MULTI-HAZARD MITIGATION PLAN UPDATE

Wabash County, Indiana

Prepared for:

Wabash County, Indiana
Town of LaFontaine, Indiana
Town of Lagro, Indiana
Town of North Manchester, Indiana
Town of Roann, Indiana
City of Wabash, Indiana

April 2019

DRAFT

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CBBEL Project No. 17-510

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CHAPTER 1 INTRODUCTION

1.1 DISASTER LIFE CYCLE

The Federal Emergency Management Agency (FEMA) defines the disaster life cycle as the process through which emergency managers respond to disasters when they occur; help people and institutions recover from them; reduce the risk of future losses; and prepare for emergencies and disasters. The disaster life cycle, **Figure 1-1** includes 4 phases:

Figure 1-1 Disaster Life Cycle

- **Response** – the mobilization of the necessary emergency services and first responders to the disaster area (search and rescue; emergency relief)
- **Recovery** – to restore the affected area to its previous state (rebuilding destroyed property, re-employment, and the repair of other essential infrastructure)
- **Mitigation** – to prevent or to reduce the effects of disasters (building codes and zoning, vulnerability analyses, public education)
- **Preparedness** – planning, organizing, training, equipping, exercising, evaluation and improvement activities to ensure effective coordination and the enhancement of capabilities (preparedness plans, emergency exercises/training, warning systems)

The Wabash County Multi-Hazard Mitigation Plan (MHMP) focuses on the mitigation phase of the disaster life cycle. According to FEMA, mitigation is most effective when it's based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs. Recent reviews of grant programs have determined for every $1 spent on mitigation efforts, between $6 and $10 are saved within the community on efforts following disasters. The MHMP planning process identifies hazards, the extent that they affect the municipality, and formulates mitigation practices to ultimately reduce the social, physical, and economic impact of the hazards.

1.2 PROJECT SCOPE AND PURPOSE

REQUIREMENT §201.6(d)(3):
A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five (5) years in order to continue to be eligible for mitigation project grant funding.

A MHMP is a requirement of the Federal Disaster Mitigation Act of 2000 (DMA 2000). According to DMA 2000, the purpose of mitigation planning is for State, local, and Indian tribal governments to identify the natural hazards that impact them, to identify actions and activities to reduce any losses from those hazards, and to establish a coordinated process to implement the plan, taking advantage of a wide range of occurrences.

A FEMA-approved MHMP is required to apply for and/or receive project grants under the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), and Flood Mitigation Assistance (FMA). Although the Wabash County MHMP meets the requirements of DMA 2000 and eligibility requirements of these grant programs, additional detailed studies may need to be completed prior to applying for these grants.

In order for National Flood Insurance Program (NFIP) communities to be eligible for future mitigation funds, they must adopt either their own MHMP or participate in the development of a multi-jurisdictional MHMP. The Indiana Department of Homeland Security (IDHS) and the United States Department of Homeland Security (US DHS)/FEMA Region V offices administer the MHMP program in Indiana. As noted above, it is required that local jurisdictions review, revise, and resubmit the MHMP every five years. MHMP updates must demonstrate that progress has been made in the last five years to fulfill the commitments outlined in the previously approved MHMP. The updated MHMP may validate the information in the previously approved Plan or may be a major plan rewrite. The updated MHMP is not intended to be an annex to the previously approved Plan; it stands on its own as a complete and current MHMP.

The Wabash County MHMP Update is a multi-jurisdictional planning effort led by the Wabash County Emergency Management Agency (EMA). This Plan was prepared in partnership with Wabash County, the towns of LaFontaine, Lagro, North Manchester, and Roann; and the city of Wabash. Representatives from these communities attended the Committee meetings, provided valuable information about their community, reviewed and commented on the draft MHMP, and assisted with local adoption of the approved Plan. As each of the communities had an equal opportunity for participation and representation in the planning process, the process used to update the Wabash County MHMP satisfies the requirements of DMA 2000 in which multi-jurisdictional plans may be accepted.

Throughout this Plan, activities that could count toward Community Rating System (CRS) points are identified with the NFIP/CRS logo. The CRS is a voluntary incentive program that recognizes and encourages community floodplain activities that exceed the minimum NFIP requirements. As a result, flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions that meet the 3 goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote education and awareness of flood insurance. Savings in flood insurance premiums are proportional to the points assigned to various activities. A minimum of 500 points are necessary to enter the CRS program and receive a 5% flood insurance premium discount. This MHMP could contribute as many as 292 points toward participation in the CRS. At the time of this planning effort, none of the Wabash County municipalities participate in the CRS program.

Funding to update the MHMP was made available through a FEMA/DHS PDM grant awarded to the Wabash County EMA and administered by IDHS. Wabash County provided the local 25% match required by the grant. Christopher B. Burke Engineering, LLC (CBBEL) was hired to facilitate the planning process and prepare the Wabash County MHMP under the direction of an American Institute of Certified Planners (AICP) certified planner.

1.3 PLANNING PROCESS

REQUIREMENT §201.6(c)(1):
The plan shall document the planning process used to prepare the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Preparation for the Wabash County MHMP Update began in 2017 when the County EMA submitted a PDM Grant application to IDHS. The grant request was approved by FEMA and grant funds were awarded in 2017.

The planning process to update the 2011 MHMP took 12 months. This included a 9-month planning process, followed by a review period by IDHS and FEMA for the draft MHMP Update, and another month for Wabash County and communities to adopt the final MHMP Update.

1.3.1 **Planning Committee and Project Team**

In June of 2018, the EMA compiled a list of Planning Committee members to guide the MHMP Update planning process. These individuals were specifically invited to serve on the Committee because they were knowledgeable of local hazards; have been involved in hazard mitigation; have the tools necessary to reduce the impact of future hazard events; and/or served as a representative on the original Planning Committee in 2011. **Table 1-1** lists the individuals that participated on the Committee and the entity they represented.

Table 1-1 MHMP Update Committee

NAME	OFFICE	REPRESENTING
Ryan Baker	Wabash County Sheriff's Department	Wabash County
Bob Brown	Wabash County EMA	Wabash County
Kipp Cantrell	Building Department	City of Wabash
Rick Dolsen	District 3 Coordinator	IDHS
Bob Ferguson	Clerk Treasurer	Town of Roann
Kelvin Grumpp	Wabash County Surveyor's Office	Wabash County
Tyler Guenin	Wabash County Sheriff's Department	Wabash County
Brian Haupert	County Commissioners	Wabash County
Mike Howard	County Plan Commission	Wabash County
John Martin	Wabash County Health Department	Wabash County
Janet Pattee	Town Council	Town of LaFontaine
Adam Penrod	Town Manager	Town of North Manchester
Jen Rankin	Wabash County Solid Waste Management District	Wabash County
Jennifer Scott	Wabash County Health Department	Wabash County
Scott Siders	Town Superintendent	Town of Lagro
Cheri Slee	Wabash County Surveyor	Wabash County
Keith Walters	Wabash County EMA	Wabash County
Nathan Zinn	Wabash County Fire Chiefs Association	Wabash County

Members of the Committee participated in the MHMP Update as a Planning Committee member or through various other group meetings. During these meetings, the Committee revisited mitigation measures proposed in the previous MHMP and identified new critical infrastructure and local hazards; reviewed the State's mitigation goals and updated the local mitigation goals; reviewed the most recent local hazard data, vulnerability assessment, and maps; evaluated the effectiveness of existing mitigation measures and identified new mitigation projects; and reviewed materials for public participation. A sign-in sheet recorded those present at each meeting to document participation. Meeting agendas and summaries are included in **Appendix 2**.

Members of the Committee reviewed a Draft MHMP, provided comments and suggestions, and assisted with adoption of the Wabash County MHMP Update.

1.3.2 Public Involvement

A draft of the Wabash County MHMP Update was posted online on the County's website and provided at county libraries in LaFontaine, Lagro, North Manchester, Roann, and Wabash for public review and comment. A Press Release indicating the posting of the Draft MHMP and the ability to comment was submitted for publishing to *The Wabash Plain Dealer*. Committee members were provided with an informational flyer to display in their respective offices. The media release and informational flyer are located in **Appendix 3**.

Add comments, clippings, or social media posts. when received or ran in media

1.3.3 Involvement of Other Interested Parties

Indiana District 3 EMAs, interested agencies, businesses, academia, and nonprofits were invited to review and comment on the draft Wabash County MHMP Update (Appendix 3). Information related to the planning process and the availability of the draft Wabash County MHMP was directly provided to such potentially interested parties via personal conversations, informational flyer, and press releases. Successful implementation and future updates of the Wabash County MHMP Update will rely on the partnership and coordination of efforts between such groups.

1.4 PLANS, STUDIES, REPORTS, AND TECHNICAL INFORMATION

REQUIREMENT §201.6(c)(1):
The plan shall include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

During the development of the Wabash County MHMP Update, several relevant sources of information were reviewed either as a document, or through discussions with local personnel. This exercise was completed to gather updated information since the development of the original Wabash County MHMP, and to assist the Committee in developing potential mitigation measures to reduce the social, physical, and economic losses associated with hazards affecting Wabash County.

For the purposes of this planning effort, the following materials (and others) were discussed and utilized:

- City of Wabash Strategic Investment Plan, 2013-2018
- City of Wabash and Wabash County, Comprehensive Economic Development Plan of 2013 Amendment
- City of Wabash Flood Response Plan, 2018
- Town of North Manchester, Town Code, 2018
- Town of North Manchester, 2015 Comprehensive Plan
- Wabash County (LaFontaine, Lagro, Roann), Unified Zoning Ordinances, DRAFT, 2018
- Wabash County Flood Insurance Rate Maps

Planning and Building ordinances, planning efforts, and code enforcement within the Towns of LaFontaine, Lagro, and Roann are provided by the County Building and Planning Department. Additional information related to the overall capabilities of Wabash County and municipalities is contained in **Appendix 9**.

The CRS program credits NFIP communities a maximum of 170 points for organizing a planning committee composed of staff from various departments; involving the public in the planning process; and coordinating among other agencies and departments to resolve common problems relating to flooding and other known natural hazards.

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CHAPTER 2 COMMUNITY INFORMATION

Although much of the information within this section is not required by DMA 2000, it is important background information about the physical, social, and economical composition of Wabash County necessary to better understand the Risk Assessment discussed in **Chapter 3**.

Wabash County, established in 1832, is named in reference to the Wabash River. The white limestone river bottom, now covered by sediment and debris, evoked the Indian name Wabashike, meaning "pure white" and the French name Ouabache. The total area of Wabash County is approximately 421 square miles. The location of Wabash County within the State of Indiana is identified in **Figure 2-1**.

2.1 POPULATION AND DEMOGRAPHICS

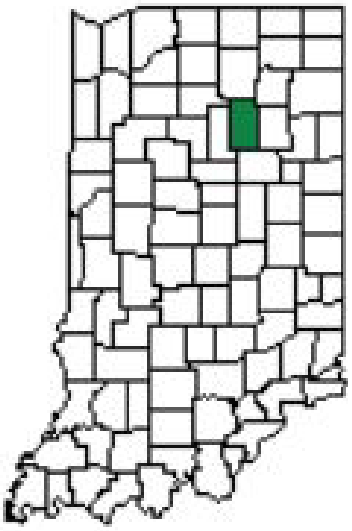

Figure 2-1 Wabash County Location

The most recent data for Wabash County estimates that the 2017 population was 31,443 which ranks 54th in the State. Of that total, the City of Wabash accounts for 10,112 or 32.2% of the county's population while the Town of North Manchester is the second largest community with 5,838 or 18.6% of the population.

In 2017, the median age of the population in the county was 42 years of age. The largest demographic age groups in the county are older adults (45-64 years) with a population of 8,649, and young adults (25 to 44) with a population of 6,959. Older residents (65+) are the third largest age group with a population of 6,202 individuals living in Wabash County. The approximate median household income in 2016 was reported to be $51,561 while the poverty rate in the same year was reported at 11.5% county-wide. In total, 17.3% of households are married with children, and 35.1% of households are married without children.

Nearly 88.7% of the adults, older than 25, within the county have reportedly completed a High School education. Further, 18.7% of those same adults have also completed a Bachelor of Arts or higher degree.

2.2 EMPLOYMENT

US Census data indicates that of the Wabash County work force, 23.3% are employed in manufacturing positions. Retail trade and Accommodation and Food services account for 11.0% and 8.4% respectively. The total resident labor force according to estimates in 2016 is 17,007 with 609 unemployed and an unemployment rate of 3.6% or 82nd in the State out of 92 counties. Table 2-1 provides a list of major employers according to Hoosiers By the Numbers. Local representatives also list Living Essentials, MSD Wabash County, North Manchester City Schools, and Wabash City Schools as large employers

Table 2-1 List of Major Employers

Ford Meter Box Co (Wabash)	Beacon Credit Union (Wabash)
Manchester University (North Manchester)	Parkview Wabash Hospital (Wabash)
Peabody Retirement (North Manchester)	Real Alloys (Wabash)
Paperworks Industries (Wabash)	Timbercrest Senior Living (North Manchester)
Walmart Supercenter (Wabash)	Thermafiber Inc. (Wabash)

(Hoosiers By the Numbers, 2018)

2.3 TRANSPORTATION AND COMMUTIING PATTERNS

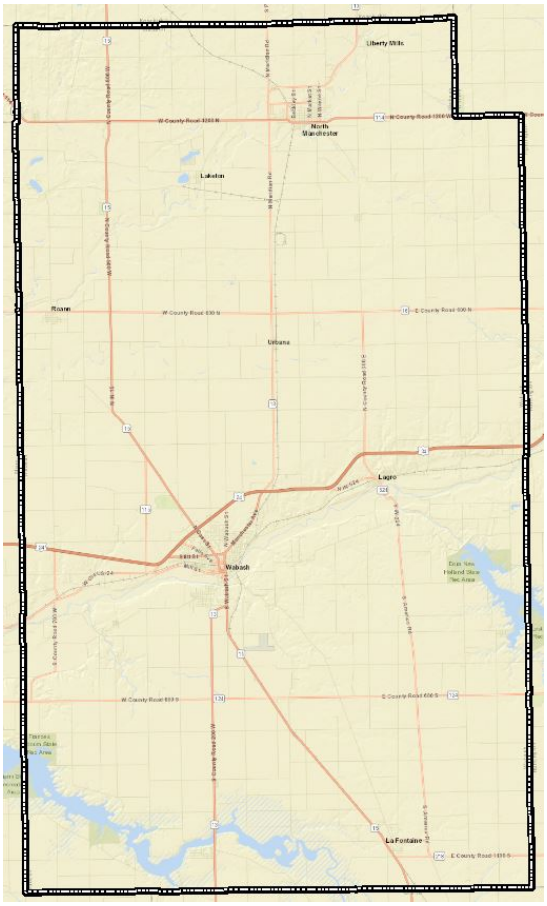

Figure 2-2 Wabash County Transportation Routes

There are several major transportation routes passing through Wabash County and the municipalities within. US Highway 24 and State Roads 13, 15, 16, 114, 218, and 524 serve as main routes between the various municipalities. Active railroad lines are also present in Wabash County. These transportation routes are identified in **Figure 2-2**.

According to the Indiana Business Research Center, nearly 1,775 people commute into Wabash County daily. Approximately 39% of those commuters travel from Miami County. Further, approximately 2,330 Wabash County residents commute to other counties with the majority traveling to Kosciusko County (35%).

Figure 2-3 indicates the number of workers 16 and older who do not live within Wabash County but commute into Wabash County for employment purposes. Similarly, **Figure 2-4** indicates the number of Wabash County residents 16 and older that commute out of the county for employment.

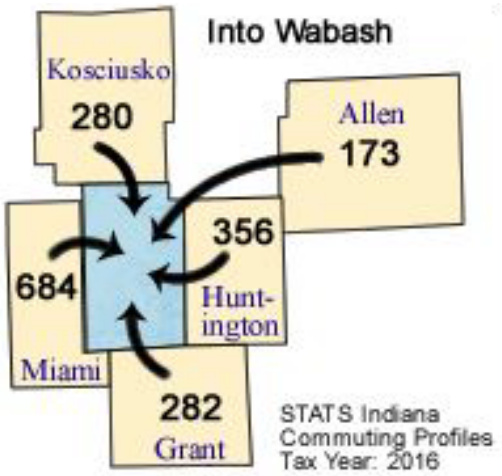

Figure 2-4 Workers Commuting into Wabash County

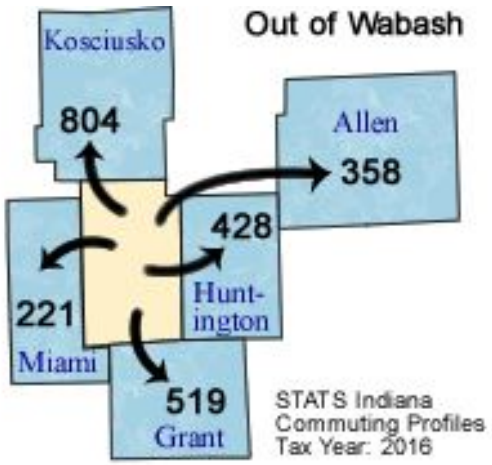

Figure 2-3 Workers Commuting out of Wabash County

2.4 CRITICAL AND NON-CRITICAL INFRASTRUCTURE

REQUIREMENT §201.6(c)(2)(ii)(A):
The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas….

Critical facilities, or critical infrastructure, are the assets, systems, and networks, whether physical or virtual, so vital to the local governments and the United States that their incapacitation or destruction would have a debilitating effect on security, economic security, public health or safety, or any combination thereof.

These structures are vital to the community's ability to provide essential services and protect life and property, are critical to the community's response and recovery activities, and/or are the facilities the loss of which would have a severe economic or catastrophic impact. The operation of these facilities becomes especially important following a hazard event.

The Wabash County EMA and Geographic Information System (GIS) Departments provided the listing and locations of the following 245 critical infrastructure points for the MHMP Update:

- 1 Airport
- 2 Colleges
- 2 Dams
- 25 Daycare Centers
- 7 Electric/Power Facilities
- 1 Emergency Operation Center

- 12 Fire Departments
- 14 Government Facilities
- 8 Group Homes
- 54 Hazardous Materials Facilities
- 11 Healthcare Facilities
- 1 Jail
- 12 Medical Facilities
- 5 Police Facilities
- 25 Public Wells
- 2 Radio Stations
- 9 Retirement Homes
- 17 Schools
- 10 Shelters
- 8 Wastewater Treatment Facilities
- 6 Water Towers
- 8 Water Treatment Plants

Information provided by the EMA, GIS Department, and the MHMP Planning Committee members was utilized to identify the types and locations of critical structures throughout Wabash County. Draft maps were provided to the EMA and GIS Department for their review and all comments were incorporated into the maps and associated databases.

Exhibit 1 illustrates the critical infrastructure identified throughout Wabash County. **Appendix 4** lists the critical structures in Wabash County by NFIP Community. Non-critical structures include residential, industrial, commercial, and other structures not meeting the definition of a critical facility and are not required for a community to function. The development of this MHMP focused on critical structures; thus, non-critical structures are not mapped or listed.

2.5 MAJOR WATERWAYS AND WATERSHEDS

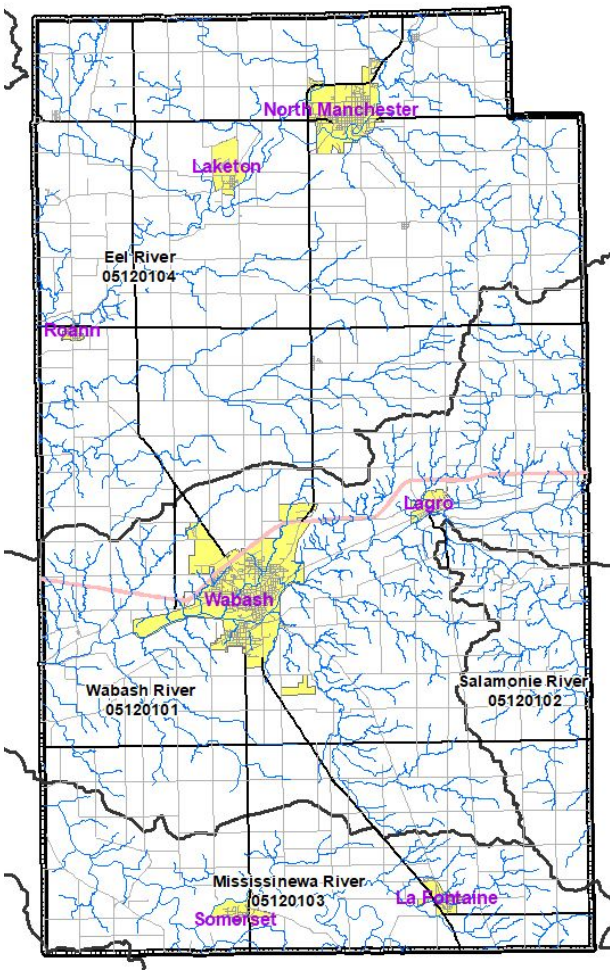

Figure 2-5 Wabash County Waterways

According to the United States Geological Survey (USGS) there are 92 waterways in Wabash County; they are listed in Appendix 5. The County's main waterways are the Eel River and the Wabash Rivers and county lies within four 8-digit Hydrologic Unit Codes (HUC): the Eel River (05120104), the Mississinewa River (05120103), the Salamonie River (05120102), and the Wabash River (05120101). These major waterways are identified on **Figure 2-5**. Within Wabash County, there are four active real-time USGS stream gages: the Eel River in North Manchester, Salamonie Lake, Salamonie River at Dora, and the Wabash River in Wabash.

2.6 NFIP PARTICIPATION

The NFIP is a FEMA program that enables property owners in participating communities to purchase insurance protection against losses from flooding. Wabash County and several municipalities are participants in the NFIP. Any smaller communities, such as Laketon and Somerset, within Wabash County may also be provided coverage by the MHMP through the county's program. Since the development of the 2011 Wabash County MHMP, these communities continue to participate in the NFIP program.

