ILLINOIS STATE UNIVERSITY
MULTI-HAZARD MITIGATION PLAN

2019 State University MHMP

ILLINOIS STATE UNIVERSITY
Illinois' first public university

Office of the President

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Illinois State University Multi-Hazard Mitigation Plan
Adoption Letter

Illinois State University

ADOPTING THE ILLINOIS STATE UNIVERSITY MULTI-HAZARD MITIGATION PLAN

Illinois State University recognizes the threat that both natural and human-caused hazards pose to people and property, and the threats to public health and safety. Undertaking hazard mitigation actions before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars. Section 322 of the Disaster Mitigation Act of 2000 (DMA 2000) recommends public entities develop and submit for approval to the President of the United States a mitigation plan that outlines processes for identifying their respective natural hazards, risks, and vulnerabilities.

I acknowledge the recommendation of Section 322 of DMA 2000 that an adopted multi-hazard mitigation plan is required as a condition of future grant funding for mitigation projects and the University's Emergency Management department participated in planning process with University stakeholders and local community partners to prepare a Multi-Hazard Mitigation Plan.

The resulting Plan recommends mitigation activities that will reduce losses to life and property affected by both natural and human-caused hazards that affect the University and its students, faculty, staff, and members of the general public. I hereby approve and adopt the Multi-Hazard Mitigation Plan as an official plan of the University.

Illinois State University's Emergency Management department will submit on behalf of the University and local community partners the adopted Multi-Hazard Mitigation Plan to the Illinois Emergency Management Agency and the Federal Emergency Management Agency for final review and approval.

ADOPTED THIS 31st Day of March, 2019.

Larry H. Dietz, Ph.D.
President
Illinois State University

Multi-Hazard Mitigation Plan

Illinois State University

Adoption Date: -- March 31, 2019

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Acknowledgements

The Illinois State University Multi-Hazard Mitigation Plan would not have been possible without the feedback and input provided by University constituents and community partners. Your time and input are critical to ensuring a more resilient University. Illinois State University gratefully acknowledges the following people for the time, energy, and resources given to create the first Illinois State University Multi-Hazard Mitigation Plan.

Eric Hodges, Director, Emergency Management
John Goodman, Director, Environmental Health & Safety
Don Kunde, Assistant Director, Environmental Health & Safety
David Marple, Director, University Risk Management
Steve Lancaster, Associate Director, Facilities Management
Rick Kentzler, University Architect
Nichol Bleichner, Deputy Chief, University Police
Chris Homan, Director, Office of Energy Management
Teri Winings, Medical Technologist, Student Health Services
John Burkhart, Director, Town of Normal Water Department
Wayne Aldrich, Director, Town of Normal Public Works Department
Jon Hauge, Battalion Chief, Town of Normal Fire Department
Bob Clark, Director, McLean County Emergency Management Agency
Cathy Beck, Assistant Director, McLean County Emergency Management Agency
Bernie Anderson, Community Relations Manager, Nicor Gas
Marty Behrens, Supervising Engineer, Ameren
Jeff Clarkson, Safety Officer & Emergency Management Director, Advocate BroMenn Medical Center

President's Office

Larry Dietz, President

Table of Contents

Section 1. Introduction

Hazard mitigation is any sustained action to reduce or eliminate long-term risk to human life and property from hazards. The Federal Emergency Management Agency (FEMA) makes reducing hazards one of its primary goals. Hazard-mitigation planning and the subsequent implementation of mitigation projects, measures, and policies is a primary mechanism in achieving FEMA's goal.

The Multi-Hazard Mitigation Plan (MHMP) is a requirement of the Federal Disaster Mitigation Act of 2000 (DMA 2000). The development of a local government plan is required in order to maintain eligibility for certain federal disaster assistance and hazard mitigation funding programs. In order for the National Flood Insurance Program (NFIP) communities to be eligible for future mitigation funds, they must adopt an MHMP.

In recognition of the importance of planning in mitigation activities, FEMA created Hazus Multi-Hazard (Hazus-MH), a powerful geographic information system (GIS)-based disaster risk assessment tool. This tool enables communities of all sizes to estimate losses from floods, hurricanes, earthquakes, and other natural hazards and to measure the impact of various mitigation practices that might help reduce those losses. The Illinois Emergency Management Agency (IEMA) has determined that Hazus-MH should play a critical role in the risk assessments performed in Illinois.

The Illinois State University Emergency Management and Southern Illinois University have joined efforts in developing the University's first mitigation plan. The implementation actions within this MHMP apply to the University and any administrative units, academic departments, or other related organizations that formally adopt this plan as their own. Throughout the planning process and writing of the MHMP, the planning team sought thorough stakeholder participation. For the purpose of this planning process, stakeholder participation was defined as submission of department/organization-specific information (e.g., completing a Risk Assessment worksheet and identifying mitigation strategies) and attendance at a planning or public meeting by a department/organizational representative.

This plan incorporates state-of-the art hazard analyses, addresses changes in probability and impact of specific hazards, incorporates changes in land-use, population and demographics within a University level. Detailed GIS and Hazus-MH Level 2 analyses were performed for the risk assessment and sound mitigation strategies were established for each university department and community partner. This document hereby serves as Illinois State University 2019 Multi-Hazard Mitigation Plan.

Section 2. Planning Process

2.1 Timeline

The MHMP process is broken into a series of five meetings. These meetings were organized by SIU, and hosted by the Director of Emergency Management at Illinois State University. At these meetings, various tasks were completed by SIU, and the ISU Mitigation Planning Team.

Meeting 1: Introduction of the MHMP process and organize resources. SIU gathered local resources that contributed to the detailed Illinois State University risk assessment and presented the historical hazards. Based on this information, the Planning Team identified natural hazards to include in the plan, and ranked hazards by potential damages and occurrences.

Meeting 2: SIU presented the draft risk assessment, derived from the Hazus-MH and GIS modeling of the identified disasters, to the Planning Team. The general public was invited to this meeting through a series of newspaper articles and/or radio spots. At the end of the meeting, SIU encouraged the general public to ask questions and provide input to the planning process, fulfilling one of FEMA's requirements for public input.

Meeting 3: This meeting also consisted of a "brainstorming session." The Planning Team lent local knowledge to identify and prioritize mitigation strategies and projects that can address the threats identified in the risk assessment. FEMA requires the plan to contain mitigation strategies specific to each hazard. At this meeting, SIU presented options for funding implementation of different mitigation strategies, including a written guide to be distributed to all participants.

Meeting 4: The Planning Team reviewed the draft plan and, proposed revisions, and accepted the plan after SIU incorporated the necessary changes. Subsequently, SIU forwarded the University MHMP to the mitigation staff at the Illinois Emergency Management Agency (IEMA) for review prior to submitting it to FEMA.

Meeting 5: This is not a formal meeting of the Planning Team, but rather the adoption of the approved plan. Once FEMA approves the plan, the plan is returned to the University for formal adoption by the Office of the President.

2.2 University Department & Community Partner Participation

Approximately fifteen university departments and community partners participated in the development of this MHMP with the intent of formally adopting the plan and subsequently fulfilling the requirements of the DMA 2000. Various representatives from each department/organization were present at the meetings (see Section 2.3 Planning Team Information).

Participating University Departments and Community Partners

Emergency Management	Normal Water Department
Environmental Health & Safety	Normal Public Works
Office of Risk Management	Normal Fire Department
Facilities Management	McLean County EMS
Facilities Planning & Construction	Nicor Gas
University Police Department	Ameren
Office of Energy Management	Advocate BroMenn Medical Center
Student Health Services	

2.3 Planning Team Information

Eric Hodges, Director of Emergency Management, heads the Planning Team. The Planning Team includes representatives from various university departments, local municipalities, and public and private utilities. Members of the Planning Team have a common vested interest in the University's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage. All members of the Planning Team actively participated in the meetings, reviewed and provided comments on the draft plan, participated in the public input process and the University's formal adoption of the plan.

Illinois State University Planning Team Members

Department/Community Partner	Name	Title
Emergency Management	Eric Hodges	Emergency Management Director
Environmental Health & Safety	John Goodman Don Kunde	EHS Director Assistant Director
Office of Risk Management	David Marple	Risk Management Director
Facilities Management	Steve Lancaster	Associate Director
Facilities Planning & Construction	Rick Kentzler	University Architect
University Police Department	Nichol Bleichner	Deputy Chief
Office of Energy Management	Chris Homan	Director
Student Health Services	Teri Winings	Medical Technologist
Normal Water Department*	John Burkhart	Director
Normal Public Works*	Wayne Aldrich	Director
Normal Fire Department*	Jon Hauge	Battalion Chief
McLean County Emergency Management Agency*	Bob Clark Cathy Beck	EMA Director Assistant Director

Department/Community Partner	Name	Title
Nicor Gas*	Bernie Anderson	Community Relations Manager
Ameren*	Marty Behrens	Supervising Engineer
Advocate BroMenn Medical Center*	Jeff Clarkson	Safety Officer & Emergency Management Director

**Community Partner*

The DMA 2000 planning regulations require that Planning Team members from each University Department and Community Partner actively participate in the MHMP process. The Planning Team was actively involved on the following components:

- Attending the MHMP meetings
- Providing available assessment and campus building inventory and historical hazard information
- Reviewing and providing comments on the draft plans
- Coordinating and participating in the public input process
- Coordinating the formal adoption of the plan by the University

The first MHMP meeting was held in Normal, Illinois on October 26th, 2016. Representatives from SIU explained the rationale behind the MHMP process and answered questions from the participants. SIU representatives also provided an overview of GIS/Hazus-MH, described the timeline and the process of mitigation planning.

The ISU Planning Team assembled for four formal meetings and held one informal meeting for adopting the plan. Each meeting was approximately two hours in length. Appendix A includes the attendance records for all meetings. During these meetings, the Planning Team successfully identified critical facilities, reviewed hazard data and maps, identified and assessed the effectiveness of existing mitigation measures, established mitigation projects for the future, and assisted with preparation of the public participation information.

Planning Meetings

MEETING 1	Oct 26th, 2016
MEETING 2	Feb 9th, 2017
MEETING 3	April 18th, 2017
MEETING 4	December 5th, 2017

2.4 Public Involvement

The ISU Director of Emergency Management solicited public input throughout the planning process. A public meeting was held on February 9th, 2017 to review the Illinois State University risk assessment. Appendix A contains attendance records for the public meeting. Appendix B contains press releases and/or articles sent to local newspapers throughout the MHMP development process to inform the public of meetings.

2.5 McLean County Involvement

As shown in Section 2.3, the Illinois State University MHMP included a broad spectrum of university and non-university stakeholders. In addition to the constituents having attended meetings, the following individuals were invited to participate in the planning process: McLean County Emergency Management

Agency, and various representatives of county government and community groups to obtain their involvement in the planning process.

2.6 Review of Technical Documents

The Illinois State University Planning Team identified technical documents from key agencies to assist in the planning process. These documents include land use plans, comprehensive plans, emergency response plans, municipal ordinances, and building codes. The planning process incorporated the existing natural hazard mitigation elements from previous planning efforts. The following technical data, reports, and studies were utilized for hazard mitigation:

Federal Emergency Management Agency
- *Developing the Mitigation Plan (April 2003)*
- *Mitigation Ideas (January 2003)*
- *Local Mitigation Planning Handbook*
- *Flood Insurance Study (May 2008)*

United States Census Bureau
- *County Profile Information*
- *2010 Census Data*
- *American Community Survey (2009-2013)*

NOAA National Climatic Data Center
- *Climate Data*

NOAA / National Water Service Storm Prediction Center
- *Severe Weather Data*

Illinois Emergency Management Agency
- *2013 Illinois Natural Hazard Mitigation Plan*
- *Hazardous Materials Incident Reports*

Illinois Environmental Protection Agency
- *2014 303d Listed Waters and Watershed Maps*

Illinois State Water Survey
- *Climate Data*

Illinois State Geological Survey
- *Panno, et al, 1997, Karst Regions of Illinois*
- *Bauer, 2008, Planned Coal Mines Subsidence in Illinois: A Public Information Booklet*

Geologic Sources
- *Illinois Coal Association*
- *White, 1988, Geomorphology and Hydrology of Karst Terrains, Journal of Quaternary Science*

Illinois State University
- *Emergency Management Plan (2014)*
- *Master Plan (2010-2030)*
- *2016 ISU Building Inventory Data*
- *University Fall 2016 Factbook*

Normal
- *Town of Normal 2040 Comprehensive Plan (2017)*

Bloomington
- *City of Bloomington Comprehensive Plan 2035 (2015)*

McLean County
- *McLean County Regional Comprehensive Plan (2009)*

East Stroudsburg University Hazard Mitigation Plan 2015

2.7 Adoption by Local Government

Upon IEMA and FEMA approval, the Planning Team presented and recommended the plan to the Illinois State University Office of the President for formal adoption. The plan was formally adopted by the President of Illinois State University on March 31, 2019. The Planning Team worked with the university departments and its community partners to ensure all parties formally adopted the plan. Appendix C contains the Adopting Resolution signed by the President of Illinois State University.

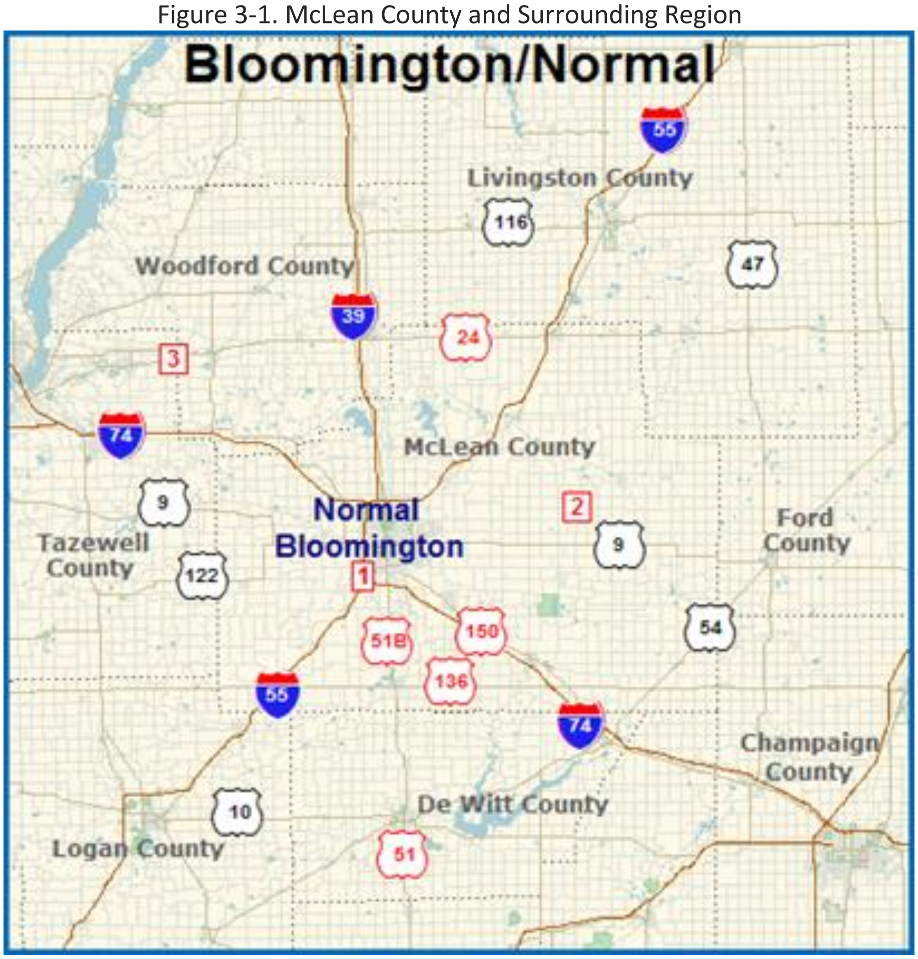
Section 3. University Profile

3.1 Geography and Environment

Illinois State University (ISU) is located in Normal, McLean County, Illinois (Figure 3-1 depicts a map of McLean County and surrounding region). The campus is in the twin-city community of Bloomington-Normal and occupies 920 acres, including over 60 major buildings and state-of-the-art technology. Conveniently located in Central Illinois, the University is situated at the intersection of three major interstate highways, as well as along the Chicago-St. Louis railroad corridor. Its proximity to major metro areas are as follows: 137 miles southwest of Chicago and 164 miles northeast of St. Louis. Interstates 74, 55, and 39; U.S. Route 150; and Illinois Route 9 intersect in Bloomington-Normal, creating a transportation hub. The Bloomington-Normal Amtrak station is just two blocks from the campus.

Formerly known as North Bloomington, the town was renamed Normal in February 1865 and officially incorporated on February 25, 1867. Normal is the smaller of two principal municipalities of the Bloomington-Normal metropolitan area and is Illinois' seventh most populous community outside of the Chicago Metropolitan area. The name Normal was taken from Illinois State Normal University, which has since been renamed Illinois State University after it become a four-year university. Normal is home to three higher learning institutions, one being Illinois State University.

Figure 3-1. McLean County and Surrounding Region



Bloomington and Normal are adjoining cities forming an urban area that serves a portion of central Illinois as an agricultural, commercial, and industrial center. The rich agricultural area surrounding Bloomington-Normal is located in the Bloomington Ridged Plain physiographic subdivision of the Till Plains section. The region is a flat glacial plain crossed with moraine ridges.

The climate in Normal is generally characterized by hot dry summers and cool wet winters. The variables of temperature, precipitation, and snowfall can vary greatly from one year to the next. In summer, the average low is 65°F and the average high is 86°F. Average monthly precipitation ranged from 1.71 inches in February to 4.52 inches in May. (NCDC data from 1971 to 2000). The average low temperature in January is 14°F accompanied by significant amounts of ice and snow.

The two main watersheds in Bloomington-Normal are Evergreen Lake and Lake Bloomington. Evergreen Lake consists of 900 acres and 22.5 miles of shoreline. Lake Bloomington is a man-made lake consisting of 570 acres and 9.5 miles of shoreline. Both watersheds offer an array of recreational fishing, including largemouth bass, smallmouth bass, crappie, hybrid walleye, muskie, white bass, bluegill, channel catfish, and flathead catfish.

Figure 3-2. Watterson Towers

Topographically, the highest elevation on campus is 281.5 feet at Watterson Towers (Figure 3-2). Located in Normal, Illinois at the corner of Fell and Beaufort Streets, it is the second tallest dormitory in the world. Illinois State University campus quadrangle consists of buildings spaced closely together around a rectangular center lawn. This popular site is known as the "Quad" where special events including concerts and Festival ISU takes place. The ISU Quad is also host to the Fell Arboretum, which is part of a 350-acre site that represents over 150 tree species from the state of Illinois. Uniquely, trees on the north side of the quad are from Northern Illinois and those on the south side are from Southern Illinois. In 2008, Fell Arboretum won the Tree Campus USA award.

3.2 University Facts and Institutional Trends

On February 18, 1857, Governor William Bissell signed a bill to create a normal school and establish the Board of Education of the State of Illinois as its governing body, with Abraham Lincoln acting as attorney of the board. As a result, Illinois State Normal University was founded as the first public institution of higher education in the state. The name was to reflect its primary mission as being a teaching school. Initially classes were held in downtown Bloomington in Mayor's Hall, previously the site of Lincoln's "Lost Speech." After the completion of Old Main in 1860, the school moved to its current campus. ISU is one of the oldest institutions of higher education in the Midwest, and one of 12 public universities in Illinois.

Traditionally a training school for teachers, the University's 34 academic departments in 6 colleges offer 67 undergraduate programs in more than 188 major/minor fields of study in the Colleges of Applied Science and Technology, Arts and Sciences, Business Education, Fine Arts, and Mennonite College of Nursing. The Graduate School coordinates 94 master's degree sequences, 10 doctoral programs, and 33 certificate programs. The University also offers extended education non-degree programs throughout the state of Illinois. Milner Library supports the University's academic programs offering a collection of more than three million holdings. ISU is accredited by the North Central Association of Colleges and Schools.

Illinois State University is the land of "Redbird Country" and home of the red and white. The unofficial nickname was first the "Fighting Teachers." Since 1960, Reggie Redbird has been on the sidelines for Illinois State. In 1981, he took on the name of "Reggie" after baseball hall of famer Reggie Jackson (Figure 3-3).

Figure 3-3. Reggie Redbird

3.3 Population, Occupancy, and Demographics

The University enrollment includes students from throughout Illinois, 40 other states, the District of Columbia, and 61 other countries. Illinois State University continues to see record-breaking enrollment numbers, despite an increasingly competitive recruiting environment and an ongoing state budget crisis. For the third year in a row, Illinois State has a record-breaking freshman class, and has seen growth in the number of transfer and graduate students. The University's total enrollment has also topped 21,000 students. (news.illinoisstate.edu/2016).

Population and demographic information provides baseline data about the University community. This community consists of specific key groups, such as students, faculty, and staff. Any changes in the demographics or populations may be used to identify higher-risk populatons. Baseline demographic information for ISU is provided in tables 3-1, 3-2, and 3-3 below.

Table 3-1 Baseline Demographic Information (University Factbook, Fall 2016)

DEMOGRAPHICS	FULL-TIME	PART-TIME
Total Population	**21,039**	**2,345**
Male	9,164	984
Female	11,873	1,361
Not Disclosed	2	--
Student Enrollment		
Undergraduate	18,643	1,187
Graduate	2,396	1,158
Freshman	5,264	77
First Time in College Students	3,694	--
New Undergraduate Transfer Students	2,049	--
New Graduate Students	794	444

Table 3-2 Baseline ISU Employees Demographic Information (University Factbook, Fall 2016)

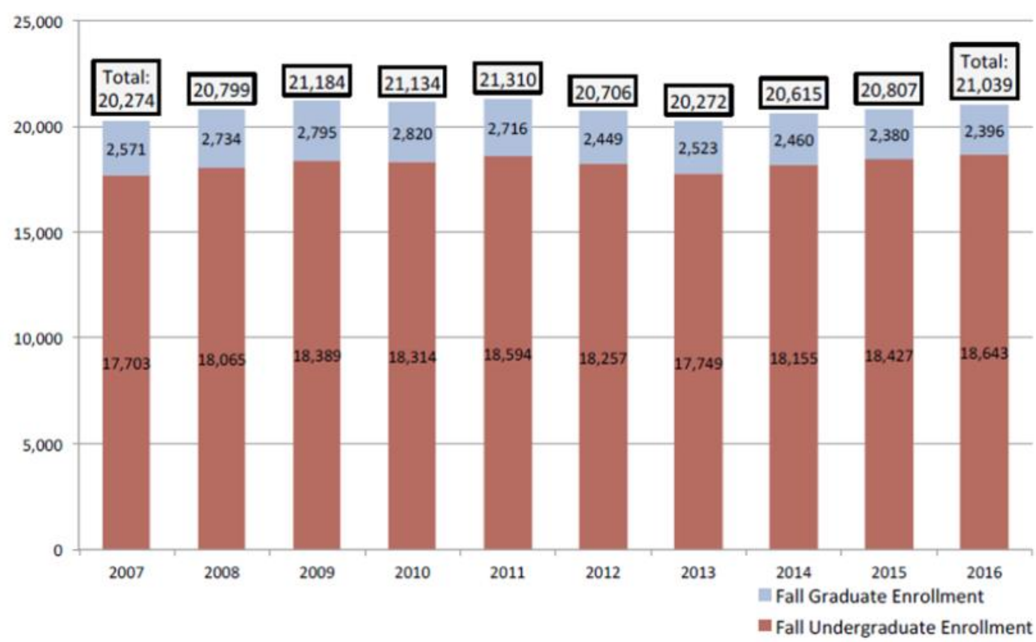
DEMOGRAPHICS	Fall 2016
Departmental Faculty	1,210
Non-Departmental Faculty	55
Library Faculty	25
Lab School Faculty	89
Administrative/Professional	712
Civil Service	1,461
Total	**3,552**

Table 3-3 **Race and Ethnicity for ISU students, Fall 2016 (University Factbook, 2016)**		
RACE AND ETHNICITY	**UNDERGRADUATE**	**GRADUATE**
American Indian/Alaskan Native	29	3
Black or African American	1,563	129
Asian	403	41
Hispanic	1,883	123
Hawaiian or Pacific Islander	16	--
White	14,056	1,772
Two or More Selections	520	47
No Response	62	16
Non-U.S. Citizen	111	265
Total	**18,643**	**2,396**

Based on figures from the University Factbook 2016, ISU has a population of 21,039 students and 3,552 faculty and staff members. Nearly all undergraduate students are traditional-aged (under 25). Additionally, according to the 2016 ACS 5-year estimates, the town of Normal, IL has a population of 54,264; nearby Bloomington, IL has a population of 78,005.

