VIGO COUNTY MULTI-HAZARD MITIGATION PLAN

MARCH 2023

Prepared for:

Vigo County Emergency Management Agency
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EXECUTIVE SUMMARY

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 Vigo 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. 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.

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. Further, it is required that local jurisdictions review, revise, and resubmit the MHMP every five years. As representatives from **Vigo County, Riley, Seelyville, Terre Haute, and West Terre Haute** have provided information, attended meetings, and participated in the planning process, the planning process used to update the Vigo County MHMP satisfies the requirements of a multi-jurisdictional plan.

During Planning Committee meetings, those in attendance revisited existing (in the 2016 MHMP) and identified new critical facilities and local hazards; reviewed the State's mitigation goals and updated the local 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. Meetings were also conducted with key groups such as city planners and various emergency responders and their information will continue to be incorporated into the MHMP update.

Risk Assessment

The risk assessment conducted for the Vigo County MHMP is based on the methodology described in the Local Multi-Hazard Mitigation Planning Guidance published by FEMA in 2013 and is incorporated into the following sections:

1. **Hazard Identification** lists the natural, technological, and political hazards selected as having the greatest direct and indirect impact to the county as well as the system used to rank and prioritize the hazards.
2. **Hazard Profile** for each hazard, discusses the 1) historic data relevant to the municipalities where available; 2) vulnerability in terms of number and type of structures, repetitive loss properties (flood only), estimation of potential losses, and impacts based on an analysis of development trends; and 3) the relationship to other hazards identified.
3. **Hazard Summary** provides an overview of the risk assessment process; a table summarizing the relationship of the hazards; and a composite map to illustrate areas impacted by hazards.

When considering the hazards selected for study (drought; earthquake; extreme temperature; fire; flood; hail, thunder, wind; land subsidence; snow and ice storm; tornado; dam failure; and hazardous materials incidents) and the information obtained regarding the hazard profile and the hazard summary, the attached table identifies the hazards studied and ranking outcome. The ranking is completed utilizing the Calculated Risk Priority Index (CPRI), a tool by which individual hazards are evaluated and ranked according to an indexing system considering probability, magnitude, warning time, and duration for any hazard.

1. **Probability** is defined as the likelihood of the hazard occurring over a given period.

2. **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.
3. **Warning Time** is defined as the length of time before the event occurs.
4. **Duration** is defined as the length of time that the actual event occurs. This does not include response or recovery efforts.

Mitigation Goals and Practices

The overall goal of the Vigo 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.

As part of the planning process the Planning Committee discussed the strengths and weaknesses of existing mitigation practices and made recommendations for improvements, as well as suggested new practices. To provide further detail, information on the local status, local priority, benefit-cost ratio, project location, responsible entity, and potential funding source will be included with regard to each proposed practice. Those practices ranked by participants as a high priority are anticipated to be implemented within five years from the final Plan adoption and additional steps, or an implementation plan is included for each.

Plan Maintenance

The successful implementation of the MHMP will require the participation and cooperation of the entire Planning Committee to successfully monitor, evaluate, and update the Vigo County MHMP. Local jurisdictions are required to update and resubmit the MHMP every five years. 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 Vigo County.

Type of Hazard	List of Hazards	Weighted Average CPRI
Natural	Drought	
	Earthquake	
	Extreme Temperature	
	Fire	
	Flood	
	Hail/Thunder/Windstorm	
	Landslide/Subsidence	
	Tornado	
	Winter Storm/Ice	
Technological	Dam/Levee Failure	
	Hazardous Materials Incident	
	Terrorism	

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** includes four phases:

Figure 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 Vigo 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 & 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 Building Resilient Infrastructure and Communities (BRIC), Hazard Mitigation Grant Program (HMGP), and Flood Mitigation Assistance (FMA). Although the Vigo 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.

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 Vigo County MHMP Update is a multi-jurisdictional planning effort led by the Vigo County Emergency Management Agency (EMA). This Plan was prepared in partnership with Vigo County, the towns of Riley, Seelyville, Terre Haute, and West Terre Haute. 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 Vigo 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 three 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 is necessary to enter the CRS program and receive a 5% flood insurance premium discount. This MHMP could contribute as many as 382 points toward participation in the CRS. At the time of this planning effort, none of the communities or Vigo County participate in the CRS program.

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

1.3 ANALYSIS 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 Vigo County MHMP Update began in 2020 when the County EMA submitted a PDM Grant application to IDHS. The grant request was approved by FEMA and grant funds were awarded in 2020.

Once the grant was awarded, the planning process to update the 2016 MHMP took 18 months. This included a review period by IDHS and FEMA for the draft MHMP Update, and time for Vigo County and communities to adopt the final MHMP Update.

1.3.1 Planning Committee

In June of 2021, 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 2016. **Table 1** lists the individuals that actively participated on the Committee and the entity they represented.

Table 1: MHMP Update Committee

Name	Office	Representing
Scott Barber	Vigo County Engineer	Vigo County
Kevin Barrett	Terre Haute Police Department	Terre Haute
Kurt Brinegar	Safety and Security	Vigo County School Corp.
Jake Campbell	Security Director	Rose-Hulman Inst. Of Tech.
Neil Costello	Terre Haute City Engineer	Terre Haute
Russ Feuquay	Terre Haute Fire Department	Terre Haute
Dorene Hojnicki	Emergency Management Agency	Vigo County
Keith Holbert	Emergency Management Agency	Vigo County/West Terre Haute
Jeremy Jessie	Seelyville Town Manager	Seelyville
Brent Lloyd	Terre Haute Police Dept.	Terre Haute
Aaron Loudermilk	Vigo County Council	Vigo County
Matt McCullough	Riley Fire Dept.	Riley
Barry Nicoson	EMS System Manager	Union Hospital
Jason Parker	Seelyville Town Marshall	Seelyville
Troy Ramsey	Emergency Management Agency	Vigo County
Curtis Stoffel	Security Director	Regional Hospital

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 existing (in the 2016 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
- 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 also reviewed a draft MHMP, provided comments and suggestions, and assisted with adoption of the Vigo County MHMP Update.

1.3.2 Public Involvement

A draft of the Vigo County MHMP update was posted to the Vigo County website (www.vigocounty.in.gov) for public review and comment. A media release indicating the posting of the draft MHMP and the ability to comment was submitted for publishing to *The Tribune Star* in Terre Haute. Committee members were provided with an informational flyer regarding the same information to display in their respective offices and to provide to family, friends and colleagues. The media release, informational flyer, and any comments received are included in **Appendix 3**. Planning Committee members provided comments to assist with remaining gaps in the planning effort while no comments were received from the public.

1.3.3 Involvement of Other Interested Parties

Neighboring EMAs (Parke and Vermillion to the North; Clay to the East; Sullivan to the South; and Clark and Edgar (Illinois) to the West) were also invited to review and comment on the MHMP update. No comments were received from neighboring EMAs. Information related to the planning process and the availability of the draft Vigo County MHMP was directly provided to such potentially interested parties via personal conversations, informational flyer, and email correspondence. Successful implementation and future updates of the Vigo 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 Vigo 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 Vigo County MHMP, and to assist the Committee in developing potential mitigation measures to reduce the social, physical, and economic losses associated with hazards affecting Vigo County.

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

- Vigo County MHMP, 2016
- Terre Haute Vigo County Thrive 2025 Comprehensive Plan
- Unified Zoning Ordinances (Vigo County, Riley, Seelyville, Terre Haute, West Terre Haute), 1996
- Unified Floodplain Ordinance, 2019
- GIS data from county contacts

Planning and building ordinances and comprehensive planning efforts for many of the other communities do not exist or are not up to date. Several of the small communities are serviced by the county departments.

In addition to local agencies and offices such as those listed above, several regional and state agencies were contacted and subsequently provided data for this planning effort. Those contacts, and the information they provided, include:

- Indiana Department of Natural Resources, Division of Water – *Flood insurance policies, claims, and payment information*

- Indiana Department of Natural Resources, Division of Water – *Dam records*
- FEMA, Region V – Repetitive loss structure counts and payments

The CRS program credits NFIP communities a maximum of 155 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.

CHAPTER 2: COMMUNITY INFORMATION

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

Vigo County's boundaries were established in 1873 and is named for Colonel Francis Vigo, who was instrumental as a financier to George Rogers Clark's expedition and later as an informant for Clark against the British. Vigo County is the 84th of the 92 Indiana counties to be organized. The total area of Vigo County is approximately 410.5 square miles and the location of the county within the State of Indiana is identified in **Figure 2**.

2.1 POPULATION AND DEMOGRAPHICS

Figure 2 Vigo County Location

The most recent data for Vigo County estimates that the 2021 population was 105,994, which ranks 17th in the State. Of that total, the City of Terre Haute accounts for 58,525 or 55% of the county's population while the Town of West Terre Haute is the second largest community with 2,144 or 2.0% of the population.

In 2020, the median age of the population in the county was 36.5 years of age. The largest demographic age groups in the county are young adults (25-44) with a population of 26,379 and older adults (45-64 years) with a population of 24,695. Seniors (65 and older) are the third largest age group with a population of 18,203 individuals living in Vigo County. The approximate median household income in 2019 was reported to be $48,082 while the poverty rate in the same year was reported at 20.8% county-wide. In total, 14.5% of households are married with children, and 26.4% of households are married without children.

Within the county, 89.6% of the adults older than 25, have reportedly completed a High School education. Further, 24.9% of those same adults have also completed a Bachelor of Arts or higher degree.

2.2 EMPLOYMENT

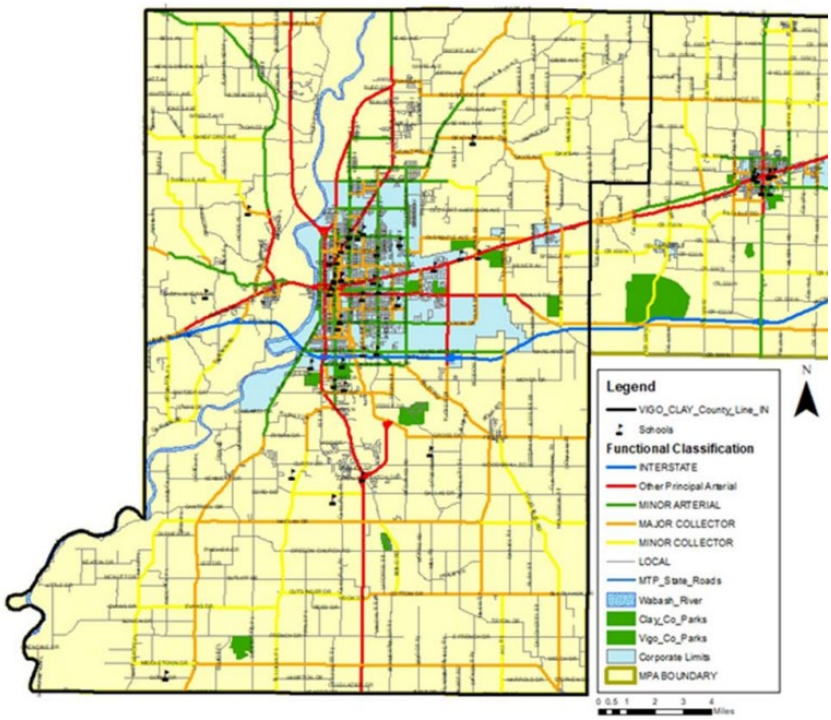
US Census data indicate that of the Vigo County workforce, 21.1% are employed in "Other" positions. Health Care/Social Services and Government account for 17.0% and 15.8% respectively. The total resident labor force according to estimates in 2021 is 45,481 (with 1,958 unemployed) and a April 2022 unemployment rate of 4.3% which places Vigo County as 8th of 92 counties in the State. **Table 2** lists the ten largest employers within Vigo County as of 2020.

Table 2: List of Major Employers

Union Hospital (Terre Haute)	Hamilton Center Inc. (Terre Haute)
Air National Guard Recruiter (Terre Haute)	Union Medical Group (Terre Haute)
Bemis Performance Packaging (Terre Haute)	Walmart SuperCenter (Terre Haute)
Union Medical Group Bone-Joint (Terre Haute)	Staples (Terre Haute)
Terre Haute Regional Hospital (Terre Haute)	USPS (Terre Haute)

2.3 TRANSPORTATION AND COMMUTING PATTERNS

Several major transportation routes pass through Vigo County and the municipalities within. Interstate 70; US Highways 40, 41, and 150; and State Roads 42, 46, 63, 159, 246, and 641 serve as main routes between the various municipalities. CSX and Indiana Rail Road maintain rail lines which travel through the county. These transportation routes are identified in **Figure 3**, from the 2018 Wes Central Indiana Metropolitan Transportation Plan.



According to STATSIndiana, just nearly 8,500 people commute into Vigo County daily. Approximately 27% of commuters travel from Clay County. Further, approximately 2,500 Vigo County residents commute to other counties, with the majority traveling to Illinois (27%).

Figure 4 indicates the number of workers 16 and older who do not live within Vigo County but commute into the County for employment purposes. Similarly, **Figure 5** indicates the number of Vigo County residents 16 and older that commute out of the county for employment.

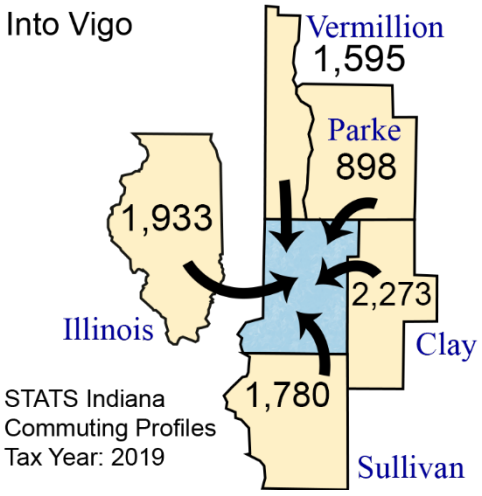


Figure 4 Workers into Vigo County

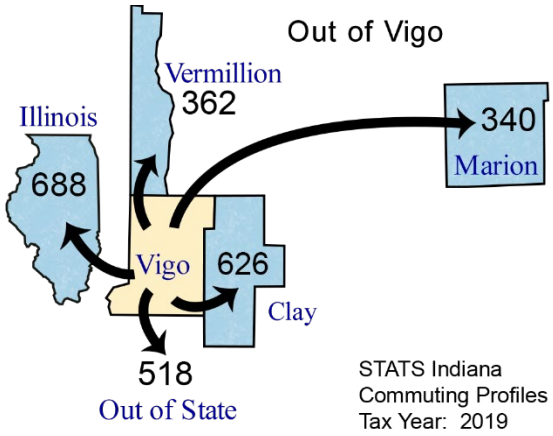


Figure 5 Workers out of Vigo County

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 Vigo County EMA provided the listing and locations of the following 465 critical infrastructure points for the MHMP update:

- 2 Airport
- 7 Cell Towers
- 79 Daycare Centers
- 26 EMS Facilities
- 10 Electric Facilities
- 24 Fire Stations
- 4 Hospitals
- 5 Law Enforcement
- 10 Government Facilities
- 31 Medical Facilities
- 1 Military Installation
- 1 Potable Water
- 1 Power Plant
- 35 Schools
- 118 Tier II Facilities
- 2 Wastewater Treatment Plants
- 2 Water Towers
- 54 Dams
- 73 Large Employers

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 Vigo County. Draft maps were provided to the EMA and Planning Committee for their review and all comments were incorporated into the maps and associated databases.

