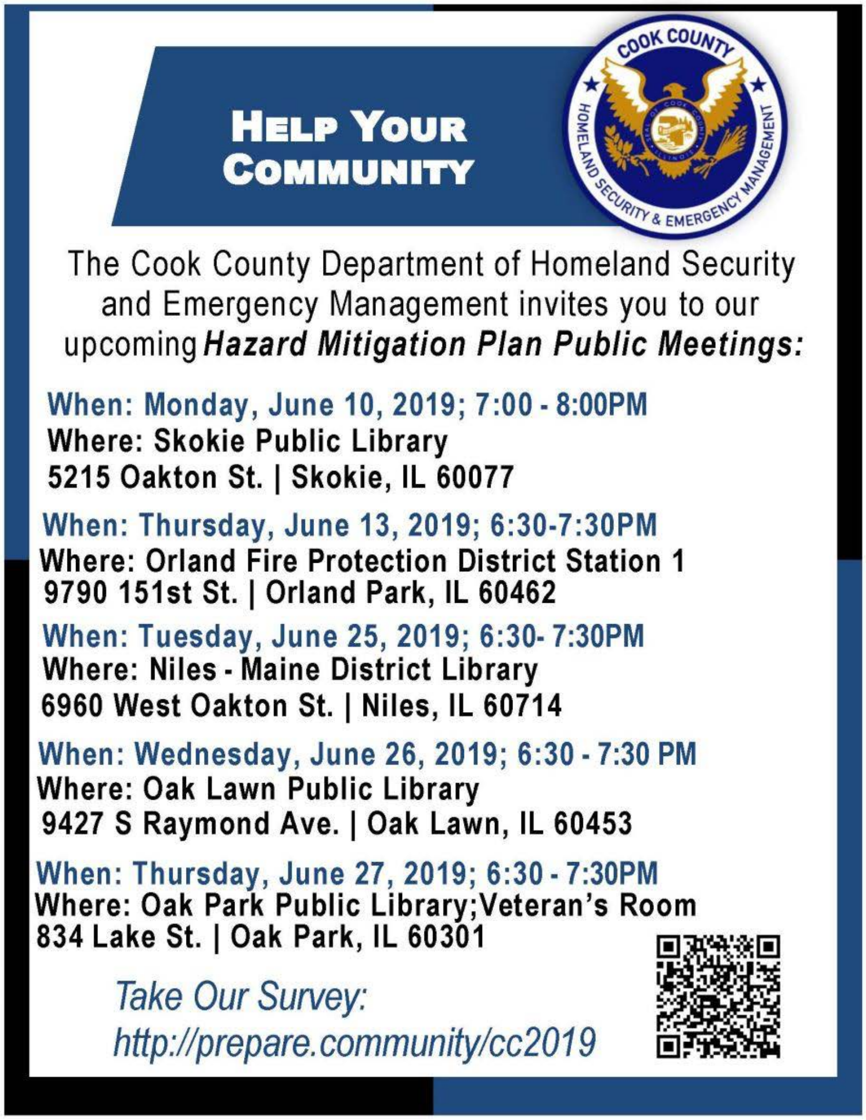


Figure: Hazard Mitigation Plan Public Meeting Series Flyer

Internet - Hazard Mitigation Plan Public Meetings Outreach

As previously noted, the internet was a major component of the public involvement strategy for both the survey and public meetings. Social media platforms such as Facebook, Twitter, and Nextdoor were also used for outreach activities.

June 3, 2019

Figure: @CCDHSEM advertises the Southern Region Hazard Mitigation Plan Public Meeting.

June 6, 2019

- Kim Nowicki - Spoke with Natalia Derevyanny, Director of Communications Cook County Bureau of Administration regarding the following:
  - Press Release #3 to be sent out the Monday before the meetings
  - Meeting date flyer will be posted multiple times on Cook County Twitter and Facebook
  - Meeting Flyer/Press release will be sent out to Cook County Employees 1 week before last 3 meetings.
  - Press release out to at least 3 journalists
- Kim Nowicki sends reminder Email to all POCs requesting them to post meeting information on their community social media and physically post flyers in their Village halls, libraries and public areas. The flyer includes meeting dates and survey information.
- Kim Nowicki works with MWRD, Red Cross, COAD, Cook County Economic Development, Cook County DOTH to send out flyer to all their contacts as well as social media.

June 10, 2019

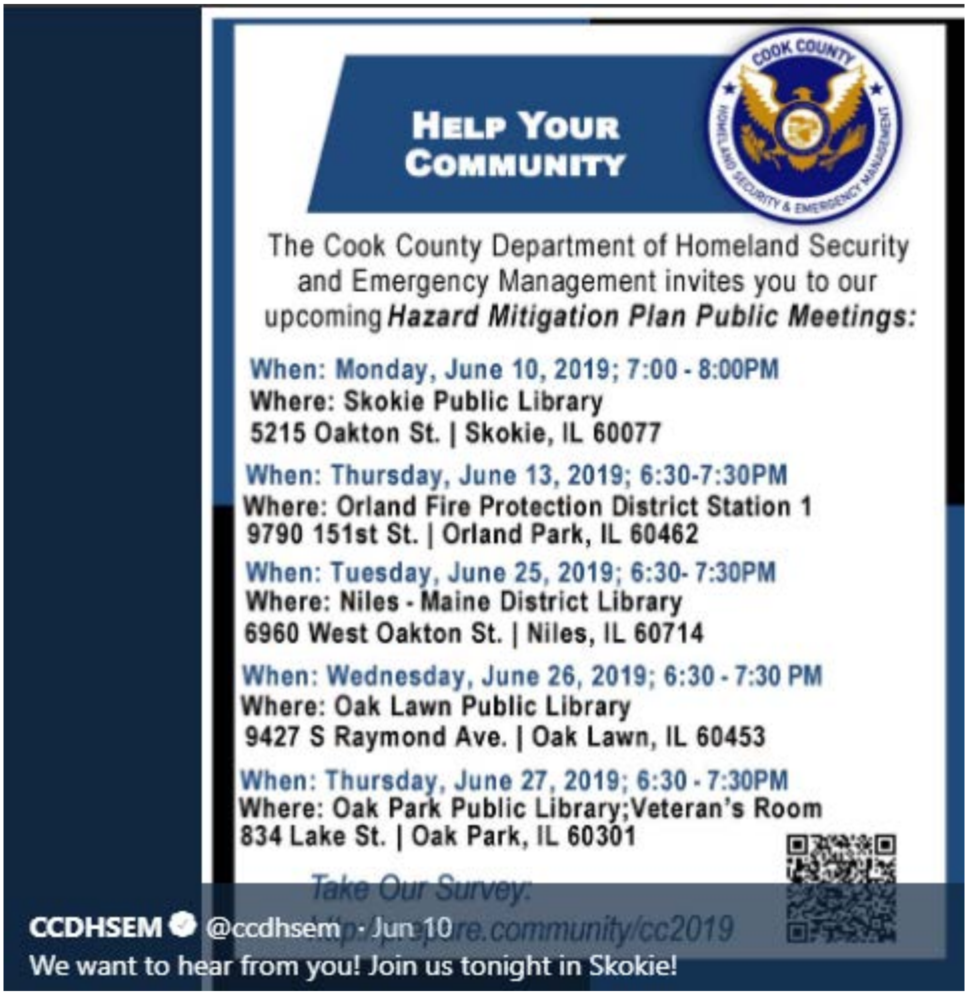


Figure: @CCDHSEM advertises the Hazard Mitigation Plan Public Meetings

June 11, 2019

Executive Director William Barnes Agency
Cook County Department of Homeland Security and Emergency Management · 11 Jun

Hello From Cook County DHSEM

Hello Cook County Residents,

I am pleased to announce that the Cook County Department of Homeland Security and Emergency Management (DHSEM) will be utilizing Nextdoor to help make our neighborhoods stronger and safer.

DHSEM is excited to share important news, updates and emergency notifications that are relevant to your neighborhood.

Please be assured our staff will not be able to see any of the content on your neighborhood site, except direct replies to our posts. We look forward to communicating with you on Nextdoor to make Cook County an even better place to live.

Thank you,

Bill Barnes
Executive Director
Cook County DHSEM

Posted on 11 Jun to subscribers of Cook County Department of Homeland Security and Emergency Management

Thank 657

Figure: Cook County DHSEM Executive Director, William "Bill" Barnes announces the DHSEM's adoption of the Nextdoor platform

June 14, 2019

K

Regional Planner Kimberly Nowicki Agency
Cook County Department of Homeland Security and Emergency Management · 14 Jun

Save the Date: Hazard Mitigation Plan Public Meetings

Neighbors,

We are hosting a meeting to discuss Cook County's Multi-Jurisdictional Hazard Mitigation Plan Update, and you're invited! DHSEM uses hazard mitigation planning to identify risks and vulnerabilities associated with natural disasters and develop long-term strategies for protecting our community from future natural hazard events, like flooding.

During these meetings, we will present our updated Hazard Mitigation Plan and are looking for your feedback. All three meetings will be the same, so attend the one most convenient for you:

DHSEM North Hazard Mitigation Plan Review
Tuesday, June 25, 2019
6:30 to 7:30 p.m.
Niles-Maine District Library
6960 West Oakton Street
Niles, IL 60714

DHSEM South Hazard Mitigation Plan Review
Wednesday, June 26, 2019
6:30 to 7:30 p.m.
Oak Lawn Public Library
9427 South Raymond Avenue

Figure: Kimberly Nowicki advertises the Public Meetings through Nextdoor, reaching over 34,000 views

June 19, 2019

- Kimberly Nowicki reaches out to the POCs of bordering municipalities - municipalities that are within the jurisdiction of more than one county - to confirm if they will participate in the 2019 Cook County MHJ-HMP Update. See here for correspondence.

Hazard Mitigation Plan Public Meetings, Series II

While the first series of the Hazard Mitigation Plan Public Meetings focused on educating and collecting information from the public, the second series of the meetings focused on reviewing a draft of the 2019 MJ-HMP Update with the community members of participating municipalities.