At the time of preparing this MHMP, none of the communities in Wabash County participate in the CRS program. The CRS program is a voluntary incentive program that recognizes and encourages community floodplain activities that exceed the

minimum NFIP requirements. As a result, flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions that meet the 3 goals of the CRS: 1) reduce flood losses; 2) facilitate accurate insurance rating; and 3) promote education and awareness of flood insurance. For CRS participating communities, flood insurance premium rates are discounted in increments of 5% for each class level achieved. **Table 2-2** lists the NFIP number, effective map date, and the date each community joined the NFIP program.

Table 2-2 NFIP Participation

NFIP COMMUNITY	NFIP NUMBER	EFFECTIVE MAP DATE	JOIN DATE
Wabash County	180266	09/18/2013	08/19/1986
Town of LaFontaine	180267	09/18/2013	04/17/1987
Town of Lagro	180268	09/18/2013	06/18/1987
Town of North Manchester	180269	09/18/2013	08/19/1985
Town of Roann	180270	09/18/2013 (M)	11/19/1997
City of Wabash	180271	09/18/2013	01/18/1984

(FEMA, 2018)

2.7 TOPOGRAPHY

Wabash County's topography ranges from a nearly flat plain in the western portion to gently rolling areas in the eastern portions and rolling knobs and ridges north of the Eel River. The highest elevations are slightly above 920 ft near the northwest and southeast corners. The lowest elevation (approximately 650 ft) is on the west side where the Wabash River exits the county.

Wabash County has five physiographic subdivisions:

1) Upland till plains: in the western half of Wabash County; poorly drained soils; poorly defined surface drainage; few natural drainageways. Excess water is removed from soils by an elaborate system of open ditches and subsurface drains.

2) Moraines:
    a. Packerton Moraine in the northwest consisting of rolling knobs with well drained soils to depressions with poorly drained soils. Again, open ditches and subsurface drainage is needed to drain the soils for crop production
    b. Mississinewa Moraine in the east with varied topography and drainage. Subsurface drainage is used for excess drainage and in most areas, there are easy access to drainage outlets.
3) Outwash terraces along the Eel River and along the Mississinewa River; soils are typically well drained with a few areas difficult to drain due to the rapid recharge from surrounding area.

4) Limestone terraces along the Wabash River with well drained soils and good surface drainage. Subsurface drainage installation is difficult due to shallow depth to bedrock.
5) Bottom lands along creeks are nearly level and somewhat to poorly drained. Drainage ditches are common and carry water from the uplands to the creeks and rivers.

2.8 CLIMATE

The Midwestern Regional Climate Center (MRCC) provided climate data that includes information retrieved from a weather station located in Columbia City (Whitley County), identified as station USC00121739. A station is not located within Wabash County. The average annual precipitation is 39.89 inches per year, with the wettest month being June averaging 4.46 inches of precipitation and the driest month being February with an average of 2.12 inches of precipitation. The highest 1-day maximum precipitation was recorded in June of 2013 with 5.0 inches of rain. On average, there are 78.7 days of precipitation greater than or equal to 0.1 inches; 25.1 days with greater than or equal to 0.5 inches; and 8.3 days with greater than or equal to 1.0 inch of precipitation.

Studies have recently been completed by the Indiana Climate Change Impacts Assessment, overseen by Purdue University Climate Change Research Center and made of a Steering Committee and several topic oriented Working Groups. This work indicates that average annual precipitation for Indiana is increasing seasonally, during the winter and spring. Conversely, summers and falls are trending toward less precipitation. In addition, their report shows changes in rain intensity and duration, along with frost free days and growing seasons. These changes in climate, especially in Indiana, will impact natural hazards and how municipalities prepare for them.

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CHAPTER 3 RISK ASSESSMENT

REQUIREMENT §201.6(c)(2):
[The risk assessment shall provide the] factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessment must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

A risk assessment measures the potential loss from a hazard incident by assessing the vulnerability of buildings, infrastructure, and people in a community. It identifies the characteristics and potential consequences of hazards, how much of the community may be affected by a hazard, and the impact on community assets. The risk assessment conducted for Wabash County and the NFIP communities is based on the methodology described in the Local Multi-Hazard Mitigation Planning Guidance published by FEMA in 2008 and is incorporated into the following sections:

Section 3.1: Hazard Identification lists the natural, technological, and political hazards selected by the Planning Committee as having the greatest direct and indirect impact to the County as well as the system used to rank and prioritize the hazards.

Section 3.2: Hazard Profile for each hazard, discusses 1) historic data relevant to the County where applicable; 2) vulnerability in terms of number and types of structures, repetitive loss properties (flood only), estimation of potential losses, and impact based on an analysis of development trends; and 3) the relationship to other hazards identified by the Planning Committee.

Section 3.3: Hazard Summary provides an overview of the risk assessment process; a comparative hazard ranking with other methodologies used by the Wabash County EMA; a table summarizing the relationship of the hazards; and a composite map to illustrate areas impacted by the hazards.

3.1 HAZARD IDENTIFICATION

3.1.1 Hazard Selection

The MHMP Planning Committee reviewed the list of natural and technological hazards from the 2011 Wabash County MHMP and discussed recent and the potential for future hazard events. The Committee identified those hazards that affected Wabash County and the NFIP communities and selected the hazards to study in detail as part of this planning effort. As shown in **Table 3-1** these include: dam failure; drought; earthquake; extreme temperature; flooding; hailstorms, thunderstorms, and windstorms; hazardous materials incident; land subsidence; snow storms and ice storms; tornado; and wildfire. There are no FEMA certified levees within Wabash County and therefore, Levee Failure, has not been included in this planning effort.

All hazards studied with the 2011 Wabash County MHMP, and within the 2014 Indiana MHMP, are included in the update.

Table 3-1 Hazard Identification

TYPE OF HAZARD	LIST OF HAZARDS	DETAILED STUDY	
		2011 MHMP	MHMP UPDATE
Natural	Drought	No	Yes
	Earthquake	Yes	Yes
	Extreme Temperature	No	Yes
	Flood	Yes	Yes
	Hail/Thunder/Wind	Yes	Yes
	Land Subsidence	No	Yes
	Snow / Ice Storm	Yes	Yes
	Tornado	Yes	Yes
	Wildfire	Yes	Yes
Technological	Dam Failure	Yes	Yes
	Hazardous Material Incident	Yes	Yes

3.2 HAZARD RANKING

The Planning Committee ranked the selected hazards in terms of importance and potential for disruption to the community using a modified version of the Calculated Priority Risk Index (CPRI). The CPRI, adapted from MitigationPlan.com, is a tool by which individual hazards are evaluated and ranked according to an indexing system. The CPRI value (as modified by CBBEL) can be obtained by assigning varying degrees of risk probability, magnitude/severity, warning time, and the duration of the incident for each event, and then calculating as index value based on a weighted scheme. For ease of communications, simple graphical scales are used.

3.2.1 **Probability**

Probability is defined as the likelihood of the hazard occurring over a given period. The probability can be specified in one of the following categories:

- Unlikely – incident is possible, not probable, within the next 10 years (1)
- Possible – incident is probable within the next 5 years (2)
- Likely - incident is probable within the next 3 years (3)
- Highly Likely – incident is probable within the next calendar year (4)

3.2.2 **Magnitude / Severity**

Magnitude/severity is defined by the extent of the injuries, shutdown of critical infrastructure, the extent of property damage sustained, and the duration of the incident response. The magnitude can be specified in one of the following categories:

- Negligible – few injuries OR critical infrastructure shutdown for 24 hours or less OR less than 10% property damaged OR average response duration of less than 6 hours (1)
- Limited – few injuries OR critical infrastructure shut down for more than 1 week OR more than 10% property damaged OR average response duration of less than 1 day (2)
- Critical – multiple injuries OR critical infrastructure shut down of at least 2 weeks OR more than 25% property damaged OR average response duration of less than 1 week (3)
- Significant – multiple deaths OR critical infrastructure shut down of r1 month or more OR more than 50% property damaged OR average response duration of less than 1 month (4)

3.2.3 **Warning Time**

Warning time is defined as the length of time before the event occurs and can be specified in one of the following categories:

- More than 24 hours (1)
- 12-24 hours (2)
- 6-12 hours (3)
- Less than 6 hours (4)

3.2.4 **Duration**

Duration is defined as the length of time that the actual event occurs. This does not include response or recovery efforts. The duration of the event can be specified in one of the following categories:

- Less than 6 hours (1)
- Less than 1 day (2)
- Less than 1 week (3)
- Greater than 1 week (4)

3.2.5 **Calculating the CPRI**

The following calculation illustrates how the index values are weighted and the CPRI value is calculated. CPRI = Probability x 0.45 + Magnitude/Severity x 0.30 + Warning Time x 0.15 + Duration x 0.10. For the purposes of this planning effort, the calculated risk is defined as:

- **Low** if the CPRI value is between 1 and 2
- **Elevated** if the CPRI value is between 2 and 3
- **Severe** if the CPRI value is between 3 and 4

The CPRI value provides a means to assess the impact of one hazard relative to other hazards within the community. A CPRI value for each hazard was determined for each NFIP community in Wabash County, and then a weighted CPRI value was computed based on the population size of each community. **Table 3-2** presents each community, population, and the weight applied to individual CPRI values to arrive at a combined value for the entire County. Weight was calculated based on the average percentage of each community's population in relation to the total population of the County. Thus, the results reflect the relative population influence of each community on the overall priority rank.

Table 3-2 Determination of Weighted Value for NFIP Communities

NFIP COMMUNITY	POPULATION (2017)	% OF TOTAL POPULATION	WEIGHTED VALUE
Wabash County	13,800	43.9%	0.44
Town of LaFontaine	838	2.7%	0.03
Town of Lagro	397	1.3%	0.01
Town of North Manchester	5,838	18.6%	0.19
Town of Roann	458	1.5%	0.01
City of Wabash	10,112	32.2%	0.32
Total	**31,443**	**100.0%**	**1.00**

3.3 HAZARD PROFILES

The hazards studied for this report are not equally threatening to all communities throughout Wabash County. While it would be difficult to predict the probability of an earthquake or tornado affected a specific community, it is much easier to predict where the most damage would occur in a known hazard area such as a floodplain or near a facility utilizing an Extremely Hazardous Substance (EHS). The magnitude and severity of the same hazard may cause varying levels of damages in different communities.

This section describes each of the hazards that were identified by the Planning Committee for detailed study as a part of this MHMP Update. The discussion is divided into the following subsections:

- **Hazard Overview** provides a general overview of the causes, effects, and characteristics that the hazard represents
- **Historic Data** presents the research gathered from local and national courses on the hazard extent and lists historic occurrences and probability of future incident occurrence
- **Assessing Vulnerability** describes, in general terms, the current exposure, or risk, to the community regarding potential losses to critical infrastructure and the implications to future land use decisions and anticipated development trends
- **Relationship to Other Hazards** explores the influence one hazard may have on another hazard.

Natural Hazards

3.3.1 Drought

Drought: Overview

Drought, in general, means a moisture deficit extensive enough to have social, environmental, or economic effects. Drought is not a rare and random climate incident; rather, it is a normal, naturally recurring feature of climate. Drought may occur in virtually all climactic zones, but its characteristics vary significantly from one region to another. Drought is a temporary aberration and is different from aridity, which is restricted to low rainfall regions.

Figure 3-1 Drought Affected Soil

There are four academic approaches to examining droughts; these are meteorological, hydrological, agricultural, and socio-economic. Meteorological drought is based on the degree, or measure, of dryness compared to a normal, or average amount of dryness, and the duration of the dry period. Hydrological drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply. Agricultural drought is related to agricultural impacts; focusing on precipitation shortages, differences between actual and potential evapo-transpiration, soil water deficits, reduced ground water or reservoir levels, and crop yields. Socioeconomic drought relates the lack of moisture to community functions in the full range of societal functions, including power generation, the local economy, and food sources. **Figure 3-1** shows soil affected by drought conditions.

Drought: Recent Occurrences

Data gathered from the U.S. Drought Monitor indicated that between January 2011 and November 2018, there were 35 weeks where some portion of Wabash County was considered to be in a "Moderate Drought" including seven weeks where portions of the county were considered to be in an "Extreme Drought". **Figure 3-2**, from the U.S. Drought Monitor, describes the rational to classify the severity of droughts. Those weeks of Extreme Drought are all associated with the summer 2012 event.

In July and August 2012, nearly 100% of Indiana was experiencing drought conditions ranging from "D0-Abnormally Dry" to "D4-Exceptional Drought". **Figure 3-3** identifies those areas and categories of drought throughout Indiana for August 7, 2012, the peak of the drought. Wabash County is located entirely in the

Category	Description	Possible Impacts
D0	Abnormally Dry	Going into drought: ▪ short-term dryness slowing planting, growth of crops or pastures Coming out of drought: ▪ some lingering water deficits ▪ pastures or crops not fully recovered
D1	Moderate Drought	▪ Some damage to crops, pastures ▪ Streams, reservoirs, or wells low, some water shortages developing or imminent ▪ Voluntary water-use restrictions requested
D2	Severe Drought	▪ Crop or pasture losses likely ▪ Water shortages common ▪ Water restrictions imposed
D3	Extreme Drought	▪ Major crop/pasture losses ▪ Widespread water shortages or restrictions
D4	Exceptional Drought	▪ Exceptional and widespread crop/pasture losses ▪ Shortages of water in reservoirs, streams, and wells creating water emergencies

Figure 3-2 US Drought Monitor Drought Severity Classification

"D3-Extreme Drought". D3 includes major crop or pasture losses, and widespread shortages of water potentially resulting in restrictions. The July 31, 2012 report shows all of Wabash County within the "D2-Severe Drought" consideration. It wasn't until the October 30, 2012 report that the entire county was considered out of drought condition status.

The National Data Climate Center (NCDC) doesn't report any events or property or crop losses within Wabash County since 1950.

The Planning Committee, utilizing the CPRI, determined the overall risk of drought throughout Wabash County is "Low". The impact of drought was determined to be the same for all communities within the County. The committee agreed that a drought is "Possible" (to occur within the next five years) and the magnitude of drought is anticipated to be "Negligible". Further it is anticipated that with the enhanced weather forecasting abilities, the warning time for a drought is greater than 24 hours and the duration will be greater than one week. A summary is shown in **Table 3-3**.

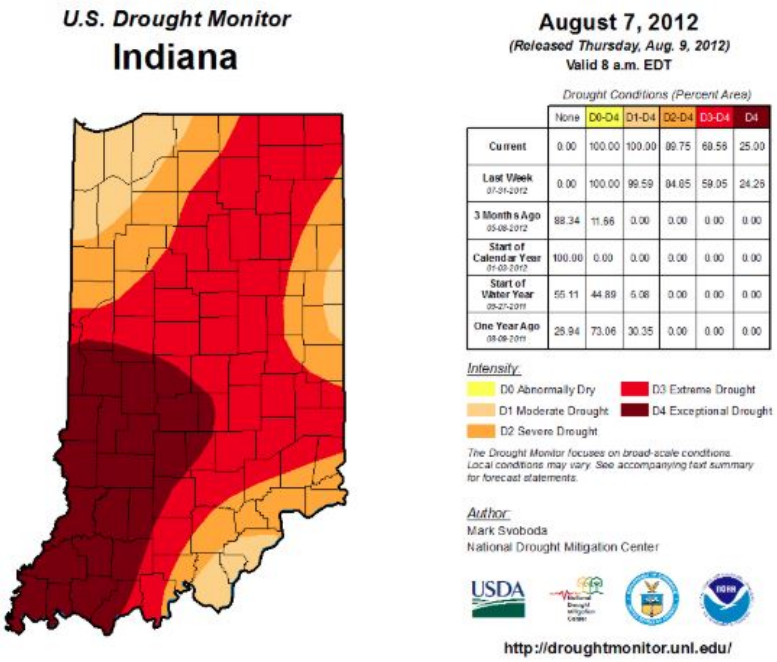


Figure 3-3 August 2012 Indiana Drought Map

Table 3-3 CPRI for Drought

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Wabash County	Possible	Negligible	> 24 Hours	> 1 Week	Low
Town of LaFontaine	Possible	Negligible	> 24 Hours	> 1 Week	Low
Town of Lagro	Possible	Negligible	> 24 Hours	> 1 Week	Low
Town of North Manchester	Possible	Negligible	> 24 Hours	> 1 Week	Low
Town of Roann	Possible	Negligible	> 24 Hours	> 1 Week	Low
City of Wabash	Possible	Negligible	> 24 Hours	> 1 Week	Low

According to the National Drought Mitigation Center, scientists have difficulty predicting droughts more than one month in advance due to the numerous variables such as precipitation, temperature, soil moisture, topography, and air-sea interactions. Further anomalies may also enter the equation and create more dramatic droughts or lessen the severity of droughts. Based on the previous occurrences of droughts and drought related impacts felt within Wabash County, the Committee estimated that the probability of a drought occurring in the area is "Possible"; or occurrence is possible within the next five years.

Drought: Assessing Vulnerability

This type of hazard will generally affect entire counties and even multi-county regions at one time. Within Wabash County, direct and indirect effects from a long period of drought may include:

Direct Effects:

- Urban and developed areas may experience revenue losses from landscaping companies, golf courses, restrictions on industry cooling and processing demands, businesses dependent on crop yields; and increased potential for fires.
- Rural areas within the county may experience revenue losses from reductions in livestock and crop yields as well as increased field fires.
- Citizens served by drinking water wells may be impacted during low water periods and may require drilling of deeper wells or loss of water service for a period of time.

Indirect Effects:

- Loss of income of employees from businesses and industry affected; loss of revenue to support services (food service, suppliers, etc.)
- Loss of revenue from recreational or tourism sectors associated with reservoirs, streams, and other open water venues.
- Lower yields from domestic gardens increasing the demand on purchasing produce and increased domestic water usage for landscaping
- Increased demand on emergency responders and firefighting resources

Estimating Potential Losses

It is difficult to estimate the potential losses associated with a drought for Wabash County because of the nature and complexity of this hazard and the limited data on past occurrences. However, for the purpose of this MHMP Update, a scenario was used to estimate the potential crop loss and associated revenue lost due to a drought similar to that experienced during the drought of record from 1988. In 2017, Wabash County produced approximately 12.2M bushels of corn and 4.7M bushels of soybeans, as reported by the United States Department of Agriculture (USDA) National Agricultural Statistics Service. Using national averages of $3.45 per bushel of corn and $9.50 per bushel of soybeans, the estimated crop receipts for 2017 would be $86.79M. Using the 39% crop yield decreases following the 2012 drought in the Midwest, (estimated in Farm Futures in February 2013), and assuming a typical production year, economic losses from corn and soybeans along could reach $33.85M; depending on the crop produced and the market demand. Effects of drought on corn crops can be seen in **Figure 3-4**.

Figure 3-4 Crops Affected by Drought

Purdue Agriculture News reports that as of March 2013, Indiana producers received more than $1.0B in crop insurance payments for 2012 corn, soybean, and wheat losses. This amount is nearly double that of the previous record, $522M following 2008 losses, also due to drought.

According to a July 5, 2012 article in *The Times* (Noblesville, IN), "The effects of drought also could touch agricultural businesses, such as handlers and processors, equipment dealers, and see, fertilizer and pesticide providers". Further, "…consumers are likely to see an increase in food prices of 2.5 percent to 3.5 percent into 2013".

Additional losses associated with a prolonged drought are more difficult to quantify. Drought has lasting impacts on urban trees: death to all or portions of a tree, reduction in the tree's ability to withstand insects and diseases, and interruption of normal growth patterns. Such effects on trees, especially urban trees can lead to additional impacts, both environmentally and monetarily in terms of the spread of Emerald Ash Borer insect and the weakening of tree limbs and trunks which may lead to increased damages during other hazard events such as wind and ice storms.

Future Considerations

Advancements in plant hybrids and development have eased the impacts from short-lived droughts. Seeds and plants may be more tolerant of dryer seasons and therefore fewer crop losses may be experienced.

As the more urban areas of the county continue to grow and expand, protocols may need to be developed which create a consistency throughout the communities and the unincorporated portions of the county for burn bans and water usage advisories.

According to the Indiana Climate Change Impacts Assessment, Indiana has experienced a rise in the average annual precipitation between 1895 and 2016; an increase of 4.8 inches for the area of Wabash County. This increase in precipitation may lessen the likelihood or overall impact of a drought in Wabash County. However, the Assessment also notes seasonal shifts in precipitation which may lead to seasonal short-term droughts. In either scenario, changes in precipitation are not anticipated to relieve the area of a probability of a drought occurring.

Drought: Relationship to Other Hazards

A drought will not be caused by any other hazard studied during this planning effort. However, it is anticipated that areas of the county may be more susceptible to fires during a drought and this may lead to increased losses associated with a structural or land fire.

3.3.2 Earthquake

Earthquake Overview

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

Ground shaking from earthquakes can collapse buildings and bridges; disrupt gas, electric, and phone service; and sometimes trigger landslides, avalanches, flash floods, fires, and huge destructive ocean waves (tsunamis). Buildings with foundations resting on unconsolidated landfill and other unstable soil, and trailers and homes not tied to their foundations are at risk because they can move off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths, injuries, and extensive property damage.