ISU has experienced a growth in undergraduate students from 2014 to 2016 with a growth rate of 3%. At the same time, graduate enrollment has seen a slight decline. It is crucial that the University properly maintains its existing infrastructure and has plans to manage or redevelop unused properties to guarantee adequate housing, classrooms, and facilities related to changes in student enrollment. Figure 3-4 depicts the student enrollment trends for ISU.

Figure 3-4. ISU Student Enrollment Trends 2007 - 2016



ISU Office of Student Admissions, 2017

Illinois State University and the surrounding community have a variable population density. A variable population density means the level of vulnerability to risk will shift throughout the course of the year and throughout the course of the day. Periods of time where there are fewer people on campus and the University has a lower population density (i.e., evening, nights, weekends, and intersession periods) can make it difficult to determine who and where people are on campus. Furthermore, a low population density helps prevent hazards from affecting a greater number of people.

The demographics referenced above are based on enrollment rates for an entire academic year. University populations tend to fluctuate with both time of year and time of day. The student population of ISU radically shifts during the winter session (typically mid-December to mid-January) and summer session (mid-May to mid-August) as students return to their primary place of residence. Many classes are held throughout the day, though classes may be held in the late afternoon and evening hours. Full-time or part-time status of a student, staff member, or faculty member will also impact the frequency with which they are on campus. The majority of the university population consists of resident students during the weekday evening and weekends. In contrast, periods of time where there are more people on campus and the University has a higher population density (i.e., fall/spring semesters and weekdays) can result in a greater risk as transportation accidents, utility interruptions, and other events will disrupt a greater number of people.

ISU is a co-educational, residential university comprising undergraduate student housing clustered in four neighborhoods located across the 920-acre campus. The four areas house more than 6,000 students; Watterson Towers, East Campus (Hewett and Manchester Hall), West Campus (Haynie, Wilkins, and Wright Hall), and Cardinal Court. According to the Factbook, Fall 2016, 31.5% of the University's student live in the residence halls; another 1.1% live in University-owned housing. Damage to residential properties as a result of environmental hazards are not only expensive to repair or rebuild, but also can be devastating to displaced individuals.

3.4 Land Use and Development Trends

Illinois State University's physical campus comprises 920 acres, 221 structures, 20 miles of sidewalks, approximately 70 acres of parking lots, and more than 150 tree species. The Historic Quad and adjacent areas consist of 350 acres. Roughly, 270 acres are located on the Gregory Street property, which is immediately west of the Weibring Golf Club and close to one mile from the Historic Quad's center point. (Figure 3-5). Formerly the University Farm site, the Gregory Street property encompasses land equal to three times the area of the Historic Quad. The University Farm was relocated to approximately 300 acres in Lexington in 2002.

Figure 3-5. The Historic Quad

Illinois State maintains 6.8 million square feet of facility space. The vast majority of this space is located on-campus, although there are off-campus facilities. Most of on-campus space is used for residential facilities (24 percent), followed by office space which supports administrative purposes, as well as instructional, research, and public service activities (16 percent). Figure 3-6 depicts a current campus map of ISU. The map shows university buildings, green space, and the campus boundary. The map does not show the University Farm or other off-campus areas. The map also includes some areas and buildings not owned by the University solely for the purpose of identifying various campus landmarks in relationship to the local community.

Figure 3-6. Current Campus Map of ISU

Illinois State University Master Plan 2010-2030: Looking to the Future

Master Plan 2010-2030: Looking to the Future

The plan examined all aspects of the University's facilities, including requirements for rehabilitation, renovation, and construction of new facilities that must accommodate emerging technologies and provide more classroom space for future students in the areas of instruction, research, creative activities and public service. The plan assessed existing conditions in terms of total space, space by type, age of facilities, and condition of space. The plan presents a series of recommendations designed to foster the University's physical transformation in addition to what has been accomplished in recent years. The physical campus environment is an important feature of the University, not only for the faculty, staff, and students, but also for the local communities.

Master Plan 2010-2030: Looking to the Future, is intended to act as a long-range blueprint for the physical development of Illinois State University – its future size, form, function, character, image, and environment. Appropriate facilities and a healthy, safe, and environmentally sustainable campus are keys to positioning student to excel, promote academic excellence, and enhance student, faculty, staff, alumni, and community pride in the University (Master Plan 2010-2030, December 2010). Figure 3-7 depicts the future land use for ISU as proposed by the Master Plan 2010. Eight discrete districts will be formed as the physical transformation of the campus advances.

Figure 3-7. Future Campus of ISU

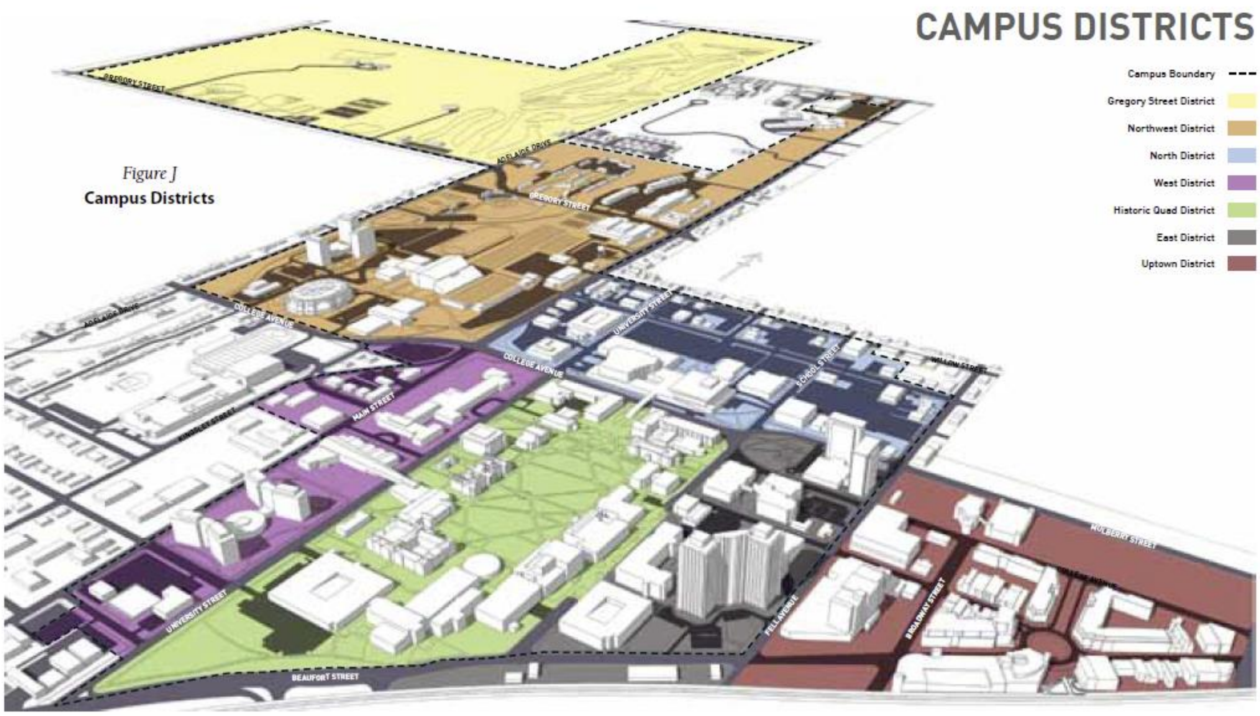


Image courtesy of RATIO

Illinois State University Master Plan 2010-2030: Looking to the Future

Section 4. Risk Assessment

The goal of mitigation is to reduce future hazard impacts including loss of life, property damage, disruption to local and regional economies, and the expenditure of public and private funds for recovery. Sound mitigation requires a rigorous risk assessment. A risk assessment involves quantifying the potential loss resulting from a disaster by assessing the vulnerability of buildings, infrastructure, and people. This assessment identifies the characteristics and potential consequences of a disaster, how much the disaster could affect the community, and the impact on community assets. This risk assessment consists of three components—hazard identification, vulnerability assessment, and risk analysis.

4.1 Hazard Identification

4.1.1 Existing Plans

The Planning Team identified technical documents from key agencies to assist in the identification of potential hazards. Several other documents were used to profile historical hazards and guide the Planning Team during the hazard ranking exercise. It should be noted that Illinois State University is located in Normal, Illinois, McLean County. McLean County does not have a FEMA-approved hazard mitigation plan. Many university students, faculty, and staff are residents of the county. At the same time, the ISU MHMP focuses on hazards and issues that are specifically related to a small, fairly densely populated area within the county. Section 2.6 contains a complete list of the technical documents utilized to develop this plan.

4.1.2 National Hazard Records

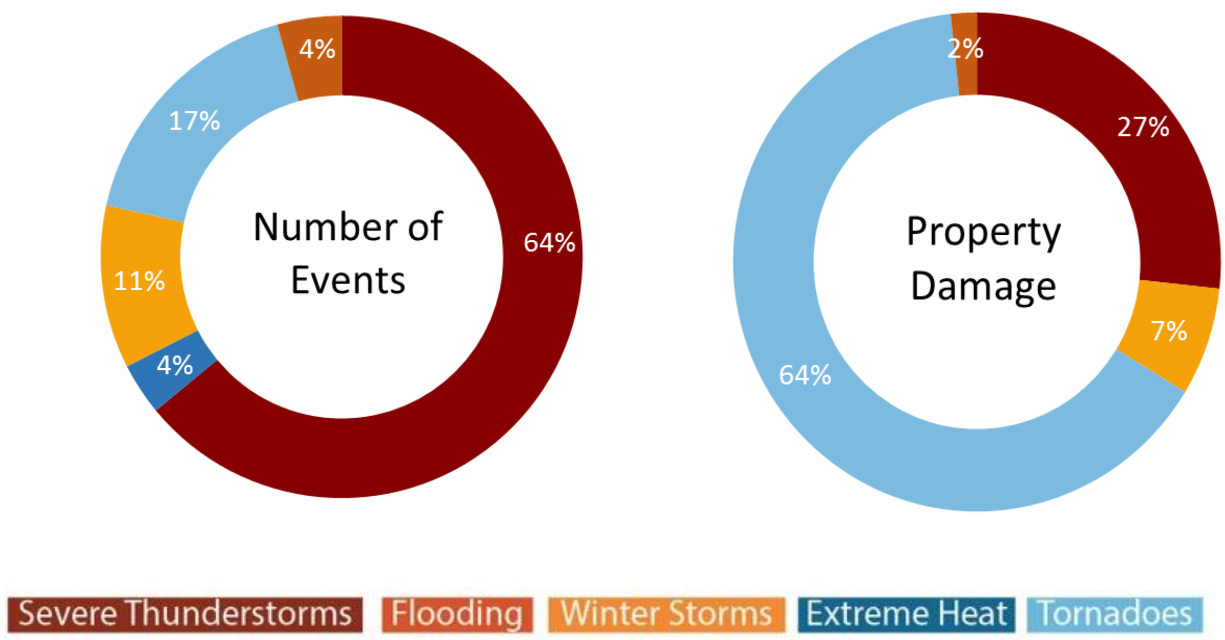
To assist the Planning Team, historical storm event data from the National Climatic Data Center (NCDC) was complied. NCDC records are estimates of damages reported to the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses.

The NCDC database included 603 reported meteorological events in McLean County from 1950-2016. The following hazard-profile sections each include a summary table of events related to each hazard type. Table 4-1 summarizes the meteorological hazards reported for McLean County. Figure 4-1 summarizes the relative frequency of NCDC reported meteorological hazards and the percent of total damage associated with each hazard for McLean County. Full details of individual hazard events are on the NCDC website. In addition to NCDC data, Storm Prediction Center (SPC) data associated with tornadoes, strong winds, and hail was mapped using SPC-recorded latitudes and longitudes. Appendix D contains a map of these events.

Table 4-1. Summary of Meteorological Hazards Reported by the NCDC for McLean County

Hazards	Time Period		Number of Events	Property Damage	Deaths	Injuries
	Start	End				
Tornadoes	1950	2014	104	$19, 199,000	0	5
Winter Storm	1996	2016	62	$2,175,000	3	2
Severe Thunderstorm	1958	2016	393	$7,271,000	0	11
Drought/Extreme Heat	1997	2014	21	$0	4	0
Flooding	1998	2015	26	$535,000	0	0

Figure 4-1. Distribution of NCDC Meteorological Hazards for McLean County



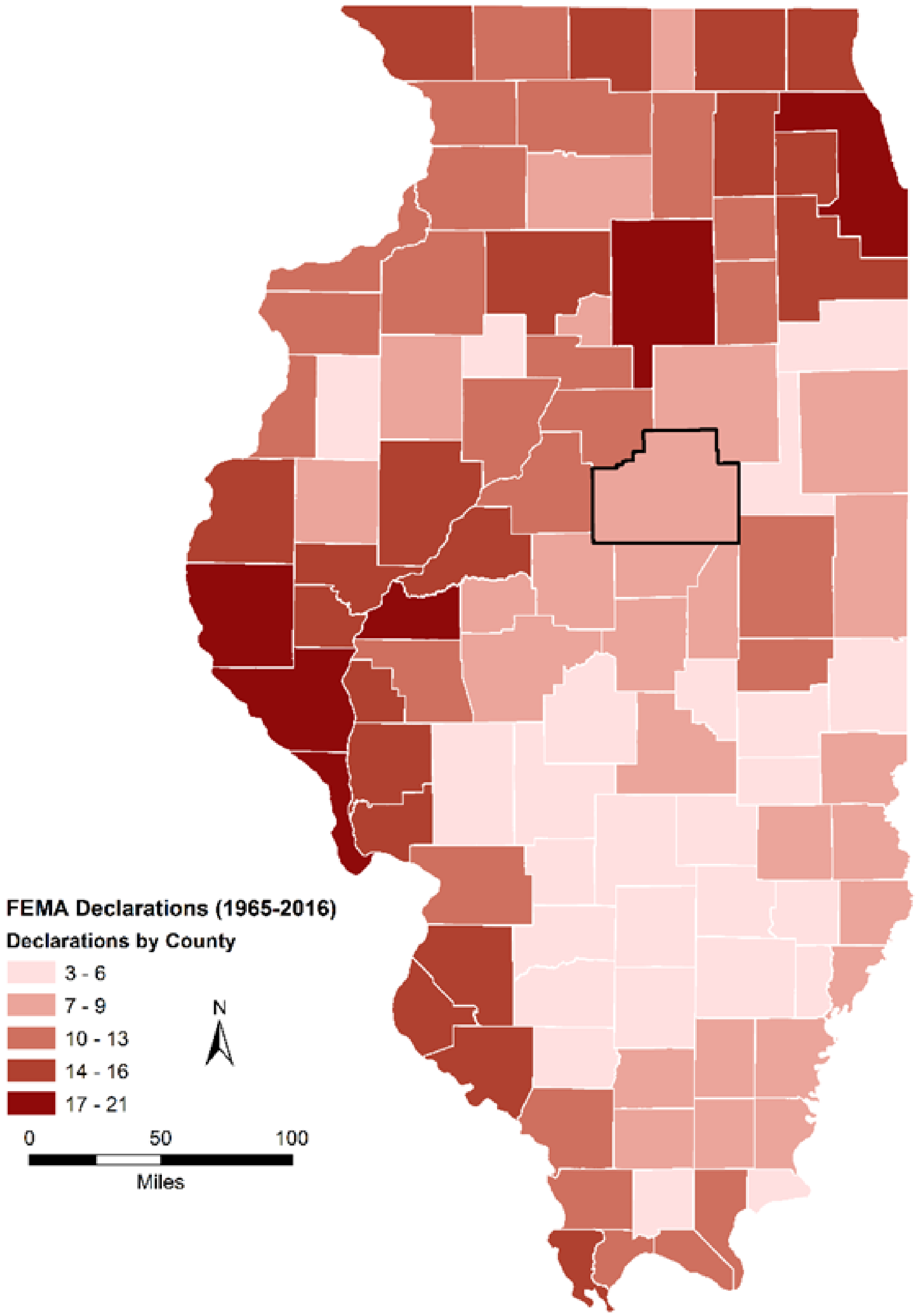
4.1.3 FEMA Disaster Information

Since 1957, FEMA has declared 53 major disasters and 7 emergencies for the State of Illinois. Emergency declarations allow states to access FEMA funds for Public Assistance (PA); disaster declarations allow for additional PA funding, including Individual Assistance (IA) and the Hazard Mitigation Grant Program (HMGP). McLean County has received federal aid for six declared disasters and three emergencies since 1965. Table 4-2 lists specific information for each disaster declaration in McLean County. Figure 4-2 depicts the number of disasters and emergencies that have been declared for the State of Illinois and McLean County since 1965.

Table 4-2. Details of FEMA-declared Emergencies and Disasters in McLean County

Declaration Number	Date of Declaration	Description
242	06/05/1968	Tornadoes, Severe Storms and Flooding
373	04/26/1973	Severe Storms and Flooding
427	04/11/1974	Tornadoes
860	03/06/1990	Severe Ice Storm
1681	02/09/2007	Severe Winter Storm
1960	03/17/2011	Severe Winter Storm and Snowstorm
3134	01/08/1999	IL-Winter Storm 1/1/99
3161	01/17/2001	Illinois Winter Snow Storms
3230	09/07/2005	Hurricane Katrina Evacuation

Figure 4-2. FEMA-declared Emergencies and Disasters in Illinois



4.1.4 Hazard Ranking Methodology

Based on Planning Team input, national datasets, and existing plans, the ISU Planning Team developed and ranked a list of hazards. These hazards ranked the highest based on the Risk Priority Index discussed in Section 4.1.5. It should be noted that Dam/Levee Failure and Wildfire have been omitted from the plan and were not natural hazards identified by Illinois State University or participating community partners during the risk assessment process.

ISU Hazard List

TORNADOES

WINTER STORMS

HAZARDOUS MATERIALS RELEASE

SEVERE THUNDERSTORMS

DROUGHT / EXTREME HEAT

EARTHQUAKES

FLOODING

GROUND FAILURE

4.1.5 Risk Priority Index

The Risk Priority Index (RPI) quantifies risk as the product of hazard probability and magnitude so Planning Team members can prioritize mitigation strategies for high-risk-priority hazards. Planning Team members use historical hazard data to determine the probability, combined with knowledge of local conditions to determine the possible severity of a hazard. Tables 4-3 and 4-4 display the criteria the Planning Team used to quantify hazard probability and magnitude.

Table 4-3. Hazard Probability Ranking

Probability	Characteristics
4 – Highly Likely	Event is probable within the next calendar year This event has occurred, on average, once every 1-2 years in the past
3 – Likely	Event is probable within the next 10 years Event has a 10-50% chance of occurring in any given year This event has occurred, on average, once every 3-10 years in the past
2 – Possible	Event is probable within the next 50 years Event has a 2-10% chance of occurring in any given year This event has occurred, on average, once every 10-50 years in the past
1 – Unlikely	Event is probable within the next 200 years Event has a 0.5-2% chance of occurring in any given year This event has occurred, on average, once every 50-200 years in the past

Table 4-4. Hazard Severity Ranking

Magnitude/Severity	Characteristics
8 – Catastrophic	Multiple deaths Complete shutdown of facilities for 30 or more days More than 50% of property is severely damaged
4 – Critical	Injuries and/or illnesses result in permanent disability Complete shutdown of critical facilities for at least 14 days More than 25% of property is severely damaged
2 – Limited	Injuries and/or illnesses do not result in permanent disability Complete shutdown of critical facilities for more than seven days More than 10% of property is severely damaged
1 – Negligible	Injuries and/or illnesses are treatable with first aid Minor quality of life lost Shutdown of critical facilities and services for 24 hours or less Less than 10% of property is severely damaged

The product of hazard probability and magnitude is the RPI (Risk Priority Index). The ISU Planning Team ranked specified hazards based on the RPI, with larger numbers corresponding to greater risk. After evaluating the calculated RPI, the ISU Planning Team adjusted the ranking to better suit the campus community.

During the five-year review of the plan, the ISU Planning Team will update this table to ensure these rankings accurately reflect the campus community's assessment of these hazards.

Table 4-5 identifies the RPI and adjusted ranking for each hazard specified by the ISU Planning Team (Ranking 1 being the highest concern). The ISU Planning Team made these rankings at Meeting 1.

Table 4-5. Illinois State University Hazard Priority Index and Ranking

Hazard	Probability	Magnitude/Severity	Risk Priority Index	Rank
Tornadoes	4	3	12	1
Winter Storms	4	2	8	2
Hazardous Materials Release	3	2	6	3
Severe Thunderstorms	4	1	4	4
Drought	2	2	4	5
Extreme Heat	3	1	3	6
Earthquakes	2	1	2	7
Flooding	1	2	2	8
Ground Failure	1	1	1	9

4.2 Vulnerability Assessment

4.2.1 Asset Inventory

Processes and Sources for Identifying Assets

Before meeting one, the Planning Team used their resources to update the list of critical facilities from university and state resources. Local GIS data was used to verify the locations of all critical facilities on campus as well as within the local community. SIU GIS analysts incorporated these updates and corrections to the Hazus-MH data tables prior to performing the risk assessment. The updated Hazus-MH inventory contributed to a Level 2 analysis, which improved the accuracy of the risk assessment. Illinois State University also provided local assessment and campus building inventory data to estimate the actual number of buildings susceptible to damage for the risk assessment.

Essential Facilities List

Table 4-6 identifies the number of essential facilities identified at Illinois State University and the community of Normal, IL. Essential facilities are a subset of critical facilities. Appendix E include a comprehensive list of the essential facilities at Illinois State University and the community of Normal, IL and Appendix F displays a large format map of the locations of the critical facilities within the planning area.

Table 4-6. ISU and Community Essential Facilities

Facility	Number of Facilities
Student Health Centers	1
Emergency Operations Centers	1
ISU Police Department	1
Residential Housing	9
Campus Utilities	1
Healthcare Facilities*	7
Emergency Operations Centers*	1
Fire Stations*	10
Police Stations*	3
Schools*	41
Utilities*	5

*Community Essential Facilities

Facility Replacement Costs

Table 4-7 identifies facility replacement costs and total building exposure. ISU provided local assessment data for updates to replacement costs. Included are the replacement costs for the structures as well as the documented content costs.

Table 4-7. ISU's Building Exposure

General Occupancy	Estimated Total Buildings	Total Building Exposure
Educational	30	$870,184,845
Athletics/ Public Assembly	13	$204,621,544
Residential Housing	30	$289,615,721
Administrative	13	$55,202,563
Utility/Warehouse/ Garage	16	$96,201,171
Recreational	2	$56,141,489
Total:	**80**	**$1,571,967,333**

Future Development

Illinois State University is not expected to undergo any new construction at this time, but some renovation, demolition, and expansion of the campus is taking place at this time. Most of the near term expansion is expected to take place downtown Normal along the Main Street corridor.

4.3 Risk Analysis

4.3.1 GIS and Hazus-MH

The third step in the risk assessment is the risk analysis, which quantifies the risk to the population, infrastructure, and economy of the community. The hazards were quantified using GIS analyses and Hazus-MH where possible. This process reflects a Level 2 Hazus-MH analysis. A level 2 Hazus-MH analysis involves substituting selected Hazus-MH default data with local data and improving the accuracy of model predictions.

Updates to the default Hazus-MH data include:

- Updating the Hazus-MH defaults, critical facilities, and essential facilities based on the most recent available data sources.
- Reviewing, revising, and verifying locations of critical and essential point facilities with local input.
- Applying the essential facility updates (schools, medical care facilities, fire stations, police stations, and EOCs) to the Hazus-MH model data.
- Updating Hazus-MH reports of essential facility losses.