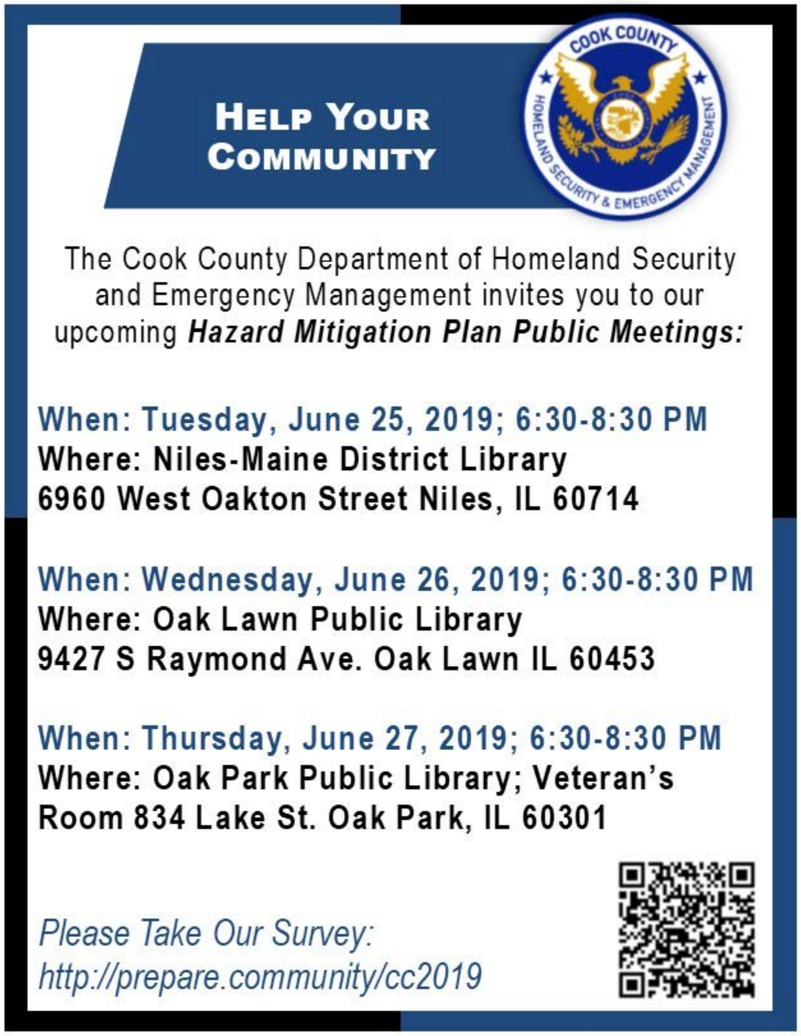


Figure: Flyer for the Second Series of Hazard Mitigation Plan Public Meetings (see here for PDF).

June 25, 2019

6960 West Oakton Street

Niles, IL 60714

See here for sign-in sheet.


COOK COUNTY DEPARTMENT OF HOMELAND SECURITY AND EMERGENCY MA
Multi-Jurisdictional Hazard Mitigation Plan Update Public Meetings
Why Mitigate?
Protect human life, and prevent damage or loss of prop
Ensure continuity of government/business.
Promote inter-agency coordination and response.
Increase public awareness and preparedness about haza
within the community.
Maintain compliance with State and Federal regulations
requirements for continued eligibility for mitigation gra
funding. Plans must be updated and approved by FEMA
every 5 years.
Niles-Maine District Library


Definition of Mitigation
EXIT


PROTECT
Niles-Maine District Library
METROPOLITAN WATER RECLAMATION DISTRICT
OF GREATER CHICAGO


EXIT


PROTECTING OUR
WATER ENVIRONMENT
METROPOLITAN WATER RECLAMATION DISTRICT
OF GREATER CHICAGO


GREEN INFRASTRUCTU


EXIT
Flood Insurance Rate Maps
http://gispub.mwrd.org/swima/

Park Ridge

Dempster flooding
blocking access to
Lutheran General Hospital
(Trauma center)

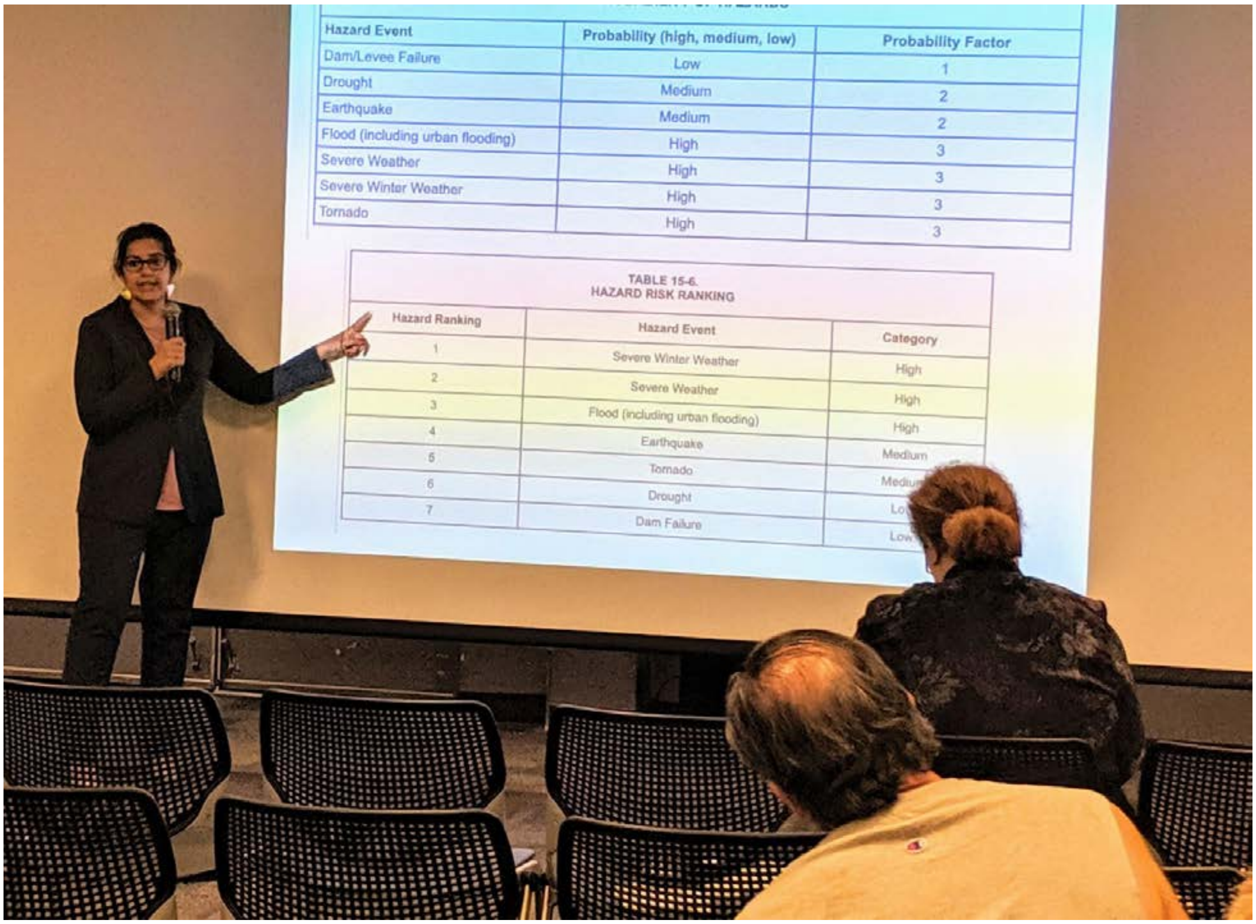
June 26, 2019

9427 Raymond Avenue

Oak Lawn, IL 60453

See here for sign-in sheet.

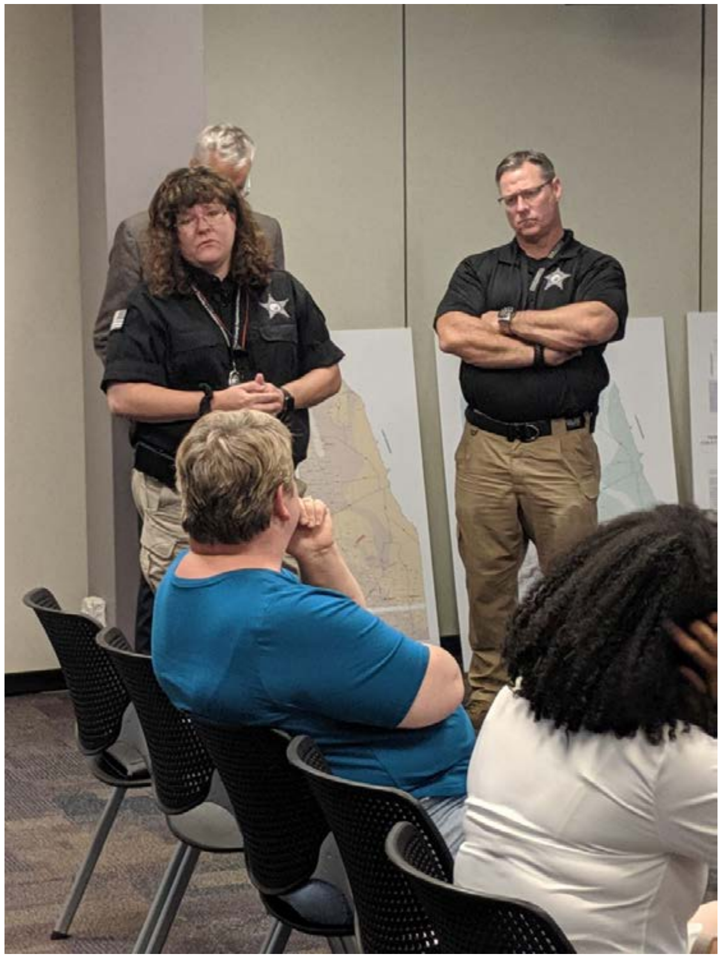
Ms. Shamsi introduces the 2019 MJ-HMP Update to the southern region crowd. See here for audience member feedback on the plan.



Ms. Shamsi explains hazard probability and the County's risk ranking to the audience

Ms. Shamsi discusses southern Cook County jurisdictions' role in the plan

Chief Ryan answering audience questions



Ms. Nowicki explains the Cook County DHSEM's website language options to a curious member of the public

Executive Director Barnes clarifies the DHSEM's mission and objective

Deputy Chief and discusses Cook County's forthcoming Mass Notification System he played a key role in developing

Mr. Fisher teaching the public about flood prone property acquisitions

On behalf of the MWRD, Mr. Fisher supplies free saplings, a rain barrel, and green infrastructure project brochures to meeting attendees

June 27, 2019

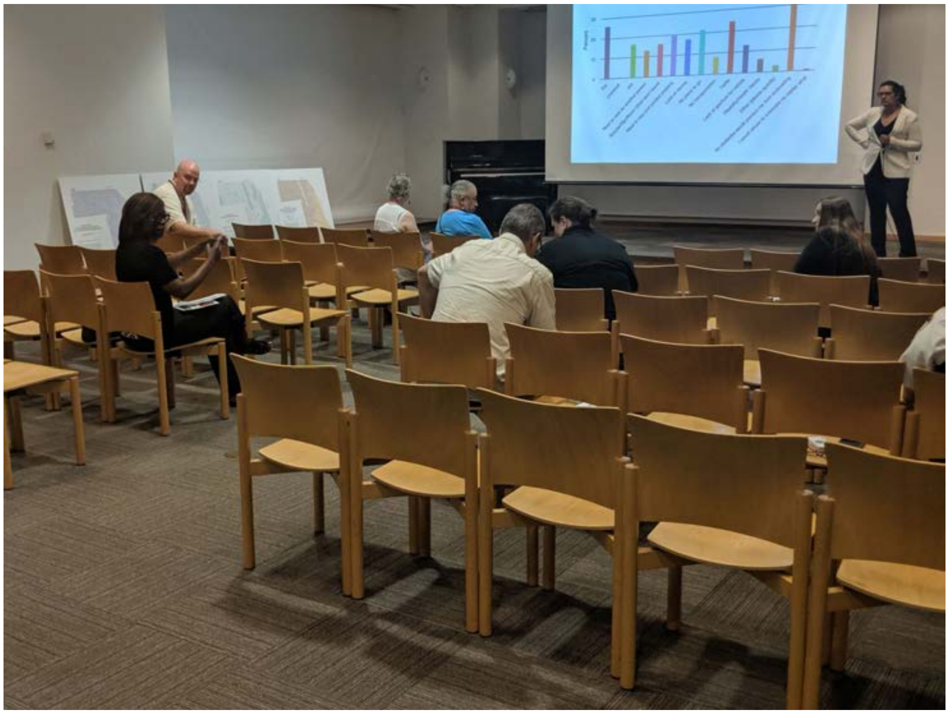
834 Lake Street

Oak Park, IL 60301

[See here for sign-in sheet.]

