Hazard Mitigation Plan

Massac County, Illinois

Adoption Date: -- _____ --

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This document is dedicated to the memory of O.D. Troutman, a faithful servant for 23 years to the residents of Massac County. Mr. Troutman's tireless efforts and commitment to public safety helped make this Plan a reality.

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Section 1 - Public Planning Process

1.1 Narrative Description

Hazard Mitigation is defined as any sustained action to reduce or eliminate long-term risk to human life and property from hazards. The Federal Emergency Services Disaster Agency (FEMA) has made reducing hazards one of its primary goals; hazard mitigation planning and the subsequent implementation of resulting 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 a requirement 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 has created HAZUS-MH (**Haz**ards **US**A **M**ulti-**H**azard) a powerful geographic information system (GIS)-based disaster risk assessment tool. This tool enables communities of all sizes to predict the estimated losses from floods, hurricanes, earthquakes, and other related phenomena and to measure the impact of various mitigation practices that might help reduce those losses. The Illinois Emergency Services Disaster Agency (IEMA) has determined that HAZUS-MH should play a critical role in the risk assessments in Illinois. Southern Illinois University at Carbondale (SIUC) and The Polis Center at Indiana University Purdue University Indianapolis (IUPUI) are assisting Massac County planning staff with performing the hazard risk assessment.

1.2 Planning Team Information

The Massac County Multi-Hazard Mitigation Planning team is made up of representatives from each of the incorporated areas within the county. All municipalities are represented, as well as local business leaders, community leaders, and fire and police departments. The committee decided to hold six meetings to develop the plan. The meetings are as follows:

> **Meeting 1**: Initial Meeting held on October 28, 2008 at the Metropolis Community Center to discuss the development of the plan and to identify key infrastructure and facilities within the county.
>
> **Meeting 2**: Hazard Identification meeting was held on December 11, 2008 at the Metropolis Community Center to prioritize and profile hazards for modeling.
>
> **Meeting 3**: PUBLIC meeting was held on June 25, 2009 at the Metropolis Community Center for a presentation of historical disasters and hazard modeling results. A draft risk assessment was presented and mitigation actions were presented and prioritized.

Meeting 4: The planning team met on September 22, 2009 at the Metropolis Community Center to develop the mitigation strategies for each of the hazards that they had previously determined. These strategies were then ranked by importance. These strategies will be the top priority for the plan.

M**eeting 5**: The planning team met on January 26, 2010 at the Metropolis Community Center and did a final review of the plan prior to its submission to IEMA. The group made revisions to the plan before submission.

The Massac County Multi-Hazard Mitigation Planning Team is headed by O.D. Troutman, whom is the primary point of contact. Members of the planning team including jurisdictions within the county and state representatives. Table 1-1 below identifies the planning team individuals and the organizations they represent.

Table 1-1: Multi-Hazard Mitigation Planning Team Members

Name	Title	Organization	Jurisdiction
Billy Hillebrand	County Commissioner	Massac County	Massac County
Billy McDaniel	Mayor	City of Metropolis	Metropolis
Robin McDaniel	Administration	Massac Memorial Hospital	Massac County
Keith Davis	911 Coordinator	Massac County	Massac County
Bob Griffey	Sheriff	Massac County	Massac County
Lisa Monkman	Administration	Massac Unit Dist #1 School	Massac County
Theresa Bunting	Director	Ambulance Service	Massac County
Bob Stokes	Emergency Coordinator	Honeywell	Massac County
O.D. Troutman	ESDA Director	Massac County	Massac County
Judy Askew	Mayor	City of Brookport	Brookport
Julia Johnson	Mayor	Village of Joppa	Joppa
Jon Teutrine	Fire Management Officer	U.S. Forest Service	Massac County

The Disaster Mitigation Act (DMA) planning regulations and guidance stress that planning team members must be active participants. The Massac County MHMP committee members were actively involved on the following components:

- Attending the MHMP meetings
- Providing available Geographic Information System (GIS) data 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 county

An MHMP kickoff meeting was held at the Shawnee Community College in Ullin, IL on April 14, 2008. Representatives of Massac County attended the meeting. Lisa Thurston Director of Southern Five Regional Planning Commission explained the rationale behind the MHMP program and answered questions from the participants. Nicholas Pinter from SIU, provided an introduction to hazards, and John Buechler, from The Polis Center, provided an overview of HAZUS-MH. Nicholas described the timeline and the process of the mitigation planning project and presented Massac County with a Memorandum of Understanding (MOU) for sharing data and information.

The Massac County Multi-Hazard Mitigation Planning Team met on October 29, 2008, December 11, 2008, June 25, 2009, September 22, 2009, and January 26, 2010. These meetings were held at the Metropolis Community Center. Each meeting was approximately two hours in length. The meeting minutes and attendance sheets are included in Appendix A. 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, and assisted with preparation of the public participation information.

1.3 Public Involvement in Planning Process

The planning process commenced on January 29, 2008 when Southern Illinois University-Carbondale held a news conference to advise the general public that FEMA had approved funding of proposed planning activities for natural disaster preparedness. It was explained that the university would collaborate with members of The Polis Center as well as the five regional planning commissions. The news conference was attended by representatives of the local papers, radio, and television.

Massac County conducted presentations for the public to give an overview of the planning process, inform them of the benefits of completing the plan, and discuss natural hazards affecting the county. The public meeting was held on June 25, 2009. Appendix A contains the minutes from the public meeting. Appendix B contains articles published by the local newspaper throughout the public input process.

1.4 Neighboring Community Involvement

The Massac County planning team invited participation from various representatives of neighboring counties and local, city, and town governments. The initial planning meeting at SIUC on March 19, 2008 included representatives from the adjacent Southern Five Regional Planning Commission counties of Johnson, Alexander, Pulaski, and Union. In the meeting, the county board chairmen and their ESDA/EMA directors discussed creating county planning teams, scheduling meetings throughout the planning process, and ways to ensure public involvement in the plan. The county board chairmen also agreed to allow university research staff to have access to county GIS data from the supervisor of the assessment.

Massac County is located along the Ohio River at southern tip of Illinois and bounded by Johnson County to the North, Pope County to the East and Pulaski County to the West. Massac County has working relationships and cooperation with these counties through regional partnerships. Details of how neighboring stakeholders were involved are summarized in Table 1-2.

Table 1-2: Neighboring Community Participation

Person Participating	Neighboring Jurisdiction	Organization	Participation Description
Kenneth Kerley	Pulaski County	Pulaski County ESDA	Mailed draft copy and asked for suggestions
Chris Hahn	Pope County	Pope County EMA Director	Mailed draft copy and asked for suggestions
Jim Haney	Johnson County	Johnson County ESDA	Mailed draft copy and asked for suggestions

1.5 Review of Technical and Fiscal Resources

The MHMP planning team has identified representatives from key agencies to assist in the planning process. Technical data, reports, and studies were obtained from these agencies. The organizations and their contributions are summarized in Table 1-3.

Table 1-3: Key Agency Resources Provided

Agency Name	Resources Provided
Illinois Environmental Protection Agency	Illinois 2008 Section 303(d) Listed Waters and watershed maps
U.S. Census	County Profile Information such as Population and Physical Characteristics
Department of Commerce and Economic Opportunity	Community Profiles
Illinois Department of Employment Security	Industrial Employment by Sector
National Climatic Data Center	Climate Data
Illinois Emergency Services Disaster Agency	2007 Illinois Natural Hazard Mitigation Plan
United States Geological Survey	Physiographic/Hill Shade Map, Earthquake Information, Hydrology
Illinois State Geological Survey	Geologic, Karst Train, Physiographic Division and Coal Mining Maps

1.6 Review of Existing Plans

Massac County and its associated local communities utilize a variety of planning documents to direct community development. These documents include land use plans, master plans, emergency response plans, municipal ordinances, and building codes. The MHMP planning process incorporated the existing natural hazard mitigation elements from these previous planning efforts. Table 1-4 lists the plans, studies, reports, and ordinances used in the development of the plan.

Table 1-4: Planning Documents Used for MHMP Planning Process

Author(s)	Year	Title	Description	Where Used
Illinois Emergency Services Disaster Agency	2007	Illinois Natural Hazard Mitigation Plan	The Illinois Natural Hazard Mitigation Plan (INHMP) establishes a process for identifying and mitigating the effects of natural hazards in the State of Illinois as required under the Disaster Mitigation Act of 2000.	Mitigation Actions/Projects
Southern Five RPC	2007 – 2010	Comprehensive Economic Development Strategy (CEDS)	Lists economic and community projects for local governments. Includes mitigation to prevent developing in floodplain and building safer structures to withstand a potential earthquake.	Background and Mitigation Actions/ Projects

Section 2 - Jurisdiction Participation Information

The jurisdictions included in this multi-jurisdictional plan are listed in Table 2-1.

Table 2-1: Participating Jurisdictions

Jurisdiction Name
Massac County
City of Brookport
Village of Joppa
City of Metropolis

2.1 Adoption by local governing body

The draft plan was made available to the planning team and other agencies on *<data made available>*, for review and comments. The Massac County Hazard Mitigation Planning team presented and recommended the plan to *<the officials responsible for adopting>*, who adopted the Massac County Hazard Mitigation Plan on *<date adopted>*. Resolution adoptions are included in Appendix C of this plan.

2.2 Jurisdiction Participation

It is required that each jurisdiction participates in the planning process. Each of the incorporated communities within Massac County was invited to participate on the planning team. Table 2-2 lists each jurisdiction and describes its participation in the construction of this plan.

Table 2-2: Jurisdiction Participation

Jurisdiction Name	Participating Member	Participation Description
City of Brookport	Judy Askew, Mark Schneider	Member, MHMP planning committee
Village of Joppa	Julia Johnson, Ron Traverse	Member, MHMP planning committee
Massac County	Billy Hillebrand, Keith Davis, O.D. Troutman, Bob Griffey, Lisa Monkman, Theresa Bunting, Robbin McDaniel, Bob Stokes, Joe Sharp, Pat Windhorst, Sean Patterson	Member, MHMP planning committee
City of Metropolis	Billy McDaniel	Member, MHMP planning committee

All members of the MHMP planning committee were actively involved in attending the MHMP meetings, providing available Geographic Information System (GIS) data and historical hazard information, reviewing and providing comments on the draft plans, coordinating and participating in the public input process, and coordinating the county's formal adoption of the plan. Each meeting culminated with an open forum to invite questions and input from the council members. Appendix A provides further description of the meetings, including dates.

Section 3 - Jurisdiction Information

Massac County was organized in 1843 and claimed its boundaries from the division of Johnson and Pope Counties. The County was named for Fort Massac, which was built by the French in 1757, during the French and Indian War. The County Seat is Metropolis.

Massac County is located along the Ohio River at the southern tip of Illinois. It is bounded on the north by Johnson County, on the south by the Ohio River, on the East by Pope County and on the west by Pulaski County. It relates to major urban areas as follows: 130 miles southeast of St. Louis, Missouri; 185 miles south of Springfield, Illinois; 325 miles south-southwest of Chicago, Illinois. Figure 3-1 shows the location of Massac County.

The major sources of economic activity in Massac County include tourism, gaming, recreation health service, social service, public administration and transportation. The Harrah's Metropolis offers entertainment, gaming, and luxury hotel accommodations. The Shawnee National Forest and Fort Massac Historic State Park offer opportunities for fishing, hunting, boating, camping, and hiking. The villages in Massac County offer amenities, such as restaurants, entertainment, and shopping on a rural community scale.

Sources: Illinois State Archives Depository, Massac County Fact Sheet, 4/17/09, http://www.ilsos.net/departments/archives/irad/Massac.html

State of Illinois, Origin and Evolution of Illinois Counties, 1982

3.1 Physical Setting (Topography)

Massac County is located within two physiographic proveniences the Interior Low Plateaus Province (Shawnee Hills) in the northern half the County and the Coastal Plain Province which encompasses the southern half of the County. The Low Plateaus Province or Shawnee Hills are underlain by sandstone and limestone bedrock. In areas of sandstone bedrock the topography is characterized by bluffs, steep-sided ridges, and hills with narrow to broad valleys. In areas of limestone bedrock the terrain tends to be similar in character but the slopes tend to be less-step with broader valleys. Because of the limestone bedrock, sinkholes and caves are commonly found in these areas.

The Coastal Plain Province is underlain by unconsolidated sediments (Cretaceous, Tertiary and Quaternary in age). The Coastal Plain Province can be dived into two sub-sections, the Cretaceous Hills and Mississippi/Ohio River Bottom Lands. The bottom lands are characterized broad by river valleys with alluvial terrace and recent fluvial landforms related to movement of the Ohio, Mississippi and Cache rivers. The Cretaceous hills are gently rolling hills located between the Cache and Ohio River Floodplains.

The highest elevation(s) (~440 feet above sea level) in Massac County are found in the west-central portion of the county along Fritz Korte Road. The lowest elevation(s) (~315 feet above sea level) are found at the southeastern corner of the county along Ohio River. Figure 3-2 depicts the physiographic division within Massac County and it characteristics.

Figure 3-1: Map of Massac County

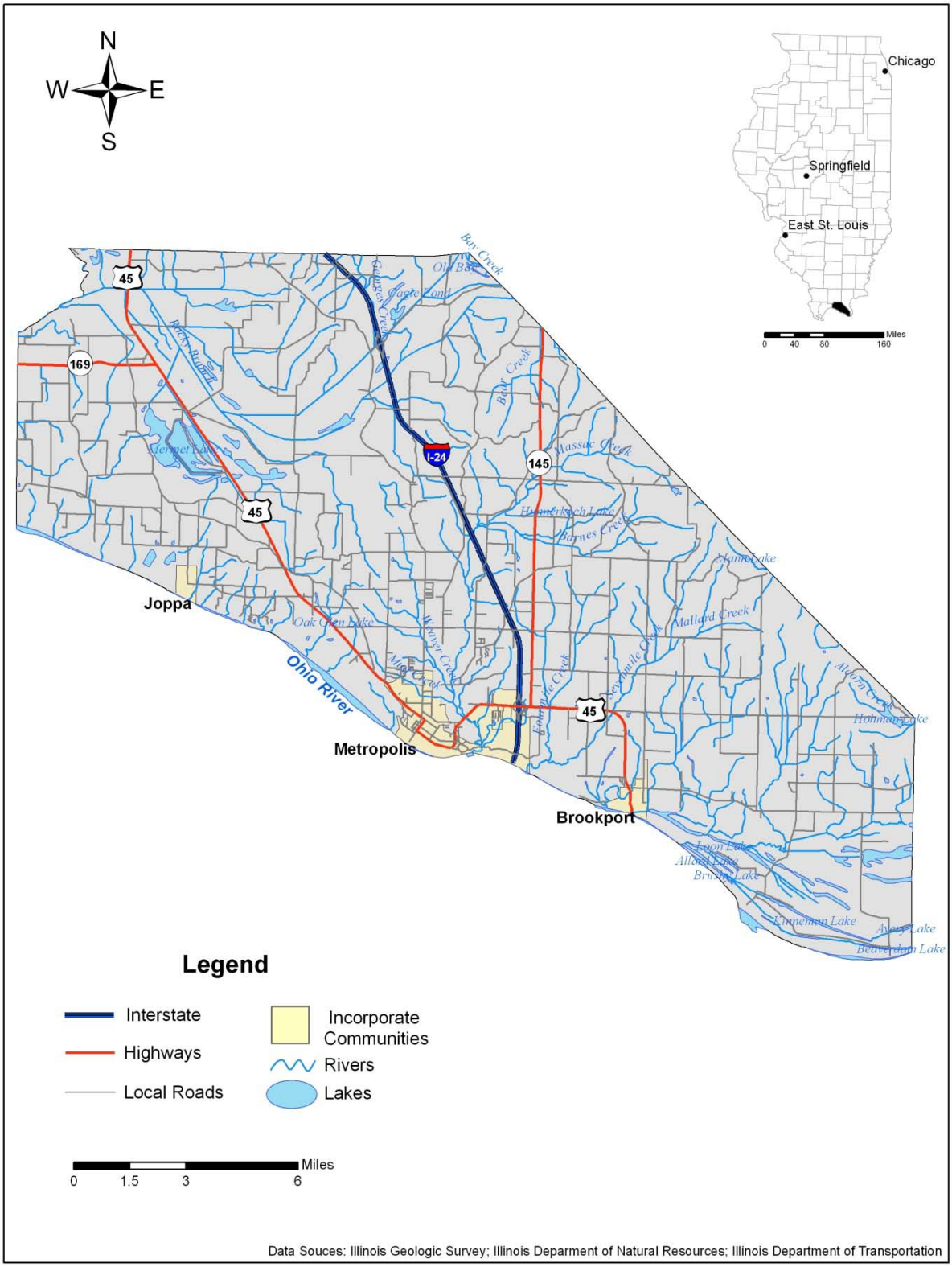
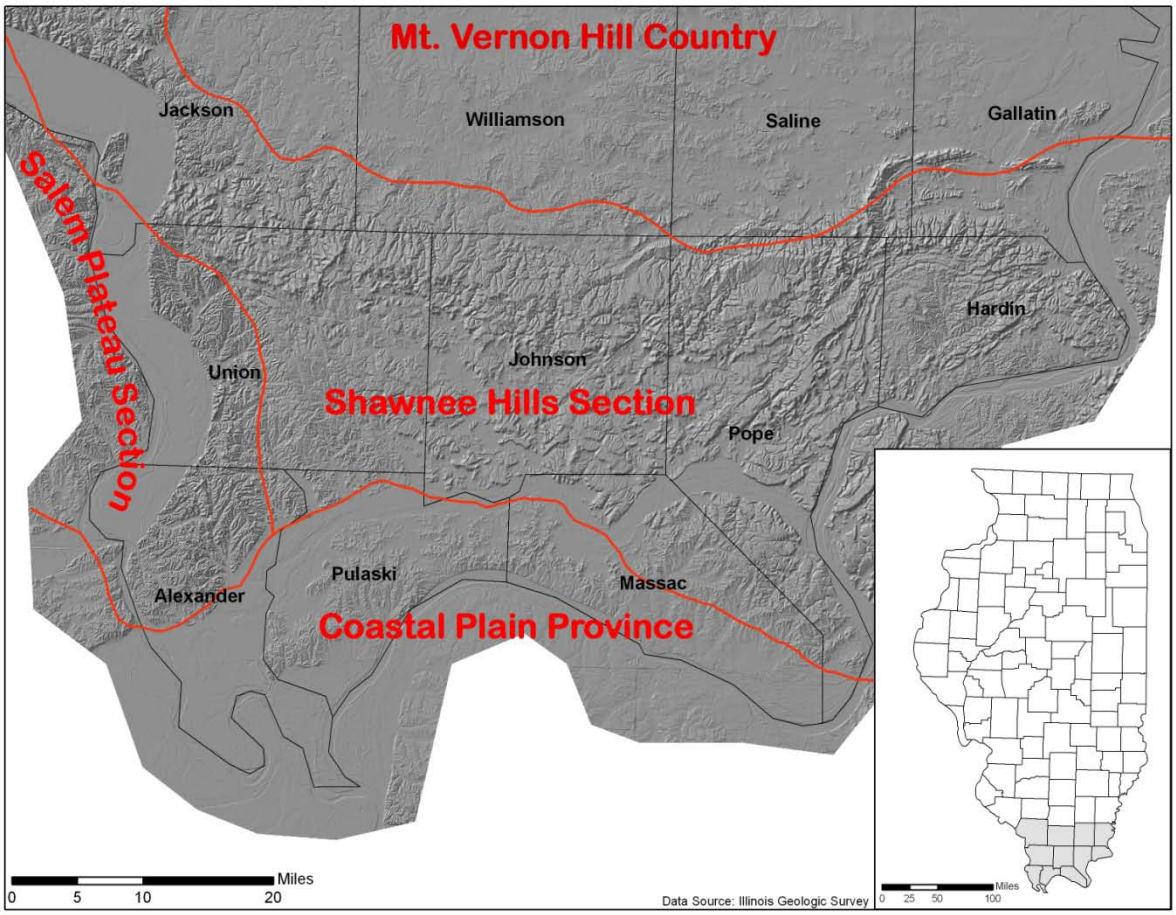


Figure 3-2: Physiographic Divisions of Massac County



Sources: Illinois Geologic Survey, 1998, The Physiographic divisions of Illinois, including Provinces, Sections, and Divisions. http://www.isgs.illinois.edu/nsdihome/webdocs/st-geolq.html.

Leighton, M.M., Ekblaw, G.E., Horberg, L., 1948, Physiographic Divisions of Illinois. Journal of Geology. v. 56, n. 1, p. 16-33.

3.2 Climate

Massac County climate is generally characterized by hot dry summers and cool wet winters. The variables of temperatures, precipitation, and snowfall can vary greatly from one year to the next. In summer, the average low is 66.1° F and average high is 87.9° F; however, daily maximum temperatures often exceed 103° F for the period of time (weeks) between June and September.

During the late fall and into the spring, freezing temperatures can occur any time between late September and early May. The average low and high temperatures in January are 27.6° F and 45.7° F, respectively. Average annual precipitation is 22.9 inches (IL State Climatologist Data

from 1928 to 2008 at Brookport, IL). While the winters are generally cool, i.e. temperatures are above freezing most days, extended periods (days to a couple of weeks) of sub-freezing temperatures often occur and are sometimes accompanied by significant amounts of ice and snow.

3.3 Demographics

According the U.S. Census of 2006, Massac County is estimated to have a population of 15,135. The population of Massac County has decreased by 0.2% between 2000 and 2006. The largest town in Massac County is Metropolis with a population of approximately. The breakdown of population by incorporated areas is included in Table 3-1.

Table 3-1: Population by Community

Community	2000 Population	% of County
City of Brookport	1,054	7.0%
Village of Joppa	409	2.5%
City of Metropolis	6,482	43.0%
Rural Population	7,216	47.5%

Source: American FactFinder, 2009 and Illinois MapStats, 2009

3.4 Economy

Illinois MapStats and Illinois Department of Employment Security report for 2007 and 2008 state that 92.7% of the workforce in Massac County was employed in the private sector. The breakdown is included in Table 3-2. Entertainment, Recreation, Accommodation and Food Services represents the largest sector, employing approximately 35.7% of the workforce. However, manufacturing generates the majority of the workforce earnings, approximately 25.7% of the earnings. The US Census 2005 annual per capita income (inflation adjusted) in Massac County is $25,194 compared to an Illinois average of $36,264.

Table 3-2: Industrial Employment by Sector

Industrial Sector	% of County Workforce (2007)
Agriculture, Forestry, Fishing, Hunting, and Mining	0.0%
Construction	0.0%
Manufacturing	13.8%
Wholesale Trade	0.0%
Retail Trade	8.2%
Transportation, Warehousing and Utilities	16.0%
Information	0.0%
Finance, Insurance, Real Estate, and Rental/Leasing	3.0%
Professional and Business Services	0.0%
Educational, Health, and Social Services	11.0%
Arts, Entertainment, Recreation, Accommodation and Food Services	35.7%
Other Services (except Public Administration)	5.0%
Public Administration	7.3%

Source: Illinois Department of Employment Security 2008 and Illinois MapStats, 2009

3.5 Industry

Massac County's major employers and number of employees are listed in Table 3-3. The largest employers in Massac County are Harrah's Metropolis, Honeywell Security Group, and Electric Energy, Inc. Entertainment, Recreation, Accommodation and Food Services, Manufacturing, and Utilities are the largest employment sectors in the county.

Table 3-3: Major Employers

Manufacturing				
Company Name	**Location**	**Established**	**Employees**	**Type of Business**
Honeywell Security Group	Metropolis		~300	Chemical Manufacturing
Lafarge North America	Joppa		~175	Cement Manufacturing
Transportation, Warehousing and Utilities				
Electric Energy, Inc	Joppa		~300	Electric Co Distribution
Entertainment, Recreation, Accommodation and Food Services				
Harrah's Metropolis	Metropolis		~2,000	Entertainment - Casino
Educational, Health, and Social Services				
Massac Memorial Hospital	Metropolis		~175	Hospital
Southgate Health Care	Metropolis		~175	Nursing Care Facility

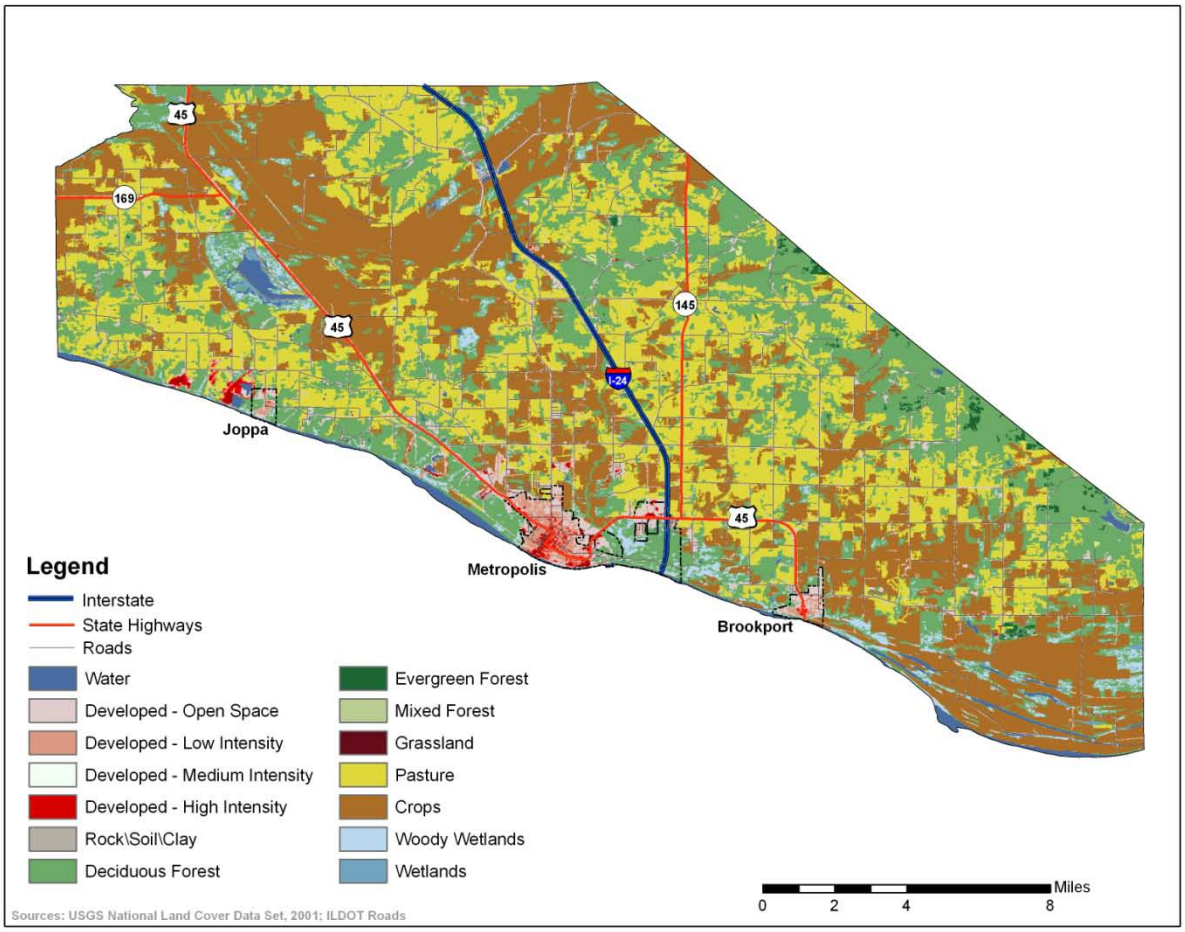
Source: Department of Commerce and Economic Opportunity, Community Profiles 2007; and Direct Contact

3.6 Land Uses and Development Trends

Pre-European settlement, Massac County was a land of dense upland and floodplain forests. Since settlement, agriculture, logging, and urbanization have dramatically altered the county's land cover. Today, agriculture is the predominant land cover in the County. The uplands and Ohio River Bluffs in Massac County remain forested because the soils in these areas are not suited to agriculture (Figure 3-3).

Recent developments in Massac County have been mostly confined to the City of Metropolis. Since the completion of Harrah's Metropolis Casino and Hotel in 2005, there has been modest residential development and growth in businesses associated with the tourism and entertainment industry. Any significant growth in Massac County within the next five years is expected to be in or near Metropolis.

Figure 3-3: Land Cover of Massac County



3.7 Major Lakes, Rivers, and Watersheds

Massac County is located along the Ohio River. The majority of surface water flows from north to south across the county empting into the Ohio River. The larger streams in the County include Rocky Branch, Massac Creek, and Seven Mile Creek. There are also two significant lakes located outside the Ohio River Floodplain in Massac County, Mermet and Hohlman Lakes (Figure 3-1).

Section 4 - Risk Assessment

The goal of mitigation is to reduce the future impacts of a hazard including loss of life, property damage, disruption to local and regional economies, and the expenditure of public and private funds for recovery. Sound mitigation must be based on sound risk assessment. 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 of the community could be affected by a disaster, and the impact on community assets. A risk assessment consists of three components: hazard identification, vulnerability analysis, and risk analysis.

4.1 Hazard Identification/Profile

4.1.1 Existing Plans

The previous Massac County Comprehensive Emergency Management Plan (CEMP) did not contain a risk analysis. Additional local planning documents were reviewed to identify historical hazards and help identify risk. To facilitate the planning process, FIRM maps were used for the flood analysis.

4.1.2 Planning Team

During Meeting #2, which occurred on December 10, 2008, the planning team developed and ranked a list of hazards that affect the county. The team identified 1) severe thunderstorms with tornadoes, 2) winter storms river, 3) flooding which occurs on an annual basis during the spring earthquakes, and 4) Earthquakes. The plan also identified Massac County's principal technological hazards (in order of likelihood): 1) land transportation accidents with hazardous material release, 2) fire\explosion, and 3) dam or levee failure.

4.1.3 National Hazard Records

In addition to these identified hazards, the MHMP planning committee reviewed the list of natural hazards prepared by FEMA. To assist the planning team, historical storm event data was compiled from the National Climatic Data Center (NCDC; http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll). This NCDC data included 256 reported events in Massac County between December 2, 1950 and April 2, 2008. A summary table of events related to each hazard type is included in the hazard profile sections that follow. List of the events, including additional sources that identify specific occurrences, are included as Appendix D. In addition to NCDC data, Storm Prediction Center (SPC) data associated with tornadoes, strong winds, and hail were plotted using SPC recorded latitude and longitude. These events are plotted and included as Appendix E. The list of NCDC hazards is included in Table 4-1.

Table 4-1: Climatic Data Center Historical Hazards

Hazard
Tornadoes
Severe Thunderstorms
Drought/Extreme Heat
Winter Storms
Flood/Flash flood

4.1.4 Hazard Ranking Methodology

Based on planning team input, national datasets, and existing plans, Table 4-2 lists the hazards Massac County will address in this multi-hazard mitigation plan. In addition, these hazards ranked the highest based on the Risk Priority Index discussed in section 4.1.5.

Table 4-2: Planning Team Hazard List

Hazard
Transportation Hazardous Material Release
Tornado
Winter Storms
Flooding
Earthquakes
Thunderstorms/ High Winds/Hail/ Lightning
Fire/Explosion
Dam or Levee Failure

4.1.5 Calculating the Risk Priority Index

The first step in determining the Risk Priority Index (RPI) was to have the planning team members generate a list of hazards which have befallen or could potentially befall their community. Next, the planning team members were asked to assign a likelihood rating based on the criteria and methods described in the following table. Table 4-3 displays the probability of the future occurrence ranking. This ranking was based upon previous history and the definition of hazard. Using the definitions given, the likelihood of future events is "Quantified" which results in the classification within one of the four "Ranges" of likelihood.

Table 4-3: Future Occurrence Ranking

Probability	Characteristics
4 - *Highly Likely*	Event is probable within the calendar year. Event has up to 1 in 1 year chance of occurring. (1/1=100%) History of events is greater than 33% likely per year.
3 - *Likely*	Event is probable within the next three years. Event has up to 1 in 3 years chance of occurring. (1/3=33%) History of events is greater than 20% but less than or equal to 33% likely per year.
2 - *Possible*	Event is probable within the next five years. Event has up to 1 in 5 years chance of occurring. (1/5=20%) History of events is greater than 10% but less than or equal to 20% likely per year.
1 - *Unlikely*	Event is possible within the next ten years. Event has up to 1 in 10 years chance of occurring. (1/10=10%) History of events is less than or equal to 10% likely per year.

Next, planning team members were asked to consider the potential magnitude/severity of the hazard according to the severity associated with past events of the hazard. Table 4-4 gives four classifications of magnitude/severity.

Table 4-4: Hazard Magnitude

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.

Finally, the RPI was calculated by multiplying the probability by the magnitude/severity of the hazard. Using these values, the planning team members were then asked to rank the hazards. Table 4-5 identifies the RPI and ranking for each hazard facing Massac County.

Table 4-5: Massac County Hazards (RPI)

Hazard	Probability	Magnitude/Severity	Risk Priority Index	Rank
Transportation of Hazardous Material Release	4 - Highly Likely	8 - Catastrophic	32	1
Tornado	3 - Likely	8 - Catastrophic	24	2
Winter Storms	3 - Likely	2 - Limited	6	3
Flooding	4 - Highly Likely	2 - Limited	8	4
Earthquake	2 - Possible	8 - Catastrophic	16	5
Thunderstorms/ High Winds/Hail/ Lightning	4 - Highly Likely	1 - Negligible	4	6
Fire/Explosion	3 - Likely	2 - Limited	6	7
Dam/Levee Failure	4 - Highly Likely	2 - Limited	8	8

4.1.6 Jurisdictional Hazard Ranking

Because the jurisdictions in Massac County differ in their susceptibilities to certain hazards—for example, the city of Metropolis which has several railroad lines, an interstate, and a port is more likely to experience a hazardous material release than Joppa which is small village located a significant distance away major transportation lines and hubs—the hazards identified by the planning team were ranked by SIUC for each individual jurisdiction using the methodology outlined in Section 4.1.5. The SIUC rankings were based on input from the planning team members, available historical data, and the hazard modeling results described within this hazard mitigation plan. During the five-year review of the plan this table will be updated by the planning team to ensure these jurisdictional rankings accurately reflect each community's assessment of these hazards. Table 4-6 lists the jurisdictions and their respective hazard rankings (Ranking 1 being the highest concern).

Table 4-6: Hazard Rankings by Jurisdiction

Jurisdiction	Hazard							
	Tornado	HAZMAT	Earthquake	Thunderstorms	Flooding	Winter Storms	Dam or Levee Failure	Fire/Explosion
City of Brookport	3	4	6	7	2	5	1	8
Village of Joppa	1	3	6	5	4	2	NA	7
City of Metropolis	2	1	5	6	4	3	NA	7

NA = Not applicable

4.1.7 GIS and HAZUS-MH

The third step in this assessment is the risk analysis, which quantifies the risk to the population, infrastructure, and economy of the community. Where possible, the hazards were quantified using GIS analyses and HAZUS-MH. This process reflects a level two approach to analyzing hazards as defined for HAZUS-MH. The approach includes substitution of selected default data with local data. Level two analysis significantly improves the accuracy of the model predictions.

HAZUS-MH generates a combination of site-specific and aggregated loss estimates depending upon the analysis options that are selected and upon the input that is provided by the user. Aggregate inventory loss estimates, which include building stock analysis, are based upon the assumption that building stock is evenly distributed across census blocks/tracts. Therefore, it is possible that overestimates of damage will occur in some areas while underestimates will occur in other areas. With this in mind, total losses tend to be more reliable over larger geographic areas than for individual census blocks/tracts. It is important to note that HAZUS-MH is not intended to be a substitute for detailed engineering studies. Rather, it is intended to serve as a planning aid for communities interested in assessing their risk to flood-, earthquake-, and hurricane-related hazards. This documentation does not provide full details on the processes and procedures completed in the development of this project. It is only intended to highlight the major steps that were followed during the project.

Site-specific analysis is based upon loss estimations for individual structures. For flooding, analysis of site-specific structures takes into account the depth of water in relation to the structure. HAZUS-MH also takes into account the actual dollar exposure to the structure for the costs of building reconstruction, content, and inventory. However, damages are based upon the assumption that each structure falls into a structural class, and that structures in each class will respond in similar fashion to a specific depth of flooding. Site-specific analysis is also based upon a point location rather than a polygon; therefore the model does not account for the percentage of a building that is inundated. These assumptions suggest that the loss estimates for site-specific structures as well as for aggregate structural losses need to be viewed as approximations of losses that are subject to considerable variability rather than as exact engineering estimates of losses to individual structures.

The following events were analyzed. The parameters for these scenarios were created using GIS, HAZUS-MH, and historical information to predict which communities would be at risk.

Using HAZUS-MH

1. 100-year overbank flooding
2. Earthquake

Using GIS

1. Tornado
2. Hazardous Material Release

4.2 Vulnerability Assessment

4.2.1 Asset Inventory

4.2.1.1 Processes and Sources for Identifying Assets

The HAZUS-MH data is based on best available national data sources. The initial step involved updating the default HAZUS-MH data using State of Illinois data sources. At Meeting #1, the planning team members were provided with a plot and report of all HAZUS-MH critical

facilities. The planning team took GIS data provided by SIU-Polis, verified the datasets using local knowledge, and allowed SIU-Polis to use their local GIS data for additional verification. SIU-Polis GIS analysts made these updates and corrections to the HAZUS-MH data tables prior to performing the risk assessment. These changes to the HAZUS-MH inventory allow a level two analysis. This update process improved the accuracy of the model predictions.

The default HAZUS-MH data has been updated as follows:

- The HAZUS-MH defaults, critical facilities, and essential facilities have been updated based on most recent available data sources. Critical and essential point facilities have been reviewed, revised, and approved by local subject matter experts at each county.
- The essential facility updates (schools, medical care facilities, fire stations, police stations, and EOCs) have been applied to the HAZUS-MH model data. HAZUS-MH reports of essential facility losses reflect updated data.
- Parcels with assessment improvements (buildings) values were used to estimate the number of buildings in the flood-prone areas.
- The analysis is restricted to the county boundaries. Events that occur near the county boundary do not contain damage assessments from the adjacent county.

4.2.1.2 Essential Facilities List

Table 4-7 identifies the critical facilities that were added or updated for the analysis. A complete list of the critical facilities is included as Appendix F. A map of all the critical facilities is included as Appendix G.

Table 4-7: Critical Facilities List

Facility	Number of Facilities
Care Facilities	4
Emergency Operation Centers	2
Fire Stations	5
Police Stations	4
Schools	10

4.2.1.3 Facility Replacement Costs

Default HAZUS-MH building stock data were used for the HAZUS-MH analyses. Facility replacement costs and total building exposure are identified in Table 4-8. Table 4-8 also includes the estimated numbers of buildings within each occupancy class.