Exhibit 1 illustrates the critical infrastructure identified throughout unincorporated Vigo County and the individual municipalities. **Appendix 4** lists the critical structures in Vigo County by 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 only on critical structures; non-critical structures are neither mapped nor listed.

2.5 MAJOR WATERWAYS AND WATERSHEDS

According to the United States Geological Survey (USGS), there are 59 waterways in Vigo County, which are listed in **Appendix 5**. The county's main waterway is the Wabash River, and the county lies within two 8-digit Hydrologic Unit Code (HUC) watersheds: Lower Eel River and the Middle Wabash Busseron River. These major waterways, and others, are identified on **Exhibit 2**.

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. Vigo County and the City of Terre Haute participate in the NFIP. At the time of this planning effort, the Vigo County Area Planning Department is responsible for the administration of the floodplain program in the unincorporated areas of the County and within the municipalities of Riley, Seelyville, Terre Haute and West Terre Haute.

Table 3 lists the NFIP number, effective map date, and the date each community joined the NFIP program.

Table 3: NFIP Participation

NFIP Community	NFIP Number	Effective Map Date	Join Date
Vigo County	180263#	02/18/11	11/02/83
Town of Riley			
Town of Seelyville			
City of Terre Haute	180264#	02/18/11	12/01/81
Town of West Terre Haute			

2.7 TOPOGRAPHY

Vigo County is bordered geographically to the west by Clarke and Edgar Counties (Illinois), to the east by Clay County, to the north by Parke and Vermillion Counties, and to the south by Sullivan County. The highest elevation within the county is known as the "Yaw Hill" at 670 ft above sea level approximately one mile northwest of Blackhawk. Conversely the lowest elevation is approximately 440 ft above sea level at the southwestern corner of the county.

2.8 CLIMATE

The Midwestern Regional Climate Center (MRCC) provided climate data that includes information retrieved from a weather station located Perrysville Indiana, identified as station USC00126830. The average annual precipitation is 39.4 inches per year, with the wettest month being July averaging 4.59 inches of precipitation and the driest month being February with an average of 2.03 inches of precipitation. The highest 1-day maximum precipitation was recorded in August of 2016 with 4.26 inches of rain. On average, there are 73.4 days of precipitation greater than or equal to 0.1 inch; 27.1 days with greater than or equal to 0.5 inch; and 9.4 days with greater than or equal to 1.0 inch of precipitation.

Studies have recently been completed by the Indiana Climate Change Impacts Assessment, which is overseen by Purdue University Climate Change Research Center and comprised of a Steering Committee and several topic-oriented Working Groups. These studies indicate that average annual precipitation for Indiana is increasing seasonally during the winter and spring. Conversely, summers and autumns 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.

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 Vigo County and the communities within is based on the methodology described in the Local Multi-Hazard Mitigation Planning Guidance published by FEMA in 2011 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 Vigo 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 2016 Vigo County MHMP and discussed recent events and the potential for future hazard events. The Committee identified those hazards that affected Vigo County and each community and selected the hazards to study in detail as part of this planning effort. As shown in **Table 4** these hazards include dam failure; drought; earthquake; extreme temperature; fire; flooding; hailstorms, thunderstorms, and windstorms; hazardous materials incident; land subsidence/landslides; snowstorms and ice storms; and tornado. All hazards studied within the 2016 Vigo County MHMP, are included in the update.

Table 4: Hazard Identification

Type of Hazard	List of Hazards	Detailed Study	
		2016 MHMP	MHMP UPDATE
Natural	Drought	Yes	Yes
	Earthquake	Yes	Yes
	Extreme Temperature	Yes	Yes
	Fire	Yes	Yes
	Flood	Yes	Yes
	Hail/Thunder/Wind	Yes	Yes
	Land Subsidence/Landslide	Yes	Yes
	Snow / Ice Storm	Yes	Yes
	Tornado	Yes	Yes
Technological	Dam Failure	Yes	Yes
	Hazardous Material Incident	Yes	Yes
	Terrorism	No	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 Burke) 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, but not probable, within the next 10 years
- Possible – incident is probable within the next five years
- Likely - incident is probable within the next three years
- Highly Likely – incident is probable within the next calendar year

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 six hours
- Limited – few injuries OR critical infrastructure shut down for more than one week OR more than 10% property damaged OR average response duration of less than one day
- Significant – multiple injuries OR critical infrastructure shut down of at least two weeks OR more than 25% property damaged OR average response duration of less than one week
- Critical – multiple deaths OR critical infrastructure shut down of one month or more OR more than 50% property damaged OR average response duration of less than one month

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
- 12-24 hours
- 6-12 hours
- Less than six hours

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 six hours
- Less than one day
- Less than one week
- Greater than one week

3.2.5 Calculating the CPRI

The following calculation illustrates how the index values are weighted and how 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 community in Vigo County, and then a weighted CPRI value was computed based on the population size of each community. **Table 5** 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 5: Determination of Weighted Value for Communities

Community	Population (2021)	% of Total Population	Weighted Value
Vigo County	44,082	41.6%	0.42
Town of Riley	234	0.2%	0.00
Town of Seelyville	1,009	1.0%	0.01
City of Terre Haute	58,525	55.2%	0.55
Town of West Terre Haute	2,144	2.0%	0.02
Total	**105,994**	**100.0%**	**1.00**

3.3 HAZARD PROFILES

The hazards studied for this report are not equally threatening to all communities throughout Vigo County. While it would be difficult to predict the probability of an earthquake or tornado affecting 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 upon another hazard.

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 6 Urban Drought Affects

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; and focuses 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 source **Figure 6** shows urban grassed areas affected by drought conditions.

Drought: Recent Occurrences

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 7 US Drought Monitor Severity Classification

Data gathered from the U.S. Drought Monitor indicated that between January 2016 and February 2022, there were 63 weeks where some portion of Vigo County was considered to be in "Abnormally Dry" or in a DO drought status. For five weeks in September 2017 to October 2017, and eight weeks between September 2020 and November 2020, portions of Vigo County were categorized as D1 or a "Moderate Drought". **Figure 7**, from the U.S. Drought Monitor, describes the rationale to classify the severity of droughts.

The National Climate Data Center (NCDC) does not report any events or property or crop losses within Vigo County during this planning period.

The Planning Committee, utilizing the CPRI, determined the overall risk of drought throughout Vigo County is "Elevated". 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" to "Significant". The impact in the unincorporated area is anticipated to be impacted more severely due to the possible agricultural impacts and impacts to water wells. 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 6**.

Table 6 CPRI for Drought

	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI
Vigo County	Likely	Significant	> 24 Hours	> 1 Week	Elevated
Town of Riley	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of Seelyville	Likely	Limited	> 24 Hours	> 1 Week	Elevated
City of Terre Haute	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of West Terre Haute	Likely	Limited	> 24 Hours	> 1 Week	Elevated

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 significant droughts and drought related impacts felt within Vigo County, the Committee estimated that the probability of a drought occurring in the area is "Possible"; or occurrence is probable within the next five years.

"Negligible" to "Significant" damages are anticipated throughout the county as many municipalities rely on groundwater supplies for fire response efforts and face a higher risk during times of prolonged drought. Throughout the unincorporated areas of the county, increased crop and livestock damages would also be expected during a significant drought.

Drought: Assessing Vulnerability

This type of hazard will generally affect entire counties and even multi-county regions at one time. Within Vigo 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

Figure 8 Crops Affected by Drought

It is difficult to estimate the potential losses associated with a drought for Vigo 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 2021, Vigo County produced approximately 8.6M bushels of corn and 3.2M bushels of soybeans, as reported by the United States Department of Agriculture (USDA) National Agricultural Statistics Service. Using national averages of $7.50 per bushel of corn and $16.00 per bushel of soybeans, the estimated crop receipts for 2021 would be $115.7M. Using the range of crop yield decreases reported in 1988 and 1989, just after the 1988 drought period (50%-86%) and assuming a typical year, economic losses could range between $57.9M-$99.5M; depending on the crop produced and the market demand. Effects of drought on corn crops can be seen in **Figure 8**.

To provide examples of previous drought impacts, 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. Also, 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 drier seasons and therefore fewer crop losses may be experienced.

As the municipal 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 6.5 inches for the area of Vigo County. This increase in precipitation may lessen the likelihood or overall impact of a drought in Vigo 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.

Prior to municipalities expanding, provisions and considerations should be given regarding the potential additional demand for both water usage and fire response efforts. Following such expansion or development plans, alternative water sources should be explored. Since the previous MHMP was prepared, development has occurred on the borders of the incorporated communities within the central and eastern areas of the county. Much of the development has occurred near the City of Terre Haute along the I-70 corridor in the central portion of the county. Industrial expansion has occurred in Seelyville with Hearthside Foods and animal production has increased in regard to both turkey and hog facilities. All of these facilities may be impacted by droughts.

Drought: Relationship to Other Hazards

Discussions with the Planning Committee were held regarding the similar effects of prolonged periods of extreme heat and the similar impacts that may be experienced during these times. Planning and mitigation efforts for one hazard may benefit the other. It is anticipated that rural areas of the county may be more susceptible to cropland or woodland fires during a drought, while urban areas may experience these impacts in areas where several abandoned buildings or overgrown lots exist, and this may lead to increased losses associated with a 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.

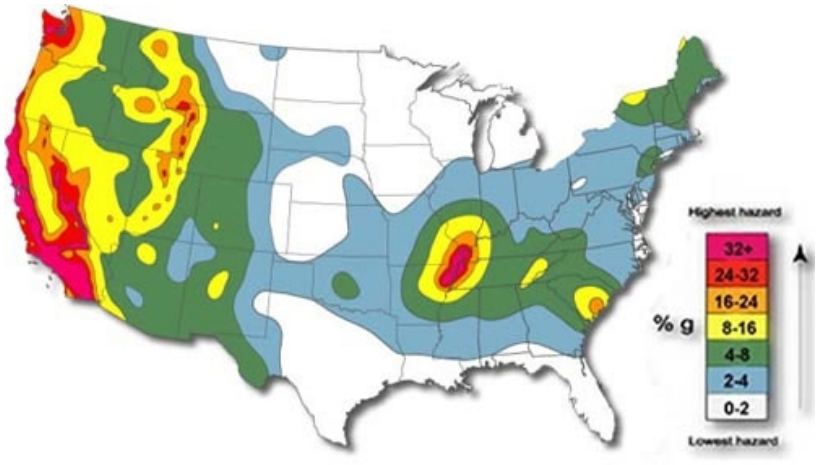


Figure 9 Earthquake Hazard Areas in the US

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.

One method of measuring the magnitude or energy of an earthquake is the Richter Scale. This scale uses whole numbers and decimal fractions whereby each increase of a whole number represents a release of 31 times more energy than the amount associated with the previous whole number on the scale. 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 an earthquake, and they are located in every region of the county (**Figure 9**). 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 Vigo County, the nearest areas of concern are the New Madrid Fault Zone and the Wabash Seismic Zone.

On June 17, 2021 an earthquake centered near Bloomingdale, Indiana in Parke County was felt as far north as Chicago, Illinois and as far east as Cincinnati, Ohio. With a magnitude of 3.8 several localized reports included descriptions of shaking buildings and feelings of tremors. No injuries or severe damages were reported due to this incident. As reported by the NBC 5 Chicago, "Once the earthquake was confirmed, officials said the 9-1-1 phone line "started ringing immediately."" Previous to this event, the last earthquake to be felt in Indiana was a magnitude 5.1 centered in Sparta, North Carolina and the last event to actually occur within the state was a magnitude 2.3 earthquake centered in Haubstadt, IN on May 28, 2015. No injuries or damages were reported with either of these events.

An event occurred on December 30, 2010, when central Indiana experienced an earthquake with a magnitude of 3.8. This event was 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 10 Earthquake Damaged Porch

A 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, results of HAZUS-MH scenarios, and that earthquakes have occurred close to Vigo County, the Committee determined that the probability of an earthquake occurring in Vigo County or any of the communities is "Possible". Should an earthquake occur, the impacts associated with this hazard are anticipated to be "Significant" to "Critical" within all areas of the county. As with all earthquakes, it was determined that the residents of Vigo County would have little to no warning time (less than six hours) and that the duration of the event would be expected to also be less than one week. A summary is shown in **Table 7**.

Table 7 CPRI for Earthquake

	Probability	Magnitude / Severity	Warning Time	Duration	CPRI
Vigo County	Possible	Negligible	< 6 Hours	< 1 Week	Low
Town of Riley	Possible	Negligible	< 6 Hours	< 1 Week	Low
Town of Seelyville	Possible	Limited	< 6 Hours	< 1 Week	Elevated
City of Terre Haute	Possible	Negligible	< 6 Hours	< 1 Week	Low
Town of West Terre Haute	Possible	Limited	< 6 Hours	< 1 Week	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 Vigo County is "Possible" to occur within the next five years.

Figure 11 Minor Earthquake Damages

Earthquake: Assessing Vulnerability

Earthquakes generally affect broad areas and potentially many counties at one time. Within Vigo 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

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 10** and **Figure 11**.

Estimating Potential Losses

In order to determine the losses associated with an earthquake, the HAZUS-MH software was utilized in the Vigo County MHMP update to determine the potential impacts anticipated from an arbitrary earthquake scenario. This scenario placed a magnitude 5.0 within Vigo County located east of North 12th Street north of Florida Avenue. This type of modeling is useful for planning efforts such as this.

Per the HAZUS-MH scenario noted above, total economic losses are anticipated to be near $2.3B with moderate damages to approximately 9,500 buildings, of which most are anticipated to be single-family residential structures. Nearly 700 structures are expected to be damaged beyond repair. In addition, there are moderate damages expected to nine segments of bridges and two segments of railroad. Planning should include the potential need to remove 444.0K tons of debris requiring an estimated17,760 dump trucks. Further, just over 1,000 households are expected to be displaced due to the earthquake and of those, over 800 people will seek shelter.

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.

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.

Future Considerations

While the occurrence of an earthquake in or near to Vigo 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, Vigo County should continue to provide education and outreach regarding earthquakes and even earthquake insurance along with education and outreach for other hazards. As Vigo 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.

It can be anticipated that while all structures in Vigo County will remain at-risk to earthquake damages and effects, new construction or redevelopment may reduce the overall risks. As redevelopment occurs, the new construction may be significantly sturdier. Further, as blighted or abandoned areas are addressed, those communities and the county as a whole, are less susceptible to economic and physical damages associated with earthquakes.

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 Vigo 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.