Ms. Shamsi addresses public meeting attendees

Ms. Shamsi explains 2019 Community Preparedness Survey findings with the audience



Meeting attendee asks questions and suggests mitigation actions to DHSEM, MWRD, and ISC personnel. [*See here for meeting feedback forms.*]()

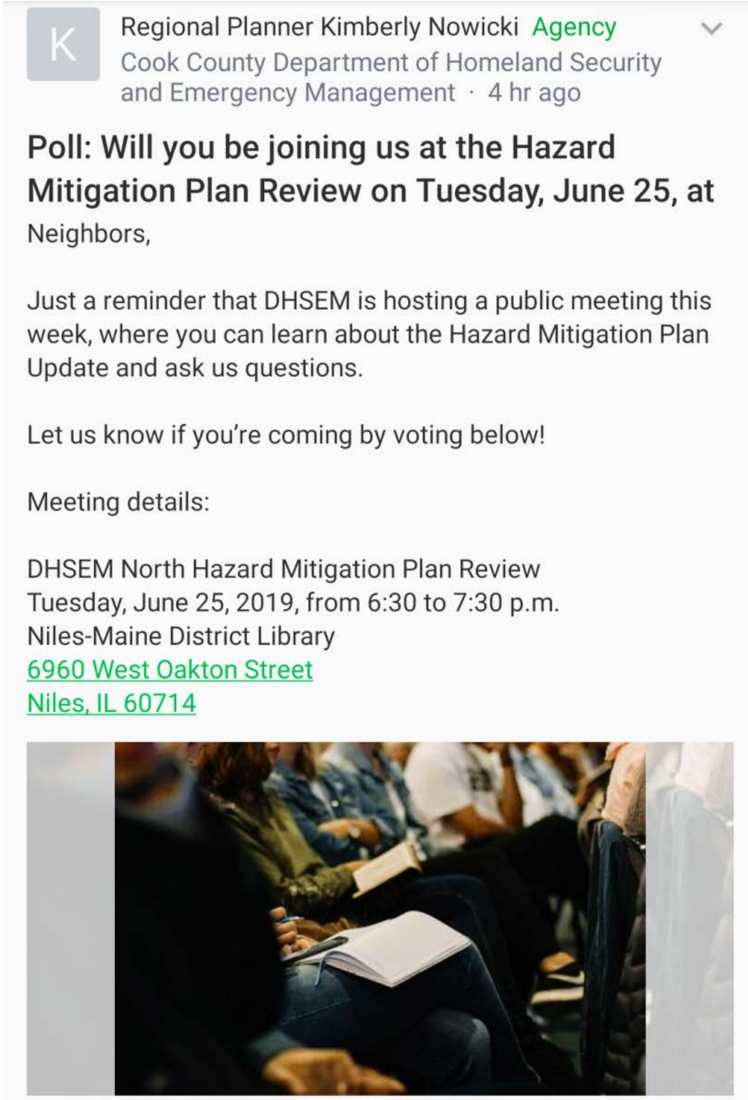
Chief Ryan discusses the importance of public participation in the hazard mitigation plan update process

Mr. Fisher walks the audience through water management projects and their key elements

Multimedia - Hazard Mitigation Plan Public Meetings Series II Outreach

- Adopting the lessons learned from Public Meeting Series I, Cook County DHSEM's public outreach efforts for Public Meeting Series II focused on developing a more robust social media presence to increase total meeting attendance. In addition to Twitter and the DHSEM website, NextDoor was also used to share meeting information. A full report of DHSEM's Nextdoor statistics can be accessed here.

June 21, 2019



K

Regional Planner Kimberly Nowicki Agency
Cook County Department of Homeland Security and Emergency Management · 4 hr ago

Poll: Will you be joining us at the Hazard Mitigation Plan Review on Tuesday, June 25, at

Neighbors,

Just a reminder that DHSEM is hosting a public meeting this week, where you can learn about the Hazard Mitigation Plan Update and ask us questions.

Let us know if you're coming by voting below!

Meeting details:

DHSEM North Hazard Mitigation Plan Review
Tuesday, June 25, 2019, from 6:30 to 7:30 p.m.
Niles-Maine District Library
6960 West Oakton Street
Niles, IL 60714

Figure: Kimberly Nowicki creates and shares a poll for attendance to the DHSEM North Hazard Mitigation Plan Review Meeting on Nextdoor

June 26, 2019

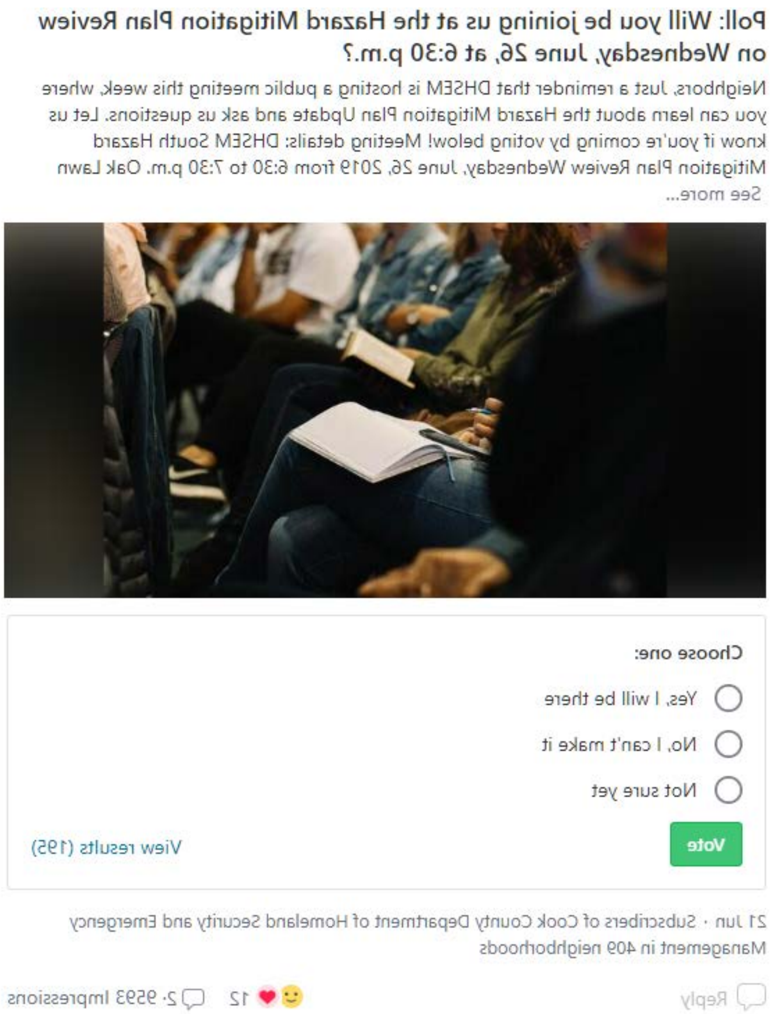


Figure: Kimberly Nowicki creates and shares a poll for attendance to the DHSEM Central Hazard Mitigation Plan Review Meeting on Nextdoor

June 27, 2019

Poll: Will you be joining us at the Hazard Mitigation Plan Review on Thursday, June 27, at 6:30 p.m.?

Neighbors, Just a reminder that DHSEM is hosting a public meeting this week, where you can learn about the Hazard Mitigation Plan Update and ask us questions. Let us know if you're coming by voting below! Meeting details: DHSEM Central Hazard Mitigation Plan Review Thursday, June 27, 2019 from 6:30 to 7:30 p.m. Main Library, See more...

Choose one:

- Yes, I will be there
- No, I can't make it
- Not sure yet

Vote

View results (251)

21 Jun · Subscribers of Cook County Department of Homeland Security and Emergency Management in 450 neighborhoods

Reply 6 2· 20646 Impressions

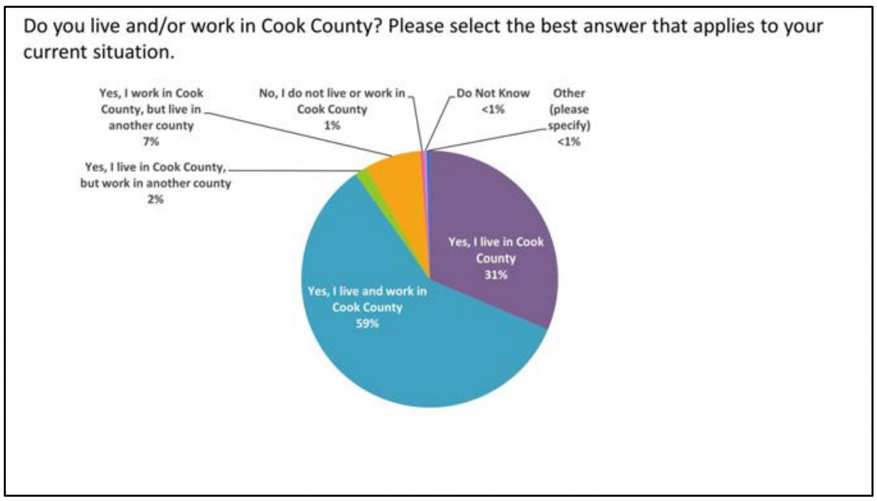
Figure: Kimberly Nowicki creates and shares a poll for attendance to the DHSEM South Hazard Mitigation Plan Review Meeting on Nextdoor