Table 4-8: Building Exposure (default HAZUS-MH) for Massac County

General Occupancy	Estimated Total Buildings	Total Building Exposure (X 1000)
Agricultural	5	$8,961
Commercial	94	$149,100
Education	4	$18,664
Government	6	$6,422
Industrial	14	$22,091
Religious/Non-Profit	15	$34,427
Residential	6,586	$704,441
Total	**6,724**	**$944,106**

Massac County provided parcel boundaries with assessed values. The parcel data was used to estimate the actual number of buildings within the flood-prone areas. The parcel data identified parcels with building improvements, which were then converted into centroid point locations. The parcels with improvements are summarized by occupancy class in Table 4-9.

Table 4-9: Parcels with Improvements by Occupancy Class for Massac County

Occupancy Class	Number of Structures
Residential	4,757
Commercial	677
Industrial	19
Agriculture	984
Exempt	25
Total	**6,462**

4.3 Future Development

Massac County is subject to a variety of natural disasters. County government, in partnership with State government, must make a commitment to prepare for those types of disasters. Likewise, the Massac County manufacturing base leaves the county vulnerable to major hazardous materials events and other technological threats. However, as the county-elected and appointed officials become better informed on the subject of community hazards, they will be better able to set and direct policies that will enable emergency management and county response agencies to effectively plan, train, and exercise. The end result will be a stronger community and a better place in which to work, live, and grow.

4.4 Hazard Profiles

4.4.1 Tornado Hazard

Hazard Definition for Tornado Hazard

Tornadoes pose a great risk to the State of Illinois and its citizens. Tornadoes historically have occurred during any month of the year. The unpredictability of tornadoes makes them one of Illinois' most dangerous hazards. Their extreme winds are violently destructive when they touch down in the region's developed and populated areas. Current estimates place the maximum velocity at about 300 mph, but higher and lower values can occur. A wind velocity of 200 mph will result in a wind pressure of 102.4 pounds per square foot of surface area, a load that exceeds the tolerance limits of most buildings. Considering these factors, it is easy to understand why tornadoes can be so devastating for the communities they hit.

Tornadoes are defined as 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 very quickly and become a tornado. If the funnel cloud picks up and blows around debris, it has reached the ground and is a tornado.

Tornadoes are classified according to the Fujita tornado intensity scale. The tornado scale ranges from low intensity F0, with effective wind speeds of 40 to 70 mph, to F5 tornadoes with effective wind speeds of over 260 mph. The Fujita intensity scale is included in Table 4-10.

Table 4-10: Fujita Tornado Rating

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, sign boards 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 for Tornado Hazard

There have been several occurrences of tornadoes within Massac County during recent decades. The NCDC database reported nine tornadoes/funnel clouds in Massac County since 1989. These

tornados have been attributed with one death, 23 injuries, and $10.6 million dollars in property damage within Massac and adjacent counties. As of April 2008, the most recent tornado touchdown occurred on September 22, 2006. This tornado, which contained peak winds near 160 MPH, struck between Joppa and the Metropolis airport. The damage path started about a mile from the Ohio River, where F-1 winds uprooted numerous trees. As the tornado crossed U.S. Highway 45 near Joppa Road, a barn was destroyed. The tornado then strengthened to F-3 intensity, destroying a log home. The roof and an exterior wall of the well-constructed log home were blown about one-half mile and a nearby house sustained major damage. Four mobile homes were destroyed, along with garages and outbuildings. Part of a double wide mobile home blew into a church sanctuary. Six vehicles were tossed up to 100 yards. At least one of the vehicles landed in a pond. The only two persons injured were residents of a destroyed mobile home. The worst of the injuries was a broken arm. Hundreds of trees were broken or uprooted, and numerous trees fell on cars. Numerous power poles were downed. A seriously injured dog was found in a ditch one quarter mile away. The most intense damage, where vehicles were tossed, occurred about two-thirds of the way along the damage path near Red Oak Road. The tornado was witnessed by the general public. The average path width was 100 yards.

Massac County tornadoes recorded in the NCDC database are identified in Table 4-11. Additional details for NCDC events are included in Appendix D.

Table 4-11: Massac County Tornadoes*

Location	Date	Type	Magnitude	Deaths	Injuries	Property Damage
Massac	4/3/1989	Tornado	F1	0	0	0K
Metropolis	4/5/1999	Tornado	F0	0	1	10K
Joppa	5/4/2003	Tornado	F1	0	0	0
Hillerman	5/6/2003	Tornado	F4	1	20	10.0M
Samoth	5/6/2003	Tornado	F0	0	0	0
Metropolis	5/6/2003	Tornado	F2	0	0	80K
Metropolis	11/15/2005	Tornado	F0	0	0	0
Boaz	3/12/2006	Tornado	F0	0	0	50K
Metropolis Municipal Airport	9/22/2006	Tornado	F3	0	2	500K

Source: NCDC

* 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 for occurrence of tornadoes. They can occur at any location within the county.

Hazard Extent for Tornado Hazard

The historical tornadoes listed previously generally move from west to east across the county—although many other tracks are possible—from more southerly to northerly. The extent of the hazard varies both in terms of the extent of the path and the wind speed.

Calculated Risk Priority Index for Tornado Hazard

Based on historical information, the probability of future tornadoes in Massac County is likely. Tornadoes with varying magnitudes are expected to happen. According to the RPI, tornadoes ranked as the number two hazard.

RPI = Probability x Magnitude/Severity.

Probability	x	Magnitude /Severity	=	RPI
3	x	8	=	**24**

Vulnerability Analysis for Tornado Hazard

Tornadoes can occur within any area of the county; therefore, the entire county population and all buildings are vulnerable to tornadoes. To accommodate this risk, this plan will consider all buildings located within the county as vulnerable. The existing buildings and infrastructure in Massac County are discussed in types and numbers in Table 4-9.

Critical Facilities

All critical facilities are vulnerable to tornadoes. A critical facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts will vary based on the magnitude of the tornado, but can include structural failure, debris (trees or limbs) causing damage, 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 4-7 lists the types and numbers of all of the essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

A table of the building exposure for the entire county is listed in Table 4-8. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure, debris (trees or limbs) causing damage, roofs blown off or windows broken by hail or high winds, and loss of building function (e.g. a damaged home will no longer be habitable causing residents to seek shelter).

Infrastructure

During a tornado the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable, it is important to emphasize that any number of these items could become damaged during a tornado. 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 fail or become impassable causing risk to traffic.

An example scenario is described as follows to illustrate the anticipated impacts of tornadoes in the county in terms of numbers and types of buildings and infrastructure.

Massac County Tornado Analysis

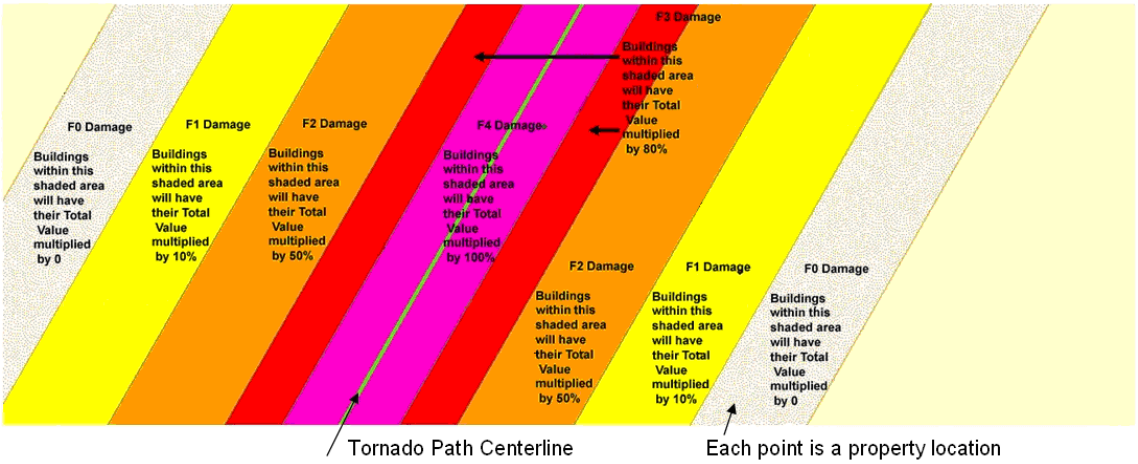
GIS overlay modeling was used to determine the potential impacts of an F4 tornado. The analysis used a hypothetical path based. The selected widths were based on a recreation of the Fujita-Scale guidelines based on conceptual wind speeds, path widths, and path lengths. There is no guarantee that every tornado will fit exactly into one of these six categories. The Fujita Scale guidelines are described in Table 4-12.

Table 4-12: Tornado Path Widths and Damage Curves

Fujita Scale	Path Width (feet)	Maximum Expected Damage
F-5	3000	100%
F-4	2400	100%
F-3	1800	80%
F-2	1200	50%
F-1	600	10%
F-0	300	0%

Within any given tornado path there are degrees of damage. The most intense damage occurs within the center of the damage path with a decreasing amount of damage away from the center of the damage path. This natural process was modeled in GIS by adding damage zones around the tornado path. Figures 4-1 and Table 4-13 describe the zone analysis.

Figure 4-1: GIS Analysis Using Tornado Buffers



Once the hypothetical route is digitized on the map, several buffers are created to model the damage functions within each zone.

An F4 tornado has four damage zones. Total devastation is estimated within 150 feet of the tornado path (the darker colored zone 1). The outer buffer is 900 feet from the tornado path (the lightest colored zone 4), within which 10% of the buildings will be damaged.

Table 4-13: Tornado Zones and Damage Curves

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

The selected hypothetical tornado path is depicted in Figure 4-2, and the damage curve buffers with damaged buildings are shown in Figures 4-3 and 4-4.

Figure 4-2: Hypothetical F-4 Tornado Path in Massac County

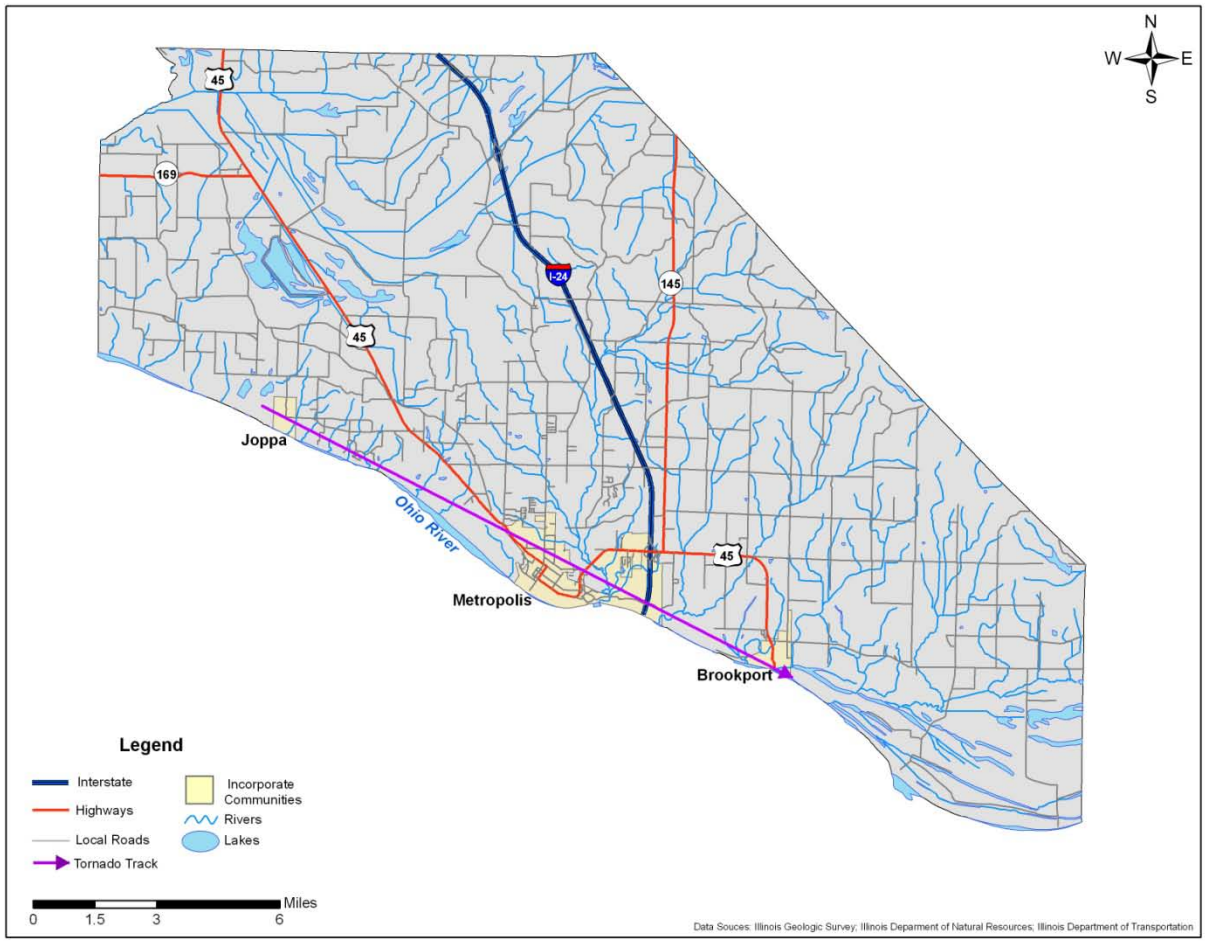


Figure 4-3: Modeled F-4 Tornado Damage Buffers in Metropolis

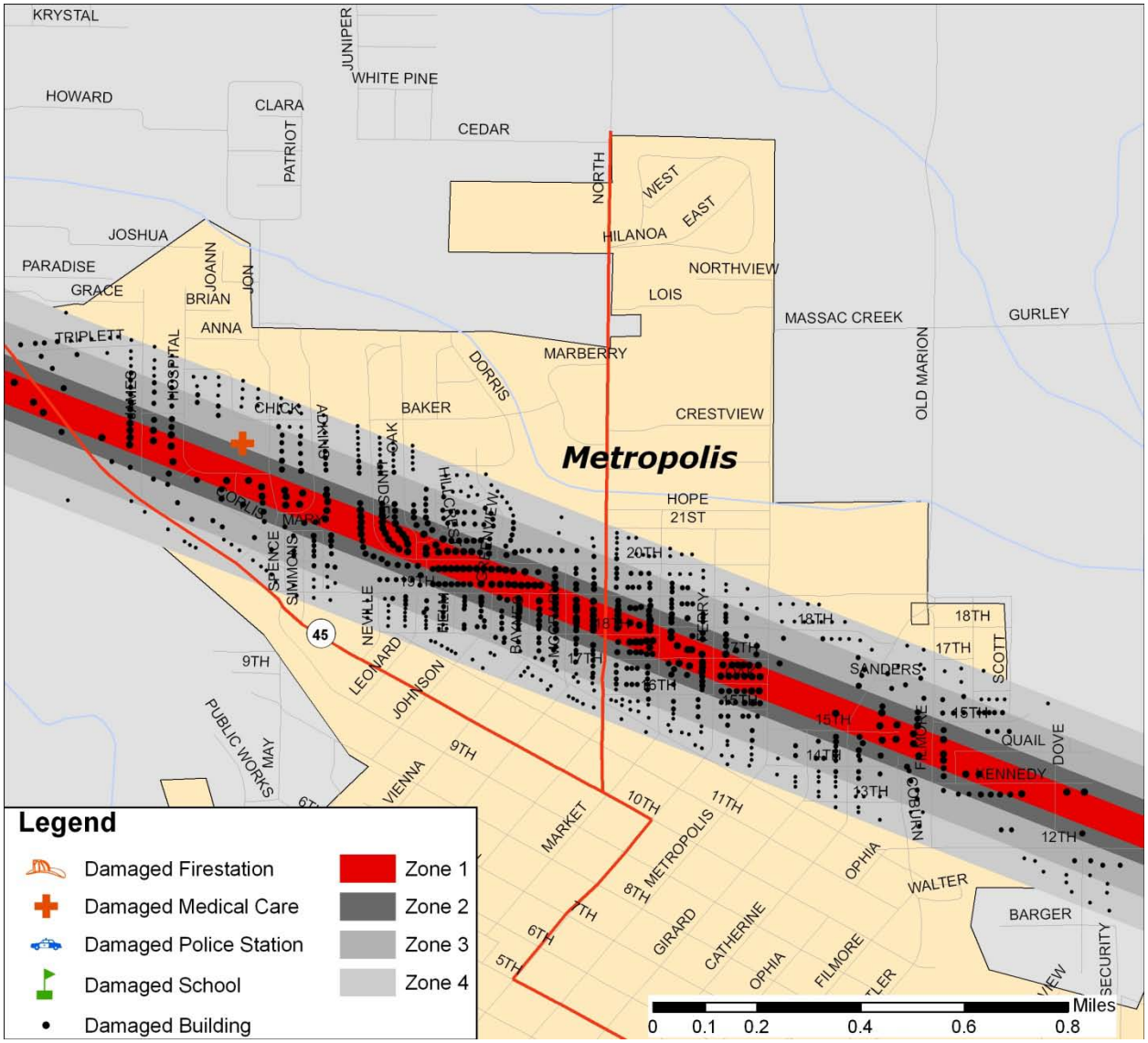
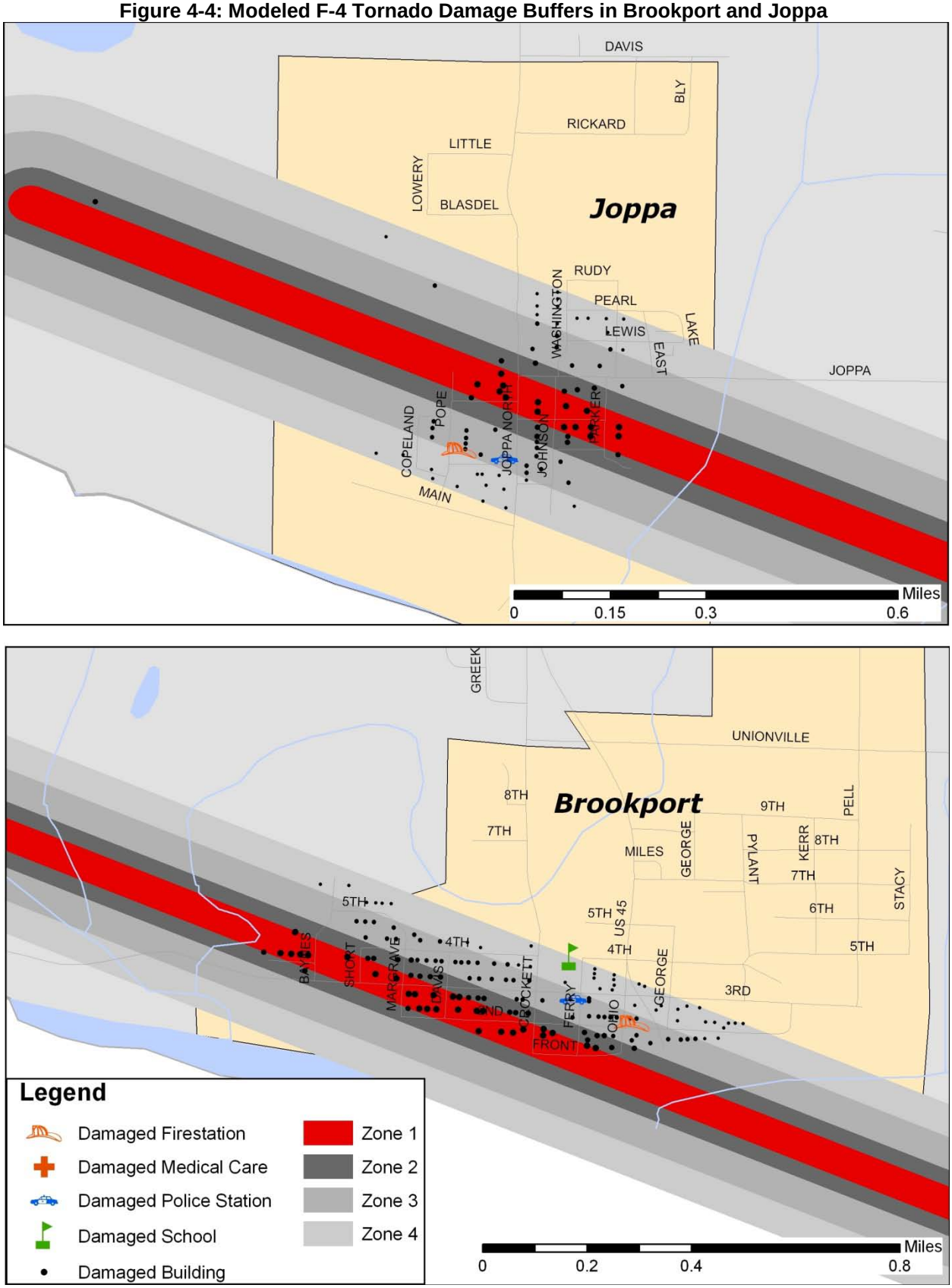


Figure 4-4: Modeled F-4 Tornado Damage Buffers in Brookport and Joppa



The results of the analysis are depicted in Tables 4-14 and 4-15. The GIS analysis estimates that 1,134 buildings will be damaged. The estimated building losses were approximately $108 million. The building losses are an estimate of assessed values multiplied by the percentages of damage. The overlay was performed against parcels provided by Massac County that were joined with Assessor records showing property improvement.

The Assessor records often do not distinguish parcels by occupancy class if the parcels are not taxable. For purposes of analysis, the total number of buildings and the assessed values for government, religious/non-profit, and education should be lumped together as exempt.

Table 4-14: Estimated Numbers of Buildings Damaged by Occupancy Type

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	194	189	339	346
Commercial	9	8	24	19
Industrial	2	1	2	1
Agriculture	0	0	0	0
Exempt	0	0	0	0
Total	**205**	**198**	**365**	**366**

Table 4-15: Estimated Building Losses by Occupancy Type

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	$9,060,415	$8,655,308	$16,008,073	$16,072,193
Commercial	$1,689,760	$609,260	$3,536,320	$2,024,960
Industrial	$5,726,673	$5,920,632	$38,520,306	$313,065
Agriculture	0	0	0	0
Exempt	0	0	0	0
Total	**$16,476,848**	**$15,185,200**	**$58,064,699**	**$18,410,218**

Essential Facilities Damage

There are six essential facilities located within 900 feet of the hypothetical tornado path. The model predicts two police departments, two fire departments, one school would and one hospital would experience damage. The affected facilities are identified in Table 4-16, and their geographic locations are shown in Figures 4-3 and 4-4.

Table 4-16: Estimated Essential Facilities Affected

Name
Brookport Elementary School
Brookport Fire Department
Brookport Police Department
Village of Joppa Police Department
Joppa Fire Department
Massac Memorial Hospital

Vulnerability to Future Assets/Infrastructure for Tornado Hazard

The entire population and buildings have been identified as at risk because tornadoes can occur anywhere within the State of Illinois, at any time of the day, and during any month of the year. Furthermore, any future development in terms of new construction within the county will be at risk. The building exposure for Massac County is included in Table 4-8.

All critical facilities in the county and its communities are at risk. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Analysis of Community Development Trends

Preparing for severe storms will be enhanced if officials sponsor a wide range of programs and initiatives to address the overall safety of county residents. New structures should be built with sturdier construction, and existing structures should be hardened to lessen the potential impacts of severe weather. Community sirens to warn of approaching storms are also vital to ensuring the safety of Massac County residents.

4.4.2 Flood 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 amount and distribution of precipitation over a given area, the rate at which precipitation infiltrates into the ground, the geometry and hydrology of the catchment, and flow dynamics and conditions in and along the river channel. Floods can be classified as one of two types: 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; another eighteen inches might carry off a car. Generally, upstream floods cause damage over relatively localized areas, but they can be quite severe in the local areas where they occur. Urban flooding is a type of upstream flood. Urban flooding involves the overflow of storm drain systems and can be the result of inadequate drainage combined with heavy rainfall or rapid snowmelt. Upstream or flash floods can occur at anytime 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.

Hazard Definition for Dam and Levee Failure

Dams are structures that retain or detain water behind a large barrier. When full or partially full, the difference in elevation between the water above the dam and below creates large amounts of potential energy, creating the potential for failure. The same potential exists for levees when they serve their purpose, which is to confine flood waters within the channel area of a river and exclude that water from land or communities land-ward of the levee. Dams and levees can fail due to either: 1) water heights or flows above the capacity for which the structure was designed; or 2) deficiencies in the structure such that it cannot hold back the potential energy of the water. If a dam or levee fails, issues of primary concern include loss of human life/injury, downstream property damage, lifeline disruption (of concern would be transportation routes and utility lines required to maintain or protect life), and environmental damage.

Many communities view both dams and levees as permanent and infinitely safe structures. This sense of security may well be false, leading to significantly increased risks. Both downstream of dams and on floodplains protected by levees, security leads to new construction, added infrastructure, and increased population over time. Levees in particular are built to hold back

flood waters only up to some maximum level, often the 100-year (1% annual probability) flood event. When that maximum is exceeded by more than the design safety margin, then the levee will be overtopped or otherwise fail, inundating communities in the land previously protected by that levee. It has been suggested that climate change, land-use shifts, and some forms of river engineering may be increasing the magnitude of large floods and the frequency of levee-failure situations.

In addition to failure that results from extreme floods above the design capacity, levees and dams can fail due to structural deficiencies. Both dams and levees require constant monitoring and regular maintenance to assure their integrity. Many structures across the U.S. have been under-funded or otherwise neglected, leading to an eventual day of reckoning in the form either of realization that the structure is unsafe or, sometimes, an actual failure. The threat of dam or levee failure may require substantial commitment of time, personnel, and resources. Since dams and levees deteriorate with age, minor issues become larger compounding problems, and the risk of failure increases.

Previous Occurrences for Riverine and Flash Flooding

The NCDC database reported 59 flood events in Massac County since 1995. These flood events have been attributed with nearly $4.3 million in property damage. A recent example of flooding in Massac County occurred during January 2005 when moderate to major flooding occurred along the Ohio River and some of its tributaries. The major flooding was partially the result of a record-setting snowstorm on December 22 that dumped from 14 to 22 inches across the Lower Ohio Valley. The snow pack melted rapidly by New Year's Day. A series of heavy rainfall events in early to mid January contributed to serious flooding. Average rainfall from 3 to 4 inches occurred from the 1st to the 5th. An additional 1 to 2 inches of rain fell between the January 10th and 13th. In Illinois a state disaster was declaration was declared for Massac, Pope, Hardin, and Gallatin Counties. Flood-fighting activities during this flood included the construction of temporary sandbag levees and isolated evacuations of some lowland residents were conducted. In the city of Metropolis several streets were closed, a few residences were evacuated, and the Harrah’s Metropolis Casino was closed for several days because of flooding of its parking lot and entrance. The closure of the casino had a major impact on the local economy. However, there was very little property damage to the casino itself.

Significant Massac County floods recorded by the NCDC are shown in Table 4-17. A complete list of flood events and additional information about the significant flood events are included in Appendix D. Historical flood crests and discharges at hydrologic monitoring stations are summarized in Appendix H.

Table 4-17: Massac County Previous Occurrences of Flooding*

Location	Date	Type	Deaths	Injuries	Property Damage
Extreme South II	4/9/1995	Flash Flood	0	0	50K
Unionville	11/7/1996	Flash Flood	0	0	5K
Brookport	3/1/1997	Flash Flood	0	0	0
Metropolis	3/1/1997	Flash Flood	0	0	50K
Metropolis	5/28/1997	Flash Flood	0	0	10K
Massac	4/3/1999	Flash Flood	0	0	0
Massac	1/3/2000	Flash Flood	0	0	10K
Massac	12/17/2001	Flash Flood	0	0	10K
Massac	5/17/2002	Flash Flood	0	0	0
Massac	5/4/2003	Flash Flood	0	0	0
Massac	5/6/2003	Flash Flood	0	0	0
Metropolis	6/18/2004	Flash Flood	0	0	0
Massac	3/9/2006	Flash Flood	0	0	0
Brookport	6/29/2007	Flash Flood	0	0	0K
Midway	7/5/2007	Flash Flood	0	0	10K
Massac	1/26/1996	Flood	0	0	5K
Massac	2/1/1996	Flood	0	0	0
Massac	4/26/1996	Flood	0	0	40K
Massac	5/1/1996	Flood	0	0	80K
Massac	6/1/1996	Flood	0	0	0
Massac	12/4/1996	Flood	0	0	0
Massac	12/19/1996	Flood	0	0	0
Massac	1/30/1997	Flood	0	0	0
Massac	2/1/1997	Flood	0	0	0
Massac	3/1/1997	Flood	0	0	2.5M
Massac	6/1/1997	Flood	0	0	0
Massac	1/11/1998	Flood	0	0	0
Massac	3/22/1998	Flood	0	0	0
Massac	4/1/1998	Flood	0	0	0
Massac	5/1/1998	Flood	0	0	0
Massac	6/15/1998	Flood	0	0	0
Massac	1/22/1999	Flood	0	0	0
Massac	2/1/1999	Flood	0	0	30K
Massac	3/9/1999	Flood	0	0	0
Massac	2/19/2001	Flood	0	0	0
Massac	12/1/2001	Flood	0	0	0
Massac	12/17/2001	Flood	0	0	8K
Massac	12/18/2001	Flood	0	0	0
Massac	1/26/2002	Flood	0	0	0
Massac	2/1/2002	Flood	0	0	0
Massac	3/20/2002	Flood	0	0	3K
Massac	4/1/2002	Flood	0	0	0
Massac	5/1/2002	Flood	0	0	762K
Massac	2/18/2003	Flood	0	0	0
Massac	3/1/2003	Flood	0	0	0
Massac	5/7/2003	Flood	0	0	0
Massac	1/5/2004	Flood	0	0	0
Massac	2/8/2004	Flood	0	0	0
Massac	3/9/2004	Flood	0	0	0
Massac	6/1/2004	Flood	0	0	0
Massac	12/3/2004	Flood	0	0	0
Massac	1/5/2005	Flood	0	0	700K
Massac	4/1/2005	Flood	0	0	0
Massac	1/27/2006	Flood	0	0	0
Brookport	1/14/2007	Flood	0	0	0K
Brookport	2/11/2008	Flood	0	0	0K
Metropolis	7/30/1996	Urban/sml Stream Fld	0	0	0

Location	Date	Type	Deaths	Injuries	Property Damage
Metropolis	2/28/1997	Urban/sml Stream Fld	N/A	0	0
Metropolis	8/7/1998	Urban/sml Stream Fld	N/A	0	0

Source: NCDC

* 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.

Previous Occurrences for Dam and Levee Failure

In Massac County there are no records or local knowledge of any dam or any other certified levee failure in the county. However, the Brookport Levee is in severe disrepair and has been rate unacceptable by the U.S. Army Corps of Engineers and decertified by Federal Emergency Management Agency (FEMA). This levee was originally designed to protect against a 100-year flood. In its current condition, this levee would not protect Brookport from inundation during a large flood.

Repetitive Loss Properties

FEMA defines a repetitive loss structure as a structure covered by a contract of flood insurance issued under the National Flood Insurance Program (NFIP), which 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.

Illinois Emergency Management was contacted to determine the location of repetitive loss structures in Massac County. Records show that there are no repetitive loss structures within the county.

Geographic Location for Flooding

Most riverine floods in Illinois occur during either the spring or summer and are the result of excessive rainfall and/or the combination of rainfall and snowmelt. Flash flooding in Illinois can occur during anytime of the year, but tends to be less frequent and more localized between mid-summer and early winter.

The primary sources of river flooding in Massac County are the Ohio River, Massac Creek, Rocky Branch, and Seven Mile Creek. Flooding along the Ohio River can inundate portions of Brookport, Joppa, and Metropolis. Massac and Seven Mile Creek flood waters can inundate portions of Metropolis and close State Route 145, US Route 45 and several county roads. Flooding along Rocky Branch and its tributaries can inundate a large portion of the northwest quarter of the County and cause the closure of US Route 45 and several state and county roads.

Flash flooding in Massac County typically occurs or is best documented in urban/developed areas. For example on March 9, 2006 flash flooding closed numerous roads throughout the County. In Metropolis, a few streets were covered by several inches of water. Along Seven Mile Creek, a secondary road was impassable, with over 6 inches of water running over the approach to the bridge.

A digital file of the FIRM maps was used to identify specific stream reaches for analysis. The areas of riverine flooding are depicted on the map in Appendix E.

In meeting #4 held on September 22, 2009, the planning team members listed voluntary buyouts as a mitigation strategy to alleviate flood damage in the county. They identified potential hazard areas in which buyouts may be a useful to mitigate flood damages. The jurisdiction, general location and the approximate number of structures are listed in Table 4-18.

Table 4-18: Potential Voluntary Buyout Properties

Jurisdiction	Number of Structures	Location
Joppa	2	Ohio River
Metropolis	4	Ohio River and Massac Creek

Geographic Location for Dam and Levee Failure

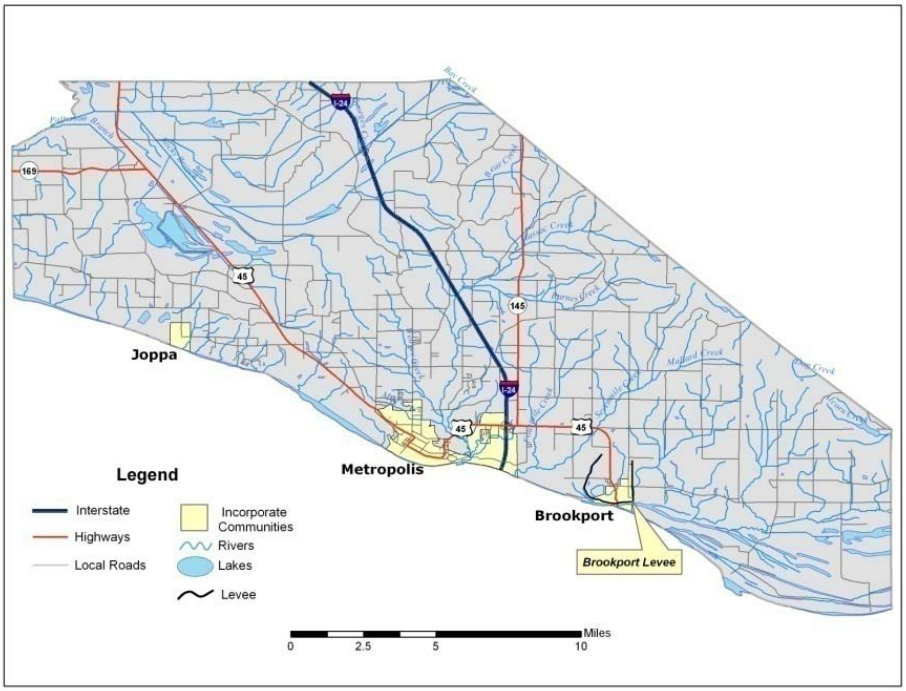
The National Inventory of Dams identified three dams in Massac County. The map in Appendix G illustrates the location of Massac County dams. Table 4-18 summarizes the National Inventory of Dams information.

Table 4-18: National Inventory of Dams

Name	River	Hazard	EAP
Hohlman Lake Dam	Tributary to Alcorn Creek	L	N
Mann Lake Dam	Tributary Barren Creek	L	N
Mermet Dam	Tributary to Tucker Ditch	L	N

A review of the United States Army Corps of Engineers and IDNR records revealed one levee, the Brookport Levee, within Massac County. Figure 4-5 shows the location of the Brookport Levee. The Brookport Levee is approximately four miles in length, and its purpose is to protect the City of Brookport from Ohio River floodwaters. When constructed in 1940 with assistance from the U.S. Federal Government, the Brookport Levee was designed to protect against the 100-year flood. However, in recent years the levee has fallen into disrepair and the U.S. Army Corps of Engineers has rate the levee as unacceptable and FEMA has decertified the levee. The FRIM maps were modified to place the town of Brookport within the 100-year floodplain. This map modification will be become effective as of December 3, 2009.

Figure 4-5: Massac County Levees Map



Hazard Extent for Flooding

The HAZUS-MH flood model is designed to use a flood depth grid and flood boundary polygon from the FIRM data. HAZUS-MH was used to model the Base Flood Elevation (BFE). The BFE is defined as the area that has a 1% chance of flooding in any given year. Planning team input and a review of historical information provided additional information on specific flood events.

Hazard Extent for Dam and Levee Failure

Dams assigned the low (L) hazard potential classification are those where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property. Dams assigned the significant (S) hazard classification are those dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Dams classified as significant hazard potential dams are often located in predominantly rural or agricultural areas, but could be located in populated areas with a significant amount of infrastructure. Dams assigned the high (H) hazard potential classification are those dams where failure or mis-operation has the highest risk to cause loss of human life and significant damage to buildings and infrastructure.

According to the IDNR and the National Inventory of Dams, none of the dams in Alexander County are classified as a high hazard dams. These dams do not have an Emergency Action Plan (EAP). An EAP is not required by the State of Illinois but is recommended by the Illinois Department of Natural Resources.

Accurate mapping of the risks of flooding behind levees depends on knowing the condition and level of protection the levees actually provide. FEMA and the U.S. Army Corps of Engineers are working together to make sure that flood hazard maps better reflect the flood protection capabilities of levees and that the maps accurately represent the flood risks posed to areas situated behind them. Levee owners—usually states, communities, or private individuals or organizations such as local levee districts—are responsible for ensuring that the levees they own are maintained to their original design level and condition. In order to be considered creditable flood protection structures on FEMA's flood maps, levee owners must provide documentation to prove that the levee meets design, operation, and maintenance standards for protection against the 1% annual probability (100-year) flood.

Calculated Risk Priority Index for Flooding

Based on historical information and the HAZUS-MH flooding analysis results, the probability of flooding in Massac County is likely. According to the Risk Priority Index (RPI), flooding ranked as the number four hazard.

RPI = Probability x Magnitude/Severity.

Probability	x	Magnitude /Severity	=	RPI
4	x	2	=	8

Calculated Risk Priority Index for Dam and Levee Failure

Based on operation and maintenance requirements and local knowledge of the dams in Massac County, the probability of failure is possible. However, if a high hazard dam were to fail, the magnitude and severity of the damage could be great. The warning time and duration of the dam failure event would be very short. According to the RPI, dam and levee failure ranked as the number seven hazard.

RPI = Probability x Magnitude/Severity.