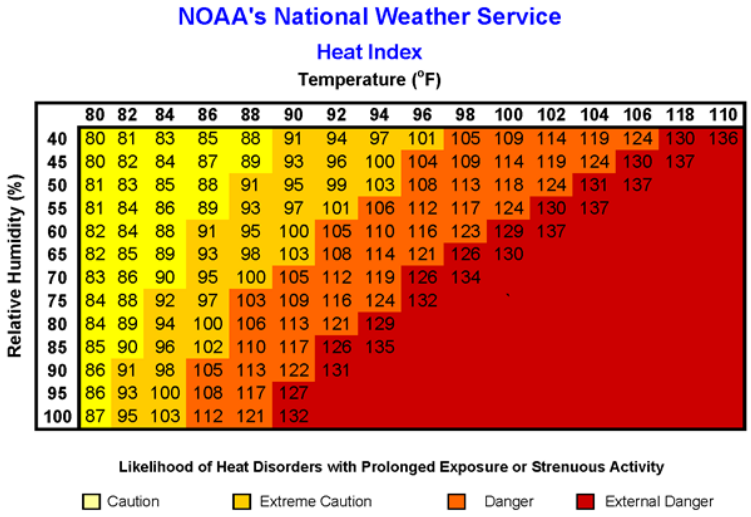


Figure 12 Heat Index Chart

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 12**. 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.

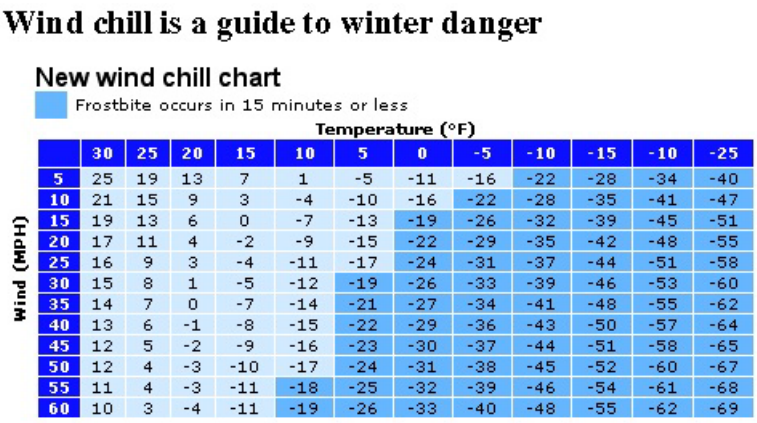
It is important to also note that these heat index values were devised for shady, light wind conditions. Exposure to full sunshine may increase heat index values by up to 15°F. Further, strong winds, particularly with very hot, dry air, can also be extremely hazardous.

As Figure 3-9 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.



Wind (MPH)	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 13 NWS Wind Chill Chart

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 13** identifies the Wind Chill Chart and how the same ambient temperature may feel vastly different in varying wind speeds.

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 no extreme heat event or extreme cold events between January 2016 and February 2022. Local reports provide information regarding instances within this timeframe where temperatures have dipped below freezing for multiple days. In 2021 and 2022, St. Stephen's Episcopal Church has opened their doors to serve as a warming shelter for homeless individuals in the Terre Haute area. Similarly, in July of 2019, cooling centers were opened at Washington High School to assist those in need of escaping the extreme heat affecting the region.

It is difficult to predict the probability that an extreme temperature event will affect Vigo County residents within any given year. However, based on historic knowledge and information provided by the community representatives, an extreme temperature event is "Highly Likely" (possible within the calendar year) to occur and if an event did occur, it would result in "Limited" magnitude. **Table 8** identifies the CPRI for extreme temperature events for all communities in Vigo County.

Table 8 CPRI for Extreme Temperatures

	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI
Vigo County	Highly Likely	Limited	> 24 Hours	<1 Week	Elevated
Town of Riley	Highly Likely	Limited	> 24 Hours	<1 Week	Elevated
Town of Seelyville	Highly Likely	Limited	> 24 Hours	<1 Week	Elevated
City of Terre Haute	Highly Likely	Limited	> 24 Hours	<1 Week	Elevated
Town of West Terre Haute	Highly Likely	Limited	> 24 Hours	<1 Week	Elevated

As shown in the table, index values remain identical throughout each community due to the regional extent and diffuse severity of this hazard event. The anticipation of experiencing such damages is due

to the number of livestock and cropland within the county and the potential to realize impacts within the urban areas.

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.

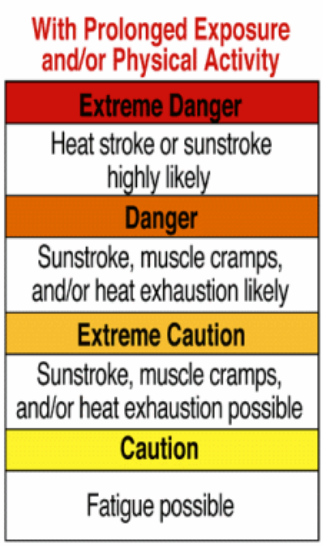


Figure 14 Danger Levels with Prolonged Heat Exposure

By assessing the demographics of Vigo County, a better understanding of the relative risk that extreme temperatures may pose to certain populations can be gained. In total, 17% of the county's population is over 65 years of age, nearly 6% of the population is below the age of 5, and approximately 21% 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.

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 14**.

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 Vigo 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 Vigo 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.

New construction associated with development of residential areas often brings upgraded and more efficient utilities such as central heating and air units further reducing vulnerabilities to the aging populations in those municipalities mentioned above. Conversely, new development associated with industrial or large commercial structures in the inner-urban centers often result in increased heat over time, which may cause additional stress to labor-related populations. Since the last planning effort, there has been residential and commercial development within the county, primarily along the Interstate 70 corridor and within Terre Haute. This actually decreases the overall vulnerability with the newer construction practices and open space requirements within neighborhoods.

Extreme Temperatures: Relationship to Other Hazards

While extreme temperatures may be extremely burdensome on the power supplies in Vigo County, the Committee concluded that this type of hazard is not expected to cause any hazards studied. 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 Fire

Fire: Overview

Figure 15 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 15**) 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.

A structural fire is an incident where a fire starts within a structure and is largely contained to that structure. Causes of structure fires can be related to electrical shorts, carelessness with ignition sources, poor storage of flammable materials, as well as arson. These types of fires can be deadly if no warning or prevention measures are present. The most dangerous aspect of structural fires is the production of toxic gases and fumes that can quickly accumulate in enclosed areas of structures and asphyxiate those who might be in the structure.

Problems associated with structural fires are compounded when high-rise buildings catch fire. High-rise fires hinder the ability of rescue workers to fight the fire, reach impacted building occupants, and evacuate impacted occupants. Rescue efforts also become more complicated when handicapped or disabled persons are involved. Complications associated with high-rise fires typically increase as the height and occupancy levels of the buildings increase. Structural collapse is another concern associated with high-rise fires. Structural collapse often results in persons becoming trapped and severely injured. However, it is important to note that the concern associated with structural collapse, is not limited to high-rise buildings; the collapse of smaller residential buildings can also lead to severe injury and death.

Typically, a fire 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 or a structure fire may be extremely dangerous. If weather conditions change suddenly, the wildfire may change course and overtake firefighters, causing severe injury or death. Fires can travel at speeds greater than 45 mph. Therefore, these hazard events can pose a serious threat to county residents and response agencies.

Fire: Recent Occurrences

Within the NCDC, there are no reports of wildfires occurring within Vigo County between January 1950 and February 2022. Within the same time parameter, there were only two 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.

The NCDC does not report structure fires; therefore, local sources were utilized to provide historical information. According to WTWO 2, the fire at the ReConserve warehouse could be seen for miles. Crews battled the fire for more than four hours and continued to deal with hot spots long after that.

Figure 16 Fire at ReConserve Warehouse in South Vigo County

The warehouse was a total loss but no injuries were reported from this event. (**Figure 16**). No injuries or fatalities were reported as a result of this event although US 50 was shut down for approximately five hours. Over 40 firefighters responded to the event and over 500,000 gallons of water was used in efforts to contain the blaze.

On December 11, 2020, shortly before 6:00 pm, several businesses in the 1700 block of Wabash Avenue in Terre Haute were either completely destroyed or heavily damaged. Several people were in the affected buildings but were able to get out and get to a safe area. **Figure 17** shows firefighters battling the fire from the outside while the flames emerge from the roof.

Figure 17 Wabash Avenue Fire in Terre Haute

Due to the expansive acreage of cropland and woods within Vigo County, and the potential for urban areas to be at risk due to abandoned homes, blighted areas, or industrial activities, the Planning Committee determined the probability to be "Likely" throughout most of the County. Further, the probability is anticipated to be "Highly Likely" within Terre Haute due to the number of structures and increased population. **Table 9** identifies the CPRI rankings for fire in Vigo County.

Table 9 CPRI for Fire

	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI
Vigo County	Likely	Limited	< 6 Hours	< 1 Day	Elevated
Town of Riley	Likely	Critical	< 6 Hours	< 1 Day	Severe
Town of Seelyville	Likely	Critical	< 6 Hours	< 1 Day	Severe
City of Terre Haute	Highly Likely	Critical	< 6 Hours	< 1 Day	Severe
Town of West Terre Haute	Likely	Critical	< 6 Hours	< 1 Day	Severe

Many of the municipalities are anticipated to have "Critical" level of severity due to the age and status of the construction as well as the proximity of structures. When a fire is started, it will travel quickly, taking several structures at a time.

Information provided in **Table 10** highlights the number of fire department runs for a few of the Vigo County departments between 2019 and 2021. These numbers include calls related to fires, motor vehicle accidents, wellness checks, and health related issues but do represent the overall need for these services throughout Vigo County. Based on this information, annual damages to structures, contents, and vehicles may be significant for each municipality on an annual basis. Social losses, such as being unable to work following a residential structure fire or losses associated with a business fire should also be considered as an impact.

Table 10 Vigo County Fire Runs

	2019	2020	2021
Honey Creek	1,444	1,763	2,142
Otter Creek	600	721	804
Pierson Township	91	90	102
Prairieton	166	149	195
Riley	373	510	491
Seelyville	500	607	723
Terre Haute	9,441	11,052	12,452
TOTAL	**14,634**	**16,912**	**18,930**

Fire: Assessing Vulnerability

A fire typically affects a large regional area with potential for physical, economic, and/or social losses. Typically, a structural fire affects one or two structures, as one of the main functions of fire response is to prevent the fire from spreading to neighboring structures. This type of action works to reduce the magnitude and severity from "Critical" throughout the county and municipalities.

Much of the county is rural and agricultural in land use, which may be more susceptible to brush or crop fires, especially in times of drought. As most development has continued to occur within central Vigo County near Terre Haute and the I-70 corridor since the last planning effort, vulnerabilities to this hazard have not shifted in location. Urbanized areas within Vigo County are susceptible to urban and industrial fires, while much of the remaining Vigo County remains vulnerable to field, crop, and woodland fires. **Figure 18**, from IndianaMap, identifies areas such as Wabashiki Fish and Wildlife Area, Wabash River Conservation Areas, and Fairbanks Landing Fish and Wildlife Area. These areas are densely wooded and managed in natural ways which may make them more susceptible to fires.

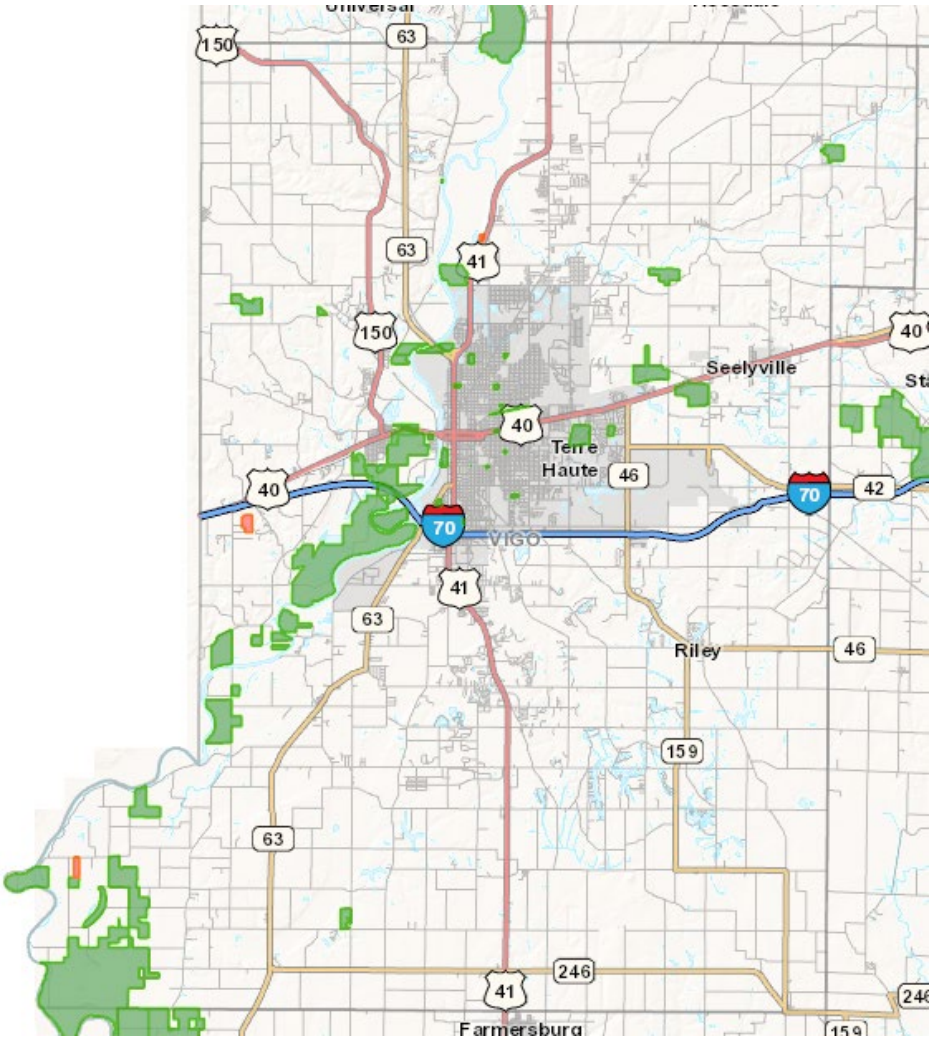


Figure 18 Vigo County IDNR Managed Areas

Direct and indirect effects of a such an event within Vigo 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.

Monetary damages associated with the direct effects of the fires are difficult to estimate, other than utilizing historic information as provided. Indirect effects would cause increased efforts associated with emergency response services as wildfires are difficult to contain and may accelerate very quickly. Further, multi-level business or residential structures place increased risks to those who work or live within those structures or nearby structures.

Future Considerations

As populations increase and communities continue to grow in size, the need to respond to fire 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.