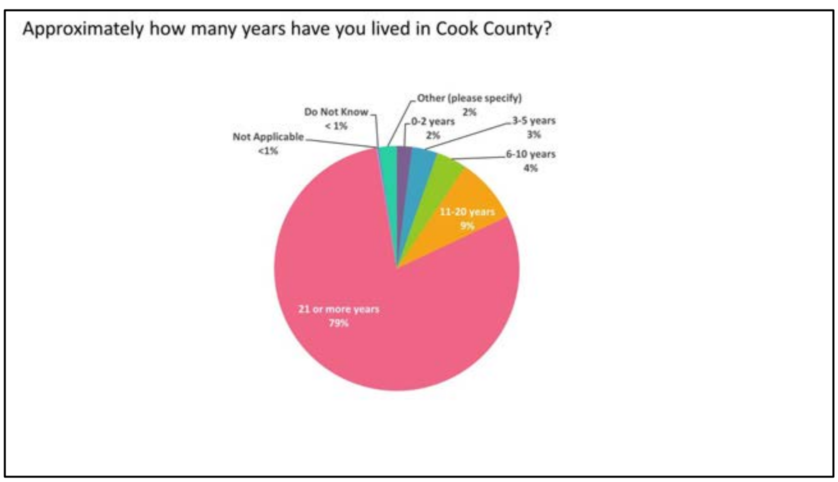
2019 Cook County Community Preparedness Survey Results

The public involvement strategy was able to meet its objectives by educating the public about hazard mitigation planning while collecting input from the public to assist the Steering Committee in making informed decisions. The following graphs are a summary of the results from the 2019 Cook County Community Preparedness Survey and the Meeting Series. Details comparing 2014 and 2019 results are provided when possible to highlight changes throughout the years. These improvements enable Cook County's 2019 MJ-HMP Update serve as not only a plan, but also be integrated as a continual program for future updates.

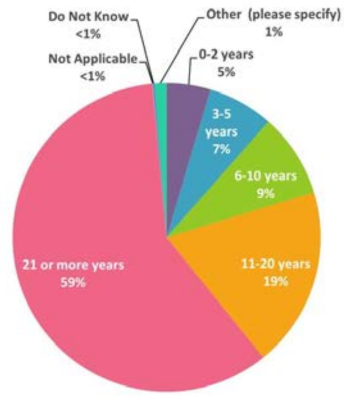
Results - 2019 Cook County Community Preparedness Survey

Overall, 6,532 survey responses were received. This represents an about 263 percent increase in responses relative to 2014. Survey results are included below. Full results can be found at the following link.

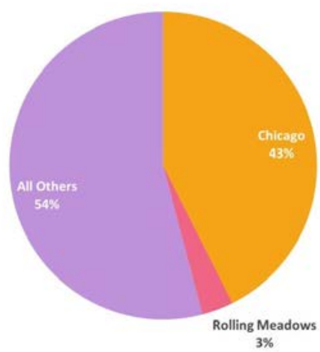


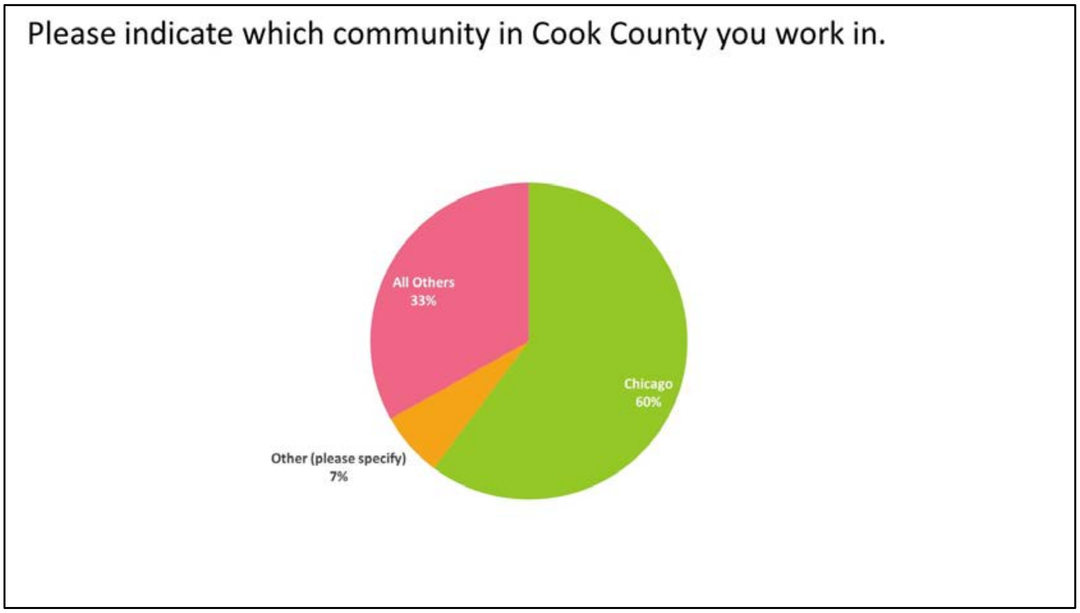


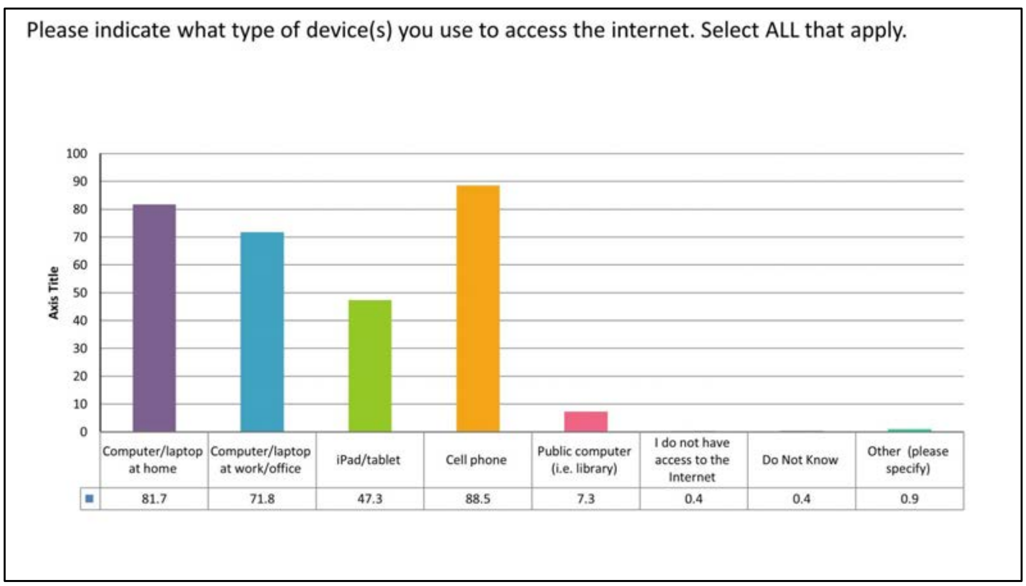
Approximately how many years have you worked in Cook County?



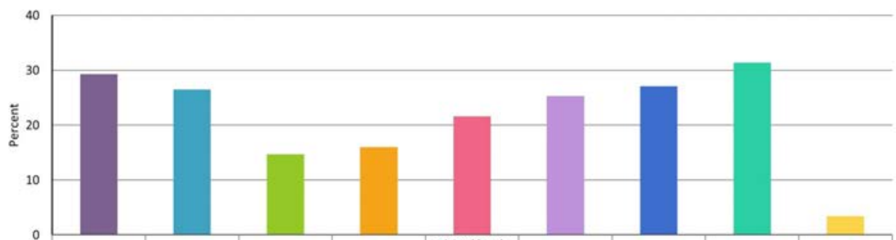
Please indicate which community in Cook County you live in.




Please indicate which community in Cook County you work in.
All Others
33%
Chicago
60%
Other (please specify)
7%

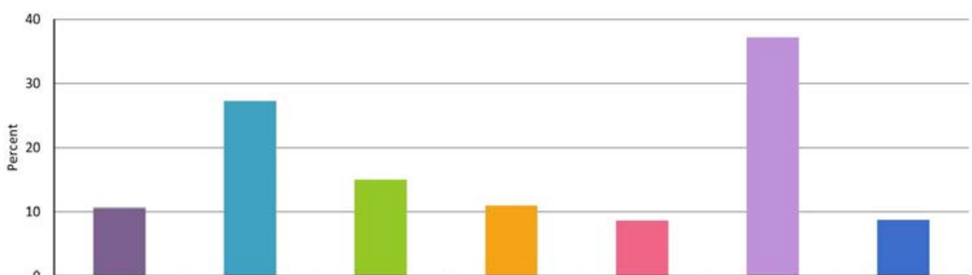

Please indicate what type of device(s) you use to access the internet. Select ALL that apply.
Axis Title
100
90
80
70
60
50
40
30
20
10
0
Computer/laptop at home
Computer/laptop at work/office
iPad/tablet
Cell phone
Public computer (i.e. library)
I do not have access to the Internet
Do Not Know
Other (please specify)
81.7
71.8
47.3
88.5
7.3
0.4
0.4
0.9

Please indicate those activities you have done to prepare for emergencies and disasters. Please select ALL that apply.
I have...



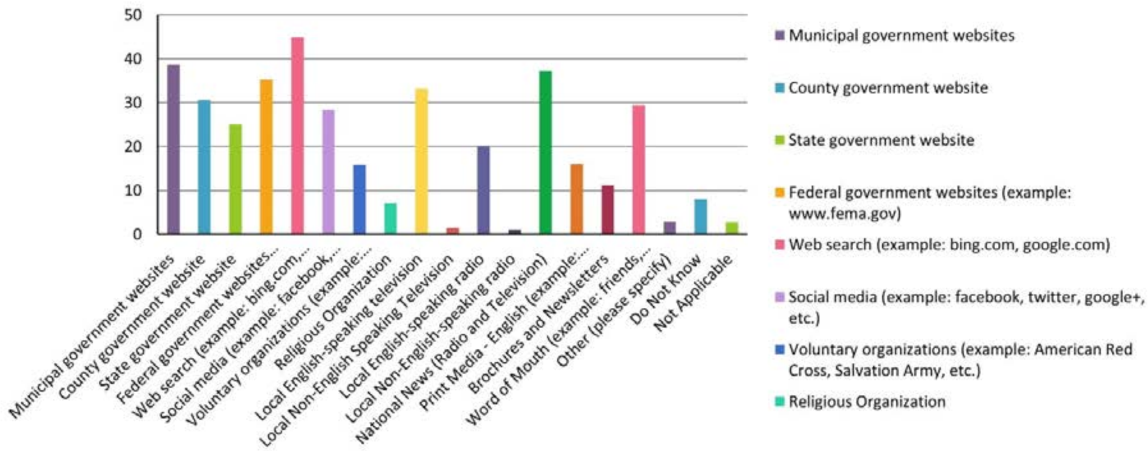
Mass Notification System (i.e. Smart 911)	an emergency preparedness plan	flood Insurance	a 72 hour kit/Disaster supply kit	visited local government web site(s) for emergency preparedness information	an evacuation plan	a weather radio	done nothing	Other (please specify)
29.3	26.5	14.7	16	21.6	25.3	27.1	31.4	3.4

Have any of the reasons below prevented you from pursuing additional preparedness activities? Please select ALL that apply.