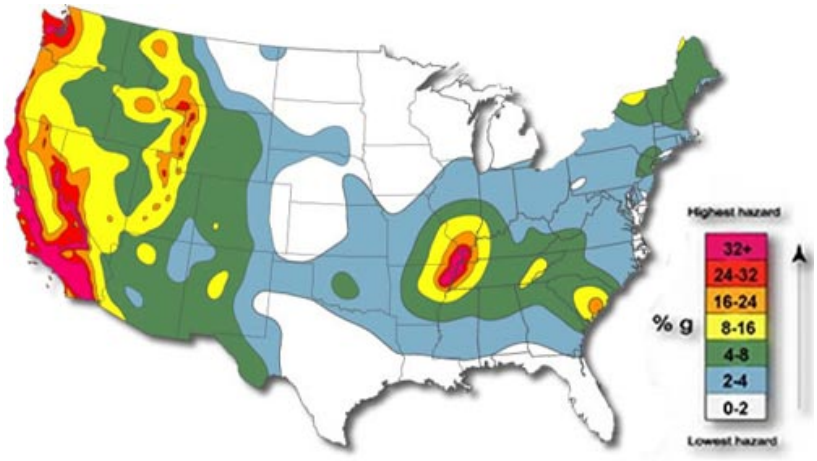


Figure 3-5 Earthquake Hazard Areas in the US

Earthquakes strike suddenly, without warning. Earthquakes can occur at any time of the year and at any time of the day or night. On a yearly basis, 70-75 damaging earthquakes occur throughout the world. Estimates of losses from a future earthquake in the United States approach $200B. Scientists are currently studying the New Madrid fault area and have predicted that the chances of an earthquake in the M8.0 range occurring within the next 50 years are approximately 7%-10%. However, the chances of an earthquake at a M6.0 or greater, are at 90% within the next 50 years.

There are 45 states and territories in the United States at moderate to very high risk from earthquake, and they are located in every region of the country (**Figure 3-5**). California experiences the most frequent damaging earthquakes; however, Alaska experiences the greatest number of large earthquakes-most located in uninhabited areas. The largest earthquakes felt in the United States were along the New Madrid Fault in Missouri, where a three-month long series of quakes from 1811 to 1812 occurred over the entire Eastern United States, with Missouri, Tennessee, Kentucky,

Indiana, Illinois, Ohio, Alabama, Arkansas, and Mississippi experiencing the strongest ground shaking.

Earthquake: Recent Occurrences

Indiana, as well as several other Midwestern states, lies in the most seismically active region east of the Rocky Mountains. Regarding Wabash County, the nearest areas of concern are the Wabash Seismic Zone, and the Anna Ohio Fault zone, one of the most seismically active areas outside of the New Madrid Seismic Zone. Within this area, approximately 40 earthquakes have been felt since 1875 with damages ranging from reports of feeling shaking to toppled chimneys and cracked windows.

On April 18, 2008, an M5.2 quake, reported by the Central United States Earthquake Consortium, struck southeast Illinois in Wabash County and included reports of strong shaking in southwestern Indiana, Kansas, Georgia, and the upper peninsula of Michigan. With over 25,000 reports of feeling the earthquake, there were no reports of injuries or fatalities caused by the event.

On December 30, 2010, central Indiana experienced an earthquake with a magnitude of 3.8; rare for this area in Indiana as it is only the 3rd earthquake of notable size to occur north of Indianapolis. Even rarer is the fact that scientists believe that the quake was centered in Greentown, Indiana approximately 13 miles southeast of Kokomo, Indiana. According to *The Kokomo Tribune,* "113 people called 911 in a 15-minute period after the quake, which was the first tremblor centered in Indiana since 2004". Further, a geophysicist from the USGS in Colorado stated, "It was considered a minor earthquake", and "Maybe some things would be knocked off shelves, but as far as some significant damage, you probably wouldn't expect it from a 3.8".

Figure 3-6 Earthquake Damaged Porch

Most recently, an M5.8 centered in Mineral, Virginia affected much of the East Coast on August 23, 2011. According to USA Today, 10 nuclear power plants were shutdown of precautionary inspections following the quake, over 400 flights were delayed, and the Washington Monument was closed indefinitely pending detailed inspections by engineers.

Based on historical earthquake data, local knowledge of previous earthquakes, and the results of HAZUS-MH scenarios, the Committee determined that the probability of an earthquake occurring in Wabash County or any of the communities is "Possible". Should an earthquake occur, the impacts associated with this hazard are

anticipated to be "Limited" within the unincorporated areas of the county and "Critical" if an earthquake were to affect any of the communities dependent on the amount of infrastructure and resources within the area.

As with all earthquakes, it was determined that the residents of Wabash County would have little to no warning time (less than six hours) and that the duration of the event would be expected to be less than six hours. A summary is shown in **Table 3-4**.

Table 3-4 CPRI for Earthquake

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Wabash County	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of LaFontaine	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Lagro	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of North Manchester	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
Town of Roann	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
City of Wabash	Possible	Critical	< 6 Hours	< 6 Hours	Elevated

Per the Ohio Department of Natural Resources Division of Geological Survey, "…it is difficult to predict the maximum-size earthquake that could occur in the state and certainly impossible to predict when such an event would occur. In part, the size of an earthquake is a function of the area of a fault available for rupture. However, because all known earthquake-generating faults in Ohio are concealed beneath several thousand feet of Paleozoic sedimentary rock, it is difficult to directly determine the size of these faults." Further according to the Indiana Geological Survey, "…no one can say with any certainty when or if an earthquake strong enough to cause significant property damage, injury, or loss of life in Indiana will occur…we do indeed face the possibility of experiencing the potentially devastating effects of a major earthquake at some point in the future". The Committee felt that an earthquake occurring within or near to Wabash County is in fact, "Possible" to occur within the next five years.

Earthquake: Assessing Vulnerability

Earthquakes generally affect broad areas and potentially many counties at one time. Within Wabash County, direct and indirect effects from an earthquake may include:

Direct Effects:

- Urban areas may experience more damages due to the number of structures and critical infrastructure located in these areas
- Rural areas may experience losses associated with agricultural structures such as barns and silos
- Bridges, buried utilities, and other infrastructure may be affected throughout the county and municipalities

Indirect Effects:

- Provide emergency response personnel to assist in the areas with more damage
- Provide shelter for residents of areas with more damage
- Delays in delivery of goods or services originating from areas more affected by the earthquake

Figure 3-7 Minor Earthquake Damages

Types of loss caused by an earthquake could be physical, economic, or social in nature. Due to the unpredictability and broad impact regions associated with an earthquake, all critical and non-critical infrastructure are at risk of experiencing earthquake related damages. Damages to structures, infrastructure, and even business interruptions can be expected following an earthquake. Examples of varying degrees of damages are shown in **Figure 3-6** and **Figure 3-7**.

Estimating Potential Losses

In order to determine the potential losses associated with an earthquake, the HAZUS-MH software was utilized in the 2011 Wabash County MHMP to determine the impact anticipated from a 7.1 earthquake with an epicenter in the Wabash Valley Seismic Zone.

Per the HAZUS-MH scenario noted above, total economic loss associated with this earthquake is anticipated to be near $120.0M. The HAZUS-MH model computes anticipated economic losses for the hypothetical earthquake due to direct building losses and business interruption losses. Direct building losses are the costs to repair or to replace the damage caused to the building and contents, while the interruption losses are associated with the inability to operate a business due to the damage sustained. Business interruption losses also include the temporary living expenses for those people displaced from their homes. Nearly all the damages anticipated are directly related to the structural and content losses with very little to no losses associated with income losses. Much of the damage is anticipated to be experienced within the western portion of the Town of North Manchester as indicated in **Figure 3-8** from the 2011 MHMP.

The HAZUS-MH Earthquake Model allows local building data to be imported into the analysis. However, these local data are imported as "general building stock", meaning that the points are assigned to a census tract rather than a specific XY coordinate. HAZUS performs the damage analysis as a county wide analysis and reports losses by census tract. While the results of the hypothetical scenario appear to be plausible, care should be taken when interpreting these results.

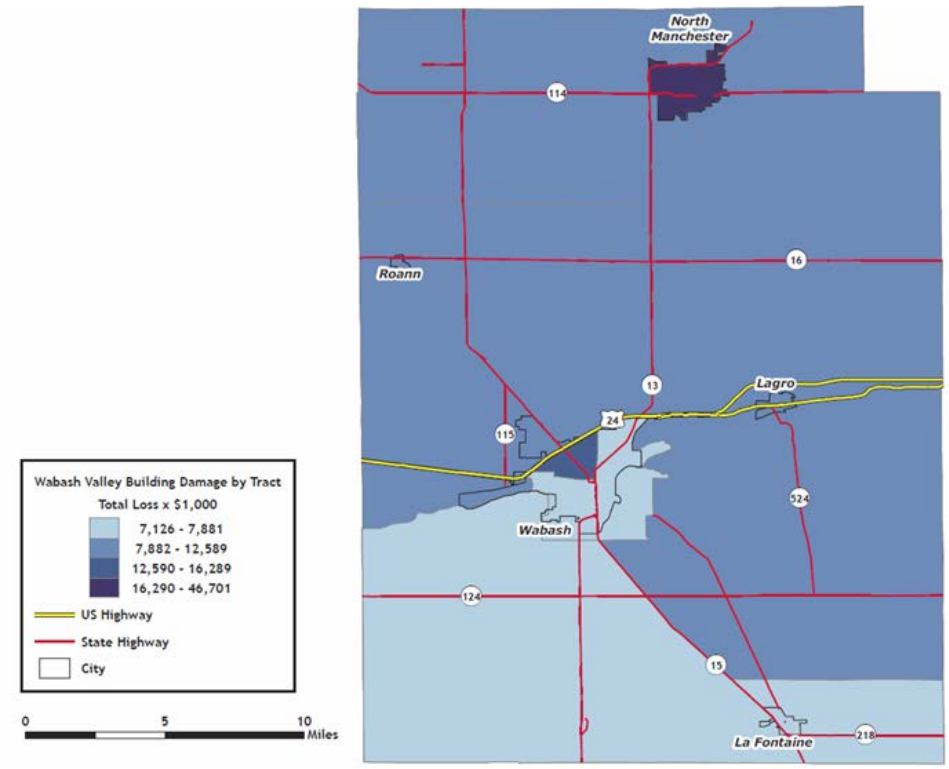


Figure 3-8 HAZUS-MH Estimated Building Losses (Thousands of Dollars)

Future Considerations

While the occurrence of an earthquake in or near to Wabash County may not be the highest priority hazard studied for the development of the Plan, it is possible that residents, business owners, and visitors may be affected should an earthquake occur anywhere within the state. For that reason, Wabash County should continue to provide education and outreach regarding earthquakes and even earthquake insurance along with education and outreach for other hazards. As Wabash County and the communities within the county continue to grow and develop, the proper considerations for the potential of an earthquake to occur may help to mitigate against social, physical, or economic losses in the future.

Earthquake: Relationship to Other Hazards

Hazardous materials incidents may occur as a result of damage to material storage containers or transportation vehicles involved in road crashes or train derailments. Further, dam failures may occur following an earthquake or associated aftershocks due to the shifting of the soils in these hazard areas. These types of related hazards may have greater impacts on Wabash County communities than the earthquake itself. It is not expected that earthquakes will be caused by other hazards studied within this plan.

3.3.3 Extreme Temperature

Extreme Temperatures: Overview

Extreme heat is defined as a temporary elevation of average daily temperatures that hover 10 degrees or more above the average high temperature for the region for the duration of several weeks. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when a dome of high atmospheric pressure traps water-laden air near the ground. In a normal year, approximately 175 Americans die from extreme heat.

According to the NWS, "The Heat Index or the "Apparent Temperature" is an accurate measure of how hot it really feels when the Relative Humidity is added to the actual air temperature". To find the Heat Index Temperature, refer to the Heat Index Chart in **Figure 3-9**. As an example, if the air temperature is 96°F and the relative humidity is 65%, the heat index – how hot it feels – is 121°F. The Weather Service will initiate alert procedures when the Heat Index is expected to exceed 105°-110°F for at least two consecutive days.

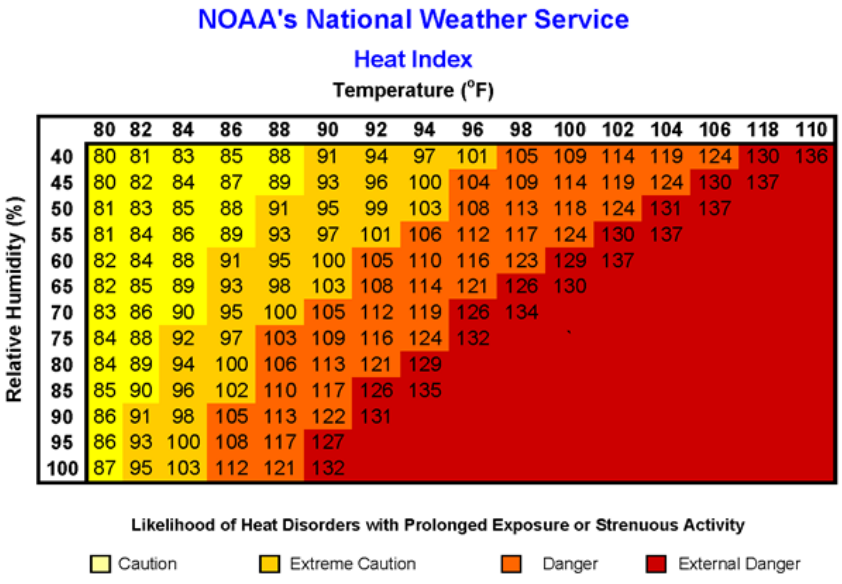


Figure 3-9 Heat Index Chart

It is important to also note that these heat index values were devised for shady, light wind conditions. Exposure to full sunshine may increase heat index values by up to 15°F. Further, strong winds, particularly with very hot, dry air, can also be extremely hazardous.

As Figure 3-7 indicates, there are four cautionary categories associated with varying heat index temperatures.

- Caution: 80°-90°F: Fatigue is possible with prolonged exposure and physical activity
- Extreme Caution: 90°-95°F: Sunstroke, heat cramps, heat exhaustion may occur with prolonged physical activity
- Danger: 105°-130°F: Sunstroke, heat cramps, or heat exhaustion is likely
- Extreme Danger: >130°F: Heatstroke is imminent

Extreme cold is defined as a temporary, yet sustained, period of extremely low temperatures. Extremely low temperatures can occur in winter months when

continental surface temperatures are at their lowest point and the North American Jet Stream pulls arctic air down into the continental United States. The jet stream is a current of fast-moving air found in the upper levels of the atmosphere. This rapid current is typically thousands of kilometers long, a few hundred kilometers wide, and only a few kilometers thick. Jet streams are usually found somewhere between 10-15 km (6-9 miles) above the Earth's surface. The position of this upper-level jet stream denotes the location of the strongest surface temperature contrast over the continent. The jet stream winds are strongest during the winter months when continental temperature extremes are greatest. When the jet stream pulls arctic cold air masses over portions of the United States, temperatures can drop below 0° F for one week or more. Sustained extreme cold poses a physical danger to all individuals in a community and can affect infrastructure function as well.

In addition to strictly cold temperatures, the wind chill temperature must also be considered when planning for extreme temperatures. The wind chill temperature, according to the NWS, is how cold people and animals feel when outside and it is based on the rate of heat loss from exposed skin. **Figure 3-10** identifies the Wind Chill Chart and how the same ambient temperature may feel vastly different in varying wind speeds.

Wind chill is a guide to winter danger

New wind chill chart

Frostbite occurs in 15 minutes or less

Wind (MPH) \ Temperature (°F)	30	25	20	15	10	5	0	-5	-10	-15	-10	-25
5	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40
10	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47
15	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51
20	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55
25	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58
30	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60
35	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62
40	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64
45	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65
50	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67
55	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68
60	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69

Figure 3-10 NWS Wind Chill Chart

Extreme Temperature: Recent Occurrences

The effects of extreme temperatures extend across large regions, typically affecting several counties, or states, during a single event. According to the NCDC, there have been 0 reported occurrences of extreme heat and two wind chill events between January 2011 and October 2018. The events occurred in January 2014 and January 2015. During the 2014 event, wind gusts up to 40 mph, wind chill of -30° to -45°, and blowing snow led to numerous vehicle accidents and slide-offs. In 2015, nearly the same conditions led to school delays and closures throughout the region.

Local media outlets have provided information related to regional extreme high temperatures occurring since the last planning effort. While not specific to Wabash County, these reports provide a regional view of the extremes that were occurring. Local representatives indicated during recent extreme heat and extreme cold events, larger shopping or worship facilities open doors for the local community as a temporary shelter where citizens can seek a respite from the weather.

In July 2012, the RTV6 *TheIndyChannel.com* reported that "The average high temperature in Indianapolis from June 28 to July 6 was a little more than 100 degrees, and Friday's high temperature of 105 was the hottest since 1936, just one-degree shy of the all-time highest temperature in Indianapolis since records began in 1871". Further, the article highlighted the average temperature for the 10-day period was nearly 101 degrees. The record 10-day average high temperature of 103 degrees was set in 1936.

It is difficult to predict the probability that an extreme temperature event will affect Wabash County residents within any given year. However, based on historic knowledge and information provided by the NFIP representatives, an extreme temperature event is "Likely" (possible within the next three years) to occur and if an event did occur, it would range in "Negligible" to "Limited" magnitude. **Table 3-5** identifies the CPRI for extreme temperature events for all NFIP communities in Wabash County.

Table 3-5 CPRI for Extreme Temperatures

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Wabash County	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of LaFontaine	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of Lagro	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of North Manchester	Likely	Negligible	> 24 Hours	> 1 Week	Elevated
Town of Roann	Likely	Limited	> 24 Hours	> 1 Week	Elevated
City of Wabash	Likely	Negligible	> 24 Hours	> 1 Week	Elevated

As shown in the table, index values remain identical throughout each NFIP community due to the regional extent and diffuse severity of this hazard event. Variations in magnitude were provided for North Manchester and the City of Wabash due to the number of facilities available to the public and the population available to provide additional assistance as needed. In some of the more rural or remote areas of Wabash County, the magnitude may increase as residents are more isolated.

Extreme Temperatures: Assessing Vulnerability

As noted above, this type of hazard will generally affect entire counties and even multi-county regions at one time; however, certain portions of the population may be more vulnerable to extreme temperatures. For example, outdoor laborers, very young and very old populations, low income populations, and those in poor physical condition are at an increased risk to be impacted during these conditions.

By assessing the demographics of Wabash County, a better understanding of the relative risk that extreme temperatures may pose to certain populations can be gained. In total, nearly 20% of the County's population is over 65 years of age, more than 5% of the population is below the age of 5, and approximately 11.5% of the

population is considered to be living below the poverty line. People within these demographic categories are more susceptible to social or health related impacts associated with extreme heat or extreme cold.

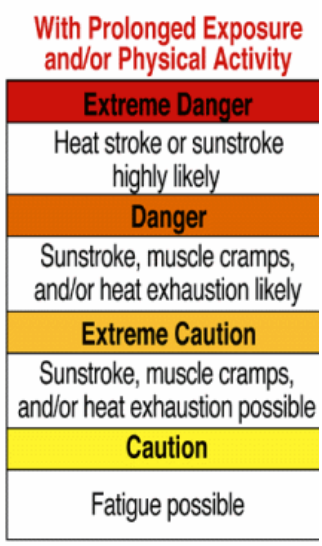


Figure 3-11 Danger Levels with Prolonged Heat Exposure

Extreme heat can affect the proper function of organ and brain systems by elevating core body temperatures above normal levels. Elevated core body temperatures, usually in excess of 104°F are often exhibited as heat stroke. For weaker individuals, an overheated core body temperature places additional stress on the body, and without proper hydration, the normal mechanisms for dealing with heat, such as sweating in order to cool down, are ineffective. Examples of danger levels associated with prolonged heat exposure are identified in **Figure 3-11**.

Extreme cold may result in similar situations as body functions are impacted as the temperature of the body is reduced. Prolonged exposure to cold may result in hypothermia, frostbite, and even death if the body is not warmed.

Within Wabash County, direct and indirect effects from a long period of extreme temperature may include:

Direct Effects:

- Direct effects are primarily associated with health risks to the elderly, infants, people with chronic medical disorders, lower income families, outdoor workers, and athletes.

Indirect Effects:

- Increased need for cooling or warming shelters
- Increased medical emergency response efforts
- Increased energy demands for heating or cooling

Estimating Potential Losses

It is difficult to estimate the potential losses due to extreme temperatures as damages are not typically associated with buildings but instead, with populations and persons.

This hazard is not typically as damaging to structures or critical infrastructure as it is to populations so monetary damages associated with the direct effects of the extreme temperature are not possible to estimate. Indirect effects would cause increased expenses to facilities such as healthcare or emergency services, manufacturing facilities where temperatures are normally elevated may need to alter work hours or experience loss of revenue if forced to limit production during the heat of the day, and energy suppliers may experience demand peaks during the hottest and/or coldest portions of the day.

Future Considerations

As more and more citizens are experiencing economic difficulties, local power suppliers along with charitable organizations have implemented programs to provide cooling and heating mechanisms to residents in need. Often, these programs are donation driven and the need for such assistance must be demonstrated. As susceptible populations increase, or as local economies are stressed, such programs may become more necessary to protect Wabash County's at-risk populations.

The Climate Change Assessment identifies several temperature related considerations of which communities should be aware and begin planning to avoid further impacts. For example, rising temperatures will increase the number of extreme heat days, thereby increasing the potential for heat related illnesses, potential hospitalizations, and medication costs to vulnerable populations. In addition, added days of extreme heat will impact agriculture, manufacturing, and potentially, water sources.

Extreme Temperatures: Relationship to Other Hazards

While extreme temperatures may be extremely burdensome on the power supplies in Wabash County, the Committee concluded that this type of hazard is not expected to cause any hazards studied. These types of events may, however, lead to increased social disturbances or crimes. It is anticipated that due to prolonged extreme temperatures, primarily long periods of high temperatures, citizens may become increasingly agitated and irritable and this may lead to a disturbance requiring emergency responder intervention.

3.3.4 **Flood**

Flood: Overview

Floods are the most common and widespread of natural disasters. Most communities in the United States have experienced some kind of flooding, after spring rains, heavy thunderstorms, or winter snow melts. A flood, as defined by the NFIP, is a general and temporary condition of partial or complete inundation or two or more acres of normally dry land area or of two or more properties from overflow of inland or tidal waters and unusual and rapid accumulation or runoff of surface waters from any sources, or a mudflow. Floods can be slow or fast rising but generally develop over a period of days.