In addition, increased populations require increased housing. Many urban communities develop large multi-family residential structures, or apartment complexes, where structures are not only in close proximity to each other, but also contain a large number of citizens. As communities age, some structures may become abandoned, significantly increasing the risk of fire due to potential vagrant populations and lack of maintenance. These areas should be considered at-risk and potentially demolished to avoid such risk and potential hazard.

Fires 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 fire and how it may affect those businesses directly related to cropland or natural resource areas.

Fire: Relationship to Other Hazards

Fires 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. Fires 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.

3.3.5 Flood

Flood: Overview

Floods are the most common and widespread of all the 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 Exceedance Probability (AEP), 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% AEP is referred to as the "regulatory" or "base" flood. Another term commonly used, the "100-year flood", can be misleading. It does not mean that only one flood of that size will occur every 100 years, but rather 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. Yet another term for this area is the Special Flood Hazard Area (SFHA).

Flood: Recent Occurrences

The NCDC indicates that between January 2016 and February 2022, there were six floods and five flash floods reported. In total, these eleven events resulted in a reported $104.25K in property damages and an additional $11.0K in crop damages with no reported injuries or deaths.

The narrative report through NCDC regarding the June 2021 flash flood event detailed how sandbags were deployed throughout the area of Prairieton to hold back the water. Numerous roads were closed due to flowing water in southern Vigo County resulting in approximately $50.0K in reported damages. Several other narrative event descriptions provided little description other than roads were closed due to rising water or as they were overtopped.

One local report provided additional information regarding flood events not reported through NCDC. February 2022 flooding resulted in the closure of nearly 40 roads in Vigo County alone. In addition, several of the roads and bridges were washed out, making them especially dangerous. **Figure 19** shows the high water in the area leading to early school closures and delays for the following day to decrease the amount of traffic on the roads.

Figure 19 High Water in Vigo County

During Planning Committee meetings, attendees mentioned several locations considered to be especially vulnerable to impacts from flooding, either due to riverine flooding or poor drainage from heavy rains. Those areas are:

- Hasselberger Avenue (Otter Creek)
- Between Lafayette and Fruit Ridge (Otter Creek)
- Western Prairieton (Honey Creek)
- Pennington Road/Pottsville Road (Coal Creek)
- Oregon Church Road
- Near Lewis
- State Road 159, south of the Riley Fire Department

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 Vigo County, there is one active USGS stream gages with capabilities of issuing forecasts as needed during flood events, the Wabash River at Terre Haute.

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 1/3 of the country's flood insurance payments. According to FEMA Region V, there are a total of 30 repetitive loss structures (28 single-family and 2 multi-family) within the unincorporated areas of Vigo County and seven additional single-family structure in Terre Haute.

There have been a number of claims made for damages associated with flooding in Vigo County. Within the unincorporated areas of the county, there have been 598 claims resulting in over $16.3M in payments. Further, within the City of Terre Haute, there were 57 payments totaling approximately $851.0K. **Table 11** identifies the number of claims per community as well as payments made, as provided by IDNR. Information regarding the Towns of Riley, Seelyville, and West Terre Haute was not provided independently as they do not participate in the NFIP program individually and are included within the information for the unincorporated county.

Table 11 Repetitive Properties, Claims, and Payments

Community	# of Repetitive Loss Properties	Claims Since 1978	$$ Paid
Vigo County	30	57	$16,345,952
Town of Riley			
Town of Seelyville			
City of Terre Haute	7	598	$850,873
Town of West Terre Haute			
TOTAL	**37**	**655**	**$17,196,825**

Mandatory flood insurance purchase requirements apply to structures in 1% annual chance of flooding delineated areas. Total flood insurance premiums for Vigo County and the communities is approximately $684.0K. Total flood insurance coverage for Vigo County and the communities is nearly $144.5M. **Table 12** further indicates the premiums and coverage totals for individual communities.

Information regarding the Towns of Riley, Seelyville, and West Terre Haute was not provided independently as they do not participate in the NFIP program individually and are included within the information for the unincorporated county.

Table 12 Insurance Premiums and Coverage

Community	Flood Insurance Premiums	Flood Insurance Coverage
Vigo County	$600,577	$119,950,600
Town of Riley		
Town of Seelyville		
City of Terre Haute	$83,458	$24,571,300
Town of West Terre Haute		
TOTAL	**$684,035**	**$144,521,900**

As determined by the Committee, the probability of a flood occurring throughout Vigo County is "Highly Likely" throughout the unincorporated county and the municipalities. This is largely based on the presence or absence of rivers or water systems in or near the communities and issues associated with localized drainage. Impacts from such an event are anticipated to range from "Negligible" to "Significant". The Committee also determined that the warning time would be 12-24 hours based on forecasting methods, local knowledge of stream activities, and the warning provided by gages upstream. Finally, the duration of such an event is anticipated to last less than one week in most areas and greater than one week within the unincorporated areas. A summary is shown in **Table 13**.

Table 13 CPRI for Flood

	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI
Vigo County	Highly Likely	Significant	> 24 hours	> 1 week	Severe
Town of Riley	Highly Likely	Significant	> 24 hours	< 1 week	Severe
Town of Seelyville	Highly Likely	Limited	> 24 hours	< 1 week	Elevated
City of Terre Haute	Highly Likely	Significant	> 24 hours	< 1 week	Severe
Town of West Terre Haute	Highly Likely	Significant	> 24 hours	< 1 week	Severe

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 NCDC, and previous experiences, the Committee determined that flooding is "Highly Likely" throughout the county.

Flood: Assessing Vulnerability

Flood events may affect large portions of Vigo County at one time as river systems and areas with poor drainage cover much of the county and several communities. In addition to riverine flooding or flooding in poorly drained areas, is the consideration of fluvial erosion hazard (FEH). This represents the risk associated with natural stream movements and losses associated with buildings and infrastructure. In some cases, this may be represented by a gradual movement of a stream across a farm field. In other, more extreme instances, homes or other infrastructure may actually be lost as steep riverbanks or bluffs sluff into the water below. This will be discussed more within the Landslide/land subsidence discussion.

Within Vigo 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

In the time period since the last planning effort, development has occurred within the municipalities near the center of the county near Terre Haute and the I-70 corridor. Other incorporated areas have also grown and what has occurred, has been directed away from various floodplains. This mitigation measure helps to reduce the county-wide flood risk and vulnerability. Structures have prevented from being built in the high-risk areas while growth has been directed to more appropriate areas, less at risk from riverine flooding.

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 a Modified Building Inventory developed with information provided by Vigo County. 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 classified in the Assessor's database as a non-habitable structure was assumed to be an outbuilding. It was assumed that a building was located on a parcel if the value listed in the "Assessed Value (Improvements)" showed a value greater than zero dollars. Parcels that intersected any portion of the FEMA flood zones were considered to be flood prone, and subsequently, further analyzed separately from parcels without structures. 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

In order to estimate anticipated damages associated with each flood zone in Vigo County and 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 14** 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 community within Vigo County. The structure counts within each zone are not inclusive and those shaded blue are indicated to be protected by a levee on the FEMA floodplain map.

Table 14 Manual GIS Analysis Utilizing Best Available Data and Vigo County Building Inventory

	Floodway		1% AEP		0.2% AEP		Approximate		Totals	
	#	$	#	$	#	$	#	$	#	$
Vigo County	157	$14.0M	1,630	$123.9M	179	$12.3M	120	$9.5M	**2,086**	**$159.7M**
Town of Riley	0	0	0	0	0	0	0	0	**0**	**0**
Town of Seelyville	0	0	0	0	0	0	0	0	**0**	**0**
City of Terre Haute	38	$5.0M	89	$12.0M	33	$3.5M	53	$16.8M	**213**	**$37.4M**
Town of West Terre Haute	8	$1.7M	0	0	595	$39.5M	0	0	**603**	**$41.2M**
Totals	**203**	**$20.7M**	**1,719**	**$135.9M**	**807**	**$55.3M**	**173**	**$26.3M**		

Utilizing the same GIS information and process, critical infrastructure within each of the flood hazard areas in Vigo County was assessed and are included in **Table 15**. These buildings are included in the overall number of structures and damage estimate information provided in Table 14.

Table 15 Critical Infrastructure in Flood Hazard Areas in Vigo County

Community	Floodway	1% AEP	0.2% AEP
Vigo County	Markle Mill Dam	Eduplay Daycare Grandma's Daycare Otter Creek Twp Fire Dept Honey Creek Fire and Rescue Bethesda Gardens Harborside Healthcare Midwest Surgery Center Wyndmoor Senior Living Wabash Valley Power Allendale Substation Lowe's Sam's Club Terre Haute South 1st St Substation First Reactions Auto Rebuilder Kohl's Kroger Springhill Village Walmart Hawthorne Wildlife Dam	Kiddie Carousel
Town of Riley			
Town of Seelyville			
City of Terre Haute	WWTP	Terre Haute Honey Creek Substation JC Penney Red Lobster	KNKA-497
Town of West Terre Haute	Water Tower WWTP		Busy Bee Daycare/Preschool Police Department *(Levee)*

Utilizing the information in Table 14 regarding the number of structures within each flood hazard area, it is also important to note the number of flood insurance policies within each area in Vigo County. **Table 16** provides the comparison between the number of structures in the hazard areas 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 16 Number of Structures in the 1% AEP and Number of Flood Insurance Policies

Community	# Structures in 1% AEP	# Policies
Vigo County	1,966	669
Town of Riley	0	0
Town of Seelyville	0	0
City of Terre Haute	160	74
Town of West Terre Haute	603	0
Total	**1,412**	**743**

Future Considerations

As the municipalities within Vigo County continue to grow in population, it can be anticipated that the number of critical and non-critical infrastructure will also increase accordingly. Within Vigo County, it is discouraged for new schools, medical facilities, community centers, municipal buildings, and other critical infrastructure to be located within the 0.2% AEP (500-year) floodplain. New structures must also be 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 infrastructures will be able to continue functioning during major flood events. Flooding due to poor drainage, low-lying land, or flash flooding is also an important consideration. It will be important for recognition of potential flood impacts to residents and businesses in these areas to be coupled with proper planning for future development and redevelopment of the flood zones. Since the previous planning effort, no development has occurred within the flood zones of Vigo County.

It is 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.

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.

Figure 20 Fire Engine in Flood Waters

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.

Indirect effects of flooding may include increased emergency response times due to flooded or redirected streets (**Figure 20**), 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 Vigo 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

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 or levee 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 snowstorm 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.

Repeated flooding may also create impacts associated with landslides along riverbanks and bluff areas. As floodwaters travel through the systems, saturating shorelines and increasing volumes and velocities of water, the natural process of fluvial erosion may be exacerbated. As these processes are increased, structures and infrastructure located in proximity to the river may be at risk.

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.

3.3.6 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 20**), 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 21 Damaging Hail on Vehicles

In Vigo County, the NCDC has recorded 15 hailstorms and 29 thunderstorms/windstorms between January 2016 and February 2022. The largest recorded hailstone was 1.75 inch in diameter and occurred on May 1, 2016 near Swalls and again on July 13, 2016 near Terre Haute. The average diameter hailstone occurring throughout Vigo County is approximately 1.0 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 Vigo County, NCDC reports 22 instances between January 2016 and February 2022 where top wind speeds were greater than 60 mph.

Total NCDC recorded damages for hailstorms, thunderstorms, and windstorms throughout Vigo County are $246.4K in property damages, no additional crop damages, and no injuries or deaths 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 Vigo County. Even in instances where monetary damages were reported, narrative descriptions of the event rarely extended beyond reports of damages to broken tree limbs, downed power lines, or roof damages.

During the May 10, 2017 event near Southwood, high winds impacted the area resulting in several trees blown over and some blown onto homes and vehicles. One news station reported that a large sign was lifted from the base and landed on the roof 20 feet away. In total, $100.0K in damages were reported for this event. Many other events described limbs and trees blown over, sometimes resulting in power outages and debris blocking roads. Appendix 6 provides the NCDC information regarding hailstorms, thunderstorms, and windstorms that have resulted in injuries, deaths, and monetary damages to property and/or crops.

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 anywhere throughout Vigo County is "Highly Likely" and will typically affect broad portions of the county at one time resulting in potentially "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 less than six hours (for storms anticipated to result in damages) and the duration is also 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 similar throughout the county. These events are highly unpredictable, and the occurrences are distributed through the county, sometimes impacting one community more often or more severely than another. Therefore, the CPRI values reflect the distributed risk and associated priority for a hailstorm, thunderstorm, or windstorm. A summary is provided in **Table 17**.

Table 17 CPRI for Hailstorm, Thunderstorm, and Windstorm

	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI
Vigo County	Highly Likely	Limited	< 6 Hours	< 6 Hours	Severe
Town of Riley	Highly Likely	Limited	< 6 Hours	< 6 Hours	Severe
Town of Seelyville	Highly Likely	Limited	< 6 Hours	< 6 Hours	Severe
City of Terre Haute	Highly Likely	Limited	< 6 Hours	< 6 Hours	Severe
Town of West Terre Haute	Highly Likely	Limited	< 6 Hours	< 6 Hours	Severe

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 be similar based on the number of critical infrastructure and populations of each of the municipalities, 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 Vigo 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 22 Home Damaged During Windstorm

Due to the unpredictability of this hazard all critical infrastructure and non-critical structures in Vigo 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 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 that shown in **Figure 22**, are common.

Future Considerations

As the populations of the communities in Vigo County continue to grow, it can be anticipated that the number of critical and non-critical structures will also increase. 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.

Indirect effects resulting from a hailstorm, thunderstorm, or windstorm can include power outages caused by downed tree limbs or flying debris, 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 Vigo 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. A similar concern due to the potential precipitation would be dam failure. 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.

The risk of social losses also increases during a hailstorm, thunderstorm, or windstorm, as these hazards often 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 because of falling debris.

3.3.7 Landslide/Subsidence

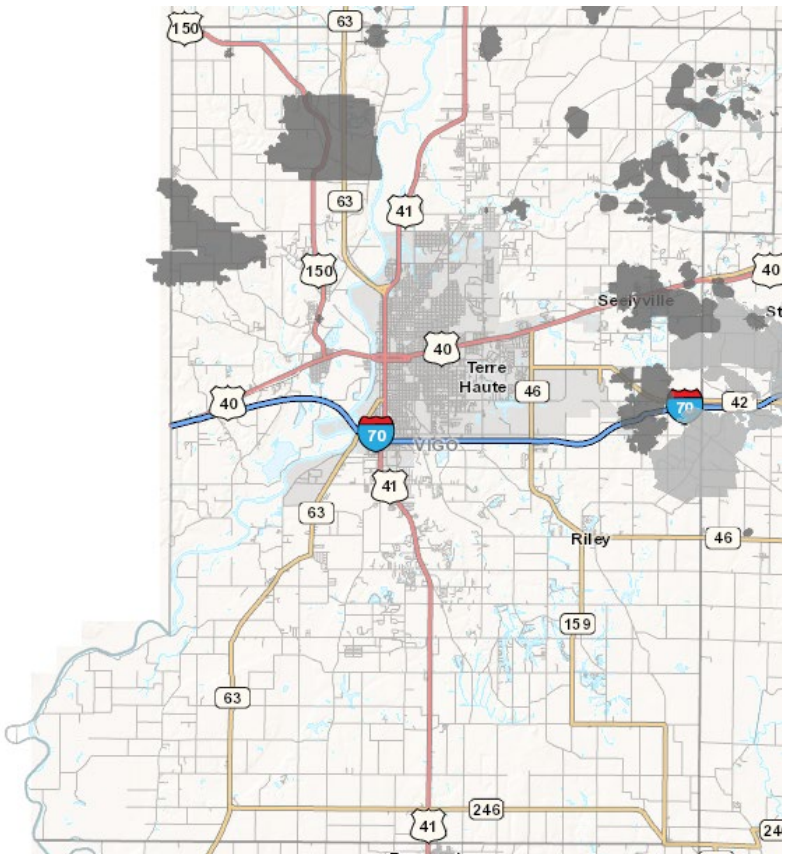
Landslide/Subsidence: Overview

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.