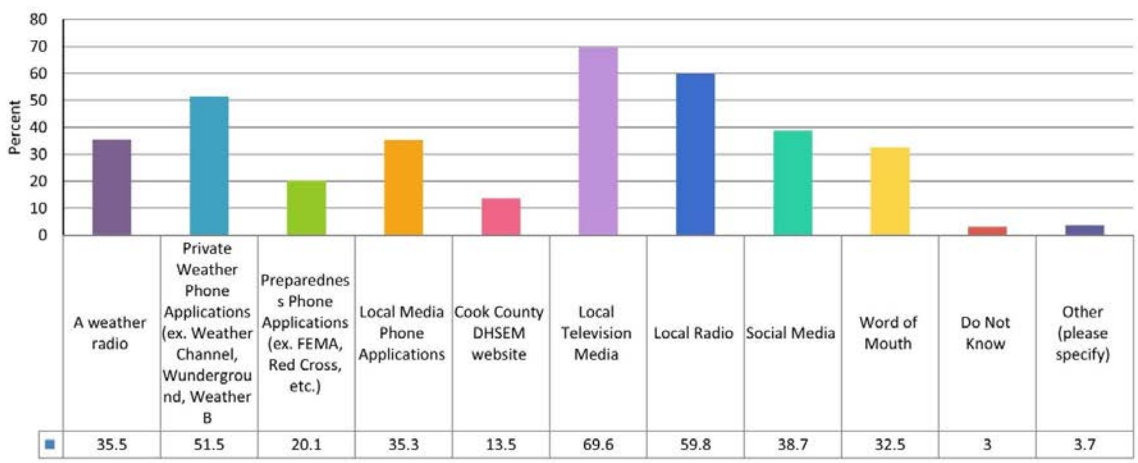


I don't think it will make a difference.	I don't know what to do.	I don't have the time.	It costs too much.	I don't need to prepare because emergency responders (fire, police, etc.) will help	None of the above apply to me.	Other (please specify)
10.6	27.3	15	10.9	8.6	37.2	8.7

Please indicate where you go to obtain emergency and disaster preparedness related information? Please select ALL that apply.



Please indicate how you expect to receive alerts and information during an emergency. Please select ALL that apply.



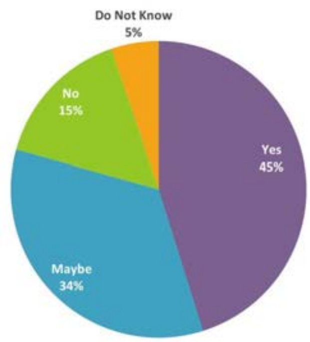
Would you agree or disagree with the following statements?

	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
My jurisdiction is providing the services necessary to prepare me for a disaster.	534	9.9%	1,595	29.7%	1,484	27.6%	543	10.1%	296	5.5%	921	17.1%	5,373
I am familiar with my jurisdiction's website and can easily obtain information about emergencies and disasters.	551	10.4%	1,598	30.0%	1,131	21.3%	993	18.7%	476	8.9%	573	10.8%	5,322

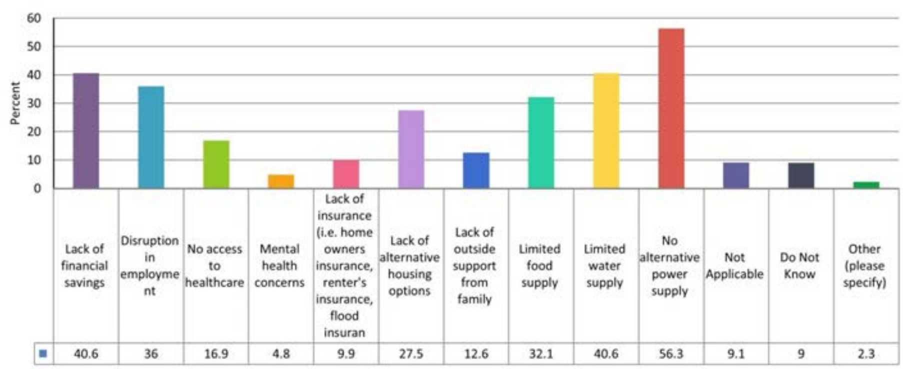
Would you agree or disagree with the following statements?

	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
During times of emergency, information is provided in a language and format I can understand.	1,760	33.0%	2,392	44.9%	585	11.0%	92	1.7%	49	0.9%	452	8.5%	5,330
I can easily obtain emergency information in times of crisis.	833	15.7%	2,247	42.4%	1,193	22.5%	276	5.2%	123	2.3%	628	11.8%	5,300
I am familiar with the Cook County DHSEM website and use it to obtain information about emergencies.	364	6.8%	977	18.4%	1,027	19.3%	1,470	27.7%	923	17.4%	553	10.4%	5,314

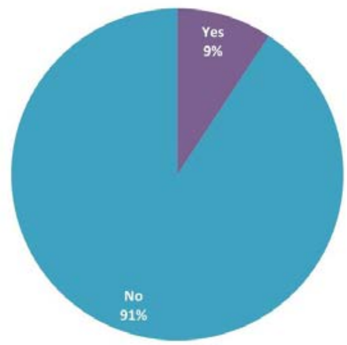
If a disaster (i.e. snowstorm) impacted your community, knocking out electricity and running water, would your household be able to manage on its own for at least three (3) days?



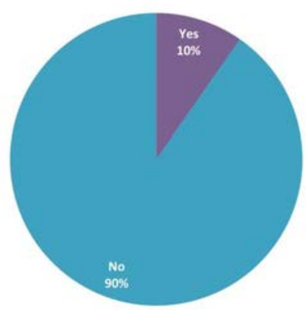
Which of the following may prevent you from recovering from a disaster? Please select ALL that apply.



Does someone in your household require electricity from a home-use medical device?



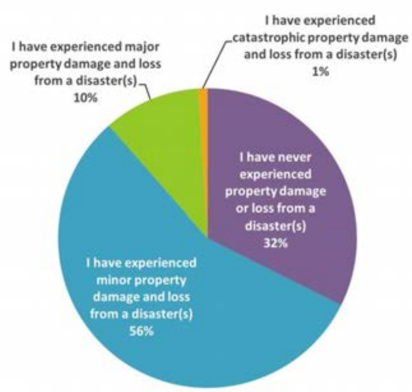
Do you or does anyone in your household have any special access or other special needs that would require early warning or specialized response during natural hazard events? (For example, a wheelchair, walker or oxygen.)



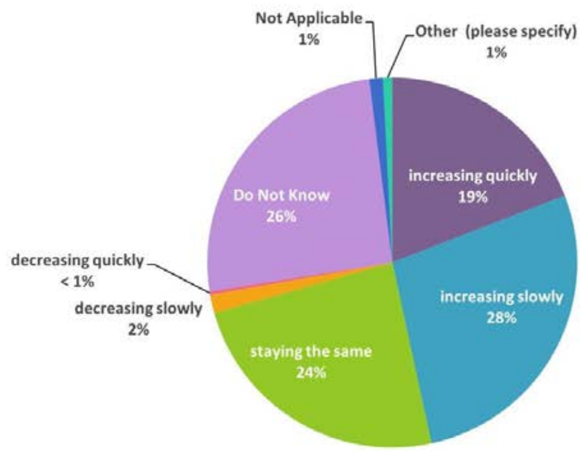
Do you believe that your household and/or place of business might ever be threatened by the following hazards? Please rate what hazards present the greatest risk.
Low Risk = Low impact on threat to life and property damage
Medium Risk = Medium impact on threat to life and property damage
High Risk = 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
Dam/Levee Failure	2,757	58.0%	343	7.2%	134	2.8%	1,517	31.9%	4,751
Drought	2,935	61.5%	987	20.7%	177	3.7%	670	14.0%	4,769
Earthquake	3,087	64.4%	919	19.2%	323	6.7%	461	9.6%	4,790
Flood	1,366	28.1%	2,195	45.2%	1,144	23.6%	151	3.1%	4,856
Extreme Heat	1,041	21.6%	2,220	46.0%	1,465	30.4%	99	2.1%	4,825
Lightning	993	20.5%	2,413	49.8%	1,359	28.1%	76	1.6%	4,841
Hail	1,009	20.9%	2,496	51.6%	1,266	26.2%	63	1.3%	4,834
Fog	1,932	40.3%	1,808	37.7%	926	19.3%	127	2.6%	4,793
High Winds	556	11.4%	2,176	44.8%	2,057	42.3%	70	1.4%	4,859
Snow	465	9.6%	1,672	34.4%	2,642	54.4%	78	1.6%	4,857
Extreme Cold	407	8.4%	1,550	31.9%	2,822	58.1%	78	1.6%	4,857
Blizzards	479	9.9%	1,766	36.5%	2,509	51.9%	84	1.7%	4,838
Ice Storms	565	11.7%	1,954	40.4%	2,237	46.2%	86	1.8%	4,842
Tornado	1,353	28.1%	2,145	44.6%	1,177	24.5%	135	2.8%	4,810

Please select the answer that best describes your experience.