Flooding and associated flood damages is most likely to occur during the spring because of heavy rains combined with melting snow. However, provided the right saturated conditions, intense rainfall of short duration during summer rainstorms are capable of producing damaging flash flood conditions.

The traditional benchmark for riverine or coastal flooding is a 1% annual chance of flooding, or the 100-year flood. This is a benchmark used by FEMA to establish a standard of flood protection in communities throughout the country. The 1% Annual Exceedance Probability (AEP) chance flood is referred to as the "regulatory" or "base" flood. Another term commonly used, the "100-year flood", is often incorrectly used and can be misleading. It does not mean that only one flood of that size will occur every 100 years. What it actually means is that there is a 1% chance of a flood of that intensity and elevation happening in any given year. In other words, the regulatory flood elevation has a 1% chance of being equaled, or exceeded, in any given year and it could occur more than once in a relatively short time period.

Figure 3-12 Local Volunteers Sandbag During June 2015 Event

Flood: Recent Occurrences

The NCDC indicates that between January 2011 and October 2018, there were two flood events and four flash flood events reported. Flooding in May 2011 near the Servia area occurred as three to four inches of rain fell from numerous storm cells resulting in several flooded roads. Later that same May, several residents were evacuated from a mobile home park in North Manchester as a result of floodwaters. The event occurring more recently in June of 2015 in Wabash resulted in several cars under water along Columbus Street and waist high water over 200W outside of the City.

A local news source, The Paper of Wabash County, provided information related to an additional event in June 2015 (**Figure 3-12**). During this

event, the Wabash and Eel Rivers flooded, causing several residents to evacuate and major damages to sewers and roads. County officials declared a disaster. In addition, water levels at Salamonie Reservoir were such that a release was required, which may have exacerbated flood conditions in some areas and increased the chances of flooding in others. To prepare for these conditions, the EMA and other county agencies began sandbagging efforts while the Red Cross began preparations for sheltering those in need.

Stream gages are utilized to monitor surface water elevations and/or discharges at key locations and time periods. Some such gages are further equipped with NWS' Advanced Hydrologic Prediction Service (AHPS) capabilities. These gages have the potential to provide valuable information regarding historical high and low water stages, hydrographs representing current and forecasted stages, and a map of the surrounding areas likely to be flooded. Within Wabash County, there are four active USGS stream gage equipped with AHPS capabilities, Eel River at North Manchester, Salamonie Lake, Salamonie River at Dora, and Wabash River at Wabash IN, which are identified on **Exhibit 2**. Since the development of the previous MHMP in 2011, the Eel River gage has registered 20 events higher than Flood Stage (11 ft.); one of which was a Major Flood (16 ft.). Similarly, the Wabash River gage has registered 16 events higher than Flood Stage (14 ft.); one of which was a Major Flood (23 ft.).

Any property having received two insurance claim payments for flood damages totaling at least $1,000, paid by the NFIP within any 10-year period since 1978 is defined as a repetitive loss property. These properties are important to the NFIP because they account for approximately one-third of the country's flood insurance payments. According to FEMA Region V, there are a total of four repetitive loss properties within Wabash County; two residential properties in the City of Wabash and two properties (residential) within the unincorporated county areas.

There have been a small number of claims made for damages associated with flooding in Wabash County. Within the City of Wabash, there have been 23 paid losses resulting in nearly $230K in payments. Further, within the unincorporated areas of the county, there were 12 payments totaling approximately $142K. Information regarding the Town of Roann was not provided individually, it is included within the report for the county. **Table 3-6** identifies the number of claims per NFIP community as well as payments made.

Table 3-6 Repetitive Loss Properties, Claims, and Payments

NFIP COMMUNITY	# OF REPETITIVE LOSS PROPERTIES	CLAIMS SINCE 1978	$$ PAID
Wabash County	2	12	$142,067
Town of LaFontaine	0	0	$0
Town of Lagro	0	2	$11,713
Town of North Manchester	0	7	$8,592
Town of Roann	0		
City of Wabash	2	23	$229,388
TOTAL	**4**	**44**	**$391,760**

(IDNR, 2018)
(FEMA Region V, 2018)

Mandatory flood insurance purchase requirements apply to structures in 1% annual chance of flooding delineated areas. Total flood insurance premiums for Wabash County and the NFIP communities is approximately $92K. Total flood insurance coverage for Wabash County is approximately $15M. Information specific to the Town of Roann was not provided individually but is included within the reports for the county. **Table 3-7** further indicates the premiums and coverage totals for individual NFIP communities.

Table 3-7 Insurance Premiums and Coverage

NFIP COMMUNITY	FLOOD INSURANCE PREMIUMS	FLOOD INSURANCE COVERAGE
Wabash County	$16,185	$5,282,400
Town of LaFontaine	$664	$350,000
Town of Lagro	$598	$61,200
Town of North Manchester	$16,245	$3,016,200
Town of Roann		
City of Wabash	$57,889	$6,630,600
TOTAL	**$91,581**	**$15,340,400**

(IDNR, 2017)

As determined by the Committee, the probability of a flood occurring throughout Wabash County ranges from "Possible" in the Town of Roann to "Highly Likely" in all other areas of the county. This is largely based on the presence or absence of rivers or water systems in or near the communities. Impacts from such an event are anticipated to range from "Negligible" in all municipal areas to "Limited" in the unincorporated areas of the county. The Committee also determined that the warning time would be between 12 and 24 hours based on forecasting methods and local knowledge of stream activities, and that the duration of such an event is anticipated to last less than 1 week for all areas, except within Lagro, where it is expected to last less than 1 day. A summary is shown in **Table 3-8**.

Table 3-8 CPRI for Flood

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Wabash County	Highly Likely	Limited	12-24 Hours	< 1 Week	Elevated
Town of LaFontaine	Highly Likely	Negligible	12-24 Hours	< 1 Week	Elevated
Town of Lagro	Highly Likely	Negligible	12-24 Hours	< 1 Day	Elevated
Town of North Manchester	Highly Likely	Negligible	12-24 Hours	< 1 Week	Elevated
Town of Roann	Possible	Negligible	12-24 Hours	< 1 Week	Low
City of Wabash	Highly Likely	Negligible	12-24 Hours	< 1 Week	Elevated

As mentioned within this section, there is a 1% chance each year that the regulatory flood elevation will be equaled or exceeded and these types of events may occur more than once throughout each year. Further, based on information provided by the USGS/NWS stream gages, the NCDC, and previous experiences, the Committee determined that flooding is "Possible" to "Highly Likely" throughout the county.

Flood: Assessing Vulnerability

Flood events may affect large portions of Wabash County at one time as large river systems and areas with poor drainage cover areas of the county and smaller communities. Several areas that experience routine flooding, according to the Planning Committee, the previous MHMP, and news articles are:

- Low-lying areas in and around Lagro
- Low-lying areas in and around Richvalley
- 325 East south of Liberty Mills on the Eel River
- 200 West between 700 North and 800 North
- 400 North east of 100 East for approximately 1/4 mile
- 300 East between 300 North and 400 North
- 100 South east of State Road 115 for one-tenth of a mile
- Old U.S. 24 between Wabash and Lagro
- 700 West south of Old U.S. 24 and north of Cooper Road
- 400 South between 475 West and 400 West and between S.R. 13 and S.R. 15
- 700 South between S.R. 13 and 300 West
- 700 West south of 700 South
- 800 South west of 650 West
- Old Slocum Trail between 600 West and 800 West
- Pearson Mill Boat State Recreation Area at the south end of 400 South
- 925 South east of S.R. 13 for half a mile
- 100 West south of 925 South to 1000 South
- 50 East south of 1000 South to 1050 South
- 1050 South east one mile
- South Bruner Road south of 1100 South

- 100 East north of 1200 South
- S.R. 124 east of 600 East
- 700 East north of 500 South
- 500 South between 700 East and 800 East
- 200 South between 750 East and 800 East
- Division Road between 600 East and 750 East
- 50 South between 65 East and 750 East
- 100 South (Salamonie Dam Road) between 650 East and 750 East

Many Planning Committee members also participated in meetings in early 2018 to develop a Flood Response Plan (FRP) for the City of Wabash. The FRP is developed to serve as an action plan when Action Stage flood events are detected in the City, upstream in the unincorporated areas of Wabash or Huntington Counties. As a result of flood modeling, historical events, and participant knowledge, areas of concern for various flood events were identified and mapped. **Figure 3-13** is an example of a Flood Impact exhibit included in the City of Wabash FRP; the 1.0% AEP or 100-year Flood. Similar maps were produced for the 10-Year, 50-Year, and 500-Year events.

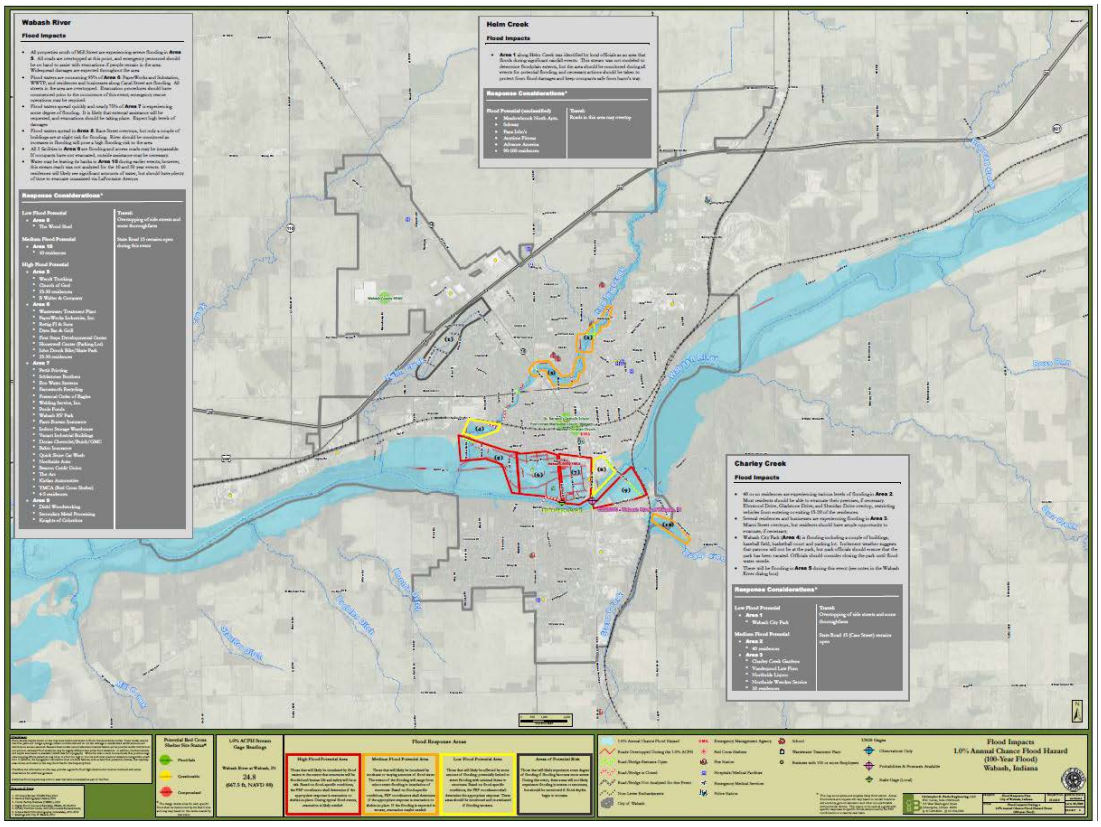


Figure 3-13 City of Wabash FRP Flood Impacts Exhibit

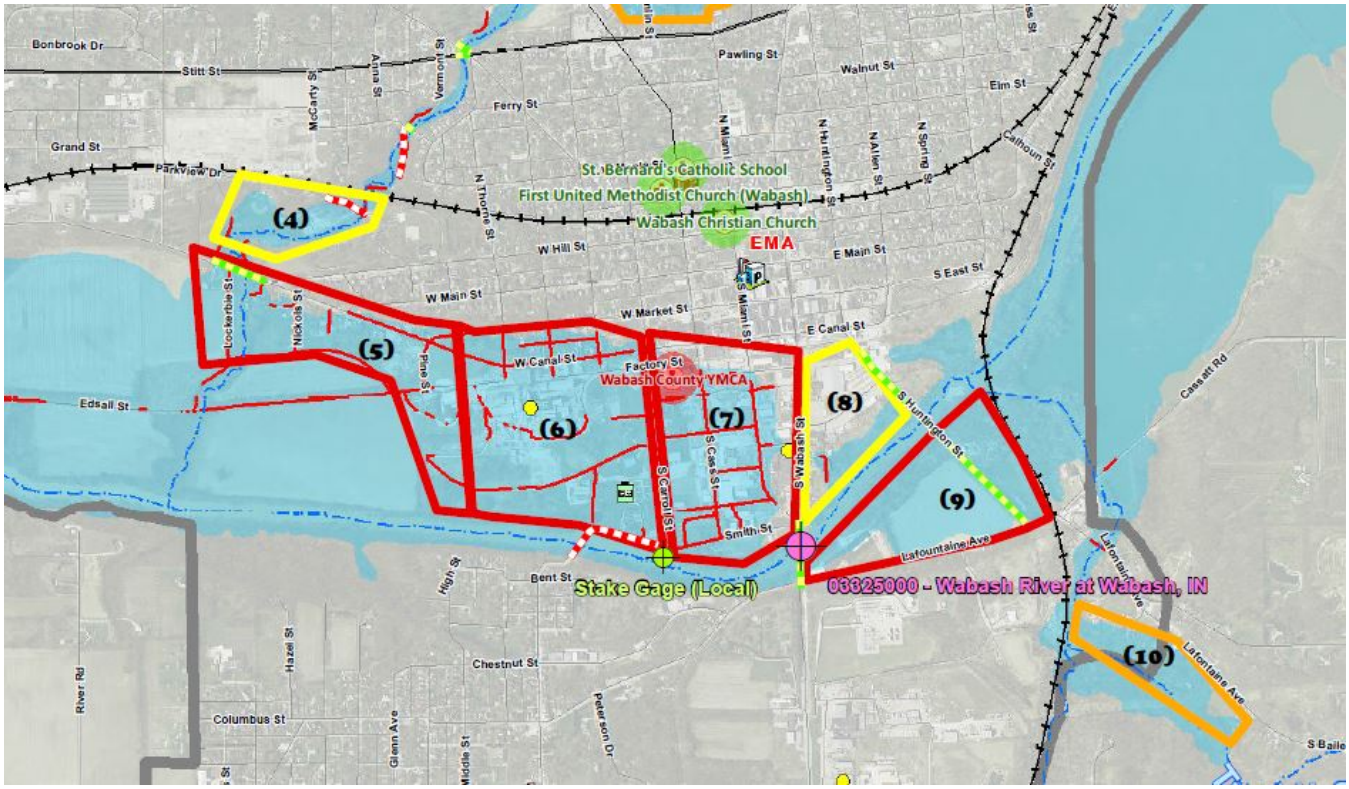


Figure 3-14 1.0% AEP Flood Potential Areas, Wabash IN

Figure 3-14 is a closer view of the FRP Flood Impacts Exhibit in Figure 3-13. The areas in red are those with a High Flood Potential, areas in orange are Medium Flood Potential, and yellow are a Low Flood Potential. Additionally, the gray boxes on Figure 3-13 describe the anticipated flood impacts such as the number and type of structures to be flooded and transportation routes to be effected at that level of flood event.

Within Wabash County, direct and indirect effects of a flood event may include:

Direct Effects:

- Structural and content damages and/or loss of revenue for properties affected by increased water
- Increased costs associated with additional response personnel, evacuations, and sheltering needs

Indirect Effects:

- Increased response times for emergency personnel if roads are impassable
- Increased costs associated with personnel to carry out evacuations in needed areas
- Increased risk of explosions and other hazards associated with floating propane tanks or other debris

- Losses associated with missed work or school due to closures or recovery activities
- Cancellations of special events in impacted areas or water related activities that become too dangerous due to high water

Estimating Potential Losses

Critical and non-critical structures located in regulated floodplains, poorly drained areas, or low-lying areas are most at risk for damages associated with flooding. For this planning effort, a GIS Desktop Analysis methodology was utilized to estimate flood damages.

For the GIS Desktop Analysis method, an analysis was completed utilizing the effective Digital FIRMs (DFIRMs) overlaid upon the Modified Building Inventory developed through information provided by Wabash County and structures located within each flood zone were tallied using GIS analysis techniques.

In the assessment, any structure listed as less than 400 ft^2 in area or was classified in the Assessor's database as a non-habitable structure was assumed to be an outbuilding. Also, buildings with an assessed value of $0.00 or buildings that did not match the Assessor Data (parcel numbers did not match) were excluded from the analysis. Structure values were calculated using:

Residential = Assessed Value x 0.5
Commercial = Assessed Value x 1.0
Industrial = Assessed Value x 1.5
Agricultural = Assessed Value x 1.0
Education = Assessed Value x 1.0
Government = Assessed Value x 1.0
Religious = Assessed Value x 1.0

The resulting Modified Building Inventory was used in the GIS analyses.

To estimate anticipated damages associated with each flood in Wabash County and NFIP communities, it was estimated that 25% of structures in the flood zones would be destroyed, 35% of structures would be 50% damaged, and 40% of structures would be 25% damaged. **Table 3-9** identifies the estimated losses associated with structures in the floodway, the 1% AEP (100-year) floodplain, and the 0.2% AEP (500-year) floodplain areas by NFIP community within Wabash County.

Table 3-9 Manual GIS Analysis Utilizing Most Recent Preliminary DFIRM Data and Wabash County Building Inventory

	FLOODWAY		1% AEP		0.2% AEP		UNNUMBERED	
	#	$	#	$	#	$	#	$
Wabash County	71	$2.8M	29	$1.1M	8	$0.3M	109	$5.2M
Town of LaFontaine	6	$0.2M	0	$0	2	$89K	0	$0
Town of Lagro	1	$39K	0	$0	0	$0	10	$0.4M
Town of North Manchester	39	$1.7M	46	$1.8M	21	$0.8M	0	$0
Town of Roann	0	$0	0	$0	0	$0	0	$0
City of Wabash	6	$0.3M	97	$4.7M	41	$1.5M	68	$2.7M
Total	**123**	**$44M**	**172**	**$7.6M**	**72**	**$2.7M**	**187**	**$8.3M**

Structures and damages within each zone are not inclusive

Utilizing the same GIS information and process, **Table 3-10** identifies the number of critical infrastructure within each of the Special Flood Hazard Areas (SFHA) in Wabash County. These buildings are included in the overall number of structures and damage estimate information provided in Table 3-7.

Table 3-10 Critical Infrastructure in SFHA by NFIP Community

NFIP	FLOODWAY	1%AEP	0.2%AEP
Wabash County	White's Treatment Plant		
LaFontaine			
Lagro			
North Manchester		Siren	
Roann			
Wabash		ARC of Wabash County, Pathfinder Home, Siren, YMCA, WWTP	

Utilizing the information in Table 3-7 regarding the number of structures within each Flood Hazard Area, it is also important to note the number of flood insurance policies within each NFIP area in Wabash County. **Table 3-11** provides the comparison between the number of structures in the SFHA and the number of flood insurance policies. It is also important to note that flood insurance is voluntary unless the property owner carries a federally subsidized mortgage; insurance coverage may be discontinued when the mortgage is completed.

Table 3-11 Number of Structures in the SFHA and Number of Flood Insurance Policies

NFIP COMMUNITY	# STRUCTURES IN SFHA	# POLICIES
Wabash County	108	30
Town of LaFontaine	8	2
Town of Lagro	1	2
Town of North Manchester	106	22
Town of Roann		
City of Wabash	144	40
Total	**367**	**96**

(IDNR, 2018)

Future Considerations

As the municipalities within Wabash County continue to grow in population, it can be anticipated that the number of critical and non-critical infrastructure will also increase accordingly. Location of these new facilities should be carefully considered and precautions should be encouraged to ensure that school, medical facilities, community centers, municipal buildings, and other critical infrastructure are located outside the 0.2% AEP (500-year) floodplain and/or are protected to that level along with a flood-free access to reduce the risk of damages caused by flooding and to ensure that these critical infrastructure will be able to continue functioning during major flood events.

It is also important to ensure that owners and occupants of residences and businesses within the known hazard areas, such as delineated or approximated flood zones and fluvial erosion hazard areas, are well informed about the potential impacts from flooding incidents as well as proper methods to protect themselves and their property.

Despite these efforts, the overall vulnerability and monitory value of damages is expected to increase in the area unless additional measures, such as those discussed later in Chapter 4 of this report, are implemented.

Increased precipitation, as predicted in the Indiana Climate Change Assessment, is anticipated to come in the form of heavier, shorter events which lead to the increased potential for flooding and stress on infrastructure such as sanitary and storm sewers. Heavy precipitation events are anticipated to occur more frequently as temperatures rise, replacing rain when previously there was snow.

Indirect effects of flooding may include increased emergency response times due to flooded or redirected streets (**Figure 3-14**), the danger of dislodged and floating propane tanks causing explosions, and the need for additional personnel to carry out the necessary evacuations. Additional effects may include sheltering needs for those evacuated, and the loss of income or revenue related to business interruptions. As many communities within Wabash County are closely tied to the river systems,

special events occurring near to or on these rivers and waterways may be cancelled or postponed during periods of flooding or high-water levels.

Flood: Relationship to Other Hazards

Figure 3-15 Fire Engine in Flood Waters

While flooding creates social, physical, and economic losses, it may also cause other hazards to occur. For example, flooding may increase the potential for a hazardous materials incident to occur. Above ground storage facilities may be toppled or become loosened and actually migrate from the original location. In less severe situations, the materials commonly stored in homes and garages such as oils, cleaners, and de-greasers, may be mobilized by flood waters. Should access roads to hazardous materials handlers become flooded, or if bridges are damaged by flood waters, response times to more significant incidents may be increased, potentially increasing the damages associated with the release.