Another important consideration is that of fluvial erosion hazard (FEH). This represents the risk associated with natural stream movements and losses associated with buildings and infrastructure. In some cases, this may be represented by a gradual movement of a stream across a farm field. In other, more extreme instances, homes or other infrastructure may actually be lost as steep riverbanks or bluffs sluff into the water below.

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 Vigo County was discussed by the Planning Committee. To the knowledge of the Planning Committee, there are no Karst areas within Vigo County. However, there are several areas which have been mined for coal either on the surface or underground. The Seelyville Coal member is the name provided to the band of coal present near Seelyville, Indiana which has been mined since the late 1800's. This band travels through other areas in Indiana but is primarily in the northern reaches of Vigo County. These mined areas, both surface in light gray and underground in dark gray are shown on **Figure 23**.

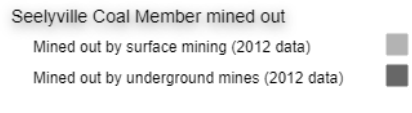


Figure 23 Mining Activities in Vigo County Indiana

The information and map files utilized in creating the map are accessible through Indiana MAP and provided through a partnership between the National Coal Resource Data System Database, the USGS, and the Indiana Geological Survey. This partnership works to make data such as this readily available for those who may need to use it for historical research, land use planning, or other educational purposes.

In addition of this, to date, there has not been any landslides or subsidence events in Vigo County that were not caused by leaking sewer or water pipes slowly eroding away the soil. These types of events will not be studied further within this planning effort.

The Committee determined the probability of a landslide or subsidence occurring in Vigo County is "Unlikely" to "Possible" in various areas throughout the county, dependent on the proximity to underground mines and known areas of steep slopes along water courses. The committee also anticipates an event to result in potentially "Limited" damages. Currently, the Committee feels that the warning time is anticipated to be less than six hours in areas where an event is expected to occur. Similarly, the duration is expected to last less than six hours. These events are highly unpredictable and the risk, although very low 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 18.**

Table 18 CPRI for Landslide/Land Subsidence

	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI
Vigo County	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Riley	Unlikely	Limited	< 6 Hours	< 6 Hours	Low
Town of Seelyville	Likely	Limited	< 6 Hours	< 6 Hours	Elevated
City of Terre Haute	Likely	Limited	< 6 Hours	< 6 Hours	Elevated
Town of West Terre Haute	Possible	Limited	> 24 Hours	< 6 Hours	Low

Landslide/Subsidence: Assessing Vulnerability

Vigo County, without the presence of Karst geology, is at a lower risk of land subsidence or sink holes; "Unlikely" to "Likely" according to the Planning Committee with "Limited" magnitude estimates. 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. **Figure 24** identifies the landslide susceptibility throughout Indiana. Areas of low susceptibility are shown in green and areas with a moderate susceptibility, yet low incidence are identified in yellow. With the entirety of Vigo County having a low susceptibility with a low incidence, it is anticipated that minimal losses will be realized.

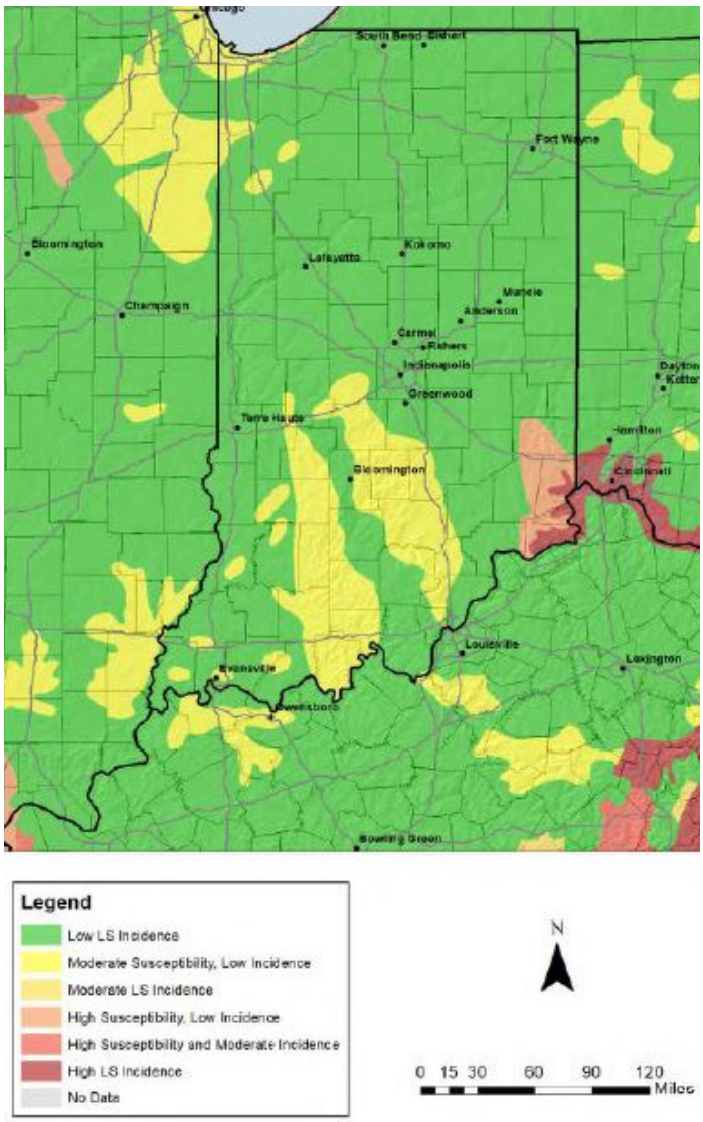


Figure 24 Indiana Landslide Susceptibility

Within Vigo 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 critical infrastructure and non-critical structures in Vigo County are at very low 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. As additional data becomes available risks and vulnerabilities will be reevaluated

Future Considerations

As the populations of the communities in Vigo 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. The FEH areas should also be considered for new and redevelopment proposals.

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.

3.3.8 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-blown 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 24** 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 25 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 19**. 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, Vigo County has not experienced any tornadoes between January 2016 and February 2022.

Table 19 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

The Committee estimated the probability of a tornado occurring in Vigo County would be "Likely" and the magnitude and severity of such an event to be "Significant" to "Critical" throughout much of the county. As with many hazardous events, the Committee anticipated a short warning time of typically less than six hours, and a short duration, also less than six hours. The summary is shown in **Table 20**.

Table 20 CPRI for Tornado

	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI
Vigo County	Likely	Significant	< 6 Hours	< 6 Hours	Elevated
Town of Riley	Likely	Significant	< 6 Hours	< 6 Hours	Elevated
Town of Seelyville	Likely	Significant	< 6 Hours	< 6 Hours	Elevated
City of Terre Haute	Likely	Critical	< 6 Hours	< 6 Hours	Elevated
Town of West Terre Haute	Likely	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 Vigo County is "Likely" (within 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 Vigo County that would be 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 EF2 intensity tornado traveled through portions of the county and Terre Haute. 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% of the structures would be 50% damaged, and 40% of the structures would sustain 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 theoretically lower wind speed. **Table 21** provides summary data for the hypothetical tornado, which is identified on Exhibit 3.

Table 21 Summary of Hypothetical Tornado Damages

	Zone A		Zone B		Zone C		Total	
	#	$	#	$	#	$	#	$
Terre Haute	599	$52.6M	448	$38.1M	442	$37.1M	**1,489**	**$127.8M**
County	25	$1.7M	17	$1.4M	23	$1.4M	**65**	**$4.5M**
Totals	**624**	**$54.3M**	**465**	**$39.5M**	**465**	**$38.5M**	**1,554**	**$132.3M**

Future Considerations

Within Vigo 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, few outdoor warning sirens are located within the county, located at either university settings such as Indiana State University or Rose Hulman, or private industries. Coverage provided by these outdoor warning sirens is primarily meant to serve those populations and areas relevant to those institutions or businesses. Currently, Vigo County is working to provide economical and efficient warnings through social media, weather radios, and other outlets and does not have plans to expand the outdoor warning siren capabilities.

While it can be anticipated that new construction associated with development may be stronger than older or existing construction, most of Vigo County will remain vulnerable in areas left uncovered by outdoor warning sirens. It is impossible to predict the path of a tornado and therefore all current and future development will continue to be at risk for damages. However, risk to the citizens of Vigo County has been lessened through participation in mass notification programs and outdoor warning siren activations.

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 they are 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.

3.3.9 Winter Storm and 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 defined as one that drops four or more inches of snow during a 12-hour period, or six 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 26 Ice Covered Power Lines

Storm effects such as extreme cold, flooding, and snow and ice accumulation (**Figure 27**) 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. 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 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 Vigo County and the surrounding region. Such conditions can result in substantial personal and property damage, even death.

Winter Storm & Ice: Recent Occurrences

Since January 2016, the NCDC has recorded only one heavy snow event (no blizzards, ice storms, winter storms, or winter weather events). NCDC reported only $50.0K in property damages, and no injuries or deaths associated with the heavy snow. Narrative descriptions for the February 2021 heavy snow event indicated poor travel conditions, power outages and debris which may be expected with similar events.

Snowfalls in the Terre Haute area measured nearly nine inches and travel warnings were issued throughout the county. Interstate 70 was briefly shut down due to a crash caused by poor visibility and driving conditions.

The probability, magnitude, warning times, and duration of a snowstorm or ice storm causing disruption to residents and businesses in Vigo County, as determined by the Planning Committee, is expected to be mostly consistent throughout the county and communities. It is "Highly Likely" that this type of hazard will occur in this area and will typically affect the entire county, and possibly several surrounding counties at one time, resulting in primarily "Significant" damages due to the remoteness of some areas and the number of critical facilities in others. The warning time for severe temperatures or several inches of snow associated with a winter storm is usually greater than 24 hours while the duration of the incident is anticipated to be less than one week. A summary is shown in **Table 22**.

Table 22 CPRI for Winter Storm and Ice

	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI
Vigo County	Highly Likely	Significant	> 24 Hours	< 1 Week	Severe
Town of Riley	Highly Likely	Significant	> 24 Hours	< 1 Week	Severe
Town of Seelyville	Highly Likely	Significant	> 24 Hours	< 1 Week	Severe
City of Terre Haute	Highly Likely	Significant	> 24 Hours	< 1 Week	Severe
Town of West Terre Haute	Highly Likely	Significant	> 24 Hours	< 1 Week	Severe

The Planning Committee determined that the probability for a snowstorm or ice storm to occur in Vigo County and the communities within is "Highly Likely" or will occur within the next calendar year. Based on historical data and the experience of the Planning Committee, snowstorms are common within Vigo County and will continue to be a regular occurrence.

Winter Storm & Ice: Assessing Vulnerability

A snowstorm typically affects a large regional area with potential for physical, economic, and/or social losses. Direct and indirect effects of a snowstorm or ice storm within Vigo 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 snowstorm, 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 snowstorm and ice storm incidents.

Figure 27 Travel Impacted During Snowstorm

For planning purposes, information collected in snowstorms 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 Vigo County communities. For example, a March 2003 snowstorm 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 repair. The agencies found over 300 homes and businesses either damaged or destroyed in six counties. Snowstorms and blizzards also make road travel difficult and dangerous, as in **Figure 28.**

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 closed 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, winter storms generally 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, the need to respond to snowstorms 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. These hazard events will typically affect the entire county as a whole, perhaps multiple counties, and therefore all development, current and future, will be at risk for damages associated with snow and ice storms.

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 three quarters of 1977 to approximately -1% in the last quarter of 1977 and 3% during the first quarter of 1978.

Winter Storm & Ice: Relationship to Other Hazards

Figure 28 Flooding Caused by Snow Melt

Winter storms and ice storms can lead to flooding as the precipitation melts and enters local receiving waters. This increased volume of water on already saturated, or still frozen ground can quickly result in flood-related damages to structures and properties (**Figure 29**) as well as within the stream or river channel. The increased flooding may then lead to a dam or levee 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 Vigo County, or where open areas are more susceptible to snow drifts on 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/Levee Failure

Dam/Levee 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.

A levee is a flood control structure designed to hold water away from a building. Levees protect buildings from flooding as well as from the force of water, from scour at the foundation, and from impacts of floating debris. The principle causes of levee failure are like those associated with dam failure and include overtopping, surface erosion, internal erosion, and slides within the levee embankment or the foundation walls. Levees are designed to protect against a particular flood level and may be overtopped in a more severe event. When a levee system fails or is overtopped, the result can be catastrophic and often more damaging that if the levee were not there, due to increased elevation differences and water velocity. The water flowing through the breach continues to erode the levee and increase the size of the breach until it is repaired or water levels on the two side of the levee have equalized.

Dam/Levee Failure: Recent Occurrences

Within Vigo County, there are seven DNR-regulated High Hazard dams (Daisy Lake Dam, Griggs Lake Dam, Hawthorn Park Dam, Hulman Lodge Dam, Llewellyn Lake Dam, St Mary of the Woods Dam, Thompson Ditch Dam); 15 Significant hazard dams; and 22 Low Hazard Dams, all shown on Exhibit 2. According to local information, there have been no dam failures within Vigo County.

According to the National Levee Database (NLD) managed by the USACE, there are six levee systems within Vigo County which provide protection against portions of the Wabash River (**Figure 29**). Currently, only one levee system, the West Terre Haute Levee System, is provisionally accredited and recognized on the FIRM as providing protection for the 1% AEP flood. The other levee systems identified have been installed as protection for agricultural lands and crop production. There have been no reported levee failures within Vigo County within this reporting period.