Probability	x	Magnitude /Severity	=	RPI
4	x	2	=	8

HAZUS-MH Analysis Using 100-Year FIRM Boundary and County Parcels

HAZUS-MH was used to generate flood depth grids for two scenarios, 1) a flood depth grid with the Brookport Levee and 2) flood depth grid without the Brookport Levee. As discussed above the Brookport Levee would not likely protect Brookport from a large flood (e.g., 100-year flood; see Previous Occurrences for Dam and Levee Failure). In order to estimate potential increase in flood losses for Massac County resulting from the inundation of Brookport, a scenario analysis without the Brookport levee was performed. For the scenario with the Brookport Levee scenario, the flood depth grid was generated for the 100-year return period and made calculations by clipping the USGS One-arc-second (~30m) DEM to the FIRM boundary. The scenario without the Brookport Levee scenario used a modified FIRM boundary in which the Brookport

Levee was removed and 100-year flood boundary was moved to the base flood elevation as if the levee did not exist. Then calculations were made by clipping the USGS One-arc-second (~30m) DEM to modified the FIRM boundary. For both scenarios HAZUS-MH utilized a user defined analysis for with site-specific parcel data provided by the county.

HAZUS-MH estimates that the 100-year flood for the scenario with the Brookport Levee would result in 410 buildings damaged and $37.5 million in total economic losses. For the without scenario without the Brookport Levee, HAZUS-MH estimates the 100-year event would damage 782 buildings resulting in $126.7 million in economic losses. The total estimated numbers of damaged buildings and economic losses are given by occupancy class in Table 4-21. Figure 4-6 depicts the Massac County parcel points that fall within the 100-year floodplain. Figures 4-7 and 4-8 highlight damaged buildings within the floodplain near Metropolis, Brookport, and Joppa for with the scenario with the Brookport Levee. Figure 4-9 shows the building damaged during the 100-year flood for the scenario without the Brookport Levee. The assessor records often do not distinguish parcels by occupancy class if the parcels are not taxable. For purposes of analysis, the total number of buildings and the assessed values for government, religious/non-profit, and education should be lumped together as exempt.

Table 4-21: Massac County HAZUS_MH Analysis Total Loss (100-Year Flood)

General Occupancy	Total Damaged Buildings		Total Economic Loss (X 1000)	
	With Brookport Levee	Without Brookport Levee	With Brookport Levee	Without Brookport Levee
Agricultural	80	82	$8,390	$8,480
Commercial	29	50	$17,810	$18,320
Exempt	1	5	$522	$87,490
Industrial	0	2	$0	$41
Residential	301	644	$10,755	$12,333
Total	**410**	**782**	**$37,477**	**$126,664**

Figure 4-6: Massac County Buildings in Floodplain (100-Year Flood with Brookport Levee)

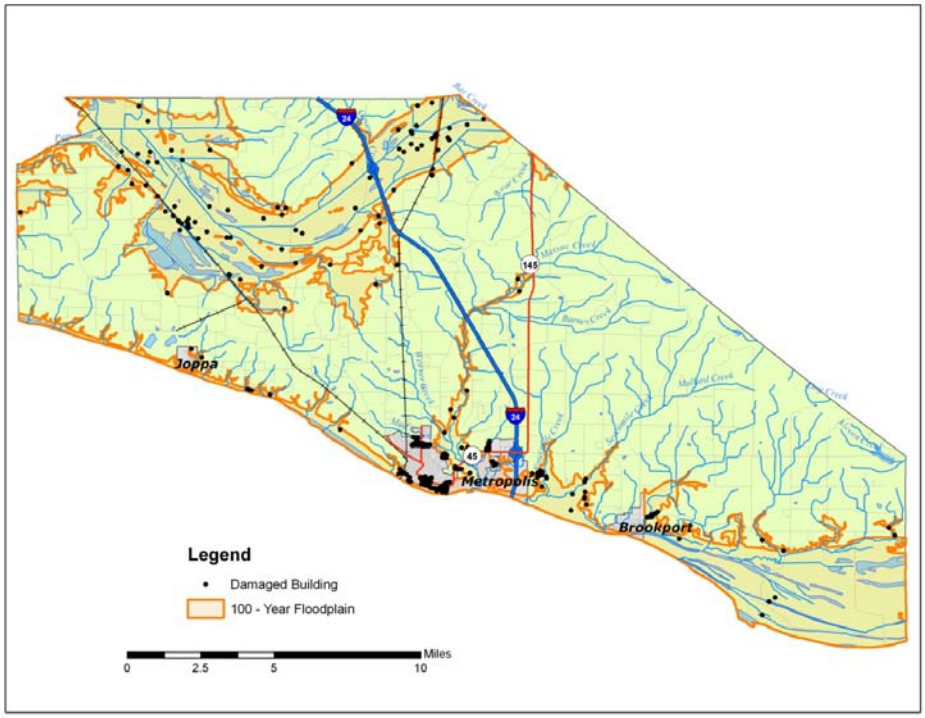


Figure 4-7: Buildings in Floodplain (100-Year Flood) near Metropolis

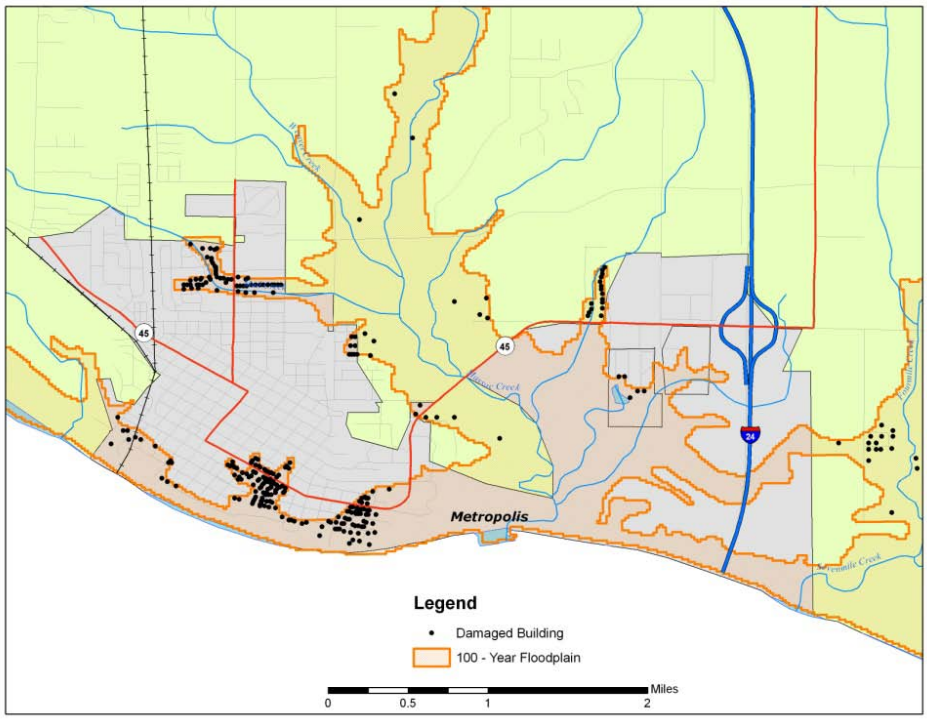


Figure 4-8: Buildings in Floodplain (100-Year Flood) near Joppa and Brookport

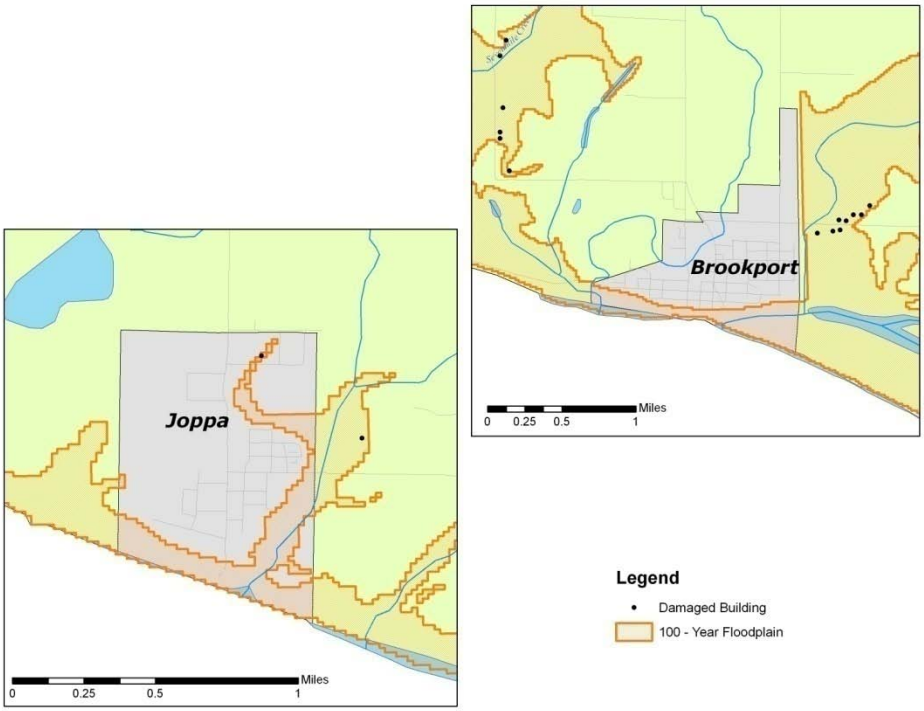
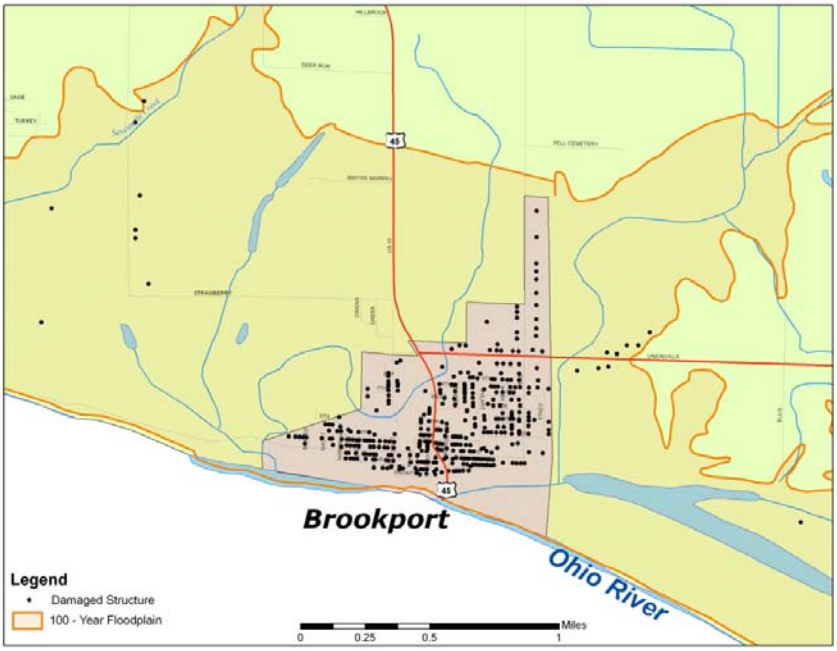


Figure 4-9: Buildings in floodplain without the Brookport Levee (100-Year Flood)



Essential Facilities

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 will no longer be able to serve the community). A complete list of all the critical facilities, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

For the functioning Brookport Levee scenario, HAZUS-MH analysis identified only one school, George R. Clark Elementary School, which may be subject to flooding. A list of the essential facilities subject flooding for the nonfunctioning Brookport Levee scenario is given in Table 4-22. A map of essential facilities potentially at risk to flooding is shown in Figure 4-10 for the functioning Brookport Levee scenario and Figure 4-11 for the nonfunctioning Brookport Levee scenario.

Table 4-22: Damaged Essential Facilities for the without Brookport Levee scenario

Facility Name
George R. Clark Elementary School
Brookport Elementary
Brookport Fire Department
Brookport Police Department

Figure 4-10: Boundary of 100-Year Flood Overlaid with Essential Facilities (Functioning Brookport Levee Scenario)

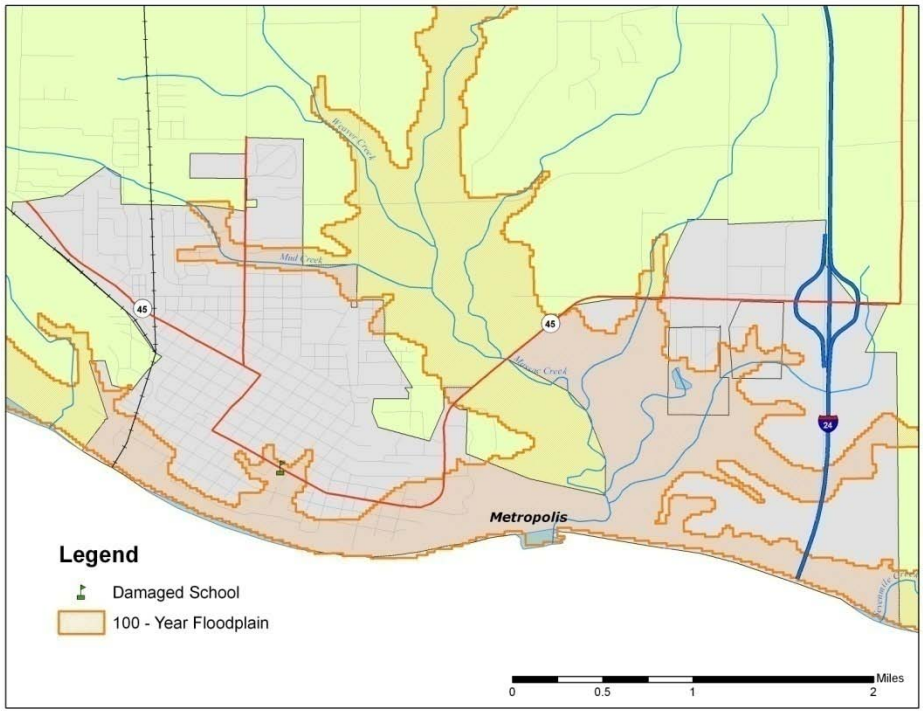
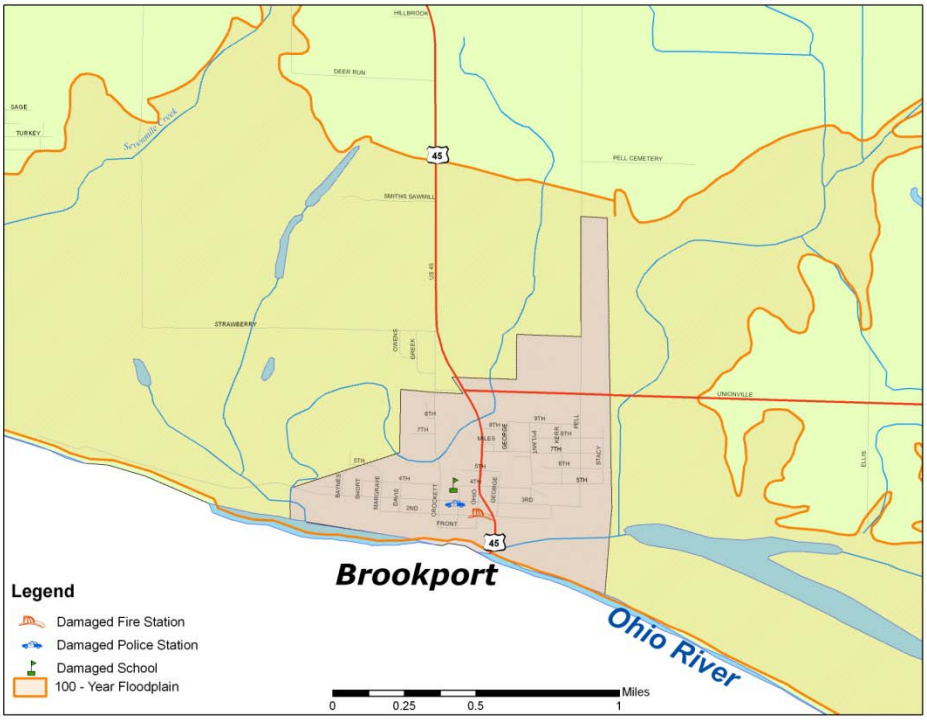


Figure 4-11: Boundary of 100-Year Flood Overlaid with Essential Facilities (Without Brookport Levee Scenario)



Infrastructure

The types of infrastructure that could be 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 any number of these items could become damaged in the event of a flood. 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 fail or become impassable, causing a traffic risk.

Vulnerability Analysis for Flash Flooding

Flash flooding could affect any low lying location within this jurisdiction; therefore, a significant portion of the county's population and buildings are vulnerable to a flash flood. These structures can expect the same impacts as discussed in a riverine flood.

Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Vulnerability Analysis for Dam and Levee Failure

An EAP is required to assess the effect of dam failure on these communities. In order to be considered creditable flood protection structures on FEMA's flood maps, levee owners must

provide documentation to prove the levee meets design, operation and maintenance standards for protection against the 1% annual probability flood.

Vulnerability to Future Assets/Infrastructure for Flooding

Flash flooding may affect nearly any location within the county; therefore all buildings and infrastructure are vulnerable to flash flooding. Currently, the municipality zoning boards review new development for compliance with local zoning ordinances. The county floodplain manager administers the floodplain for the county. At this time no construction is planned within the area of the 100-year floodplain. Therefore, there is no new construction, which will be vulnerable to a 100-year flood.

Vulnerability to Future Assets/Infrastructure for Dam and Levee Failure

Municipal Planning Departments/Commissions review new developments for compliance with local zoning ordinances.

Analysis of Community Development Trends

Areas with recent development within the county may be more vulnerable to drainage issues. Storm drains and sewer systems are usually most susceptible, which can cause the 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. Controlling floodplain development is the key to reducing flood-related damages.

4.4.3 Earthquake Hazard

Hazard Definition for Earthquake Hazard

An earthquake is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earth's surface. For hundreds of millions of years, plate tectonics has shaped the Earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. At their boundaries, the plates typically are locked together and unable to release the accumulating energy. When this energy grows strong enough, the plate boundary breaks free and causes the ground to shake. Most earthquakes occur at the boundaries where the plates meet; however, some earthquakes occur in the middle of plates, as is the case for seismic zones in the Midwestern United States. The most seismically active area in the Midwest U.S. is the New Madrid Seismic Zone. Scientists have learned that the New Madrid fault system may not be the only fault system in the Central U.S. capable of producing damaging earthquakes. The Wabash Valley fault system in Illinois and Indiana manifests evidence of large earthquakes in its geologic history, and there may be other, as yet unidentified, faults that could produce strong earthquakes.

Ground shaking from strong earthquakes can collapse buildings and bridges; disrupt gas, electric, and phone service; and sometimes trigger landslides, avalanches, flash floods, fires, and destructive ocean waves (tsunamis). Buildings with foundations resting on unconsolidated materials and other unstable soil, and trailers and homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths, injuries, and extensive property damage. Magnitude measures the energy released at the source of the earthquake. Magnitude is determined from measurements on seismographs, and a single earthquake will have a single magnitude to quantify its strength. Earthquake intensity measures the strength of shaking produced by the earthquake at a certain location. Intensity is determined from effects on people, human structures, and the natural environment, and a single earthquake will have a wide range of intensity values at different locations around the epicenter. Table 4-23 is a description of earthquake intensity using an abbreviated Modified Mercalli Intensity scale, and Table 4-24 lists earthquake magnitudes and their corresponding intensities.
(Source: *http://earthquake.usgs.gov/learning/topics/mag_vs_int.php*)

Table 4-23: 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 motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.

Mercalli Intensity	Description
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, 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.

Table 4-24: Earthquake Magnitude vs. Modified Mercalli Intensity Scale

Earthquake Magnitude	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

Historical Earthquakes that have Affected Massac County

Numerous instrumentally measured earthquakes have occurred in Illinois. In the past few decades, with many precise seismographs positioned across Illinois, measured earthquakes have varied in magnitude from very low microseismic events of M=1-3 to larger events up to M=5.4. Microseismic events are usually only detectable by seismographs and rarely felt by anyone. The most recent earthquake in Illinois—as of the date of this report—occurred on August 30, 2008 at 0:46:00 local time about 2.4 km (1.5 miles) southeast of Gale, IL and measured 2.6 in magnitude.

The consensus of opinion among seismologists working in the Midwest is that a magnitude 5.0 to 5.5 event could occur virtually anywhere at any time throughout the region. Earthquakes occur in Illinois all the time, although damaging quakes are very infrequent. Illinois earthquakes causing minor damage occur on average every 20 years, although the actual timing is extremely variable. Most recently, a magnitude 5.2 earthquake shook southeastern Illinois on April 18, 2008, causing minor damage in the Mt Carmel, IL area. Earthquakes resulting in more serious damage have occurred about every 70 to 90 years.

First on the list of historical earthquakes that have affected Illinois and first on the list on continuing earthquake threats at present and into the future is seismic activity on the New Madrid Seismic Zone of southeastern Missouri. On December 16, 1811 and January 23 and February 7 of 1812, three earthquakes struck the central U.S. with magnitudes estimated to be 7.5-8.0. These earthquakes caused violent ground cracking and volcano-like eruptions of sediment *(sand blows)* over an area of >10,500 km^2, and uplift of a 50 km by 23 km zone (the Lake County uplift). The shaking rang church bells in Boston, collapsed scaffolding on the Capitol in Washington, D.C., and was felt over a total area of over 10 million km^2 (the largest

felt area of any historical earthquake). Of all the historical earthquakes that have struck the U.S., an 1811-style event would do the most damage if it recurred today.

The New Madrid earthquakes are especially noteworthy because the seismic zone is in the center of the North American Plate. Such intraplate earthquakes are felt, and do damage, over much broader areas than comparable earthquakes at plate boundaries. The precise driving force responsible for activity on the New Madrid seismic zone is not known, but most scientists infer that it is compression transmitted across the North American Plate. That compression is focused on New Madrid because it is the site of a Paleozoic structure—the Reelfoot Rift—which is a zone of weakness in the crust.

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 (magnitude 7.5–8.0) is 7%–10% over the next 50 years (*USGS Fact Sheet 2006-3125*.) Frequent large earthquakes on the New Madrid seismic zone are geologically puzzling because the region shows relatively little deformation. Three explanations have been proposed: 1) recent seismological and geodetic activity is still a short-term response to the 1811–12 earthquakes; 2) activity is irregular or cyclic; or 3) activity began only in the recent geologic past. There is some dispute over how often earthquakes like the 1811–12 sequence occur. Many researchers estimate a recurrence interval of between 550 and 1100 years; other researchers suggest that either the magnitude of the 1811–12 earthquakes have been over-stated, or else the actual frequency of these events is less. It is fair to say, however, that even if the 1811–12 shocks were just magnitude ~7 events, they nonetheless caused widespread damage and would do the same if another such earthquake or earthquake sequence were to strike today.

[Above: New Madrid earthquakes and seismic zone modified from N. Pinter, 1993, Exercises in Active Tectonic history adapted from *Earthquake Information Bulletin*, 4(3), May-June 1972. *http://earthquake.usgs.gov/regional/states/illinois/history.php*]

The earliest reported earthquake in Illinois was in **1795**. This event was felt at Kaskaskia, IL for a minute and a half and was also felt in Kentucky. At Kaskaskia, subterranean noises were heard. Due to the sparse frontier population, an accurate location is not possible, and the shock may have actually originated outside the state.

An intensity VI-VII earthquake occurred on **April 12, 1883**, awakening several people in Cairo, IL. One old frame house was significantly damaged, resulting in minor injuries to the inhabitants. This is the only record of injury in the state due to earthquakes.

On **October 31, 1895** a large M6.8 occurred at Charleston, Missouri, just south of Cairo. Strong shaking caused eruptions of sand and water at many places along a line roughly 30 km (20 mi) long. Damage occurred in six states, but most severely at Charleston, with cracked walls, windows shattered, broken plaster, and chimneys fallen. Shaking was felt in 23 states from Washington, D.C. to Kansas and from southernmost Canada to New Orleans, LA.

A Missouri earthquake on **November 4, 1905**, cracked walls in Cairo. Aftershocks were felt over an area of 100,000 square miles in nine states. In Illinois, it cracked the wall of the new education building in Cairo and a wall at Carbondale, IL.

Among the largest earthquakes occurring in Illinois was the **May 26, 1909** shock, which knocked over many chimneys at Aurora. It was felt over 500,000 square miles and strongly felt in Iowa and Wisconsin. Buildings swayed in Chicago where there was fear that the walls would collapse. Just under two months later, a second Intensity VII earthquake occurred on **July 18, 1909**, damaged chimneys in Petersburg, IL, Hannibal, MO, and Davenport, IA. Over twenty windows were broken, bricks loosened and plaster cracked in the Petersburg area. This event was felt over 40,000 square miles.

On **November 7, 1958**, a shock along the Indiana border resulted in damage at Bartelso, Dale and Maunie, IL. Plaster cracked and fell, and a basement wall and floor were cracked.

On **August 14, 1965**, a sharp but local shock occurred at Tamms, IL, a town of about 600 people. The magnitude 5 quake damaged chimneys, cracked walls, knocked groceries from the shelves, and muddied the water supply. Thunderous earth noises were heard. This earthquake was only felt within a 10 mile radius of Tamms, in communities such as Elco, Unity, Olive Branch, and Olmstead, IL. Six aftershocks were felt.

An earthquake of Intensity VII occurred on **November 9, 1968**. This magnitude 5.3 shock was felt over an area of 580,000 square miles in 23 states. There were reports of people in tall buildings in Ontario and Boston feeling the shock. Damage consisted of bricks being knocked from chimneys, broken windows, toppled television antenna, and cracked plaster. There were scattered reports of cracked foundations, fallen parapets, and overturned tombstones. Chimney damage was limited to buildings 30 to 50 years old. Many people were frightened. Church bells rang at Broughton and several other towns. Loud rumbling earthquake noise was reported in many communities.

Dozens of other shocks originating in Missouri, Arkansas, Kansas, Nebraska, Tennessee, Indiana, Ohio, Michigan, Kentucky, and Canada have been felt in Illinois without causing damage. There have been three earthquakes slightly greater than magnitude 5.0 and Intensity level VII which occurred in 1968, 1987 and 2008 and that were widely felt throughout southern Illinois and the midcontinent.

Above text adapted from *http://earthquake.usgs.gov/regional/states/illinois/history.php* and from *Seismicity of the United States, 1568-1989 (Revised), C.W. Stover and J.L. Coffman, U.S. Geological Survey Professional Paper 1527, United States Government Printing Office, Washington: 1993.*

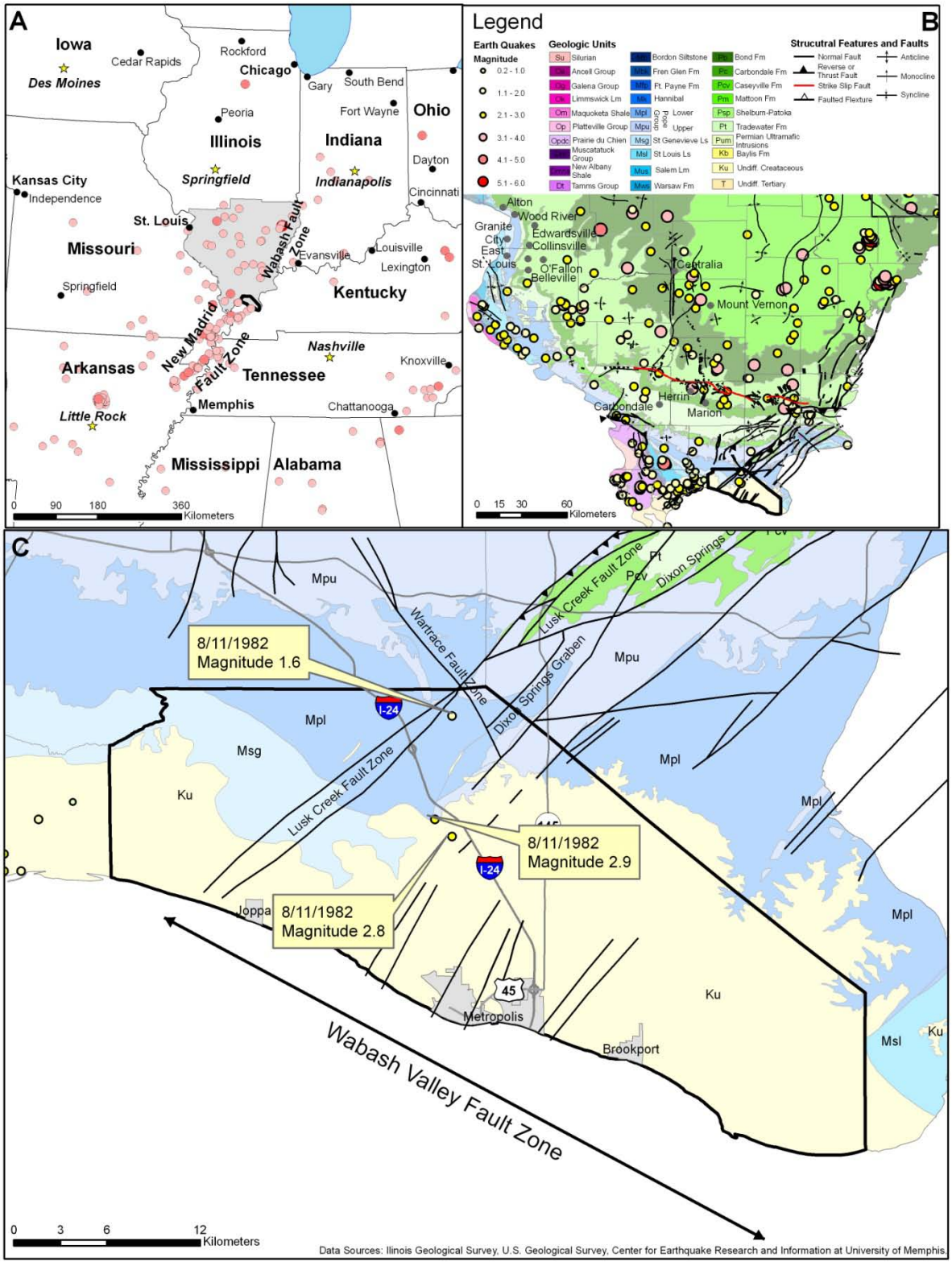
Geographic Location for Earthquake Hazard

Massac County occupies a region susceptible to earthquakes. Regionally, the two most significant zones of seismic activity are the New Madrid Seismic Zone and the Wabash Valley Fault System. The epicenters of three small earthquakes (M1.8–2.9) have been recorded in Massac County (Figure 4-12). The geologic mechanism related to the minor earthquakes is poorly understood. 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. The USGS and the Center for Earthquake Research and Information estimate the probability of a repeat of the 1811–1812 type earthquakes (magnitude 7.5–8.0) at 7%–10% and the probability of a magnitude 6.0 or larger at 25%–40% within the next 50 years.

Figure 4-12 depicts the following: a) Location of notable earthquakes in the Illinois region with inset of Massac County; b) Generalized geologic bedrock map with earthquake epicenters, geologic structures, and inset of Massac County; c) Geologic and earthquake epicenter map of Massac County.

Figure 4-12 a, b, c: Massac County Earthquakes



Hazard Extent for Earthquake Hazard

The extent of the earthquake is countywide.

Calculated Risk Priority Index for Earthquake Hazard

Based on historical information as well as current USGS and SIU research and studies, future earthquakes in Massac County are possible. According to the RPI, earthquake is ranked as the number five hazard.

RPI = Probability x Magnitude/Severity.

Probability	x	Magnitude /Severity	=	RPI
2	x	**8**	=	**16**

Vulnerability Analysis for Earthquake Hazard

This hazard could impact the entire jurisdiction equally; therefore, the entire county's population and all buildings are vulnerable to an earthquake and can expect the same impacts within the affected area. To accommodate this risk this plan will consider all buildings located within the county as vulnerable.

Critical Facilities

All critical facilities are vulnerable to earthquakes. A critical facility would encounter many of the same impacts as any other building within the county. These impacts include structural failure and loss of facility functionality (e.g. damaged police station will no longer be able to serve the community). A complete list of all of the critical facilities, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

Table 4-8 shows building exposure for the entire county. The buildings within the county can all expect the same impacts, similar 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 residence to seek shelter).

Infrastructure

During an earthquake, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since a full inventory of infrastructure is not available for this plan, 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 fail or become impassable causing

risk to traffic. Typical scenarios are described to gauge the anticipated impacts of earthquakes in the county in terms of number and types of buildings and infrastructure.

The SIU-Polis team reviewed existing geological information and recommendations for earthquake scenarios. Three earthquake scenarios—two based on USGS modeled scenarios and one based on deterministic scenarios were developed to provide a reasonable basis for earthquake planning in Massac County. The two USGS analyses were a M7.7 event on the New Madrid fault zone and M7.1 earthquake on the Wabash Valley Seismic Zone. Shake maps provided by FEMA were used in HAZUS-MH to estimate losses for Massac County based on these events. The final scenario was a Moment Magnitude of 5.5 with the epicenter located in Massac County. Note that a deterministic scenario, in this context, refers to hazard or risk models based on specific scenarios without explicit consideration of the probability of their occurrences. This scenario was selected based upon a rupture of a local unnamed fault located underneath Metropolis, IL that presents a realistic earthquake scenario for planning purposes.

Modeling a deterministic scenario requires user input for a variety of parameters. One of the most critical sources of information that is required for accurate assessment of earthquake risk is soils data. Illinois Geologic Survey provided a NEHRP (National Earthquake Hazards Reduction Program) soil classification map for southern Illinois (Bauer and Su, 2007). NEHRP soil classifications portray the degree of shear-wave amplification that can occur during ground shaking.

Earthquake hypocenter depths in southern Illinois range from less than 1.0 to ~25.0 km. The average hypocenter depth, ~10.0 km, was used for the deterministic earthquake scenario. For this scenario type HAZUS-MH also requires the user to define an attenuation function. To maintain consistency with the USGS's (2006) modeling of strong ground motion in the central United States, the Toro et al. (1997) attenuation function was used for the deterministic earthquake scenario.

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

Results for 7.7 Magnitude New Madrid Earthquake Scenario

The results of the 7.7 New Madrid Earthquake Scenario are depicted in Table 4-25, Table 4-26, and Figure 4-13. HAZUS-MH estimates that approximately 5,146 buildings will be at least moderately damaged. This is more than 77% of the total number of buildings in the region.

The total building related losses totaled $443.3 million; 14% of the estimated losses were related to the business interruption of the region. Large losses were sustained by the residential occupancies, which comprised more than 53% of the total loss.

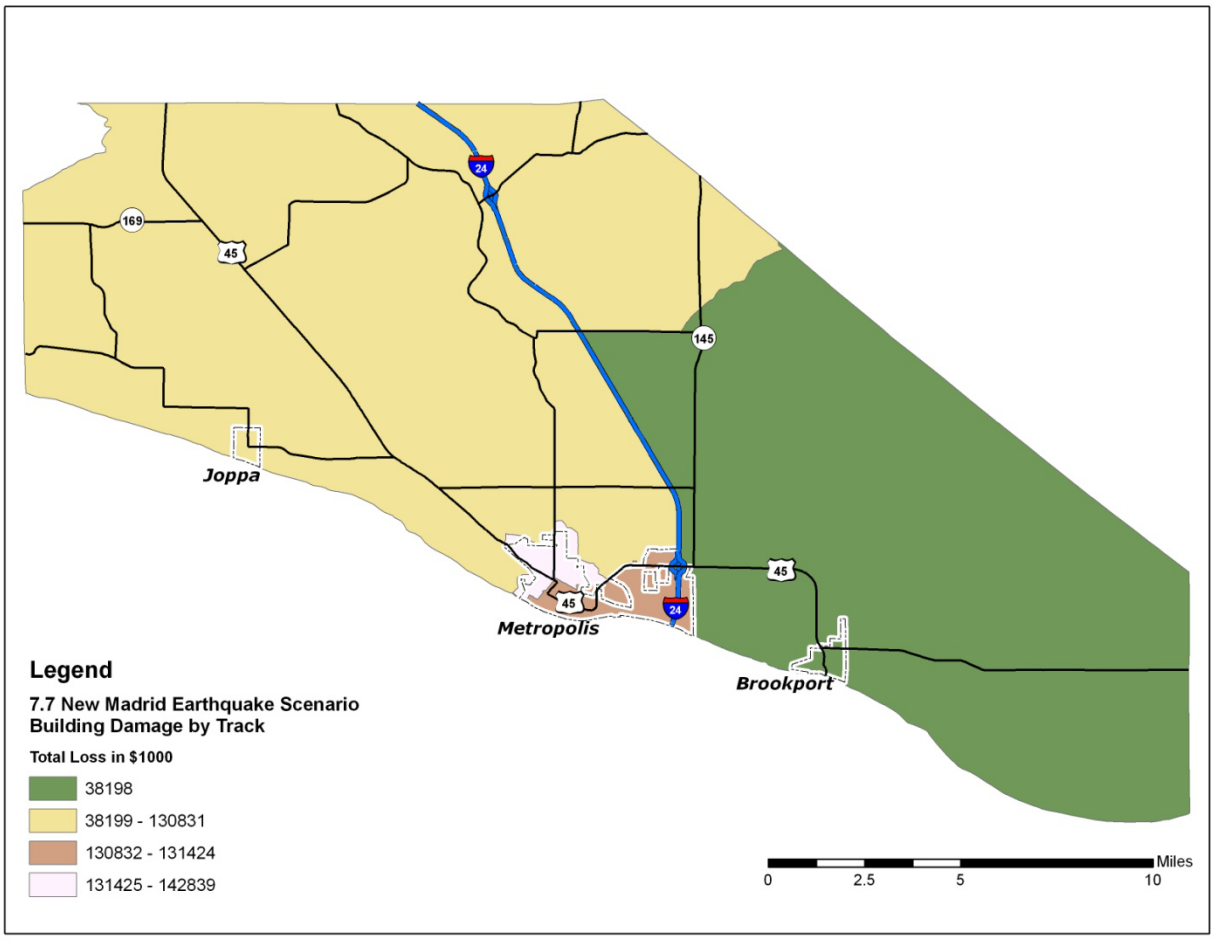
Table 4-25: New Madrid Scenario-Damage Counts by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0.01	0	0.01	1	0.03	2	0.13	2	0.24
Commercial	0	0.15	3	0.19	19	0.69	34	2.45	37	3.92
Education	0	0.03	0	0.02	1	0.04	1	0.11	1	0.11
Government	0	0.01	0	0.01	1	0.04	2	0.16	2	0.26
Industrial	0	0.03	0	0.03	2	0.09	5	0.35	6	0.65
Other Residential	7	3.61	71	5.09	361	12.93	563	40.24	474	49.52
Religion	0	0.11	2	0.12	4	0.15	4	0.31	5	0.48
Single Family	179	96.05	1,315	94.53	2,401	86.03	787	56.26	429	44.83
Total	**186**		**1,391**		**2,791**		**1,398**		**957**	

Table 4-26: New Madrid Scenario-Building Economic losses in Millions of Dollars

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Loses							
	Wage	0.00	2.25	19.82	0.33	1.64	24.04
	Capital-Related	0.00	0.95	16.14	0.19	0.48	17.77
	Rental	5.69	4.01	6.46	0.10	0.73	16.99
	Relocation	0.67	0.18	0.49	0.01	0.26	1.61
	Subtotal	**6.37**	**7.39**	**42.90**	**0.64**	**3.11**	**60.40**
Capital Stock Loses							
	Structural	28.14	11.78	16.74	2.20	8.61	67.46
	Non_Structural	99.38	43.48	57.39	8.43	23.18	231.86
	Content	28.31	9.46	27.27	5.37	11.06	81.47
	Inventory	0.00	0.00	0.70	1.12	0.28	2.10
	Subtotal	**155.83**	**64.72**	**102.09**	**17.12**	**43.14**	**382.89**
	Total	**162.20**	**72.11**	**144.99**	**17.76**	**46.24**	**443.29**

Figure 4-13: New Madrid Valley Scenario-Building Economic Losses in Thousands of Dollars



New Madrid Earthquake Scenario—Essential Facility Losses

Before the earthquake, the region had 38 care beds available for use. On the day of the earthquake, the model estimates that only 0 care beds (0%) are available for use by patients already in medical care facilities and those injured by the earthquake. After one week, 1% of the beds will be back in service. By day 30, 6% will be operational.