The following assumptions were made during analysis:

- Hazus-MH aggregate data was used to model the building exposure for all earthquake analyses. It is assumed that the aggregate data is an accurate representation of Illinois State University.
- The analyses were restricted to the county boundaries. Events that occur near the county boundaries do not contain damage assessments from adjacent counties.
- For each tax-assessment parcel, it is assumed there is only one building that bears all the associated values (both structure and content).
- For each parcel, it is assumed that all structures are wood-framed, one-story, slab-on-grade structures, unless otherwise stated in assessment records. These assumptions are based on sensitivity analyses of Hazus and regional knowledge.

Depending upon the analysis options and the quality of data the user inputs, Hazus-MH generates a combination of site-specific and aggregated loss estimates. Hazus-MH is not intended as a substitute for detailed engineering studies; it is intended to serve as a planning aid for communities interested in assessing their risk to flood-, earthquake-, and hurricane-related hazards. This plan does not fully document the processes and procedures completed in its development, but this documentation is available upon request. Table 4-8 indicates the analysis type (i.e. GIS, Hazus-MH, or historical records) used for each hazard assessment.

Table 4-8. Risk Assessment Tool Used for Each Hazard

Hazard	Risk Assessment Tool(s)
Tornadoes	GIS-based
Earthquakes	Hazus-MH
Severe Thunderstorm	Historical Records
Winter Storms	Historical Records
Flooding	Hazus-MH
Hazmat Release	GIS-based
Drought / Extreme Heat	Historical Records
Ground Failure	GIS-based

4.3.2 Tornado Hazard

Hazard Definition

Tornadoes are violently rotating columns of air extending from thunderstorms to the ground. Funnel clouds are rotating columns of air not in contact with the ground; however, the violently rotating column of air can reach the ground quickly and become a tornado. If the funnel cloud picks up and blows debris, it has reached the ground and is a tornado.

Tornadoes are a significant risk to Illinois and its citizens. Tornadoes most frequently occur in the afternoon, but can occur at any time on any day. The unpredictability of tornadoes makes them one of Illinois' most dangerous hazards. Tornado winds are violently destructive in developed and populated areas. A wind velocity of 200 miles per hour results in a pressure of 102.4 pounds per square foot—a load that exceeds the tolerance limits of most buildings. Thus, it is easy to understand why tornadoes can devastate the communities they hit.

Tornadoes are classified according to the Enhanced Fujita tornado intensity scale. The Enhanced Fujita scale ranges from intensity EF0, with effective wind speeds of 40 to 70 miles per hour, to EF5 tornadoes, with effective wind speeds of over 260 miles per hour. Table 4-9 outlines the Enhanced Fujita intensity scale.

Table 4-9. Enhanced Fujita Tornado Rating

Enhanced Fujita Number	Estimated Wind Speed	Path Width	Path Length	Description of Destruction
0 Gale	40-72 mph	6-17 yards	0.3-0.9 miles	Light damage, some damage to chimneys, branches broken, signboards damaged, shallow-rooted trees blown over.
1 Moderate	73-112 mph	18-55 yards	1.0-3.1 miles	Moderate damage, roof surfaces peeled off, mobile homes pushed off foundations, attached garages damaged.
2 Significant	113-157 mph	56-175 yards	3.2-9.9 miles	Considerable damage, entire roofs torn from frame houses, mobile homes demolished, boxcars pushed over, large trees snapped or uprooted.
3 Severe	158-206 mph	176-566 yards	10-31 miles	Severe damage, walls torn from well-constructed houses, trains overturned, most trees in forests uprooted, heavy cars thrown about.
4 Devastating	207-260 mph	0.3-0.9 miles	32-99 miles	Complete damage, well-constructed houses leveled, structures with weak foundations blown off for some distance, large missiles generated.
5 Incredible	261-318 mph	1.0-3.1 miles	100-315 miles	Foundations swept clean, automobiles become missiles and thrown for 100 yards or more, steel-reinforced concrete structures badly damaged.

Previous Occurrences of Tornadoes

There have been several occurrences of tornadoes in McLean County during recent decades. The National Climatic Data Center (NCDC) database reported 104 tornadoes/funnel clouds in McLean County since 1950. The most significant event occurred in May 2000, when a tornado touched down half a mile north of Shamrock. It traveled east/northeast causing minor to moderate damage to several machine sheds and barns. The most severe damage was to a two story house two miles north/northwest of Downs. The 3 to 5 year old house sustained major damage with the roof lifted off and two exterior walls caved in. Four family members sustained minor cuts and bruises. A neighboring house sustained minor damage, mainly due to flying debris from the destroyed home. Table 4-10 identifies NCDC-recorded tornadoes that caused damage (over $100,000), death, or injury in McLean County. Additional details of individual hazard events are on the NCDC website.

Table 4-10. NCDC-Recorded Tornadoes That Caused Damage (over $100,000), Death, or Injury in McLean County

Location or County*	Date	Scale	Deaths	Injuries	Property Damage
McLean County	6/04/1960	F2	0	0	$250,000
McLean County	3/04/1961	F1	0	1	$250,000
McLean County	4/30/1970	N/A	0	0	$250,000
McLean County	4/3/1974	F3	0	0	$250,000
McLean County	7/18/1977	F1	0	0	$250,000
McLean County	4/13/1981	F2	0	0	$2,500,000
McLean County	8/04/1982	F0	0	0	$250,000
McLean County	8/24/1982	F2	0	0	$2,500,000
McLean County	8/24/1982	F0	0	0	$2,500,000
McLean County	8/24/1982	F0	0	0	$2,500,000
McLean County	8/24/1982	F0	0	0	$250,000
McLean County	8/24/1982	F0	0	0	$2,500,000
McLean County	9/29/1986	F2	0	0	$2,500,000
McLean County	12/8/1991	F0	0	0	$250,000
McLean County	5/09/1995	F1	0	0	$150,000
McLean County	5/09/1995	F1	0	0	$106,000
McLean County	5/13/1995	F0	0	0	$150,000
McLean County	5/13/1995	F1	0	0	$518,000
McLean County	4/19/1996	F3	0	0	$1,000,000
McLean County	4/30/1997	F0	0	0	$100,000
McLean County	5/08/2000	F2	0	4	$175,000
		Total:	**0**	**5**	**$19,199,000**

*NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

Geographic Location for Tornado Hazard

The entire county has the same risk of tornado occurrence. Tornadoes can occur at any location within the county.

Hazard Extent for Tornado Hazard

Historical tornadoes generally moved from southwest to northeast across the county, although many other tracks are possible, from more southerly to northerly directions. The extent of the hazard varies in terms of the size of the tornado, its path, and its wind speed.

Risk Identification for Tornado Hazard

Based on historical information, the probability of future tornadoes in McLean County is highly likely. The University should expect tornadoes with varying magnitudes to occur in the future. Tornadoes ranked as the number one hazard according to the ISU Planning Team's risk assessment.

Risk Priority Index

Probability	x	Magnitude	=	RPI
4	x	3	=	12

Vulnerability Analysis for Tornado Hazard

Tornadoes can occur within any area in the county; therefore, the entire county population and all buildings are vulnerable to tornadoes. To accommodate this risk, this plan considers all buildings located within the planning area as vulnerable. Tables 4-6 and 4-7 display the existing buildings and critical infrastructure within the planning area.

Critical Facilities

All critical facilities are vulnerable to tornadoes. Critical facilities are susceptible to many of the same impacts as any other building within the planning area. These impacts vary based on the magnitude of the tornado but can include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, and loss of facility functionality (e.g., a damaged police station will no longer be able to serve the community). Table 4-6 lists the types and number of critical facilities for ISU and community and Appendix F displays a large format map of the locations of all critical facilities within the planning area.

Building Inventory

Table 4-7 lists the building exposure in terms of types and numbers of buildings for the University. The buildings within the planning area can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, and loss of building function (e.g., damaged home will no longer be habitable, causing residents to seek shelter).

Infrastructure

The types of infrastructure that could be impacted during a tornado include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is vulnerable, it is important to emphasize that any number of these structures could become damaged during a tornado. The impacts to these structures include impassable roadways, broken or failed utility lines (e.g., loss of power or gas to community), and railway failure from broken or impassable rail lines. Bridges could fail or become impassable, causing risk to motorists.

GIS-based Tornado Analysis

One tornado scenario was conducted for Illinois State University with a path through the town of Normal. The following analysis quantifies the anticipated impacts of tornadoes in the county in terms of numbers and types of buildings and infrastructure damaged.

GIS-overlay modeling was used to determine the potential impacts of an EF4 tornado. The analysis used a hypothetical path based upon the F4 tornado event that runs for 42 miles through the town of Normal. Table 4-11 depicts tornado damage curves and path widths utilized for the modeled scenario. The damage curve is based on conceptual wind speeds, path winds, and path lengths from the Enhanced-Fujita Scale guidelines.

Table 4-11. Tornado Path Widths and Damage Curves

Fujita Scale	Path Width (feet)	Maximum Expected Damage
5	2,400	100%
4	1,800	100%
3	1,200	80%
2	600	50%
1	300	10%
0	150	0%

Degrees of damage depend on proximity to the path centerline within a given tornado path. The most intense damage occurs within the center of the damage path, with decreasing amounts of damage away from the center. To model the EF4 tornado, a hypothetical tornado path was used in GIS with buffers added (damage zones) around the tornado path. Table 4-12 and Figure 4-3 illustrate the zone analysis. Figure 4-4 depicts the selected hypothetical tornado path.

Table 4-12. EF4 Tornado Zones and Damage Curves

Zone	Buffer (feet)	Damage Curve
1	0-150	100%
2	150-300	80%
3	300-600	50%
4	600-900	10%

Figure 4-3. Tornado Analysis (Damage Curves) Using GIS Buffers

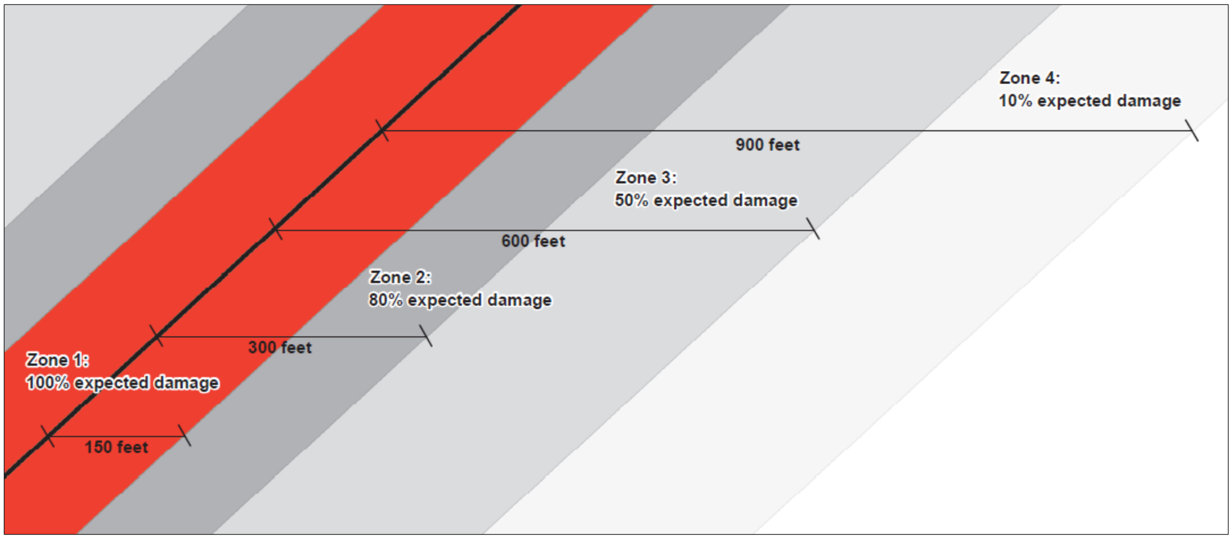
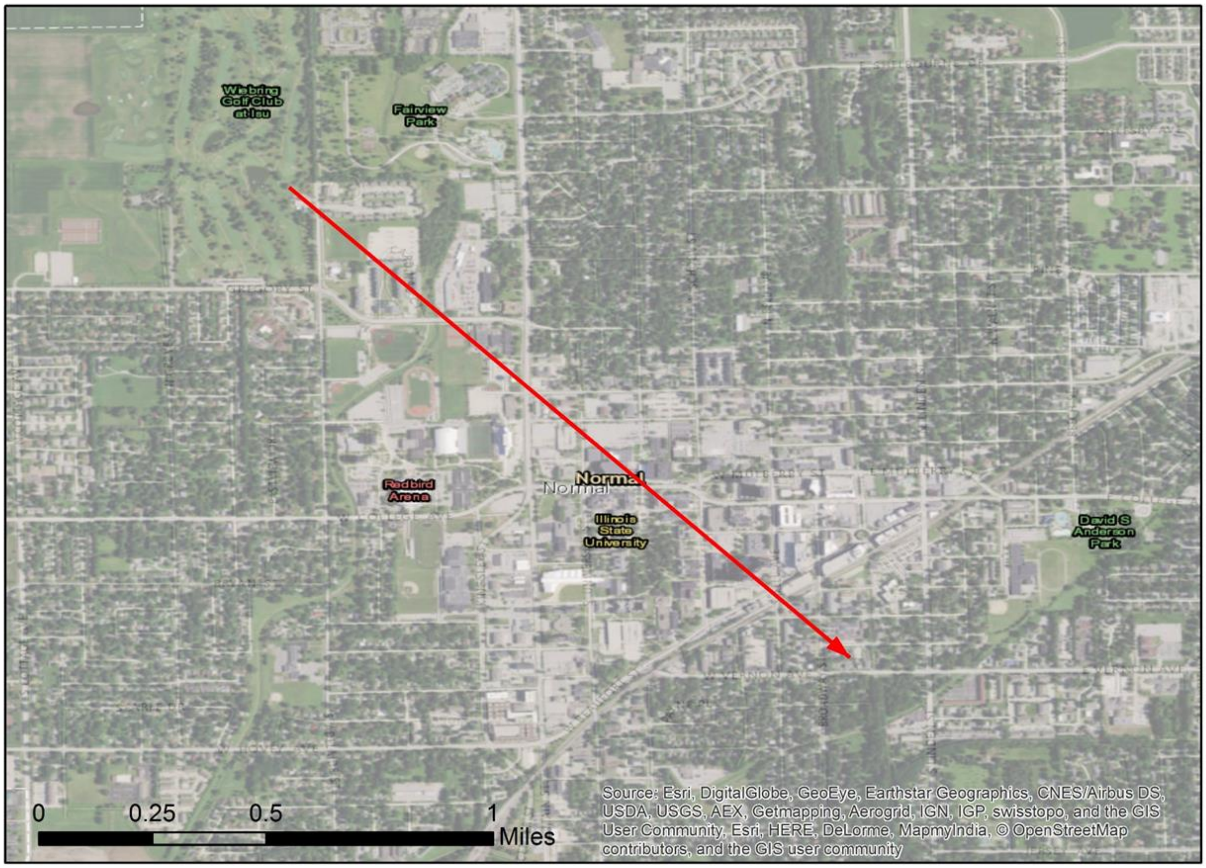


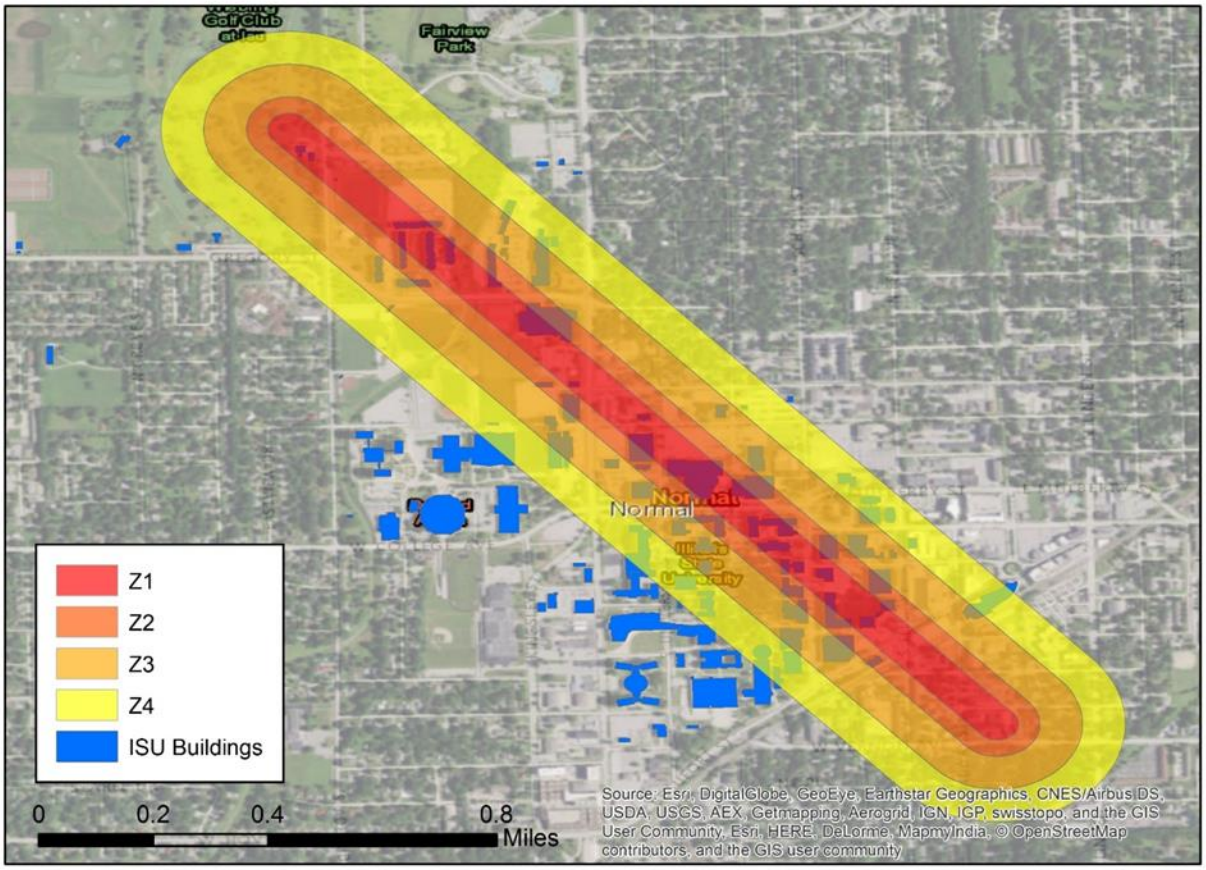
Figure 4-4. Modeled Hypothetical EF4 Tornado Track for Normal



Modeled Impacts of the EF4 Tornado

The GIS analysis estimates that the modeled EF4 tornado would damage 93 buildings, 11 of those being residence housing. The estimated building losses are $522 million. The building losses are an estimate of building replacement costs multiplied by the damage percent.

Figure 4-5. Building Inventory Affected by the EF4 Tornado Modeled for ISU



Vulnerability to Future Assets/Infrastructure for Tornado Hazard

The entire population and all buildings are at risk because tornadoes can occur anywhere within the state, at any time. Furthermore, any future development in terms of new construction within the planning area is at risk. Table 4-7 includes the building exposure for Illinois State University. All essential facilities in the planning area are at risk. Appendix E includes a list of the essential facilities for ISU and community and Appendix F displays a large format map of the locations of all critical facilities within the planning area.

Suggestions for Community Development Trends

Preparing for severe storms will be enhanced if local officials sponsor initiatives to address severe storm preparedness. It is suggested that the University should build with more sturdy construction, and existing structures may be hardened to lessen the potential impacts of severe weather. Additional warning sirens can warn the campus of approaching storms to ensure the safety of Illinois State University's faculty, staff and students and minimize property damage.

4.3.3 Winter Storm Hazard

Hazard Definition of Winter Storm Hazard

Severe winter weather consists of various forms of precipitation and weather conditions. This may include one or more of the following: freezing rain, sleet, heavy snow, blizzards, icy roadways, extreme low temperatures, and strong winds. These conditions can cause human health risks such as frostbite, hypothermia, or death and cause property damage and disrupt economic activity. Figure 4-6 shows a picture taken by the *Pantagraph* newspaper following a massive snow storm in Bloomington-Normal.

Figure 4-6. Freezing Rain Event

The Pantagraph, 12/29/15

Ice or sleet, even in small quantities, can result in hazardous driving conditions and can cause property damage. Sleet involves raindrops that freeze completely before reaching the ground. Sleet does not stick to trees and wires. Ice storms, on the other hand, involve liquid rain that falls through subfreezing air and/or onto sub-freezing surfaces, freezing on contact with those surfaces. The ice coats trees, buildings, overhead wires, and roadways, sometimes causing extensive damage.

Ice storms are some of the most damaging winter storms in Illinois. Ice storms occur when moisture-laden Gulf air converges with the northern jet stream causing freezing rain that coats power and communication lines and trees with heavy ice. Strong winds can cause the overburdened limbs and cables to snap; leaving large sectors of the population without power, heat, or communication.

Rapid accumulation of snow, often accompanied by high winds, cold temperatures, and low visibility, characterize significant snowstorms. A blizzard is categorized as a snow storm with winds of 35 miles per hour or greater and/or visibility of less than one-quarter mile for three or more hours. Strong winds during a blizzard blow falling and fallen snow, creating poor visibility and impassable roadways. Blizzards potentially result in property damage.

Blizzards repeatedly affect Illinois. Blizzard conditions cause power outages, loss of communication, and transportation difficulties. Blizzards can reduce visibility to less than one-quarter mile, and the resulting disorientation makes even travel by foot dangerous if not deadly.

Severe cold involves ambient air temperatures that drop to 0˚F or below. These extreme temperatures can increase the likelihood of frostbite and hypothermia. High winds during severe cold events can enhance the air temperature's effects. Fast winds during cold weather events can lower the wind chill factor (how cold the air feels on your skin). As a result, the time it takes for frostbite and hypothermia to affect a person's body will decrease.

Previous Occurrences of Winter Storm Hazard

The NCDC database reported 62 winter storm and extreme cold events for McLean County since 1950. The most recent reported event occurred in February 2016 when a powerful winter storm system impacted parts of central and southeast Illinois on February 24th, bringing snow and strong winds. Low pressure tracked from east Texas during the evening of February 23rd to Ohio by the evening of the 24th. This particular track focused the heaviest precipitation across east-central Illinois, mainly east of the I-55 corridor. Snowfall amounts generally ranged from 3 to 6 inches and strong northerly winds gusting as high as 45 to 55 mph created blizzard conditions for several hours. Considerable blowing and drifting snow reduced visibility to less than 1/4 mile at times, and caused numerous traffic accidents. Table 4-13 identifies NCDC-recorded winter storm events that caused damage, death, or injury in McLean County.

Table 4-13. NCDC-Recorded Winter Storms that Caused Damage, Death, or Injury in McLean County

Location or County*	Date	Deaths	Injuries	Property Damage
McLean County	01/26/97	0	1	$0
McLean County	03/08/99	0	1	$0.00
McLean County	12/01/2006	0	0	$400,000
McLean County	12/18/2008	0	0	$300,000
McLean County	01/15/2009	1	0	$0
McLean County	02/01/2011	0	0	$500,000
McLean County	12/01/2013	1	0	$0
McLean County	01/26/2014	1	0	$0
McLean County	12/28/2015	0	0	$975,000
McLean County	02/24/2016	0	0	$0
	Total:	**3**	**2**	**$2,175,000**

Geographic Location of Winter Storm Hazard

Severe winter storms are regional in nature. Most of the NCDC data are calculated regionally or in some cases statewide.

Hazard Extent of Winter Storm Hazard

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 the county.

Risk Identification of Winter Storm Hazard

Based on historical information, the probability of future winter storms in McLean County is highly likely. The University should expect winter storms with varying magnitudes to occur in the future. Winter storms ranked as the number two hazard according to the ISU Planning Team's risk assessment.