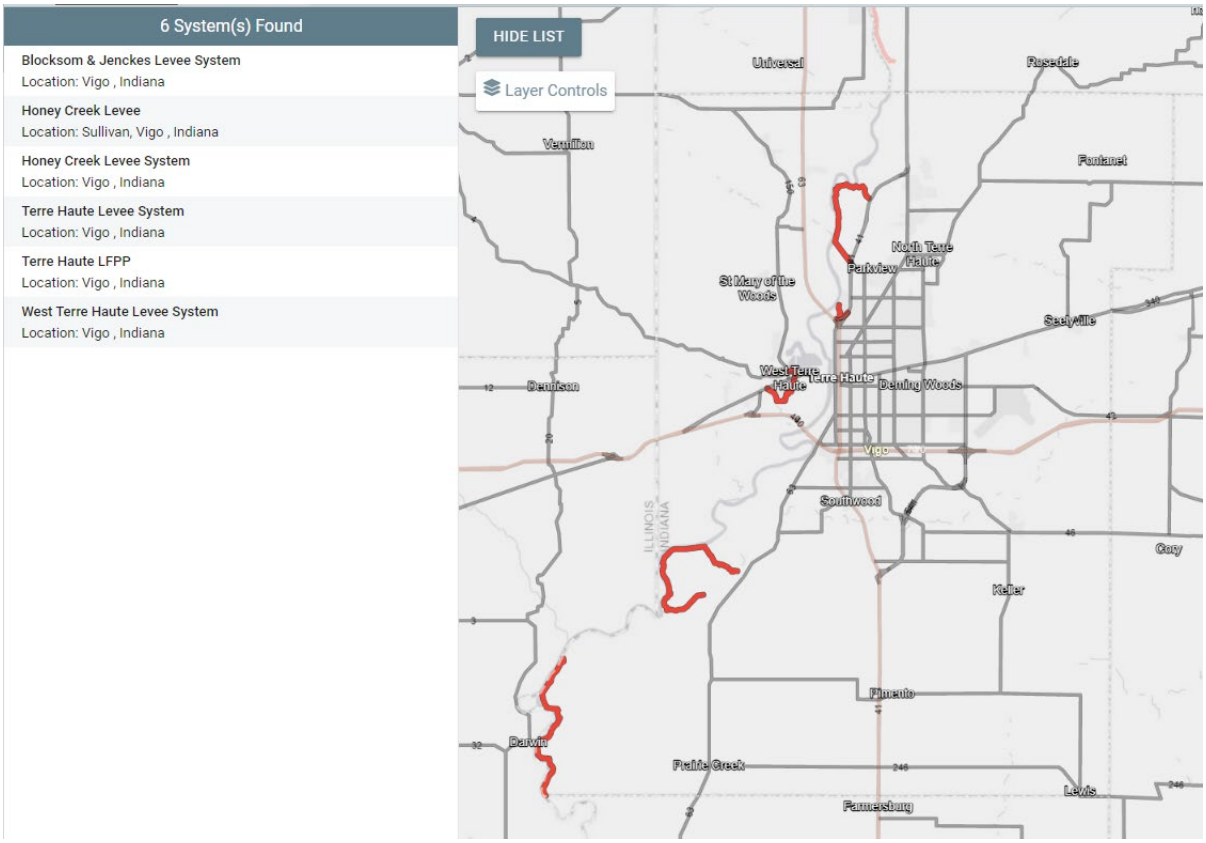


Figure 29 NLD Levee Systems within Vigo County Indiana

Based on the information provided to them and their local knowledge, experience, and expertise, the Committee determined the probability of a dam or levee failure is "Unlikely" in those areas where a dam or levee does not exist or in area not anticipated to be directly impacted by a dam or levee breach (Riley and Seelyville). In areas of the county with a dam or levee, or those anticipated to be affected by a breach, the probability, according to the Planning Committee, was also determined to be "Likely". With similar regard, the magnitude ranges from "Significant" (areas within the potential inundation area) to "Negligible" (areas not anticipated to be within the inundation area or where structures are anticipated to be in good standing) damages. For a dam or levee failure that occurs on a sunny day, the warning time is anticipated to be less than six hours in areas which may be impacted; and the duration is anticipated to last less than six hours. **Table 23** provides a summary of the Planning Committee's expectations during a dam or levee failure.

Table 23 CPRI for Dam/Levee Failure

	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI
Vigo County	Likely	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Riley	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of Seelyville	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
City of Terre Haute	Likely	Significant	< 6 Hours	< 6 Hours	Elevated
Town of West Terre Haute	Unlikely	Significant	< 6 Hours	< 6 Hours	Elevated

Dam/Levee Failure: Assessing Vulnerability

The actual magnitude and extent of damages due to a dam or levee failure depend on the type of breach, the volume of water that is released, and the width of the floodplain valley to accommodate the flood wave. Due to the conditions beyond the control of the dam or levee owner or engineer, there may be unforeseen structural problems, natural forces, mistakes in operation, negligence, or vandalism that may cause a structure to fail.

Within Vigo 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
- Loss of 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

Estimating Potential Losses

As of July 1, 2022 it is required that High Hazard dams have Incident and Emergency Action Plans (IEAP) developed. These plans have detailed potential dam failure inundation areas identified along with at-risk structures identified. None of the High Hazard dams within Vigo County have an IEAP developed. Potential dam failure inundation areas are developed for these High Hazard dams through the IEAP effort to provide an example of at-risk areas and anticipated damages. The actual magnitude and extent of damages depend on the type of dam break, the volume of water that is released, and the width of the floodplain valley to accommodate the dam break flood wave. The owners of these dams will be strongly encouraged to develop an IEAP with potential inundation mapping to better define the at-risk areas and populations.

Recent aerial photography was reviewed to roughly estimate the number of critical and non-critical structures potentially affected by a sunny-day dam failure. 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 24** provides overview information of each of the individual High Hazard dams.

Table 24 Vigo County Potential Dam Failure Impacts

High Hazard Dam	Potential Damages	
	# Structures	$ Damages
Daisy Lake	7	$0.4M
Griggs Lake	25	$1.5M
Hawthorn Park Lake	9	$2.2M
Hulman Lodge	4	$1.8M
Llewellyn Lake	4	$0.2M
St Mary of the Woods	30	$1.8M
Thompson Ditch	25	$1.5M

Utilizing the same rough review of aerial photography, it is anticipated that the only critical infrastructure expected to be impacted outside of the dams themselves is Rose Hulman Institute of Technology. This facility may be impacted by both the Hawthorn Park Lake Dam and the Hulman Lodge Dam. Development of the IEAPs with inundation mapping may help to more specifically identify the number of structures at risk from a dam failure.

As discussed earlier, there are six levee systems in Vigo County, one of which is provisionally accredited through FEMA. FEMA accredits levees as providing adequate risk reduction on the FIRM if the certification and adopted operation and maintenance plan provided by the levee owner are confirmed to be adequate. This accreditation process is not a standard of safety; it only affects insurance and building requirements for the areas protected by the levee.

Table 25 provides overview information of each of the levee systems noted in the NLD as relevant for Vigo County Indiana. The primary purpose of most of these systems is to protect agricultural lands and crop production. No municipalities within Vigo County are provided full flood protection by the levee systems and no critical infrastructure are anticipated to be impacted should a levee breech.

Table 25 Vigo County Indiana Levee Systems

LEVEE SYSTEM	NLD RISK	PEOPLE AT RISK	# STRUCTURES / $ VALUE	ACCREDIDATION
Blocksom & Jenckes Levee	Low	1	0 / 0	No
Honey Creek Levee	NA	10	4 / $0.9M	No
Honey Creek Levee System	Low	57	26 / $3.8M	No
Terre Haute Levee System	Moderate	769	109 / $22.4M	No
Terre Haute LFPP	NA	0	0 / 0	No
West Terre Haute Levee System	Moderate	2296	1,144 / $219.0M	Provisionally

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 could 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. Large areas of new development have not yet occurred downstream of the high hazard dams in Vigo

County. Until such development or re-development downstream of a dam is prohibited, those areas remain vulnerable to losses and damages associated with a failure of that structure.

It is also very important to all downstream communities and property owners that dam IEAPs are developed, kept up-to-date, and routinely exercised to ensure the greatest safety to those within the hazard area. This is a good suggestion even for Significant Hazard dams as well.

In regard to levee structures, a document similar to the IEAP for dams should be prepared levees, the Flood Warning and Emergency Evacuation Plan, FWEEP. Along with the development of the FWEEP, it is important that recommendations from studies completed along the Wabash River be implemented to provide additional protection, especially in areas where interior drainage remains the primary concern. This will continue to reduce risk in these areas, as well as provide additional protections to existing structures and potentially allow additional acres to be used in economic development projects.

Dam/Levee Failure: Relationship to Other Hazards

With the potentially large volumes and velocities of water released during a breach, it can be expected that such a failure would lead to flooding within the inundation areas downstream of the dam and behind the levee. Nearby bridges and roads are also in danger of being destroyed or damaged due to a dam failure. 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 or levee failure.

Several other independent hazards may also lead to a dam or levee 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 30 Drums of Potentially Hazardous Waste

As materials are mobilized for treatment, disposal, or transport to another facility, all infrastructure, facilities, and residences near the transportation routes are at an elevated risk of being affected by a hazardous materials release. Often these releases can cause serious harm to Vigo County and its residents if proper and immediate actions are not taken. Most releases are the result of human error or improper storage (**Figure 30**), 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 numerous small and moderately sized 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 "Highly Likely" within many areas of the county due to the number of facilities and transportation routes within and through these municipalities. "Significant" damages are anticipated to result from an incident dependent upon the location of the event. As with hazards of this nature, a short warning time of less than six hours and a duration of less than one day is anticipated in the event of a hazardous materials incident. A summary is shown in **Table 26**.

Table 26 CPRI For Hazardous Materials Incident

	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI
Vigo County	Highly Likely	Significant	< 6 Hours	< 1 Day	Severe
Town of Riley	Highly Likely	Significant	< 6 Hours	< 1 Day	Severe
Town of Seelyville	Highly Likely	Significant	< 6 Hours	< 1 Day	Severe
City of Terre Haute	Highly Likely	Significant	< 6 Hours	< 1 Day	Severe
Town of West Terre Haute	Highly Likely	Significant	< 6 Hours	< 1 Day	Severe

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

Hazardous Materials Incident: Assessing Vulnerability

Within Vigo 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 reconstruction 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

Figure 31 Fuel Tanker Fire

While the possibility of an incident occurring may be likely, the vulnerability of Vigo 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), creating chemical inventories of local industries and businesses, and reporting materials necessary for compliance.

In Vigo County, nearly 120 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 and the response it would require, and to better prevent serious effects 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 generated.

Future Considerations

Additional facilities, both critical and non-critical in nature may be affected if a hazardous materials release were to occur along a transportation route. Several routes including railways, Interstate 70; US Highway 40, 41, and 150; State Routes 42, 46, 63, 159, 246, and 641 are traveled by carriers of hazardous materials.

By restricting development within the known hazardous materials facility buffer zones, future losses associated with a hazardous materials release can be reduced. Critical infrastructure should be especially 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. Such construction would likely reduce the risk to highly populated buildings and populations with specials needs or considerations such as children, elderly, and medically unfit.

Many facilities constructed within close proximity to a hazardous materials facility are similar due to local zoning ordinances. This reduces the risk and vulnerability of some populations. However, there are several facilities and numerous transportation routes located throughout each of the communities making current and future development at risk for losses associated with a hazardous materials release.

Hazardous Materials Incident: Relationship to Other Hazards

Dependent on the nature of the release, conditions may exist where an ignition source such as a fire or spark ignites 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 decrease the social losses such as injuries or even deaths.

3.3.12 Terrorism

Terrorism: Overview

An act of terrorism, according to the 2019 Indiana State Mitigation Plan, may "occur in may forms, depending on technological means available to the terrorist, the motivation behind the act, the points of weakness of the target, and the terrorist's ingenuity". In many cases, terrorism may include acts of sabotage, or the destruction of property, or interruption of normal operations with the intent to create difficulties or win against another group or groups. This may take the form of cybercrimes; bombings; biological, chemical, or radiological attacks; intimidation; or other acts which disrupt, harm, or scare people.

Within FEMA guidance developed to assist planners with integrating man-made hazards into the mitigation planning efforts such as this, terrorism as an intentional act is discussed to include the following categories:

- Conventional bombs/improvised explosive devices
- Biological agents
- Chemical agents
- Nuclear bombs
- Radiological agents
- Arson/incendiary attacks
- Armed attacks
- Cyberterrorism
- Agriterrorism
- Hazardous materials release (intentional)

Although acts of terrorism within the United States, and Indiana, do not happen frequently, that does not mean local planners and responders should not consider the potential and be prepared. The unknown timing and unforeseen targets make it difficult to plan for and discuss terrorism. However, there are slight similarities to planning for natural hazards such as tornadoes and earthquakes. The reasoning and occurrence may be the difference, but the outcomes and consequences may be very similar in response and recovery.

Terrorism: Recent Occurrences

Local examples of domestic-style terroristic attacks primarily are cyber-attacks. A cyber-attack is an attempt to gain access to computers, networks, or data systems in an effort to gain control of the information or damage the systems. Attacks may range from a breach of an individual's data and/or identify theft to holding all county records for ransom to more malicious attacks on cyber controlled infrastructure such as water and electric supplies. Three reasons are suggested for engaging in a cyber-attack. Personal: such as disgruntled or former employees seeking revenge or retribution against a company; Criminal: seeking monetary gain through a theft of information or data; and Political: seeking attention for a certain cause.

While many unsuccessful attacks may occur each day and go unnoticed, an October 2021 article in the Hospital Review noted there were a record number of attempts on Indiana hospitals since August 2021. Within the same time period, Eskenazi Health in Indianapolis experienced a network shutdown forcing hospital officials to divert their emergency department and, in the end, patient and employee

data was stolen. In addition, Schneck Medical Center in Seymour experienced an IT outage for 10 days in September 2021 following an attack and Johnson Memorial Hospital in Franklin fell victim to ransomware and computer systems were taken offline.

Vigo County fell victim to cyber-attacks twice within a two-week period in 2019. The first attack affected the county's email and computer systems in many government-based offices, including those within the courthouse. Many systems were affected for two days while IT departments worked to restore data and function to those offices. The second attack focused on the county's Sheriff's Department and slowed functions of the jail processing, recordkeeping, and the computer aided dispatching used throughout the county.

Based on the information provided to them and their local knowledge, experience, and expertise, the Committee determined the probability of a terrorism event is "Likely" throughout all areas of the county. The magnitude of such an attack is anticipated to be "Significant" regardless of the location and the warning time is anticipated to be less than six hours. The duration of such an incident is anticipated to last greater than one week.

	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI
Vigo County	Likely	Significant	< 6 Hours	> 1 Week	Severe
Town of Riley	Likely	Significant	< 6 Hours	> 1 Week	Severe
Town of Seelyville	Likely	Significant	< 6 Hours	> 1 Week	Severe
City of Terre Haute	Likely	Significant	< 6 Hours	> 1 Week	Severe
Town of West Terre Haute	Likely	Significant	< 6 Hours	> 1 Week	Severe

Terrorism: Assessing Vulnerability

The actual magnitude and extent of damages due to a terrorism event would depend on several factors such as the type of attack, the populations, systems, or structures affected, and the length of disruption. In addition, vulnerability may increase or decrease dependent upon which systems are impacted by the attack. For example, the community or county may be impacted to a lesser degree as a whole following a cyber-attack on the hospital compared to an explosive or armed attack at one of the Universities or large employers.