Increased volumes of water during a flood event may also lead to a dam failure. As the water levels rise in areas protected by dams, at some point, these structures will over-top or will breach leading to even more water released. These two hazards, flood and dam failure, when combined, may certainly result in catastrophic damages.

In a similar fashion, a snow storm or ice storm can also lead to flooding on either a localized or regional scale. When a large amount of snow or ice accumulates, the potential for a flood is increased. As the snow or ice melts, and the ground becomes saturated or remains frozen, downstream flooding may occur. Ice jams near bridges and culverts may also result in flooding of localized areas and potentially damage the bridge or culvert itself.

Flooding in known hazard areas may also be caused by dams that experience structural damages or failures not related to increased volumes or velocities of water. These "sunny day failures", while not typical, may occur wherever these structures exist.

3.3.5 Hailstorms, Thunderstorms, and Windstorms

Hailstorms, Thunderstorms, and Windstorms: Overview

Hail occurs when frozen water droplets form inside a thunderstorm cloud, and then grow into ice formations held aloft by powerful thunderstorm updrafts, and when the weight of the ice formations becomes too heavy, they fall to the ground as hail. Hail size ranges from smaller than a pea to as large as a softball, and can be very destructive to buildings, vehicles (**Figure 3-16**), and crops. Even small hail can cause significant damage to young and tender plants. Residents should take cover immediately in a hailstorm, and protect pets and livestock, which are particularly vulnerable to hail, and should be under shelter as well.

Thunderstorms are defined as strong storm systems produced by a cumulonimbus cloud, usually accompanied by thunder, lightning, gusty winds, and heavy rains. All thunderstorms are considered dangerous as lightening is one of the by-products of the initial storm. In the United States, on average, 300 people are injured, and 80 people are killed each year by lightning. Although most lightning victims survive, people struck by lightning often report a variety of long-term, debilitating symptoms. Other associated dangers of thunderstorms included tornados, strong winds, hail, and flash flooding.

Windstorms or high winds can result from thunderstorm inflow and outflow, or downburst winds when the storm cloud collapses, and can result from strong frontal systems, or gradient winds (high- or low-pressure systems). High winds are speeds reaching 50 mph or greater, either sustained or gusting.

Hailstorm, Thunderstorm, and Windstorm: Recent Occurrences

Figure 3-16 Damaging Hail on Vehicles

In Wabash County, the NCDC has recorded 10 hailstorms and 17 thunderstorms/windstorms between January 2011 and October 2018. The largest recorded hailstone was 1.00 inch in diameter and has occurred several times throughout the County. The average diameter hailstone occurring throughout Wabash County is 0.9 inch.

Significant windstorms are characterized by the top wind speeds achieved during the incident, characteristically occur in conjunction with thunderstorms, and have historically occurred year-round with the greatest frequency and damage occurring in May, June, and July. Within Wabash County, NCDC reports 13 instances between January 2011 and October 2018 where top wind speeds were greater than 60 mph.

NCDC does not indicate any recorded damages for hailstorms, thunderstorms, and windstorms throughout Wabash County, and no injuries or deaths have been associated with these events. Many event reports included in the NCDC did not provide descriptive information on the social, physical, and economic losses resulting from individual storms specific to Wabash County.

During the June 2013 event in Wabash, extensive tree damages along with the complete destruction of a grain silo and two pole barns was the result of a system moving through with 90-100 mph wind speeds. A similar situation in June of 2017 occurred in North Manchester and resulted in roof damage to the Dairy Queen on SR 13, north of SR 114. As can be expected, numerous events reported large numbers of trees and power lines downed along with damages to homes and other structures.

According to the Institute for Business and Home Safety, central Indiana can expect to experience damaging hailstorms three to four times over 20 years; the average life of a residential roof. Further, thunderstorms and windstorms are considered a high frequency hazard and may occur numerous times per year.

The Committee determined the probability of a hailstorm, thunderstorm, or windstorm occurring in Wabash County is "Highly Likely" and will typically affect broad portions of the county at one time resulting in potentially "Negligible" to "Limited" damages. As advancements in technologies such as weather radar systems and broadcast alerts are continually made, the warning time for such incidents may increase. Currently, the Committee feels that the warning time is anticipated to be six to twelve hours and the duration is expected to last less than six hours.

Indicative of a regional hazard, the probability, magnitude, warning time, and duration of a hailstorm, thunderstorm, or windstorm are expected to be much the same throughout the county. These events are highly unpredictable, and the occurrences are distributed through the county. Therefore, the CPRI values reflect the nearly equally distributed risk and associated priority for a hailstorm, thunderstorm, or windstorm. A summary is provided in **Table 3-12**.

Table 3-12 CPRI for Hailstorm, Thunderstorm, and Windstorm

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Wabash County	Highly Likely	Limited	6-12 Hours	< 6 Hours	Elevated
Town of LaFontaine	Highly Likely	Negligible	6-12 Hours	< 6 Hours	Elevated
Town of Lagro	Highly Likely	Negligible	6-12 Hours	< 6 Hours	Elevated
Town of North Manchester	Highly Likely	Limited	6-12 Hours	< 6 Hours	Elevated
Town of Roann	Highly Likely	Limited	6-12 Hours	< 6 Hours	Elevated
City of Wabash	Highly Likely	Limited	6-12 Hours	< 6 Hours	Elevated

Specific locations and frequency of hailstorms, thunderstorms, and windstorms are difficult to predict as many of these individual events are without significant warning

time and may have impacts to very limited areas or may affect broader areas. However, based on NCDC data and personal experiences of the Committee, it was determined that all areas within the County are anticipated to experience a hailstorm, thunderstorm, or windstorm within the calendar year. More likely, these communities will be impacted by several of these hazard events each year. The magnitude is anticipated to differ based on the number of critical infrastructure and populations of the municipalities ranked higher, or "Limited".

Hailstorm, Thunderstorm, and Windstorm: Assessing Vulnerability

The effects of a hailstorm, thunderstorm, or windstorm may be minimal to extensive in nature and may affect small or broad ranges of land area. Within Wabash County, direct and indirect effects from a hailstorm, thunderstorm, or windstorm may include:

Direct Effects:

- Damages to infrastructure (power lines)
- Damages to individual properties (homes, cars)

Indirect Effects:

- Downed power lines due to falling tree limbs
- Losses associated with power outages
- Damages sustained from blowing debris

Estimating Potential Losses

Figure 3-17 Home Damaged During Windstorm

Due to the unpredictability of this hazard all critical infrastructure and non-critical structures in Wabash County are at risk of damage including temporary or permanent loss of function. For hailstorms, thunderstorms, and windstorms, it is not possible to isolate specific critical infrastructure or non-critical structures that would be more or less vulnerable to damages. However, areas where utility lines are above ground and areas where dead or dying trees have not been removed may be at a higher risk of property damages or power outages during hailstorms, thunderstorms, and windstorms. Additionally, mobile homes and accessory buildings such as pole barns and sheds may also be at a higher risk of damages from hailstorms, thunderstorms, and windstorms if not properly anchored to the ground. Damages from falling limbs or uprooted trees such as shown in **Figure 3-17**, are common.

Future Considerations

As the populations of the communities in Wabash County continue to grow, it can be anticipated that the number of critical and non-critical structures will also increase. In order to reduce the vulnerability for damages resulting from a hailstorm, thunderstorm, or windstorm, measures such as proper anchoring, enforcement of the International Building Codes, and burial of power lines should be completed. While measures can be taken to remove existing structures or prevent future structures from being built in known hazard areas such as floodplains and hazardous materials facility buffers, such measures are not applicable to hailstorms, thunderstorms, and windstorms due to the diffuse nature and regional impacts of this hazard.

Scientists are continuing to determine the effects of climate change and increased precipitation events as they relate to the number of storm events occurring each year. Models have suggested an increase in the frequency and intensity of such events but not with enough certainty. As temperatures rise, storms seasons may be lengthened, necessitating an increase in readiness and planning for response agencies.

Indirect effects resulting from a hailstorm, thunderstorm, or windstorm can include power outages caused by downed tree limbs, damages resulting from prolonged power outages, and damages to structures or property as a result of debris.

Hailstorm, Thunderstorm, and Windstorm: Relationship to Other Hazards

Hailstorms, thunderstorms, and windstorms may be the precursor for other hazards. For example, hazardous materials incidents can be the result of a hailstorm, thunderstorm, or a windstorm. Material storage containers can become damaged by high winds, debris, or even lightning, and can result in a spill or release of materials. With wind speeds greater than 58 mph, tankers and other transportation vehicles carrying hazardous materials are also at risk while on the road. High winds may also cause gaseous substances to travel farther distances at a much faster rate, increasing the evacuation area necessary to protect residents and visitors of Wabash County.

Additionally, rainfall typically occurs with a thunderstorm and this additional precipitation may lead to localized flooding or riverine flooding depending on the amount of rain during the event. Debris from a windstorm may also lead to localized flooding if debris is deposited over drains or if obstructions are created by downed limbs, trees, or other storm related debris. High winds may also lead to structural damages to a dam or may cause damages to nearby trees or other structures, leading to indirect damages to the dam.

The risk of social losses also increases during a hailstorm, thunderstorm, or windstorm as many times, these hazards result in downed power lines, utility poles, and trees. Debris such as this may impede traffic patterns and make it difficult for emergency vehicles (Fire, EMS, and Police) to pass through affected areas or people may be directly injured as a result of falling debris.

3.3.6 **Landslide/Subsidence**

Landslide/Subsidence: Overview

The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Although gravity acting on an over steepened slope is the primary reason for a landslide, there are other contributing factors. For example, erosion by rivers, glaciers, or ocean waves can cause rock to fall. Rock and soil slopes may be weakened through saturation by snowmelt or heavy rains, earthquakes can create stresses that make weak slopes fail, and excess weight from accumulation of rain or snow, stockpiling of rock or ore, from waste piles, or man-made structures that may stress weak slopes to the point of collapse.

Land subsidence, according to the USGS, is "a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials". Further, there are three processes that attribute to subsidence: compaction of aquifer systems, drainage and subsequent oxidation of organic soils, and dissolution and collapse of susceptible rocks.

Landslide/Subsidence: Recent Occurrences

The potential for any of landslides or land subsidence within Wabash County was discussed by the Planning Committee. To the knowledge of the Planning Committee, there are no Karst areas within Wabash County. However, there is an extensive network of excavation for limestone mining which pass under railroads, residential areas, and even rivers. In light of this, to date, there has not been any landslides or subsidence events in Wabash County.

The Committee determined the probability of a landslide or subsidence occurring in Wabash County is "Unlikely" to "Possible" resulting in potentially "Negligible" to "Significant" damages. Currently, the Committee feels that the warning time is anticipated to be less than six hours and the duration is also expected to last less than six hours. These events are highly unpredictable and the risk, although very low in some areas according to the Committee, is distributed throughout the county. Therefore, the CPRI values reflect the distributed risk and associated priority for a landslide or subsidence event. A summary is provided in **Table 3-13.**

Table 3-13 CPRI for Landslide/Subsidence

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Wabash County	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
Town of LaFontaine	Possible	Negligible	< 6 Hours	< 6 Hours	Low
Town of Lagro	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of North Manchester	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Roann	Possible	Negligible	< 6 Hours	< 6 Hours	Elevated
City of Wabash	Likely	Limited	< 6 Hours	< 6 Hours	Elevated

Landslide/Subsidence: Assessing Vulnerability

Wabash County, with the presence of limestone mines, is at a low risk of land subsidence or sink holes; "Unlikely" to "Possible" according to the Planning Committee. Magnitude estimates are associated with these areas as well. For example, the Town of Lagro is not over a limestone mining area, and therefore is anticipated to have an "Unlikely" probability along with a "Negligible" magnitude. However, within the City of Wabash, the probability and severity are anticipated to be higher. Fluvial erosion, or erosion and failures along water courses, were considered within the flood discussion.

The effects of a landslide or subsidence event may be minimal to extensive in nature and may affect small or broad ranges of land area. Within Wabash County, direct and indirect effects may include:

Direct Effects:

- Damages to infrastructure (power lines, roads, bridges)
- Damages to individual properties (homes, cars)

Indirect Effects:

- Increased response time for emergency vehicles
- Losses associated with affected land (crop loss)
- Potential contamination of groundwater resources

Estimating Potential Losses

Due to the unpredictability of this hazard all critical infrastructure and non-critical structures in Wabash County are at risk of damage including temporary or permanent loss of function. For landslide and subsidence, it is difficult to isolate specific critical infrastructure or non-critical structures that would be more or less vulnerable to damages. However, areas where underground mines have been identified may be at a higher risk of property damages following these events. **Figure 3-18** identifies the general location of the mine discussed by the Planning Committee, the West Plaines

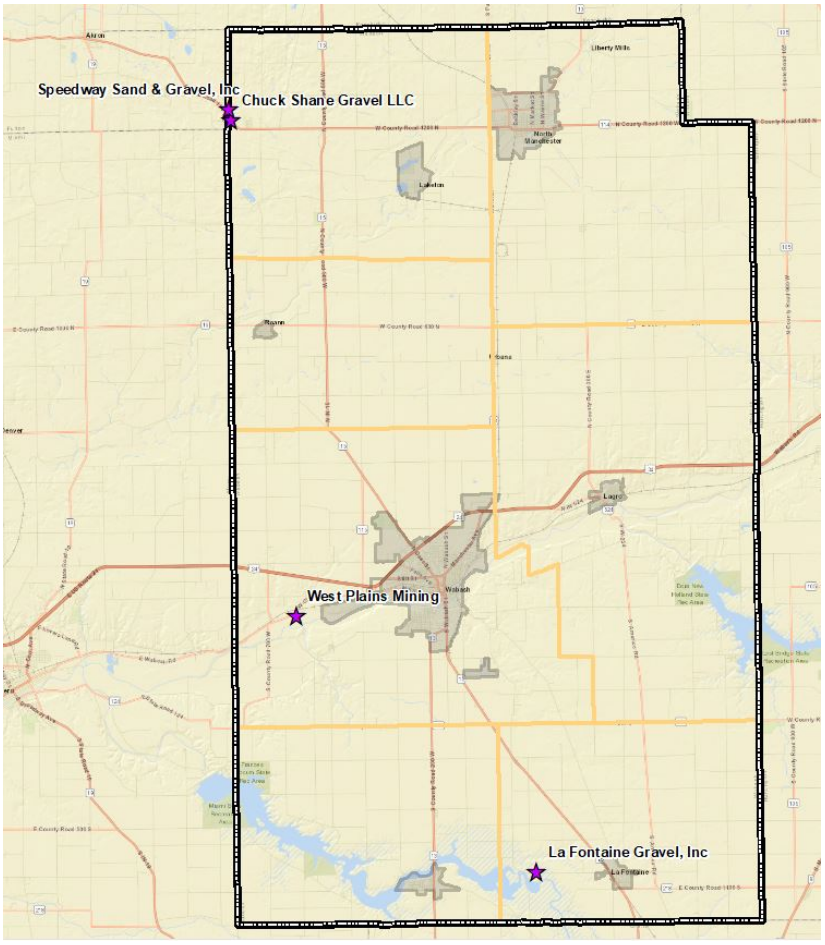


Figure 3-18 Mining and Gravel Locations in Wabash County, Indiana

Mining facility, located approximately three miles southwest of Wabash near the intersection of Old 24 and the Norfolk Southern Railroad. This quarry produces various sizes of crushed stone, rip-rap, and agricultural lime. As it is difficult to know the extensiveness of the underground systems associated with this facility, it may serve the county and the quarry to work together to develop a general outline of affected areas. This area may be at a higher risk for land subsidence. Further, any existing or proposed future developments should be warned of the existence of the higher risk. Additional sand and gravel facilities exist within the county but do not produce the same risk as the mining facility near Richvalley, according to the Planning Committee.

Future Considerations

As the populations of the communities in Wabash County continue to grow, it can be anticipated that the number of critical and non-critical structures will also increase. In order to reduce the vulnerability for damages resulting from a landslide or land subsidence, soils and mining GIS layers should be integrated into the building permit or approval process.

Indirect effects resulting from a landslide or land subsidence event can include power outages caused by downed tree limbs, increased response times for emergency personnel if transportation routes are damaged, and potentially shot down of businesses.

Landslide/Subsidence: Relationship to Other Hazards

A landslide or a subsidence may be the precursor for other hazards. Depending on the location of the event, material storage containers can become damaged resulting in a spill or release of materials and potentially contaminating groundwater reserves. Dam failures may occur in much the same fashion if located in the potential hazard areas, or resulting from heavy saturation following a rainstorm, heavy snow, or rapid snow melt.

Similarly, these types of events may be caused by hail, thunder, or windstorms and their effects on the soils; an earthquake may release the ground enough to set a slide

in motion; or a flood may add increased soil saturation or weight to at-risk areas increasing the potential for an event and resulting damages.

3.3.7 **Tornado**

Tornado: Overview

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 funnel cloud may reach the ground very quickly – becoming a tornado. If there is debris lifted and blown around by the "funnel cloud", then it has reached the ground and is a tornado.

A tornado is generated when conditions in a strong cell are produced that exhibit a wall of cool air that overrides a layer of warm air. The underlying layer of warm air rapidly rises, while the layer of cool air drops – sparking the swirling action. The damage from a tornado is a result of the high wind velocity and wind-clown debris. Tornado season is generally April through June in Indiana, although tornadoes can occur at any time of year. Tornadoes tend to occur in the afternoons and evenings; over 80 percent of all tornados strike between 3:00 pm and 9:00 pm but can occur at any time of day or night as shown in **Figure 3-19**. Tornadoes occur most frequently in the United States east of the Rocky Mountains. Tornadoes in Indiana generally come from the south through the east.

Figure 3-19 Funnel Cloud During a Lightning Storm at Night

While most tornadoes (69%) have winds of less than 100 mph, they can be much stronger. Although violent tornadoes (winds greater than 205 mph) account for only 2% of all tornadoes, they cause 70% of all tornado deaths. In 1931, a tornado in Minnesota lifted an 83-ton rail car with 117 passengers and carried it more than 80 feet. In another instance, a tornado in Oklahoma carried a motel sign 30 miles and dropped it in Arkansas. In 1975, a Mississippi tornado carried a home freezer more than a mile.

Tornado: Recent Occurrences

The classification of tornadoes utilizes the Enhanced Fujita Scale of tornado intensity and damages, described in **Table 3-14**. Tornado intensity ranges from low intensity (EF0) tornadoes with effective wind speeds of 65-85 mph to high intensity (EF5+) tornadoes with effective wind speeds of 200+ mph. According to the NCDC, Wabash County has experienced five tornadoes (2-EF1 and 2-EF2), between January 2011 and October 2018.

Table 3-14 Enhanced Fujita Scale of Tornado Intensity

EF-SCALE	WINDS	CHARACTER OF DAMAGE	RELATIVE FREQUENCY	TYPICAL DAMAGES
EF0	65-85 mph	Light damage	29%	Shallow rooted trees blown over; damage to roofs, gutters, siding
EF1	86-110 mph	Moderate damage	40%	Mobile homes overturned, roofs stripped, windows broken
EF2	111-135 mph	Considerable damage	24%	Large trees snapped, light-object missiles generated, cars lifted
EF3	136-165 mph	Severe damage	6%	Severe damages to large buildings, trains overturned
EF4	166-200 mph	Devastating damage	2%	Whole houses destroyed, cars thrown
EF5	200+ mph	Incredible damage	<1%	High-rise buildings with significant damage, strong framed homes blown away

A tornado reported by the NCDC occurred on July 1, 2014 and touched down west of SR 15 in a corn field. The funnel stayed on the ground for approximately seven miles before entering Kosciusko County, damaging crops and several farmsteads along the path. While no monetary property or crop damages were reported with this event, from the narrative, it can be anticipated that several tens of thousands of dollars in losses were experienced.

Again, with no reports of monetary damages, a March 31, 2016 tornado near Hartman (W CR100S, east of S CR475W) destroyed farm outbuildings and removed a roof from a pole barn as well as launched a mobile home four feet and drove it into the ground 18 inches. Debris from this mobile home was located a quarter mile away.

The Committee estimated the probability of a tornado occurring in Wabash County would be "Likely" within the unincorporated to "Possible" in all other areas. While this may not seem to coincide with the number of tornadoes experienced in the most recent past, it is the anticipation of the Planning Committee that this hazard may occur. The magnitude and severity of such an event to be "Limited" within the County and smaller municipalities, "Critical" in the city of Wabash, and "Significant" if a tornado were to strike any of the town of North Manchester. As with many hazardous events, the Committee anticipated a short warning time, less than six hours, and a short duration, also less than six hours. The summary is shown in **Table 3-15**.

Table 3-15 CPRI for Tornado

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Wabash County	Likely	Limited	< 6 Hours	< 6 Hours	Elevated
Town of LaFontaine	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Lagro	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of North Manchester	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
Town of Roann	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
City of Wabash	Possible	Critical	< 6 Hours	< 6 Hours	Elevated

The Indiana State Climate Office estimates that throughout Indiana, there is an average of 20 tornado touchdowns per year. Based on the number of tornado touchdowns previously reported through the NCDC and local weather agencies, the Committee determined the general probability of a future tornado occurring in Wabash County is likely to "Possible" (within the next five years) in all areas except the larger, unincorporated region, where it is anticipated to be "Likely" or in the next three years.