Risk Priority Index

Probability	x	Magnitude	=	RPI
4	x	2	=	8

Vulnerability Analysis of Winter Storm Hazard

Winter storm impacts are equally likely across the entire county; therefore, the entire county is vulnerable to a winter storm and can expect impacts within the affected area. To accommodate this risk, this plan considers all buildings located within the county as vulnerable. Tables 4-6 and 4-7 display the existing buildings and critical infrastructure in the planning area.

Critical Facilities

All critical facilities are vulnerable to winter storms. A critical facility will encounter many of the same impacts as other buildings within the planning area. These impacts include loss of gas or electricity from broken or damaged utility lines, damaged or impassable roads and railways, broken water pipes, and roof collapse from heavy snow. Table 4-6 lists the types and number of critical facilities for ISU and community and Appendix F displays a large format map of the locations of all critical facilities within the planning area.

Building Inventory

Table 4-7 lists the building exposure in terms of types and numbers of buildings for the entire University. The impacts to the general buildings within the planning area are similar to the damages expected to the critical facilities. These include loss of gas or electricity from broken or damaged utility lines, damaged or impassable roads and railways, broken water pipes, and roof collapse from heavy snow.

Infrastructure

During a winter storm, the types of potentially impacted infrastructure include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is vulnerable, it is important to emphasize that a winter storm could impact any structure. Potential impacts include broken gas and/or electricity lines or damaged utility lines, damaged or impassable roads and railways, and broken water pipes.

Potential Dollar Losses from Winter Storm Hazard

According to the NCDC, McLean County has incurred approximately $2.2 million in damages relating to winter storms since 1950. NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event. As a result, the potential dollar losses for a future event cannot be narrowly constrained.

Vulnerability to Future Assets/Infrastructure for Winter Storm Hazard

Any new development within the county will remain vulnerable to these events.

Suggestions for Community Development Trends

Because winter storm events are regional in nature, future development across the county will also face winter storms.

4.3.4 Hazardous Material Storage and Transportation Hazard

Hazard Definition

Illinois has numerous active transportation lines that run through many of its counties. Active railways transport harmful and volatile substances across county and state lines every day. Transporting chemicals and substances along interstate routes is commonplace in Illinois. The rural areas of Illinois have considerable agricultural commerce, meaning transportation of fertilizers, herbicides, and pesticides is common on rural roads. These factors increase the chance of hazardous material releases and spills throughout the state of Illinois.

The release or spill of certain substances can cause an explosion. Explosions result from the ignition of volatile products such as petroleum products, natural and other flammable gases, hazardous materials/chemicals, dust, and bombs. An explosion can potentially cause death, injury, and property damage. In addition, a fire routinely follows an explosion, which may cause further damage and inhibit emergency response. Emergency response may require fire, safety/law enforcement, search and rescue, and hazardous materials units.

Previous Occurrences of Hazardous Materials Storage and Transportation Hazard

Illinois State University has not experienced a significantly large-scale hazardous material incident at a fixed site or during transport resulting in deaths or serious injuries. Minor releases have put local firefighters, hazardous materials teams, emergency management, and local law enforcement into action to try to stabilize these incidents and prevent or lessen harm to the University's faculty, staff, and students.

The Illinois Emergency Management Agency maintains a comprehensive Hazardous Materials Incident Report Database for the State of Illinois. The database contains information on all Hazardous Materials Reports since 1987 but does not include an assessment of economic and property losses in terms of dollars of damage. The database reported 709 incidents in McLean County as of June 2016.

Industries regulated by The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) are required to report incidents which meet or exceed established reporting criteria. The data for reported incidents are available on the PHMSA website via the U.S. Department of Transportation Hazmat Intelligence Portal. The database reported 43,105 incidents for the State of Illinois since 2008. As of December 2017, 138 incidents were reported for McLean County.

Geographic Location of Hazardous Materials Storage and Transportation Hazard

Hazardous material hazards are countywide and are primarily associated with the transport of materials via highway, railroad, and/or river barge.

Hazard Extent of Hazardous Materials Storage and Transportation Hazard

The extent of the hazardous material hazard varies both in terms of the quantity of material being transported as well as the specific content of the container

Risk Identification of Hazardous Materials Storage and Transportation Hazard

Based on input from the ISU Planning Team, future occurrence of hazardous materials accident in the planning area is likely. According to the Risk Priority Index (RPI) and the Planning Team's input, hazardous materials storage and transportation is ranked as the number three hazard.

Risk Priority Index

Probability	x	Magnitude	=	RPI
3	x	2	=	6

Vulnerability Analysis for Hazardous Materials Storage and Transportation Hazard

The county is vulnerable to a hazardous material release and can expect impacts within the affected area. The main concern during a release or spill is the affected population. To accommodate this risk, this plan considers all buildings located within the county as vulnerable. Tables 4-6 and 4-7 display the existing buildings and critical infrastructure in the planning area.

Critical Facilities

All critical facilities and communities within the county are at risk. A critical facility will encounter many of the same impacts as any other building within the planning area. These impacts include structural failure due to fire or explosion and loss of function of the facility (e.g., a damaged police station can no longer serve the community). Table 4-6 lists the types and number of critical facilities for the entire

University and community and Appendix F displays a large format map of the locations of all critical facilities within the planning area.

Building Inventory

Table 4-7 lists the building exposure in terms of types and numbers of buildings for the entire University. The buildings within the planning area can expect similar impacts to those discussed for critical facilities. These impacts include structural failure due to fire or explosion or debris, and loss of function of the building (e.g., a person cannot inhabit a damaged home, causing residents to seek shelter).

Infrastructure

During a hazardous material release, the types of potentially impacted infrastructure include roadways, utility lines/pipes, railroads, and bridges. Since an extensive inventory of the infrastructure is not available to this plan, it is important to emphasize that a hazardous materials release could damage any number of these items. The impacts to these items include: broken, failed, or impassable roadways; broken or failed utility lines (e.g., loss of power or gas to community); and railway failure from broken or impassable railways. Bridges could become impassable causing risk to motorists.

ALOHA Hazardous Chemical Release Analysis

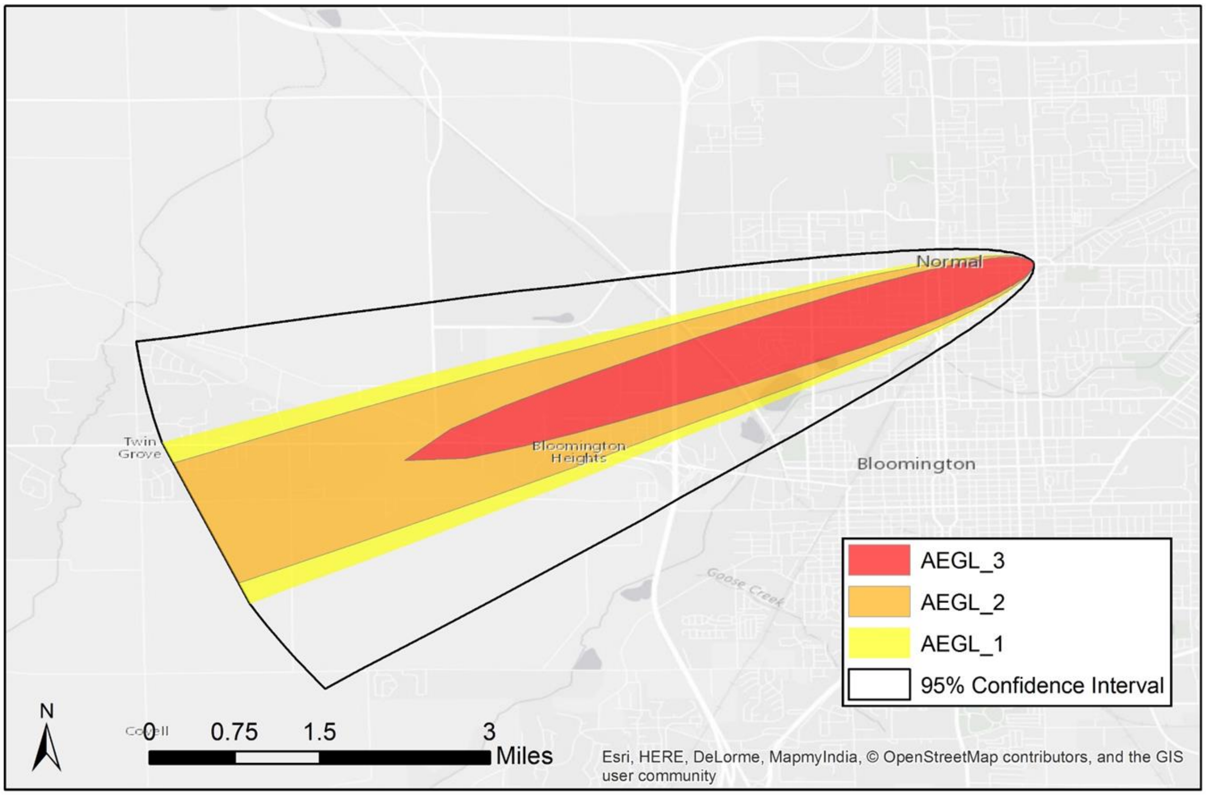
The U.S. Environmental Protection Agency's ALOHA (Areal Locations of Hazardous Atmospheres) model was used to assess the impacted area for chlorine release at the water treatment plant in Normal. The ISU Planning Team selected the scenario because bulk chemicals are transported within a relatively densely populated area and within close proximity to essential facilities.

ALOHA is a computer program designed for response to chemical accidents, as well as emergency planning and training. Ammonia, chlorine, and propane are common chemicals used in industrial operations and are found in either liquid or gas form. Rail and truck tankers haul ammonia, chlorine, and propane to and from facilities.

Chlorine is a greenish yellow gas with a pungent suffocating odor, toxic by inhalation, slightly soluble in water, liquefies at -35°C and room pressure, and readily liquefied by pressure applied at room temperature. Contact with unconfined liquid can cause frostbite by evaporative cooling. It does not burn but, like oxygen, supports combustion. Long-term inhalation of low concentrations or short-term inhalation of high concentrations has ill effects. Vapors are much heavier than air and tend to settle in low areas.

For the chlorine scenario, SIU assumed average atmospheric and climatic conditions for the fall season with a breeze from the northeast. Figures 4-7 depicts the plume origins of the modeled hazardous chemical releases in Normal, IL.

Figure 4-7. ALOHA Modeled Hazardous Chemical Plume Origin in Normal



ALOHA displays the estimated threat zones as Acute Exposure Guideline Levels (AEGL). The AEGLs are intended to describe the risk to humans resulting from once-in-a-lifetime, or rare exposure to airborne chemical (U.S. EPA AEGL Program). The National Advisory Committee for the Development of Acute Exposure Guideline Levels for Hazardous Substances (AEGL Committee) is involved in developing these guidelines to help both national and local authorities, as well as private companies, deal with emergencies involving spills, or other catastrophic exposures. AEGLs represent threshold exposure limits for the general public and are applicable to emergency exposure periods ranging from 10 minutes to 8 hours. The three AEGLs have been defined as follows:

AEGL-1: the airborne concentration, expressed as parts per million or milligrams per cubic meter (ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGL-2: the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL-3: the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

Airborne concentrations below the AEGL-1 represent exposure levels that can produce mild and progressively increasing but transient and non-disabling odor, taste, and sensory irritation or certain asymptomatic, non-sensory effects. With increasing airborne concentrations above each AEGL, there is a progressive increase in the likelihood of occurrence and the severity of effects described for each corresponding AEGL. Although the AEGL values represent threshold levels for the general public, including susceptible subpopulations, such as infants, children, the elderly, persons with asthma, and those with other illnesses, it is recognized that individuals, subject to unique or idiosyncratic responses, could experience the effects described at concentrations below the corresponding AEGL.

Analysis Parameters of the Chlorine Scenario

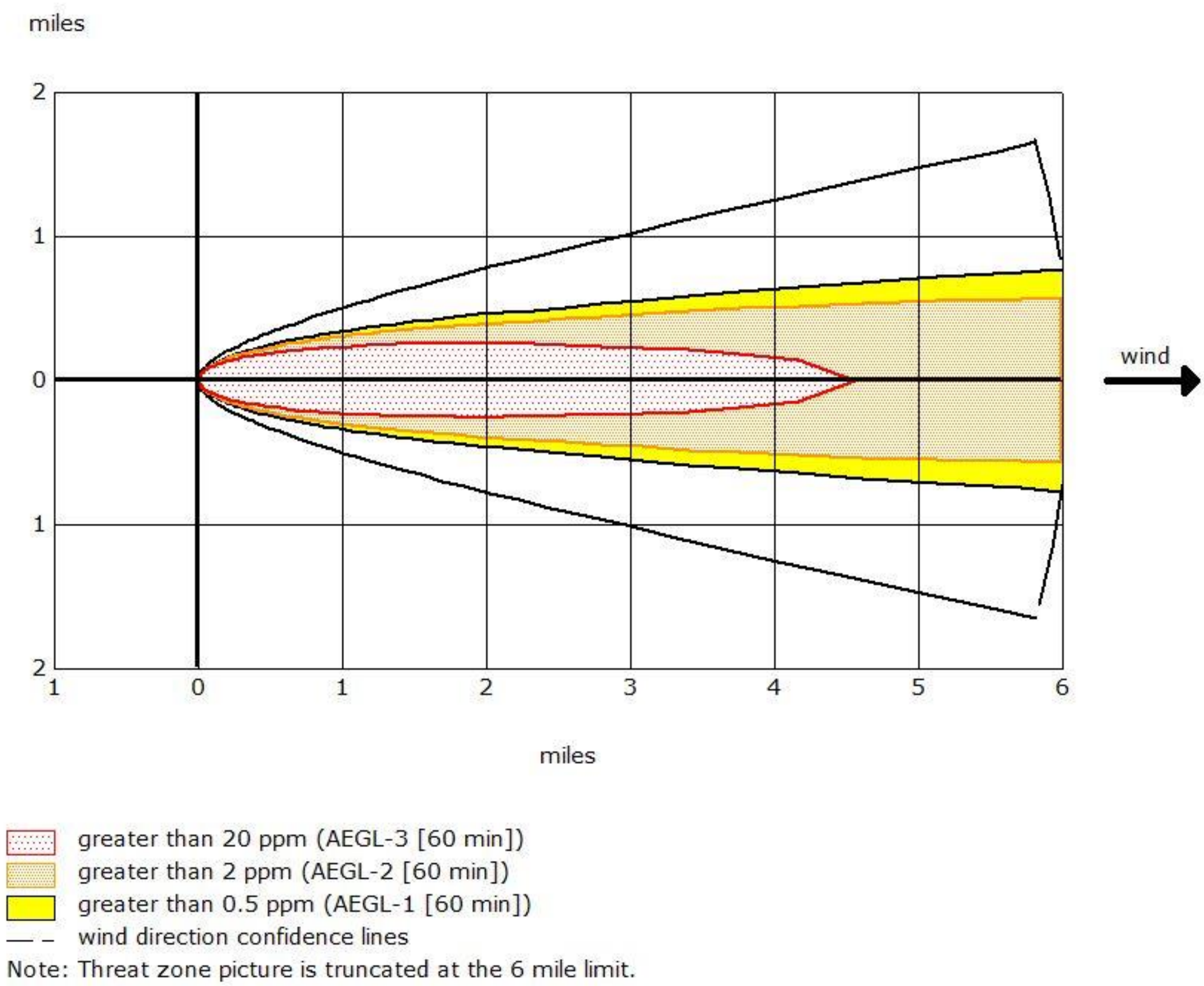
The ALOHA atmospheric modeling parameters for the chorine release, depicted in Figure 4-8, were based upon a northeasterly speed of 10 miles per hour. The temperature was 50°F with 75% humidity and a cloud cover of five-tenths skies. SIU used average weather conditions reported by NOAA for wind direction, wind speed, and temperature to simulate spring conditions. The source of the chemical spill is a horizontal, cylindrical-shaped tank. The diameter of the tank was set to 8 feet and the length set to 33 feet (12,408 gallons). At the time of its release, it was estimated that the tank was 75% full. The chlorine in this tank is in its liquid state. This release was based on a leak from a 2.5-inch-diameter hole, 12 inches above the bottom of the tank. Figure 4-8 shows the plume modeling parameters in greater detail.

Figure 4-8. ALOHA Modeling Parameters for Chlorine Release

```
SITE DATA:
  Location: NORMAL, ILLINOIS
  Building Air Exchanges Per Hour: 0.98 (unsheltered single storied)
  Time: January 30, 2017  1315 hours CST (using computer's clock)

CHEMICAL DATA:
  Chemical Name: CHLORINE                Molecular Weight: 70.91 g/mol
  AEGL-1 (60 min): 0.5 ppm   AEGL-2 (60 min): 2 ppm   AEGL-3 (60 min): 20 ppm
  IDLH: 10 ppm
  Ambient Boiling Point: -30.5° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 10 miles/hour from ENE at 10 feet
  Ground Roughness: open country         Cloud Cover: 5 tenths
  Air Temperature: 50° F                 Stability Class: D
  No Inversion Height                    Relative Humidity: 75%

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Non-flammable chemical is escaping from tank
  Tank Diameter: 8 feet                  Tank Length: 33 feet
  Tank Volume: 12,408 gallons
  Tank contains liquid                   Internal Temperature: 50° F
  Chemical Mass in Tank: 56.1 tons       Tank is 75% full
  Circular Opening Diameter: 2.5 inches
  Opening is 12 inches from tank bottom
  Release Duration: 19 minutes
  Max Average Sustained Release Rate: 8,860 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 103,972 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

THREAT ZONE:
  Model Run: Heavy Gas
  Red   : 4.6 miles --- (20 ppm = AEGL-3 [60 min])
  Orange: greater than 6 miles --- (2 ppm = AEGL-2 [60 min])
  Yellow: greater than 6 miles --- (0.5 ppm = AEGL-1 [60 min])
```

Using the parameters in Figure 4-8, approximately 8,860 pounds of material would be released per minute. The image in Figure 4-9 depicts the plume footprint generated by ALOHA. As the substance moves away from the source, the level of substance concentration decreases. Each color-coded area depicts a level of concentration measured in parts per million.

Figure 4-9. Aloha Generate Plume Footprint of Chlorine Scenario

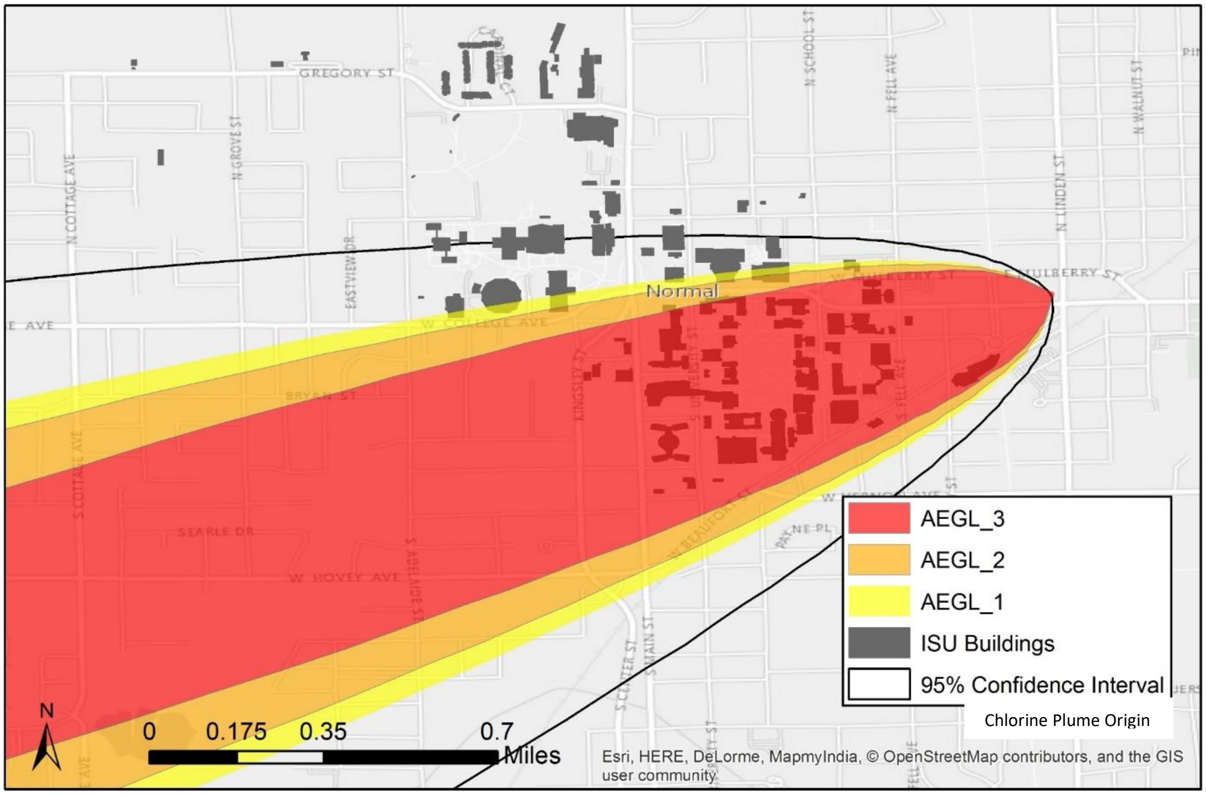


The red buffer (20 ppm) extends no more than 4.5 miles from the point of release after one hour. The orange buffer (2 ppm) and yellow buffer (0.5 ppm) extends no more than six miles from the point of release. The dashed line depicts the level of confidence within the confines of the entire plume footprint. The ALOHA model is 95% confident that the release will stay within this boundary.

Results for Chlorine Release

An estimate of property exposed to the chlorine spill was calculated by using the building inventory and intersecting these data with each of the AEGL levels (AEGL 3: ≥ 20.0 ppm, AEGL 2: ≥ 2.0 ppm and AEGL 1: ≥ 0.5 ppm). There are 68 buildings within the chlorine plume. It should be noted that the results should be interpreted as potential degrees of loss rather than exact number of buildings damaged to the chlorine release. Figure 4-10 depicts the chlorine spill footprint and location of the buildings exposed.

Figure 4-10. ALOHA Plume Footprint and Buildings Exposed to Chlorine Release



Essential Facilities Damage

There are two essential facilities within the limits of the chlorine scenario. The police and campus EOC are on the edge of the plume and could be affected. Most are located in the confines of the >2 ppm concentration level. Table 4-14 identifies the affected facilities.

Table 4-14. Essential Facilities within the Chlorine Plume Footprint

Essential Facility	Facility Name
EOC/Police	Emergency Operations Center
	University Police

Vulnerability to Future Assets/Infrastructure for Hazardous Materials Storage and Transportation Hazard

Illinois State University is not expected to undergo any physical changes to the campus at this time. However, future economic expansion is expected to take place downtown Normal along the Main Street corridor. These areas are particularly vulnerable to chemical releases because of transportation of hazardous materials.

Because the hazardous material hazard events may occur anywhere within the county, future development is impacted. The major transportation routes and the industries located in planning area pose a threat of dangerous chemicals and hazardous materials release.

4.3.5 Severe Thunderstorm Hazard

Hazard Definition

Severe thunderstorms are weather events with one or more of the following characteristics: strong winds, large and damaging hail, and frequent lightning. Severe thunderstorms most frequently occur in Illinois during the spring and summer months, but can occur at any time. A severe thunderstorm's impacts can be localized or can be widespread in nature. A thunderstorm is classified as severe when it meets one or more of the following criteria:

Hail 0.75 inches or greater in diameter

> Hail is a possible product of a strong thunderstorm. Hail usually falls near the center of a storm, but strong winds occurring at high altitudes in the thunderstorm can blow the hailstones away from the storm center, resulting in damage in other areas near the storm. Hailstones range from pea-sized to baseball-sized, and some reports note hailstones larger than softballs.

Frequent and dangerous lightning

> Lightning is a discharge of electricity from a thunderstorm. Lightning is often perceived as a minor hazard, but lightning damages many structures and kills or severely injures numerous people in the United States each year.