Results for 7.1 Magnitude Wabash Valley Earthquake Scenario

The results of the 7.1M Wabash Valley Earthquake are depicted in Table 4-27, Table 4-28, and Figure 4-14. HAZUS-MH estimates that approximately 108 building will be at least moderately damaged.

The total building related losses totaled $7.4 million; 10% of the estimated losses were related to the business interruption of the region. Large losses were sustained by the residential occupancies, which comprised more than 57% of the total loss.

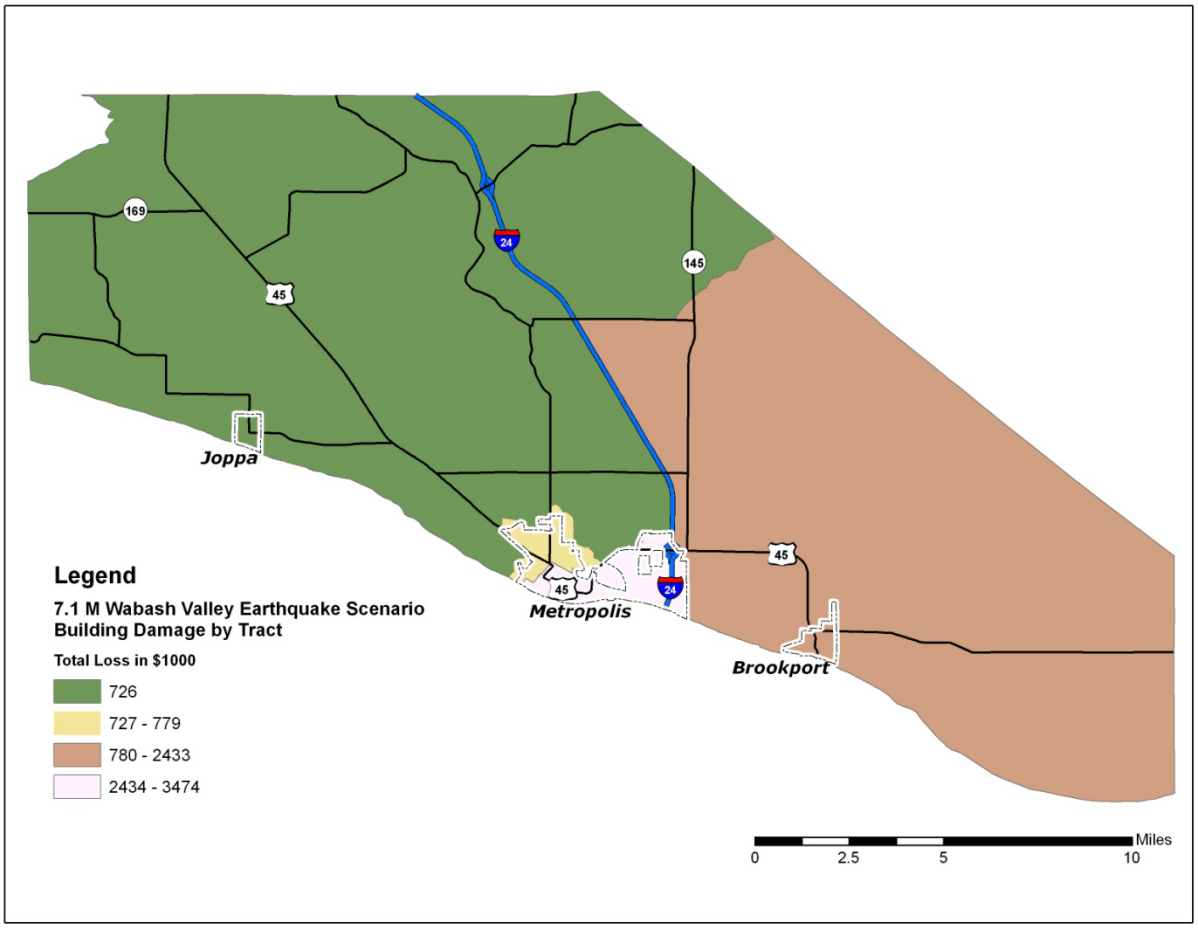
Table 4-27: Wabash Valley Scenario-Damage Counts by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	4	0.07	0	0.08	0	0.13	0	0.25	0	0.13
Commercial	80	1.31	11	2.07	3	2.97	0	5.59	0	3.57
Education	3	0.05	1	0.11	0	0.16	0	0.28	0	0.31
Government	5	0.09	1	0.10	0	0.13	0	0.21	0	0.21
Industrial	12	0.20	1	0.23	0	0.37	0	0.68	0	0.27
Other Residential	1,213	19.90	207	39.71	55	52.07	0	14.97	0	2.77
Religion	13	0.22	1	0.28	0	0.38	0	0.72	0	0.66
Single Family	4,764	78.16	299	57.42	46	43.78	2	77.31	0	92.08
Total	**6,095**		**521**		**106**		**3**		**0**	

Table 4-28: Wabash Valley Scenario-Building Economic losses in Millions of Dollars

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Loses							
	Wage	0.00	0.02	0.22	0.00	0.02	0.26
	Capital-Related	0.00	0.01	0.21	0.00	0.01	0.23
	Rental	0.05	0.05	0.11	0.00	0.01	0.22
	Relocation	0.01	0.00	0.01	0.00	0.00	0.01
	Subtotal	**0.05**	**0.08**	**0.55**	**0.01**	**0.04**	**0.73**
Capital Stock Loses							
	Structural	0.29	0.14	0.16	0.02	0.08	0.68
	Non_Structural	1.78	0.68	0.82	0.13	0.36	3.77
	Content	1.00	0.23	0.60	0.09	0.27	2.19
	Inventory	0.00	0.00	0.02	0.02	0.01	0.04
	Subtotal	**3.07**	**1.04**	**1.59**	**0.27**	**0.71**	**6.68**
	Total	**3.12**	**1.12**	**2.15**	**0.28**	**0.75**	**7.41**

Figure 4-14: Wabash Valley Scenario-Building Economic Losses in Thousands of Dollars



Wabash Valley Scenario—Essential Facility Losses

Before the earthquake, the region had 38 care beds available for use. On the day of the earthquake, the model estimates that only 19 care beds (51.0%) are available for use by patients already in medical care facilities and those injured by the earthquake. After one week, 89% of the beds will be back in service. By day 30, 97% will be operational.

Results for 5.5 Magnitude Earthquake in Massac County

The results of the arbitrary 5.5 magnitude earthquake scenario within Massac County are depicted in Tables 4-29 and 4-30 and Figure 4-15. HAZUS-MH estimates that approximately 1,475 buildings will be at least moderately damaged. This is more than 22% of the total number of buildings in the region. It is estimated that 62 buildings will be damaged beyond repair.

The total building related losses totaled $91 million; 14% of the estimated losses were related to the business interruption of the region. Large losses were sustained by the residential occupancies, which comprised more than 60% of the total loss.

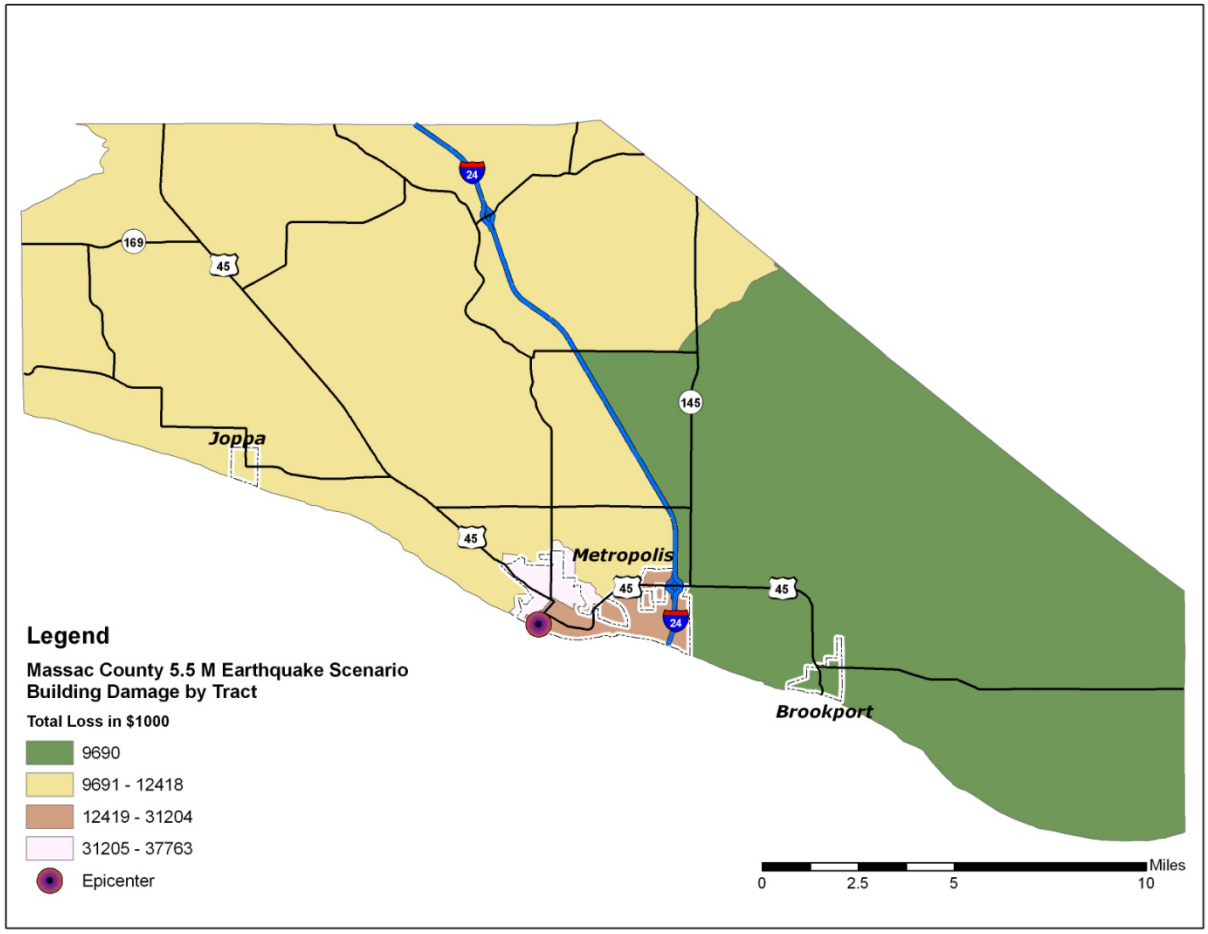
Table 4-29: Massac County 5.5M Scenario-Damage Counts by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	2	0.07	1	0.06	1	0.09	0	0.15	0	0.14
Commercial	40	1.12	22	1.27	22	1.92	9	3.05	2	3.39
Education	2	0.06	1	0.05	1	0.06	0	0.09	0	0.11
Government	3	0.08	1	0.08	1	0.12	0	0.16	0	0.22
Industrial	7	0.20	3	0.16	3	0.26	1	0.41	0	0.35
Other Residential	657	18.65	360	20.86	369	32.79	81	28.13	8	13.23
Religion	7	0.20	3	0.20	3	0.27	1	0.43	0	0.53
Single Family	2,806	79.62	1,333	77.32	725	64.50	195	67.59	52	82.02
Total	**3,525**		**1,724**		**1,124**		**289**		**63**	

Table 4-30: Massac County 5.5M Scenario-Building Economic Losses in Millions of Dollars

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Loses							
	Wage	0.00	0.58	4.03	0.04	0.31	4.96
	Capital-Related	0.00	0.25	3.19	0.02	0.08	3.54
	Rental	1.26	1.00	1.37	0.02	0.13	3.78
	Relocation	0.15	0.03	0.11	0.00	0.04	0.33
	Subtotal	**1.41**	**1.86**	**8.69**	**0.09**	**0.56**	**12.61**
Capital Stock Loses							
	Structural	6.03	1.99	2.70	0.25	1.23	12.19
	Non_Structural	23.69	8.42	9.02	1.00	3.63	45.75
	Content	9.06	2.39	5.74	0.73	2.26	20.19
	Inventory	0.00	0.00	0.15	0.15	0.03	0.33
	Subtotal	**38.78**	**12.80**	**17.60**	**2.13**	**7.16**	**78.47**
	Total	**40.19**	**14.66**	**26.30**	**2.21**	**7.72**	**91.07**

Figure 4-15: Massac County 5.5M Scenario-Building Economic Losses in Thousands of Dollars



Arbitrary Earthquake Scenario—Essential Facility Losses

Before the earthquake, the region had 38 care beds available for use. On the day of the earthquake, the model estimates that only 2 care beds (7.0%) are available for use by patients already in medical care facilities and those injured by the earthquake. After one week, 31% of the beds will be back in service. By day 30, 62.0% will be operational.

Vulnerability to Future Assets/Infrastructure for Earthquake Hazard

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

Analysis of Community Development Trends

Community development will occur outside of the low-lying areas in floodplains with a water table within five feet of grade which are susceptible to liquefaction. Furthermore, Massac County will continue to provide training to county officials, implement public education, and institute leaders who are proactive in mapping and studying the risks of earthquakes in the county.

4.4.4 Thunderstorm Hazard

Hazard Definition for Thunderstorm Hazard

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

- Hail of diameter 0.75 inches or higher
- Frequent and dangerous lightning
- Wind speeds equal to or greater than 58 mph

Hail

Hail can be a product of a strong thunderstorm. Hail usually falls near the center of a storm; however strong winds occurring at high altitudes in the thunderstorm can blow the hailstones away from the storm center, resulting in a broader distribution. Hailstones range from pea-sized to baseball-sized, but hailstones larger than softballs have been reported on rare occasions.

Lightning

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

Severe Winds (Straight-Line Winds)

Straight-line winds from thunderstorms are a fairly common occurrence across 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 for Thunderstorm Hazard

The NCDC database reported 25 hailstorms in Massac County since 1979. Hailstorms occur nearly every year in the late spring and early summer months. The most recent significant occurrence of hail occurred in February 2007 when severe thunderstorms produced a swath of golf-ball size hail crossed central Massac County. These storms were also prolific hail producers in other part of southern Illinois.

Massac County hailstorms are listed in Table 4-31; additional details for NCDC events are included in Appendix D.

Table 4-31: Massac County Hailstorms*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage
Massac	6/20/1979	Hail	1.00 in.	0	0	0
Massac	5/29/1982	Hail	1.75 in.	0	0	0
Massac	5/5/1989	Hail	0.75 in.	0	0	0
Massac	7/29/1989	Hail	0.75 in.	0	0	0
Massac	7/4/1992	Hail	1.50 in.	0	0	0
Metropolis	4/12/1993	Hail	0.75 in.	0	0	0
Dixon Springs	4/20/1995	Hail	1.50 in.	0	0	0
Joppa	5/16/1995	Hail	1.00 in.	0	0	0
Joppa	6/8/1995	Hail	1.00 in.	0	0	0
Metropolis	6/3/1996	Hail	1.75 in.	0	0	0
Metropolis	4/13/1998	Hail	1.00 in.	0	0	0
Metropolis	8/26/2000	Hail	0.75 in.	0	0	0
Brookport	9/23/2001	Hail	0.75 in.	0	0	0
New Columbia	4/29/2003	Hail	0.88 in.	0	0	0
New Columbia	4/29/2003	Hail	0.88 in.	0	0	0
Joppa	5/4/2003	Hail	1.25 in.	0	0	0
Metropolis	5/26/2004	Hail	0.88 in.	0	0	0
Metropolis	6/30/2005	Hail	1.00 in.	0	0	0
Round Knob	11/15/2005	Hail	1.75 in.	0	0	0
Metropolis	4/2/2006	Hail	1.00 in.	0	0	0
Mermet	5/2/2006	Hail	0.88 in.	0	0	0
Joppa	5/3/2006	Hail	0.75 in.	0	0	0
Metropolis	5/3/2006	Hail	1.00 in.	0	0	0
Joppa	2/20/2007	Hail	1.50 in.	0	0	0
Metropolis	5/15/2007	Hail	1.00 in.	0	0	0

Source: NCDC

* 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 identified 74 wind storms reported since 1980. On multiple occasions in the past 50 years trees have been uprooted by severe winds in Massac County. These storms have been attributed with one injury and $1.2 million in property damage in Massac and adjacent counties.

As shown in Table 4-32, wind storms have historically occurred year-round with the greatest frequency and damage in April through August.

Table 4-32: Massac County Wind Storms*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage
Massac	7/2/1980	Thunderstorm Winds	NM	0	0	0
Massac	7/4/1982	Thunderstorm Winds	NM	0	0	0
Massac	5/30/1987	Thunderstorm Winds	NM	1	0	0
Massac	4/3/1989	Thunderstorm Winds	NM	0	0	0
Massac	6/1/1989	Thunderstorm Winds	NM	0	0	0
Massac	5/9/1990	Thunderstorm Winds	NM	0	0	0
Massac	3/22/1991	Thunderstorm Winds	NM	0	0	0
Metropolis	4/12/1993	Thunderstorm Winds	NM	0	0	1K
Metropolis	4/15/1994	Thunderstorm Winds	NM	0	0	0K
Many Areas	4/18/1995	Thunderstorm Winds	NM	0	0	0
Metropolis	5/16/1995	Thunderstorm Winds	NM	0	0	0
Hillerman	5/17/1995	Thunderstorm Winds	NM	0	0	0
Metropolis	5/17/1995	Thunderstorm Winds	NM	0	0	0
Unionville	5/18/1995	Thunderstorm Winds	NM	0	0	0
Brookport	5/18/1995	Thunderstorm Winds	NM	0	0	0
Unionville	6/7/1995	Thunderstorm Winds	NM	0	0	0
Massac	6/8/1995	Thunderstorm Winds	NM	0	5	250K
Brookport	7/4/1995	Thunderstorm Winds	NM	0	0	0
Massac	11/11/1995	High Winds	NM	0	0	0
Brookport	1/18/1996	Thunderstorm Winds	NM	0	0	40K
Metropolis	3/5/1996	Thunderstorm Winds	NM	0	0	1K
Joppa	5/5/1996	Thunderstorm Winds	NM	0	2	100K
Metropolis	7/21/1996	Thunderstorm Winds	NM	0	0	5K
Metropolis	9/26/1996	Thunderstorm Winds	50 kts.	0	0	0
Metropolis	10/22/1996	Thunderstorm Winds	50 kts.	0	0	0
Big Bay	3/1/1997	Thunderstorm Winds	52 kts.	0	0	0
Metropolis	4/20/1997	Thunderstorm Winds	NM	0	0	3K
Massac	4/30/1997	High Wind	52 kts.	0	0	20K
Metropolis	5/2/1997	Thunderstorm Winds	52 kts.	0	0	0
Joppa	6/13/1997	Thunderstorm Winds	52 kts.	0	0	0
Metropolis	7/14/1997	Thunderstorm Winds	50 kts.	0	0	5K
Brookport	4/8/1998	Thunderstorm Winds	52 kts.	0	0	3K
Boaz	5/21/1998	Thunderstorm Winds	50 kts.	0	0	4K

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage
Metropolis	6/21/1998	Thunderstorm Winds	52 kts.	0	0	20K
Brookport	10/6/1998	Thunderstorm Winds	52 kts.	0	0	5K
Metropolis	1/17/1999	Thunderstorm Winds	52 kts.	0	0	0
Metropolis	1/22/1999	Thunderstorm Winds	NM	0	1	40K
Massac	2/7/1999	Strong Winds	NM	0	0	23K
Round Knob	4/5/1999	Thunderstorm Winds	87 kts.	0	0	50K
Metropolis	5/17/1999	Thunderstorm Winds	52 kts.	0	0	5K
Midway	6/4/1999	Thunderstorm Winds	50 kts.	0	0	3K
Massac	1/3/2000	Thunderstorm Winds	50 kts.	0	0	3K
Metropolis	3/26/2000	Thunderstorm Winds	NM	0	0	5K
Massac	4/20/2000	Wind	NM	0	0	0
Unionville	2/24/2001	Thunderstorm Winds	50 kts.	0	0	3K
Midway	6/27/2001	Thunderstorm Winds	50 kts.	0	0	0
Massac	10/24/2001	Thunderstorm Winds	50 kts.	0	0	10K
Massac	3/9/2002	Wind	N/A	0	0	3K
New Columbia	4/28/2002	Thunderstorm Winds	61 kts.	0	0	100K
Metropolis	5/9/2002	Thunderstorm Winds	52 kts.	0	0	10K
Metropolis	5/4/2003	Thunderstorm Winds	60 kts.	0	0	20K
Metropolis	8/30/2003	Heavy Rain	NM	0	0	0
Metropolis	4/30/2004	Thunderstorm Winds	50 kts.	0	0	4K
Massac	4/30/2004	Thunderstorm Winds	50 kts.	0	0	0
Massac	5/30/2004	Thunderstorm Winds	78 kts.	0	0	20K
Metropolis	6/18/2004	Thunderstorm Winds	50 kts.	0	0	0
Massac	4/11/2005	High Wind	50 kts.	0	0	7K
Brookport	5/13/2005	Thunderstorm Winds	50 kts.	0	0	15K
Massac	8/30/2005	Heavy Rain	NM	0	0	0
Metropolis	11/15/2005	Thunderstorm Winds	56 kts.	0	0	250K
Massac	1/8/2006	Strong Wind	NM	0	0	19K
Massac	1/19/2006	Strong Wind	NM	0	0	19K
Massac	2/16/2006	Strong Wind	NM	0	0	14K
Metropolis	3/9/2006	Thunderstorm Winds	51 kts.	0	0	15K
New Columbia	3/12/2006	Thunderstorm Winds	61 kts.	0	0	0
Metropolis	4/2/2006	Thunderstorm Winds	56 kts.	0	0	0
Metropolis	5/25/2006	Thunderstorm Winds	50 kts.	0	0	0
Metropolis	5/30/2006	Thunderstorm Winds	NM	0	0	0

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage
Metropolis	5/30/2006	Thunderstorm Winds	50 kts.	0	0	15K
Round Knob	9/22/2006	Thunderstorm Winds	52 kts.	0	0	2K
Unionville	9/23/2006	Thunderstorm Winds	65 kts.	0	0	6K
Metropolis	5/15/2007	Thunderstorm Wind	NM	0	0	25K
Mermet	1/29/2008	Thunderstorm Wind	NM	0	0	100K

Source: NCDC
NM = Not Measured

* 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 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 historical thunderstorms listed previously varies in terms of the extent of the storm, the wind speed, and the size of hailstones. Thunderstorms can occur at any location within the county.

Calculated Risk Priority Index for Thunderstorm Hazard

Based on historical information, the probability of future high wind damage is highly likely. High winds with widely varying magnitudes are expected to happen. According to the RPI, thunderstorms and high wind damage ranked as the number six hazard.

RPI = Probability x Magnitude/Severity.

Probability	x	Magnitude /Severity	=	RPI
4	x	**1**	=	**4**

Vulnerability Analysis for Thunderstorm Hazard

Severe thunderstorms are an evenly distributed threat across the entire jurisdiction; therefore, the entire county's population and all buildings are susceptible to severe thunderstorms and can expect the same impacts. This plan will therefore consider all buildings located within the county as vulnerable. The existing buildings and infrastructure in Massac County are discussed in types and numbers in Table 4-9.

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 jurisdiction. These impacts include structural failure, debris (trees or limbs) causing damage, roofs blown off or windows broken by hail or high winds, fires caused by lightning, and loss of function of the facility (e.g. a damaged police station will no longer be able to serve the community). Table 4-7 lists the types and numbers of all essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is provided in Table 4-8. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure, debris (trees or limbs) causing damage, roofs blown off or windows broken by hail or high winds, fires caused by lightning, and loss of building functionality (e.g. a damaged home will no longer be habitable causing residence to seek shelter).

Infrastructure

During a severe thunderstorm, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable, it is important to emphasize that any number of these items could become damaged during a severe thunderstorm. 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 fail or become impassable causing risk to traffic.

Vulnerability to Future Assets/Infrastructure for Thunderstorm Hazard

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

Analysis of Community Development Trends

Preparing for severe storms will be enhanced if officials sponsor a wide range of programs and initiatives to address the overall safety of county residents. New structures need to be built with more sturdy construction, and those structures already in place need to be hardened to lessen the potential impacts of severe weather. Community warning sirens to provide warning of approaching storms are also vital to preventing the loss of property and ensuring the safety of Massac County residents.

4.4.5 Winter Storm Hazard

Hazard Definition for Winter Storm Hazard

Severe winter weather consists of various forms of precipitation and strong weather conditions. This may include one or more of the following conditions: 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, and death.

Ice (glazing) and Sleet Storms

Ice or sleet, even in small quantities, can result in hazardous driving conditions and can cause property damage. Sleet involves frozen raindrops that bounce when they hit the ground or other objects. 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.

The most damaging winter storms in southern Illinois have been ice storms. Ice storms occur when moisture-laden gulf air converges with the northern jet stream causing strong winds and heavy precipitation. This precipitation takes the form of freezing rain coating power and communication lines and trees with heavy ice. The winds will then cause the overburdened limbs and cables to snap; leaving large sectors of the population without power, heat, or communication. In the past few decades, including the winter of 2007–08, numerous ice storm events have occurred in southern Illinois.

Snow Storms

Significant snow storms are characterized by the rapid accumulation of snow, often accompanied by high winds, cold temperatures, and low visibility. A blizzard is categorized as a snow storm with winds of 35 miles per hour or greater and/or visibility of less than ¼ mile for three or more hours. Blizzards are the most dramatic and perilous of all winter storm events. Most snow within a blizzard is in the form of fine, powdery particles, which are wind-blown in such great quantities that visibility is reduced to only a few feet. Blizzards have the potential to result in property damage.

Illinois has repeatedly been struck by blizzards, although they are less common in the southern part of the state. Blizzard conditions can cause power outages, loss of communication, and make transportation impossible. The blowing of snow can reduce visibility to less than ¼ mile, resulting in disorientation that can make even travel by foot dangerous.

Severe Cold

Severe cold is characterized by the ambient air temperature that may drop to 0°F or below. These extreme temperatures can increase the likelihood of frostbite and hyperthermia. 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), which can lower the time it takes for frostbite and hypothermia to affect a person's body.

Previous Occurrences for Winter Storm Hazard

The NCDC database identified 47 winter storm and extreme cold events for Massac County since 1994. These storms have been attributed with three deaths, four injuries, and $750,000 in property damage in Massac and surrounding counties. A recent example a severe winter storm occurred in February 2008 when low pressure developed over the southern Plains, spreading widespread heavy precipitation across southern Illinois. At the same time, high pressure over the upper Ohio Valley produced a cold easterly wind flow. The result was a crippling ice storm.

Approximately one inch of ice caused extensive damage across far southern Illinois, along and south of a line from Carbondale and Marion to Harrisburg and Carmi. Many of those same areas received three to six inches of sleet and snow. The most destructive icing occurred in an east to west band across Union, Johnson, Massac, and Pope Counties. The state designated most counties in southern Illinois as a disaster area. Numerous trees and power lines were brought down, knocking out power to many thousands of homes. Power outages lasted up to a week.

The NCDC winter storms for Massac County are listed in Table 4-33. Additional details for NCDC events are included in Appendix D.

Table 4-33: Winter Storm Events*

Location or County	Date	Type	Deaths	Injuries	Property Damage
Southern Illinois	1/16/1994	Winter Storm	0	0	0
Southern Illinois	3/8/1994	Heavy Snow	0	0	500K
Massac	9/24/1995	Frost	0	0	0
Massac	12/8/1995	Snow	0	0	0
Massac	12/9/1995	Cold Wave	0	0	0
Massac	1/2/1996	Winter Storm	0	0	0
Massac	1/6/1996	Winter Storm	0	0	0
Massac	2/2/1996	Extreme Cold	0	0	0
Massac	12/16/1996	Winter Storm	0	0	0
Massac	1/8/1997	Winter Storm	0	0	0
Massac	1/10/1997	Extreme Wind chill	1	0	0
Massac	1/15/1997	Ice Storm	0	0	0
Massac	4/18/1997	Frost	0	0	0
Massac	1/17/1998	Freezing Drizzle	0	0	0
Massac	12/21/1998	Freezing Rain	0	0	0
Massac	12/23/1998	Snow	0	0	0

Location or County	Date	Type	Deaths	Injuries	Property Damage
Massac	1/1/1999	Ice Storm	0	0	150K
Massac	1/8/1999	Ice Storm	0	0	0
Massac	1/22/2000	Snow	0	0	0
Massac	12/12/2000	Extreme Cold	0	0	0
Massac	12/13/2000	Winter Storm	0	0	0
Massac	1/1/2001	Extreme Cold	0	0	0
Massac	1/26/2001	Freezing Rain	0	0	0
Massac	2/21/2001	Winter Storm	0	0	0
Massac	4/18/2001	Frost	0	0	0
Massac	1/19/2002	Heavy Snow	0	0	0
Massac	12/4/2002	Winter Storm	0	0	0
Massac	1/16/2003	Winter Storm	0	0	0
Massac	1/22/2003	Winter Weather/mix	0	0	0
Massac	1/23/2003	Extreme Cold/wind Chill	0	0	0
Massac	2/6/2003	Heavy Snow	0	0	0
Massac	2/16/2003	Winter Storm	0	0	0
Massac	1/25/2004	Ice Storm	0	0	0
Massac	12/22/2004	Winter Storm	1	1	100K
Massac	12/23/2004	Extreme Cold/wind Chill	1	0	0
Massac	10/28/2005	Frost/freeze	0	0	0
Massac	2/18/2006	Winter Weather/mix	0	0	0
Massac	2/19/2006	Winter Weather/mix	0	0	0
Massac	2/11/2008	Winter Storm	0	3	0
Massac	2/18/2006	Winter Weather/mix	0	0	0
Massac	2/19/2006	Winter Weather/mix	0	0	0
Massac	2/11/2008	Winter Storm	0	3	0

Source: NCDC

* 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 Winter Storm Hazard

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

Hazard Extent for Winter Storm Hazard

The extent of the historical winter storms listed previously varies in terms of storm extent, temperature, and ice or snowfall. Severe winter storms affect the entire jurisdiction equally.

Calculated Risk Priority Index for Winter Storm Hazard

Based on historical information, the probability of future winter storms is likely. Winter storms of varying magnitudes are expected to happen. According to the RPI, winter storms ranked as the number fifth highest hazard.

RPI = Probability x Magnitude/Severity.

Probability	x	Magnitude /Severity	=	RPI
3	x	2	=	6

Vulnerability Analysis for Winter Storm Hazard

Winter storm impacts are evenly distributed across the jurisdiction; therefore the entire county is vulnerable to winter storms and can expect the same impacts within the affected area. The building exposure for Massac County, as determined from the building inventory, is included in Table 4-8.

Critical Facilities

All critical facilities are vulnerable to a winter storm. A critical facility will encounter many of the same impacts as any other buildings within the jurisdiction. These impacts include loss of gas or electricity from broken or damaged utility lines, roads and railways damaged or impassable, broken water pipes, and roof collapse from heavy snow. Table 4-7 lists the types and numbers of the essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

Table 4-8 lists the building exposure in terms of types and numbers of buildings for the entire county. The impacts to the building stock within the county are similar to the damages expected to the critical facilities, including loss of gas of electricity from broken or damaged utility lines, roads and railways damaged or impassable, broken water pipes, and roof collapse from heavy snow.

Infrastructure

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

Vulnerability to Future Assets/Infrastructure for Winter Storm Hazard

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

Analysis of Community Development Trends

Because the winter storm events are regional in nature, future development will be impacted across the county. Rural areas in Massac County are particularly vulnerable due to the likely hood of long term power outages. Human service agencies, volunteer organizations, the Massac County Health Department, medical and health care facilities, and schools have definite roles to play in public education, planning, and response to extreme winter conditions.

4.4.7 Hazardous Materials Storage and Transport Hazard

Hazard Definition for Hazardous Materials Storage and Transport Hazard

Explosions result from the ignition of volatile materials such as petroleum products, natural gas and other flammable gases, hazardous materials/chemicals and dust, and explosive devices. 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 for Hazardous Materials Storage and Transport Hazard

Massac County has not experienced a significant or large-scale hazardous material incident at a fixed site or transportation route that has resulted in multiple deaths or serious injuries.

Geographic Location for Hazardous Materials Storage and Transport Hazard

The hazardous material hazards are countywide and are primarily associated with the transport of materials via highway or rail.

Hazard Extent for Hazardous Materials Storage and Transport 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.

Calculated Risk Priority Index for Hazardous Materials Storage and Transport Hazard

The possibility of a hazardous materials accident is likely, based on input from the planning team. According to the RPI, Hazardous Materials Storage and Transport ranked as the number one hazard.

RPI = Probability x Magnitude/Severity.

Probability	x	Magnitude /Severity	=	RPI
4	x	8	=	32

Vulnerability Analysis for Hazardous Materials Storage and Transport Hazard

Hazardous material impacts are evenly distributed across the jurisdiction; therefore the entire county is vulnerable to a release associated with hazardous materials storage or transport and can expect the same impacts within the affected area. The building exposure for Massac County, as determined from building inventory, is included in Table 4-8. This plan will therefore consider all buildings located within the county as vulnerable.

Critical Facilities

All critical facilities and communities within the county are at risk. A critical facility, if vulnerable, will encounter many of the same impacts as other buildings within the jurisdiction. These impacts include structural failure due to fire or explosion and loss of function of the facility (e.g. a damaged police station will no longer be able to serve the community). Table 4-7 lists the types and numbers of all essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

Table 4-8 lists the building exposure in terms of type and number of buildings for the entire county. The buildings within the county can all expect the same impacts, similar 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 damaged home will no longer be habitable causing residence to seek shelter).

Infrastructure

During a hazardous materials release, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since a full inventory of infrastructure is not available for this plan, it is important to emphasize that any number of these items could become damaged in the event of a hazardous material release. 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 fail or become impassable causing risk to traffic.

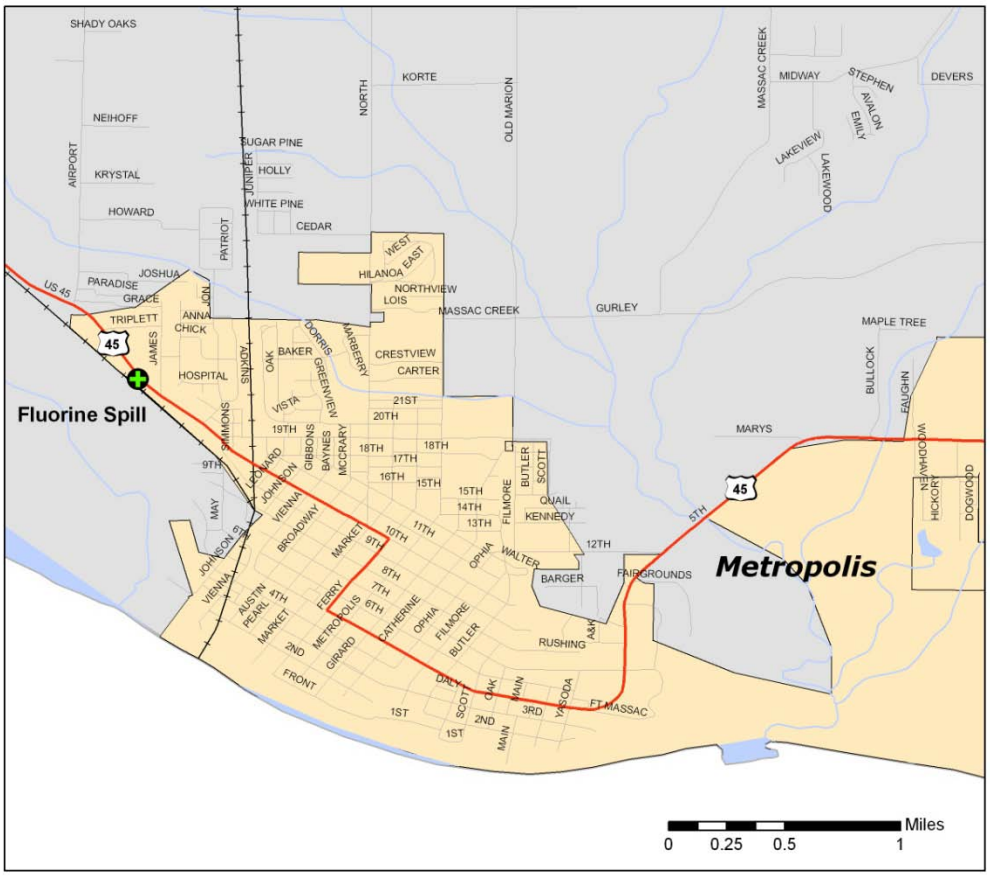
The U.S. EPA's ALOHA (Areal Locations of Hazardous Atmospheres) is a computer program designed especially for use by people responding to chemical accidents, as well as for emergency planning and training. ALOHA was utilized to assess the area of impact for a fluorine gas release at a fixed facility which manufactures and uses fluorine for its operations.

Fluorine is a pale yellow gas with a pungent odor. It is toxic by inhalation and skin absorption. Contact with skin lower than lethal concentrations causes chemical burns. Chronic absorption may cause osteosclerosis and calcification of ligaments. It reacts with water to form hydrofluoric acid and oxygen. It is corrosive to most common materials. It reacts with most combustible materials to the point that ignition occurs. Under prolonged exposure to fire or intense heat containers may violently rupture and rocket (NOAA Reactivity 2007).