Tornado: Assessing Vulnerability

As a path of a tornado is not pre-defined, it is difficult to isolate specific critical infrastructure and non-critical structures, or areas of Wabash County that would be more or less vulnerable to a tornado. Direct and indirect effects from a tornado may include:

Direct Effects:

- Damages to older construction structures, mobile homes, and accessory structures (pole barns, sheds, etc.)
- Damages to above ground utility lines and structures

Indirect Effects:

- Expenses related to debris clean-up and/or reconstruction
- Loss of revenue for affected businesses
- Loss of work if employers are affected

Estimating Potential Losses

Due to the unpredictability of this hazard, all critical and non-critical structures within the County are at risk of future damage or loss of function. Estimates of potential physical losses were determined through a hypothetical exercise where an F2 intensity tornado traveled through portions of the County. This is intended to present a "what-if" scenario of a tornado incident and associated damages. Damage estimates were derived by assuming that 25% of all structures in the path of the tornado would be completely destroyed, 35% would be 50% damaged, and 40%

would have only 25% damage. These estimations were also determined utilizing three wind speed zones based on distance from the tornado path. Zone A is nearest the center of the tornado path, while Zone C is the farthest from the path and with a theoretical lower wind speed. **Table 3-16** provides summary data for the hypothetical tornado, which is identified on Exhibit 3.

Table 3-16 Summary of Hypothetical Tornado Damages

	Zone 1		Zone 2		Zone 3		Total	
	#	$	#	$	#	$	#	$
Wabash	176	$7.4M	80	$3.3M	77	$3.0M	**333**	**$13.7M**

Future Considerations

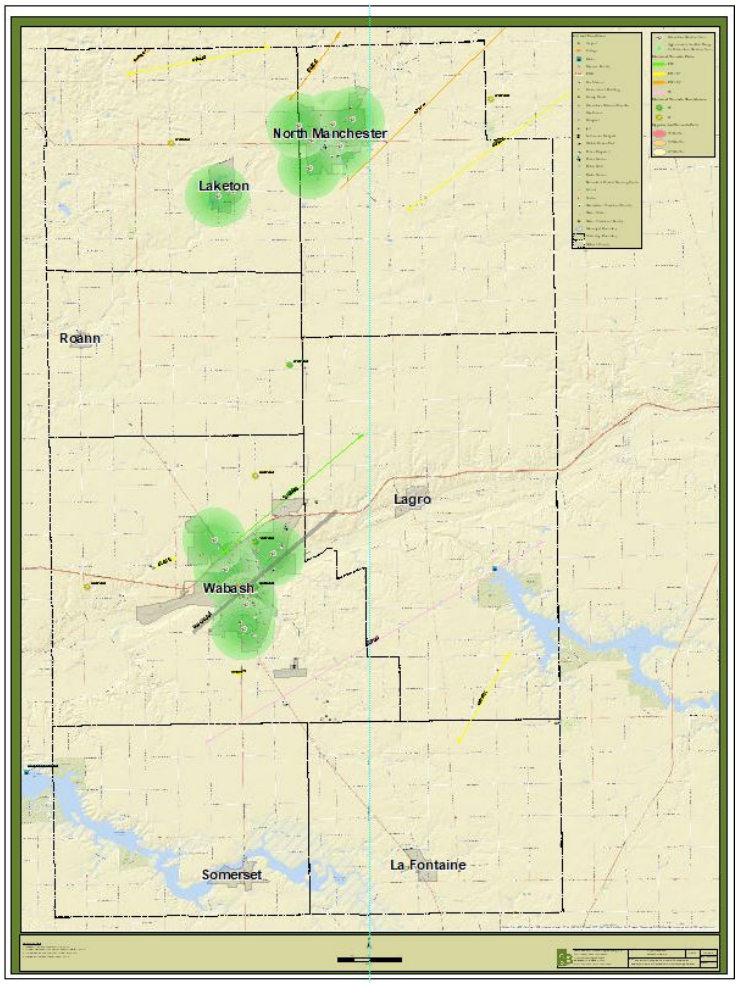


Figure 3-20 Wabash County Outdoor Warning Sirens

Within Wabash County, there are numerous events each year that draw thousands of guests. Due to this, it is imperative that the EMA place continued importance on the need to maintain, and as necessary, upgrade their outdoor warning siren coverage. Currently, much of the more populous areas of the County are covered by the audible ranges of the existing outdoor warning sirens. However, much of the unincorporated area and the communities of LaFontaine, Lagro, and Roann are not covered by an outdoor warning siren. The existing siren locations and their coverage areas are provided in **Figure 3-20**.

Scientists are continuing to determine the effects of climate change related to the number of tornadoes occurring each year. As temperatures rise, storms seasons may be lengthened, necessitating an increase in readiness and planning for response agencies.

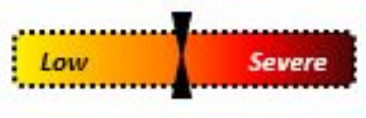
There may also be indirect effects of a tornado event. For example, post-event clean-up may result in high expenses or inability to work for property owners that have experienced damages from either the tornado directly or by debris from high winds. Affected business owners may experience loss of revenue if unable to continue operations following the event. Similarly, if a business is affected and unable to operate, employees may experience a loss of wages during the period of recovery.

Tornado: Relationship to Other Hazards

Tornadoes may result in a hazardous materials incident. Material storage containers can become damaged by high winds and debris can result in a spill or release of materials. As wind speeds increase, the potential for damages to above ground storage containers also increases. Tankers and other transportation vehicles carrying hazardous materials are also at an increased risk while on the road or rail.

Tornadoes may also result in a dam failure as the increased wind speeds, and debris caused by the tornado, may directly impact the dam, or cause indirect damages through large debris or downed trees. In addition, tornadoes may lead to structural fires as the destruction path is sometimes long and broad, leading to an increased number of potentially damaged homes, exposed power lines, and large amounts of debris.

3.3.8 **Wildfire**



Wildfire: Overview

Figure 3-21 Wildfire in Forested Area

A wildfire, also known as a forest fire, vegetation fire, or a bushfire, is an uncontrolled fire in wildland areas and is often caused by lightening; other common causes are human carelessness and arson. Small wildfires may be contained to areas less than one acre, whereas larger wildfires can extend to areas that cover several hundred or even thousand acres. Generally, ambient weather conditions determine the nature and severity of a wildfire event. Very low moisture and windy conditions can help to exacerbate combustion in forested or brush areas (**Figure 3-21**) and turn a small brush fire into a major regional fire event in a very short period. Wildfires can be very devastating for residents and property owners.

Typically, a wildfire will incinerate all structures and objects in its path. A resident may lose all possessions and structures to a wildfire event. Additionally, combating a wildfire may be extremely dangerous. If weather conditions change suddenly, the wildfire may change course and overtake firefighters, causing severe injury or death. Particularly dangerous are the narrow valley corridors that could act like a chimney and direct wildfire rapidly up the valley corridor. Wildfires can travel at speeds greater than 45 mph. Therefore, these hazard events can pose a serious threat to County residents and response agencies.

Wildfire: Recent Occurrences

Within the NCDC, there are no reports of wildfires occurring within Wabash County between January 1950 and October 2018. Within the same time parameter, there were only 2 reported events within the State of Indiana, both within Pike County and both within 2006. During each of these events over 350 acres were burned.

Due to the expansive acreage of cropland and woods within Wabash County, the Planning Committee decided to include this hazard within the MHMP, as it is a real concern, but determined the probability to be "Unlikely" to "Possible" throughout the County. **Table 3-17** identifies the CPRI rankings for wildfire in Wabash County.

Table 3-17 CPRI for Wildfire

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Wabash County	Possible	Negligible	< 6 Hours	< 1 Week	Elevated
Town of LaFontaine	Possible	Negligible	< 6 Hours	< 6 Hours	Low
Town of Lagro	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of North Manchester	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Roann	Possible	Negligible	< 6 Hours	< 6 Hours	Low
City of Wabash	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low

Few reports were provided for small to moderate wildfires within Indiana, but none provided information related to property or structural damages, or any injuries or deaths resulting from the fire. An article from the UPI discusses an event from 2010 affecting several counties in east-central Indiana. Several homes were evacuated and the fire reached nearly 1,000 acres. At this same time, the Mayor of Indianapolis issued a burn ban due to the extremely dry weather.

Wildfire: Assessing Vulnerability

A wildfire typically affects a large regional area with potential for physical, economic, and/or social losses. Direct and indirect effects of a such an event within Wabash County may include:

Direct Effects:

- Loss of structures
- Loss of production crop
- Loss of natural resources

Indirect Effects:

- Loss of revenue as businesses may be closed
- Increased emergency response times based on safety of roads
- Loss of income if dependent on crop production

Estimating Potential Losses

Given the nature and complexity of a potentially large hazard such as a wildfire, it is difficult to quantify potential losses to property and infrastructure. As a result, all critical and non-critical structures and infrastructure may be at some degree of risk from wildfire impacts.

In general, this hazard is not typically as damaging to structures or critical infrastructure as it is to cropland and natural resources such as forests and grasslands so monetary damages associated with the direct effects of the wildfire are not possible to estimate. Indirect effects would cause increased efforts associated with emergency response services as wildfires are difficult to contain and may accelerate very quickly.

Future Considerations

As populations increase and communities continue to grow in size, the need to respond to wildfire will remain an important municipal effort. As new construction or re-development occurs, especially new or existing critical infrastructure, it is important to ensure that these new structures are equipped to deal with the potential risks associated with this hazard. Those may include increased risk for wooden or flammable outer structures and potential lengthy power outages.

With an increase in temperatures associated with predicted climate change, areas may be more susceptible to fires in the urban, rural, or forest settings. The anticipated increase in precipitation may combat the vulnerability, however, there may be instances when the two weather instances are not aligned, and a period of extreme heat is matched with a period of no rain, increasing the vulnerability of an ignition. During these periods, response agencies need to be on high alert.

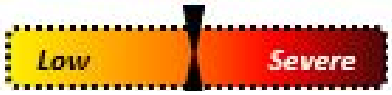
Wildfires can also result in substantial indirect costs. Increased emergency response times, loss of work or the inability to get to work, as well as business interruption, are possible indirect effects of a wildfire and how it may affect those businesses directly related to cropland or natural resource areas.

Wildfire: Relationship to Other Hazards

Wildfires may certainly result in a hazardous materials incident if storage structures are within the path of the burn. Material storage containers farther away from the burn path may become damaged by high winds and embers resulting in a spill or release of materials.

Wildfires may result from lightning associated with a thunderstorm. Typical wind speeds during a thunderstorm may also exacerbate the impacts from any ignitions from the lightning.

3.3.9 Winter Storm & Ice



Winter Storm & Ice: Overview

A winter storm can range from moderate snow over a few hours to blizzard conditions with high winds, ice storms, freezing rain or sleet, heavy snowfall with blinding wind-driven snow, and extremely cold temperatures that can last for several days. Some winter storms may be large enough to affect several states while others may affect only a single community. All winter storms are accompanied by cold temperatures and blowing snow, which can severely reduce visibility. A winter storm is one that drops 4 or more inches of snow during a 12-hour period, or 6 or more inches during a 24-hour span. An ice storm occurs when freezing rain falls from clouds and freezes immediately on impact. All winter storms make driving and walking extremely hazardous. The aftermath of a winter storm can affect a community or region for days, weeks, and even months.

Figure 3-22 Ice Covered Power Lines

Storm effects such as extreme cold, flooding, and snow and ice accumulation (**Figure 3-22**) can cause hazardous conditions and hidden problems for people in the affected area. People can become stranded on the road or trapped at home, without utilities or other services, including food, water, and fuel supplies. The conditions may overwhelm the capabilities of a local jurisdiction. Winter storms are considered deceptive killers as they may indirectly cause transportation accidents, and injury and death resulting from exhaustion/overexertion, hypothermia and frostbite from wind chill, and asphyxiation; and house fires occur more frequently in the winter due to lack of proper safety precautions.

Wind chill is a calculation of how cold it feels outside when the effects of temperature and wind speed are combined. On November 1, 2001, the NWS implemented a replacement Wind Chill Temperature (WCT) index for the 2001/2002 winter season. The reason for the change was to improve upon the current WCT Index, which was based on the 1945 Siple and Passel Index.

A winter storm watch indicates that severe winter weather may affect your area. A winter storm warning indicates that severe winter weather conditions are definitely on the way. A blizzard warning means that large amounts of falling or blowing snow and sustained winds of at least 35 mph are expected for several hours. Winter storms

are common in Wabash County. Such conditions can result in substantial personal and property damage, even death.

Winter Storm & Ice: Recent Occurrences

Since January 2011, the NCDC has recorded one blizzard, four winter storms, and five heavy snow events. NCDC reports did not include injuries, deaths, or monetary damages associated with any of the events. Narrative descriptions indicated poor travel conditions, power outages and debris associated with similar events.

The most recent event recorded in NCDC occurred on December 11, 2016 following 7.0 inches of snowfall, freezing rain, and small amounts of ice accumulations throughout the day. Roads were very slick resulting in slide-offs and school cancellations. Similar results were experienced during the February 2, 2015 event when rain mixed with snow between January 31 and February 2. Accumulations ranged from three inches in the southern areas of Wabash County to slightly more than 10 inches in the northern areas of Wabash County. Slide-offs and power outages were common during this event.

The probability, magnitude, warning times, and duration of a snow storm or ice storm causing disruption to residents and businesses in Wabash County, as determined by the Planning Committee, is expected to be somewhat consistent throughout the County and NFIP communities. It is "Highly Likely" that this type of hazard will occur in areas of North Manchester and Wabash and "Likely" to occur in all other areas. Such an event will result in primarily "Limited" severity as many residents of Wabash County are accustomed to snow and ice storms and have therefore, prepared themselves accordingly. The warning time for severe temperatures or several inches of snow associated with a winter storm is usually between six and twelve hours while the duration of the incident is anticipated to last less than one week in the more remote areas and less than one day in areas where crews are able to deal with the repercussions of the event. A summary is shown in **Table 3-18**.

Table 3-18 CPRI for Winter Storm and Ice

	PROBABILITY	MAGNITUDE / SEVERITY	WARNING TIME	DURATION	CPRI
Wabash County	Likely	Limited	6-12 Hours	< 1 Week	Elevated
Town of LaFontaine	Likely	Limited	6-12 Hours	< 1 Week	Elevated
Town of Lagro	Likely	Limited	6-12 Hours	< 1 Week	Elevated
Town of North Manchester	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe
Town of Roann	Likely	Limited	6-12 Hours	< 1 Day	Elevated
City of Wabash	Highly Likely	Limited	6-12 Hours	< 1 Day	Severe

The Planning Committee determined that the probability for a snow storm or ice storm to occur in Wabash County is "Likely" to "Highly Likely" or will occur within

the next three years. Based on historical data and the experience of the Planning Committee, snow storms are common within Wabash County and will continue to be a routine occurrence.

Winter Storm & Ice: Assessing Vulnerability

A snow storm typically affects a large regional area with potential for physical, economic, and/or social losses. Direct and indirect effects of a snow storm or ice storm within Wabash County may include:

Direct Effects:

- More urban area employers may experience loss of production as employees may not be able to get to work
- Rural (County) roads may impassable
- Expenses related to snow removal or brine/sand applications

Indirect Effects:

- Loss of revenue as businesses are closed
- Increased emergency response times based on safety of roads
- Loss of income if unable to get to place of employment

Estimating Potential Losses

Given the nature and complexity of a regional hazard such as a snow storm, it is difficult to quantify potential losses to property and infrastructure. As a result, all critical and non-critical structures and infrastructure are at risk from snow storm and ice storm incidents.

For planning purposes, information collected in snow storms impacting other communities around the nation is also useful in assessing the potential social, physical, and economic impact that a winter storm could have on Allen County communities. For example, a March 2003 snow storm in Denver, Colorado dropped approximately 31 inches of snow and caused an estimated $34M in total damages. In addition, a February 2003 winter storm dropped an estimated 15-20 inches of snow in parts of Ohio. The Federal and Ohio Emergency Management Agencies and U.S. Small Business Administration surveyed damaged areas and issued a preliminary assessment of $17M in disaster related costs. These costs included snow and debris removal, emergency loss prevention measures, and public utilities

Figure 3-23 Travel Impacted During Snow Storm

repair. The agencies found over 300 homes and businesses either damaged or destroyed in 6 counties. Snow storms and blizzards also make road travel difficult and dangerous, as in **Figure 3-23**.

The Denver, Colorado area snowstorms from December 2006 through January 2007 surpassed the expenses and damages of the 2003 winter storms. In snow removal costs alone, it is estimated that over $19M was spent throughout the area, with approximately $6.4M of that allocated to clearing Denver International Airport. Additional economic expenses are realized when such a large storm closes local businesses and Denver International Airport for nearly 48 hours.

While the above examples indicate the wide-ranging and large-scale impact that winter storms can have on a community or region, in general, winter storms tend to result in less direct economic impacts than many other natural hazards. According to the Workshop on the Social and Economic Impacts of Weather, which was sponsored by the U.S. Weather Research Program, the American Meteorological Society, the White House Subcommittee on Natural Disaster Relief, and others, winter storms resulted in an average of 47 deaths and more than $1B in economic losses per year between 1988 and 1995. However, these totals account for only 3% of the total weather-related economic loss and only 9% of fatalities associated with all weather-related hazards over the same period.

Future Considerations

As populations increase and communities continue to grow in size, the need to respond to snow storms or ice storms will remain an important municipal effort. As new construction or re-development occurs, especially new or existing critical infrastructure, it is important to ensure that these new structures are equipped to deal with the potential risks associated with this hazard. Those may include lengthy power outages and potentially impassable transportation routes, making it difficult to obtain supplies or for passage of response vehicles.

Winter storms can also result in substantial indirect costs. Increased emergency response times, loss of work or the inability to get to work, as well as business interruption, are possible indirect effects of a winter storm. According to a report by the National Center for Environmental Predictions, the cold and snowy winter in late 1977 and early 1978, which impacted several heavily populated regions of the country, was partially responsible for reducing the nation's Gross Domestic Product (GDP) from an estimated growth rate of between 6% and 7% during the first 3 quarters of 1977 to approximately -1% in the last quarter of 1977 and 3% during the first quarter of 1978.

<u>Winter Storm & Ice: Relationship to Other Hazards</u>

Winter storms and ice storms can lead to flooding as the precipitation melts and enters local receiving water bodies. This increased volume of water on already saturated, or still frozen ground can quickly result in flooding related damages to

Figure 3-24 Flooding Caused by Snow Melt

structures and properties (**Figure 3-24**) as well as within the stream or river channel. The increased flooding may then lead to a dam failure within the same area, further exacerbating the damages.

Hazardous materials incidents may be caused by poor road conditions during winter storms or ice storms. Many hazardous materials are transported by rail or by tanker over highways and interstates. In the more rural areas of Wabash County, or where open areas are more susceptible to drifted roads, the possibility of a traffic related hazardous materials incident may increase.

Power outages and other infrastructure failures may also occur during a winter storm. Weight from snow and ice accumulations can directly or indirectly cause power lines to fail. During extreme cold temperatures, power outages may prove deadly for certain populations such as the elderly or ill.

TECHNOLOGICAL HAZARDS

3.3.10 Dam Failure

Dam Failure: Overview

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

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

Of the approximately 80,000 dams identified nationwide in the National Inventory of Dams, the majority are privately owned. Each dam is assigned a downstream hazard classification based on the potential loss of life and damage to property should the dam fail. The three classifications are high, significant, and low. With changing demographics and land development in downstream areas, hazard classifications are updated continually. The following definitions of hazard classification currently apply to dams in Indiana:

- High Hazard Dam: a structure the failure of which may cause the loss of life and serious damage to homes, industrial and commercial buildings, public utilities, major highways, or railroads.
- Significant Hazard Dam: a structure the failure of which may damage isolated homes and highways or cause the temporary interruption of public utility services.
- Low Hazard Dam: a structure the failure of which may damage farm buildings, agricultural land, or local roads.

Dam Failure: Recent Occurrences

Within Wabash County, there is one high hazard dam (regulated by the Army Corps of Engineers) as shown on Exhibit 2; the Salamonie Reservoir Dam. There have been no recorded dam failures within Wabash County. Further, there are two additional High Hazard dams, also regulated by the Army Corps of Engineers, which are located outside of Wabash County. If a breach were to ok at either of these dams, it is anticipated that flood waters would reach into Wabash County. These dams are the Mississinewa Dam in Miami County to the west, and Roush Lake Dam in Huntington County to the east.

Based on the information provided to them, the Committee determined the probability of a dam failure is "Unlikely" to "Possible" dependent upon location of the community in regard to the location of either of the three dams listed above. The anticipated effects of "Negligible" (areas not anticipated to be within the inundation area) to "Significant" (areas anticipated to be within the inundation area) damages were determined by the Committee. **Table 3-19** provides a summary of the Planning Committee's expectations during a dam failure.

Table 3-19 CPRI for Dam Failure

	PROBABILITY	MAGNITUDE / SEVERITY	WARNING TIME	DURATION	CPRI
Wabash County	Possible	Critical	< 6 Hours	< 1 Day	Elevated
Town of LaFontaine	Possible	Significant	< 6 Hours	< 1 Day	Elevated
Town of Lagro	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of North Manchester	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of Roann	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
City of Wabash	Possible	Significant	< 6 Hours	< 1 Day	Elevated

Dam Failure: Assessing Vulnerability

Within Wabash County, direct and indirect effects from a dam failure may include:

Direct Effects:

- Loss of life and serious damage to downstream homes, industrial and commercial buildings, public utilities, major highways, or railroads
- Use of reservoirs for flood control, recreation, and water supply

Indirect Effects:

- Loss of land in the immediate scour area
- Increased response times due to damaged or re-routed transportation routes and/or bridges
- Loss of park area near dams

Due to the conditions beyond the control of the dam owner or engineer, there may be unforeseen structural problems, natural forces, mistakes in operation, negligence, or vandalism that may cause a dam to fail. Fortunately, all three dams currently have an Incident & Emergency Action Plan (IEAP) prepared along with estimated dam failure inundation mapping. Further, the IEAPs are routinely reviewed with county response agencies to review the action items and efforts needed during various phases and levels of emergency.