Wind speeds greater than or equal to 58 miles per hour

> Straight-line winds from thunderstorms are fairly common in Illinois. Straight-line winds can cause damage to homes, businesses, power lines, and agricultural areas, and may require temporary sheltering of individuals who are without power for extended periods of time.

Previous Occurrences of Thunderstorm Hazards

The National Climatic Data Center (NCDC) database reported 179 hailstorms in McLean County since 1950. Hailstorms occur nearly every year in the late spring and early summer months. The most significant event occurred in July 1994, when hail resulting in a magnitude of 1.75 inches fell in Towanda and Lexington causing $5,000 in property damage. Table 4-15 lists the significant hailstorms (such as those that cause death, damage or injury) in McLean County.

Table 4-15. Selected NCDC-Recorded Hail that Caused Damage, Death, or Injury in McLean County

Location or County*	Date	Deaths	Injuries	Property Damage
McLean County	07/06/1994	0	0	$5,000
Total:		**0**	**0**	**$5,000**

*NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

The NCDC database reported 4 lightning events in McLean County. The most recent reported event was in May 2016, when a stationary frontal boundary triggered scattered thunderstorms across central Illinois during the morning of May 26th. A few of the storms produced winds of around 60 mph and hail as large as nickels. In addition, lightning stuck a home in Normal causing considerable damage to the attic and roof. Damage was estimated at about $60,000. Table 4-16 identifies NCDC-recorded lightning that caused damage, death, or injury in McLean County.

Table 4-16. Selected NCDC-Recorded Lightning that Caused Damage, Death, or Injury in McLean County

Location or County*	Date	Deaths	Injuries	Property Damage
Bloomington	07/21/2008	0	0	$200,000
McLean County	06/18/2009	0	0	$30,000
Bloomington	09/02/2010	0	0	$50,000
Normal	05/26/2016	0	0	$60,000
	Total:	**0**	**0**	**$340,000**

*NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

The NCDC database reported 204 wind storms in McLean County. The most damaging wind event occurred in August 2012, when a vigorous upper-level disturbance interacting with an approaching cold front triggered scattered severe thunderstorms across north-central Illinois during the afternoon and early evening of August 9th. Downburst winds of 70 to 80 mph produced extensive damage across McLean County from near Danvers to just north of Heyworth. In addition to the wind damage, large hail up to the size of half dollars was reported north of Heyworth in McLean County. Table 4-17 identifies selected NCDC-recorded wind storms that caused major damage (over $40,000), death, or injury in McLean County.

Table 4-17. Selected NCDC-Recorded Wind Storms that Caused Major Damage (over $40,000), Death, or Injury in McLean County

Location or County*	Date	Deaths	Injuries	Property Damage
McLean County	04/05/1988	0	6	$0
McLean County	06/29/1998	0	0	$1,100,000
McLean County	11/10/1998	0	1	$275,000
McLean County	11/15/1988	0	2	$0
McLean County	04/20/2000	0	0	$1,100,000
McLean County	04/06/2001	0	0	$45,000
Normal	08/22/2001	0	0	$100,000
McLean County	03/13/2006	0	0	$126,000
McLean County	06/15/2008	0	1	$40,000
Bloomington	12/27/2008	0	0	$40,000
McLean County	06/18/2009	0	0	$140,000
McLean County	08/04/2009	0	0	$65,000
McLean County	10/26/2010	0	0	$40,000
McLean County	08/09/2012	0	1	$3,500,000
McLean County	11/17/2013	0	0	$200,000
Normal	11/17/2013	0	0	$225,000
Bloomington-Normal	11/17/2013	0	0	$60,000
McLean County	06/30/2014	0	0	$45,000
McLean County	07/13/2016	0	0	$40,000
Normal	07/13/2016	0	0	$90,000
McLean County	07/21/2016	0	0	$40,000
	Total:	**0**	**11**	**$7,271,000**

*NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

Geographic Location of Thunderstorm Hazard

The entire county has the same risk for occurrence of thunderstorms. They can occur at any location within the county.

Hazard Extent for Thunderstorm Hazard

The extent of the hypothetical thunderstorms depends upon the extent of the storm, the wind speed, and the size of hail stones. Thunderstorms can occur at any location within the county.

Risk Identification for Thunderstorm Hazard

Based on historical information, the occurrence of future high winds, hail, and lightning is highly likely. The University should expect high winds, hail, and lightning of widely varying magnitudes in the future. According to the ISU Planning Team's assessment, severe thunderstorms are ranked as the number four hazard.

Risk Priority Index

Probability	x	Magnitude	=	RPI
4	x	1	=	4

Vulnerability Analysis for Thunderstorm Hazard

The entire county's population and all buildings are vulnerable to a severe thunderstorm and can expect the same impacts within the affected area. To accommodate this risk, this plan considers all buildings located within the planning area as vulnerable. Tables 4-6 and 4-7 display the existing buildings and critical infrastructure in the planning area.

Critical Facilities

All critical facilities are vulnerable to severe thunderstorms. A critical facility will encounter many of the same impacts as any other building within the planning area. These impacts include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, fires caused by lightning, and loss of building functionality (e.g., a damaged police station cannot serve the community). Table 4-6 lists the types and number of critical facilities for the entire University and community and Appendix F displays a large format map of the locations of all critical facilities within the planning area.

Building Inventory

Table 4-7 lists the building exposure in terms of types and numbers of buildings for the entire University. The buildings within the planning area can expect impacts similar to those discussed for critical facilities. These impacts include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, fires caused by lightning, and loss of building functionality (e.g., a person cannot inhabit a damaged home, causing residents to seek shelter).

Infrastructure

A severe thunderstorm could impact roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is vulnerable, it is important to emphasize that a severe thunderstorm could damage any number of these structures. The impacts to these structures include impassable roadways;

broken or failed utility lines (e.g., loss of power or gas to community; or impassable railways). Bridges could become impassable causing risk to motorists.

Potential Dollar Losses from Thunderstorm Hazard

According to the NCDC McLean County has incurred approximately $6.7 million in damages relating to thunderstorms, including hail, lightning, and high winds since 1950. NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event. As a result, the potential dollar losses for a future event cannot be narrowly constrained; however, based on average property damage in the past decade, SIU estimates that McLean County incurs property damages of approximately $1.7 million per year related to severe thunderstorms.

Vulnerability to Future Assets/Infrastructure for Thunderstorm Hazard

All future development within the county and all communities will remain vulnerable to severe thunderstorm events.

Suggestions for University/Community Development Trends

Local officials should enhance severe storm preparedness but they sponsor a wide range of programs and initiatives to address the overall safety of faculty, staff, students, and community residents. It is suggested that the University should build new structures with more sturdy construction, and harden existing structures to lessen the potential impacts of severe weather. Additional warning sirens can warn the University and community of approaching storms to ensure the safety of faculty, staff, students, and community residents.

4.3.6 Drought and Extreme Heat Hazard

Hazard Definition for Drought Hazard

Drought is a normal climatic phenomenon that can occur across the state of Illinois and within McLean County. The meteorological condition that creates a drought is below-normal rainfall over a sustained period of time. Excessive heat can lead to increased evaporation, which enhances drought conditions. Droughts can occur in any month. Drought differs from normal arid conditions found in low-rainfall areas. Drought is the consequence of a reduction in the amount of precipitation over an undetermined length of time (usually a growing season or longer).

The severity of a drought depends on location, duration, and geographical extent. Additionally, drought severity depends on the water supply, usage demands by human activities, vegetation, and agricultural operations. Droughts will affect the quality and quantity of crops, livestock, and other agricultural assets. Droughts 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 exceed the average high for the area by 10°F or more for the last for several weeks. Such extreme heat can have severe implications for humans. Below are common terms associated with extreme heat:

Heat Wave
Prolonged period of excessive heat often combined with excessive humidity.

Heat Index
A number, in degrees Fahrenheit, which estimates how hot it feels when relative humidity is added to air temperature. Exposure to full sunshine can increase the heat index by 15°F.

Heat Cramps
Muscular pains and spasms due to heavy exertion. Although heat cramps are the least severe, they are often the first signal that the body is having trouble with heat.

Heat Exhaustion
Typically occurs when people exercise heavily or work in a hot, humid place where body fluids are lost through heavy sweating. Blood flow to the skin increases, causing blood flow to decrease to the vital organs, resulting in a form of mild shock. If left untreated, the victim's condition will worsen. Body temperature will continue to rise, and the victim may suffer heat stroke.

Heat and Sun Stroke
A life-threatening condition. The victim's temperature control system, which produces sweat to cool the body, stops working. The body's temperature can rise so high that brain damage and death may result if the body is not cooled quickly.

Previous Occurrences for Drought and Extreme Heat

The NCDC database reported 21 drought/heat wave events in McLean County since 1950. The most recent event occurred in August 2014 when a large upper-level ridge of high pressure built into the Midwest from August 22nd through August 26th, causing afternoon high temperatures to soar into the 90s. The hot temperatures combined with high relative humidity to produce heat index values in excess of 100 degrees. As a result, heat advisories were posted along and north of I-74, with an Excessive Heat Warning in effect further south across the remainder of south-central and southeast Illinois. One person died in northern McLean County due to prolonged heat exposure. Table 4-18 identifies NCDC-recorded drought/heat wave events that caused major damage, death, or injury in McLean County.

Table 4-18. NCDC-recorded Extreme Heat Events that caused Death, Damage or Injury in McLean County

Location or County	Date	Deaths	Injuries	Property Damage	Crop Damage
McLean County	07/26/1997	1	0	$0	$0
McLean County	08/19/2005	1	0	$0	$0
McLean County	06/06/2011	1	0	$0	$0
McLean County	09/01/2012	0	0	0	$65,500,000
McLean County	08/25/2014	1	0	$0	$0
	Total:	**4**	**0**	**$0**	**$65,500,000**

Geographic Location for Drought and Extreme Heat

Droughts are regional in nature. Most areas of the United States are vulnerable to the risk of drought and extreme heat.

Hazard Extent for Drought and Extreme Heat

The extent of droughts or extreme heat varies both depending on the magnitude and duration of the heat and the range of precipitation.

Risk Identification for Drought and/or Extreme Heat

Based on historical information, the occurrence of future droughts and/or prolonged extreme heat is possible. Illinois State University should expect extreme heat and prolonged periods of less than average rainfall in the future. According to the Illinois State University Planning Team's assessment, drought and/or extreme heat are ranked as the number five hazard.

Risk Priority Index

Probability	x	Magnitude	=	RPI
2	x	2	=	4

Vulnerability Analysis for Drought and Extreme Heat

Drought and extreme heat are a potential threat across the entire county; therefore, the county is vulnerable to this hazard and can expect impacts within the affected area. According to FEMA, approximately 175 Americans die each year from extreme heat. Young children, elderly, and hospitalized populations have the greatest risk. The entire population and all buildings are at risk. To accommodate this risk, this plan considers all buildings located within the planning area as vulnerable. Tables 4-6 and 4-7 display the existing buildings and critical infrastructure in the planning area. Even though the exact areas affected are not known, a discussion of the potential impact are detailed below.

Critical Facilities

All critical facilities are vulnerable to drought. A critical facility will encounter many of the same impacts as any other building within the planning area, which should involve little or no damage. Potential impacts include water shortages, fires as a result of drought conditions, and residents in need of medical care from the heat and dry weather. Table 4-6 lists the types and number of critical facilities for the University and community and Appendix F displays a large format map of the locations of all critical facilities within the planning area.

Building Inventory

Table 4-7 lists the building exposure in terms of types and numbers of buildings for the entire University. The buildings within the planning area can expect similar impacts to those discussed for critical facilities. These impacts include water shortages, fires as a result of drought conditions, and residents in need of medical care from the heat and dry weather.

Infrastructure

During a drought, the risk to these structures is primarily associated with fire, which could result from hot, dry conditions.

Potential Dollar Losses from Drought and Extreme Heat

According to the NCDC, McLean County has experienced $65.5 million in crop damages relating to drought and extreme heat events storms since 1950. NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event. As a result, the potential dollar losses for a future event cannot be reliably constrained.

Vulnerability to Future Assets/Infrastructure from Drought/Extreme Heat Hazard

Future development will remain vulnerable to droughts. Typically, some urban and rural areas are more susceptible than others. For example, urban areas are subject to water shortages during periods of drought. Excessive demands of densely populated areas put a limit on water resources. In rural areas, crops and livestock may suffer from extended periods of heat and drought. Dry conditions can lead to the ignition of wildfires that could threaten residential, commercial, and recreational areas.

Suggestion of Community Development Trends

Because droughts and extreme heat are regional in nature, future development is susceptible to drought. Although urban and rural areas are equally vulnerable to this hazard, those living in urban areas may have a greater risk from the effects of a prolonged heat wave. The atmospheric conditions that create extreme heat tend to trap pollutants in urban areas, adding contaminated air to the excessively hot temperatures and creating increased health problems. Furthermore, asphalt and concrete store heat longer, gradually releasing it at night and producing high nighttime temperatures. This phenomenon is known as the “urban heat island effect.”

Local officials should address drought and extreme heat hazards by educating the public on steps to take before and during the event—for example, temporary window reflectors to direct heat back outside, staying indoors as much as possible, and avoiding strenuous work during the warmest part of the day.

4.3.7 Earthquake Hazard

Hazard Definition for Earthquake Hazard

An earthquake is the shaking of the earth caused by the energy released when large blocks of rock slip past each other in the earth’s crust. Most earthquakes occur at tectonic plate boundaries; however, some earthquakes occur in the middle of plates, for example the New Madrid Seismic Zone or the Wabash Valley Fault System. Both of these seismic areas have a geologic history of strong quakes, and an earthquake from either seismic area could possibly affect Illinois counties. There may be other, currently unidentified faults in the Midwest also capable of producing strong earthquakes.

Strong earthquakes can collapse buildings and infrastructure, disrupt utilities, and trigger landslides, avalanches, flash floods, fires, and tsunamis. When an earthquake occurs in a populated area, it may cause death, injury, and extensive property damage. An earthquake might damage essential facilities, such as fire departments, police departments, and hospitals, disrupting emergency response services in the affected area. Strong earthquakes may also require mass relocation; however, relocation may be impossible in the short-term aftermath of a significant event due to damaged transportation infrastructure and public communication systems.

Earthquakes are usually measured by two criteria: intensity and magnitude (M). Earthquake intensity qualitatively measures the strength of shaking produced by an earthquake at a certain location and is determined from effects on people, structures, and the natural environment. Earthquake magnitude quantitatively measures the energy released at the earthquake’s subsurface source in the crust, or epicenter. Table 4-19 provides a comparison of magnitude and intensity, and Table 4-20 provides qualitative descriptions of intensity, for a sense of what a given magnitude might feel like.

Table 4-29. Comparison of Earthquake Magnitude and Intensity

Magnitude (M)	Typical Maximum Modified Mercalli Intensity
1.0 – 3.0	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 and higher	VIII or higher

Table 4-20. Abbreviated Modified Mercalli Intensity Scale

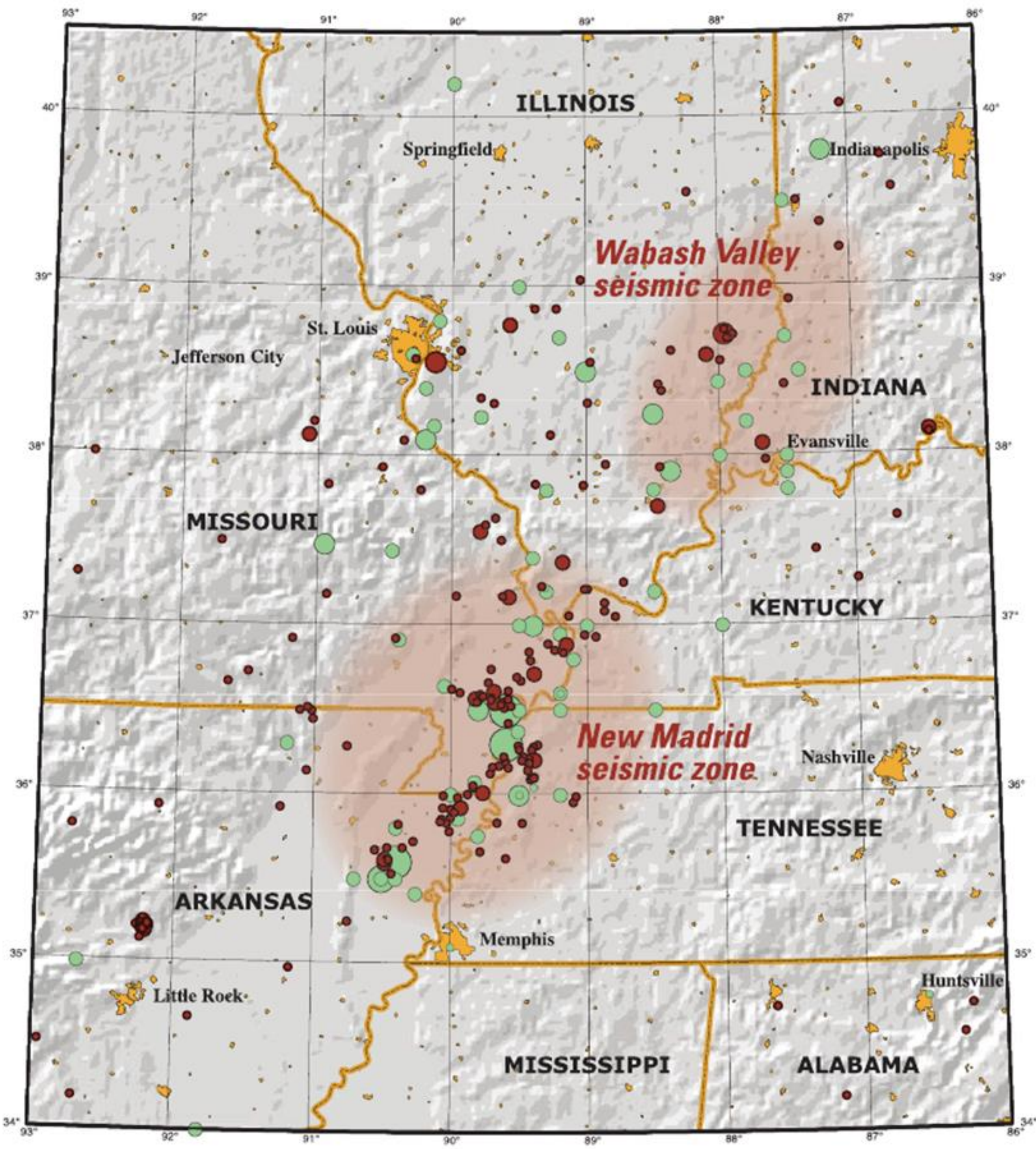
Mercalli Intensity	Description
I	Not felt except by a very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motorcars 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 heavy truck striking building. Standing motorcars 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 to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, and 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.

Previous Occurrences for Earthquakes

Historically, the most significant seismic activity in Illinois is associated with New Madrid Seismic Zone. The New Madrid Seismic Zone produced three large earthquakes in the central U.S. with magnitudes estimated between 7.0 and 7.7 on December 16, 1811, January 23, 1812, and February 7, 1812. These earthquakes caused violent ground cracking and geyser-like eruptions of sediment (sand blows) over an area >10,500 km^2, and uplifted a 50 km by 23 km zone (the Lake County uplift). The shaking was felt over a total area of over 10 million km^2 (the largest felt area of any historic earthquake). The United States Geological Survey (USGS) and the Center for Earthquake Research and Information (CERI) at the University of Memphis estimate the probability of a repeat of the 1811-1812 type earthquakes (M7.5-8.0) is 7%-10% over the next 50 years (USGS Fact Sheet 2006-3125).

Earthquakes measured in Illinois typically vary in magnitude from microseismic events of M=1.3 to larger events up to M=5.4. Figure 4-11 depicts the location of notable earthquakes in the Illinois region. The most recent earthquake in Illinois larger than M3.0—as of the date of this report—was a M3.8 event in September 2017, approximately 12km ENE of Albion, Illinois in Edwards County. The last earthquake in Illinois to cause minor damage occurred on April 18, 2008 near Mt. Carmel, IL and measured 5.2 in magnitude. Earthquakes resulting in more serious damage have occurred about every 70 to 90 years and are historically concentrated in southern Illinois.

Figure 4-11. Notable Earthquakes in Illinois with Geologic and Earthquake Epicenters in McLean County

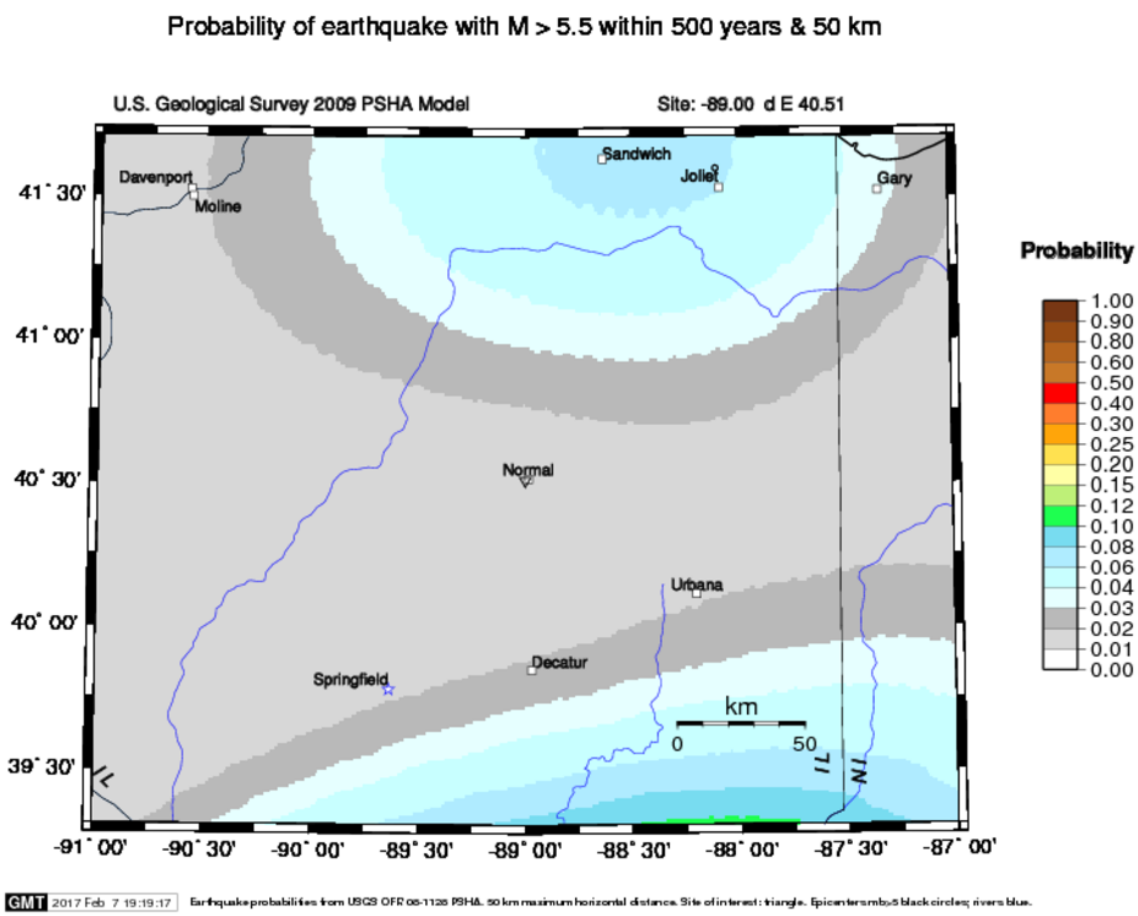


Geographic Location for Earthquake Hazard

Since 1974, the epicenter of one small earthquake (M2.0-M2.9) has been recorded in McLean County. Some the of this local seismic activity has been focused along and near the large fault zones such as the Cottage Grove Fault System and other smaller faults such St. Genevieve Fault Zone, Pomona Fault and Dowel Fault. The seismogenic potential of these structures is unknown, and the geologic mechanism related to the minor earthquakes is poorly understood.