Within Vigo County, direct and indirect effects from a terrorism event may include:

Direct Effects:

- Damages to structures, infrastructure, and populations
- Increased number of emergency responders needed to activate if the event escalates
- Increased security efforts for buildings and grounds crews during events
- Increased potential for escalating chaos or criminal activity

Indirect Effects:

- Loss of revenue due to closure of businesses during or following the event
- Increased expenditures related to observation and reinforcement needs by emergency response
- Increased real or perceived risk based on historical disturbances or events

Estimating Potential Losses

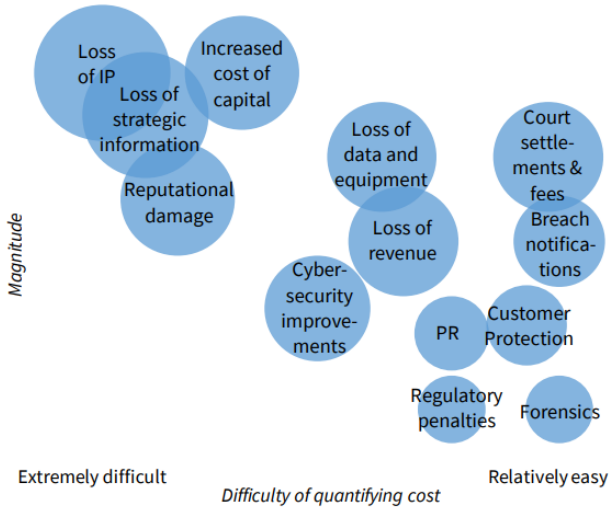


Figure 32 Cost Components of Cyber Attack, *FEMA*

Given the nature and complexity of a terrorism event, it is difficult to limit potential losses to property and infrastructure as this type of hazard also affects people and personal information and may impact entire counties, municipalities, or companies at one time. As a result, all critical and non-critical structures and infrastructure are at risk from a terrorist attack. **Figure 32** helps to identify the magnitude of costs and the difficulty of quantifying the costs associated with cyber-attacks. Much of this graphic may also be applicable to several other categories of terrorism activities.

Risks from cyber-attacks such as those impacting Vigo County are anticipated to continue to grow exponentially and impact all levels of device from an individual computer to an international company's server. In 2018, approximately 12 billion data records were stolen through cyber-attacks. This number is expected to nearly triple to 33 billion by 2023. Between 2017 and 2018 the number of identity theft reports increased from 15 million to 60 million. In 2020, an article published in *Cybercrime* magazine reported one cyber security company expected "global cybercrime costs to grow by 15 percent per year over the next five years, reaching $10.5 trillion USD annually by 2025, up from $3 trillion USD in 2015". Damages associated with cyber-attacks and cybercrime include theft of money, intellectual property, personal data; investigation costs, restoration of systems and data, and damages to personal or business related reputation.

More local considerations are presented in a September 2021 article in *Inside Indiana Business,* "Cybersecurity for Indiana's Cities and Towns". It is presented that the average ransom demanded was nearly $840K and the cost of the average cyber breach ranges between $665K to $40.5M.

Future Considerations

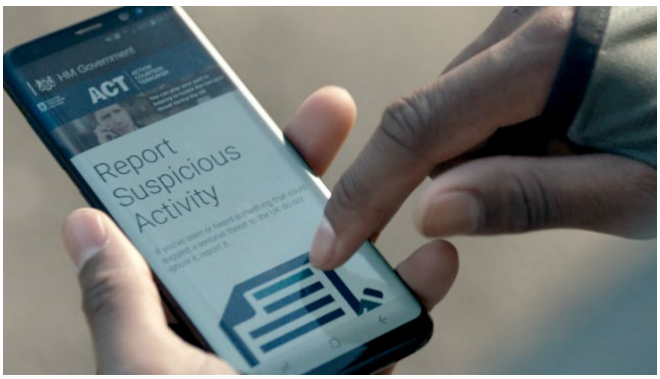


Figure 33: Mobile Reporting App for Suspicious Activity

Terrorism is not a hazard for which populations and structures may be protected simply by moving them out of or away from a known hazard zone such as a floodplain or an area with karst geology. Therefore, many of the mitigation or protective actions should be designed to harden structures and increase situational awareness in municipal residents and workers, such as in the mobile app shown in **Figure 33**.

Following the movement of nearly half the US labor force to a work-from-home status during the COVID-19 pandemic and potentially a hybrid working situation into 2022, it is

expected that cyber security risks will continue to rise. The same article in *Cybercrime* magazine outlined that "roughly one million more people join the internet every day. We expect there will be 6 billion people connected to the internet interacting with data in 2022, up from 5 billion in 2020 – and more than 7.5 billion internet users in 2030". With the number of users skyrocketing, so too will the interconnected devices, applications, networks, and services, all leading to an increase in vulnerabilities throughout municipal and private operations.

Terrorism: Relationship to Other Hazards

Terrorism is not anticipated to cause hazards considered to be more natural such as blizzards or tornadoes and conversely, natural hazards are not expected to directly lead to a terrorism event. There should be considerations regarding the relationship between terrorism and mechanical or structural failures which may then lead to a dam failure, large fire, or hazardous materials release.

In addition, vulnerabilities to many critical infrastructures and systems may exist following any natural hazard studied through this planning effort. For example, as infrastructure is impacted by natural hazards, chaos may ensue, and municipal staff may not be as vigilant as under normal circumstances. Likewise, damaged infrastructure may include some of the safety measures installed to protect the cyber infrastructure within the county, making it easier for a cyber-attack to be successful.

3.4 HAZARD SUMMARY

For the development of this MHMP, the Committee utilized the CPRI method to prioritize the hazards they felt affected Vigo 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 communities.

Table 27 summarizes the CPRI values for the various hazards studied within this MHMP. Hazards ranked as:

- "**Low**" hazards: None
- "**Elevated**" hazards: Dam and Levee Failure; Drought; Earthquake; Extreme Temperature; Land Subsidence
- "**Severe**" hazards: Fire; Flood; Hail, Thunder, and Windstorm; Hazardous Materials Incident; Winter Storm and Ice; Tornado

Table 27 Combined CPRI

Type of Hazard	List of Hazards	Weighted Average CPRI
Natural	Drought	
	Earthquake	
	Extreme Temperature	
	Fire	
	Flood	
	Hail/Thunder/Windstorm	
	Landslide/Subsidence	
	Tornado	
	Winter Storm/Ice	
Technological	Dam/Levee Failure	
	Hazardous Materials Incident	
	Terrorism	

It can be important to understand the cause-and-effect relationship between the hazards selected by the Committee. **Table 28** 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 28 Hazard Relationship Table

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

As a method of better identifying the potential relationships between hazards, the community exhibits 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, many of the communities in Vigo

County 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 a facility experiencing a hazardous materials incident. These areas may also be at a greater risk of a dam failure.

Future development in areas where multiple known hazard areas (dam failure inundation 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 Vigo 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 2016 Vigo County MHMP and determined that each of these remain valid and effective. In summary, the overall goal of the Vigo 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 the 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. In addition, by designing and construction buildings which exceed select items in the 2015 International Code, $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 Vigo County. Mitigation measures that were included in the 2016 Vigo County MHMP are noted as such.

Emergency Services

- The County has developed a plan for responses to rising flood waters including consistent locations for sandbag supplies and distribution, traffic control on routinely flooded roads, and publicizing Turn Around, Don't Drown messaging. *(2016 Measure)*
- National weather service alerts and stream gage is utilized for flood forecasting, flood warnings, and river levels along the Wabash River.
- Many communities have developed snow removal routes to keep primary streets clean during and after snowstorms.
- Training and table-top exercises are conducted by the LEPC and include response agencies such as police, fire, and local hospitals.
- Many response agencies have mobile data terminals and necessary software utilized by the vehicle fleet and dispatchers.
- Locations of safer rooms and areas are clearly advertised during large gatherings such as fairs, festivals and outdoor gatherings
- Vigo and Terre Haute Fire Departments maintain a HazMat Response Team
- A HazMat Plan has been developed including evacuation routes *(2016 Measure)*

Natural Resource Protection

- Vigo County and Terre Haute are in good standing with the NFIP Program and have flood protection ordinances which meets or exceeds the minimum requirements.
    - The 2019 Unified Floodplain Ordinance of Vigo County includes updated language and requirements for all areas of the county. This includes a requirement to locate critical facilities outside of the SFHA where possible and elevate and floodproof if not. Also included is an additional note that the best available data and any future updates, amendments, or revisions to flood maps should be used.
- Current facility maps and response plans are on file for all Tier II HazMat facilities

Prevention

- Vigo County utilizes GIS data collection and maintenance which may be used independently and collectively in land use planning decisions and can be utilized in HAZUS-MH "what-if" scenarios.
- The Vigo County LEPC provides routine training regarding the proper storage, transport, and disposal of hazardous materials.
- Information related to natural hazards has been incorporated into the Comprehensive Land Use Plan and other plans to better guide future growth and development
    - Terre Haute and Vigo County Comprehensive Plan – ThirVe 2025:
        i. It is noted that to accomplish some of the goals and issues outlined within the plan, the floodplain zoning should be reviewed for its consistency with FEMA best practices and with county emergency management plans. This was in part due to development in the floodplain raised as an issue several times as a part of the ThriVe effort.

Property Protection

- Properties have been purchased in Toad Hop along Otter Creek. This reduces potential risk and impacts due to flooding in the area.
- Critical facilities are discouraged from being constructed within the SFHA throughout the county.
- Drainage system maintenance, including repair and replacement of broken tiles and culverts occurs routinely throughout the county.
- Vigo County uses a 3rd party to complete an annual bridge inspection followed by a prioritization of needed improvements and work is completed as funding allows *(2016 Measure)*

Public Information

- Outreach materials and hazard preparedness materials are routinely provided within offices and agencies throughout Vigo County, large public events, speaking opportunities within schools, etc. *(2016 Measure)*
- Social media outlets are used to disseminate hazard preparedness, warning, and recovery information as well as track damages and impacts *(2016 Measure)*
- The County utilizes a mass notification system during times of impending severe weather.
- Each municipality has a designated Public Information Office (PIO) through which emergency related information is disseminated *(2016 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.
- Each intersection between rail and road has various warnings such as flashing lights, crossing arms, signage, or

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 projects 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 29 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 entities, and potential funding sources, associated with each proposed practice. The proposed mitigation practices are listed in order of importance to Vigo 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 5-10 years from final Plan adoption, and projects identified by the Committee to be of "low" local priority may be implemented within 10+ years from final Plan adoptions. However, depending on availability of funding, some proposed mitigation projects may take longer to implement.

As part of the process to identify potential mitigation projects, the Planning Committee weighed the benefit derived from each mitigation practice against the estimated cost of that practice. This basic benefit-cost ratio was based on experience and professional judgement and was utilized to identify the mitigation practices as 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 Vigo County. The intent of this planning effort was to identify the hazards and the extent to which they affect Vigo 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 to apply for and/or receive project grants under the HMGP, BRIC, 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. Appendix 7 provides a sample listing of grants available at the time of the development of this plan. Table 29 indicates in places that grant funding may be sought to pay for mitigation measures; however it is difficult to specify which grant as opportunities, funding priorities, and/or eligibility requirements may change from year to year. The "grant" term is only meant to identify that outside sources of funding will be sought for this measure. **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 97 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 29 Proposed Mitigation Measures

Mitigation Practice	Mitigation Strategy	Hazard Addressed	Status	Priority	Benefit-Cost Ratio	Responsible Entity	Funding Source
Emergency Preparedness & Warning 1. Improve disaster preparedness and emergency response at the local level through the CERT or similar program focusing on youth *(2016 Measure)* 2. Utilize a hazard broadcast system to distribute mass notifications to residents and visitors *(2016 Measure)* 3. Coordinate with private building owners with large dynamic message boards for business and utilize them during hazard events 4. Determine how to address services for special needs, elderly, or other vulnerable populations in the event of an emergency *(2016 Measure)* 5. Work with schools, large employers, and prioritized public facilities to develop hazard plans and emergency event exercises *(2016 Measure)* 6. Purchase additional mobile message boards to provide current hazard information *(2016 Measure)* 7. Create bilingual notifications and hazard preparedness materials 8. Develop and install signage to warn of mine and shaft areas and associated dangers *(2016 Measure)* 9. Investigate the most efficient and protected method to back up county and municipal records 10. Propose ordinance language to require developer to pay to install or update outdoor warning sirens, communications, or other community alert options	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☐ Structural Control	☒ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Fire ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Winter Storm/Ice ☒ Dam/Levee Failure ☒ HazMat Incident ☒ Terrorism	**Ongoing –** 2. Few county and Terre Haute residents subscribe to the existing NIXLE program 3. Several Fire Departments now have private message boards 4. There seems to be a large need within the county to deal with specialized populations 5. Many schools and large employers have plans and trainings for what to do in an emergency 6. Vigo County makes wooden and metal signs to deploy as needed 7. FEMA materials available in Spanish **Proposed Enhancements –** 1. Develop CERT team and improve member maintenance by collaborating with other organizations 2. Increase awareness and participation in hazard notification system 3. Coordinate with private message board owners to display messages as needed 4. Work with local organizations to investigate potential methods to work with and organize vulnerable populations 5. Increase the number of facilities that have emergency plans and exercises 6. Purchase 6 additional message boards for use in Vigo County 7. Create alternate forms of printed and voiced messaging in Spanish to reach additional residents 8. Determine appropriate messaging and place signs in high-risk areas 9. Investigate options for back-up of records and select feasible method 10. Review language from other counties and propose to local officials	High *(CERT, mass notifications, private message boards, special needs, hazard plans)* Moderate *(mobile message boards, bilingual notifications, mine signage, records backup, warning siren ordinance)*	High	EMA CERT Advisors Community Liaisons: *Riley* *Seelyville* *Terre Haute* *W. Terre Haute* Private Building Owners Special Needs Agencies Town/City Councils: *Riley* *Seelyville* *Terre Haute* *W. Terre Haute*	Existing Budgets Grants