Estimating Potential Losses

The actual magnitude and extent of damages due to a dam failure depend on the type of dam break, volume of water that is released, and the width of the floodplain valley to accommodate the dam break flood wave. However, to provide an example of anticipated damages, the potential dam failure inundation areas (created during the development of the IEAP) for the Salamonie Reservoir Dam in Wabash County, and the Mississinewa Dam and the Roush Lake Dam, both outside of Wabash County were overlaid onto recent aerial photography to estimate the number of critical and non-critical structures potentially affected by a dam failure.

Detailed mapping completed by the Army Corps of Engineers is not intended for public distribution and will not be included within this plan. For this planning effort, however, the potential impacts to structures located within those areas anticipated to be affected by a dam failure may be presented. As with previous hazards, damage estimates were derived by assuming 25% of all structures would be completely destroyed, 35% would be 50% damaged, and the remaining 40% of structures would have only 25% in damages. **Table 3-20** provides summary data for the individual dam failures.

Table 3-20 Potential Dam Failure Impacts

NFIP	Salamonie Reservoir Dam		Roush Lake Dam		Mississinewa Lake Dam		Total	
	#	$	#	$	#	$	#	$
Wabash County	286	$11.3M	73	$2.8M	58	$2.2M	417	**$16.3M**
Wabash	460	$22.4M	79	$4.0M	24	$1.4M	563	**$27.8M**
Lagro	118	$4.8M	4	$0.2M	2	$0.1M	124	**$5.1M**
TOTAL	**864**	**$38.5M**	**156**	**$7.0M**	**84**	**$3.7M**	**1,104**	**$49.2M**

Utilizing the same GIS process, **Table 3-21** identifies the number of critical infrastructure within each of the potential dam failure inundation areas in Wabash County. These buildings are included in the overall number of structures and damage estimate information provided in Table 3-20.

Table 3-21 Critical Infrastructure Impacted by Dam Failure

NFIP	Salamonie Reservoir Dam	Roush Lake Dam	Mississinewa Lake Dam
Wabash County	Austin Powder (Hazmat)	Austin Powder (Hazmat)	Austin Powder (Hazmat)
Wabash	City Hall, Group Homes (3), Siren, Nustart (Healthcare), YMCA, WWTP, Bulldog Battery, IN-American Water, JM Reynolds Oil, North Central Co-Op, Smurfit Stone, Speedway, Verizon, Wabash Plain Dealer		
Lagro	Fire Station, Town Hall, Public Well #1, IN Bell (Hazmat)		

To best estimate anticipated damages from dams within and surrounding Wabash County, IEAPs should be reviewed and response agencies should continue to participate in the exercises and updates associated with each dam.

Future Considerations

As areas near existing dams continue to grow in population, it can be anticipated that the number of critical and non-critical structures will also increase accordingly. Location of these new facilities should be carefully considered, and precautions should be taken to ensure that schools, medical facilities, municipal buildings, and other critical infrastructure are located outside of the delineated or estimated dam failure inundation areas. Also, flood-free access should be provided for these facilities.

Within this section, considerations have been related to a sunny day dam failure. However, climate change may have an indirect effect on dams. As an increase in rainfall is anticipated, dams may be under additional stress due to the amount of water behind them. Further, the structures may be overtopped or fail following a period of increased rainfall. As increased precipitation falls in the area upstream of the dam and these events are happening with greater frequency and over a shorter duration, stress increases on the dam structures.

It is also very important to all downstream communities and property owners that IEAPs are kept up-to-date, and routinely exercised to ensure the greatest safety to those within the hazard area.

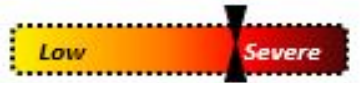
Dam Failure: Relationship to Other Hazards

With the large volumes and velocities of water released during a dam breach, it can be expected a dam failure would lead to flooding within the inundation areas downstream of the dam. Downstream bridges and roads are also in danger of being destroyed or damaged. Bridges may become unstable and portions of road surfaces

may be washed away, or the entire road may be undermined. Other infrastructure such as utility poles and lines may be damaged as the water flows along the surface or pipes may become exposed due to scouring; all of which may lead to utility failures within the area downstream of the dam failure.

Several other independent hazards may also lead to a dam failure. Hazards such as flooding, the melting of snow or ice, or rapid precipitation associated with thunderstorms, may all lead to increased pressure on the dam structures or overtopping of the structures, leading to failure. Additionally, earthquakes or tornadoes may cause damage to the structures or earthen components of the dam resulting in irreparable damages or failure.

3.3.11 **Hazardous Materials Incident**



Hazardous Materials Incident: Overview

Hazardous materials are substances that pose a potential threat to life, health, property, and the environment if they are released. Examples of hazardous materials include corrosives, explosives, flammable materials, radioactive materials, poisons, oxidizers, and dangerous gases. Despite precautions taken to ensure careful handling during manufacture, transport, storage, use, and disposal, accidental releases are bound to occur. These releases create a serious hazard for workers, neighbors, and emergency response personnel. Emergency response may require fire, safety/law enforcement, search and rescue, and hazardous materials response units.

Figure 3-25 Drums of Potentially Hazardous Waste

As materials are mobilized for treatment, disposal, or transport to another facility, all infrastructure, facilities, and residences in close proximity to the transportation routes are at an elevated risk of being affected by a hazardous materials release. Often these releases can cause serious harm to Wabash County and its residents if proper and immediate actions are not taken. Most releases are the result of human error or improper storage (**Figure 3-25**), and corrective actions to stabilize these incidents may not always be feasible or practical in nature.

Railways often transport materials that are classified as hazardous and preparations need to be made and exercised for situations such as derailments, train/vehicle crashes, and/or general leaks and spills from transport cars.

Hazardous Materials Incident: Recent Occurrences

During conversations with Committee members and through information provided by local news outlets, it was noted that no significant incidents involving manufacturing facilities and transportation routes have occurred since the development of the original MHMP. However, the number of facilities utilizing, storing, and/or manufacturing chemicals and the number of high-volume transportation routes increase the likelihood of an incident.

According to the Committee, the probability of a hazardous materials release or incident is "Likely" to "Highly Likely" due to the number of facilities and transportation routes within and through the municipalities and unincorporated areas of the county. "Limited" to "Critical" damages are anticipated to result from an incident dependent upon the location of the incident. As with hazards of this nature, a short warning time of less than six hours and duration of less than one week is anticipated in the event of a hazardous materials incident. A summary is shown in **Table 3-22**.

Table 3-22 CPRI for Hazardous Materials Incident

	PROBABILITY	MAGNITUDE / SEVERITY	WARNING TIME	DURATION	CPRI
Wabash County	Highly Likely	Limited	< 6 Hours	< 1 Week	Severe
Town of LaFontaine	Likely	Critical	< 6 Hours	< 1 Week	Severe
Town of Lagro	Likely	Critical	< 6 Hours	< 1 Week	Severe
Town of North Manchester	Likely	Critical	< 6 Hours	< 1 Week	Severe
Town of Roann	Likely	Limited	< 6 Hours	< 1 Week	Elevated
City of Wabash	Highly Likely	Critical	< 6 Hours	< 1 Week	Severe

Relatively small hazardous materials incidents have occurred throughout Wabash County in the past and may, according to the Committee, to occur again. As the number of hazardous materials producers, users, and transporters increase within or surrounding Wabash County, it can be anticipated that the likelihood of a future incident will also increase.

Hazardous Materials Incident: Assessing Vulnerability

Within Wabash County, direct and indirect effects from a hazardous materials incident may include:

Direct Effects:

- More densely populated areas with a larger number of structures, railroad crossings, and heavily traveled routes are more vulnerable
- Expense of re-construction of affected structures

Indirect Effects:

- Loss of revenue or production while recovery and/or reconstruction occurs
- Anxiety or stress related to event
- Potential evacuation of neighboring structures or facilities

While the possibility of an incident occurring may be likely, the vulnerability of Wabash County has been lowered due to the enactment of Superfund Amendments and Reauthorization Act (SARA) Title III national, state and local requirements. SARA Title III, also known as the Emergency Planning and Community Right to Know Act (EPCRA), establishes requirements for planning and training at all levels of government and industry. EPCRA also establishes provisions for citizens to have access to information related to the type and quantity of hazardous materials being utilized, stored, transported or released within their communities.

One local result of SARA Title III is the formation of the Local Emergency Planning Commission (LEPC). This commission has the responsibility for preparing and implementing emergency response plans, cataloging Material Safety Data Sheets

(MSDS), chemical inventories of local industries and businesses, and reporting materials necessary for compliance.

Figure 3-26 Fuel Tanker Fire

In Wabash County, 61 facilities are subject to SARA Title III provisions due to the presence of listed hazardous materials in quantities at or above the minimum threshold established by the Act. These facilities are also required to create and distribute emergency plans and facility maps to local emergency responders such as the LEPC, fire departments, and police departments. With this knowledge on hand, emergency responders and other local government officials can be better prepared to plan for an emergency, the response it would require, and prevent serious affects to the community involved.

Estimating Potential Losses

In addition, the very nature of these events makes predicting the extent of their damage very difficult. A small-scale spill or release might have a minor impact and would likely require only minimal response efforts. Another slightly larger incident might result in the disruption of business or traffic patterns, and in this situation might require active control response measures to contain a spill or release. On the other hand, even small or moderate events could potentially grow large enough that mass evacuations or shelter in place techniques are needed, multiple levels of response are utilized, and additional hazards such as structural fires and/or additional hazardous materials releases (or explosions) may occur. Given the unpredictable nature of hazardous materials incident, an estimate of potential losses was not estimated.

Future Considerations

Figure 3-27 Wabash County Transportation Routes

Additional facilities, both critical and non-critical in nature may be affected if a hazardous materials release were to occur along a transportation route (**Figure 3-27**). Several routes including US Highway 24; SR 13, 15, 16, 114, 218, and 524 are traveled by carriers of hazardous materials. Several rail lines also dissect Wabash County.

By restricting development within the known hazardous materials facility buffer zones, future losses associated with a hazardous materials release can be reduced. Critical infrastructure especially should be discouraged from being located within these areas. Further, by restricting construction in these zones, the number of potentially impacted residents may also be greatly reduced, lowering the risk for social losses, injuries, and potential deaths. Future construction of hazardous materials facilities should be located away from critical infrastructure such as schools, medical facilities, municipal buildings, and daycares, reducing the risk to highly populated buildings and potentially populations with specials needs or considerations such as children, elderly, and medically unfit.

<u>Hazardous Materials Incident: Relationship to Other Hazards</u>

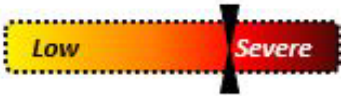
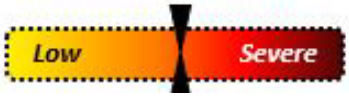
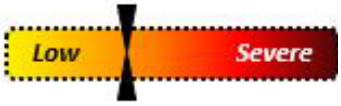
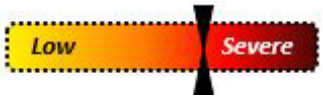
Dependent on the nature of the release, conditions may exist where an ignition source such as a fire or spark is in close proximity to a flammable or explosive substance. As the fire spreads throughout the facility or the area, structural and/or property damages will increase. Response times to a hazardous materials incident may be prolonged until all necessary information is collected detailing the type and amount of chemicals potentially involved in the incident. While this may increase structural losses, it may actually decrease the social losses such as injuries or even deaths.

3.4 HAZARD SUMMARY

For the development of this MHMP, the Committee utilized the CPRI method to prioritize the hazards they felt affected Wabash County. Hazards were assigned values based on the probability or likelihood of occurrence, the magnitude or severity of the incident, as well as warning time and duration of the incident itself. A weighted CPRI was calculated based on the percent of the County's population present in the individual NFIP communities.

Table 3-23 summarizes the CPRI values for the various hazards studied within this MHMP. The hazards that ranked as "Low" were Drought and Wildfire. "Elevated" risks were Dam Failure; Earthquake; Extreme Temperature; Flood; Hailstorm, Thunderstorm and Windstorm; Land Subsidence; Tornado; and Winter Storm and Ice. The hazard with a "Severe" risk was Hazardous Materials Incident.

Table 3-23 Combined CPRI

TYPE OF HAZARD	LIST OF HAZARDS	WEIGHTED AVERAGE CPRI
Natural	Drought	
	Earthquake	
	Extreme Temperature	
	Flood	
	Hail/Thunder/Windstorm	
	Landslide/Subsidence	
	Tornado	
	Wildfire	
	Winter Storm/Ice	
Technological	Dam Failure	
	Hazardous Materials Incident	

It can be important to understand the cause and effect relationship between the hazards selected by the Committee. **Table 3-24** can be utilized to identify those relationships. For example, a winter storm (along the side of the table) can result in a flood (along the top of the table). In a similar fashion, a hazardous materials incident (along the top of the table) can be caused by an earthquake; flood; tornado; or a winter storm or ice storm (along the side of the table)

Table 3-24 Hazard Relationship Table.

EFFECT → / CAUSE ↓	Drought	Earthquake	Extreme Temperature	Flood	Hailstorm, Thunderstorm, Windstorm	Landslide / Subsidence	Tornado	Winter Storm, Ice	Wildfire	Dam Failure	Hazardous Materials
Drought											
Earthquake						X				X	X
Extreme Temperature											
Flood						X				X	X
Hailstorm, Thunderstorm, Windstorm				X		X				X	X
Landslide / Subsidence											X
Tornado										X	X
Winter Storm, Ice				X						X	X
Wildfire						X					X
Dam Failure				X		X					X
Hazardous Materials											

As a method of better identifying the potential relationships between hazards, Exhibit 3 can be referenced to indicate the proximity of one or more known hazard areas such as the delineated floodplains and the locations of EHS facilities. For this reason, the City of Wabash or any other community may be impacted by more than one hazard at a time, depending on certain conditions. It can be anticipated that if a flood were to occur within these areas, there would be a potentially increased risk of this facility experiencing a hazardous materials incident.

Future development in areas where multiple known hazard areas (dam failure inundations areas, floodplains and surrounding hazardous materials facilities) overlap should undergo careful design, review, and construction protocol to reduce the risk of social, physical, and economic losses due to a hazard incident. While it may certainly be difficult, critical infrastructure should not be constructed within these regions.

CHAPTER 4 MITIGATION GOALS AND PRACTICES

This section identifies the overall goal for the development and implementation of the Wabash County MHMP. A summary of existing and proposed mitigation practices discussed by the Committee is also provided.

4.1 MITIGATION GOAL

REQUIREMENT §201.6(c)(3)(i):
[The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

The Committee reviewed the mitigation goals as outlined within the 2011 Wabash County MHMP and determined that each of these remain valid and effective. In summary, the overall goal of the Wabash County MHMP is to reduce the social, physical, and economic losses associated with hazard incidents through emergency services, natural resource protection, prevention, property protection, public information, and structural control mitigation practices.

4.2 MITIGATION PRACTICES

REQUIREMENT §201.6(c)(3)(ii):
[The mitigation strategy shall include a] section that identifies and analyzed a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

REQUIREMENT §201.6(c)(3)(iii):
[The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

In 2005, the Multi-Hazard Mitigation Council conducted a study about the benefits of hazard mitigation. This study examined grants over a 10-year period (1993-2003) aimed at reducing future damages from earthquake, wind, and flood. It found that mitigation efforts were cost-effective at reducing future losses; resulted in significant benefits to society; and represented significant potential savings to federal treasury in terms of reduced hazard-related expenditures. This study found that every $1 spent on mitigation efforts resulted in an average of $4 savings for the community. The study also found that FEMA mitigation grants are cost-effective since they often lead to additional non-federally funded mitigation activities and have the greatest benefits in communities that have institutionalized hazard mitigation programs.

A more recent (2017) study by the National Institute of Building Sciences, reviewed over 20 years of federally funded mitigation grants, not only from FEMA, but also

from the US Economic Development Administration (EDA) and the US Department of Housing and Urban Development (HUD). From this broadened review, it has been determined that for every $1 spent on mitigation, $6 are saved on disaster costs. Further, by designing and constructing buildings which exceed select items in the 2015 International Code, an additional $4 can be saved for every $1 invested in those changes.

Six primary mitigation practices defined by FEMA are:

- **Emergency Services** – measures that protect people during and after a hazard.
- **Natural Resource Protection** – opportunities to preserve and restore natural areas and their function to reduce the impact of hazards.
- **Prevention** – measures that are designed to keep the problem from occurring or getting worse.
- **Property Protection** – measures that are used to modify buildings subject to hazard damage rather than to keep the hazard away.
- **Public Information** – those activities that advise property owners, potential property owners, and visitors about the hazards, ways to protect themselves and their property from the hazards.
- **Structural Control** – physical measures used to prevent hazards from reaching a property.

4.2.1 Existing Mitigation Practices

As part of this planning effort, the Committee discussed the strengths and weaknesses of existing mitigation practices and made recommendations for improvements, as well as suggested new practices. The following is a summary of existing hazard mitigation practices within Wabash County. Mitigation measures that were included in the 2011 Wabash County MHMP are noted as such.

<u>Emergency Services</u>

- Outdoor warning sirens provide coverage for the larger populated areas of Wabash County (City of Wabash and Town of North Manchester). These sirens are activated by Central Dispatch but owned and maintained by the respective communities. *(2011 Measure)*
- The County has developed a centralized system for testing, maintenance, and operation of outdoor warning sirens, which is operated by Central Dispatch. *(2011 Measure)*
- Weather radios are encouraged and provided throughout the County during presentations, events, and on the EMA website. *(2011 Measure)*
- Wabash County and municipalities have been designated StormReady Communities by the National Weather Service.
- Stream gages on the Eel and Wabash Rivers are utilized for flood forecasting and flood warnings for various stream levels.

- The City of Wabash has developed a Flood Response Plan to assist with timely and coordinated response efforts during times of impending and actual flood events.
- The County partners with The American Red Cross to develop and maintain agreements for temporary and long-term sheltering facilities *(2011 Measure)*
- The County maintains Mutual Aid Agreements with IDHS partner counties and Grissom Air Force Base *(2011 Measure)*
- The Wabash County LEPC completes reporting and training efforts as required through SARA Title III and ensures current facility maps and response plans are on file for Tier II facilities.

Natural Resource Protection

- Wabash County, LaFontaine, Lagro, North Manchester, and Wabash are in good standing with the NFIP Program and have flood protection ordinances which exceed the minimum requirements.

Prevention

- Information related to hazard mitigation has been incorporated, where appropriate, into individual Comprehensive Land Use Plans, other long-range plans, and decision-making processes.
- Wabash County has developed a GIS database which is used in land use planning decisions and can be utilized in HAZUS-MH "what-if" scenarios.
- The Wabash County LEPC provides routine training regarding the proper storage, transport, and disposal of hazardous materials.
- Electric providers routinely complete preventative maintenance on trees within the ROW and utility corridor.
- Local developers routinely bury new and retrofitted utilities to minimize exposure to hazards.
- Wabash County and Town of North Manchester have utilized residential property buyouts to reduce the number of repetitive loss properties. *(2011 Measure)*

Property Protection

- Wabash County and the municipalities follow the International Building Code which includes requirements to minimize damages from natural hazards.
- Development downstream of dams is discouraged by the Wabash County Planning and Building Department.
- Wabash County and communities within have developed a Water Conservation Ordinance and an Open Burning Ordinance.

Public Information

- Outreach materials are routinely provided within office and agencies throughout Wabash County, large public events, speaking opportunities within schools, etc. *(2011 Measure)*
- Wabash County and communities within utilize the Code Red mass notification system. *(2011 Measure)*
- The City of Wabash maintains a public-address system which is utilized with speakers placed through downtowns and on response vehicles *(2011 Measure)*
- Hazard information is provided to Wabash County residents through local radio announcements and social media outlets. *(2011 Measure)*

Structural Control

- Stormwater conveyances and regulated drains are maintained on a routine basis to prevent localized flooding, increased erosion, and material deposition as a result of rainfall or snowmelt.

4.2.2 Proposed Mitigation Practices

After reviewing existing mitigation practices, the Committee reviewed mitigation ideas for each of the hazards studied and identified which of these they felt best met their needs as a community according to selected social, technical, administrative, political, and legal criteria. The following identifies the key considerations for each evaluation criteria:

- **Social** –mitigation projects will have community acceptance, they are compatible with present and future community values, and do not adversely affect one segment of the population.
- **Technical** –mitigation project will be technically feasible, reduce losses in the long-term, and will not create more problems than they solve.
- **Administrative** –mitigation projects may require additional staff time, alternative sources of funding, and have some maintenance requirements.
- **Political** –mitigation projects will have political and public support.
- **Legal** –mitigation projects will be implemented through the laws, ordinances, and resolutions that are in place.
- **Economic** –mitigation projects can be funded in current or upcoming budget cycles.
- **Environmental** –mitigation projects may have negative consequences on environmental assets such as wetlands, threatened or endangered species, or other protected natural resources.

Table 4-1 lists a summary of all proposed mitigation practices identified for all hazards, as well as information on the local status, local priority, benefit-cost ratio, project location, responsible entity, and potential funding source, associated with

each proposed practice. The proposed mitigation practices are listed in order of importance to Wabash County for implementation. Projects identified by the Committee to be of "High" local priority may be implemented within five years from final Plan adoption. Projects identified to be of "Moderate" local priority may be implemented within five to ten years from final Plan adoption, and projects identified by the Committee to be of "Low" local priority may be implemented more than ten years from final Plan adoptions. However, depending on availability of funding, some proposed mitigation projects may take longer to implement.

The benefit derived from each mitigation practice along with the estimated cost of that practice was utilized to identify the mitigation practices having a high, moderate, or low benefit cost ratio. Preparing detailed benefit cost ratios was beyond the scope of this planning effort and the intent of the MHMP.