The two most significant zones of seismic activity in Illinois are the New Madrid Seismic Zone and the Wabash Valley Fault System. Return periods for large earthquakes within the New Madrid System are estimated to be ~500–1000 years; moderate quakes between magnitude 5.5 and 6.0 can recur within approximately 150 years or less. The Wabash Valley Fault System extends nearly the entire length of southern Illinois and has the potential to generate an earthquake of sufficient strength to cause damage between St. Louis, MO and Indianapolis, IN. While large earthquakes (>M7.0) experienced during the New Madrid Events of 1811 and 1812 are unlikely in McLean County, moderate earthquakes (≤ 6.0M) in or in the vicinity of the planning area are probable. The USGS estimates the probability of a moderate M5.5 earthquake occurring in McLean County within the next 500-years at approximately 1-2% (see Figure 4-12).

Figure 4-12. Probability of M5.5 Earthquake occurring in Central Illinois within the next 500 years



Hazard Extent for Earthquake Hazard

Earthquake effects are possible anywhere in McLean County. One of the most critical sources of information that is required for accurate assessment of earthquake risk is soils data. The National Earthquake Hazards Reduction Program (NEHRP) compliant soils map was provided by FEMA for the analysis. This map identifies the soils most susceptible to failure.

Risk Identification for Earthquake Hazard

Based on historical information and current USGS and SIU research and studies, future earthquakes in planning area are possible, but large (>M7.0) earthquakes that cause catastrophic damage are unlikely. According to the Illinois State University Planning Team's assessment, earthquakes are ranked as the number seven hazard.

Risk Priority Index

Probability	x	Magnitude	=	RPI
2	x	1	=	2

Vulnerability Analysis for Earthquake Hazard

Earthquakes could impact the entire county equally; therefore, the entire county's population and all buildings are vulnerable to an earthquake. To accommodate this risk, this plan considers all buildings located within the planning area as vulnerable. Tables 4-6 and 4-7 display the existing buildings and critical infrastructure in the planning area.

Critical Facilities

All critical facilities are vulnerable to earthquakes. Critical facilities are susceptible to many of the same impacts as any other building within the planning area. These impacts include structural failure and loss of facility functionality (e.g., a damaged police station will no longer be able to serve the community). Table 4-6 lists the types and number of essential facilities for Illinois State University and community and Appendix F displays a large format map of the locations of all critical facilities within the planning area.

Building Inventory

Table 4-7 lists the building exposure in terms of types and numbers of buildings for Illinois State University. The buildings within the planning area can expect similar impacts to those discussed for critical facilities. These impacts include structural failure and loss of building function which could result in indirect impacts (e.g., damaged homes will no longer be habitable causing residents to seek shelter).

Infrastructure

During an earthquake, the types of infrastructure that shaking could impact include roadways, utility lines/pipes, railroads, and bridges. Since an extensive inventory of the infrastructure was not available for use in the earthquake models, it is important to emphasize that any number of these items could become damaged in the event of an earthquake. The impacts to these items include broken, failed, or impassable roadways, broken or failed utility lines (e.g., loss of power or gas to community), and railway failure from broken or impassable railways. Bridges could also fail or become impassable, causing risk to motorists.

Hazus-MH Earthquake Analyses

Existing geological information was reviewed prior to the Planning Team's selection of earthquake scenarios. A Magnitude 5.5 arbitrary earthquake scenario was performed to provide a reasonable basis for earthquake planning in the county. The other two scenarios included a Magnitude of 7.7 with the epicenter located on the New Madrid Fault Zone and a Magnitude 7.1 with the epicenter located on the Wabash Fault Zone.

The earthquake-loss analysis for the probabilistic scenario was based on ground-shaking parameters derived from U.S. Geological Survey probabilistic seismic hazard curves for the earthquake with the 500-year return period. This scenario evaluates the average impacts of a multitude of possible earthquake epicenters with a magnitude typical of that expected for a 500-year return period. The New Madrid Fault Zone runs along the Mississippi River through Arkansas, Tennessee, Missouri, Kentucky and Southern Illinois. The Wabash Valley Fault Zone runs through Southeastern Illinois, Western Kentucky and Southwest Indiana. This represents a realistic scenario for planning purposes.

The earthquake hazard modeling scenarios performed:

- Magnitude 5.5 arbitrary earthquake epicenter in McLean County
- Magnitude 7.7 event along the New Madrid Fault Zone
- Magnitude 7.1 event along the Wabash Valley Fault Zone

This report presents two types of building losses: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those displaced from their homes because of the earthquake.

Results for M5.5 Earthquake Scenario

The results of the M5.5 arbitrary earthquake scenario are depicted in Tables 4-21 and 4-22. Hazus-MH estimates that approximately 430 buildings will be at least moderately damaged. This is over 1% of the total number of buildings in the region. It is estimated that 3 buildings would be damaged beyond repair.

The total building-related losses are approximately $31.41 million dollars. It is estimated that 27% of the losses are related to the business interruption of the region. The largest loss is sustained by the residential occupancies which make up over 65% of the total loss.

Table 4-21. M5.5 Earthquake Damage Estimates by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	426	0.76	17	1.32	7	1.73	1	2.16	0	1.17
Commercial	2,701	4.82	102	7.82	35	9.05	5	11.11	0	7.05
Educational	129	0.23	5	0.37	2	0.45	0	0.54	0	0.55
Government	86	0.15	3	0.21	1	0.24	0	0.27	0	0.27
Industrial	622	1.11	23	1.80	8	2.14	1	2.61	0	1.45
Other Residential	6,131	10.94	258	19.86	87	22.64	4	9.50	0	6.27
Religion	291	0.52	10	0.80	4	1.02	1	1.29	0	1.10
Single Family	45,645	81.46	881	67.81	241	62.73	31	72.52	3	82.14
Total:	**56,031**		**1,299**		**384**		**43**		**4**	

Table 4-22. M5.5 Earthquake Estimates of Building Economic Losses (in Millions of Dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Other	Total
Income Losses	Wage	0.00	0.15	1.23	0.03	0.16	1.57
	Capital-Related	0.00	0.06	1.08	0.02	0.04	1.21
	Rental	0.54	0.70	0.66	0.01	0.05	1.97
	Relocation	1.87	0.42	0.92	0.07	0.49	3.79
	Subtotal:	**2.41**	**1.35**	**3.89**	**0.13**	**0.75**	**8.53**
Capital Stock Losses	Structural	3.75	1.33	1.48	0.21	0.60	7.37
	Non-Structural	7.02	2.88	1.87	0.25	0.84	12.87
	Content	1.14	0.41	0.62	0.13	0.29	2.60
	Inventory	0.00	0.00	0.02	0.02	0.00	0.04
	Subtotal:	**11.92**	**4.62**	**3.99**	**0.62**	**1.74**	**22.88**
	Total:	**14.33**	**5.96**	**7.89**	**0.75**	**2.49**	**31.41**

Results for M7.7 New Madrid Earthquake

The results of the M7.7 New Madrid earthquake scenario are depicted in Tables 4-23 and 4-24. Hazus-MH estimates that approximately 62 buildings will be at least moderately damaged. It is estimated that zero buildings would be damaged beyond repair.

The total building-related losses are approximately $19.29 million dollars. It is estimated that 6% of the losses are related to the business interruption of the region. The largest loss is sustained by the residential occupancies which make up over 61% of the total loss.

Table 4-23. New Madrid M7.7 Earthquake Damage Estimates by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	440	0.77	10	1.36	1	1.86	0	2.12	0	0.00
Commercial	2,779	4.88	57	7.74	6	9.99	0	11.42	0	0.00
Educational	133	0.23	3	0.41	0	0.43	0	0.58	0	0.00
Government	88	0.15	2	0.26	0	0.30	0	0.37	0	0.00
Industrial	640	1.12	13	1.80	2	2.42	0	2.64	0	0.00
Other Residential	6,210	10.90	248	33.85	23	36.52	0	6.32	0	0.00
Religion	299	0.53	6	0.81	1	0.93	0	1.26	0	0.00
Single Family	46,377	81.41	394	53.79	29	47.55	1	75.30	0	0.00
Total:	**56,966**		**732**		**62**		**1**		**0**	

Table 4-24. New Madrid M7.7 Earthquake Estimates of Building Economic Losses (in Millions of Dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Other	Total
Income Losses	Wage	0.00	0.01	0.20	0.01	0.05	0.26
	Capital-Related	0.00	0.00	0.18	0.00	0.01	0.20
	Rental	0.07	0.11	0.16	0.00	0.01	0.35
	Relocation	0.17	0.06	0.12	0.01	0.06	0.43
	Subtotal:	**0.24**	**0.19**	**0.65**	**0.02**	**0.13**	**1.23**
Capital Stock Losses	Structural	0.71	0.29	0.32	0.05	0.12	1.51
	Non-Structural	4.62	2.08	2.19	0.52	0.78	10.19
	Content	2.79	0.78	1.62	0.36	0.68	6.24
	Inventory	0.00	0.00	0.04	0.06	0.01	0.12
	Subtotal:	**8.13**	**3.16**	**4.19**	**0.99**	**1.60**	**18.06**
	Total:	**8.37**	**3.34**	**4.84**	**1.01**	**1.72**	**19.29**

Results M7.1 Magnitude Wabash Valley Earthquake – General Building Stock

The results of the Wabash Valley M7.1 earthquake scenario are depicted in Tables 4-25 and 4-26. Hazus-MH estimates that approximately 70 buildings will be at least moderately damaged. Zero buildings would be damaged beyond repair.

The total building-related losses are approximately $11.34 million dollars. It is estimated that 10% of the losses are related to the business interruption of the region. The largest loss is sustained by the residential occupancies which make up over 63% of the total loss.

Table 4-25. Wabash Valley 7.1 Magnitude Earthquake Damage Estimates by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	434	0.76	13	2.30	3	5.05	0	7.82	0	3.37
Commercial	2,788	4.88	46	7.88	8	11.52	0	13.93	0	7.35
Educational	133	0.23	3	0.43	0	0.59	0	0.69	0	0.80
Government	88	0.15	2	0.35	0	0.57	0	0.72	0	0.74
Industrial	644	1.13	9	1.61	2	2.23	0	2.38	0	1.06
Other Residential	6,359	11.14	110	18.84	11	16.08	0	3.71	0	1.12
Religion	300	0.53	5	0.84	1	1.11	0	1.28	0	1.08
Single Family	46,361	81.18	395	67.74	43	62.86	1	69.27	0	84.49
Total:	**57,107**		**583**		**69**		**2**		**0**	

Table 4-26. Wabash 7.1 Magnitude Earthquake Estimates of Building Economic Losses (in Millions of Dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Other	Total
Income Losses	Wage	0.00	0.01	0.17	0.00	0.05	0.23
	Capital-Related	0.00	0.00	0.16	0.00	0.01	0.17
	Rental	0.09	0.06	0.12	0.00	0.01	0.28
	Relocation	0.25	0.03	0.11	0.01	0.06	0.47
	Subtotal:	**0.34**	**0.10**	**0.55**	**0.02**	**0.13**	**1.14**
Capital Stock Losses	Structural	0.77	0.16	0.24	0.03	0.15	1.36
	Non-Structural	2.93	1.04	1.10	0.24	0.43	5.75
	Content	1.37	0.38	0.76	0.17	0.36	3.04
	Inventory	0.00	0.00	0.02	0.03	0.01	0.06
	Subtotal:	**5.06**	**1.59**	**2.12**	**0.47**	**0.96**	**10.20**
	Total:	**5.40**	**1.69**	**2.68**	**0.49**	**1.09**	**11.34**

Vulnerability to Future Assets/Infrastructure for Earthquake Hazard

New construction, especially critical facilities, should accommodate earthquake mitigation design standards.

Suggestions for Community Development Trends

Community development should occur outside of the low-lying areas in floodplains with a water table within five feet of grade that is susceptible to liquefaction. It is important to harden and protect future and existing structures against the possible termination of public services and systems including power lines, water and sanitary lines, and public communication.

4.3.8 Flooding Hazard

Hazard Definition for Flooding

Flooding is a significant natural hazard throughout the United States. The type, magnitude, and severity of flooding are functions of the magnitude and distribution of precipitation over a given area, the rate at which precipitation infiltrates the ground, the geometry and hydrology of the catchment, and flow dynamics and conditions in and along the river channel. Floods are classified as one of two types in this plan: upstream floods or downstream floods. Both types of floods are common in Illinois.

Upstream floods, also called flash floods, occur in the upper parts of drainage basins and are generally characterized by periods of intense rainfall over a short duration. These floods arise with very little warning and often result in locally intense damage, and sometimes loss of life, due to the high energy of the flowing water. Flood waters can snap trees, topple buildings, and easily move large boulders or other structures. Six inches of rushing water can upend a person; 24 inches might carry off a car. Generally, upstream floods cause severe damage over relatively localized areas. Urban flooding is a type of upstream flood. Urban flooding involves the overflow of storm drain systems and can result from inadequate drainage combined with heavy rainfall or rapid snowmelt. Upstream or flash floods can occur at any time of the year in Illinois, but they are most common in the spring and summer months.

Downstream floods, sometimes called riverine floods, refer to floods on large rivers at locations with large upstream catchments. Downstream floods are typically associated with precipitation events that are of relatively long duration and occur over large areas. Flooding on small tributary streams may be limited, but the contribution of increased runoff may result in a large flood downstream. The lag time between precipitation and time of the flood peak is much longer for downstream floods than for upstream floods, generally providing ample warning for people to move to safe locations and, to some extent, secure some property against damage. Riverine flooding on the large rivers of Illinois generally occurs during either the spring or summer.

<u>Previous Occurrences of Flooding</u>

The NCDC database reported 26 flooding events in McLean County. The most damaging event occurred in July 2015, when light to moderate rain fell across central Illinois throughout the day on July 8th. As an area of low pressure tracked northward through the area, pockets of heavy rain developed during the evening hours. Excessive rainfall rates of 1 to 2 inches per hour created flash flooding across portions of central and eastern McLean County, as well as northern Champaign County. The Bloomington Airport reported a 24-hour rainfall total for the day of 4.42 inches, with most of the rain falling in a 2 to 3 hour time frame in the evening. As a result, widespread street flooding occurred across Bloomington-Normal, with several roads closed and cars stalled in high water. Farther east, a few roads were closed due to water flowing across them in northern Champaign County. Table 4-27 identifies NCDC-recorded flooding events that caused major damage, death, or injury in McLean County.

Table 4-27. NCDC-recorded Flooding Events that caused Death, Damage (over $35,000) or Injury in McLean County

Location or County*	Date	Deaths	Injuries	Property Damage
McLean	09/13/2008	0	0	$35,000
McLean	07/08/2015	0	0	$500,000
Total:		**0**	**0**	**$535,000**

*NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

There are several structures in McLean County that have experienced repetitive losses due to flooding. FEMA defines a repetitive loss structure as a structure covered by a contract of flood insurance issued under the NFIP that has suffered flood loss damage on two or more occasions during a 10-year period that ends on the date of the second loss, in which the cost to repair the flood damage is ≥ 25% of the market value of the structure at the time of each flood loss.

The Illinois Emergency Management Agency and Illinois Department of Natural Resources were contacted to determine the location of repetitive loss structures in McLean County. Records indicate that there are 14 repetitive loss structures within the county. The total amount paid for building replacement and building contents for damage to these repetitive loss structures is $463,948. Table 4-28 describes the repetitive loss structures for each jurisdiction.

Table 4-28. Repetitive Loss Structures for each Jurisdiction in McLean County

Jurisdiction	Number of Properties	Number of Losses	Total Paid
Bloomington	5	10	$181,546
Heyworth	1	3	$81,896
Hudson	1	2	$7,461
Leroy	1	2	$14,782
McLean County	2	4	$146,944
McLean Village	1	2	$11,540
Normal	2	5	$10,535
Towanda	1	2	$9,244
Total	**14**	**30**	**$463,948**

Geographic Location of Flooding

Most riverine flooding in Illinois occurs during either the spring or summer and is the result of excessive rainfall and/or the combination of rainfall and snowmelt. Flash flooding of low-lying areas in Illinois can occur during any time of the year, but tends to be less frequent and more localized between mid-summer and early winter. Figure 4-13 depicts flash flooding along a major underpass in Normal.

Figure 4-13. Flooding under the Kingsley Street railroad underpasses in Normal

The Pantagraph, November 17, 2013

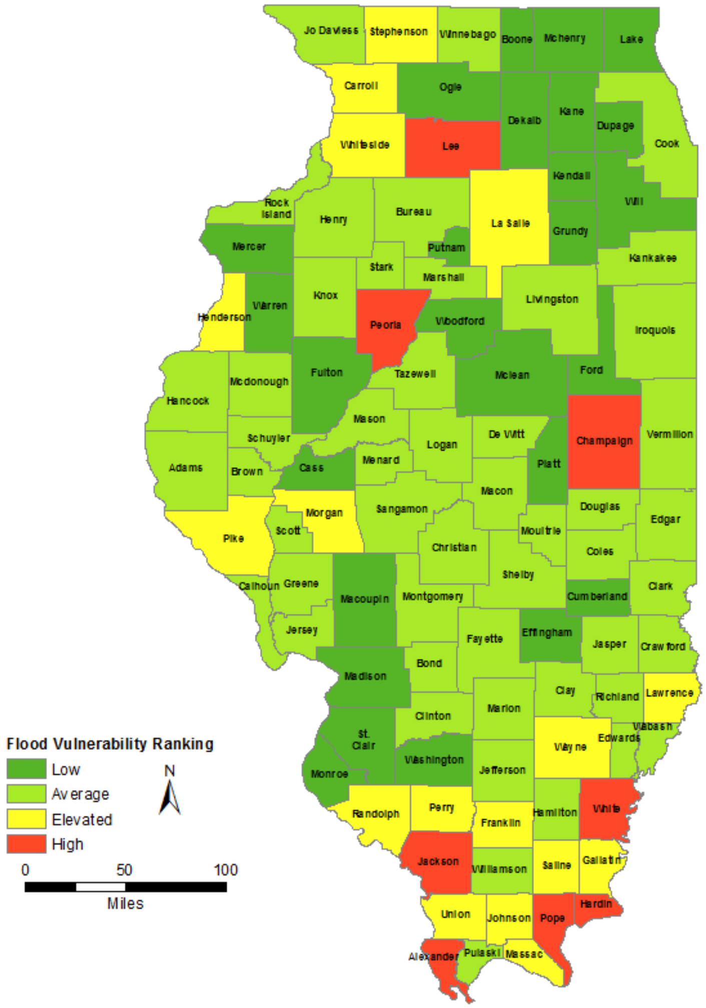
Hazard Extent for Flooding

All floodplains downstream of rivers, streams, and creeks are susceptible to flooding. The floodplain of concern is for the 100-year flood event which is defined as areas that have a 1% chance of flooding in any given year. However, flooding is dependent on various local factors including, but not limited to, impervious surfaces, amount of precipitation, river-training structures, etc. The 100-year flood plain covers approximately 13% of McLean County. There are no dams in the planning area.

Vulnerability Analysis for Flooding

The 2013 Illinois Hazard Mitigation Plan analyzed a variety potential natural hazards including vulnerability to flooding. A Flood Vulnerability Index (FVI) was calculated for all counties and jurisdictions in Illinois. FVI combines Hazus-based estimates of flood exposure and loss with the widely utilized Social Vulnerability Index (SoVI). The highest vulnerability scores and vulnerability ratings were generally in rural counties and communities located along Illinois's large rivers (i.e., Mississippi, Green, Illinois, Kaskaskia, Rock and Ohio Rivers). Figure 4-14 displays the Flood Vulnerability Ratings for the 102 counties in Illinois. The vulnerability ratings are categorical representations (low, average, elevated, or high) of the flood vulnerability index. McLean County has a Low Flood Vulnerability Rating and ranks 95 out of the 102 counties in Illinois in terms of loss estimation according to Hazus-MH for floods.

Figure 4-14. County Flood Vulnerability Rating for Illinois



Risk Identification for Flood Hazard

Based on historical information and the Flood Vulnerability Rating, future occurrence of flooding in the planning area is unlikely. According to the Risk Priority Index (RPI) and ISU Planning Team's input, flooding is ranked as the number six hazard.

Risk Priority Index

Probability	x	Magnitude	=	RPI
1	x	2	=	2

Critical Facilities

All critical facilities within the floodplain are vulnerable to floods. An essential facility will encounter many of the same impacts as other buildings within the flood boundary. These impacts can include structural failure, extensive water damage to the facility, and loss of facility functionality (e.g., a damaged police station cannot serve the community). Appendix E include a list of the critical facilities for the University and community and Appendix F displays a large format map of the locations of all critical facilities within the planning area.

Building Inventory

All buildings within the floodplain are vulnerable to floods. These impacts can include structural failure, extensive water damage to the facility, and loss of facility functionality (e.g., damaged home will no longer be habitable, causing residents to seek shelter). This plan considers all buildings located downstream of major rivers and streams within 100-year flood plain as vulnerable.

Infrastructure

The types of infrastructure potentially impacted by a flood include roadways, utility lines/pipes, railroads, and bridges. Since an extensive inventory of the infrastructure is not available for this plan, it is important to emphasize that a flood could damage any number of these items. The impacts to these items include: broken, failed, or impassable roadways; broken or failed utility lines (e.g., loss of power or gas to community); or railway failure from broken or impassable railways. Bridges could also fail or become impassable, causing risk to motorists.

Hazus-MH Flood Analysis

Hazus-MH was utilized to generate the flood depth grid for a 100-year return period and made calculations by clipping the USGS one-third-arc-second DEM (~10 m) to the flood boundary. Next, Hazus-MH was used to estimate the damages for ISU by utilizing a detailed building inventory database provided by the University Risk Manager.

According to this analysis, there are no Illinois State University buildings located in the 100-year floodplain. Although there are areas added that flood frequently on campus. There are 15 buildings exposed to urban flooding with minimal damages. This flooding occurs around roadways and paths and low lying delivery access areas, thus hindering the University's ability to get supplies onto campus. Some of these areas are being currently mitigated. It should be noted that the results should be interpreted as degrees of loss rather than exact number of buildings exposed to flooding. Figure 4-15 depicts the building inventory within the 100-year floodplain. Figure 4-16 depicts the map of building inventory in urban flooded areas within the ISU campus.