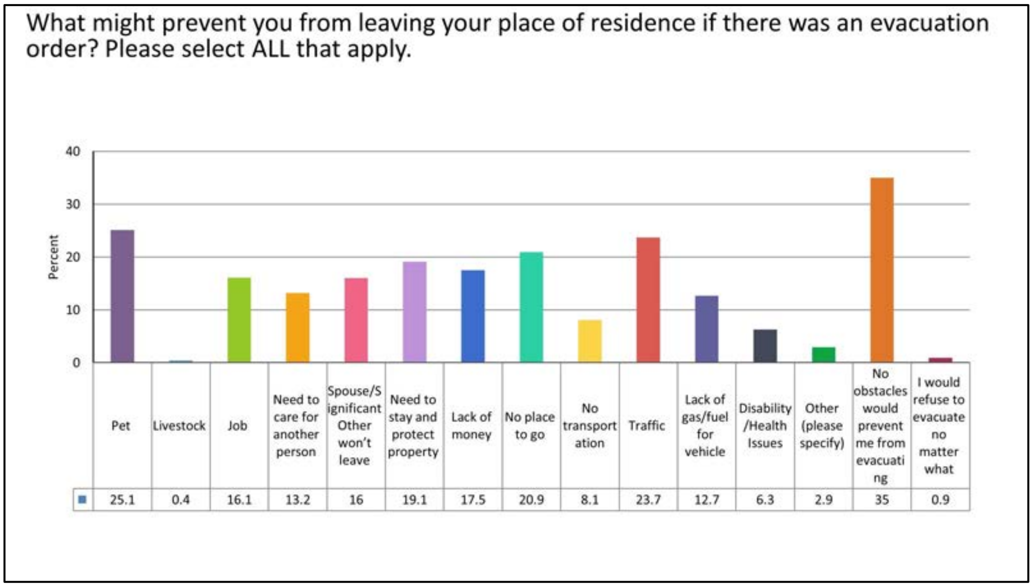
Please select the best answer. The risks associated with Cook County's most prevalent hazards are:

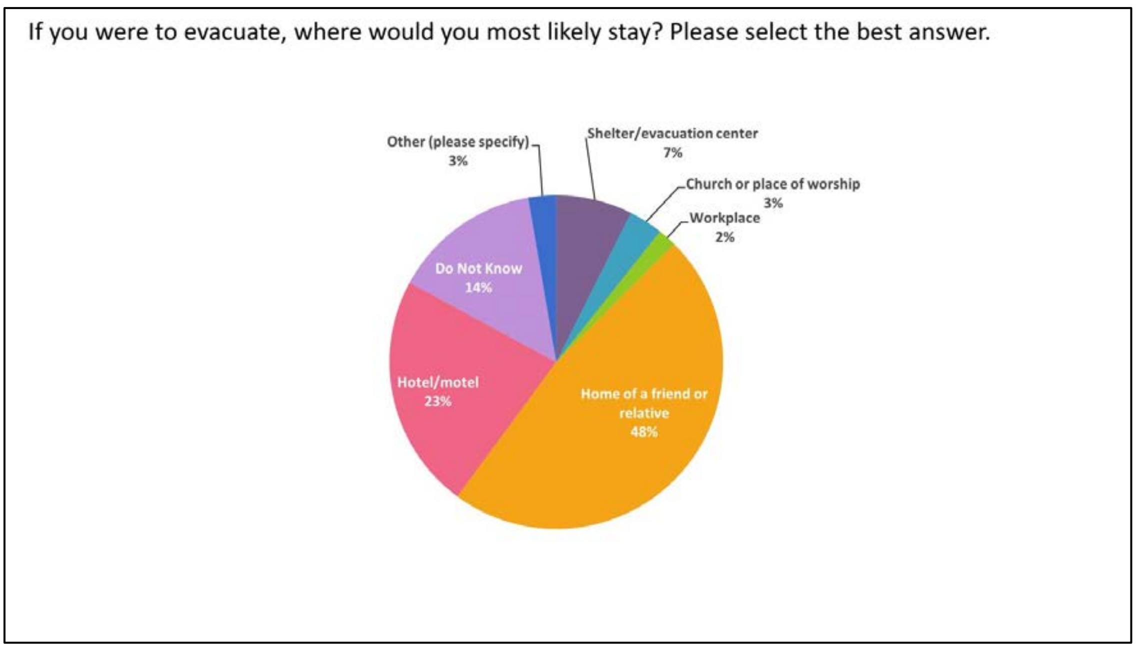


24.Based on YOUR PERCEPTION, to what degree of emphasis would you expect your jurisdiction to mitigate the following hazards? Mitigation definition: The purpose of mitigation planning is to identify policies and actions that can be implemented over the long term to reduce risk and future losses. Mitigation 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.

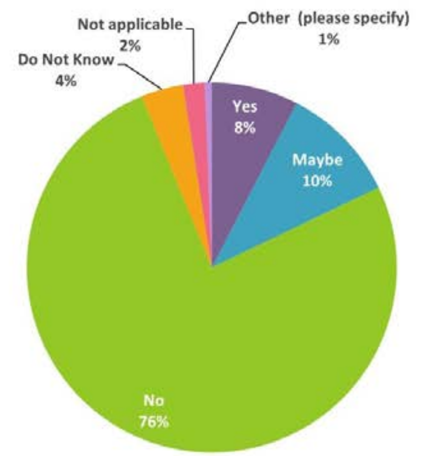
No Mitigation Needed = No mitigation on this hazard is expected or needed
Low Priority = This hazard should be mitigated, but is not a high priority compared to other hazards
Medium Priority = It is important to mitigate this hazard
High Priority = It is a high priority to emphasize mitigation for this hazard

	No Mitigation Needed		Low Priority		Medium Priority		High Priority		Responses
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count
Dam/levee failure	2,293	48.8%	1,281	27.3%	634	13.5%	492	10.5%	4,700
Drought	1,510	32.2%	2,129	45.4%	755	16.1%	298	6.4%	4,692
Earthquake	1,445	30.8%	2,087	44.5%	687	14.6%	475	10.1%	4,694
Flood	249	5.3%	857	18.1%	1,666	35.2%	1,963	41.5%	4,735
Extreme Heat	327	6.9%	1,086	23.0%	1,731	36.7%	1,572	33.3%	4,716
Lightning	575	12.2%	1,715	36.3%	1,608	34.1%	824	17.5%	4,722
Hail	599	12.7%	1,807	38.3%	1,572	33.3%	738	15.6%	4,716
Fog	1,191	25.3%	2,027	43.1%	1,020	21.7%	463	9.8%	4,701
High Winds	355	7.5%	1,182	25.0%	1,815	38.4%	1,375	29.1%	4,727
Snow	221	4.7%	690	14.6%	1,691	35.8%	2,119	44.9%	4,721
Blizzards	211	4.5%	682	14.4%	1,575	33.3%	2,259	47.8%	4,727
Extreme Cold	201	4.3%	628	13.3%	1,510	32.0%	2,382	50.5%	4,721
Ice Storms	265	5.6%	894	19.0%	1,699	36.1%	1,845	39.2%	4,703
Tornado	477	10.2%	1,334	28.6%	1,455	31.1%	1,406	30.1%	4,672

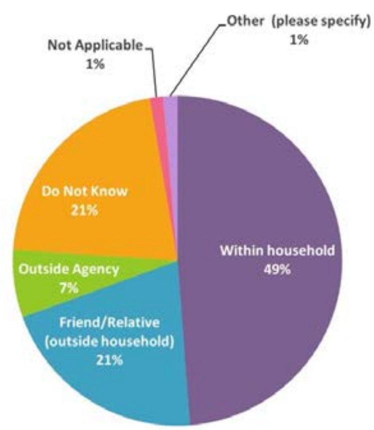

What might prevent you from leaving your place of residence if there was an evacuation order? Please select ALL that apply.
Percent
40
30
20
10
0
Pet
Livestock
Job
Need to care for another person
Spouse/Significant Other won't leave
Need to stay and protect property
Lack of money
No place to go
No transportation
Traffic
Lack of gas/fuel for vehicle
Disability/Health Issues
Other (please specify)
No obstacles would prevent me from evacuating
I would refuse to evacuate no matter what
25.1
0.4
16.1
13.2
16
19.1
17.5
20.9
8.1
23.7
12.7
6.3
2.9
35
0.9


If you were to evacuate, where would you most likely stay? Please select the best answer.
Other (please specify) 3%
Shelter/evacuation center 7%
Church or place of worship 3%
Workplace 2%
Do Not Know 14%
Hotel/motel 23%
Home of a friend or relative 48%

In an evacuation, would you or anyone in your household require special assistance?



If yes, would that assistance be provided by someone within your household, by an outside agency, or by a friend or relative outside your household?



Appendix D: Concepts, Methods and Data Sources Used for Hazard Mapping

Information and methodologies used to develop the hazard maps included in the Cook County Multi-Jurisdictional Hazard Mitigation Plan were taken from a range of sources as summarized in this appendix.

EARTHQUAKE MAPPING

Probabilistic Peak Ground Acceleration

Probabilistic peak ground acceleration data was generated by Hazus-MH 2.1. In the model's probabilistic analysis procedure, the ground shaking demand is characterized by spectral contour maps developed by the United States Geological Survey as part of a 2008 update of the National Seismic Hazard Maps. USGS probabilistic seismic hazard maps are revised about every six years to reflect newly published or thoroughly reviewed earthquake science and to keep pace with regular updates of the building code. Hazus includes maps for eight probabilistic hazard levels: ranging from ground shaking with a 39-percent probability of being exceeded in 50 years (100-year return period) to the ground shaking with a 2-percent probability of being exceeded in 50 years (2,500-year return period). Probabilistic peak ground acceleration maps were developed for the following earthquakes:

- 100-year return period
- 500-year return period.

Event-Based

1909 Historical Earthquake Scenario

An epicenter map was derived from a database of historical earthquakes developed from three sources (Composite Earthquake Catalog, 2002, Earthquake Data Base, 2002, and Earthquake Seismicity Catalog, 1996). The database was sorted to remove historical earthquakes with magnitudes less than 5.0. The epicenter map is based on the following historical earthquake epicenter, selected from the database:

- Event Date: May 26, 1909
- Event ID from Hazus: 3991
- Magnitude: The original magnitude in the database was 5.0, but modeling of this magnitude showed no damage; the magnitude was increased to 6.0 to generate damage results for the earthquake risk assessment
- Depth: 10 km
- Epicenter: Approximately 7 miles southwest of the Village of Lemont, IL
- (41.6N 88.1W)

Wabash M 7.1

A shake map portrays the extent and variation of ground shaking throughout an affected region immediately following significant earthquakes. Ground motion and intensity maps are derived from peak ground motion amplitudes recorded on seismic sensors (accelerometers), with interpolation based on both estimated amplitudes where data are lacking and site amplification corrections. Color-coded instrumental intensity maps are derived from empirical relations between peak ground motions and Modified Mercalli intensity. A shake map was developed for the following earthquake:

- Magnitude: 7.1
- Epicenter along the Wabash Valley Fault System centered on the Lower Wabash River Valley in southeastern Illinois.

Liquefaction

Liquefaction is a phenomenon in which strong earthquake shaking causes a soil to rapidly lose its strength and behave like quicksand. Liquefaction typically occurs in artificial fills and in areas of loose sandy soils that are saturated with water, such as low-lying coastal areas, lakeshores, and river valleys. When soil strength is lost during liquefaction, the consequences can be catastrophic. Movement of liquefied soils can rupture pipelines, move bridge abutments and road and railway alignments, and pull apart the foundations and walls of buildings.

A liquefaction susceptibility map provides an estimate of the likelihood that soil will liquefy as a result of earthquake shaking. This type of map depicts the relative susceptibility in a range that varies from very low to high. Areas underlain by bedrock or peat are mapped separately, as these earth materials are not liquefiable, although peat deposits may be subject to permanent ground deformation caused by earthquake shaking.

Liquefaction data was provided by the Illinois State Geological Survey, based on methods from "Mapping Liquefaction-Induced Ground Failure Potential" (Youd, T.L., and Perkins, D.M., 1978. Journal of the Geotechnical Engineering Division, p. 443-446).