The update of this MHMP is a necessary step of a multi-step process to implement programs, policies, and projects to mitigate the effect of hazards in Wabash County. The intent of this planning effort was to identify the hazards and the extent to which they affect Wabash County and to determine what type of mitigation strategies or practices may be undertaken to mitigate for these hazards. A FEMA-approved MHMP is required in order to apply for and/or receive project grants under the HMGP, PDM, and FMA. Although this MHMP meets the requirements of DMA 2000 and eligibility requirements of these grant programs additional detailed studies may need to be completed prior to applying for these grants. **Section 5.0** of this plan includes an implementation plan for all high priority mitigation practices identified by the Committee.

The CRS program credits NFIP communities a maximum of 72 points for setting goals to reduce the impact of flooding and other known natural hazards; identifying mitigation projects that include activities for prevention, property protection, natural resource protection, emergency services, structural control projects, and public information.

Table 4-1 Proposed Mitigation Practices

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Public Education & Outreach 1. Provide multi-lingual hazard preparedness literature (warning sirens, radio stations, go-kits, insurance protection, etc.) during Severe Weather Awareness Week, at public facilities and events and to populations within known hazard areas such as floodplains, downstream of a dam, near hazmat facilities, etc. *(2011 Measure)*	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☐ Structural Control	☒ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Wildfire ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	Ongoing – 1. Literature provided at several public facilities, office locations, and large public events throughout the County. Populations within special flood hazard areas are educated through required flood insurance purchases and various website and literature pieces. Proposed Enhancement – 1. Encourage enhancement of messages provided to various groups and neighborhoods; Educate landowners within dam inundation areas of potential dangers and what to do in emergency situation; encourage voluntary purchase of federally-subsidized flood insurance; formalize a neighborhood or local campaign where community representatives provide residents with emergency information and protocols.	High	High	EMA Red Cross Mayoral Offices/Town Hall/Council Chambers/Court House *(County, LaFontaine, Lagro, N Manchester, Roann, Wabash)* Event Liaisons	Existing Budget
Hazardous Materials 1. Review and revise transportation survey to determine typical chemicals and quantities of chemicals being transported through the county *(2011 Measure)*	☒ Emergency Services ☐ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☐ Public Information ☐ Structural Control	☐ Drought ☒ Earthquake ☐ Extreme Temperature ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Wildfire ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	**Ongoing –** 1. Initial survey completed **Proposed Enhancement –** 1. Review and revise survey to update routes, chemicals, and quantities as well as response efforts and capabilities within the County	High	Moderate	LEPC EMA Fire Departments INDOT	Existing Budget

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Emergency Preparedness & Warning 1. Enhance disaster preparedness and emergency response at local level through CERT, or similar, program 2. Improve outdoor warning siren coverage to alert population of severe weather conditions *(2011 Measure)* 3. Create a Wabash County Community Organizations Active in Disasters (COAD) group to assist in emergency preparedness and response efforts. 4. Purchase mobile electronic messaging boards and develop protocol for local interactions to provide current hazard information 5. Encourage weather radios in critical infrastructure and encourage use by residents and businesses.	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☐ Structural Control	☒ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Wildfire ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	**Ongoing –** 1. Approximately 60 current CERT members 2. City of Wabash and Town of North Manchester covered by outdoor warning sirens 5. Numerous facilities have and utilize weather radios **Proposed Enhancements –** 1. Develop a list of refresher training courses or seminars for registrants to attend every 3-6 months 2. Install additional sirens in LaFontaine, Lagro, and Roann 3. Work with Wabash County Cooperative Extension and other partnering agencies to create and maintain a COAD 4. Investigate need and prioritize purchase of additional mobile message boards 5. Continue to encourage weather radios during presentations and events; provide to residents as funding allows	High *(CERT, warning sirens* Moderate *(COAD, mobile message boards, weather radios)*	High	EMA Purdue Extension /COAD LaFontaine Lagro Roann	Existing budgets Grants
Geographic Information Systems 1. Develop county-wide GIS with address verification within Code Red to improve emergency response times 2. Include dry hydrants as a GIS layer for responders and planners *(2011 Measure)* 3. Train GIS staff in HAZUS-MH to quantitatively estimate losses in "what if scenarios" and continue to use the most recent GIS data in land use planning efforts.	☒ Emergency Services ☒ Nat. Res. Protection ☐ Prevention ☒ Property Protection ☒ Public Information ☐ Structural Control	☒ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Wildfire ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	**Ongoing –** 1. GIS is used by Wabash County (and provided to all communities) through a contract service provider **Proposed Enhancement –** 1. Develop address verification coordinated with CodeRed and provide to all first response agencies and vehicles 2. Develop a layer of dry hydrant locations throughout the county 3. Additional training for GIS staff	High *(address verification)* Moderate *(dry hydrant layer, training)*	Low	GIS Department *(County)*	Existing Budget
Safer Rooms and Community Shelters 1. Inventory and prioritize listing of public facilities which may serve as effective shelters if hardened 2. Provide possible incentives for (private) buildings with approved safe rooms 3. Clearly advertise location of safe rooms and/or community shelters for large gatherings of people (football games, 4H fair, etc.) 4. Establish shelters in recreational and mobile home parks *(2011 Measure)*	☒ Emergency Services ☐ Nat. Res. Protection ☐ Prevention ☐ Property Protection ☒ Public Information ☒ Structural Control	☐ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Wildfire ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	**Ongoing –** 3. Shelter agreements are in place for facilities throughout the county **Proposed Enhancement –** 1. Inventory potential facilities that may be suitable as shelters and identify needs 2. Provide incentives for approved safe rooms 3. Prominently advertise or announce locations during activities where many visitors may be present 4. Establish additional shelters in vulnerable locations such as RV or mobile home parks	High *(harden public facilities)* Low *(incentives, advertisement, recreational and mobile home parks)*	High	EMA Facility Owners Wabash County Building Department Red Cross	Existing budget Facility owners

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Power Back-Up Generators 1. Inventory, prioritize, and retrofit public facilities and/or critical facilities with appropriate wiring and electrical capabilities for utilizing a large generator for power back up *(2011 Measure)* 2. Secure a fuel reserve for critical infrastructure may run on power back-up for extended periods of time 3. Develop and designate a fuel reserve transportation route 4. Investigate the potential to utilize solar generators where appropriate	☒ Emergency Services ☐ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☐ Public Information ☐ Structural Control	☐ Drought ☒ Earthquake ☐ Extreme Temperature ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Wildfire ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	**Ongoing –** 1. Many critical facilities have generators **Proposed Enhancements –** 1. Inventory and prioritize critical facilities for retrofitting, wiring, and generator capabilities and needs; especially Wabash City Hall, Volunteer Fire Departments, Lagro Fire 2. Secure a fuel reserve via contract service agreements 3. Designate a fuel route from the distribution to utilization locations 4. Install solar generators as a demonstration	High *(generators)* Low *(fuel reserve, fuel route, wind or solar generators)*	Low	EMA Facility Owners Fuel Companies	Existing budget Grant
Building Protection 1. Protect existing critical facilities in floodplains *(2011 Measure)* 2. Install additional dry hydrants throughout the county *(2011 Measure)* 3. Purchase additional fire equipment for first responders such as digital radios, personal protective equipment, and/or mapping capabilities 4. Relocate, buyout, or floodproof (non-residential) existing, non-critical facilities subject to repetitive flooding 5. Install inertial valves in critical facilities 6. Develop and complete an inventory for at-risk structures (abandoned buildings in concentration, blighted areas, or hazard areas) *(Will assist with NFIP compliance)*	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☐ Drought ☒ Earthquake ☐ Extreme Temperature ☒ Flood ☐ Hail/Thunder/Wind ☐ Landslide/Subsidence ☐ Tornado ☒ Wildfire ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	**Ongoing –** 2. Dry hydrants have been installed in northern Wabash County and in Lagro 4. City of Wabash participated in residential property buyouts **Proposed Enhancements –** 1. Protect the existing facilities identified as within the SFHA in Table 3-10 2. Prioritize additional areas and install additional hydrants 3. Inventory, prioritize, and purchase additional equipment 4. Investigate and prioritize existing, non-residential, non-critical facilities subject to repetitive flooding 5. Prioritize facilities for inertial valve installation 6. Develop inventory for at-risk structures	High *(protect existing critical facilities, dry hydrants, fire equipment)* Moderate *(existing, non-residential, non-critical)* Low *(inertial valves, at-risk structures)*	Moderate	Planning Departments *(County, N Manchester, Wabash)* EMA Floodplain Administrator *(County, N Manchester, Wabash)* Property Owners	Grant Existing budget

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Emergency Response & Recovery 1. Inventory needs for mobile data terminals or equipment in response vehicles and purchase and install as feasible 2. Review and update procedures to alert and evacuate populations (especially special needs populations) in known hazard areas SFHAs, dam failure areas, Tier II areas) *(2011 Measure)* 3. Develop a water rescue and dive team 4. Develop and implement a voluntary immunization program for all emergency responders, inspection staff, and families 5. Coordinate communications, documentation, and record keeping between NFIP communities and agencies including a database of accurate and community specific information following each hazard events 6. Investigate options for mobile sand bagging equipment and associated generator 7. Develop snow removal routes and post signage to educate residents and visitor 8. Purchase additional snow removal and pre-treatment equipment and supplies 9. Investigate reciprocal agreements between neighboring communities/counties for structural inspections following hazardous events 10. Construct a new EOC *(2011 Measure)*	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☐ Property Protection ☒ Public Information ☐ Structural Control	☒ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Wildfire ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	**Ongoing –** 1. Some vehicles have data terminals installed 2. Flood Response Plan has been developed for City of Wabash; IEAPs exist for ACoE dams 3. DNR has water recovery team 4. Some immunizations are offered through insurance plans 5. Some post-event communication occurs 6. Currently borrow sand bagging equipment 9. Reciprocal agreements exist for Fire/EMS **Proposed Enhancement –** 1. Inventory needs (hardware, software) and prioritize updates or installations 2. Continue to review and update as needed; involve additional public entities, special needs providers 3. Develop water rescue team for county 4. Increase type of immunizations offered and extend to family members as a part of employment agreement 5. Develop detailed database for all communities to track and input data during and following events 6. Investigate and purchase most appropriate equipment 7. Develop primary and secondary snow removal routes and post signage in appropriate areas 8. Inventory existing and needed snow fight equipment, purchase as able 9. Develop agreements for structural inspections or other post-event services 10. Construct new EOC	High *(data terminals, evacuations, water rescue team)* Moderate *(immunizations, record-keeping, sand bagging equipment, snow routes, snow equipment)* Low *(reciprocal agreements, new EOC)*	Moderate	DHS EMA Sheriff Department Police Departments/Town Marshall *(County, LaFontaine, Lagro, N Manchester, Roann, Wabash)* Fire Departments Health Department County Highway Municipal Street and/or Utility Department *(County, N Manchester, Wabash)* Building Department *(County, N Manchester, Wabash)*	Existing budget Grant
Community Rating System 1. Reduce flood insurance premiums through participation in the NFIP's CRS Program. *(Will assist with NFIP compliance)*	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☐ Drought ☐ Earthquake ☐ Extreme Temperature ☒ Flood ☐ Hail/Thunder/Wind ☐ Landslide/Subsidence ☐ Tornado ☐ Wildfire ☐ Winter Storm/Ice ☐ Dam Failure ☐ HazMat Incident	**Ongoing –** 1. No communities participate **Proposed Enhancement –** 1. Participation from County and others as one NFIP	Moderate	Moderate	Floodplain Administrators *(County, N Manchester, Wabash)*	Existing budget

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Floodplain Management 1. Complete flood depth mapping (RiskMAP) to better understand flood risk potential 2. Conduct detailed flood protection studies for problem areas and/or areas with repetitive flooding problems 3. Complete a Watershed Plan or Stormwater Master Plan 4. Elevate intersections to alleviate damages associated with flood impacts *(Will assist with NFIP compliance)*	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☐ Drought ☐ Earthquake ☐ Extreme Temperature ☒ Flood ☐ Hail/Thunder/Wind ☐ Landslide/Subsidence ☐ Tornado ☐ Wildfire ☐ Winter Storm/Ice ☐ Dam Failure ☐ HazMat Incident	**Ongoing –** 1. City of Wabash has flood depth mapping associated with the Flood Response Plan **Proposed Enhancements –** 1. Complete flood depth grid mapping to include all flood prone areas within the County, especially in municipalities 2. Complete studies for streams with smaller drainage areas or those locations with poor drainage 3. Prioritize areas for watershed plan or stormwater master plan development 4. Identify and prioritize intersections to elevate to alleviate flood impacts	Moderate	Moderate	Floodplain Administrators *(County, N Manchester, Wabash)* Wabash County Surveyor	Existing budget Grant
Management of High Hazard Dams 1. Review regular inspection reports and maintenance records, and participate in reviews and exercises of the IEAPs of high hazard dams (Salamonie, Mississinewa, and Roush)	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☐ Drought ☒ Earthquake ☐ Extreme Temperature ☒ Flood ☐ Hail/Thunder/Wind ☒ Landslide/Subsidence ☐ Tornado ☐ Wildfire ☐ Winter Storm/Ice ☒ Dam Failure ☐ HazMat Incident	**Ongoing –** 1. Inspections and IEAP exercises routinely completed **Proposed Enhancements –** 1. Ensure EMA continues to participate in IEAP exercises	Low	Moderate	EMA IDNR Army Corps of Engineers	Existing budget

CHAPTER 5 IMPLEMENTATION PLAN

The following is a proposed plan for implementing all high priority mitigation practices identified in this Plan. It should be noted that implementation of each of these proposed practices may involve several preparatory or intermediary steps. However, to maintain clarity, not all preparatory or intermediary steps are included.

5.1 BUILDING PROTECTION

Protect existing critical facilities in floodplains

- Review listing of critical facilities within floodplains
- Completed studies to determine localized flood depths
- Provide recommendations for protection measures for each structure
- Prioritize structures and implement recommendations as funding allows

Install additional dry hydrants throughout the county

- Create GIS layer of existing dry hydrants
- Prioritize areas underserved with dry hydrants
- Secure funding and install additional dry hydrants

Purchase additional fire eequipment for first responders such as digital radios, personal protective equipment, and/or mapping capabilities

- Inventory existing equipment at each station
- Prioritize additional needed equipment to strengthen first response efforts
- Secure funding and purchase equipment

5.2 EMERGENCY PREPAREDNESS & WARNING

Enhance disaster preparedness and emergency response at local level through CERT, or similar program

- Review existing program courses, offerings and trainees
- Determine additional training needs and prioritize areas not served by a CERT representative
- Offer additional courses or trainings
- Cover populated areas with CERT trained volunteers

Improve outdoor warning siren coverage to alert populations of severe weather conditions

- Review existing outdoor warning siren coverage
- Prioritize areas in need of primary or additional coverage

- Investigate potential funding sources and determine local level of interest
- Install additional outdoor warning sirens as feasible

5.3 EMERGENCY RESPONSE AND RECOVERY

Inventory needs for mobile data terminals in response vehicles and purchase and install as feasible

- Inventory existing data terminals within each municipality
- Determine needs to provide adequate or enhanced abilities
- Secure funding and install additional mobile data terminals as prioritized

Review and update procedures to alert and evacuate populations (especially special needs populations) in known hazard areas (SFHAs, dam failure areas, Tier II areas)

- Review current procedures and revise as necessary
- Determine limits of additional populations potentially in need of evacuation, such as those listed above
- Determine protocols for when evacuations would be required and agency or municipal officials' roles and responsibilities during events
- Define evacuation routes, any facilities to where evacuated populations will be sent
- Provide information to affected populations, land and/or facility owners, and agency or municipal officials

Develop a water rescue and dive team

- Determine annual training/certification needs for rescue team members and allow applicable staff the time to complete those needs
- Allocate funding to procure boats and water rescue equipment
- Write and conduct water rescue drills as part of routine field or tabletop exercises

5.4 GEOGRAPHIC INFORMATION SYSTEMS

Develop a county-wide GIS system with address verification within CodeRed to improve emergency response times

- Review current GIS capabilities and determine training needs for staff
- Attend CodeRed trainings to determine how to implement address verification within the system
- Develop verified address system within GIS and CodeRed and train appropriate staff

5.5 HAZARDOUS MATERIALS RESPONSE

Review and revise transportation survey to determine typical chemicals and quantities of chemicals being transported through the county

- Survey the chemicals and quantities of chemicals that are routinely transported through Wabash County
- Determine estimated response times for properly trained personnel to reach intersections or risk areas along primary routes
- Determine equipment needs to initially evacuate and isolate spill of most common chemicals
- Train additional staff or obtain additional equipment as necessary

5.6 POWER BACK-UP GENERATORS

Inventory, prioritize, and retrofit public facilities and/or critical facilities with appropriate wiring and electrical capabilities for utilizing a large generator for power back-up

- Utilize listing of critical facilities and coordinate with facility owners or operators
- Determine presence or absence of generator, fuel capacity, and fuel reserve
- Determine if additional needs are required to ensure compatibility with generator
- Secure or allocate funding to make necessary purchases or facility adjustments to ensure functioning generators are present and operable

5.7 PUBLIC EDUCATION AND OUTREACH

Provide multi-lingual hazard preparedness literature (warning sirens, radio stations, go-kits, insurance protection, etc.) during Severe Weather Awareness Week, at public facilities and events and to populations within known hazard areas such as floodplains, downstream of a dam, near hazmat facilities, etc.

- Review existing materials provided by Federal, State, and local programs
- Determine if materials need to be revised, additional hazards need to be covered, or if distribution methods need to be revised
- Develop or provide additional materials targeting at risk populations or areas based on hazards
- Provide training and educational materials to local liaisons for distribution throughout the area

5.8 SAFER ROOMS AND COMMUNITY SHELTERS

Inventory and prioritize listing of public facilities which may serve as effective shelters if hardened

- Review locations and capabilities of existing shelters within the county to determine if adequate coverage is provided in populated areas or in centralized areas of the unincorporated areas within the county
- Determine if alternative shelters are needed (those which may not be Red Cross certified but may be suitable for short term shelter at the agreement of the client)
- Determine needs for strengthening the structure to make it suitable to serve as a shelter

CHAPTER 6 PLAN MAINTENANCE PROCESS

6.1 MONITORING, EVALUATING, AND UPDATING THE PLAN

REQUIREMENT §201.6(c)(4)(i):
[The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

To effectively reduce social, physical, and economic losses in Wabash County, it is important that implementation of this MHMP be monitored, evaluated, and updated. The EMA Director is ultimately responsible for the MHMP. As illustrated in Section 4.2 Mitigation Practices, this Plan contains mitigation program, projects, and policies from multiple departments within each NFIP community. Depending on grant opportunities and fiscal resources, mitigation practices may be implemented independently, by individual NFIP communities, or through local partnerships. Therefore, the successful implementation of this MHMP will require the participation and cooperation of the entire Committee to successfully monitor, evaluate, and update the Wabash County MHMP.

The EMA Director will reconvene the MHMP Committee on an annual basis and follow a significant hazard incident to determine whether:

- the nature, magnitude, and/or type of risk have changed
- the current resources are appropriate for implementation
- there are implementation problems, such as technical, political, legal, or coordination issues with other agencies
- the outcomes have occurred as expected
- the agencies and other partners participated as originally proposed

During the annual meetings the Implementation Checklist provided in **Appendix 6** will be helpful to track any progress, successes, and problems experienced.

The data used to prepare this MHMP was based on "best available data" or data that was readily available during the development of this Plan. Because of this, there are limitations to the data. As more accurate data becomes available, updates should be made to the list of critical infrastructure, the risk assessment and vulnerability analysis.

DMA 2000 requires local jurisdictions to update and resubmit their MHMP within five years (from the date of FEMA approval) to continue to be eligible for mitigation project grant funding. In early 2024, the EMA Director will once again reconvene the MHMP Committee for a series of meetings designed to replicate the original planning process. Information gathered following individual hazard incidents and annual meetings will be utilized along with updated vulnerability assessments to

assess the risks associated with each hazard common in Wabash County. These hazards, and associated mitigation goals and practices will be prioritized and detailed as in Section 3.0 this MHMP. Sections 4.0 and 5.0 will be updated to reflect any practices implemented within the interim as well as any additional practices discussed by the Committee during the update process.

Prior to submission of the updated MHMP, a public meeting will be held to present the information to residents of Wabash County and to provide them an opportunity for review and comment of the draft MHMP. A media release will be issued providing information related to the update, the planning process, and details of the public meeting.

6.2 INCORPORATION INTO EXISTING PLANNING MECHANISMS

REQUIREMENT §201.6(c)(4)(ii):
[The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as the comprehensive or capital improvements, when appropriate.

Many of the mitigation practices identified as part of this planning process are ongoing with some enhancement needed. Where needed, modifications will be proposed to be made to each NFIP communities' planning documents and ordinances during the regularly scheduled update. Among other things, local planning documents and ordinances may include comprehensive plans, floodplain management plans, zoning ordinances, building codes, site development regulations, or permits. Modifications include discussions related to hazardous material facility buffers, floodplain areas, and discouraging development of new critical infrastructure in known hazard areas.

Based on added language within each of the Comprehensive Plan updates the appropriate Zoning Ordinances and Floodplain Management Ordinances within each community may also need to be amended.

6.3 CONTINUED PUBLIC INVOLVEMENT

REQUIREMENT §201.6(c)(4)(iii):
[The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

Continued public involvement is critical to the successful implementation of the Wabash County MHMP. Comments gathered from the public on the MHMP will be received by the EMA Director and forwarded to the MHMP Committee for discussion. Education efforts for hazard mitigation will be the focus of the annual Severe Weather Awareness Week as well as incorporated into existing stormwater planning, land use planning, and special projects/studies efforts. Once adopted, a

copy of this Plan will be available for the public to review in the EMA Office and the Wabash County website.

Updates or modifications to the Wabash County MHMP will require a public notice and/or meeting prior to submitting revisions to the individual jurisdictions for approval.

The CRS program credits NFIP communities a maximum of 37 points for adopting the Plan; establishing a procedure for implementation, review, and updating the Plan; and submitting an annual evaluation report.

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