Figure 4-15. Building Inventory Located within the 100-year Floodplain on ISU Campus

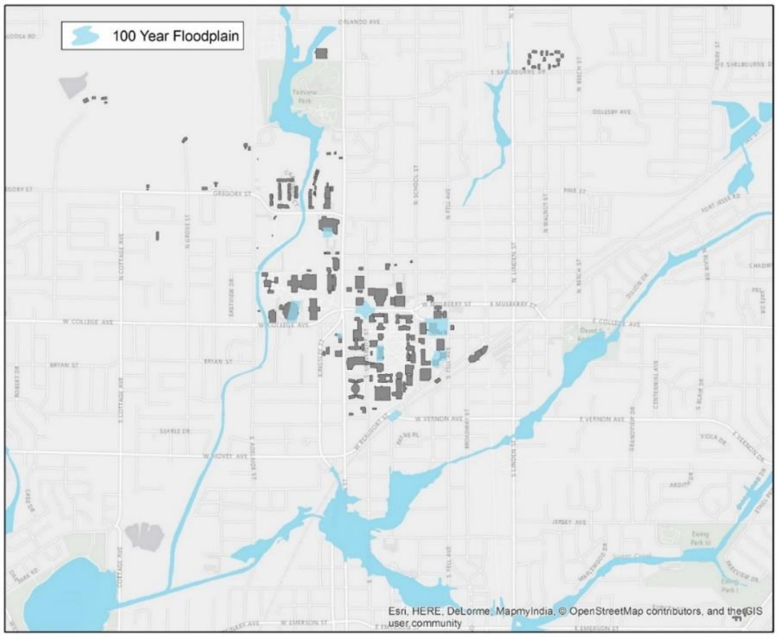
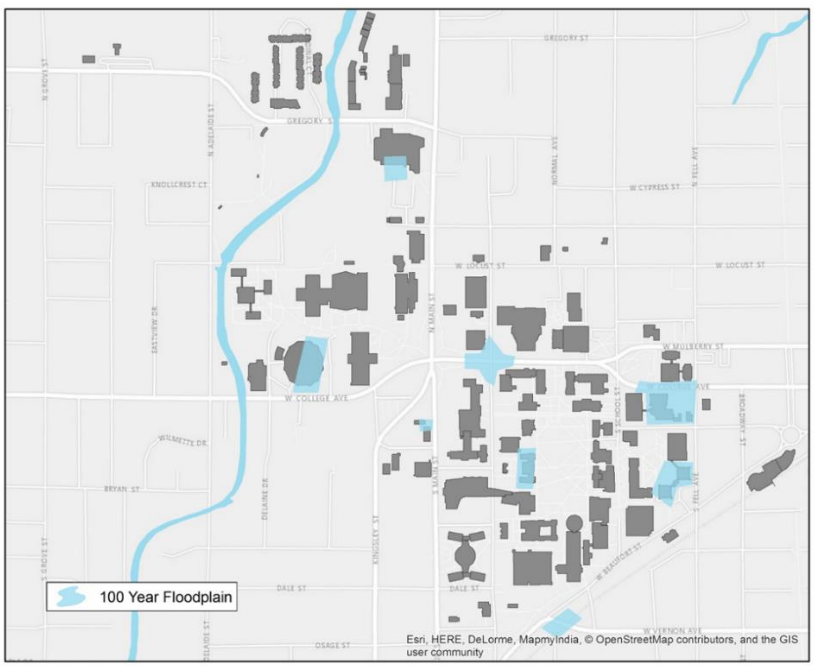


Figure 4-16. Map of Building Inventory in Urban Flooded Areas on ISU Campus



Vulnerability Analysis to Future Assets/Infrastructure

Flooding may affect nearly any location within the planning area; therefore, all buildings and infrastructure are vulnerable. Currently, new developments comply with the state flood ordinance. Table 5.1 lists local building ordinances for the county and surrounding communities. At this time no new construction is planned with the 100-year floodplain.

Suggestions for Community Development Trends

Reducing floodplain development is crucial to reducing flood-related damages. Areas with recent development may be more vulnerable to drainage issues. Storm drains and sewer systems are usually most susceptible to drainage issues. Damage to these can cause back-up of water, sewage, and debris into homes and basements, causing structural and mechanical damage as well as creating public health hazards and unsanitary conditions.

4.3.9 Ground Failure

Hazard Definition

According to the USGS, the term ground failure is generally referred to landslides, liquefaction, lateral spreads, and any other consequence of shaking that affects the stability of the ground. In Illinois, ground failure is typically associated with subsidence of the land surface related to soluble rock (karst), sink holes, or underground mining.

Subsidence Related to Karst Features

Subsidence can occur on land located over soluble bedrock. The land over such bedrock often has topography characteristic of past subsidence events. This topography is termed "karst." Karst terrain has unique landforms and hydrology found only in these areas. Bedrock in karst areas are typically limestone, dolomite, or gypsum. In Illinois, limestone and dolomite (carbonate rocks) are the principle karst rock types. 9% of Illinois has carbonate rock types close enough to the ground surface to have a well-developed karst terrain. The area in Illinois in which the karst terrain is most developed is the southern and southwestern part of the state (Panno, et al., 1997). The karst feature most associated with subsidence is the sinkhole.

Sinkhole Formation and Collapse

A sinkhole is an area of ground that has no natural external surface drainage—when it rains, water ponds inside the sinkhole and typically drains into the subsurface. Sinkholes can vary from a few feet to hundreds of acres and from less than one to more than 100 feet deep. Typically, sinkholes form slowly, so that little change is seen during a lifetime, but they also can form suddenly when a collapse occurs. Such a collapse can have a dramatic effect if it occurs in a populated setting.

Sinkholes form where rainwater moves through the soil and encounters soluble bedrock. The bedrock begins to dissolve along horizontal and vertical cracks and joints in the rock. Eventually, these cracks become large enough to start transporting small soil particles. As these small particles of soil are carried off, the surface of the soil above the conduit slumps down gradually, and a small depression forms on the ground surface. This depression acts like a funnel and gathers more water, which makes the conduit still larger and washes more soil into the conduit.

Sudden collapse of a sinkhole occurs where the soil close to the ground surface does not initially slump down, but instead forms a bridge. Beneath that surface cover, a void forms where the soil keeps washing into the conduit. These voids are essentially shallow caves. Over time, the void enlarges enough that the weight of the overlying bridge can no longer be supported. The surface layer then suddenly collapses into the void, forming a sinkhole.

The process of forming a conduit and a soil bridge usually takes years to decades. However, this natural process can be aggravated and expedited by human activities. Since the process of forming a sinkhole depends on water to carry soil particle down into the karst bedrock, anything that increases the amount of water flowing into the subsurface can accelerate sinkhole formation process. Parking lots, streets, altered drainage from construction, and roof drainage are a few of the things that can increase runoff.

Collapses are more frequent after intense rainstorms. However, drought and altering of the water table can also contribute to sinkhole collapse. Areas where the water table fluctuates or has suddenly been lowered are more susceptible to sinkhole collapse. (White, 1988)

Underground Mining and Subsidence

Underground mines have been used extensively in Illinois to extract coal, lead, zinc, fluorites, shale, clay stones, limestone, and dolomite. When mining first began in Illinois, land over mined areas was sparsely populated. If the ground subsided, homes or other structures were seldom damaged. As towns and cities expanded over mined-out areas, subsidence damage to structures became increasingly more common. The most common underground mines in Illinois are coal mines. A recent study in Illinois has found that about 333,100 housing units were located over or adjacent to 839,000 acres mined for coal (Bauer, 2008).

Illinois has abundant coal resources. All or parts of 86 of 102 counties in the state have coal-bearing strata. As of 2007, about 1,050,400 acres (2.8% of the state) have been mined. Of that total, 836,655 acres are underground mines (Bauer, 2008). Illinois ranks first among all U.S. states for reserves of bituminous coal (Illinois Coal Association, 1992).

There are two fundamental underground mining methods used in Illinois: high-extraction methods such as long-wall and low-extraction room-and pillar mining. High-extraction methods remove almost all of the coal in localized areas. For modern mining practices, subsidence associated with high-extraction methods is planned and regulated by state and federal authorities. The subsurface subsides above the mine within several days or weeks after the coal has been removed. Subsidence of the over-burden above the mined-out area can continue up to seven years after subsurface removal, depending on the local geologic conditions (Bauer, 2008). The initial ground movements associated with this mining, which tend to be the largest, diminish rapidly after a few months. After subsidence has decreased to a level that no longer causes damage to structures, the land may be suitable for development. The maximum amount of subsidence is proportional to the amount of material extracted and the depth between the mining and the surface. In general, over the centerline of the mine panel, subsidence can be 60 to 70% of the extracted material (e.g., 10ft of material extracted would cause a maximum subsidence of six to seven feet; Bauer, 2006).

For low-extraction techniques such as room-and-pillar mining, miners create openings (rooms) as they work. Enough of the coal layer is left behind in the pillars to support the ground surface. In Illinois this system of mining extracts 40% to 55% of the coal resources in modern mines and up to 75% in some older mines. Based on current state regulations, room-and-pillar mines in operation after 1983 that do not include planned subsidence must show that they have a stable design. Although these permitting requirements have improved overall mine stability, there are no guarantees that subsidence will not occur above a room-and-pillar mine in the future. In general, if coal or other mined resources have been removed from an area, subsidence of the overlying material is always a possibility (Bauer, 2006).

In Illinois, subsidence of the land surface related to underground mining undertakes two forms: pit subsidence or trough (sag) subsidence. Pit subsidence structures are generally six to eight feet deep and range from two to 40 feet in diameter. Pit subsidence mostly occurs over shallow mines that are <100 feet deep and where the overlying bedrock is <50 feet thick and composed of weak rock materials such as shale. The pit is produced when the mine roof collapses and the roof fall void works its way to the surface. These structures form rapidly. If the bedrock is only a few feet thick and the surface material are unconsolidated (loose), these material may fall into adjacent mine voids, producing a surface hole deeper than the height of the collapse mine void. Pit subsidence can cause damage to a structure if it develops under the corner a building or support post of a foundation or other critical location. Subsidence pits should be filled to ensure that people or animals don’t fall into these structures (Bauer, 2006).

Trough (or “sag”) subsidence forms a gentle depression over a broad area. Some trough subsidence may be as large as a whole mine panel (i.e. several hundred feet long and a few hundred feet wide). Several acres of land may be affected by a single trough event or feature. As discussed above, the maximum vertical settlement is 60% to 70% of the height of material removed (e.g., two to six feet). Significant troughs may develop suddenly (in a few hours or days) or gradually over a period of years. Troughs originate over places in mines where pillar has collapsed, producing downward movement at the ground surface. These failures can develop over mines of any depth. Trough subsidence produces an orderly pattern of tensile features (tension cracks) surrounding a central area of possible compression features. The type and extent of damage to surface structures relate to their orientation and position within a trough. In the tension zone, the downward-bending movements that develop in the ground may damage buildings, roads, sewer and water pipes, and other utilities. The downward bending of the ground surface causes the soil to crack, forming the tension cracks that pull structures apart. In the relatively smaller compression zone, roads my buckle and foundation walls may be pushed inward. Buildings damaged by compressional forces typically need their foundations rebuilt and leveled (Bauer, 2006).

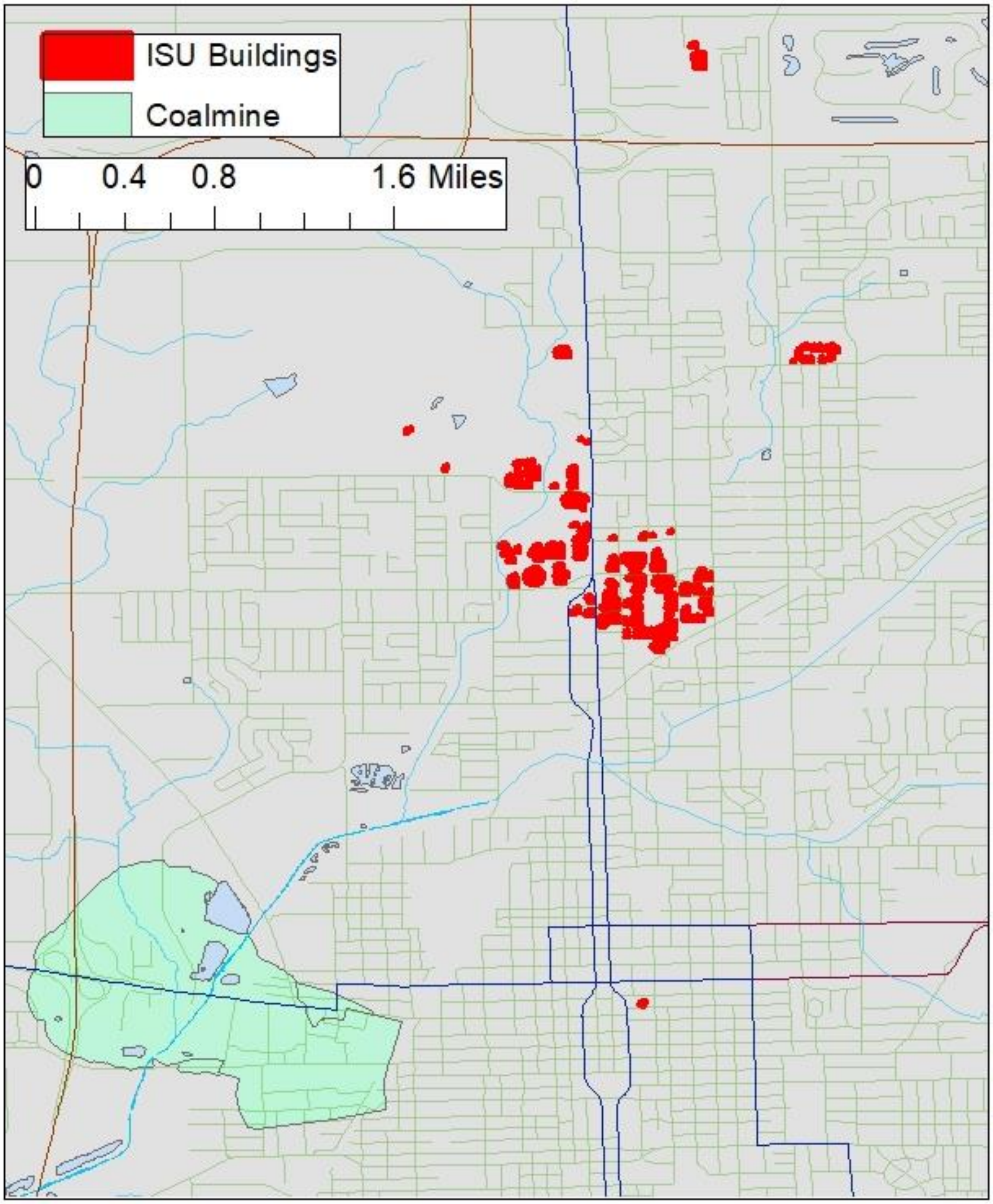
Previous Occurrences of Ground Failure

There are no documented occurrences of karstic or mine collapse in the planning area that have resulted in any significant injuries or deaths.

Geographic Location for Ground Failure

Illinois is usually associated with either underground mining or collapse of soil into crevice in underlying soluble bedrock. Areas at risk for subsidence can be determined from detailed mapping of geologic conditions or detailed mine maps. Illinois State University buildings are not vulnerable due to the location of those mines. Figure 4- 17 depicts a map of the location of underground mines in proximity to Illinois State University.

Figure 4-17 Location of Underground Mines in Proximity to Illinois State University



Hazard Extent for Ground Failure

The extent of ground failure hazard in the planning area is a function of where current development is located relative to (1) areas of past and present underground mining, and (2) areas of soluble bedrock.

Risk Identification for Ground Failure

Based on historical information and the underlying geology of the planning area, the occurrence of future ground failure is unlikely. According to the ISU Planning Team's assessment, ground failure is ranked as the number eight hazard.

Risk Priority Index				
Probability	x	Magnitude	=	RPI
1	x	1	=	1

Vulnerability Analysis for Ground Failure

The entire county is susceptible to underground mining. A small portion (<1%) of the county is undermined and there are some buildings on top of the undermined areas. To accommodate this risk, this plan considers all buildings located within the planning area as vulnerable. Tables 4-6 and 4-7 display the existing buildings and critical infrastructure in the planning area. There is no known risk from underground mining within the Illinois State University campus.

Critical Facilities

Any critical facility built above highly soluble bedrock could be vulnerable to ground failure. A critical facility will encounter the same impacts as any other building within the affected area. These impacts include damages ranging from cosmetic to structural. Buildings may sustain minor cracks in walls due to a small amount of settling, while in more severe cases, the failure of building foundations can cause cracking of critical structural elements. Table 4-6 lists the types and number of critical facilities for the University and community planning and Appendix F displays a large format map of the locations of all critical facilities within the planning area.

Building Inventory

Table 4-7 lists the building exposure in terms of types and numbers of buildings for the entire University. The buildings within the planning area can expect similar impacts to those discussed for critical facilities, ranging from cosmetic to structural. Buildings may sustain minor cracks in walls due to a small amount of settling, while in more severe cases, the failure of building foundations causes cracking of critical structural elements.

Infrastructure

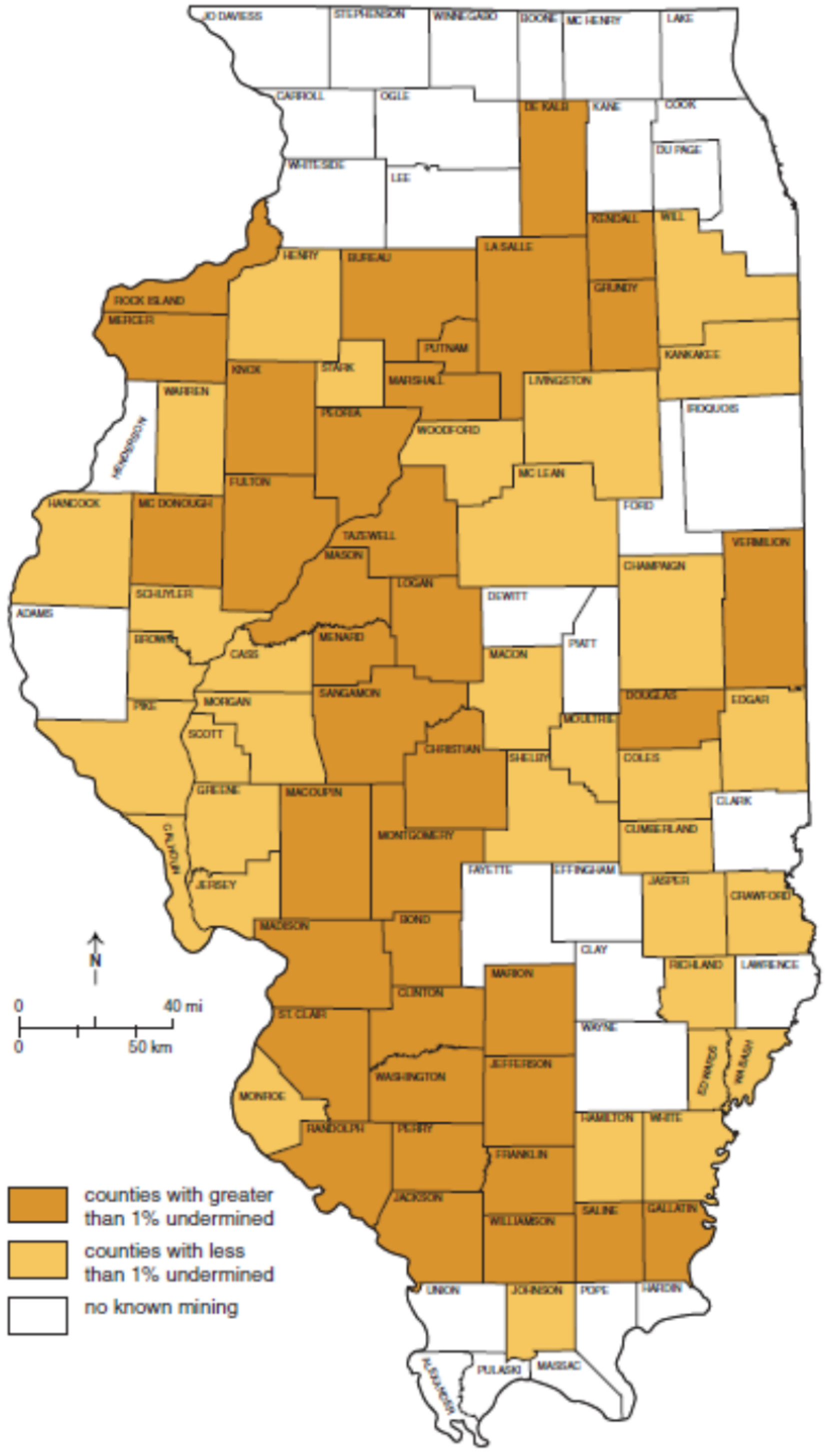
The types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. The risk to these structures is primarily associated with land collapsing directly beneath them in a way that undermines their structural integrity. The impacts to these items include broken, failed, or impassable roadways; broken or failed utility lines (i.e. loss of power or gas to community); and railway failure from broken or impassable railways. In addition, bridges could fail or become impassable causing risk to traffic.

GIS-based Analysis of Ground Failure

This section provides an overview of the ground failure hazards in Illinois in general and a discussion of the potential subsidence risk in the planning area. Ground failure in Illinois is usually associated with either underground mining or collapse of soil into crevice in underling soluble bedrock. Areas at risk for ground failure can be determined from detailed mapping of geologic conditions or detailed mine maps.

Figure 4-18 displays data sources complied from the Illinois State Geologic Survey (ISGS) and the Illinois Department of Natural Resources (IDNR) to assess the risk of ground failure in the planning area.

Figure 4-18. Distribution of Surface and Underground Mines in Mclean County



Vulnerability to Future Assets/Infrastructure for Ground Failure

New buildings and infrastructure placed on undermined land or on highly soluble bedrock will be vulnerable to ground failure.

Suggestions of Community Development Trends

Abandoned underground mine subsidence may affect several locations within the county; therefore, buildings and infrastructure are vulnerable to subsidence. Continued development will occur in many of these areas. Newly planned construction should be reviewed with the historical mining maps to minimize potential subsidence structural damage.

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Section 5. Mitigation Strategies

The goal of mitigation is to reduce the future impacts of a hazard, including property damage, disruption to local and regional economies, and the amount of public and private funds spent to assist with recovery. Throughout the planning process, the ISU Planning Team worked to identify existing hazard mitigation policies, develop mitigation goals, and create a comprehensive range of mitigation strategies specific to the university. This work provides a blueprint for reducing the potential losses identified in the risk assessment (section 4).

5.1 Existing Hazard Mitigation Policies, Programs and Resources

This section documents the University's existing authorities, policies, programs, and resources related to hazard mitigation and the ability to improve these existing policies and programs. At this time, McLean County does not have a FEMA- approved hazard mitigation plan. It is important to highlight the work that has been completed at Illinois State University that pertains to hazard mitigation. In addition, the following information also provides an evaluation of these abilities to determine whether they can be improved in order to more effectively reduce the impact of future hazards.

5.1.1 Successful Mitigation Projects

To be successful, mitigation must be a recurrent process that is continually striving to lessen the impact of natural hazards within the university. The following are projects that were successfully completed for Illinois State University.

Equipped Critical Facilities with Back-Up Generators

Illinois State University internally funded a $137K project to install a generator for the campus police department, emergency operations center and underlying systems as of February 2017.

Constructed Additional Community Safe Room

Illinois State University constructed a tornado shelter for a warehouse facility with one safe area. Completed in 2012, the $17K project was funded internally.

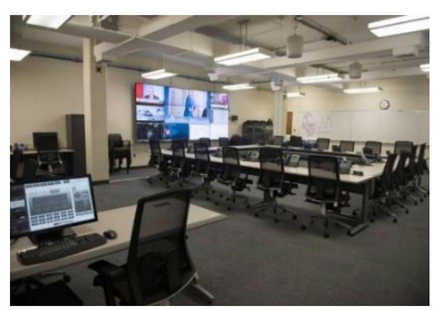
Developed Mutual Aid Agreements

Illinois State University developed radio interoperable mutual aid agreements. This was a no-cost mitigation project. During 2014 and 2015, the University secured signed MOUs for the Emergency Operations Center to have full communications interoperability with every public safely agency within McLean County.

Created New Emergency Operations Center

In 2014, the University constructed a new state-of-the-art Emergency Operations Center located on ISU campus. The $250K project was funded locally.

Figure 5-1. EOC



Enhanced Emergency Communications

In 2014, in conjunction with the new EOC, the University developed an incident communications dispatch center. Connected to the EOC, the two-station facility is equipped with radios capable of communicating with every University radio user and with every public safety agency in McLean County. Total cost of the project was $28K. 50% was funded through an Illinois Safe Schools grant and 50% was funded locally.

Established an Incident Management Team

In 2014, coinciding with the opening of the new EOC, the University formed a 20-position Incident Management Team. With each position 3 tiered, the 60-person team has been trained in their respective role, participates in drills and exercises, and responds to a number of campus wide emergencies. The project was a no-budget impact activity.

Developed a Population "Heat Map"

In 2017, the University developed a map that reflects the populations per campus buildings, per time of day and day-of-week to account for faculty, staff, and students during emergencies and natural hazards.

5.1.2 National Flood Insurance Program

In 1968, Congress created the National Flood Insurance Program (NFIP) to help provide a means for property owners to financially protect themselves. The NFIP offers flood insurance to homeowners, renters, and business owners if their community participates in the NFIP. Participating communities agree to adopt and enforce ordinances that meet or exceed FEMA requirements to reduce the risk of flooding. This section covers the planning area's NFIP status, flood insurance policy and claim statistics, repetitive loss structures, and Community Rating System status.