NEHRP Soils

Soil classification data was provided by the Illinois State Geological Society. State geologists of the Central U.S. Earthquake Consortium produced a regional Soil Site Class map for the eight states to be used in the FEMA New Madrid Catastrophic Planning Initiative Phase II work. The base map for this work was the 2003 USGS Geologic Investigation Series I-2789 "Map of Surficial Deposits and Materials in the Eastern and Central United States" (east of 102 degrees west longitude) by David S. Fullerton, Charles A. Bush and Jean N. Pennell.

Procedures outlined in the 2004 NEHRP provisions by the Building Seismic Safety Council and the 2003 International Building Codes were followed to produce the soil site class maps. The state geologists used the entire column of soil material down to bedrock and did not include any bedrock in the calculation of the average shear wave velocity for the column, since it is the soil column and the difference in shear wave velocity of the soils in comparison to the bedrock which influences much of the amplification.

FLOOD MAPPING

FEMA Flood Hazard Areas

FEMA flood hazard area mapping was taken from Digital Flood Insurance Rate Maps.

Repetitive Loss Areas

Repetitive loss data was originally obtained from Illinois Department of Natural Resources and further verified using the state's most up-to-date hazard mitigation plan and is considered sensitive information.

WEATHER MAPPING

Temperature and Precipitation

Temperature and precipitation data were provided by the National Water and Climatic Center's PRISM project. PRISM is a hybrid statistical-geographic approach to mapping climate. It uses point measurements of climate data and a digital elevation model to generate estimates of annual, monthly and event-based climatic elements. These estimates are derived for a horizontal grid from which contour lines are generated.

Wind Power

Annual average wind resource potential data were provided by the National Renewable Energy Laboratory. Wind power class is an indicator of likely resource strength, with a higher wind power class representing higher wind resource levels. The classification information is for utility-scale applications at a 50-meter height.

Tornado

Tornado data were provided by the Tornado History Project. Historical tornado data comes from the Storm Prediction Center's historical tornado data file. Enhanced tornado path data for selected tornadoes from the National Climatic Data Center is shown when available. Data covers the period from 1950 to 2012.

Probabilistic Tornado Model

In order to understand and model what could potentially occur, it is necessary to study previous tornadoes and their characteristics. To develop the probabilistic tornado analysis, a four-step approach was undertaken: (1) identify historical data, (2) generate statistics, (3) develop damage curves, and (4) model the 100- and 500-year events for all jurisdictions and calculate losses.

Appendix E: Annual Progress Report Template and Process

Reporting Period: *(Insert reporting period)*

Background: Cook County and participating municipalities in the county developed a hazard mitigation plan to reduce risk from all hazards by identifying resources, information, and strategies for risk reduction. The federal Disaster Mitigation Act of 2000 requires state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. To prepare the plan, the participating partners organized resources, assessed risks from natural hazards within the county, developed planning goals and objectives, reviewed mitigation alternatives, and developed an action plan to address probable impacts from natural hazards. By completing this process, these jurisdictions-maintained compliance with the Disaster Mitigation Act, achieving eligibility for mitigation grant funding opportunities afforded under the Robert T. Stafford Act. The plan can be viewed online at:

https://www.cookcountyhomelandsecurity.org

Summary Overview of the Plan's Progress: The performance period for the Hazard Mitigation Plan became effective on, ___2019, with the final approval of the plan by FEMA. The initial performance period for this plan will be 5 years, with an anticipated update to the plan to occur before, ___2024. As of this reporting period, the performance period for this plan is considered to be ___% complete. The Hazard Mitigation Plan has targeted ___ hazard mitigation actions to be pursued during the five-year performance period. As of the reporting period, the following overall progress can be reported:

- out of actions (%) reported ongoing action toward completion.
- out of actions (%) were reported as being complete.
- out of actions (%) reported no action taken.

Purpose: The purpose of this report is to provide an annual update on the implementation of the action plan identified in the Cook County Multi-Jurisdictional Hazard Mitigation Plan. The objective is to ensure that there is a continuing and responsive planning process that will keep the Hazard Mitigation Plan dynamic and responsive to the needs and capabilities of the partner jurisdictions. This report discusses the following:

- Natural hazard events that have occurred within the last year
- Changes in risk exposure within the planning area (all of Cook County)
- Mitigation success stories
- Review of the action plan
- Changes in capabilities that could impact plan implementation
- Recommendations for changes/enhancement

The Hazard Mitigation Plan Steering Committee: The Hazard Mitigation Plan Steering Committee, made up of planning partners and stakeholders within the planning area, reviewed and approved this progress report at its annual meeting held on ___, 201_. It was determined through the plan's development process that a steering committee would remain in service to oversee maintenance of the plan. At a minimum, the Steering Committee will provide technical review and oversight on the development of the annual progress report. It is anticipated that there will be turnover in the membership annually, which will be documented in the progress reports. For this reporting period, the Steering Committee membership is as indicated in Table 1.

TABLE 1.
STEERING COMMITTEE MEMBERS

Name	Title	Jurisdiction/Agency

Natural Hazard Events within the Planning Area: During the reporting period, there were natural hazard events in the planning area that had a measurable impact on people or property. A summary of these events is as follows:

- ____
- ____

Changes in Risk Exposure in the Planning Area: *(Insert brief overview of any natural hazard event in the planning area that changed the probability of occurrence or ranking of risk for the hazards addressed in the hazard mitigation plan)*

Mitigation Success Stories: *(Insert brief overview of mitigation accomplishments during the reporting period)*

Review of the Action Plan: Table 2 reviews the action plan, reporting the status of each action. Reviewers of this report should refer to the Hazard Mitigation Plan for more detailed descriptions of each action and the prioritization process.

Address the following in the “status” column of the following table:

- *Was any element of the action carried out during the reporting period?*
- *If no action was completed, why?*
- *Is the timeline for implementation for the action still appropriate?*
- *If the action was completed, does it need to be changed or removed from the action plan?*

TABLE 2.
ACTION PLAN MATRIX

Action Taken? (Yes or No)	**Time Line**	**Priority**	**Status**	**Status (X, O), ⍰)**
Action # ___ [description]				
Action # ___ [description]				
Action # ___ [description]				
Action # ___ [description]				
Action # ___ [description]				
Action # ___ [description]				

Completion status legend:
N = New

- Indicates a mitigation project/action that has not previously been identified in the annex/plan.

O = Action Ongoing toward Completion

- Indicates a mitigation project/action that has initiated and that steps have been taken toward completion. This also applies to projects that have made progress but do not necessarily have a definitive end (i.e. some projects, like educating the public, are always ongoing and do not have a definitive completion date).

R = Want Removed from Annex

- Indicates a mitigation project/action that is no longer relevant and can be removed from the annex/plan.

X = No Action Taken

- Indicates a mitigation project/action in which no substantial actions have been taken. For example, this would apply to projects that are dependent on a funding source in order to initiate.

C = Project Completed

- Indicates a mitigation project/action that has been completed/finished and no additional mitigation measures are needed.

Changes That May Impact Implementation of the Plan: *(Insert brief overview of any significant changes in the planning area that would have a profound impact on the implementation of the plan. Specify any changes in technical, regulatory and financial capabilities identified during the plan's development)*

Recommendations for Changes or Enhancements: Based on the review of this report by the Hazard Mitigation Plan Steering Committee, the following recommendations will be noted for future updates or revisions to the plan:

- ____
- ____
- ____
- ____
- ____
- ____

Public review notice: *The contents of this report are considered to be public knowledge and have been prepared for total public disclosure. Copies of the report have been provided to the governing boards of all planning partners and to local media outlets and the report is posted on the Cook County hazard mitigation website. Any questions or comments regarding the contents of this report should be directed to:*

Insert Contact Info Here

Appendix F: Jurisdictional Linkage Strategy

PROCEDURES FOR LINKING TO THIS PLAN FOR MUNICIPALITIES NOT CURRENTLY INCLUDED

Not all eligible local governments in Cook County are included in the Cook County Multi-Jurisdictional Hazard Mitigation Plan (MJ-HMP). It is assumed that some or all of these non-participating local governments may choose to "link" to the Plan at some point to gain eligibility for programs under the DMA 2000. In addition, some of the current partnership may not continue to meet eligibility requirements due to a lack of participation as prescribed by the Plan. The following "linkage" procedures define the requirements established by the Plan's Steering Committee and all Planning Partners for the dealing with an increase or decrease in the number of Planning Partners linked to this Plan. It should be noted that a currently non-participating jurisdiction within the defined planning area is not obligated to link to the Plan. These jurisdictions can choose to do their own "complete" plan that addresses all required elements of Section 201.6 of Chapter 44, the Code of Federal Regulations (44 CFR).

INCREASING THE PARTNERSHIP THROUGH LINKAGE

The time period for the linkage process will be during **each annual update timeframe**. Eligible linking jurisdictions are instructed to complete all of the following procedures during this time frame:

- The eligible jurisdiction requests a "Linkage Package" by contacting the Point of Contact (POC) for the Plan:

DESIGNATED POINT OF CONTACT (POC) **Name**: Gene Ryan **Title**: Chief of Planning **Address**: 69 W. Washington, Suite 2600 Chicago, IL 60602 **Phone**: 312-603-8547 **E-mail**: Gene.Ryan@cookcountyil.gov

The POC will provide a linkage package that includes:

- Copy of Volume 1 and 2 of the MJ-HMP
- Planning Partner Expectations Package
- A sample letter of intent to link to the MJ-HMP
- A jurisdictional template and instructions
- Catalog of hazard mitigation alternatives
- A request for technical assistance form
- The most current Local Mitigation Plan Review Tool

The new jurisdiction will be required to review both volumes of the MJ-HMP, which includes the following key components for the planning area:

- The planning area risk assessment

- Goals and objectives
- Plan implementation and maintenance procedures
- A comprehensive review of mitigation alternatives/strategies
- Countywide actions

Once this review is complete, the jurisdiction will complete its specific annex using the template and instructions provided by the POC. Technical Assistance can be provided upon request by completing the request for technical assistance (TA) form provided in the linkage package. This TA may be provided by the POC or any other resource within the Planning Partnership, such as a member of the Steering Committee or a currently participating municipality partner. The POC will determine who will provide the TA and the possible level of TA based on resources available at the time of the request.

Public Participation Requirement: The new jurisdiction will be required to **develop a public involvement strategy that ensures the public's ability to participate in the plan development process. At a minimum, the new jurisdiction must make an attempt to solicit public opinion on hazard mitigation at the onset of this linkage process** and a minimum of one public meeting to present their **draft** jurisdiction-specific annex for comment, prior to adoption by the governing body. The planning partnership will have resources available to aid in the public involvement strategy, such as the plan website and sample survey. However, it will be the new jurisdiction's responsibility to implement and document this strategy for incorporation into its annex. It should be noted that the jurisdictional annex templates do not include a section for the description of the public process. This is because the original partnership was covered under a uniform public involvement strategy that covered the planning area described in Volume 1 of the plan. Since new partners were not addressed by that strategy, they will have to initiate a new strategy, and **add a description of that strategy to their annex**. For consistency, new partners are encouraged to follow the public involvement format used by the initial planning effort as described in Volume 1 of the Plan.