Source: http://cameochemicals.noaa.gov/chemical/764

For this scenario, moderate atmospheric and climatic conditions with a slight breeze from the west were assumed. The target area was selected for three primary reasons: 1) a fixed facility where fluorine is used, 2) the area is highly populated, and 3) proximity to several critical facilities. The geographic area covered in this analysis is depicted in Figure 4-16.

Figure 4-16: Location of Chemical Release



Analysis

The ALOHA atmospheric modeling parameters, depicted in Figure 4-17, were based upon a north-northwesterly wind speed of five miles per hour The temperature was 68°F with 75% humidity and partly cloudy skies.

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 with 12,408 gallons of fluorine. At the time of its release, it was estimated that the tank was 100% full. The fluorine in this tank is in a gas state state.

This release was based on a leak from a 2.5 inch-diameter hole, at the bottom of the tank.

Figure 4-17: ALOHA Plume Modeling Parameters

```
SITE DATA:
   Location: METROPOLIS, ILLINOIS
   Building Air Exchanges Per Hour: 0.30 (sheltered single storied)
   Time: April 13, 2009  1017 hours CDT (user specified)

 CHEMICAL DATA:
   Chemical Name: FLUORINE                Molecular Weight: 38.00 g/mol
   ERPG-1: 0.5 ppm    ERPG-2: 5 ppm       ERPG-3: 20 ppm
   IDLH: 25 ppm
   Ambient Boiling Point: -306.9° 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: 5 miles/hour from W at 10 meters
   Ground Roughness: open country         Cloud Cover: 5 tenths
   Air Temperature: 68° F                 Stability Class: B
   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 gas only                 Internal Temperature: 68° F
   Chemical Mass in Tank: 500 pounds
   Circular Opening Diameter: 2.5 inches
   Release Duration: 3 minutes
   Max Average Sustained Release Rate: 170 pounds/min
      (averaged over a minute or more)
   Total Amount Released: 297 pounds
```

TEELs (Temporary Emergency Exposure Limits) are derived using existing LOCs (Levels of Concerns) and by manipulating current data. This process is less intensive than the AEGL or ERPG process, and TEELs have been defined for more than 3,000 chemicals.

- TEELs are used to help protect the public when AEGLs or ERPGs are not available and there has been a chemical release that is short-term in duration.

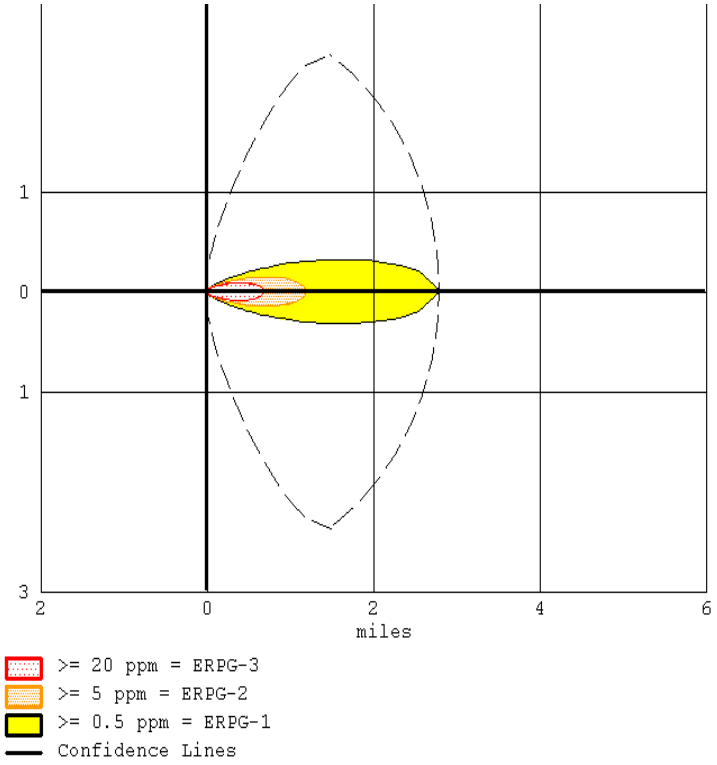
- TEELs estimate how the majority of people (except for sensitive individuals) would react to a release of this nature; TEELs could then be used to identify areas where a release of the toxic gas concentration would qualify as hazardous. For example, in areas with concentrations above the TEEL-1, most people would detect the chemical and may experience temporary, mild effects. On the other hand, in areas with concentrations above the TEEL-2, most people would experience significant, though not life-threatening, health effects.

- TEELs are derived by the U.S. Department of Energy Subcommittee on Consequence Assessment and Protective Actions (SCAPA) according to a specific, standard methodology. The TEEL methodology determines the TEELs by using available levels of concern and manipulating current data using a peer-reviewed, approved procedure.

- TEELs can be derived relatively quickly for almost any chemical, and as a result, are available for thousands of chemicals. TEELs can provide a useful reference when no other public exposure guidelines are available.

According to the ALOHA parameters, approximately 170 pounds per minute of material would be released per minute. The image in Figure 4-18 depicts the plume footprint generated by ALOHA.

Figure 4-18: Plume Footprint Generated by ALOHA

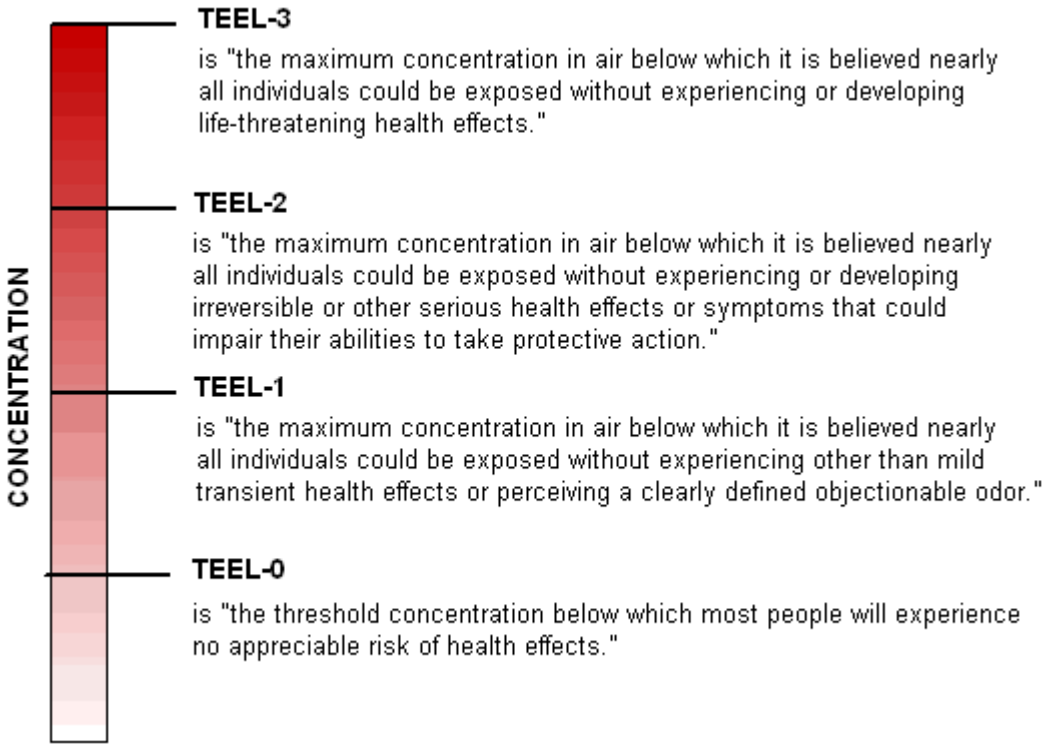


As the substance moves away from the source, the level of substance concentration decreases. Each color-coded area depicts a level of concentration measured in parts per million (ppm). For the purpose of clarification, this report will designate each level of concentration as a specific zone. The zones are as follows:

- **Zone 1** (TEEL-3): The red buffer (≥20 ppm) extends no more than 0.2 miles from the point of release after one hour.
- **Zone 2** (TEEL-2): The orange buffer (≥5.0 ppm) extends no more than 0.5 miles from the point of release after one hour.
- **Zone 3** (TEEL-1): The yellow buffer (≥0.5 ppm) extends more than 2.5 miles from the point of release after one hour.
- **Zone 4** (Confidence Lines): The dashed lines depict the level of confidence in which the exposure zones will be contained. The ALOHA model is 95% confident that the release will stay within this boundary.

TEELs estimate the concentrations at which most people will begin to experience health effects if they are exposed to a toxic chemical for a given duration. (Sensitive members of the public, such as old, sick, or very young people, are not covered by these guidelines; they may experience adverse effects at concentrations below the TEEL values.) TEELs are used in similar situations as the 60-minute AEGLs and ERPGs. Each TEEL includes four tiers, defined in Figure 4-19.

Figure 4-19: TEEL Concentration Tiers

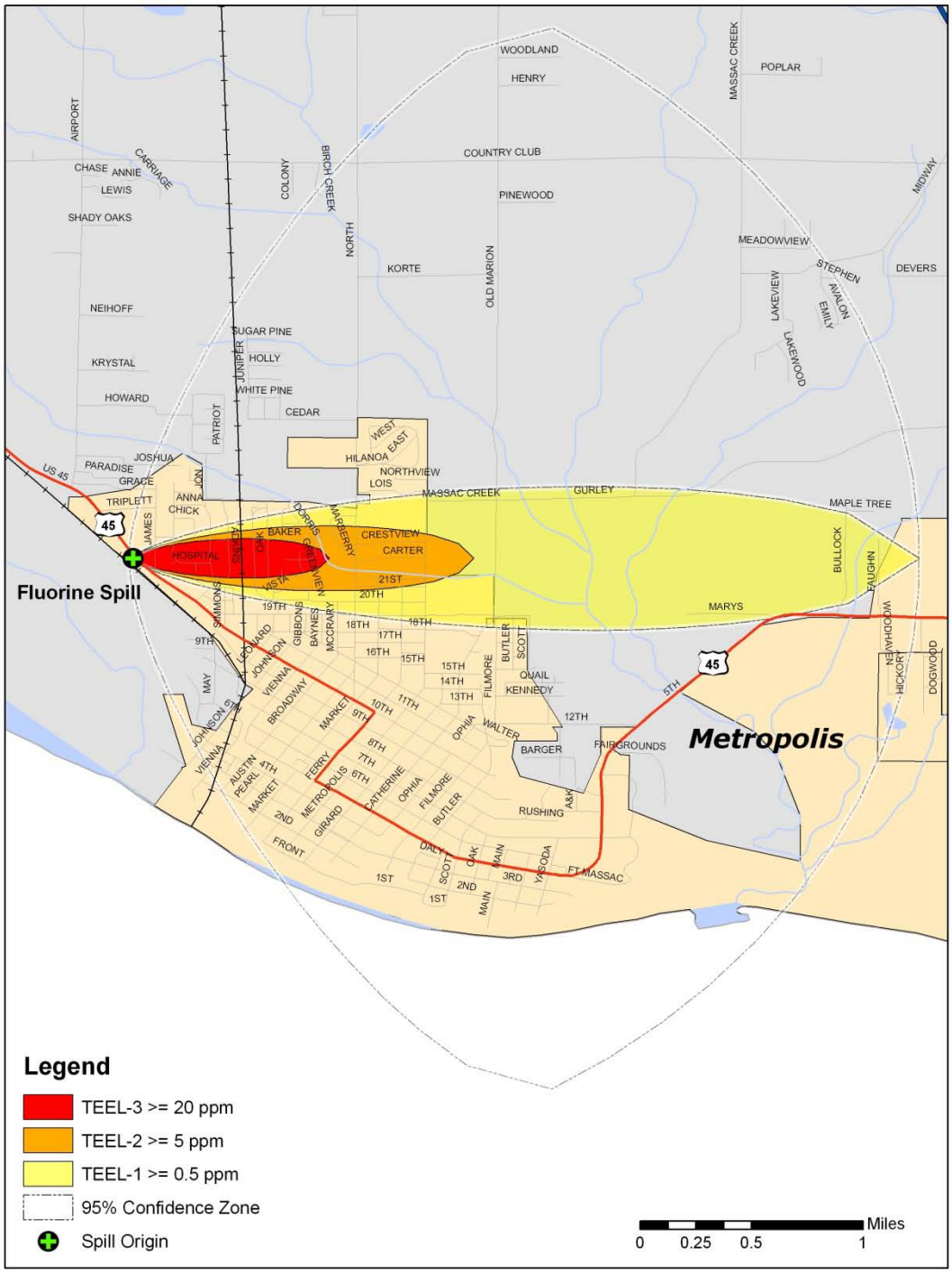


TEEL-0 tier is essentially a no-effects threshold. It is often ignored for emergency response and planning purposes. ALOHA treats TEELs as a three-tiered guideline (TEEL-1, TEEL-2, and TEEL-3), which can be compared in a general way to the AEGL and ERPG tiers. ALOHA does not include TEEL-0 values.

Source:
http://response.restoration.noaa.gov/topic_subtopic_entry.php?RECORD_KEY%28entry_subtopic_topic%29=entry_id,subtopic_id,topic_id&entry_id(entry_subtopic_topic)=664&subtopic_id(entry_subtopic_topic)=24&topic_id(entry_subtopic_topic)=1

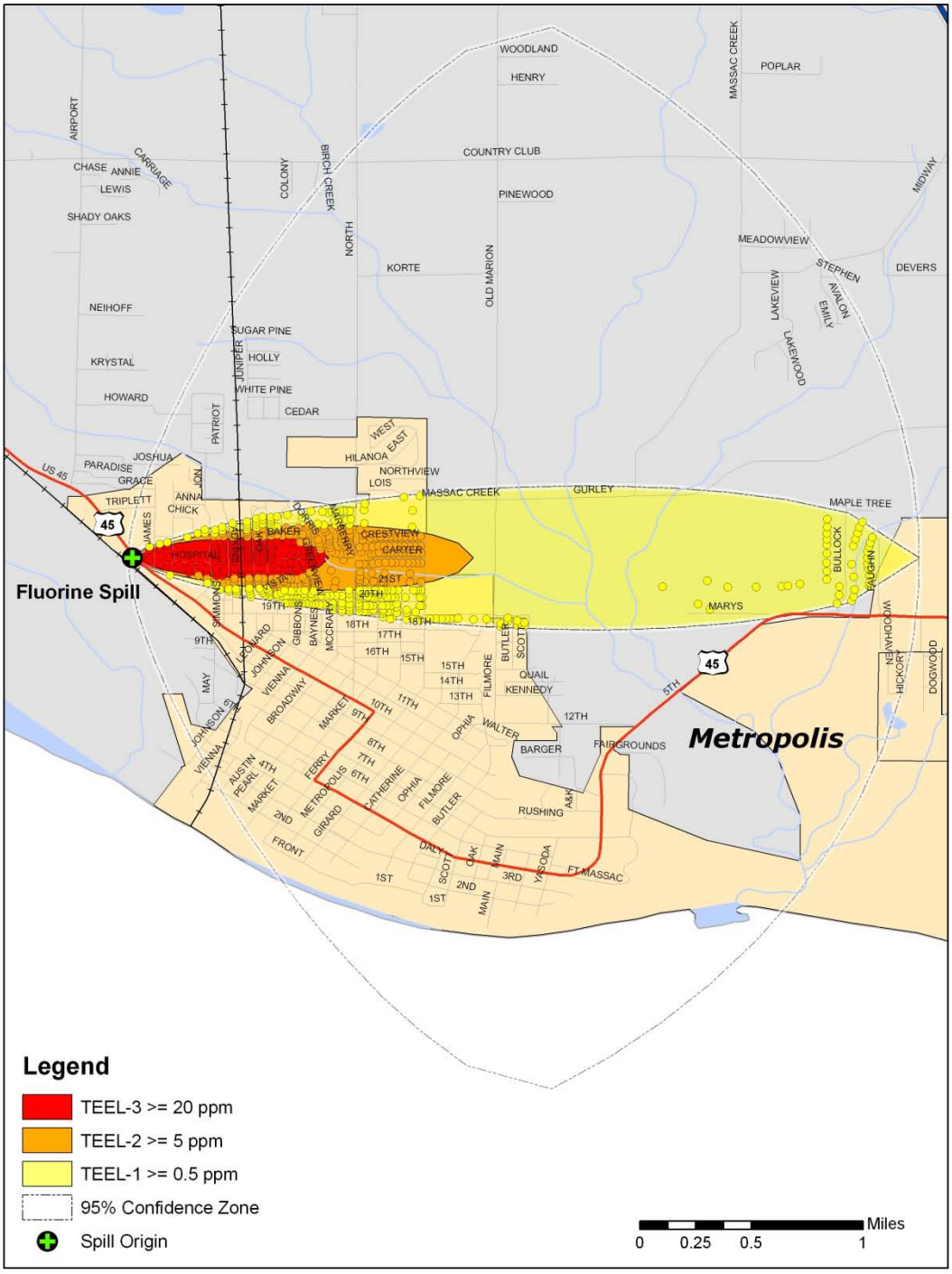
The image in Figure 4-20 depicts the plume footprint generated by ALOHA.

Figure 4-20: ALOHA Plume Footprint Overlaid in ArcGIS



The Massac County building inventory was added to ArcMap and overlaid with the plume footprint. The structure layer was then intersected with each of the four footprint areas to classify each point based upon the plume footprint in which it is located. Figure 4-21 depicts the Massac County structures after the intersect process.

Figure 4-21: Massac County Building Inventory Classified By Plume Footprint



Results

By summing the building inventory within all TEELs zones (Zone 1: 20,000 ppm, Zone 2: 5,000 ppm, and Zone 3: 50 ppm), the GIS overlay analysis predicts that as many as 554 buildings could be exposed which have a replacement cost of approximately $52.9 million dollars. In addition 1,348 people could be affected.

Building Inventory Damage

The results of the analysis against known structure locations are depicted in Table 4-34. Table 4-35 includes the results of the analysis against the Massac County Assessor Data.

Table 4-34: Number of Buildings Exposed

Occupancy	Zone 1	Zone 2	Zone 3
Residential	244	178	117
Commercial	8	2	3
Industrial	0	0	0
Agricultural	0	0	0
Exempt*	1	0	1
Government*	0	0	0
Education*	0	0	0
Total	**253**	**180**	**121**

Table 4-35: Estimated Building Exposure Occupancy Type

Occupancy	Zone 1	Zone 2	Zone 3
Residential	$7,655,533	$14,303,695	$15,503,600
Commercial	$599,160	$299,800	$3,151,620
Industrial	0	0	0
Agriculture	0	0	0
Exempt*	$10,000,000	0	$1,350,000
Government*	0	0	0
Education*	0	0	0
Total	**$18,254,693**	**$14,603,495**	**$20,005,220**

* Assessor records often do not distinguish parcels by occupancy class when the parcels are not taxable; therefore, the total number of building and building replacement costs for government, exempt, and non-profit may be underestimated.

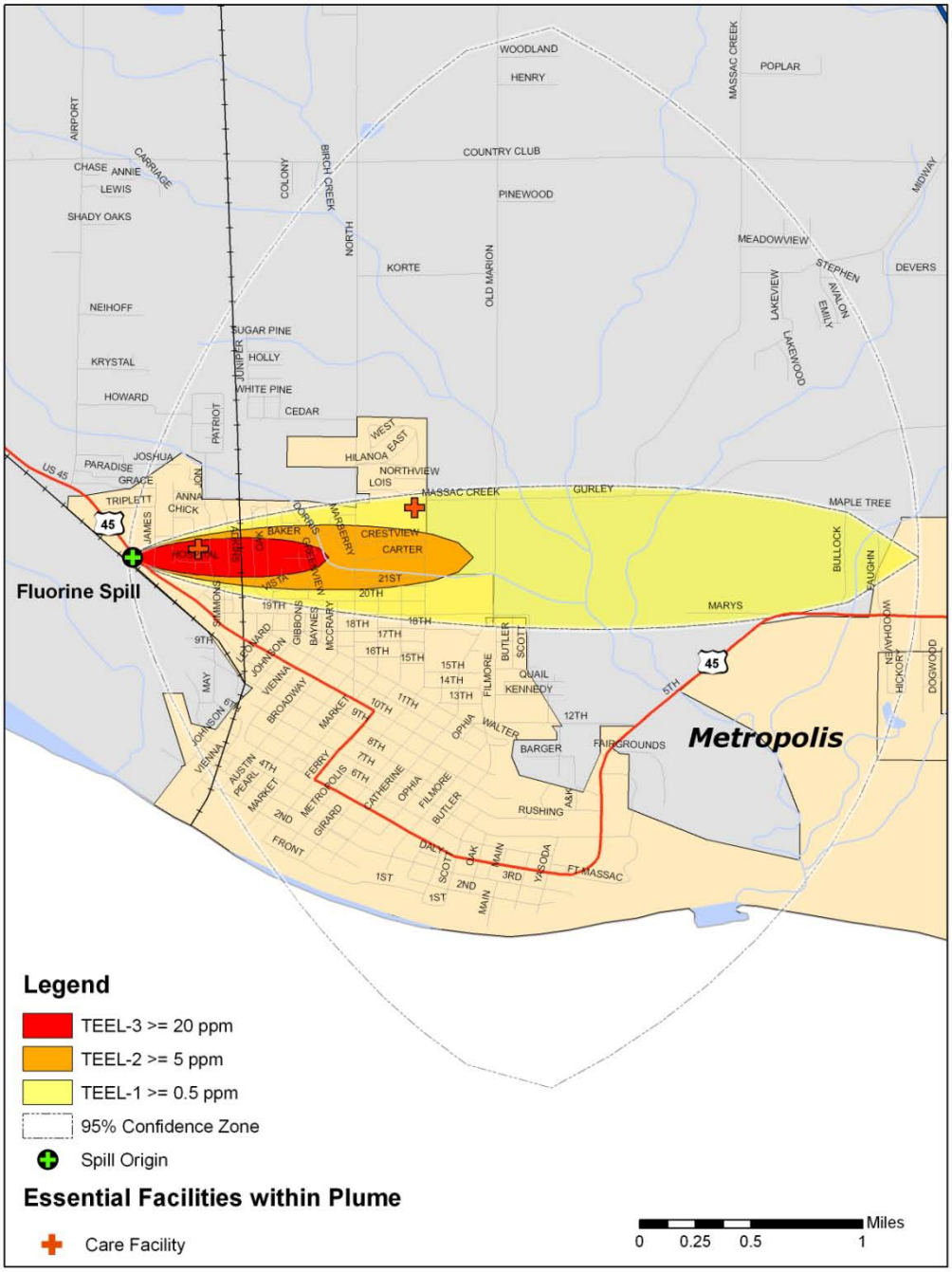
Essential Facilities Damage

There are two medical facilities within the limits of the chemical spill plume. These facilities are identified in Table 4-36, and their geographic locations are depicted in Figure 4-22.

Table 4-36: Essential Facilities within Plume Footprint

Name
Metropolis Nursing & Rehab Center
Massac Memorial Hospital

Figure 4-22: Essential Facilities within Plume Footprint



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

The city of Metropolis has a large chemical manufacturing facility, Honeywell Security Group, in which large amounts of hazardous material are stored and used in their manufacturing processes. These hazardous materials are also transported to and from this facility along the major transportation routes in the county. Hence, areas near the plant and areas along the major transportation routes are particularly vulnerable to chemical releases because of transportation and storage of large quantities of hazardous materials.

Analysis of Community Development Trends

Because the majority of new development in Massac County is occurring in and Near Metropolis and concentration of Massac County's population along the transportation network, future development is likely to be vulnerable. The major transportation routes in Massac County pose a threat of dangerous chemicals and hazardous materials release Massac County will continue to provide a comprehensive means to mitigate, prepare for, respond to, and recover from hazards relating to hazardous materials releases.

4.4.8 Fire\Explosion

Hazard Definition for Fire\Explosion Hazard

The Massac County has identified three major categories of fires within the county. These include structure fires, wildland fires, and other fires. A structure fire is any fire involving an assembly of materials for occupancy or use to serve a specific purpose. This includes buildings, open platforms, bridges, or roof assemblies over open storage or process areas. A wildland fire is any fire involving vegetative fuels that occurs in the wildland or urban-wildland interface areas. The other category captures all other fires not covered by wildland or structure fire. Examples of such fires included vehicle fires, trash or rubbish fires, and outside gas or vapor combustion.

Previous Occurrences of Fire\Explosion

Record of all fires in Massac County between January 1, 2007 and February 8, 2009 were obtained from the Illinois State Fire Marshal. In addition to these data, wildland fire data were obtained for the Shawnee National Forest and adjacent areas from the U.S. Forest Service for the period January 1986 through December 2008.

Massac County has not experienced a significant or large-scale explosion at a fixed site or transportation route that has resulted in multiple deaths or serious injuries.

Structural Fires

In terms of average annual loss property, structural fires are by far one of the most significant hazards facing Massac County. Between January 2007 and February 2009 there were a 117 structure fires in the County. These fires were attributed with one injury and over 1.3 million dollars in property damage. Table 4-37 presents the number of fires, causes, estimated losses and casualties attributed to these fires by jurisdiction.

Wildland Fires

Forested areas cover approximately one third of Massac County's total land base (Figure 3-1). When conditions are right, forests may become vulnerable to wildfires. Between January 2007 and February 2009 87 wildland fires occurred in Massac County (Table 4-37). Between 1986 and 2008, U.S. Forest Service Records revealed the occurrence of only 3 wildland fires within and near the Shawnee Nation Forest within Massac County. These fires range in size from less than 1 up to 32 acres. However, nearly all (80%) of these fires are less than 1 acre in size. These fires generally occur near roads, railroad, campgrounds, and the urban wildland interface. Figure 4-23 shows the location of the Shawnee Nation Forest in Southern Illinois and the wildland fire density within and near the Forest.

Other Fires

Other Fires in Massac County include vehicle fires, dumpster fires, and the burning of rubbish (e.g., house hold trash, construction debris, tires, or old railroad ties). Between January 2007 and February 2009, 110 such fires occurred resulting in $163,000 in property damage (Table 4-37). Most of the property damage was to vehicles and their contents.

Table 4-37 Massac County Fires 2007 to 2009

Structure Fires

Jurisdiction	Cause						Estimated Losses		Injuries	Deaths
	Accidental	Intentional	Natural	Undetermined	Under Investigation	Total	Property	Total		
Massac County	0	0	0	0	0	0	$0	$0	0	0
Brookport	32	0	0	0	0	32	$94,500	$139,400	0	0
Joppa	4	0	0	0	0	4	$100,000	$152,000	0	0
Metropolis	81	0	0	0	0	81	$695,559	$1,057,259	1	0
Total	117	0	0	0	0	117	$890,059	$1,348,659	1	0

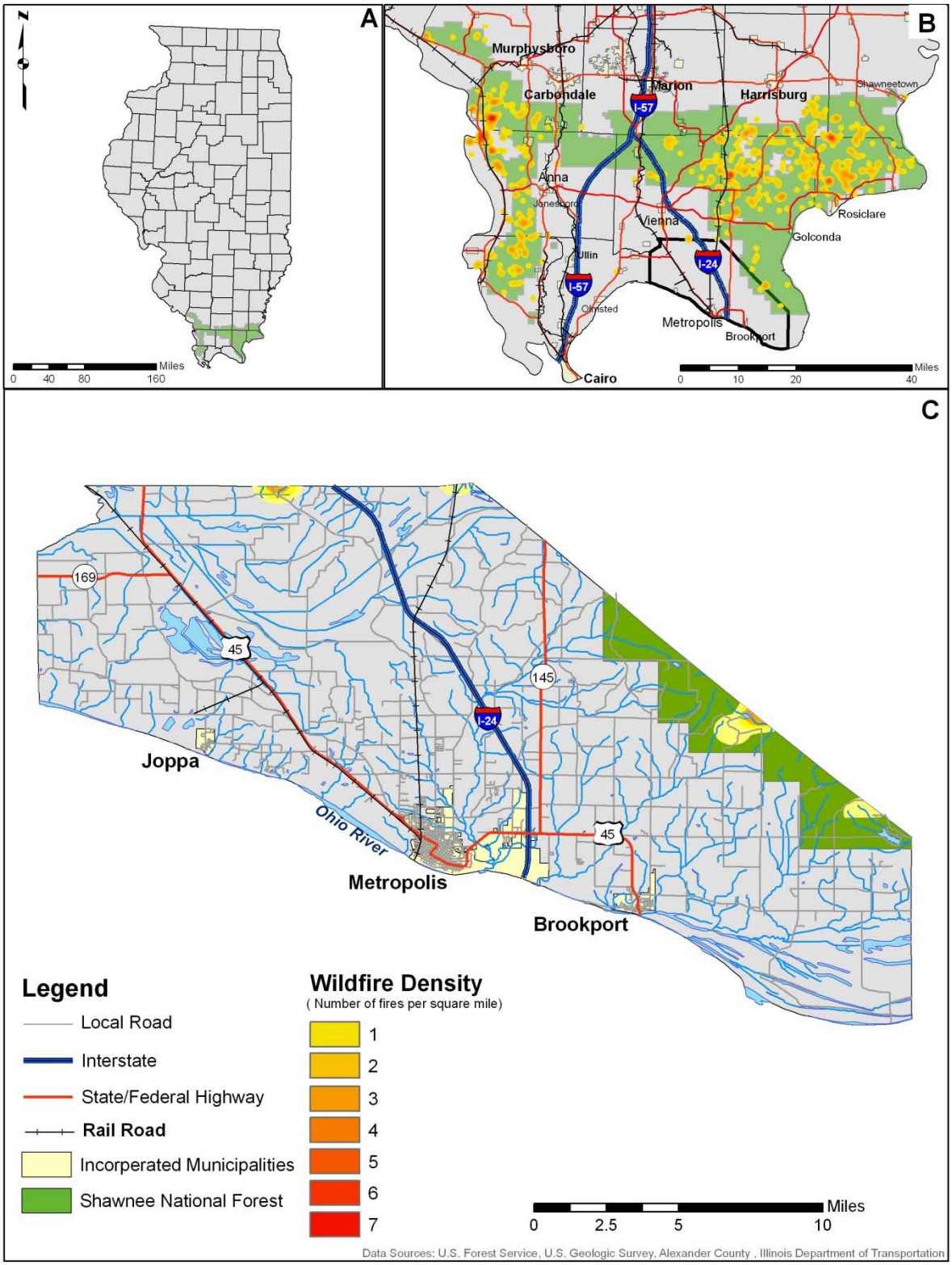
Wildland Fires

Jurisdiction	Cause						Estimated Losses		Injuries	Deaths
	Accidental	Intentional	Natural	Undetermined	Under Investigation	Total	Property	Total		
Massac County	1	0	0	0	0	1	0	0	0	0
Brookport	24	1	0	0	0	25	0	0	0	0
Joppa	1	0	0	0	0	1	0	0	0	0
Metropolis	62	0	0	0	0	62	0	0	0	0
Total	88	1	0	0	0	89	0	0	0	0

Other Fires

Jurisdiction	Cause						Estimated Losses		Injuries	Deaths
	Accidental	Intentional	Natural	Undetermined	Under Investigation	Total	Property	Total		
Massac County	1	0	0	0	0	1	$4,000	$4,375	0	0
Brookport	25	0	2	0	0	27	$72,500	$76,000	0	0
Joppa	2	0	0	0	0	2	$0	$0	0	0
Metropolis	78	0	0	0	0	78	$86,256	$96,858	0	0
Total	106	0	2	0	0	108	$162,756	$177,233	0	0

Figure 4-23 Shawnee National Forest Wildland Fire Density



Geographic Location for Fire Hazard

The structure and other fire hazards are countywide. Wildland Fires are limited to forested areas located in the north-central portion of the county and along the bluffs of the Ohio River.

Hazard Extent for Fire Hazard

The extent of the fire hazard varies both in terms of the extent of the fire and the type of material being ignited.

Calculated Priority Risk Index for Fire Hazard

Based on historical data and input from the Massac County ESDA and U.S. National Forest Service large damaging structure fires, wildland fires and explosions are possible. However, the magnitude of the damage from such an event at the county level will likely be negligible. According to the CPI, Hazardous fires are ranked as the number seven hazard in the county.

Probability	x	Magnitude /Severity	=	RPI
3	x	2	=	6

Vulnerability Analysis for Fire\Explosion Hazard

Fires and explosions are local phenomena. A large fire or explosion can possibly occur in Massac County and the damage maybe locally severe. However, the extent of damage to county as a whole is likely to be negligible. Massac County has a well-established network of fire departments with equipment capacities that enable an effective response. However for wildland fires, Massac County fire services and private land owners near the National Forest should work with the U.S. Forest Service to reduce fuel loads and developed the necessary wildland urban interface buffers to limit potential property damage from such fires.

Analysis of Community Development Trends

Vulnerable of Massac County to fires and explosions is countywide. Mitigation of the structure fire and explosions is depended on property and business owners to properly maintain their structures and machinery / equipment contained within. New development may occur within the wildland urban interface potentially increasing the risk of property damage due to wildland fire. Planned construction in these areas should be reviewed so proper protective measures are taken to minimize the wildfire risk to these properties.

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Section 5 - Mitigation Strategy

The goal of mitigation is to reduce a hazard's future impacts including property damage, disruption to local and regional economies, and the amount of public and private funds spent to assist with recovery. The goal of mitigation is to build disaster-resistant communities. Mitigation actions and projects should be based on a well-constructed risk assessment; Massac County's is provided in Section 4 of this plan. Mitigation should be an ongoing process that adapts over time to accommodate the community's needs.

5.1 Community Capability Assessment

The capability assessment identifies current activities used to mitigate hazards. The capability assessment identifies the policies, regulations, procedures, programs, and projects that contribute to the lessening of disaster damages. The assessment also provides an evaluation of these capabilities to determine whether the activities can be improved in order to more effectively reduce the impact of future hazards. The following sections identify existing plans and mitigation capabilities within all of the communities listed in Section 2 of this plan.

5.1.1 National Flood Insurance Program (NFIP)

The county and all of its communities are members of the NFIP. HAZUS-MH estimates that approximately 674 households were located in the Massac County Special Flood Hazard Area; as of June 18, 2007, the Federal Emergency Services Disaster Agency NFIP Insurance Report for Illinois stated that 104 households paid flood insurance, insuring $11,945,900 in property value. The total premiums collect amounted to $40,633 which on average was $391 annually. From 1978 to 2007, 30 claims were filed, totaling $160,557. The average claim was $5,352.

The county and incorporated areas do not participate in the National Flood Insurance Program's (NFIP) Community Rating System (CRS). 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 meeting the three goals of the CRS: 1) reduce flood losses; 2) facilitate accurate insurance rating; and 3) promote the awareness of flood insurance. Table 5-1 identifies each community and the date each participant joined the NFIP.

Table 5-1: Additional Information on Communities Participating in the NFIP

Community	Participation Date	FIRM Date	CRS Date	CRS Rating	Flood Plain Zoning Ordinance Adopted Last
Massac County	1/2/1981	7/5/1983	NA	NA	12/3/2009
City of Brookport	5/23/1997	4/30/1976	NA	NA	12/3/2009
Village of Joppa	3/2/1983	3/2/1983	NA	NA	6/3/1997
City of Metropolis	10/18/1983	10/18/1983	NA	NA	4/25/1989

5.1.2 Stormwater Management Stream Maintenance Ordinance

Massac County nor its cities or villages have a storm water management plan or ordinances.

5.1.3 Zoning Management and Subdivision Control Ordinance

Massac County nor its cities or villages have land use planning or zoning ordinances. Massac County does have a subdivision control ordinance which defines what a subdivision is within the County and places standards on subdivision roads. This ordinance was passed September 16th 1991 and covers all unincorporated areas within the County.

5.1.4 Erosion Management Program/ Policy

Massac County utilizes the Illinois Administrative Code Title 35 and the Illinois Environmental Protection Act, administered by the Illinois Environmental Protection Agency. This requires the submission of a stormwater pollution prevention plan (SWPPP) for projects involving more than one acre of land disturbance.

5.1.5 Fire Insurance Rating Programs/ Policy

Table 5-2 lists the fire departments in Massac County, as well as the ISO rating and the number of members in each department.

Table 5-2: Listing of Fire Departments, Ratings, and Number of Firefighters

Fire Department	Fire Insurance Rating	Number of Firefighters
Brookport Fire Department	8	22
Joppa Fire Department	8	20
Massac County Fire Department	6/9	30
Metropolis Fire Department	6	30

5.2 Mitigation goals

The Massac County Emergency Services Disaster Agency, Southern Illinois University-Carbondale Geology Department, the Polis Group of IUPUI, and the Southern Five Regional Planning Commission assisted the Massac County Multi-Hazard Mitigation Planning Team in the formulation of mitigation strategies and projects for Massac County. The goals and objectives set forth were derived through participation and discussion of the views and concerns of the Massac County Multi-Hazard Mitigation Team members and related public input. The MHMP will focus on these goals, with a great deal of public input, to ensure that the priorities of the communities are represented.

The goals represent long-term, broad visions of the overall vision the county would like to achieve for mitigation. The objectives are strategies and steps which will assist the communities to attain the listed goals. Table 5-5 lists mitigation actions, which are defined projects that will help to complete the defined goals and objectives.

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

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

(b) Objective: Equip public facilities and communities to guard against damage caused by secondary effects of hazards.

(c) Objective: Minimize the amount of infrastructure exposed to hazards.

(d) Objective: Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county.

(e) Objective: Improve emergency sheltering in Massac County.

Goal 2: Create new or revise existing plans/maps for Massac County

(a) Objective: Support compliance with the NFIP for each jurisdiction in Massac County.

(b) Objective: Review and update existing, or create new, community plans and ordinances to support hazard mitigation.

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

Goal 3: Develop long-term strategies to educate Massac County residents on the hazards affecting their county

(a) Objective: Raise public awareness on hazard mitigation.

(b) Objective: Improve education and training of emergency personnel and public officials.

5.3 Mitigation Actions/Projects

Upon completion of the risk assessment and development of the goals and objectives, the Planning Committee was provided with a list of the six mitigation measure categories from the *FEMA State and Local Mitigation Planning How to Guides*. The measures are listed as follows.

- **Prevention:** Government, administrative, or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building

codes, capital improvement programs, open space preservation, and stormwater management regulations.

- **Property Protection:** Actions that involve the modification of existing buildings or structures to protect them from a hazard or removal from the hazard area. Examples include acquisition, elevation, structural retrofits, storm shutters, and shatter-resistant glass.

- **Public Education and Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

- **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses, preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

- **Emergency Services:** Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.

- **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, levees, floodwalls, seawalls, retaining walls, and safe rooms.

After Meeting #3, held June 25, 2009 MHMP members were presented with the task of individually listing potential mitigation activities using the FEMA evaluation criteria. The MHMP members brought their mitigation ideas to Meeting #4, which was held September 22, 2009. The evaluation criteria (STAPLE+E) involved the following categories and questions.

Social:

- Will the proposed action adversely affect one segment of the population?
- Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?