NFIP Status

As mentioned in Section 4.3.8, none of ISU's structures are located in the 100-year floodplain. As state-owned and operated buildings, all of ISU's physical assets are self-insured. The University carries commercial insurance for flood exposures, and all university buildings have identical coverage for flood risk. ISU is not required to have coverage through the NFIP. McLean County, Bloomington, and the town of Normal all participate in the NFIP and have an effective FIRM. Table 5-1 includes a summary of information for Normal and surrounding communities' participation in the NFIP.

Table 5-1. Information on Normal and Surrounding Communities' Participation in the NFIP

Community	Participate in the NFIP	Initial Flood Hazard Boundary Map Identified	Initial FIRM Identified	Current Effective FIRM Date
McLean County	Yes	09/08/78	12/18/85	07/16/08
Normal	Yes	06/21/74	09/01/83	05/02/08
Bloomington	Yes	06/28/74	04/03/84	07/16/08

NFIP status and information are documented in the Community Status Book Report updated on 10/07/2017.
(M) – No Elevation Determined – All Zone A, C and X

Flood Insurance Policy and Claim Statistics

As of September 2017, 159 households paid flood insurance. The total premiums collected for the policies amounted to $152,720. Since the establishment of the NFIP in 1978, 93 flood insurance claims were filed in Bloomington/Normal and Rural McLean County, totaling in $757,180 in payments. Table 5-2 summarizes the claims since 1978.

Table 5-2. Flood Insurance Claim Statistics for Normal and Surrounding Communities

Community	Total Losses	Closed Losses	Open Losses	CWOP Losses	Payments
McLean County	20	18	0	2	$319,342
Normal	35	29	0	6	$198,395
Bloomington	38	30	0	8	$239,443

NFIP policy and claim statistics since 1978 until the most recently updated date of 01/31/2015. Closed Losses refer to losses that are paid; open losses are losses that are not paid in full; CWOP losses are losses that are closed without payment; and total losses refers to all losses submitted regardless of status. Lastly, total payments refer to the total amount paid on losses.

Repetitive Loss Structures

There are several structures in Normal and surrounding communities that have experienced repetitive losses due to flooding. FEMA defines a repetitive loss structure as a structure covered by a contract of flood insurance issued under the NFIP that has suffered flood loss damage on two or more occasions during a 10-year period that ends on the date of the second loss, in which the cost to repair the flood damage is ≥ 25% of the market value of the structure at the time of each flood loss. Currently there are over 122,000 Repetitive Loss properties nationwide.

The Illinois Emergency Management Agency and Illinois Department of Natural Resources was contacted to determine the location of repetitive loss structures in McLean County. Records indicate that there are 14 repetitive loss structures within the county. The total amount paid for building replacement and building contents for damage to these repetitive loss structures is $463,948. Table 5-3 describes the repetitive loss structures for Normal and surrounding communities.

Table 5-3. Repetitive Loss Structures for Normal/McLean County

Jurisdiction	Number of Properties	Number of Losses	Total Paid
Bloomington	5	10	$181,546
Heyworth	1	3	$81,896
Hudson	1	2	$7,461
Leroy	1	2	$14,782
McLean County	2	4	$146,944
McLean Village	1	2	$11,540
Normal	2	5	$10,535
Towanda	1	2	$9,244
Total	**14**	**30**	**$463,948**

Community Rating System Status

The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance. More than 1,200 communities from all 50 states participate in the CRS. In Illinois, 51 communities participate in the CRS. Although joining the CRS is free, completing CRS activities and maintain a CRS rating will require a degree of commitment from the community, including dedicating staff.

5.1.3 County and Municipal Plans and Regulations

The purpose of a comprehensive plan is to establish a framework of goals, policies and action items in terms of community development. The McLean County Regional Comprehensive Plan developed by the McLean County Regional Planning Commission is titled*: A Guide To Sensible Growth Through Regional Cooperation* was issued in November 2009 and may be due for a plan update. The Plan focuses on growth as it relates to transportation, infrastructure, and environmental sustainability.

Normal and Bloomington both have approved comprehensive plans. The McLean County Regional Planning Commission (MCRPC) helped develop Normal's 2040 Comprehensive Plan with citizen and staff input. Adopted in November 2017, the plan divides the community of Normal into sectors such as neighborhoods, centers, and corridors. Subtitled: "Complete, Connected, Compact" the plan guides the decisions about future community development, especially along Veterans Parkway which is a major transportation and business hub in Uptown Normal.

The City of Bloomington Comprehensive Plan 2035 was adopted in August 2015. The plan sets forth a series of goals to be achieved over the next twenty years in the redevelopment of existing neighborhoods, entrepreneurship, and innovation. Bloomington is the central location for transportation and commerce, as well as a highly productive agricultural region. The plan emphasizes the core values of maintaining dynamic neighborhoods, good education system, stable economy, healthy community, solid infrastructure and efficient government.

Both plans acknowledge the linkages between ISU and the municipalities, but makes no discussion of hazard preparedness or disaster mitigation planning efforts.

Hazard mitigation related ordinances, such as zoning, burning, or building codes, have the potential to reduce the risk from known hazards. These types of regulations provide many effective ways to address resiliency to known hazards. Table 5-4 lists Normal and surrounding communities current ordinances that directly pertain, or can pertain, to hazard mitigation. It is important to evaluate the local building codes and ordinances to determine if they have the ability to reduce potential damages caused by future hazards.

Table 5-4. Normal and Surrounding Communities Ordinances

Community	Building	Electrical	Stormwater	Flooding	Subdivision	Fire	Land Use	Zoning
McLean County	N	N	Y	Y	Y	N	N	Y
Normal	Y	N	Y	Y	Y	Y	N	Y
Bloomington	Y	Y	Y	Y	Y	Y	N	Y

The adoption of new ordinances, including the adoption of new development standards or the creation of hazard-specific overlay zones tied to existing zoning regulations, present opportunities to discourage hazardous construction and manage the type and density of land uses in areas of known natural hazards. Adopting and enforcing higher regulatory standards for floodplain management (i.e., those that go beyond the minimum standards of the NFIP) is another effective method for minimizing future flood losses, particularly if a community is experiencing growth and development patterns that influence flood hazards in ways that are not accounted for on existing regulatory floodplain maps. Revisions to existing building codes also present the opportunity to address safe growth. Many state and local codes are based off national or industry standard codes which undergo routine evaluations and updates. The adoption of revised code requirements and optional hazard-specific standards may help increase community resilience. Currently, the Design and Construction Guidelines and Standards provide direction for all new design, construction, remodeling, rehabilitation and maintenance projects at Illinois State University.

5.1.4 Fire Insurance Ratings

By classifying communities' ability to suppress fires, the Insurance Service Office (ISO) Public Protection Classification Program helps communities evaluate their public fire-protection services. The program provides a countrywide standard that helps fire departments in planning and budgeting for facilities, equipment, and training. Information is collected on municipal fire-protection efforts in communities throughout the United States. In each of those communities, ISO analyzes the relevant data using a Fire Suppression Rating Schedule. Ratings are assigned from 1 to 10 where Class 1 generally represents superior property fire protection, and Class 10 indicates that the area's fire-suppression program doesn't meet ISO's minimum criteria. Table 5-5 displays each Fire Department's insurance rating and total number of employees.

Table 5-5. Normal/Bloomington Fire Departments, Insurance Ratings, and Number of Employees/Volunteers

Fire Department	Fire Insurance Rating	Number of Employees
Normal Fire Department	2	63
Bloomington Fire Department	2	113

5.2 Mitigation Goals

In Section 4 of this plan, the risk assessment identified Illinois State University as prone to several hazards. The Planning Team members understand that although they cannot eliminate hazards altogether, Illinois State University can work towards building a disaster-resistant campus community. Below is a generalized list of goals, objectives, and actions. The goals represent long-term, broad visions of the overall vision the University would like to achieve for mitigation. The objectives are strategies and steps that will assist the University in attaining the listed goals.

Goal 1: Lessen the impacts of hazards to new and existing infrastructure

Objective: Retrofit critical facilities and structures with structural design practices and equipment that will withstand natural disasters and offer weather-proofing.

Objective: Equip campus facilities and community utilities to guard against damage caused by secondary effects of hazards.

Objective: Minimize the amount of infrastructure exposed to hazards.

Objective: Evaluate and strengthen the communication and transportation abilities of emergency services throughout the campus community.

Objective: Improve emergency sheltering within the campus community.

Goal 2: Create new or revise existing plans/maps for Illinois State University

Objective: Support community compliance with the NFIP.

Objective: Review and update existing, or create new, departmental emergency response plans and protocols to support hazard mitigation.

Objective: Conduct new studies/research to profile hazards and follow up with mitigation strategies.

Goal 3: Develop long-term strategies to educate McLean County residents on the hazards

Objective: Raise campus community awareness on hazard mitigation.

Objective: Improve education and training of emergency personnel and campus departments.

5.3 Illinois State University Mitigation Strategies

After reviewing the Risk Assessment, the Mitigation Planning Team was presented with the task of individually listing potential mitigation activities using the FEMA STAPLEE evaluation criteria (see table 5-6). FEMA uses their evaluation criteria STAPLEE (stands for social, technical, administrative, political, legal, economic and environmental) to assess the developed mitigation strategies. Evaluating possible natural hazard mitigation activities provides decision-makers with an understanding of the potential benefits and costs of an activity, as well as a basis upon which to compare alternative projects. The Planning Team brought their mitigation ideas to Meeting 3.

Table 5-6. FEMA's STAPLEE Evaluation Criteria

Social	Mitigation actions are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the community's social and cultural values.
Technical	Mitigation actions are technically most effective if they provide a long-term reduction of losses and have minimal secondary adverse impacts.
Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
Political	Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support for the action.
Legal	It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
Economic	Budget constraints can significantly deter the implementation of mitigation actions. Hence, it is important to evaluate whether an action is cost-effective, as determined by a cost benefit review, and possible to fund.
Environmental	Sustainable mitigation actions that do not have an adverse effect on the environment, comply with federal, state, and local environmental regulations, and are consistent with the community's environmental goals, have mitigation benefits while being environmentally sound.

Table 5-7 contains a comprehensive range of specific mitigation actions and projects for Illinois State University with an emphasis on new and existing buildings and infrastructure. At least two identifiable mitigation action items have been addressed for each hazard listed in the risk assessment. Each of the university departments and community partners were invited to participate in brainstorming sessions in which goals, objectives, and strategies were discussed and prioritized. Each participant in these sessions was armed with possible mitigation goals and strategies provided by FEMA, as well as information about mitigation projects discussed in neighboring communities and counties.

All potential strategies and goals that arose through this process are included in Table 5-3. The mitigation strategies are arranged by hazard they directly address. In some cases, certain mitigation strategies can address all hazards. If provided by the university departments and community partners, each mitigation strategy contains specific details pertaining to the implementation, responsible and/or organizing agency, and potential funding source. Potential funding sources are identified by Federal, State, Local, or Private. A code is assigned to each mitigations strategy for ease of reference when reviewing the prioritization of each mitigation strategies in Section 5.8.

Table 5-7. Illinois State University Mitigation Strategies

Code	Mitigation Strategy	Departments/Partners Involved	Status	Funding Source*	Responsible Organization or Agency
	ALL HAZARDS				
AH1	**Distribute NOAA weather radios** *NOAA radios have been distributed in support of the Storm Ready Campus designation. The Emergency Management Director will oversee the implementation of this strategy to underserved locations. If funding is available, implementation is forecasted within the next year.*	ISU	Ongoing	L	Emergency Management Director
AH2	**Create additional heating / cooling shelters** *The Emergency Management Director will oversee the implementation of this strategy. If funding is available, implementation is forecasted within the next one to three years.*	ISU	Proposed	F	Emergency Management Director
AH3	**Equip critical facilities with back-up generators** *The University has installed back-up generators to the police department, EOC, and underlying systems. The University will continue to research and purchase back-up generators for critical sites. The Emergency Management Director will oversee the implementation of this strategy. If funding is available, implementation is forecasted within one to three years.*	ISU	Ongoing	F	Emergency Management Director
AH4	**Relocate existing utility lines underground** *The Emergency Management Director will oversee the implementation of this project. If funding is available, implementation is forecasted within the next five years.*	ISU	Proposed	F	Emergency Management Director
AH5	**Acquire emergency response protective gear, equipment, and supply stockpile** *The University will rely upon identified employees and volunteer services to provide certain underlying emergency services. If funding is available, implementation is forecasted within the next year.*	ISU	Proposed	F, L	Emergency Management Director
	FLOODING				
F1	**Install backflow valves and sump pumps in critical facilities** *Emergency Management Director will oversee this strategy. If funding is available, implementation is forecasted within the next five years.*	ISU	Proposed	F	Emergency Management Director
F2	**Elevate low-lying roads** *The Emergency Management Director will oversee this strategy. If funding is available, implementation is forecasted within the next five years.*	ISU	Proposed	F	Emergency Management Director
F3	**Install drainage pipes** *The University is in the process of installing drainage pipes on the ramp leading to the Redbird Arena. The project will help to control flooding on lower levels of the building. The Emergency Management Director will oversee the implementation of this project. If funding is available, implementation is forecasted within the next three to five years.*	ISU	Ongoing	L	Emergency Management Director
	TORNADO / SEVERE THUNDERSTORMS				
ST1	**Provide outdoor siren warning coverage** *The University seeks outdoor siren warning coverage. The Emergency Management Director will oversee this strategy. If funding is available, implementation is forecasted within the next three years.*	ISU	Proposed	L, F	Emergency Management Director
ST2	**Equip critical facilities with lightning protection devices** *The Emergency Management Director will oversee this strategy. If funding is available, implementation is forecasted within the next five years.*	ISU	Proposed	F, L	Emergency Management Director
ST3	**Retrofit structures to withstand high winds** *The Emergency Management Director will oversee this strategy. If funding is available, implementation is forecasted within the next five years.*	ISU	Proposed	F, L	Emergency Management Director

Code	Mitigation Strategy	Departments/Partners Involved	Status	Funding Source*	Responsible Organization or Agency
ST4	**Install storm resistant glass to critical facilities** *The Emergency Management Director will oversee this strategy. If funding is available, implementation is forecasted within the next one to three years.*	ISU	Proposed	F, L	Emergency Management Director
	EARTHQUAKES				
EQ1	**Install automatic shutoff valves** *The Emergency Management Director will oversee this strategy. If funding is available, implementation is forecasted within the next five years.*	ISU	Proposed	F, L	Emergency Management Director
	HAZARDOUS MATERIALS RELEASE				
HAZ1	**Install chlorine scrubbers** *The University is currently in the process of installing chlorine scrubbers at the water plant. If funding is available, implementation is forecasted within the next three to five years.*	ISU	Ongoing	F, L	Emergency Management Director
	WINTER STORMS				
WS1	**Install emergency signage** *The Emergency Management Director will oversee this strategy. If funding is available, implementation is forecasted within the next five years.*	ISU	Proposed	L	Emergency Management Director

*F – Federal, S – State, L – Local, P – Private

5.4 Prioritization of Illinois State University Mitigation Strategies

Implementation of the mitigation strategies is critical to the overall success of the mitigation plan. It is important to decide, based upon many factors, which action will be undertaken first. In order to pursue the top priority first, an analysis and prioritization of the actions is vital. It is important to note that some actions may occur before the top priority due to financial, engineering, environmental, permitting, and site control issues. Public awareness and input of these mitigation actions can increase knowledge to capitalize on funding opportunities and monitoring the progress of an action. It is also critical to take into account the amount of time it will take the University to complete the mitigation project.

Table 5-8 displays the priority ranking for each mitigation strategy. Each code refers to a specific mitigation strategy listed in Table 5-3. A rating (high, medium, or low) was assessed for each mitigation item. The ranking is the result of the STAPLEE evaluation and the timeframe the university is interested in completing the strategy: H - High 1-3 years; M - Medium 3-5 years; and L - Low 5+years.

Table 5-8. Prioritization of Illinois State University Mitigation Strategies

Code	Hazard Ranking
AH1	H
AH2	H
AH3	H
AH4	L
AH5	H
F1	L
F2	L
F3	M
ST1	M
ST2	L
ST3	L
ST4	H
EQ1	L
HAZ1	M
WS1	L

*Ranking based on STAPLEE evaluation and estimated timeframe: H – High, M – Medium, and L – Low

Section 6. Plan Implementation and Maintenance

6.1 Implementation through Existing Programs

Throughout the planning process, the Illinois State University Planning Team worked to identify existing hazard mitigation policies, develop mitigation goals, and to create a comprehensive range of mitigation strategies specific to each stakeholder. This work provides a blueprint for reducing the potential losses identified in the Risk Assessment (Section 4). The ultimate goal of this plan is to incorporate the mitigation strategies proposed into ongoing planning efforts within the University. The Emergency Management Department of ISU will be the local champion for the mitigation actions. The University Departments and the Community Partners will be an integral part of the implementation process. Federal and state assistance will be necessary for a number of the identified actions.

Illinois State University hopes to use the MHMP to drive mitigation priorities for the next several years and to bring visibility to those efforts throughout the campus community. The University anticipates opportunities to move aggressively in collaboration with community partners to bridge the gap between emergency response and recovery efforts on and off campus.

The MHMP will sit along side the university's Emergency Operations Plan, and ultimately, the Continuity of Operations Plan to serve as the three top-level emergency-related plans for Illinois State University. The MHMP will address concerns before the disaster; the EOP during the disaster, and the COOP after the disaster. The University is also currently in the process of updating its Master Plan, designed to provide a blueprint for future physical development on campus. The actions and goals of each individual plan together will play an integral role in protecting the welfare of the campus and community members as well as its intellectual property and facilities.

Continued campus community involvement is also critical to the successful implementation of the MHMP. Comments from the campus community on the MHMP will be received by Emergency Management Director of ISU and forwarded to the Planning Team for discussion. Education efforts for hazard mitigation will be an ongoing effort of the University. The campus community will be notified of periodic planning meetings through notices in the local newspaper. Once adopted, a copy of the MHMP will be maintained in the Emergency Management Department of Illinois State University.

6.2 Monitoring, Evaluation, and Updating the MHMP

Throughout the five-year planning cycle, the Emergency Management Director of ISU will reconvene the Planning Team to monitor, evaluate, and update the plan on an annual basis. Additionally, a meeting will be held in 2024 to address the five-year update of this plan. Members of the planning committee are readily available to engage in email correspondence between annual meetings. If there is a need for a special meeting, due to new developments or the occurrence of a declared disaster within Illinois State University, the team will meet to update mitigation strategies. Depending on grant opportunities and fiscal resources, mitigation projects may be implemented through local partnerships.

As part of the update process, the Planning Team will review the university goals and objectives to determine their relevance to changing situations at the university level. In addition, state and federal policies will be reviewed to ensure they are addressing current and expected conditions. The team will also review the risk assessment portion of the plan to determine if this information should be updated or modified. The plan revision will also reflect changes in local development and its relation to each hazard. The parties responsible for the various implementation actions will report on the status of their projects, and will include which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies should be revised.

Updates or modifications to the MHMP during the five-year planning process will require a public notice and a meeting prior to submitting revisions to the university departments and community partners for approval. The plan will be updated via written changes, submissions as the committee deems appropriate and necessary, and as approved by the President of Illinois State University.

The GIS data used to prepare the plan was obtained from existing Illinois State University GIS data as well as data collected as part of the planning process. This updated Hazus-MH GIS data has been returned to the University for use and maintenance in the university's system. As newer data becomes available, these updated data will be used for future risk assessments and vulnerability analyses.

Definitions

100-year Floodplain	Areas subject to inundation by the 1-percent-annual-chance flood event.
Critical Facility	A structure, because of its function, size, service area, or uniqueness, that has the potential to cause serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities if it is destroyed or damaged or if its functionality is impaired. This includes, but are not limited to, water and wastewater treatment facilities, municipal buildings, educations facilities, and non-emergency healthcare facilities.
Community Rating System (CRS)	A voluntary program for National Flood Insurance Program (NFIP) participating communities. The goals of the CRS are to reduce flood damages to insurable property, strengthen and support the insurance aspects of the NFIP, and encourage a comprehensive approach to floodplain management.
Comprehensive Plan	A document, also known as a "general plan," covering the entire geographic area of a community and expressing community goals and objectives. The plan lays out the vision, policies, and strategies for the future of the community, including all the physical elements that will determine the community's future developments.
Disaster Mitigation Act of 2000 (DMA 2000)	The largest legislation to improve the planning process. It was signed into law on October 30, 2000. This new legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur.
Essential Facility	A subset of critical facilities that represent a substantial hazard to human life in the event of failure. This includes (but not limited to) hospital and fire, rescue, ambulance, emergency operations centers, and police stations.
Federal Emergency Management Agency	An independent agency created in 1979 to provide a single point of accountability for all federal activities related to disaster mitigation and emergency preparedness, response, and recovery.
Hazard	A source of potential danger or adverse condition.
Hazard Mitigation	Any sustained action to reduce or eliminate long-term risk to human life and property from hazards.

Hazard Mitigation Grant Program (HMPG)	Authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration.
Hazus-MH	A geographic information system (GIS)-based disaster risk assessment tool.
Multi-Hazard Mitigation Planning	Identify policies and actions that can be implemented over the long term to reduce risk and future losses from various hazardous events.
National Flood Insurance Program	Administered by the Federal Emergency Management Agency, which works closely with nearly 90 private insurance companies to offer flood insurance to property owners and renters. In order to qualify for flood insurance, a community must join the NFIP and agree to enforce sound floodplain management standards.
Planning Team	A group composed of government, private sector, and individuals with a variety of skills and areas of expertise, usually appointed by a city or town manager, or chief elected official. The group finds solutions to community mitigation needs and seeks community acceptance of those solutions.
Risk Priority Index	Quantifies risk as the product of hazard probability and magnitude so Planning Team members can prioritize mitigation strategies for high-risk-priority hazards.
Risk Assessment	Quantifies the potential loss resulting from a disaster by assessing the vulnerability of buildings, infrastructure, and people.
Strategy	A collection of actions to achieve goals and objectives.
Vulnerability	Describes how exposed or susceptible to damage an asset is. Vulnerability depends on an asset's construction, contents, and the economic value of its functions.

Acronyms

A B **C** **D** **E** **F** **G** **H** **I** J K L **M** **N** O **P** Q **R** **S** T **U** V W X Y Z

A

AEGL – Acute Exposure Guideline Levels
ALOHA – Areal Locations of Hazardous Atmospheres

C

CERI – Center for Earthquake Research and Information
CRS – Community Rating System

D

DEM – Digital Elevation Model
DFIRM – Digital Flood Insurance Rate Map
DMA – Disaster Mitigation Act of 2000

E

EAP – Emergency Action Plan
EMA – Emergency Management Agency
EPA – Environmental Protection Agency

F

FEMA – Federal Emergency Management Agency
FIRM – Flood Insurance Rate Map

G

GIS – Geographic Information System

H

Hazus-MH – Hazards USA Multi-Hazard
HMGP – Hazard Mitigation Grant Program
HUC – Hydrologic Unit Code

I

IA – Individual Assistance
IDNR – Illinois Department of Natural Resources
IDOT – Illinois Department of Transportation
IEMA – Illinois Emergency Management Agency
ISO – Insurance Service Office
ISGS – Illinois State Geological Survey
ISWS– Illinois State Water Survey

M MHMP – Multi-Hazard Mitigation Plan

N NCDC – National Climatic Data Center
NEHRP – National Earthquake Hazards Reduction Program
NFIP – National Flood Insurance Program
NID – National Inventory of Dams
NOAA – National Oceanic and Atmospheric Administration
NSFHA – Non-Special Flood Hazard Area

P PA – Public Assistance
PHMSA– Pipeline and Hazardous Materials Safety Administration
PPM – Parts Per Million

R RPI – Risk Priority Index

S SIU – Southern Illinois University Carbondale
SPC – Storm Prediction Center
STAPLEE – Social, Technical, Administrative, Political, Legal, Economic, and Environmental

U USGS – United States Geological Survey