The new jurisdiction will be **required to develop a public involvement strategy that ensures the public's ability to participate in the plan development process**.

- Once their public involvement strategy is completed and they have completed their template, the new jurisdiction will submit the completed package to the POC for a pre-adoption review to ensure conformance with the Regional format.
- The POC will review for the following [Note: the text in green represent key compliance metrics from the Local Mitigation Plan Review Tool]:
- **Documentation of public involvement strategy**
    - *[A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))]*
- **Conformance of template entries with guidelines outlined in the instructions**. The template has been designed to ensure compliance with the Local Mitigation Plan Review Tool.

- Chosen **mitigation actions** are consistent with goals and objectives defined in the MJ-HMP.
- A designated **point of contact**
- A **ranking of risk** specific to the jurisdiction
    - *[B1. Does the Plan include a description of the type, location, and extent of all-natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))]*
- A narrative and analysis describing **hazard risks and previous occurrences and vulnerabilities unique and specific to the jurisdiction**
    - *[B1. Does the Plan include a description of the type, location, and extent of all-natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))];*
    - *[B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))]*
    - *[B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))]*
- Make the completed annex available to **neighboring communities** and local and regional agencies
    - *[A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))]*

The POC may utilize members of the Steering Committee or other resources to complete this review. All proposed linked annexes will be submitted to the Steering Committee for review and comment prior to submittal to the Illinois Emergency Management Agency (IEMA).

- Plans approved and accepted by the Steering Committee will be forwarded to IEMA for review with a cover letter stating the forwarded plan meets locally approved plan standards and whether the plan is submitted with local adoption or for criteria met/plan not adopted review.
- IEMA will review plans for federal compliance. Non-compliant plans will be returned to the jurisdiction for correction. Compliant plans will be forwarded to FEMA for review with annotation as to the adoption status.
- FEMA will review the new jurisdiction's annex in association with the approved MJ-HMP to ensure DMA compliance. FEMA will notify the new jurisdiction of results of its review with copies to IEMA and the planning authority.
- The new jurisdiction will correct plan shortfalls, if necessary, and resubmit the plan to IEMA through the approved plan lead agency.
- For plans with no shortfalls from the FEMA review that have not been adopted, the new jurisdiction's governing authority will adopt the plan (if not already accomplished) and forward the adoption resolution to FEMA with copies to the lead agency and IEMA.
- The FEMA will notify the new jurisdiction governing authority of plan approval.

The new jurisdiction annex will then be included with the Cook County MJ-HMP with the commitment from the new jurisdiction to participate in the ongoing plan implementation and maintenance.

RESCINDING THE PARTNERSHIP

The eligibility afforded under this process to the planning partnership can be rescinded in two ways. First, a participating planning partner can ask to be removed from the partnership. This may be done because the partner has decided to develop its own plan or has identified a different planning process for which it can gain eligibility. A partner that wishes to voluntarily leave the partnership shall inform the POC of this desire in writing. This notification can occur anytime during the calendar year. A jurisdiction wishing to pursue this avenue is advised to make sure that it is eligible under the new planning effort, to avoid any period of being out of compliance with the Disaster Mitigation Act.

After receiving this notification, the POC shall immediately notify both IEMA and FEMA in writing that the partner in question is no longer covered by the MJ-HMP, and that the eligibility afforded that partner under this plan should be rescinded based on this notification.

The second way a partner can be removed from the partnership is by failure to meet the participation requirements specified in the “Planning Partner Expectations Package” provided to each partner at the beginning of the process, or the planned maintenance and implementation procedures specified in Volume 1 of this Plan. Each partner agrees to these terms by adopting the Plan.

The eligibility status of the planning partnership will be monitored by the POC. The determination of whether a partner is meeting its participation requirements will be based on the following parameters:

- Are progress reports being submitted annually by the specific time frames?
- Are partners notifying the POC of changes in designated points of contact?
- Are the partners supporting the Steering Committee by attending designated meetings or responding to needs identified by the body?
- Are the partners continuing to be supportive as specified in the “Planning Partner Expectations Package” provided to them at the beginning of the process?

Participation in the Plan does not end with plan approval and adoption. This partnership was formed on the premise that a group of Planning Partners would pool resources and work together to strive to reduce risk within the planning area. Failure to support this premise lessens the effectiveness of this effort. The following procedures will be followed to remove a partner due to the lack of participation:

- The POC will advise the Steering Committee of this pending action and provide evidence or justification for the action. Justification may include: multiple failures to submit annual progress reports, failure to attend meetings determined to be mandatory by the Steering Committee, failure to act on the partner's action plan, or inability to reach designated point of contact after a minimum of five (5) attempts.
- The Steering Committee will review the information provided by the POC, and determine action by a vote. The Steering Committee will invoke the voting process established in the ground rules established during the formation of this body.
- Once the Steering Committee has approved an action, the POC will notify the planning partner of the pending action in writing via certified mail. This notification will outline the grounds for

the action, and ask the partner if it is their desire to remain as a partner. This notification shall also clearly identify the ramifications of removal from the partnership. The partner will be given 30 days to respond to the notification.

- Confirmation by the partner that they no longer wish to participate or failure to respond to the notification shall trigger the procedures for voluntary removal discussed above.
- Should the partner respond that they would like to continue participation in the partnership, they must clearly articulate an action plan to address the deficiencies identified by the POC. This action plan shall be reviewed by the Steering Committee to determine whether the actions are appropriate to rescind the action. Those partners that satisfy the Steering Committees review remain in the partnership, and no further action is required period.
- Automatic removal from the partnership will be implemented for partners where these actions have to be initiated more than once in a 5-year planning cycle.

Steps for Municipal Linkage to the Cook County MJ-HMP

1. Eligible jurisdiction requests "linkage package" from the POC

- Linkage Package includes:
    - Copy of Volume 1 and 2 of the Cook County MJ-HMP
    - Planning Partner Expectations package
    - A "sample" letter of intent to link to the MJ-HMP
    - A jurisdictional template and instructions
    - Catalog of mitigation alternatives and ideas
    - A "request for technical assistance" form
    - A copy of the most current Local Mitigation Plan Review Tool

2. The new jurisdiction will review both volumes of the MJ-HMP, which includes the following key components:

- The planning area risk assessment
- Goals and objectives
- Plan implementation and maintenance procedures
- A comprehensive review of mitigation alternatives/strategies
- Countywide actions

3. Once the review is complete, the jurisdiction will complete its specific annex using the template and instructions provided by the POC.

4. The new jurisdiction will be responsible to develop a public involvement strategy that ensures the public's ability to participate in the plan development process. At a minimum, the new jurisdiction must attempt to solicit public opinion at the onset of the linkage process and a minimum of one public meeting to present their draft jurisdiction specific annex for comment, prior to adoption by governing body.

5. Once the public involvement strategy is complete and the template has been completed, the new jurisdiction will submit the package to the POC for review to ensure conformity with the Cook County MJ-HMP format.

6. The POC will review for the following [Note: the text in green represent key compliance metrics from the Local Mitigation Plan Review Tool]:

- **Documentation of public involvement strategy**
    - *[A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))]*
- **Conformance of template entries with guidelines outlined in the instructions**. The template has been designed to ensure compliance with the Local Mitigation Plan Review Tool.
- Chosen **mitigation actions** are consistent with goals and objectives defined in the MJ-HMP.

- A designated **point of contact**
- A **ranking of risk** specific to the jurisdiction
    - *[B1. Does the Plan include a description of the type, location, and extent of all-natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))]*
- A narrative and analysis describing **hazard risks and previous occurrences and vulnerabilities unique and specific to the jurisdiction**
    - *[B1. Does the Plan include a description of the type, location, and extent of all-natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))];*
    - *[B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))]*
    - *[B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))]*
- Make the completed annex available to **neighboring communities** and local and regional agencies
    - *[A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))]*

7. Annexes approved and accepted by the Steering Committee will be forwarded to IEMA for review with a cover letter stating the annex meets locally approved plan standards and whether the annex is submitted with local adoption or for criteria met/plan not adopted review.

8. IEMA will review annexes for federal compliance. Non-compliant annexes will be returned for corrections. Compliant annexes will be submitted to FEMA for review with annotation as to the adoption status.

9. FEMA will review the new jurisdiction's annex in association with the approved MJ-HMP to ensure DMA compliance. FEMA will notify the new jurisdiction of results of its review with copies to IEMA and the planning authority.

10. Without shortfalls from FEMA, the new governing authority will adopt the annex and forward adoption resolution to FEMA and copies to lead agency and IEMA.

11. FEMA will notify new jurisdiction of approval

Public Participation Requirement and Rationale

Local jurisdictions seeking to link to the Cook County MJ-HMP must be fully and/or partially within the boundaries of Cook County. "The public" of these jurisdictions are Cook County residents as well as residents of these local jurisdictions. Thereby, these residents have already been given the opportunity to participate in the planning process and provide feedback during the development of the Cook County

MJ-HMP, prior to the comment period and prior to the plan approval/ adoption, as required by FEMA and defined in the Local Mitigation Plan Review Guide. The linkage of these residents' local jurisdictions simply allows mitigation funding to more directly benefit their communities.

- However, to ensure that the contents of the new jurisdictional annex is also consistent with Federal requirements, the linking jurisdiction will be required to develop a public involvement strategy that gives the public an opportunity to be involved in the annex development. This participation must occur during the drafting stage, which is prior to annex approval/ jurisdictional adoption of the plan. At a minimum, the new jurisdiction must make an attempt to solicit public opinion on hazard mitigation at the onset of this linkage process and a minimum of one public meeting to present their draft jurisdiction-specific annex for comment, prior to adoption by the governing body. It should be noted that this is the same process required of jurisdictions participating in the original Cook County MJ-HMP. The planning partnership will have resources available to aid in the public involvement strategy, such as surveys and other outreach materials. However, it will be the new jurisdiction's responsibility to implement and document this strategy for incorporation into its annex.
- It should be noted that the jurisdictional annex templates do not include a section for the description of the public process. This is because the original partnership was covered under a uniform public involvement strategy that covered the planning area described in Volume 1 of the Cook County MJ-HMP. Since new partners were not addressed by that strategy, they will have to initiate a new strategy, and add a description of that strategy to their annex. For consistency, new partners are encouraged to follow the public involvement format used by the initial planning effort as described in Volume 1 of the Cook County MJ-HMP.

Appendix G: Plan Adoption Resolutions from Planning Partners

This section will include the plan adoption resolutions for each jurisdiction. Adoption resolutions will be included upon receiving FEMA's "approval pending adoption" notification.

Appendix H: References

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