Technical:

- How effective is the action in avoiding or reducing future losses?
- Will it create more problems than it solves?
- Does it solve the problem or only a symptom?
- Does the mitigation strategy address continued compliance with the NFIP?

Administrative:

- Does the jurisdiction have the capability (staff, technical experts, and/or funding) to implement the action, or can it be readily obtained?
- Can the community provide the necessary maintenance?

- Can it be accomplished in a timely manner?

Political:

- Is there political support to implement and maintain this action?
- Is there a local champion willing to help see the action to completion?
- Is there enough public support to ensure the success of the action?
- How can the mitigation objectives be accomplished at the lowest cost to the public?

Legal:

- Does the community have the authority to implement the proposed action?
- Are the proper laws, ordinances, and resolution in place to implement the action?
- Are there any potential legal consequences?
- Is there any potential community liability?
- Is the action likely to be challenged by those who may be negatively affected?
- Does the mitigation strategy address continued compliance with the NFIP?

Economic:

- Are there currently sources of funds that can be used to implement the action?
- What benefits will the action provide?
- Does the cost seem reasonable for the size of the problem and likely benefits?
- What burden will be placed on the tax base or local economy to implement this action?
- Does the action contribute to other community economic goals such as capital improvements or economic development?
- What proposed actions should be considered but be "tabled" for implementation until outside sources of funding are available?

Environmental:

- How will this action affect the environment (land, water, endangered species)?
- Will this action comply with local, state, and federal environmental laws and regulations?
- Is the action consistent with community environmental goals?

The development of the MHMP is the first step in a multi-step process to implement projects and policies to mitigate hazards in the county and its communities.

5.3.1 Completed or Current Mitigation Actions/Projects

Since this is the first mitigation plan developed for Massac County, there are no deleted or deferred mitigation items. The following tables will refer to completed, ongoing, or future mitigation actions. Table 5-4 presents the completed and ongoing mitigation actions and projects in the county.

Table 5-4: Completed or Current Mitigation Actions

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Comments
Establish an LEPC	**Goal:** Develop long-term strategies to educate Massac County residents on the hazards affecting their county **Objective:** Improve education and training of emergency personnel and public officials.	Flood, Tornado, Earthquake, Thunderstorm, Drought, Winter Storm, Hazmat, Fire	Massac County	This project was successfully completed.
Develop a database of special needs residents	**Goal:** Create new or revise existing plans/maps for Massac County **Objective:** Review and update existing, or create new, community plans and ordinances to support hazard mitigation.	Winter Storm	Metropolis	Metropolis has implemented this project.
Establish mutual aid agreements with surrounding cities	**Goal:** Create new or revise existing plans/maps for Massac County **Objective:** Review and update existing, or create new, community plans and ordinances to support hazard mitigation.	Winter Storm	Metropolis	Metropolis has mutual aid agreements with 29 cities within four hours distance from the community.
Procure generators for key facilities	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Equip public facilities and communities to guard against damage caused by secondary effects of hazards.	Winter Storm	Metropolis	The city has generators for the city hall, warming center, and public works facility.
Develop emergency shelters	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Improve emergency sheltering in Massac County.	Tornado, Thunderstorm	Massac County, Brookport, Metropolis, Joppa	There are three existing shelters between Brookport and the county. Metropolis has begun to develop another shelter at the high school, and Joppa is in the process of establishing a shelter within a local church.
Establish trained weather spotters within the county	**Goal:** Develop long-term strategies to educate Massac County residents on the hazards affecting their county **Objective:** Improve education and training of emergency personnel and public officials	Tornado, Thunderstorm	Massac County	The county has 19 trained weather spotters.
Institute FEMA buy-outs in frequently flooded areas	**Goal:** Create new or revise existing plans/maps for Massac County **Objective:** Support compliance with the NFIP for each jurisdiction in Massac County.	Flood	Metropolis, Joppa	This project was successfully completed.
Establish a water rescue team	**Goal:** Develop long-term strategies to educate Massac County residents on the hazards affecting their county **Objective:** Improve education and training of emergency personnel and public officials	Flood	Massac County	This project was successfully completed.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Comments
Create Hazmat teams and access equipment (hazmat trailer)	**Goal:** Develop long-term strategies to educate Massac County residents on the hazards affecting their county **Objective:** Improve education and training of emergency personnel and public officials	Hazmat, Fire	Massac County, Brookport, Joppa, Metropolis	This project was successfully created.
Distribute weather radios to special populations	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Equip public facilities and communities to guard against damage caused by secondary effects of hazards.	Tornado, Thunderstorm	Massac County, Brookport, Joppa, Metropolis	Shawnee Development Council has handed out weather radios to those who qualify.

5.4 Implementation Strategy and Analysis of Mitigation Projects

Implementation of the mitigation plan is critical to the overall success of the mitigation planning process. The first step is to decide based upon many factors, which action will be undertaken initially. In order to pursue the top priority first, an analysis and prioritization of the actions is important. Some actions may occur before the top priority due to financial, engineering, environmental, permission, and/or 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.

In Meeting #4, the planning team prioritized mitigation actions based on a number of factors. A rating of High, Medium, or Low was assessed for each mitigation item and is listed next to each item in Table 5-6. The factors were the STAPLE+E (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) criteria listed in Table 5-5.

Table 5-5: STAPLE+E planning factors

S – 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.
T – Technical	Mitigation actions are technically most effective if they provide a long-term reduction of losses and have minimal secondary adverse impacts.
A – Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
P – 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.
L – Legal	It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
E – 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.
E – 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.

For each mitigation action related to infrastructure, new and existing infrastructure was considered. Additionally, the mitigation strategies address continued compliance with the NFIP. While an official cost benefit review was not conducted for any of the mitigation actions, the estimated costs were discussed. The overall benefits were considered when prioritizing mitigation items from High to Low. An official cost benefit review will be conducted prior to the implementation of any mitigation actions. Table 5-6 presents mitigation projects developed by the planning team.

Table 5-6: Mitigation Strategies

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Develop a public education program to include school preparedness, family plans, preparedness kits, and nonstructural mitigation, e.g. bolting bookshelves to walls	**Goal:** Develop long-term strategies to educate Massac County residents on the hazards affecting their county **Objective:** Raise public awareness on hazard mitigation.	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Fire	Massac County, Brookport, Joppa, Metropolis	High	The county EMA will oversee this project, working with schools and healthcare facilities. Local resources will be used to develop educational literature and present to each jurisdiction at public events or in schools. If resources are available, the project will be implemented within one year.
Institute a buy-out plan for four homes in Metropolis and two in Joppa along the Ohio River	**Goal:** Create new or revise existing plans/maps for Massac County **Objective:** Support compliance with the NFIP for each jurisdiction in Massac County.	Flood	Joppa, Metropolis	High	The County ESDA Director and Floodplain Manger will oversees the implementation of the project. Funding has not been secured as of 2009 but will be sought from funding sources such as IEMA and FEMA. Implementation, if funding is available, is forecasted to begin within one year.
Secure funding for first responders and hospital staff	**Goal:** Develop long-term strategies to train Massac County's first responders in the handling hazardous material incidents. **Objective:** Improve education and training of emergency personnel and public officials.	Hazmat	Massac County, Brookport, Joppa, Metropolis	High	The ESDA Director will work with local first responders to research training opportunities. The county will request funding for training and equipment from IEMA. If funding is available, implementation will begin within one year.
Upgrade the county's sirens	**Goal:** Lessen the impacts of hazards to residents and infrastructure. **Objective:** Evaluate and strengthen the communication and improve the county's warning system for severe weather.	Tornado, Thunderstorm	Massac County, Brookport, Joppa, Metropolis	High	The county's existing sirens cannot be heard over long distances. Funding has not been secured as of 2009, but the PDM program and community grants are an option. If funding is available, implementation will begin within one year.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Construct a new earthquake/storm resistant structure for unified communication center and E.O.C	**Goal:** Maintain or improve emergency communications during a disaster. **Objective:** Build a critical facility with structural design practices and equipment that will withstand natural disasters and offer weather-proofing.	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm	Massac County	High	The ESDA and E911 directors will oversee this project. Local resources will be used to determine costs. Funding has not been secured as of 2009, but the PDM program or community grants are an option. If funding is available, implementation will begin within one year.
Procure transfer switches for generators in shelters and critical facilities	**Goal:** Lessen the impacts of hazards to residents and infrastructure. **Objective:** Equip public facilities and communities to guard reduce damage/impacts caused by secondary effects of hazards.	Tornado, Thunderstorm, Winter Storm	Massac County, Brookport, Joppa, Metropolis	Medium	The ESDA Director will oversee implementation of this project. Funding has not been secured as of 2009, but the pre-disaster mitigation program and community development grants are possible funding sources. If funding is available, this project is forecasted to begin within three years.
Install inertial valves at critical facilities	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Retrofit critical facilities with structural design practices and equipment that will withstand natural disasters and offer weather-proofing.	Earthquake	Massac County, Brookport, Joppa, Metropolis	Medium	The ESDA Director will oversee implementation of this project. Funding has not been secured as of 2009, but the PDM program and community grants are an option. If funding is available, implementation will begin within three years.
Create new and upgrade existing warming shelters: Metropolis Community Shelter needs a shower facility, and Metropolis High School needs to be established as a shelter	**Goal:** Lessen the impacts of hazards to residents **Objective:** Improve emergency sheltering in Massac County.	Tornado, Thunderstorm	Metropolis	Medium	The ESDA Director will work with local shelters to complete this project. The PDM program or local resources are funding options. If funding is available, implementation will begin within three years.
Clear trees and debris from the levee/floodwall and repair as necessary	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Minimize the amount of infrastructure exposed to hazards.	Flood	Brookport	Medium	The town of Brookport will work with U.S. Army Corps of Engineers to make the necessary repairs to their flood control levee. Funding has not been secured as of 2009, but local, state, and federal funding will be sought. Implementation will begin within three years.
Develop a countywide emergency winter storm plan	**Goal:** Create new or revise existing plans/maps for Massac County **Objective:** Review and update existing, or create new, community plans and ordinances to support hazard mitigation.	Winter Storm	Massac County, Brookport, Joppa, Metropolis	Low	The county ESDA Director will work with local first responders and IEMA to draft an emergency response plan. The MHMP planning committee will review and revise the plan as necessary. If local resources are available, implementation of this project will begin within five years.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Complete a commodity flow study	**Goal:** Create new or revise existing plans/maps for Massac County **Objective:** Conduct new studies/research to profile hazards and follow up with mitigation strategies.	Hazmat	Massac County	Low	Community planners and local government leaders will coordinate this study. Funding will be sought from county, state, and federal sources. Implementation, if funding is available, will begin within five years.
Harden/retrofit Joppa's Water Treatment Facility	**Goal:** Lessen the impacts of hazards to existing infrastructure. **Objective:** Prevent service interruption of Joppa's water supply system from flooding or power interruption.	Tornado, Flood, Thunderstorm, Winter Storm	Joppa	Low	The Village of Joppa will develop and implement a plan to harden/retrofit their water treatment facility. Local resources will be used to determine costs. Funding has not been secured as of 2009, but the PDM program or community grants are an option. If funding is available, implementation will begin within five years.

The Massac County Emergency Services Disaster Agency will be the local champions for the mitigation actions. The county commissioners and the city and town councils will be an integral part of the implementation process. Federal and state assistance will be necessary for a number of the identified actions. Southern Five Regional Planning Commission is qualified to provide technical grant writing services to assist the county in seeking resources to achieve the recommended mitigation action.

5.5 Multi-Jurisdictional Mitigation Strategy

As a part of the multi-hazard mitigation planning requirements, at least two identifiable mitigation action items have been addressed for each hazard listed in the risk assessment and for each jurisdiction covered under this plan.

Each of the four jurisdictions, including Massac County, 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 this plan. The county planning team used FEMA's evaluation criteria to gauge the priority of all items. A final draft of the disaster mitigation plan was presented to all members to allow for final edits and approval of the priorities.

Section 6 - Plan Maintenance

6.1 Monitoring, Evaluating, and Updating the Plan

Throughout the five-year planning cycle, the Massac County Emergency Services and Disaster Agency Director will reconvene the MHMP planning committee to monitor, evaluate, and update the plan on an annual basis. Additionally, a meeting will be held during January 2015 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 the need for a special meeting arises, due to new developments or a declared disaster, the team will meet as necessary to update mitigation strategies. Depending on grant opportunities and fiscal resources, mitigation projects may be implemented independently by individual communities or through local partnerships.

The committee will review the county goals and objectives to determine their relevance to changing situations in the county. In addition, state and federal policies will be reviewed to ensure they are addressing current and expected conditions. The committee will also review the risk assessment portion of the plan to determine if this information should be updated or modified. 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 individual jurisdictions for approval. The plan will be updated via written changes, submissions as the committee deems appropriate and necessary, and as approved by the county commissioners.

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

6.2 Implementation through Existing Programs

The results of this plan will be incorporated into ongoing planning efforts. Many of the mitigation projects identified as part of this planning process are ongoing. Where needed, modifications will be made to the county and community planning documents and ordinances as part of regular updates. The mitigation plan will be used to help guide building code changes and land use planning.

6.3 Continued Public Involvement

Continued public involvement is critical to the successful implementation of the MHMP. Comments from the public on the MHMP will be received by Massac County Emergency Services and Disaster Agency Director and forwarded to the MHMP planning committee for discussion. Education efforts for hazard mitigation will be ongoing through the local television stations, brochures, and yearly public meetings. Once adopted, a copy of this plan will be posted in the library and on the county website.

Glossary of Terms

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

B

BFE – Base Flood Elevation

C

CAMEO – Computer-Aided Management of Emergency Operations
CEMA – County Emergency Services Disaster Agency
CEMP – Comprehensive Emergency Management Plan
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

E

EAP – Emergency Action Plan
ERPG – Emergency Response Planning Guidelines
EMA – Emergency Services Disaster Agency
EPA – Environmental Protection Agency

F

FEMA – Federal Emergency Services Disaster Agency
FIRM – Flood Insurance Rate Maps
FIS – Flood Information Study

G

GIS – Geographic Information System

H

HAZUS-MH – **Ha**zards **US**A **M**ulti-**H**azard
HUC – Hydrologic Unit Code

I

IDNR – Illinois Department of Natural Resources
IEMA – Illinois Emergency Services Disaster Agency

M

MHMP – Multi-Hazard Mitigation Plan

N

NCDC – National Climatic Data Center
NEHRP – National Earthquake Hazards Reduction Program
NFIP – National Flood Insurance Program
NOAA – National Oceanic and Atmospheric Administration

P

PPM – Parts Per Million

R

RPI – Risk Priority Index

S

SPC – Storm Prediction Center
SWPPP – Stormwater Pollution Prevention Plan

U

USGS – United States Geological Survey

Appendix A – Minutes of the Multi-Hazard Mitigation Planning Team Meetings

IEMA Pre-Disaster Mitigation Plan

Assembly of the Massac County Planning Team Meeting 1:
Plan Directors: Southern Five Regional Planning Commission, SIUC Geology Department, and IUPUI - Polis

Meeting Date: Tuesday, October 28, 2008

Meeting Time: 3 pm

Place: Metropolis Community Center, Metropolis, IL

Planning Team/Attendance:

Jonathan Remo	SIUC Geology
Andy Flor	SIUC Geology
John Beuchler	IUPUI – Polis
Crystal Davenport	Southern Five Regional Planning Commission
Robbin McDaniel	Massac Memorial Hospital Administration
Billy McDaniel	Mayor, City of Metropolis
O.D. Troutman	Massac County ESDA Director
Theresa Bunting	Massac County Ambulance
Bob Griffey	Massac County Sheriff
Keith Davis	Massac County 911
Lisa Monkman	Massac County Unit District #1 Schools
Billy Hillebrand	Massac County Commissioner
Bob Stokes	Massac County Industry (Honeywell)

Introduction to the Pre-Disaster Mitigation Planning Process

The meeting is called to order

Narrative: A power-point presentation was given by Jonathan Remo. He explained that this project is in response to the Disaster Mitigation Act of 2000. The project is funded by a grant awarded by FEMA. A twenty-five percent match will be required from the county to fund this project. The county match will be met by sweat equity and GIS data acquired from the County Assessor's Office. The sweat equity will be an accumulation of time spent at the meetings, on research assignments, surveys, along with the time spent reviewing and producing the planning document.

Jonathan Remo introduced the Pre-Disaster Mitigation Website to the planning team. A username and password was given to the planning team, which will grant them access to the web site. The web site is used to schedule meetings, post contact information and download material pertaining to the planning process.

Jonathan Remo divided the planning project into five to six meetings. At the 1st meeting, the planning team will review critical facility maps. The planning team will be asked to research and verify the location of all critical facilities within the county. Jonathan stated that public participation is very important throughout the planning process. He explained that all of the meetings are open to the public but there will be a particular effort made to invite the public to the 3rd meeting. At that meeting, the SIUC Geology Department will present historic accounts of natural disasters that have affected this area. At the 2nd meeting the discussion will focus on natural disasters that are relevant to this area. These hazards will be given a probability rating and ranked by their occurrence and potential level of risk. Polis and SIUC Geology will research these hazards and present them to the planning team. The 3rd meeting is publicized in order to encourage public participation. Polis and SIUC Geology will produce a risk assessment in draft form; each planning team member will get a copy. Also they will present strategies and projects that FEMA and other counties have undertaken for the planning team to review. The 4th meeting consists of a brain storming session focused on disasters that were analyzed in the risk assessment report. The Planning Team will list strategies and projects that could be implemented to mitigate the potential hazards that threaten the county. FEMA requires that for every identified hazard, a strategy to mitigate the loss and damage must be in place. The strategies may range from educational awareness to hardening a building or building a levee. After the 4th meeting the plan will be in its final draft form. At the 5th meeting the planning team will need to review the plan prior to sending it to IEMA. IEMA will review the plan and will make recommendation to it as they see fit, then it is submitted to FEMA for review and approval. Once the plan has been submitted to FEMA, local governments are eligible to apply for grants to mitigate these established hazards. After FEMA approves the plan, it is sent back to the Planning Team. At the 6th meeting the Planning Team will present the Pre-Disaster Mitigation Plan to the County Board for adoption. Incorporated communities must either adopt the county plan or prepare its own plan, in order to access mitigation assistance from FEMA. The communities are encouraged to participate and contribute to development of the plan. Once the County Board has adopted the plan, each incorporated community will have the opportunity to adopt the plan as well.

Jonathan Remo then introduced Andy Flor of SIUC. Andy Flor presented three maps that identified critical facilities in the county. He asked the planning team to come up to review the maps to identify any corrections that need to be made to the maps. He assigned research homework arranged by categories to individual planning team members to locate missing or incorrect critical facilities.

Narrative: A few clarifications were made about the planning process and the participation needed to complete the plan along with dialog between the Planning Team members and Andy and Jonathan about the critical facilities maps. There was discussion about the communities that were not represented and how to contact those communities for the meetings. It was also made

known by Crystal Davenport of Southern Five Regional Planning Commission that all of the planning team members would be notified of the next meeting time and place.

Meeting was adjourned.

IEMA Pre-Disaster Mitigation Plan

Assembly of the Massac County Planning Team Meeting 2:
Plan Directors: Southern Five Regional Planning Commission, SIUC Geology Department, and IUPUI - Polis

Meeting Date: Thursday, December 11, 2008

Meeting Time: 9 am

Place: Metropolis Community Center, Metropolis, IL

Planning Team/Attendance:

Jonathan Remo	SIUC Geology
Andy Flor	SIUC Geology
Crystal Davenport	Southern Five Regional Planning Commission
Robbin McDaniel	Massac Memorial Hospital Administration
Keith Davis	Massac County 911
O.D. Troutman	Massac County ESDA Director
Jon Teutrine	Shawnee National Forest

The meeting was called to order.

Jonathan Remo began the meeting by re-introducing the objectives of the PDM Planning document. The planning document is mandated as a result of the "Disaster Mitigation Act of 2000". Jonathan stated that the objective of the meeting was to prioritize a list of disasters that are relevant to Massac County.

Jonathan Remo provided the planning team with a handout to direct the focus of the meeting discussion. As Jonathan began to conduct the prioritizing process, he described the risk assessment ranking that FEMA has established.

Narrative: The Planning Team was then asked to assess a risk level to each disaster that was identified in Massac County. The risk level is ranked as followed:

#1: Transportation of Hazardous Material Release
#2: Tornado
#3: Winter Storms
#4: Flooding
#5: Earthquake
#6: Thunderstorms/High Winds/Hail/Lightening
#7: Fire/Explosion
#8: Dam/Levee Failure

Narrative: The planning team was then asked to analyze the historical weather events that have been plotted on a map of the county and communities therein. No corrections were noted by the planning team.

The planning team agreed to complete any missing information pertaining to critical facilities by the next meeting.

Meeting was adjourned.

IEMA Pre-Disaster Mitigation Plan

Assembly of the Massac County Planning Team Meeting 3:
Plan Directors: Southern Five Regional Planning Commission, SIUC Geology Department, and IUPUI – Polis

Meeting Date: Thursday, June 25, 2009

Meeting Time: 6 pm

Place: Metropolis Community Center, Metropolis, IL

Planning Team/Attendance:

Jonathan Remo	SIUC Geology
Megan Carlson	SIUC Geology
Crystal Davenport	Southern Five Regional Planning Commission
Billy McDaniel	Mayor, City of Metropolis
Robbin McDaniel	Massac Memorial Hospital Administration
Terra Temple	Metropolis Planet Newspaper
George Giltner	Private Citizen, Metropolis
O.D. Troutman	Massac County ESDA Director
Judy Askew	Mayor, City of Brookport
Mark Schneider	Police Chief, City of Brookport
Keith Davis	Massac County 911
Lindell Bradford	Private Citizen, Metropolis

The meeting was called to order.

Jonathan Remo opened the meeting with an overview of the planning process and the roles of SIU and the Polis Center. Then he went on to explain the topics and objectives of the current meeting. Jonathan first presented the planning team with the list of hazards that the team had ranked by their level of risk from the previous meeting. He also presented a power point presentation of the history of Massac County's past disasters. This included covering each hazard that the County had focused on, the history of each and then the mitigation strategies. He defined mitigation as the act of avoidance and preparedness.

A copy of Mitigation Idea, produced by FEMA Region 5 in July 2002, was given to each of the planning team members for review. It was explained by Jonathan the contents of the booklet and that each of the planning team members should return to meeting 4 with three mitigation strategies for each of the hazards identified by the planning team.

Jonathan Remo then asked the audience for questions or comment. After some discussion about the plan and how it would affect the community and its residents, he thanked those who came and a closed the presentation.

Meeting was adjourned.

IEMA Pre-Disaster Mitigation Plan

Assembly of the Massac County Planning Team Meeting 4:
Plan Directors: Southern Five Regional Planning Commission, SIUC Geology Department, and IUPUI – Polis

Meeting Date: Tuesday, September 22, 2009

Meeting Time: 2 pm

Place: Metropolis Community Center, Metropolis, IL

Planning Team/Attendance:

Jonathan Remo	SIUC Geology
John Buechler	IUPUI – Polis
Crystal Davenport	Southern Five Regional Planning Commission
Julia Johnson	Mayor, Village of Joppa
Sean Patterson	Massac County Industry – Honeywell
Robbin McDaniel	Massac Memorial Hospital Administration
Keith Davis	Massac County 911
Joe Sharp	Massac County High School
Billy Hillebrand	Massac County Commissioner
O.D. Troutman	Massac County ESDA Director
Lisa Monkman	Massac County Unit District #1 Schools
Judy Askew	Mayor, City of Brookport
Pat Windhorst	Massac County Unit District #1 Schools
Billy McDaniel	Mayor, City of Metropolis

The meeting was called to order.

Jonathan Remo thanked everyone for attending the meeting and stated that if the planning team members needed extra mitigation strategy handbooks that they were available upon request. He introduced John Buechler from the Polis Center that was in attendance that day also.

John Buechler began by explaining that today's meeting would cover mitigation strategies that the planning team believed would prevent or eliminate the loss of life and property. He explained that the planning team should not make any reservations in the form of money or resources when developing this list. Also whenever possible, the planning team was directed to be specific about the location or focus area of a strategy, in respect to being within a municipality or county wide. Each hazard was addressed one at a time. The planning team listed new and current on-going mitigation strategies in respect to each hazard. The planning team prioritized mitigation actions based on a number of factors. A rating of High, Medium, or Low was assessed for each mitigation item. Listed below are **the New Mitigation Strategies** that the Planning Team came up with:

Mitigation Item	Hazards Addressed	Jurisdictions Covered	Priority
Develop a public education program to include school preparedness, family plans, preparedness kits, and nonstructural mitigation, e.g. bolting bookshelves to walls	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Fire	Massac County, Brookport, Joppa, Metropolis	High
Institute a buy-out plan for four homes in Metropolis and two in Joppa along the Ohio River	Flood	Joppa, Metropolis	High
Secure funding for first responders and hospital staff	Hazmat	Massac County, Brookport, Joppa, Metropolis	High
Upgrade the county's sirens	Tornado, Thunderstorm	Massac County, Brookport, Joppa, Metropolis	High
Construct a new earthquake/storm resistant structure for unified communication center and E.O.C	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm	Massac County	High
Procure transfer switches for generators in shelters and critical facilities	Tornado, Thunderstorm, Winter Storm	Massac County, Brookport, Joppa, Metropolis	Medium
Install inertial valves at critical facilities	Earthquake	Massac County, Brookport, Joppa, Metropolis	Medium
Create new and upgrade existing warming shelters: Metropolis Community Shelter needs a shower facility, and Metropolis High School needs to be established as a shelter	Tornado, Thunderstorm	Metropolis	Medium
Clear trees and debris from the levee/floodwall and repair as necessary	Flood	Brookport	Medium
Develop a countywide emergency winter storm plan	Winter Storm	Massac County, Brookport, Joppa, Metropolis	Low
Complete a commodity flow study	Hazmat	Massac County	Low
Harden/retrofit Joppa's Water Treatment Facility	Tornado, Flood, Thunderstorm, Winter Storm	Joppa	Low

Listed below are **the current Mitigation Strategies** already being implemented by the County or its municipalities:

Mitigation Item	Hazards Addressed	Jurisdictions Covered
Establish an LEPC	Flood, Tornado, Earthquake, Thunderstorm, Drought, Winter Storm, Hazmat, Fire	Massac County
Develop a database of special needs residents	Winter Storm	Metropolis
Establish mutual aid agreements with surrounding cities	Winter Storm	Metropolis
Procure generators for key facilities	Winter Storm	Metropolis
Develop emergency shelters	Tornado, Thunderstorm	Massac County, Brookport, Metropolis, Joppa
Establish trained weather spotters within the county	Tornado, Thunderstorm	Massac County
Institute FEMA buy-outs in frequently flooded areas	Flood	Metropolis, Joppa
Establish a water rescue team	Flood	Massac County
Create Hazmat teams and access equipment (hazmat trailer)	Hazmat, Fire	Massac County, Brookport, Joppa, Metropolis
Distribute weather radios to special populations	Tornado, Thunderstorm	Massac County, Brookport, Joppa, Metropolis

After prioritizing these items, **the meeting was adjourned**.

IEMA Pre-Disaster Mitigation Plan

Assembly of the Massac County Planning Team Meeting 5:
Plan Directors: Southern Five Regional Planning Commission, SIUC Geology Department, and IUPUI – Polis

Meeting Date: Tuesday, January 26, 2010

Meeting Time: 2 pm

Place: Metropolis Community Center, Metropolis, IL

Planning Team/Attendance:

Jonathan Remo	SIUC Geology
Crystal Davenport	Southern Five Regional Planning Commission
Billy McDaniel	Mayor, City of Metropolis
Robbin McDaniel	Massac Memorial Hospital Administration
Judy Askew	Mayor, City of Brookport
Keith Davis	Massac County 911
Patrick Windhorst	Massac County State's Attorney
Billy Hillebrand	Massac County Commissioner
Julia Johnson	Mayor, Village of Joppa
Sean Patterson	Honeywell
Lisa Monkman	Massac County Unit School Dist #1

The meeting was called to order.

Jonathan Remo opened the meeting with an overview of what was to happen from this point on with the plan. He stated that the plan could be reviewed by the Planning Team members for about 2 weeks so everyone would have ample amount of time look at and review the plan for any discrepancies. He also stated that in approximately 3 weeks the plan would be sent to IEMA/FEMA. They would then review it and if everything is OK with the plan, then we should hear back from IEMA/FEMA around mid-March or early April for their approval.

Jonathan then explained that once it comes back approved, then a Resolution will have to be passed by all municipalities. He stated that Crystal Davenport of Southern Five RPC will have an example of this resolution that she will give to the municipalities in order for them to pass it at their board/council meetings. After they are passed, Jonathan stated that they needed to be returned to Crystal and she will forward them on to FEMA. Once FEMA gets the Resolutions, they will send notification that the municipality has a completed and approved plan.

He also explained that once the plan is submitted to IEMA/FEMA for their review, the municipalities can begin formulating and putting together their projects for funding. There is a pool of funds from FEMA that these lower five counties can access that was allowed for the '08

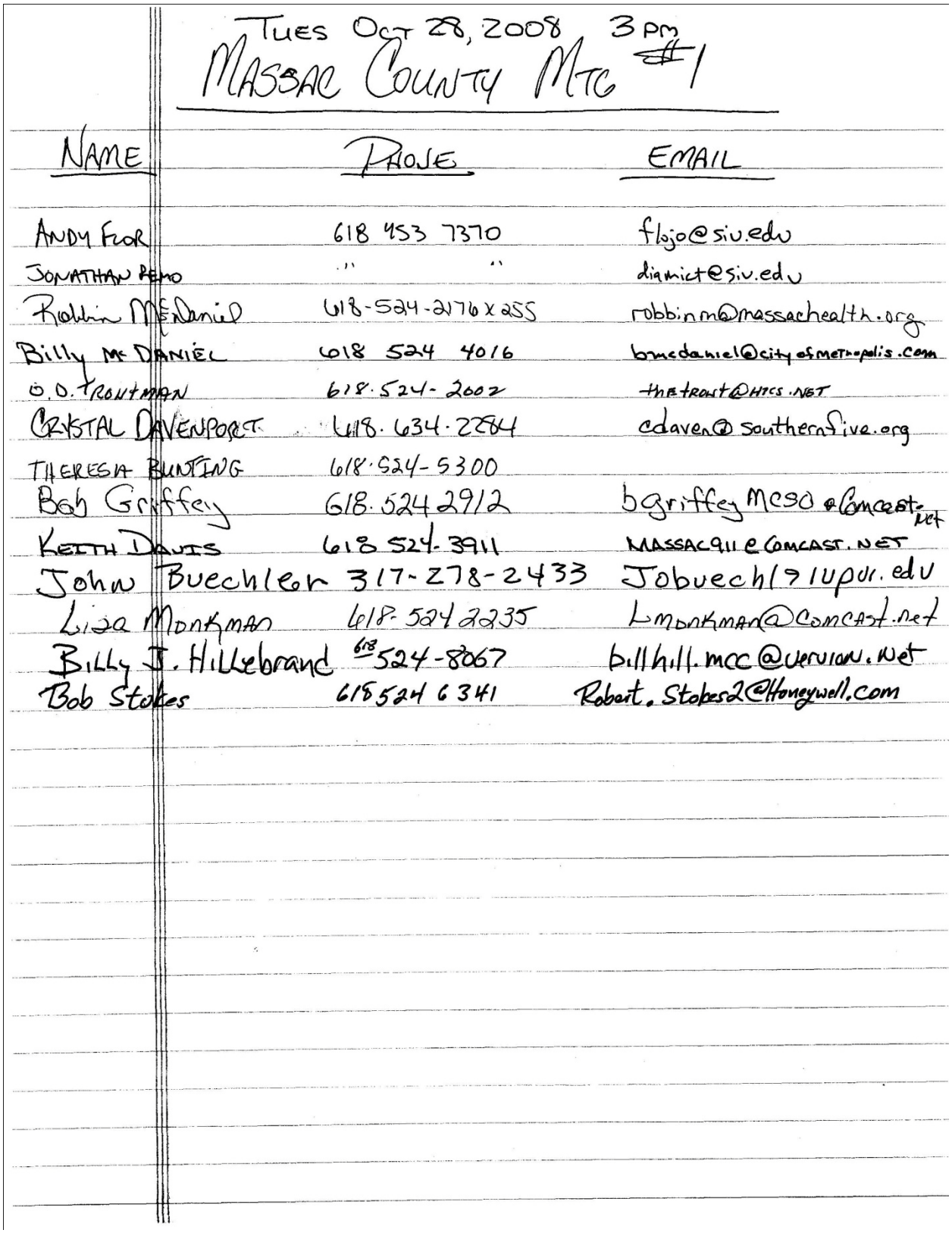
winter/ice storm that is earmarked just for the lower counties of IL. The projects must be related to the affects of this storm. He stated that if individuals wanted more specific information of this funding, they could go to the IEMA website.

It was also explained to the planning team that FEMA will require a five-year update to the plan. Jonathan told the planning team that in another five years, the members should come together again, most likely under the direction of the ESDA Director, to review the plan and make any necessary changes to it. He explained that FEMA will probably send out a reminder as to when this is supposed to take place.

After Jonathan explained the above process, he pointed out specific tables and places in the plan that needed clarification from the team members. After discussing a few changes, the planning team members looked at the plan for a while longer.

Since there were no more comments about the plan, **the meeting was adjourned.**

Appendix A – Meeting Sign in Sheets



Tues Oct 28, 2008 3pm #1

Massac County MTG

NAME	PHONE	EMAIL
Andy Flor	618 453 7370	flojo@siv.edu
Jonathan Reno	" "	diamict@siv.edu
Robbin McDaniel	618-524-2176 x 255	robbinm@massachealth.org
Billy McDaniel	618 524 4016	bmcdaniel@cityofmetropolis.com
O.O. Trautman	618.524-2002	thetrout@htcs.net
Crystal Davenport	618.634.2284	cdaven@southernfive.org
Theresia Bunting	618.524-5300	
Bob Griffey	618.524 2912	bgriffeymcso@Comcast.net
Keith Davis	618 524-3911	massac911@comcast.net
John Buechler	317-278-2433	Jobuechl@iupui.edu
Lisa Monkman	618-524 2235	Lmonkman@Comcast.net
Billy J. Hillebrand	618 524-8067	billhill.mcc@verizon.net
Bob Stokes	618 524 6341	Robert.Stokes2@Honeywell.com

MASSAC CO
PRE DISASTER MITIGATION MTG #2
12-11-08

NAME	AFFILIATION	PHONE OR EMAIL
Robbin McDaniel	Massac Memorial Hospital	524-2176 x 255 robbinm@massachealth.org
KEITH DAVIS	MASSAC CO. E-911	MASSAC911@COMCAST.NET
O.D. TROUTMAN	Metropolis/MASSAC CO ESDA	618-524-2002
ANDY FLOR	SIUC	618-453-7370 flojo@siu.edu
JONATHAN REMO	SIUC	618-453-7370 diamict@siu.edu
Jon Teutrine	Shawnee National Forest	618-658-1314 jteutrine@fs.fed.us
CRYSTAL DAVENPORT	So. FIVE RPC	

SIGN IN SHEET

PLACE: *Metropolis Community Center*

DATE: *June 25, 2009*

TIME: *6:00 pm*

PURPOSE: *Public Hearing for Multi-Hazard Mitigation Plan* (~~#~~3)

NAME	ADDRESS	[redacted]	AFFLIATION
Megan Carlson			SIUC
Billy Mc DANIEL	106 W 5th ST		City of Metropolis
Robbin McDaniel	PO Box 850		Massac Memorial Hospital
Jerra Temple	PO Box 820		Metropolis Planet
George Miltner	53 Jones Dr.		resident
O.D. TROUTMAN	Box 716		ESDA
Judy Askew	PO Box 308 / BKPT		Mayor / Brookport
Mark R. Schneider	209 Ohio St, Brookport, IL 62910		Brookport Chief of Police
KEITH DAVIS	511 MARKET ST.		METRO / MASSAC E-911
LINDELL BRADFORD	712 VIENNA ST		RESIDENT
CRYSTAL DAVENPORT			SFRPC
JONATHAN RENO			SIUC

SIGN IN SHEET

PLACE: *Metropolis Community Center Meeting Room, Metropolis, IL*

DATE: *September 22, 2009*

TIME: *2:00 pm*

PURPOSE: *Massac Co Pre Disaster Mitigation Committee Meeting #4*

NAME	ORGANIZATION	EMAIL or PHONE
Julie Johnson,	Pres. Village of Joppa	(618)543-7427
Roha Buechler	Polis	
Sean Patterson	Honeywell	618 524-6362
Robbin McDaniel	Massac Memorial Hospital	
Keith Davis	Metropolis/Massac E-911	618 524-3911
Joe Sharp	MCHS	618-524-3140
Billy J. Hillebrand	Massac Co Chairman	618-524-8067
O.D. Troutman	ESDA	618-524-2002
Lisa Monkman	Massac Unit #1	Lmonkman@comcast.net
Judy Asker	Mayor - Brookport	mzmayor@yahoo.com
Pat Windhorst	Massac Unit Dist #1	524-9386 ext 151
Billy McDaniel	City of Metropolis	524-4016
Crystal Davenport	SFRPC	
Jonathan Remo	SIUC	

SIGN IN SHEET

PLACE: *Metropolis Community Center, Metropolis, IL*

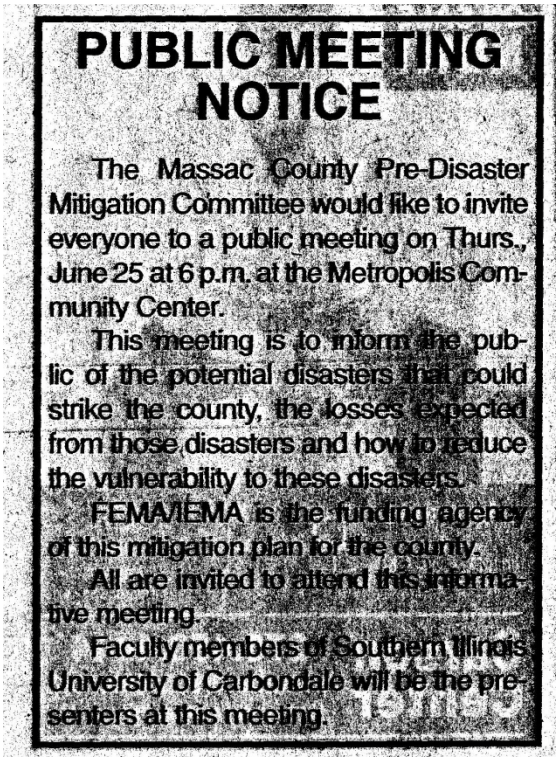
DATE: *January 26, 2010*

TIME: *2 pm*

PURPOSE: *Massac County Pre-Disaster Mitigation Committee Meeting #5*

NAME	AFFILIATION	PHONE & EMAIL
Patrick Windhorst	Massac County State's Attorney	patrickwindhorst@hotmail.com 618-524-2587
Billy Hildebrand	MASSAC Co. Commissioner	618-524-8067
JuLie Johnson	Joppa Village Pres.	618-543-7427
Sean Patterson	Honeywell	618 524-6362
Keith Davis	Metropolis/Massac E-911	618 524-3911
Robbin McDaniel	Massac Memorial Hospital	618-524-3176
Lisa Monkman	Massac Unit #1	Lmonkman@comcast.net 524-9376x101
Judy Askew	Mayor - Brookport	618-564-3351 BROOKPORTCITYGOV@yahoo.com
Billy McDaniel	Mayor Metropolis	
CRYSTAL DAVENPORT	SFRPC	
JONATHAN RENO	SIUC	

Appendix B - Articles published by Local Newspaper



PUBLIC MEETING NOTICE

The Massac County Pre-Disaster Mitigation Committee would like to invite everyone to a public meeting on Thurs., June 25 at 6 p.m. at the Metropolis Community Center.

This meeting is to inform the public of the potential disasters that could strike the county, the losses expected from those disasters and how to reduce the vulnerability to these disasters.

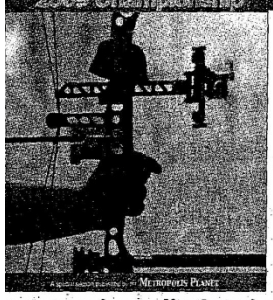
FEMA/IEMA is the funding agency of this mitigation plan for the county.

All are invited to attend this informative meeting.

Faculty members of Southern Illinois University of Carbondale will be the presenters at this meeting.

ASA Illinois Pro-Am 2009 Championship

In this issue: ASA Illinois Pro-Am 2009 Tournament special



METROPOLIS PLANET

www.metropolisplanet.com

Vol. 145 No. 25 Wednesday, June 24, 2009 3 Supplements 24 Pages 2 Sections 8

Disaster plans to be discussed

The Massac County Pre-Disaster Mitigation Committee will host a public meeting at 6 p.m. Thursday at the Metropolis Community Center, located at 900 W. 10th St. in Metropolis.

In pursuance of compliance with the federally mandated Disaster Mitigation Act (DMA) of 2000, Massac County is working to develop a Multi-Hazard Mitigation Plan (MHMP) to identify potential hazards and establish mitigation measures to reduce or eliminate the negative impacts that a particular hazard may have on the locality.

The finished plan will be reviewed and accepted by the county and sent to FEMA for federal approval.

Once FEMA approves, the county will be eligible for emergency relief funding in the event of a natural disaster.

The county will also be eligible for federal funding to implement the mitigation measures defined in the plan to minimize the effects of a natural disaster.

"Thursday's meeting is an open public meeting to inform them of what the planning committee has accomplished thus far and to show examples of what a natural disaster can do if it hits certain areas of the county and the dollars lost associated with that disaster," explained Crystal Davenport, regional planner for Southern Five Regional Planning Commission.

Faculty members of Southern Illinois University at Carbondale will be the presenters.

The public is encouraged to attend.

Though nothing was said in op
a small group of teachers from F
Jefferson Elementary schools w
at Monday night's Massac Unit
meeting, which lasted less than a
the main areas of business cente
proposed amended budget and
items.

Following the meeting, the
of district employees stayed in t
room to talk to Massac County
Association President Richard
said he could not elaborate on w
the teachers spoke about, as it
inappropriate. Corse did say Tuesd
when and if he is able to speak, he
Superintendent Bill Hatfield woul
on the reason of the meeting.

According to Hatfield, he is n
what was said or done at the meeti
the teachers and Corse.

One of the main items on the M
agenda was a proposed budget

In this issue: Super Baby winners pictured, 11A

METROPOLIS PLANET

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'ednesday, July 1, 2009 2 Supplements 24 Pages 2 Sections 85 Cents

Committee looks at potential hazards

By Terra Temple
Planet Reporter

While there are a number of natural disasters that could occur in Massac County, they have one thing in common — how emergency responders, municipal officials and the public respond to them is key.

The Massac County Pre-Disaster Mitigation Committee hosted a meeting Thursday to provide the public insight on how particular hazards would impact the county.

The meeting was part of the Southern Illinois Multi-Hazard Mitigation Planning Initiative.

The initiative is a project recently funded by the Federal Emergency Management Agency and the Illinois Emergency Management Agency. It is being implemented by the geology department at Southern Illinois University at Carbondale and the Indiana University-Purdue University Indianapolis Polis Center.

The goal of the planning initiative is to identify, quantify and model disaster potential for 17 southern Illinois counties; guide counties in the preparation of the FEMA-mandated Disaster Mitigation Plans; and stimulate and secure funding for hazard mitigation across southern Illinois.

These 17 counties are developing a Multi-Hazard Mitigation Plan (MHMP) to identify potential hazards and establish mitigation measures to reduce or eliminate the negative impacts that a particular hazard may have on the locality. When each county's municipality approves its plan, it will go to the Illinois Emergency Management Agency and then to the Federal Emergency Management Agency for funding. The pursuance is in compliance with the federally mandated Disaster Mitigation Act (DMA) of 2000.

"The major purpose (of the initiative) is to make communities eligible for money and to develop mitigation for the future," said Remo, who is working with counties in

— *Continued on Page 5A* —

Committee looks . . .

—*Continued from front*—
Illinois and Indiana.

The Massac County Pre-Disaster Mitigation Committee consists of emergency responders, municipal officials and their representatives who have been working since last year, meeting in October and December, with SIU project manager Jonathan Remo.

Committee members were appointed by Massac County Commission chairman Billy Hillebrand. They are Hillebrand, Billy McDaniel, Rodney Brugger, Mike Childers, Robbin McDaniel, Keith Davis, Mike Worthen, Bob Griffey, Lisa Monkman, Terrisa Bunting, Bob Stokes, Mark Schneider and O.D. Troutman.

"We put all of the county chairmen in charge of coming up with their committees. We tried to stress that the members of this committee needed to be a good sampling of the emergency personnel in the county as well as officials of all the towns," explained Crystal Davenport, regional planner for the Southern Five Regional Planning Commission.

Southern Five is working with the five counties it covers — Massac, Johnson, Pulaski, Union and Alexander — as the mediator of the grant/study. "Once this plan goes to FEMA and is approved, then we can work with the county/municipalities to apply for funding through FEMA and help them submit applications," Davenport said.

In developing the plan, Massac County Pre-Disaster Mitigation Committee members looked at the natural hazards and historical disasters that have or may occur in Massac County. The top eight were hazardous material release, tornadoes, winter storms, flooding, earthquakes, thunderstorms, fire/explosion and dam/levee failure.

From that list, Remo's group researched the area's past history with each hazard — looking at the loss of lives, buildings and resources and the cost in replacing buildings and resources.

The group also developed models showing the worst case scenario if those hazards occurred — from the plume field of a hazardous material release to an EF-4 tornado coming through the heart of each Massac city to earthquakes along the Wabash and New Madrid faults and in the county — and the finances needed to recover from those disasters.

So what are the solutions? Prepare, protect and mitigate, Remo said.

"We're here to come up with plans for the county," he said. "We've identified hazards and assessed the threat. At the next meeting, we'll devise strategies to reduce the impact if and when major threats happen in the future."

The Massac County Pre-Disaster Mitigation Committee will meet twice more over the next two months. "The plan is to have it finished and submitted by the fall," Davenport said.

Appendix C - Adopting Resolution

Appendix D - Massac County Historical Hazards: Photo Index

FLOOD

File: Flood_1923
Date: 1923
Description: Second and Ferry during the 1923 flood. In background are Quante Mill and stack of Metropolis power house.
Source: Ray Speckman in Pictorial History of Massac County Illinois, Volume III: 1843-1996.

File: Flood_1937
Date: January, 1937
Description: Pavilion at Fort Massac State Park in 1937 Flood.
Source: Francis Faust in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood2_1937
Date: January, 1937
Source: Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood3_1937
Date: January, 1937
Description: 1937 flood waters on 10th Street near Metropolis Community High School building. View is looking east.
Source: Phyllis Sullivan in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood4_1937
Date: January, 1937
Description: Cowling home at Fourth and Girard Streets in the 1937 flood. The home was later owned by Robert Main, Dr. Ralph Frazier, and now Warren Koch.
Source: Ella Mae Main in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood5_1937
Date: January 31, 1937
Description: Armstrong, Speckman and Morris homes at Sixth and Catherine Streets, Jan. 31, 1937, two days before the crest of the flood.
Source: Massac County Historical Society in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood6_1937
Date: January, 1937
Description: Moller Furniture Company at Third and Ferry Streets, in 1937 Flood.
Source: Pearl Moller in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood7_1937
Date: February, 1937
Description: Looking west along Third Street from a point east of Metropolis Street in late winter, 1937. The Julian Hotel is in the foreground.
Source: Robert Elliott in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood8_1937
Date: Late January, 1937
Description: Near the height of the 1937 flood, water covered much of Washington Park, extending about two-thirds of the way up Metropolis Street toward Fourth Street.
Source: Mollijean Frazier in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood9_1937
Date: Late winter, 1937
Description: Metropolis Street north of Third Street, looking south, during late winter, 1937.
Source: C.W. Sterrett in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood11_1937
Date: Winter, 1937
Description: The Miss Annie Boyd home on Old Brookport Road, in 1937 flood.
Source: Phyllis Sullivan in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood10_1937
Date: Winter, 1937
Description: East Fourth Street, between metropolis and Girard Streets, 1937 Flood.
Source: Mollijean Frazier in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood12_1937
Date: Winter, 1937
Description: Green Lantern tavern and roadhouse on Old Brookport Road, in 1937 Flood.
Source: Phyllis Sullivan in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood13_1937
Date: Winter, 1937
Description: Metropolis City Power Plant inundated during the 1937 flood.
Source: Lowanda Easterday in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood14_1937
Date: Winter, 1937
Description: St. Rose of Lima Catholic Church, northwest corner of Third and Catherine Streets, in 1937 flood.
Source: Bess LaVeau in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood15_Jan_1937
Date: January 31, 1937
Description: Tie treating plant at Joppa, Jan. 31, 1937.
Source: Massac County Historical Society in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood_1952
Date: 1952
Description: Brookport in the flood of 1952.
Source: Massac County Historical Society in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood2_1952
Date: 1952
Description: Metropolis in the flood of 1952.
Source: Massac County Historical Society in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood_Apr_1913
Date: April 1913
Description: Joppa Methodist Church, April 1913. This church was rebuilt in 1928 on another site, using lumber from the building in this picture. Brick dry goods store of J. J. Shirk is in background.
Source: Shirley Fletcher in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood2_Apr_1913
Date: April 1913
Description: Looking south on Main Street in Joppa, April 1913. Five boys and three men are standing on a specially constructed walkway leading from the C. & E.I. Railroad depot in the background and the Joppa Hotel.

Source: Shirley Fletcher in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood3_Apr_1913
Date: April 1913
Description: Joy riding in the 1913 flood in the area of Second and Girard Streets. In the background is the Quante Flour Mill.
Source: Ruby Compton in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood4_Apr_1913
Date: April 1913
Description: Metropolis Ice Co. and the Illinois Central Depot on First Street, 1913 Flood.
Source: Dorothy H. Gillespie in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flood5_Apr_1913
Date: April 1913
Description: Front Street at Metropolis Street looking west, in the flood of 1913. Old Covington Hotel and tavern are in the foreground.
Source: Massac County Historical Society in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Flooding_Jan_05
Date: January 2005
Description: Widespread heavy rain, combined with snowmelt from December, produced major flooding on the Lower Ohio River in early to mid January. This picture shows flooding of Pearl Street in Metropolis, IL
Source: http://www.crh.noaa.gov/pah/hydro/rainfall/janohio.php

File: Flooding2_Jan_05
Date: January 2005
Description: A trailer community is flooded in Metropolis, IL on 2nd Street. Photo taken on January 14, courtesy of Charlie Taylor. Click on image for full size.

File: Flooding3_Jan_05
Date: January 2005
Description: Photo of flooding on Pearl Street in Metropolis, which is not protected by a levee or floodwall. Photo courtesy of Beau Dodson.
Source:
http://www.crh.noaa.gov/pah/hydro/rainfall/janohio.php

File: Flooding4_Jan_05
Date: January 2005
Description: Another photo of flooding in Metropolis, IL, courtesy of Beau Dodson.
Source:
http://www.crh.noaa.gov/pah/hydro/rainfall/janohio.php

File: Flooding5_Jan_05
Date: January 2005
Description: In Metropolis, a casino riverboat's parking lot and entrance area was heavily impacted by the Ohio River. Photo courtesy of Kevin Smith.
Source:
http://www.crh.noaa.gov/pah/hydro/rainfall/janohio.php

File: Flooding_NovDec_2001
Date: November 26 to December 24, 2001
Description: Flooding of the Ohio River bottomland at Brookport, IL between November 26 and December 24, 2001.
Source:
http://www.crh.noaa.gov/pah/storm/dec01_flood.php

File: Flooding_Dec_2001
Date: December 2001
Description: Flooding Flooding of Fort Massac State Park near Metropolis, IL, along the Ohio
Source:
http://www.crh.noaa.gov/pah/storm/dec01_flood.php

File: Flooding_May_2002
Date: May, 2002
Description: Ohio River at Fort Massac State Park May 2002 Flooding: Metropolis, IL
Source:
http://www.crh.noaa.gov/pah/storm/flooding2002/photo.php

File: Flooding_May_2002
Date: May 21, 2002
Description: Flooding at Fort Massac State Park in Metropolis, IL.
Source:
http://www.crh.noaa.gov/pah/storm/flooding2002/flood_seaso

File: Flood_Jan_1991
Date: January 4, 1991
Description: Flooding in Massac County in January 1991
Source: The Southern

Thunderstorm/High Winds/ Hail/ Lightening

File: Thunderstorm_May_2004
Date: May, 30, 2004
Description: Severe structural damage to a house in Massac County, IL about 6 miles northwest of Metropolis on May 30, 2004.
Source:
http://www.crh.noaa.gov/pah/storm/2004photos.php

File: Thunderstorm_May_2006
Date: May 12, 2006
Description: Photo of a destroyed barn in northern Massac County, IL near Boaz. Damage occurred during early morning hours on March 12, 2006.
Source:
http://www.crh.noaa.gov/pah/?n=mar06gallery

File: Thunderstorm_May_2007
Date: May 15, 2007
Description: May 15, 2007 thunderstorm damage
Source: http://community.wpsdtv.com/photos/storm_photos/category1453.aspx

Drought

File: Drought_Aug_2005
Date: August 15, 2005
Description: in the Midwest left Harrah's riverboat casino close to sitting on the muddy bottom of the Ohio River near Metropolis, Ill on August 15, 2005
Source: http://www.nytimes.com/2005/08/15/national/15drought.html?pagewanted=1&_r=1

File: Drought_Summer_2005
Date: Summer 2005
Description: A barge passes by sandbars in the Ohio River near Paducah, KY in mid August
Source: http://www.crh.noaa.gov/pah/hydro/2005lowwater.php

TORNADO

File: Tornado_May_1927
Date: May 9, 1927
Description: Aftermath of tornado of May 9, 1927 between Karnak and Joppa. In the top picture is a cream separator amid ruins of the home across the road from William Hinners' farm.
Source: Norma Huss in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Tornado2_May_1927
Date: May 9, 1927
Description: Picture shows the damage at the Hinners' home.
Source: Norma Huss in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Tornado_Mar_1935
Date: March 25, 1935
Description: At about 3:30 pm on March 25, 1935, a tornado struck Metropolis, causing much destruction, a few injuries and one death—that of Sam Abell, proprietor of the Chevrolet agency shown, who was struck by a falling beam. Following the storms, many curious on-lookers gathered around the rear of the building to view the damage.
Source: Frank Farmer, Chevrolet-Olds-Geo, and Jerry Simpson in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

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The Illohmet
M.C.H.S NEWS

TORNADO SWEEPS METROPOLIS

WHERE THE STATION USED TO BE
Site of the old C. B. & Q. railroad station which was completely demolished by Monday's "twister".

CHEVROLET GARAGE WRECKED
Scene of disaster at Chevrolet garage soon after the storm passed. The above pictured beam is the one that proved fatal to Mr. Abel, falling on him as he emerged from the building.

MANY HOMES WRECKED BY STORM
The above picture shows a house which was completely turned over and now rests on its roof. At the right is a home that was actually torn in two.

OPENING THE STREET FOR TRAFFIC
At the right workmen are pictured clearing away the wreckage after the disaster.

IT WAS A GOOD CAR

File: Tornado2_Mar_1935
Date: March 25, 1935
Description: Scenes of the 1935 tornado's destruction as recorded in *The Illohmet* the Metropolis Community High School newspaper.
Source: Pauline Fazier in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Tornado_Sept_2006
Date: September 23, 2006

Description: "Preliminary damage assessments for Jackson and Massac counties went online Sunday morning and confirmed what many amateur storm watchers believed: At least two tornadoes touched down in the two counties on Saturday afternoon.

An F3 tornado with winds of up to 160 miles per hour in Metropolis sent two people to the hospital with minor injuries. Four mobile homes were destroyed, and hundreds of trees were uprooted or broken off, according to the damage assessment."
http://www.southernillinoisian.com/articles/2006/09/25/top/17663103.txt
Source: The Southern

File: Tornado_May_2003
Date: May 5, 2003
Description: F4 Tornado Damage in western Massac County, IL on May 5, 2003
Source: http://www.crh.noaa.gov/pah/storm/May.6.2003/May.6.2003.Massac.2/index.php

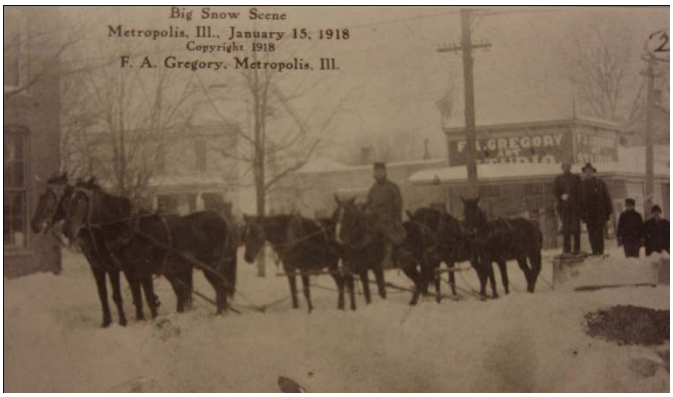
WINTER STORMS

File: Winter_Feb_1902
Date: February, 1902
Description: Ed Brauer home, located on Third Street between Washington Park and Girard Street, during a sleet storm in February of 1902.
Source: Mary Leonard in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Winter2_Jan_1902
Date: January 28-29, 1902
Description: Looking up Metropolis Street from Fourth Street, following the great sleet storm of Jan. 28-29, 1902. Old Central School is at left, Presbyterian Church is in background. Photo was taken by T.E. Craig and originally appeared in a supplement to the *Journal-Republican* of Feb. 13, 1902.
Source: Massac County Historical Society in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Winter_1917
Date: Winter, 1917
Description: Burlington Railroad towboat *Isabella* caught in ice gorge in 1917.
Source: Ruby Compton in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Winter_Jan_1918
Date: January 15, 1918
Description: The "Big Snow," Jan, 15, 1918. View looking north on Ferry Street from Second Street.
Source: Bess LaVeau in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

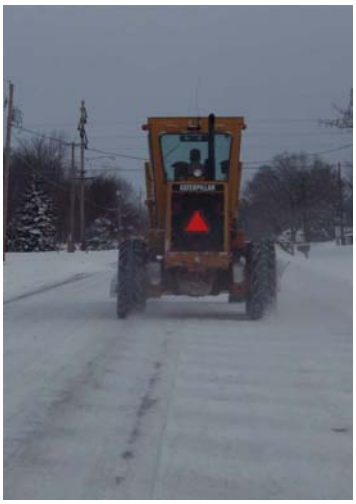


File: Winter_Jan_1918
Date: January 15, 1918
Description: Plowing snow on Fifth Street just west of Ferry Street, following the "Big Snow" of Jan. 15, 1918. F. A. Gregory, whose photo studio appears in the background, began business in Metropolis prior to 1900.
Source: Phyllis Sullivan in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Winter3_Jan_1918
Date: January 15, 1918
Description: Metropolis Fire Department's hose wagon, with Morris Arnett on the seat. This photo was taken in the alley behind the fire department and City Hall following the "Big Snow" of Jan. 15, 1918.
Source: Phyllis Sullivan in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Winter_Jan_1952
Date: January 3, 1952
Description: Large tree ruined by ice storm Jan. 3, 1952, at 918 Girard Street.
Source: Don Sullivan in Pictorial History of Massac County Illinois, Volume II: 1843-1993.

Description: December 23, 2004 winter storm in Joppa,



IL.

Description: December 23, 2004 winter storm in Joppa, IL.

Description: Abandoned car in ditch on December 22, 2004
File: Snow_Dec_2004
Date: December, 23, 2004
Source: http://www.crh.noaa.gov/pah/storm/dat/pahdec04.pdf

Hurricane Winds

Description: Shed destroyed in Metropolis, IL

Description: Tree down in Metropolis, IL

File: Wind_Sept_2008
Date: September 14, 2008
Description: Tree on house in Metropolis, IL
Source:
http://images.google.com/imgres?imgurl=http://www.crh.noaa.gov/images/pah/ike/metropolis_shed_www.jpg&imgrefurl=http://www.crh.noaa.gov/pah/%3Fn%3Dstrongwindswithike&usg=__RsUsGomjrUQ_u8gVActXHcRUZi8=&h=296&w=448&sz=47&hl=en&start=2&um=1&tbnid=eHQiiTz7PQ1aCM:&tbnh=84&tbnw=127&prev=/images%3Fq%3DSnow%2B%2522Metropolis,%2BIL%2522%26hl%3Den%26client%3Dfirefox-a%26rls%3Dorg.mozilla:en-US:official%26sa%3DG%26um%3D1

Fire

File: Fire_Dec_1942
Date: Sunday, December 20, 1942
Description: Ruins of the Illinois Theater on Upper Market Street following a fire on the morning of Sunday, Dec. 20, 1942. Other businesses in the building were destroyed.
Source: Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Fire2_Dec_1942
Date: Sunday, December 20,
Description: Remnants of upper Market Street next to fire.
Source: Pictorial History of Illinois, Volume II: 1843-1993.

1942
Illinois Theatre on
metropolis Hotel, after

Massac County

File: Fire_Aug_1923
Date: August 1923
Description: Fire at Sturgis Livery Stable, August 1923, located on the north side of Sixth Street between Pearl and Market Streets.
Source: Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Fire_Feb_1923 **Date:** February 1923
Description: Aftermath of a fire at the Robberts-Ligget Box Factory in east Metropolis.
Source: Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Fire_Nov_1946
Date: November 19, 1946
Description: Photo taken by Dr. Robert Korte of the fire at Metropolis Motors (Chevrolet Agency), Market Street. Flames from a furnace explosion ignited stored alcohol and oil. Most of the building's interior was extensively damaged, as was the stock, due to flames and water. Three new cars in the building were saved, but one had most of the paint burned off.
Source: Pictorial History of Massac County Illinois, Volume II: 1843-1993.

File: Fire_1923
Date: 1923
Description: Men who lost their jobs temporarily because of the 1923 Metropolis Bending Co. fire included, left to right, John Compton, Thelbert Compton, Orlan Compton and Guy Fitch.
Source: James Compton in Pictorial History of Massac County Illinois, Volume III: 1843-1996.

File: Fire2_1923
Date: 1923
Description: The fire at Metropolis Bending Co. in 1923 meant loss of jobs until it could be rebuilt. When it reopened more people than previously were employed found jobs there and it continued to be a very successful business.
Source: James Compton in Pictorial History of Massac County Illinois, Volume III: 1843-1996.

Appendix D - Historic Hazards: National Climatic Data Center U.S. Storm Event Database for Massac County, Illinois

Location or County	Date	Type	Mag	Deaths	Inj.	Property Damage	Crop Damage	Description
Massac	2/2/1996	Extreme Cold	N/A	0	0	0	0	The most severe cold snap of the 1995-96 winter season caused many problems with burst pipes and overworked furnaces. Calls to one heating system specialist were up 30 to 40 percent. Central Illinois Public Service Co. broke its winter electric peak record. Residents of Pinckneyville were asked to conserve natural gas due to dwindling supplies. The shortage was partly the result of gas wells that were freezing up. The overflow valve on the water tower in DeSoto froze up, causing thousands of gallons of water to escape from the top. Many cities dealt with water main breaks as the cold weather put stress on the pipes. Wind chills were occasionally as low as minus 40 degrees. Actual daytime highs on the third were in the single digits, with overnight lows from minus 6 to minus 11. The extreme cold significantly damaged the peach crop, which is vulnerable to severe winter cold snaps.
Massac	12/12/2000	Extreme Cold	N/A	0	0	0	0	An invasion of arctic air occurred on December 12. The arctic air became permanently entrenched over the region for the remainder of the month, resulting in the coldest December on record at Paducah, KY. The average monthly temperature of 25.9 degrees was 11.4 below normal. On the coldest day of the month, the 17th, the high was 17 and the low was 6. Unusually high energy prices, combined with the record cold, caused homeless shelters to fill to capacity. The usual problems associated with frigid temperatures, such as frozen pipes and water main breaks, were common during the latter half of the month. At Brookport, across the river from Paducah, the pipe extending down from the water tower froze, causing it to burst. As a result, Brookport temporarily had no water supply until emergency wells were dug. Heavy ice on the Mississippi River prompted the Coast Guard to restrict barge traffic from Cairo, IL northward.

Location or County	Date	Type	Mag	Deaths	Inj.	Property Damage	Crop Damage	Description
Massac	1/1/2001	Extreme Cold	N/A	0	0	0	0	The prolonged arctic freeze that began during the second week of December finally ended by January 4. During the first few days of the new year, temperatures averaged 15 to 25 degrees below normal. Overnight lows were around zero. As a result, ice continued to be a problem on the Mississippi River. The combination of ice and low river levels made navigation for barges very hazardous. About 10 miles north of Cape Girardeau, MO, 15 barges loaded with coal went aground.
Massac	1/23/2003	Extreme Cold/wind Chill	N/A	0	0	0	0	Wind chills fell to between minus 10 and minus 15 across southern Illinois during the morning. This cold snap was just one of many cases of harsh winter weather during January. At Paducah, KY, preliminary figures indicate January of 2003 was the eighth coldest January on record, and the coldest since 1985. After the relatively mild winters of the past several years, the bitter mid-winter cold came as a shock to many. Temperatures fell below zero at many locations for the first time in several years. At Carbondale, the low temperature on January 24 was minus 6. The prolonged cold weather resulted in numerous frozen pipes, as well as problems with heating systems. A number of house fires were blamed on overtaxed heating systems. At least one ice rescue was conducted when children fell through thin ice on a pond in Fort Massac State Park in Metropolis.
Massac	12/23/2004	Extreme Cold/wind Chill	N/A	1	0	0	0	Bitterly cold temperatures arrived in the wake of a paralyzing snowstorm. In Murphysboro, an 84-year-old woman died from hypothermia after venturing outdoors to locate her pet dog on the evening of December 22. The woman apparently became disoriented and collapsed from hypothermia. Although she was located about an hour after venturing outdoors from the assisted living facility, she was pronounced dead shortly after midnight on December 23. The low temperature on Christmas morning was 11 degrees below zero at Carbondale. Co-operative observers reported Christmas morning lows of 6 below at Grayville and 2 below zero at Cairo.

Location or County	Date	Type	Mag	Deaths	Inj.	Property Damage	Crop Damage	Description
Massac	1/10/1997	Extreme Windchill	N/A	1	0	0	0	Arctic air blew into the region in the wake of a departing snowstorm. A wind chill advisory was issued for wind chills as low as minus 30. A woman in her 60s froze to death after she slipped and fell outside her home near Orient in Franklin County. The city of Murphysboro recommended letting faucets drip to prevent pipes from freezing. F65OU
Massac	12/21/1998	Freezing Rain	N/A	0	0	0	0	Rain changed to freezing rain and sleet late in the afternoon as a sharp cold front moved across the region. Temperatures plummeted from the upper 50s during the morning into the upper 20s by early nightfall. The wintry precipitation lasted for only a few hours, but was sufficient to cause numerous accidents. Most involved vehicles spinning out of control and sliding into ditches, but one accident was fatal. In Williamson County, a vehicle left the road and flipped over, killing the driver.
Massac	1/26/2001	Freezing Rain	N/A	0	0	0	0	Light freezing rain overspread southern Illinois just before the early morning commute time. The precipitation, which amounted to less than a tenth of an inch, lasted a few hours. Along and north of Interstate 64, there was more sleet than ice. Vehicle wrecks were most numerous from the Marion and Carbondale area north. State police reported several jack-knifed semis on Interstate 57, mainly from Marion to Benton.
New Columbia	3/28/1997	Funnel Cloud	N/A	0	0	0	0	A supercell thunderstorm tracked across northern Massac and southern Johnson Counties. A spotter recorded a rotating wall cloud and brief funnel cloud on videotape near the New Columbia exit of Interstate 24.
Metropolis	4/8/1998	Funnel Cloud	N/A	0	0	0	0	A supercell thunderstorm that passed through McCracken County, Kentucky crossed the Ohio River near Fort Massac State Park. The funnel cloud was well documented by storm chasers, who observed it halfway to the ground before it dissipated.
Brookport	5/23/2000	Funnel Cloud	N/A	0	0	0	0	A supercell thunderstorm which began near Carbondale and produced baseball size hail as it moved southeast across Johnson County became tornadic over Massac County. Although no touchdowns were reported, a funnel cloud was observed quite close to the ground.

Location or County	Date	Type	Mag	Deaths	Inj.	Property Damage	Crop Damage	Description
Brookport	5/30/2004	Funnel Cloud	N/A	0	0	0	0	A funnel cloud was observed crossing the Ohio River from Paducah into Massac County, Illinois. This funnel cloud had earlier briefly touched down in West Paducah.
Unionville	10/26/2004	Funnel Cloud	N/A	0	0	0	0	The funnel clouds over southern Illinois were associated with a supercell thunderstorm that began in southeast Missouri and moved east along a warm front. The storm showed signs of strong rotation as it moved east across Alexander, Pulaski, and Massac Counties.
Southern Illinois	3/8/1994	Heavy Snow	N/A	0	0	500K	0	Four to 12 inches of snow fell across southern Illinois. The heaviest snow fell in the far south tip near the Ohio River. Many schools and businesses were closed. There were many traffic accidents due to slick, snow-covered roads. Some older barns and homes suffered roof damaged from the weight of the snow in far southern Illinois.
Massac	1/19/2002	Heavy Snow	N/A	0	0	0	0	Around four inches of snow fell across extreme southern Illinois, generally south of a line from Carbondale to Carmi. Lesser amounts of two to four inches fell north of there. Most of the snow fell in just a few hours time, when visibility was only around one quarter mile. Since surface temperatures were right near freezing during the event, snow removal was relatively easy. Traffic problems were relatively light because of the late night timing on a weekend. Some of the highest snowfall reports included: 4.5 inches at Grand Chain in Pulaski County, 4.3 inches at Carbondale, and 4 inches at Dixon Springs in Pope County.

Location or County	Date	Type	Mag	Deaths	Inj.	Property Damage	Crop Damage	Description
Massac	2/6/2003	Heavy Snow	N/A	0	0	0	0	A two-part winter storm dropped an average of 3 to 5 inches of heavy wet snow across extreme southern Illinois, mainly south of the Marion and Carbondale areas. The first round of snow occurred during the early morning and dropped 1 or 2 inches. The second round during the evening produced another 2 to 3 inches. Temperatures during the event were very close to freezing, and most of the accumulation was on grassy areas. Slushy roads were a concern at times, but the impact on travel was relatively minor. The snow was caused by an upper level disturbance moving east northeast from the Four Corners region. The highest reported snowfall amounts were along the Ohio River, including 4.5 inches at Metropolis and 4 inches at Cairo. Up to 3 inches of snow were reported as far north as Harrisburg, West Frankfort, and parts of the lower Wabash Valley around Grayville.
Massac	1/15/1997	Ice Storm	N/A	0	0	0	0	Freezing rain coated surfaces with around a half inch of ice. Travel became very difficult in a short period of time. The weather prompted Southern Illinois University in Carbondale to shut down for the fourth time in 30 years. The freezing rain virtually shut down several counties, closing schools, government offices, and health facilities. Franklin County was nearly paralyzed by the storm. Most Franklin County businesses and public offices closed for the day. A large number of vehicle accidents occurred, but no serious injuries were reported. State Route 13 in Jackson County and some county roads in Johnson, Pulaski, and Union Counties were closed because vehicles were unable to climb hills. The Southern Illinois Airport was closed for two hours. Hospitals brought in extra staff to handle an overload due to weather-related injuries. Mail delivery was cancelled in some areas due to icy conditions.

Location or County	Date	Type	Mag	Deaths	Inj.	Property Damage	Crop Damage	Description
Massac	1/1/1999	Ice Storm	N/A	0	0	150K	0	Significant ice accumulations caused travel problems across southern Illinois beginning late on New Years Day and continuing through the night. Traffic volume was especially light because it was a holiday weekend. Those who had to be out found roads extremely difficult to navigate. The hardest hit areas, from Carbondale to Benton and West Frankfort, experienced numerous power outages due to snapped tree limbs and power lines. A rural electric co-op reported slow progress in restoring power because of treacherous roads and fallen trees. Estimates of the number of residences without power were around 10,000, primarily in Franklin and Jackson Counties. Ice accumulations were estimated to be one-half to one inch thick in the area from Carbondale to DuQuoin and Mt. Vernon. Shelters were set up for those without heat, but few people took advantage of them. Local emergency rooms reported a sharp increase in slip-and-fall injuries.Dozens of vehicle accidents or mishaps occurred, including a fatal wreck on Interstate 57 about 4 miles south of Mt. Vernon. The governor of Illinois issued a disaster declaration for the entire state.
Massac	1/8/1999	Ice Storm	N/A	0	0	0	0	Freezing rain coated surfaces with around a quarter inch of ice in most areas. The exception was in the vicinity of the Ohio River from Massac County to Hardin County, where locally one half inch of ice was observed. Many schools cancelled classes again, only a day after re-opening in the wake of an ice storm on January 2. A semi-trailer overturned on Interstate 57 just south of Marion. A total of 25 ice-related falls were recorded at Union County Hospital. This ice storm was considerably less serious than the ice storm of January 1 and 2, which hit the Carbondale and West Frankfort areas worst.

Location or County	Date	Type	Mag	Deaths	Inj.	Property Damage	Crop Damage	Description
Massac	1/25/2004	Ice Storm	N/A	0	0	0	0	The areas hardest hit by this ice storm were along and north of a line from Harrisburg to Carbondale, where about one half inch of ice glazed all surfaces. Numerous accidents were reported. At least one overturned vehicle and a jackknifed semi were reported on Interstate 57 between West Frankfort and Mount Vernon. Scattered power outages occurred as brisk winds downed ice-laden trees and power lines. One of the largest utility companies in southern Illinois reported about 1,500 customers without power. In Saline County, a downed power line blocked Illinois Route 34 near West End and U.S. Route 45 near Ledford. Most schools were closed for at least a day following the ice storm, which occurred on a Sunday. To the south of a line from Carbondale to Harrisburg, around one quarter inch of ice coated trees and power lines, but roads were mainly wet with scattered icy spots. There were some ice-laden tree limbs and power lines brought down by gusty winds. Illinois Route 145 in Massac County was one of a number of roads partially blocked by downed limbs.
Massac	12/8/1995	Snow	N/A	0	0	0	0	Between three and four inches of snow fell across most of southern Illinois. At least two dozen traffic accidents occurred, including a fatal crash near Mt. Vernon. A vehicle slid across the median of Interstate 57, colliding head on with another vehicle. Two people were killed. The snow closed one of the regional airports in the Carbondale area for most of the day.

Location or County	Date	Type	Mag	Deaths	Inj.	Property Damage	Crop Damage	Description
Massac	12/23/1998	Snow	N/A	0	0	0	0	A light snowfall, the first of the season in some areas, provided a one-inch coating. Road surfaces became extremely slippery, and numerous accidents were reported. Two of the accidents left drivers with major injuries and traffic backups stretching several miles. A tractor-trailer rig northbound on Interstate 57 near Marion jackknifed and crossed the median into the southbound lanes. The driver of a car that was struck by the truck was seriously injured. Traffic on Interstate 57 was detoured onto side roads until the accident could be cleared. Another accident on U.S. 51 about 8 miles south of Carbondale closed that road for a while. Three vehicles were involved in that wreck, and one person was seriously injured. Numerous other accidents were reported across the region, mostly minor.
Massac	1/22/2000	Snow	N/A	0	0	0	0	Snow began during the morning hours and continued intermittently through the afternoon. Accumulations averaged only an inch or two, but roads still became quick slick. Slick roads may have contributed to a single-car accident in northern Pope County that critically injured a man.
Southern Illinois	1/16/1994	Winter Storm	N/A	0	0	0	0	A major winter storm brought freezing precipitation followed by heavy snow to southern Illinois mainly the night of the 16th. Much of the area received one-half inch of ice, then six to ten inches of snow. Schools and businesses were closed while road crews struggled to clear snow in the sub-freezing weather that followed the storm.

Location or County	Date	Type	Mag	Deaths	Inj.	Property Damage	Crop Damage	Description
Massac	1/2/1996	Winter Storm	N/A	0	0	0	0	A major winter storm affected parts of southern Illinois. Snowfall amounts increased from south to north, with up to 8 inches reported at Mount Vernon. Warmer temperatures closer to the Kentucky border resulted in a mixture of precipitation types. Only an inch of snow was measured in northern Pope County, less than 20 miles from the Ohio River. Benton reported 5 inches, Anna had 3 inches, and Pinckneyville reported 4 inches. In the most affected areas, including Mount Vernon, hotels were booked with holiday travelers seeking to avoid dangerous travel conditions. In Jefferson County alone, 36 weather-related accidents occurred, none with serious injuries. A school bus carrying 30 students slid into a ditch, but nobody was hurt. Most schools cancelled classes the following day. Gusty winds and very cold temperatures hampered snow removal efforts. Winds gusted to 25 MPH with temperatures in the teens.
Massac	1/6/1996	Winter Storm	N/A	0	0	0	0	A moderate snowfall, averaging 3 to 4 inches, affected all of southern Illinois. Strong gusty winds piled the dry, powdery snow into waist-high drifts in some spots. This contributed to dozens of auto accidents, including a van that slid into a guard rail on Interstate 57 near Mount Vernon. Several people were injured in this mishap. A man in Benton suffered a fatal heart attack while he was shovelling snow. Five people were treated for slip-and-fall injuries, including three fractures. The deep drifts were over car roofs in open farm country of one southeast Illinois county. Several vehicles became stuck. State Highway 161 was reduced to one lane of travel in spots due to drifts.
Massac	12/16/1996	Winter Storm	N/A	0	0	0	0	Rain changed to snow early in the evening. Rainwater on roadways froze to an icy glaze as 1 to 2 inches of snow fell on top of it. Numerous vehicle accidents resulted from the hazardous road conditions.

Location or County	Date	Type	Mag	Deaths	Inj.	Property Damage	Crop Damage	Description
Massac	1/8/1997	Winter Storm	N/A	0	0	0	0	A low pressure system moved northeast across the Tennessee River Valley, producing up to 7 inches of snow in southern Illinois. Generally 5 or 6 inches fell north of Marion and Carbondale to Mt. Vernon and Fairfield. South of the Marion-Carbondale area and in the Wabash River Valley, snowfall amounts were 3 to 4 inches. Most schools closed due to the storm.
Massac	12/13/2000	Winter Storm	N/A	0	0	0	0	A major winter storm produced 4 to 7 inches of snow across southern Illinois, followed by 1/4 to 1/2 inch of ice. The snow began during the early morning hours, falling at rates near one inch per hour. By midday, the snow changed to freezing rain after a brief period of sleet. Light to occasionally moderate freezing rain fell during the afternoon and early evening hours. The heavy precipitation was caused by a strong upper level disturbance that tracked east-northeast from the southern Rockies, across the southern Plains, and then over the lower Mississippi Valley. A strong southerly flow of milder air just above ground level was unable to scour out very cold air right at the surface, which produced an extended period of snow and ice. The liquid equivalent of all the frozen and freezing precipitation was between three quarters of an inch and one inch. Numerous accidents occurred, most of which were minor. The most significant accident was at the junction of Interstates 57 and 64 near Mount Vernon, where a jack-knifed semi-trailer held up traffic for more than an hour. Schools were closed for up to a week following the storm, especially in rural counties with limited snow removal resources. Ice on trees and power lines contributed to scattered power outages. Stores quickly sold out of winter goods, such as ice melter and snow shovels.

Location or County	Date	Type	Mag	Deaths	Inj.	Property Damage	Crop Damage	Description
Massac	2/21/2001	Winter Storm	N/A	0	0	0	0	Several hours of moderate to heavy sleet and freezing rain occurred, sometimes accompanied by thunder and lightning. The precipitation was mainly in the form of sleet in most areas, with up to an inch of sleet accumulation. In the southernmost tip of Illinois, from Cairo to Metropolis, freezing rain was more prevalent. Freezing rain glazed some surfaces, mainly trees and power lines, with up to one quarter inch of ice. On the day following the storm, numerous schools were closed. The liquid equivalent of the precipitation ranged from one quarter inch at Carbondale to just under an inch over the southern tip of Illinois near Cairo.
Massac	12/4/2002	Winter Storm	N/A	0	0	0	0	A major winter storm brought significant snow and ice accumulations to all of southern Illinois. The precipitation was mostly snow, except in counties bordering the Ohio River, where the snow changed to an extended period of freezing rain. Ice accumulations were around one quarter inch from Cairo to Metropolis and Golconda. Snow accumulations across southern Illinois were generally six to eight inches. Freezing rain kept amounts down to near 4 inches in counties bordering the Ohio River. From Pinckneyville and Mount Vernon to the Wabash Valley, the snow fell in two distinct bursts, with two to three inches during the midday hours, followed by another two or three inches during the late night hours. The spotty 8-inch snowfall amounts were reported in a band between Illinois Route 13 and the Shawnee National Forest. Travel was heavily impacted by the winter storm. Numerous vehicle accidents occurred. Schools were closed for the remainder of the week in some counties. The winter storm began during the early morning hours and ended late the following night.

Location or County	Date	Type	Mag	Deaths	Inj.	Property Damage	Crop Damage	Description
Massac	1/16/2003	Winter Storm	N/A	0	0	0	0	The storm hit during the morning commute time on a weekday, so it had a major impact on traffic. The snow fell at the rate of 1 to 2 inches per hour around the morning drive time. Many schools cancelled classes. By noon, most of the accumulating snow had ended, leaving a blanket of 3 to 4 inches in most places. Cold temperatures limited the effectiveness of salt used by road crews, and some minor blowing and drifting occurred. Temperatures were in the 20's during the snowstorm, and around 10 by the morning of the 17th. Refreezing of moisture occurred after dark, causing another round of accidents after the snow had ended. The snow was caused by a moderately strong upper level disturbance that moved east from the Plains, then across Tennessee. A weak low pressure system followed about the same path, passing just south of Missouri and Kentucky. Some specific snowfall amounts included: 4 inches at Cairo and Mound City, and 3 inches at Anna (Union County) and Eddyville (Pope County). Only the southern tip of Illinois received these heavier snow totals. Carbondale and points north received 2 inches or less.
Massac	2/16/2003	Winter Storm	N/A	0	0	0	0	A long-lasting sleet storm affected southern Illinois. The precipitation was almost all sleet south of the Marion/Carbondale area, where an inch or two was reported. Along and north of a Carbondale to Harrisburg line, there was more snow, with total accumulations of sleet and snow in the 3 to 6 inch range. Specific reports included: 6 inches at Pinckneyville in Perry County, 5.5 inches near Mount Carmel in Wabash County, 4.5 inches at West Frankfort in Franklin County, 4 inches at Carbondale, and 2.4 inches at Harrisburg in Saline County. The storm occurred on the Presidents Day weekend. Most schools and businesses scheduled to be open on Presidents Day were closed. Franklin County officials reported about 25 accidents in that county alone, none of which involved injuries.

Location or County	Date	Type	Mag	Deaths	Inj.	Property Damage	Crop Damage	Description
Massac	12/22/2004	Winter Storm	N/A	1	1	100K	0	A major winter storm dumped from 10 to 20 inches of snow across most of southern Illinois, clogging interstates and shutting down most businesses near the peak of the Christmas shopping season. The heaviest snowfall, from 14 to 20 inches, occurred along an axis from Anna (Union County) through Harrisburg (Saline County) to the lower Wabash Valley. Snowfall was not quite as heavy from Fairfield (in Wayne County) west across Mount Vernon to Du Quoin (Perry County), where amounts were mostly from 6 to 9 inches. On the north side of Anna in Union County, a man was killed and another man was injured when an awning on a VFW Post collapsed on them. The two men were standing under the 12-by-30 foot awning when it collapsed. The weight of the compacted snow, which fell several days earlier, caused the metal roof to totally collapse over the men. The other end of the awning remained partially standing. A crew of 15 to 20 rescuers took about 30 minutes to extricate the men. In Johnson County, the roof of a hardware store and a horse arena collapsed under the weight of the snow and ice. Portions of Interstates 57, 64, and 24 were extremely difficult to travel. Numerous abandoned vehicles and jack-knifed semis blocked portions of these highways, however, none were officially closed. Interstate 64 was closed at the Indiana state line. The near blizzard conditions stranded many interstate travelers in hotels, and some hotels on Interstates 64 and 57 were totally filled. State police took some stranded motorists to an emergency shelter at the Marion Senior Citizens Center, where at least 8 people spent the night. Gusty north winds from 15 to 25 MPH with a few gusts to 35 MPH caused blowing and drifting. The snow fell in two waves, the first during the late night and early morning, and the second from mid-afternoon through about midnight. The early morning burst produced an estimated 8 to 10 inches along an axis from Cape Girardeau, MO northeastward across Marion to Harrisburg. The second and more prolonged period of heavy snow dumped an additional 8 to 10 inches at

Location or County	Date	Type	Mag	Deaths	Inj.	Property Damage	Crop Damage	Description
Massac	2/11/2008	Winter Storm	N/A	0	3	0K	0K	Low pressure developed over the southern Plains, spreading widespread heavy precipitation across southern Illinois. At the same time, high pressure over the upper Ohio Valley produced a cold easterly wind flow. The result was a crippling ice storm. Around one inch of ice caused extensive damage across far southern Illinois, along and south of a line from Carbondale and Marion to Harrisburg and Carmi. Many of those same areas received three to six inches of sleet and snow. The most destructive icing occurred in an east to west band across Union, Johnson, Massac, and Pope Counties. The state designated most counties in southern Illinois as a disaster area. Numerous trees and power lines were brought down, knocking out power to many thousands of homes. Power outages lasted up to a week. An indirect fatality occurred in Carbondale, where an elderly man died of carbon monoxide poisoning while operating a gasoline generator in his garage. Three carbon monoxide poisonings were reported in Christopher. All three victims, who were from the same family, were not seriously injured. Emergency shelters were established for those without power for extended periods. Schools were closed for a week in some counties. Trees and tree limbs fell across roads, complicating recovery efforts. A number of houses and other structures were damaged by falling trees. The roof of a bakery and bread store in Herrin collapsed under the weight of the ice and snow. The walls of the store bowed out due to the collapse, and the structure was deemed a total loss. Ferne Clyffe State Park, Tunnel Hill State Bike Trail, and the Trail of Tears State Forest were closed for the remainder of the month due to widespread tree damage. Minor damage occurred to facilities and buildings in Ferne Clyffe State Park. To the north of the Marion, Carbondale, and Harrisburg areas, one to three inches of sleet and snow, and up to one-half inch of freezing rain occurred.

Location or County	Date	Type	Mag	Deaths	Inj.	Property Damage	Crop Damage	Description
Massac	1/22/2003	Winter Weather/ mix	N/A	0	0	0	0	One to three inches of snow fell across southern Illinois during the afternoon and early evening. Roads became very slick and hazardous.
Massac	12/8/2005	Winter Weather/ mix	N/A	0	0	0	0	One to three inches of snow fell across much of southern Illinois. The lowest amounts were about an inch near Metropolis, along the Ohio River. The three-inch amounts extended from Pinckneyville eastward to Benton and Harrisburg. Amounts were even higher along the Interstate 64 corridor and in the Lower Wabash Valley. The precipitation started as sleet and freezing rain, especially along and east of a Cairo to Harrisburg line. Roads were very slippery, resulting in numerous accidents. Over 50 accidents occurred in Franklin County in just a few hours. Traffic on Interstate 57 was partially blocked by a jackknifed semi-trailer in Franklin County south of Benton. At the Benton interchange of I-57, a northbound exit ramp was shut down. Some of the accidents on Interstate 57 involved injuries.
Massac	2/18/2006	Winter Weather/ mix	N/A	0	0	0	0	One to two inches of snow fell across southern Illinois. Isolated amounts of 3 inches occurred in Fairfield (Wayne County), Pinckneyville (Perry County), and Mount Carmel (Wabash County). Roads were snow-covered and slippery.
Massac	2/19/2006	Winter Weather/ mix	N/A	0	0	0	0	Two inches of snow fell over far southern Illinois, mainly south of the Marion/Carbondale area and in counties bordering the Ohio River. Roads were initially wet, then became ice and snow-covered as the precipitation continued.

Appendix E - Hazard Map

Please see attached files or map.

Appendix F - Critical Facilities

Airport Facilities Report

ID	Name	Address	City	Class	Function	Capacity	YearBuilt	ReplaCost
1	METROPOLIS MUNICIPAL	751 Airport Road	METROPOLIS	ADFLT	Public			6049.5

Communication Facilities Report

ID	Name	Address	City	Class	Owner	Function	ReplaCost
1	KDY424	209 OHIO ST	BROOKP	CDFLT	BROOKPORT,	PublicSafe	
2	WHU595	FOOT OF SCOTT ST	METROP	CDFLT	U.S. United Barge	MCCoastal	
3	WPXW659	Near Brookort, IL	Brookport	CDFLT	SUN MEDIA, INC.	AS	
4	KSI817	100 YASODA ST	METROP	CDFLT	METROPOLIS	Industrial	
5	WSX507	FORT MASSAC STATE PK .5 MI E	METROP	CDFLT	ILLINOIS, STATE	PublicSafe	
6	WPQK754			CDFLT	EMERGENCY	Industrial	
7	WQFW769		METROP	CDFLT	EMERGENCY	Industrial	
8	KWC539	108 WEST THIRD ST	METROP	CDFLT	J M WALTERS &	Industrial	
9	WPKK959			CDFLT	SMITH	Industrial	
10	WPAD848	RR 1 6 MI E	BROOKP	CDFLT	ANGELLY, GARY	Industrial	
11	WPAD848		BROOKP	CDFLT	ANGELLY, GARY	Industrial	
12	WPTS787	MASSAC COUNTY JAIL SUPERMAN	METROP	CDFLT	MASSAC,	PublicSafe	
13	WPTS787		METROP	CDFLT	MASSAC,	PublicSafe	
14	KNBS829	COUNTY COURTHOUSE CENTER	METROP	CDFLT	MASSAC,	PublicSafe	
15	WPBE241	COURTHOUSE SUPERMAN SQ	METROP	CDFLT	MASSAC,	PublicSafe	
16	WPBE241		METROP	CDFLT	MASSAC,	PublicSafe	
17	WPKA461	911 DISPATCH CTR	METROP	CDFLT	MASSAC,	PublicSafe	
18	WPKA461		METROP	CDFLT	MASSAC,	PublicSafe	
19	WPJN714	911 BLDG SUPERMAN SQ	METROP	CDFLT	METROPOLIS,	PublicSafe	
20	WPJN714		METROP	CDFLT	METROPOLIS,	PublicSafe	
21	KNKN506	Metropolis Site 106 West Fifth Street	Metropoli	CDFLT	SI RSA amd d/b/a	CL	

ID	Name	Address	City	Class	Owner	Function	ReplaCost
22	WPBM904			CDFLT	SI RIVERBOAT	Industrial	
23	WNGM814	501 E EIGHT ST	METROP	CDFLT	MILLER JR,	Industrial	
24	WNGM814		METROP	CDFLT	MILLER JR,	Industrial	
25	WNPH864	501 E EIGHT ST	METROP	CDFLT	MILLER, JOSEPH	Industrial	
26	WPMQ645	501 E 8TH ST	METROP	CDFLT	MILLER, JOSEPH	Industrial	
27	WHQ448	105 W. 5TH STREET	METROP	CDFLT	SUN MEDIA, INC.	AS	
28	WPHE985			CDFLT	HARDEES FOOD	Industrial	
29	WPHE985		METROP	CDFLT	HARDEES FOOD	Industrial	
30	KNKN477	609 Ferry Street	METROP	CDFLT	Cellco Partnership	CL	
31	WMJ702	615 1/2 FERRY ST	METROP	CDFLT	KENTUCKY DATA	CF	
32	WMU240	339 FAIRGROUNDS RD	METROP	CDFLT	WITHERS	AS	
33	KPG724	METROPOLIS	METROP	CDFLT	WITHERS	RP	
34	KPG724		METROP	CDFLT	WITHERS	RP	
35	WPSZ458	429 TANNER DR	METROP	CDFLT	METROPOLIS	Industrial	
36	WPSZ458	WELL 8 436 VIENNA ST	METROP	CDFLT	METROPOLIS	Industrial	
37	KNJH287	634 PUBLIC WORKS DRIVE	METROP	CDFLT	METROPOLIS,	PublicSafe	
38	KNJH287		METROP	CDFLT	METROPOLIS,	PublicSafe	
39	WPSZ458	WATER PLANT UNIVERSAL WAY	METROP	CDFLT	METROPOLIS	Industrial	
40	WPSZ458		METROP	CDFLT	METROPOLIS	Industrial	
41	WPFU937			CDFLT	State of IL, Dept of	PublicSafe	
42	WPQB542	203 FERRY STREET	METROP	CDFLT	SI RIVERBOAT	Industrial	
43	WPQB542		METROP	CDFLT	SI RIVERBOAT	Industrial	
44	WPQB542		METROP	CDFLT	SI RIVERBOAT	Industrial	

ID	Name	Address	City	Class	Owner	Function	ReplaCost
45	WPBW876	COR OF FERRY & MARKET STS	METROP	CDFLT	SI RIVERBOAT	Industrial	
46	WPBW876		METROP	CDFLT	SI RIVERBOAT	Industrial	
47	WNLB910	1 SUPERMAN SQ MASSAC CTY	METROP	CDFLT	MASSAC,	PublicSafe	
48	WNLB910		METROP	CDFLT	MASSAC,	PublicSafe	
49	WNLB910		METROP	CDFLT	MASSAC,	PublicSafe	
50	WPSZ458	W 11TH ST TANK	METROP	CDFLT	METROPOLIS	Industrial	
51	WNLB910	1020 BROADWAY	METROP	CDFLT	MASSAC,	PublicSafe	
52	WNLB910		METROP	CDFLT	MASSAC,	PublicSafe	
53	WPBE241	1020broadway	metropoli	CDFLT	MASSAC,	PublicSafe	
54	WPKA461	1020broadway	metropoli	CDFLT	MASSAC,	PublicSafe	
55	WPKA461		metropoli	CDFLT	MASSAC,	PublicSafe	
56	KNJH287	1020 BROADWAY	METROP	CDFLT	METROPOLIS,	PublicSafe	
57	KNJH287		METROP	CDFLT	METROPOLIS,	PublicSafe	
58	WNSK339	1020 BROADWAY	METROP	CDFLT	METROPOLIS,	PublicSafe	
59	WNSK339		METROP	CDFLT	METROPOLIS,	PublicSafe	
60	WPJN714	1020broadway	metropoli	CDFLT	METROPOLIS,	PublicSafe	
61	WPJN714		metropoli	CDFLT	METROPOLIS,	PublicSafe	
62	WPOB921	1817 NEVILLE STREET	METROP	CDFLT	CARDINAL STUDIO	Industrial	
63	WNGM814	1817 NEVILLE ST	METROP	CDFLT	MILLER JR,	Industrial	
64	WNGM814		METROP	CDFLT	MILLER JR,	Industrial	
65	WNPH864	1817 NEVILLE ST	METROP	CDFLT	MILLER, JOSEPH	Industrial	
66	WNPH864		METROP	CDFLT	MILLER, JOSEPH	Industrial	
67	WPMQ645	1817 NEVILE ST	METROP	CDFLT	MILLER, JOSEPH	Industrial	

ID	Name	Address	City	Class	Owner	Function	ReplaCost
68	WPMQ645		METROP	CDFLT	MILLER, JOSEPH	Industrial	
69	WNVT817	4 MI E	METROP	CDFLT	BUNTING, DONALD	Industrial	
70	WNVT817		METROP	CDFLT	BUNTING, DONALD	Industrial	
71	WQCE455	28 CHICK STREET	METROP	CDFLT	MASSAC	PublicSafe	
72	WQCE455		METROP	CDFLT	MASSAC	PublicSafe	
73	WNPZ862	JOHN ST NW OF CITY LIMITS	METROP	CDFLT	MASSAC CO	Industrial	
74	WNPZ862		METROP	CDFLT	MASSAC CO	Industrial	
75	WQIV788	5148 Gurley Rd	Metropoli	CDFLT	Ameren Services	YO	
76	WQDE396	5148 GURLEY ROAD	METROP	CDFLT	ILLINOIS, STATE	YF	
77	WQDE396		METROP	CDFLT	ILLINOIS, STATE	YF P	
78	WPSZ458	INDUSTRIAL PARK 700N NEAR I 24	METROP	CDFLT	METROPOLIS	Industrial	
79	WPNC827	53184 INDUSTRIAL PARK ROAD	METROP	CDFLT	MUNICIPAL	MW	
80	WPRW902	2 MI N OF RT 45 @ RAIL DUMPS	METROP	CDFLT	Amer Electric	LN	
81	WQIJ848	2959 N US 45 ROAD	METROP	CDFLT	LINDELL MAY	Industrial	
82	WQIJ848		METROP	CDFLT	LINDELL MAY	Industrial	
83	WPUU882	COOK COAL TERMINAL, 2.5 MI NW OF	METROP	CDFLT	AMER ELECTRIC	Industrial	
84	WPUU882		METROP	CDFLT	AMER ELECTRIC	Industrial	
85	KBK431	OFF US RT 45	METROP	CDFLT	Amer Electric	MC	
86	KX4288	RT 1 1.5 MI N OF RT 45	METROP	CDFLT	OHIO POWER	Industrial	
87	KX4288		METROP	CDFLT	OHIO POWER	Industrial	
88	KXM486	US RT 45 2 MI N	METROP	CDFLT	OHIO POWER	Industrial	
89	KXM486		METROP	CDFLT	OHIO POWER	Industrial	
90	KPH8	METROPOLIS MUNICIPAL AIRPORT	METROP	CDFLT	CITY OF	AF	

ID	Name	Address	City	Class	Owner	Function	ReplaCost
91	WPZR239	METROPOLIS MUNICIPAL AIRPORT	METROP	CDFLT	METROPOLIS,	PublicSafe	
92	WNMM406	2736 NORTH AVE	METROP	CDFLT	MASSAC,	PublicSafe	
93	WNMM406		METROP	CDFLT	MASSAC,	PublicSafe	
94	WPZR239	METROPOLIS MUNICIPAL AIRPORT	METROP	CDFLT	METROPOLIS,	PublicSafe	
95	KNKN477	CR 800N, 6 KM NE OF	BROOKP	CDFLT	Cellco Partnership	CL	
96	WPOK363	CR 800N, 6 KM NE OF	BROOKP	CDFLT	Cellco Partnership	CL	
97	WNRO760	AMER PWR COAL TERM FRONT GATE	METROP	CDFLT	BNSF Railway Co	Industrial	
98	WPBE241	2734 NORTH AVE	METROP	CDFLT	MASSAC,	PublicSafe	
99	WPUU882	HWY 45 & JOPPA RD	METROP	CDFLT	AMER ELECTRIC	Industrial	
100	WPUU882		METROP	CDFLT	AMER ELECTRIC	Industrial	
101	WQEV285	1275 JOPPA ROAD	METROP	CDFLT	Union Pacific RR	Industrial	
102	WQEV285		METROP	CDFLT	Union Pacific RR	Industrial	
103	WQDL871	Cook Coal Terminal, 3.5 Mi NW of	Metropoli	CDFLT	Ohio Power	Industrial	
104	WQDL871		Metropoli	CDFLT	Ohio Power	Industrial	
105	WNLP810	1 MI W	JOPPA	CDFLT	FORT MASSAC	Industrial	
106	WQFB835	Joppa Steam Electric Station	Joppa	CDFLT	Ameren Services	YO	
107	WQFB835		Joppa	CDFLT	Ameren Services	YO	
108	WBM560	JOPPA STEAM ELECTRIC STATION	JOPPA	CDFLT	Ameren Services	MG	
109	WPZH568	JOPPA STEAM ELECTRIC STATION	JOPPA	CDFLT	AMEREN	MG	
110	KBD369	JOPPA STEAM ELECTRIC STATION	JOPPA	CDFLT	Ameren Services	Industrial	
111	WNNE376	2100 PORTLAND RD	JOPPA	CDFLT	ELECTRIC	Industrial	
112	WNNE376		JOPPA	CDFLT	ELECTRIC	Industrial	
113	KSK68	JOPPA POWER PL, ELECTRIC	JOPPA	CDFLT	KENTUCKY	MG	

ID	Name	Address	City	Class	Owner	Function	ReplaCost
114	WNXD905	1/2 MI W ON GRAND CHAIN RD	JOPPA	CDFLT	BNSF Railway	Industrial	
115	WNXD905		JOPPA	CDFLT	BNSF Railway	Industrial	
116	KDB226	ON JOPPA GRAND CHAIN RD 1/2 MI W	JOPPA	CDFLT	ELECTRIC	Industrial	
117	KDB226		JOPPA	CDFLT	ELECTRIC	Industrial	
118	KSE68	DISPATCHER OFFICE	JOPPA	CDFLT	ELECTRIC	Industrial	
119	KXS391	JOPPA STEAM PLANT	JOPPA	CDFLT	ELECTRIC	MC	
120	WPXU254	BNSF Cook Yard Office @ Choat; 5 mi.	Metropoli	CDFLT	MCC Holdings	Industrial	
121	WYK621	BURLINGTON N COOK YARD OFFICE	METROP	CDFLT	BNSF Railway	Industrial	
122	WYK621		METROP	CDFLT	BNSF Railway	Industrial	
123	WQL940	1 BLK N OF E 5TH ST IN CENTER	METROP	CDFLT	MASSAC CO	PublicSafe	
124	WQL940		METROP	CDFLT	MASSAC CO	PublicSafe	
125	WPQR334	1.5 MI EAST OF JOPPA	JOPPA	CDFLT	Cellco Partnership	CF	
126	WPRX327	2200 PORTLAND ROAD	JOPPA	CDFLT	MIDWEST	Industrial	
127	WPRX327		JOPPA	CDFLT	MIDWEST	Industrial	
128	WLU382	JOPPA RD NEXT TO BOX 454	JOPPA	CDFLT	BIG RIVER	CF	
129	WPFS610	RT 1 JOPPA	METROP	CDFLT	FORT MASSAC	Industrial	
130	WPFS610		METROP	CDFLT	FORT MASSAC	Industrial	
131	KSC34	2 MI WNW OF	JOPPA	CDFLT	Trunkline Gas	MG	
132	WNTQ892	2 MI WNW	JOPPA	CDFLT	Trunkline Gas	MG	
133	KSB782	APPROX 2 MI WNW	JOPPA	CDFLT	Trunkline Gas	Industrial	
134	WHG726	STATION 27 1.72 MI E	MIDWAY	CDFLT	Maritime	MC	
135	WNLP810	5 MI N	METROP	CDFLT	FORT MASSAC	Industrial	
136	WPWZ634	BNSF MP 216.05 Joppa Jct N AEI	Mermet	CDFLT	BNSF Railway	LN	

ID	Name	Address	City	Class	Owner	Function	ReplaCost
137	KNBD912	MERMET LAKE CONS AREA .5 MI SW	MERMET	CDFLT	ILLINOIS, STATE	PublicSafe	
138	WPCD925	SW INT CR 1500N TRKS 2 MI S	BIG BAY	CDFLT	ILLINOIS	Industrial	
139	KNHK764	1 1/2 MI SW	NEW	CDFLT	KORTE, STEVEN D	Industrial	
140	KNHK764		NEW	CDFLT	KORTE, STEVEN D	Industrial	
141	WQIY354	BNSF LS13 MP213.6 - HBD	Joppa	CDFLT	BNSF Railway Co	Industrial	
142	WNEK453	US ROUTE 45 8 MI S OF	VIENNA	CDFLT	SI POWER COOP	MG	
143	WPLW535	700 MARKET ST	METROP	CDFLT	Atmos Energy Corp	Industrial	
144	WPLW535		METROP	CDFLT	Atmos Energy Corp	Industrial	
145	WNYR303	1 MI SE OF EXIT 27 ON I24	METROP	CDFLT	FOSS JR, HENRY	Industrial	
146	WNYR303		METROP	CDFLT	FOSS JR, HENRY	Industrial	
147	WNYD757	1 MI SE OF EXIT 27 ON I24	METROP	CDFLT	JOHNSON,	Industrial	
148	WNYD757		METROP	CDFLT	JOHNSON,	Industrial	
149	WNGM814	6248 NEW COLUMBIA RD	BELKNA	CDFLT	MILLER JR,	Industrial	
150	WNGM814		BELKNA	CDFLT	MILLER JR,	Industrial	
151	WNXT665	6248 NEW COLUMBIA RD	BELKNA	CDFLT	MILLER JR,	Industrial	
152	WNXT665		BELKNA	CDFLT	MILLER JR,	Industrial	
153	WNPH864	6248 NEW COLUMBIA RD	BELKNA	CDFLT	MILLER, JOSEPH	Industrial	
154	WPMQ645	6240 NEW COLUMBIA RD	BELKNA	CDFLT	MILLER, JOSEPH	Industrial	
155	WQCK288	6827 NEW COLUMBIA RD	BELKNA	CDFLT	NEXTEL WIP	YX	
156	WQCK288		BELKNA	CDFLT	NEXTEL WIP	YX	
157	WML610	INT CR 725 & CTY HWY 1 1.5 MI NW	NEW	CDFLT	SI RSA and d/b/a	CF	
158	KNKN506	INTERSECT OF CTY ROADS 725 AND 1	NEW	CDFLT	SI RSA and d/b/a	CL	
159	KNNU475	CR 1140	BIG BAY	CDFLT	MILLSTONE	Industrial	

Dams Report

ID	Name	River	City	Owner	Purpose	Height (ft)	ReplaCost
1	HOHMAN LAKE DAM	TRIB ALCORN CREEK	BROOKPORT	A. F. & J. W.	R	33	
2	MANN LAKE DAM	TRIB BARREN CREEK	BAY CITY	Donna Weaver &	R	24	
3	MERMET DAM	TRIB TUCKER DITCH	MERMET	Illinois Department	R	10	

Electric Power Facilities Report

ID	Name	Address	City	Class	Function	Stories	YearBuilt	ReplaCost
1	ELECTRIC ENERGY	2100 PORTLAND RD.	JOPPA	EDFLT				122100

EOC Facilities Report

ID	Name	Address	City	Class	YearBuilt	ShelterCap	Stories	ReplaCost
1	Emergency Services	1 Superman Square, B-1	Metropolis	EFEO				
2	Massac County Fire	2734 North Avenue	Metropolis	EFEO				

FireStation Facilities Report

ID	Name	Address	City	Class	Stories	YearBuilt	ReplaCost
1	Metropolis City Fire Dept	213 West 7th St	Metropolis	EFFS			666
2	Brookport Fire Dept	108 West 3rd St	Brookport	EFFS			666
3	Joppa Fire Dept	115 Church St	Joppa	EFFS			666
4	Massac County Fire Dept	2734 North Ave	Metropolis	EFFS			666
5	Ambulance Base	1017 North Ave	Metropolis	EFFS			666

Hazardous Materials

ID	Name	Address	City	Class	EPAID	ChemicalName
1	LAIDLAW CORP.	1212 E. 5TH ST.	METROPOLIS	HDFLT	ILD062423975	TETRACHLOROET
2	ELECTRIC ENERGY INC.	2100 PORTLAND RD.	JOPPA	HDFLT	ILD001979350	ANTIMONY
3	ELECTRIC ENERGY INC.	2100 PORTLAND RD.	JOPPA	HDFLT	ILD001979350	BARIUM
4	ELECTRIC ENERGY INC.	2100 PORTLAND RD.	JOPPA	HDFLT	ILD001979350	"HYDROCHLORIC
5	ELECTRIC ENERGY INC.	2100 PORTLAND RD.	JOPPA	HDFLT	ILD001979350	HYDROGEN
6	ELECTRIC ENERGY INC.	2100 PORTLAND RD.	JOPPA	HDFLT	ILD001979350	CHROMIUM
7	ELECTRIC ENERGY INC.	2100 PORTLAND RD.	JOPPA	HDFLT	ILD001979350	COPPER
8	ELECTRIC ENERGY INC.	2100 PORTLAND RD.	JOPPA	HDFLT	ILD001979350	MANGANESE
9	ELECTRIC ENERGY INC.	2100 PORTLAND RD.	JOPPA	HDFLT	ILD001979350	NICKEL
10	ELECTRIC ENERGY INC.	2100 PORTLAND RD.	JOPPA	HDFLT	ILD001979350	ZINC
11	ELECTRIC ENERGY INC.	2100 PORTLAND RD.	JOPPA	HDFLT	ILD001979350	"SULFURIC ACID
12	ELECTRIC ENERGY INC.	2100 PORTLAND RD.	JOPPA	HDFLT	ILD001979350	THALLIUM
13	LAFARGE CORPORATION-	COUNTY LINE RD. 1000N & 300E	JOPPA	HDFLT	ILD006294623	CHROMIUM
14	LAFARGE CORPORATION-	COUNTY LINE RD. 1000N & 300E	JOPPA	HDFLT	ILD006294623	ETHYLENE
15	LAFARGE CORPORATION-	COUNTY LINE RD. 1000N & 300E	JOPPA	HDFLT	ILD006294623	"HYDROCHLORIC
16	LAFARGE CORPORATION-	COUNTY LINE RD. 1000N & 300E	JOPPA	HDFLT	ILD006294623	NICKEL
17	HONEYWELL INTL. INC.	2768 N. U.S. 45 RD.	METROPOLIS	HDFLT	ILD006278170	AMMONIA
18	HONEYWELL INTL. INC.	2768 N. U.S. 45 RD.	METROPOLIS	HDFLT	ILD006278170	HYDROGEN
19	HONEYWELL INTL. INC.	2768 N. U.S. 45 RD.	METROPOLIS	HDFLT	ILD006278170	FLUORINE

Medical Care Facilities Report

ID	Name	Address	City	Class	Function	Beds	Stories	ReplaCost
1	MASSAC MEMORIAL	28 CHICK STREET	METROPOLI	EFHS	Hospital	38		3885
2	Metropolis Nursing &	2299 Metropolis St	METROPOLI	EFHS	NursingHom			3885
3	Southgate Health Care	900 E. 9th St	METROPOLI	EFHS	NursingHom			3885
4	Krypton House	502 W. 8th St	METROPOLI	EFHS	NursingHom			3885

Natural Gas Facilities Report

ID	Name	Address	City	Class	Function	Stories	YearBuilt	ReplaCost
1	TRUNKLINE GAS	2101 PORTLAND RD.	GRAND CHAIN	GDFLT				1209.9
2	TRUNKLINE GAS	MASSAC COUNTY NORTHWEST	JOPPA	GDFLT				1209.9

Police Station Facilities Report

ID	Name	Address	City	Class	Stories	ShelterCap	YearBuilt	ReplaCost
1	City of Metropolis Police Dept	1020 Broadway Street	Metropolis	EFPS				1554
2	Brookport Police Dept	301 Ferry St	Brookport	EFPS				1554
3	Massac County Sheriff Office	1 Superman Square	Metropolis	EFPS				1554
4	Village of Joppa PD	217 North Ave	Joppa	EFPS				1554

Port Facilities Report

ID	Name	Address	City	Class	Function	Berths	YearBuilt	ReplaCost
1	Delta Materials, Metropolis Dock.		Metropolis	PDFLT	99			2245.4
2	Cook Coal Terminal, Metropolis		Metropolis	PDFLT	10			2245.4
3	Electric Energy, Joppa Steam Plant		Joppa	PDFLT	10			2245.4
4	Lafarge Corp., Joppa Plant Wharf.		Joppa	PDFLT	43			2245.4
5	Mid-South Towing Co., Metropolis		Metropolis	PDFLT				2245.4

Rail Facilities Report

ID	Name	Address	City	Class	Function	DailyTraffic	YearBuilt	ReplaCost
1	Metropolis River Terminal			RDF	Cargo			2419.8
2	Cook Coal Terminal:			RDF	Cargo			2419.8

School Facilities Report

ID	Name	Address	City	Class	Students	Stories	YearBuilt	ReplaCost
1	MAPLE GROVE ELEM	1698 GRAND CHAIN RD	Joppa	EFS1	207			555
2	UNITY ELEMENTARY	6846 UNITY SCHOOL RD	BROOKPORT	EFS1	231			555
3	FRANKLIN ELEM SCHOOL	1006 MT MISSION RD	METROPOLIS	EFS1	220			555
4	MASSAC COUNTY HIGH	2841 OLD MARION ROAD	METROPOLIS	EFS1	622			555
5	JEFFERSON ELEM SCHOOL	4915 Jefferson School Road	METROPOLIS	EFS1	183			555
6	Joppa High School	911 N. Joppa Ave	JOPPA	EFS1				555
7	Brookport Elementary	319 Ferry Street	Brookport	EFS1				555
8	Metropolis Primary	416 East 9th Street	METROPOLIS	EFS1				555
9	Metropolis Elementary	1015 Filmore Street	METROPOLIS	EFS1				555
10	Massac Junior High	3028 Old Marion Rd	METROPOLIS	EFS1				555

WasteWater Facilities Report

ID	Name	Address	City	Function	Class	Stories	YearBuilt	ReplaCost
1	BROOKPORT	NORTH BAYNES STREET	BROOKPORT	SEWAGE	CDFLT	0		1000
2	HIDDEN ACRES	11 HIDDEN ACRES LANE	METROPOLIS	OPERATO	CDFLT	0		1000
3	JOPPA SD STP	PO BOX 105	JOPPA	SEWAGE	CDFLT	0		1000
4	METROPOLIS	400 JOHNSON STREET	METROPOLIS	SEWAGE	CDFLT	0		1000

Appendix G - Map of Critical Facilities

Please see attached pdf file or map.

Appendix H - NOAA Flood Data: USGS Stream Gauge Data

County	Massac County		Massac County		McCracken County	
Station	Metropolis, IL		Choat, IL Q Ditch		Paducah, KY	
River	Ohio River		Tributary		Ohio River	
Period of Record	1929-1991, 1993-2007		1959-1976		1867-2009	
Latitude	37.14750		37.21944		37.08900	
Longitude	88.74083		88.80000		88.59400	
Rank	**Year**	**Discharge (cfs)**	**Year**	**Discharge (cfs)**	**Date**	**Historical Crests (ft)**
1	1937	1,850,000	1967	392	02/02/1937	60.00
2	1950	1,300,000	1975	357	04/07/1913	54.30
3	1997	1,210,000	1958	292	03/23/1884	54.30
4	1991	1,190,000	1957	244	02/13/1950	53.30
5	1975	1,180,000	1965	244	03/21/1867	52.00
6	1932	1,150,000	1959	212	03/11/1997	51.79
7	1963	1,150,000	1956	205	04/03/1975	51.40
8	1979	1,140,000	1972	200	03/25/1897	50.90
9	1939	1,130,000	1961	163	02/25/1883	50.70
10	1945	1,120,000	1976	136	04/17/1886	50.40

County	Massac County		Pope County	
Station	Brookport Lock & Dam, IL		Smithland Lock & Dam, IL	
River	Ohio River		Ohio River	
Period of Record	1936-2009		1983-2009	
Latitude	37.13300		37.16700	
Longitude	88.65000		88.43300	
Rank	**Date**	**Historical Crests (ft)**	**Date**	**Historical Crests (ft)**
1	02/02/1937	62.30	03/12/1997	51.44
2	01/13/1950	55.10	01/08/1991	49.80
3	03/12/1997	53.60	01/16/2005	47.20
4	04/02/1975	53.30	05/14/1984	47.10
5	02/15/1950	53.20	05/25/1983	46.40
6	03/10/1945	52.30	02/24/1989	46.10
7	01/07/1991	51.60	02/19/1990	45.80
8	03/19/1963	51.60	04/23/1994	45.20
9	03/17/1979	51.20	03/28/2008	45.17
10	04/15/1936	50.90	04/11/2008	44.93