Mitigation Practice	Mitigation Strategy	Hazard Addressed	Status	Priority	Benefit-Cost Ratio	Responsible Entity	Funding Source
Emergency Response & Recovery 1. Coordinate communications, documentation, and record keeping between communities and agencies including a database of accurate and community specific information following each hazard events 2. Enhance capabilities for the technical rescue team including large animal rescues 3. Replace the existing mobile EOC and update equipment as needed 4. Inventory, prioritize, and obtain additional staff, equipment, and training for HazMat responders 5. Purchase mobile sandbagging supplies (sand, bladders, shovels, devices) 6. Inventory needs and prioritize purchases for mobile data terminals (hardware, software, updates, etc.) to emergency response vehicles 7. Establish plans to notify and evacuate populations in known hazard areas 8. Enhance existing EOC with additional equipment 9. Inventory and prioritize needs to strengthen rural response (ATVs, lights) capabilities within the county *(2016 Measure)* 10. Inventory and prioritize needs for additional or replacement equipment in the mass casualty response trailer *(2016 Measure)*	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☐ Property Protection ☒ Public Information ☐ Structural Control	☒ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Fire ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Winter Storm/Ice ☒ Dam/Levee Failure ☒ HazMat Incident ☒ Terrorism	**Ongoing –** 1. Communities report information in various methods 2. A technical rescue team has been established 3. Mobile EOC is older and many pieces of equipment need to be replaced 4. A HazMat Team has been established 6. Some departments (Sheriff, EMS, Terre Haute Police/Fire) have MDTs 7. Evacuation procedures have been developed for hazmat incidents 8. EOC has been established 10. Mass casualty trailer has been established **Proposed Enhancement –** 1. Create a more consistent reporting and documentation effort following hazard events 2. Purchase additional equipment for team 3. Obtain a new mobile EOC and update equipment 4. Increase staff and update equipment. Offer additional trainings to keep certifications and abilities current 5. Determine additional needs and purchase as able 6. Increase MDTs available to volunteer departments and update equipment in older set-ups 7. Establish procedures to evacuate areas during floods and dam failures and notify populations in those areas 8. Inventory capabilities and prioritize needs to strengthen EOC, replace outdated equipment and materials 9. Determine countywide needs to strengthen capabilities for rural response efforts including ATVs and portable lights 10. Increase equipment and replace outdated materials in mass casualty trailer	High *(coordinate communications, technical rescue team, mobile EOC, HazMat needs, sandbagging supplies)* Moderate *(MDTs, evacuations, EOC, rural response, mass casualty)*	High	EMA Sheriff Department Police/Marshal *Terre Haute* *W Terre Haute* Fire Departments *Riley* *Seelyville* *Terre Haute* *W. Terre Haute* *Volunteer Depts.* Building Department *Terre Haute / Vigo County (Covers all communities)*	Existing Budget Grant
Geographic Information Systems 1. 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 2. Provide first response agencies with training related to ALOHA and CAMEO mobile data *(2016 Measure)* 3. Develop and routinely update GIS layers with location and attributes of crucial facilities and known hazard areas available to individual municipalities and offices	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☐ Public Information ☒ Structural Control	☒ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Fire ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Winter Storm/Ice ☒ Dam/Levee Failure ☒ HazMat Incident ☒ Terrorism	**Ongoing –** **Proposed Enhancements –** 1. Provide training opportunities for GIS staff related to HAZUS-MH. 2. Provide mapping and viewing capabilities to first responders 3. Update GIS layers routinely	High *(HAZUS)* Moderate *(ALOHA)* Low *(GIS layers)*	Moderate	Building Department *Terre Haute / Vigo County (Covers all communities)* EMA GIS Contract Service Provider	Existing Budget Grant

Mitigation Practice	Mitigation Strategy	Hazard Addressed	Status	Priority	Benefit-Cost Ratio	Responsible Entity	Funding Source
Transportation 1. Investigate developing hazardous materials routes to utilize when I-70 is closed 2. Complete transportation survey to determine typical types and quantities of chemicals being transported throughout Vigo County	☒ Emergency Services ☐ Nat. Res. Protection ☒ Prevention ☐ Property Protection ☒ Public Information ☒ Structural Control	☐ Drought ☐ Earthquake ☐ Extreme Temperature ☐ Fire ☐ Flood ☐ Hail/Thunder/Wind ☐ Landslide/Subsidence ☐ Tornado ☐ Winter Storm/Ice ☐ Dam/Levee Failure ☒ HazMat Incident ☒ Terrorism	**Ongoing –** 1. HazMat routes established for I-70 2. Last completed in 2017 **Proposed Enhancement –** 1. Develop secondary routes for use when I-70 is closed due to accidents or construction 2. Complete updated commodity flow study for Vigo County focusing on Interstates 70, US Routes, and rail lines	High *(I-70 back-up routes)* Low *(transportation survey)*	Moderate	Rail Owners INDOT Highway Department LEPC EMA	Existing Budget Grant
Land Use Planning & Zoning 1. Incorporate hazard information, risk assessment, and hazard mitigation practices into the Comprehensive Land Use Plan to better guide future growth and development	☐ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☐ Structural Control	☒ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Fire ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Winter Storm/Ice ☒ Dam/Levee Failure ☒ HazMat Incident ☒ Terrorism	**Ongoing –** 1. Basic information has been included within the current Terre Haute Vigo County Comprehensive Plan **Proposed Enhancement –** 1. Update Comprehensive Plans and include information related to additional hazards (downstream of a dam, FEH), more definitively outline higher risk areas and those that should be avoided for future development	High	Moderate	EMA Area Plan Commission *Riley, Seelyville, Terre Haute, West Terre Haute*	Existing Budget
Power Backup 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 *(2016 Measure)*	☒ Emergency Services ☐ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☐ Public Information ☒ Structural Control	☐ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Fire ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Winter Storm/Ice ☒ Dam/Levee Failure ☒ HazMat Incident ☒ Terrorism	**Ongoing –** 1. Many critical facilities have generators or have added since the last plan **Proposed Enhancements –** 1. Inventory generator capabilities and needs and prioritize within each community to determine needs for future purchases	High	Low	EMA Building Department *Terre Haute / Vigo County (Covers all communities)* Facility Owners	Existing Budget Grant

Mitigation Practice	Mitigation Strategy	Hazard Addressed	Status	Priority	Benefit-Cost Ratio	Responsible Entity	Funding Source
Building Protection 1. Relocate, buyout, or floodproof existing non-critical facilities that are subject to repetitive flooding *(2016 Measure)* 2. Identify areas at a higher risk of land subsidence or landslide due to mining, geology, fluvial erosion, or soil liquefaction *(2016 Measure)* 3. Investigate the need for inertial shut-off valves in public facilities and industrial buildings with gas lines *(Will assist with NFIP compliance)*	☒ Emergency Services ☒ Nat. Res. Protection ☐ Prevention ☒ Property Protection ☐ Public Information ☒ Structural Control	☐ Drought ☐ Earthquake ☐ Extreme Temperature ☐ Fire ☒ Flood ☐ Hail/Thunder/Wind ☐ Landslide/Subsidence ☐ Tornado ☐ Winter Storm/Ice ☒ Dam/Levee Failure ☐ HazMat Incident ☒ Terrorism	**Ongoing –** 1. Buyouts have occurred in Toad Hop area 2. Map layers exist for risk areas listed **Proposed Enhancements –** 1. Develop a prioritized list of structures to be relocated, bought out, or floodproofed within each municipality 2. Further investigate risks in the Otter Creek, Landings, and Lost Creek areas; previously mined areas 3. Inventory and prioritize public and industrial facilities where inertial shut-off valves would be needed	Moderate *(Buyouts)* Low *(relocate, land subsidence, inertial valves)*	Moderate	EMA Facility Owners Floodplain Administrators *County, Terre Haute* Building Department *Terre Haute / Vigo County (Covers all communities)*	Grant Existing Budget
Flood Studies and Protection 1. Conduct detailed flood protection studies for problem areas and/or areas with repetitive flooding problems 2. Develop floodplain and FEH overlay district to further protect area from development while allowing passive uses 3. Update the Floodplain Ordinance to prohibit new critical facilities from being built in the floodplain and adopt fluvial erosion hazard requirements. 4. Prepare a detailed Flood Response Plan to improve response and reduce losses from a flood event *(Will assist with NFIP compliance)*	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☐ Drought ☐ Earthquake ☐ Extreme Temperature ☐ Fire ☒ Flood ☐ Hail/Thunder/Wind ☐ Landslide/Subsidence ☐ Tornado ☐ Winter Storm/Ice ☐ Dam/Levee Failure ☐ HazMat Incident ☐ Terrorism	**Ongoing –** 1. Studies are completed as funding becomes available 3. Ordinance deters new critical facilities but allows variances **Proposed Enhancements –** 1. Prioritize listing of needed studies and continue to complete as funding becomes available focusing on areas around Otter Creek and Wabash River 2. Develop floodplain and FEH overlay 3. Require new critical facilities to be located outside of known flood hazard areas only, including the 0.2% or 500-year flood zone. 4. Develop detailed plan for Terre Haute and implement recommendations as funding becomes available	Moderate *(flood studies, floodplain overlay, Floodplain Ordinance)* Low *(Flood Response Plan)*	Moderate	EMA Floodplain Administrators *County, Terre Haute* Building Department *Terre Haute / Vigo County (Covers all communities)* Area Plan Commission *Riley, Seelyville, Terre Haute, West Terre Haute*	Existing Budget Grant
Community Rating System 1. Investigate potential to reduce flood insurance premiums through additional 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 ☐ Fire ☒ Flood ☐ Hail/Thunder/Wind ☐ Landslide/Subsidence ☐ Tornado ☐ Winter Storm/Ice ☒ Dam/Levee Failure ☐ HazMat Incident ☐ Terrorism	**Ongoing –** **Proposed Enhancement –** 1. Participation from Vigo County, Terre Haute	Moderate	Moderate	Floodplain Administrators *County, Terre Haute*	Existing Budget

Mitigation Practice	Mitigation Strategy	Hazard Addressed	Status	Priority	Benefit-Cost Ratio	Responsible Entity	Funding Source
Management of Dams and Levees 1. Review regular inspection reports and maintenance records of dams regardless of ownership 2. Encourage High Hazard dam owners (7) to develop IEAPs with inundation mapping *(2016 Measure)* 3. Encourage levee owners to complete accreditation process with USACE *(2016 Measure)*	☒ Emergency Services ☐ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☐ Public Information ☒ Structural Control	☐ Drought ☐ Earthquake ☐ Extreme Temperature ☐ Fire ☐ Flood ☐ Hail/Thunder/Wind ☐ Landslide/Subsidence ☐ Tornado ☐ Winter Storm/Ice ☒ Dam/Levee Failure ☐ HazMat Incident ☐ Terrorism	**Ongoing –** 1. EMA does receive some reports and records 3. West Terre Haute Levee system is provisionally accredited **Proposed Enhancements –** 1. Provide inspection reports and maintenance records to the EMA Director for review and overall hazard assessment 2. Develop IEAPs for High Hazard dams throughout the county 3. Complete accreditation process for West Terre Haute Levee system and begin process for others	Moderate	Moderate	Dam Owners *Daisy Lake Dam, Griggs Lake Dam, Hawthorn Park Dam, Hulman Lodge Dam, Llewellyn Lake Dam, St Mary of the Woods Dam, Thompson Ditch Dam* IDNR EMA Levee Owners	Existing Budget Grant
Safer Rooms and Community Shelters 1. Develop temporary and/or long-term shelter agreements within the County. Potential for tiered levels of shelters, domestic animal shelters, etc. especially in small communities *(2016 Measure)*	☒ Emergency Services ☐ Nat. Res. Protection ☐ Prevention ☐ Property Protection ☒ Public Information ☒ Structural Control	☐ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Fire ☒ Flood ☒ Hail/Thunder/Wind ☐ Landslide/Subsidence ☒ Tornado ☒ Winter Storm/Ice ☒ Dam/Levee Failure ☒ HazMat Incident ☒ Terrorism	**Ongoing –** 1. Shelters locations are spaced throughout the county as available and as needed **Proposed Enhancement –** 1. Continue to evaluate shelter locations and needs throughout the county	Moderate	Low	EMA American Red Cross	Existing Budget
Water Conservation Ordinance 1. Establish and adopt local water conservation ordinance and contingency plans to impose at time of water shortages	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☐ Property Protection ☐ Public Information ☐ Structural Control	☒ Drought ☐ Earthquake ☐ Extreme Temperature ☒ Fire ☐ Flood ☐ Hail/Thunder/Wind ☐ Landslide/Subsidence ☐ Tornado ☐ Winter Storm/Ice ☐ Dam/Levee Failure ☐ HazMat Incident ☐ Terrorism	**Ongoing –** **Proposed Enhancement –** 1. Adopt ordinance for water conservation measures during drought events	Low	Low	EMA County Commissioners Area Plan Commission *Riley, Seelyville, Terre Haute, West Terre Haute*	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 EMERGENCY PREPAREDNESS AND WARNING

Improve disaster preparedness and emergency response at the local level through the CERT or similar program focusing on youth

- Review geographic locations and prioritize neighborhoods, regions, or large employers for recruitment
- Provide announcement and press release to partner agencies to increase the reach of the information
- Develop and implement training program for new volunteers
- Develop annual training programs for existing volunteers

Increase awareness and participation in the hazard broadcast system to distribute mass notifications to residents and visitors

- Develop outreach efforts designed to inform residents and visitors of the messaging available
- Post information on municipal and county websites and social media outlets
- Complete awareness campaign to encourage sign ups within each municipality
- Develop pre-scripted messages to utilize during hazard situation and provide for quick use and dissemination/posting

Coordinate with private building owners with large dynamic message boards for business and utilize them during hazard events

- Determine liaisons within each municipality to contact private message board owners
- Compile contact information for the facility as well as contact information for when an emergency occurs
- Develop scripted messages which may be utilized during hazard events
- Routinely review and update contact information

Determine how to address services for special needs, elderly, or other vulnerable populations in the event of an emergency

- Research how other agencies have addressed this issue
- Determine limits of various 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

Work with schools, large employers, and prioritized public facilities to develop hazard plans and emergency event exercises

- Determine liaisons within each school system, large employer and facility
- Develop checklist or template plan to assist with preparation of a facility hazard plan addressing various hazards and the impacts on the specific facilities
- Coordinate with facility to prepare and facilitate an annual exercise of the facility plan

5.2 EMERGENCY RESPONSE AND RECOVERY

Coordinate communications, documentation, and record keeping between communities and agencies including a database of accurate and community specific information following each hazard events

- Review current protocols for post-event communications
- Utilize existing IDHS software or develop a countywide database
- Determine a liaison from each municipality to be responsible for data collection following hazard events
- Review database with each municipality to review what information should be collected and reported in a consistent manner

Enhance capabilities for the technical rescue team including large animal rescues

- Inventory existing materials and equipment for the technical rescue team
- Research needs to enable technical rescue team to perform large animal rescues
- Prioritize additional equipment needs
- Seek grant funding and obtain equipment or other needs

Replace the existing mobile EOC and update equipment as needed

- Research options for new mobile EOC trailer
- Prioritize equipment needed to outfit new trailer
- Seek grant funding and obtain additional equipment as able

Inventory, prioritize, and obtain additional staff, equipment, and training for HazMat responders

- Work with each fire department to prepare a prioritized listing of equipment, staffing, or training needs
- Prioritize various needs countywide to determine what is needed to provide better response overall
- Secure funding or grants to procure equipment

Purchase mobile sandbagging supplies (sand, bladders, shovels, devices)

- Inventory existing supplies and capabilities for each sandbagging station
- Prioritize needed supplies and equipment throughout the county
- Obtain additional supplies and equipment as funding is obtained

5.3 GEOGRAPHIC INFORMATION SYSTEM

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

- Determine which staff should receive additional GIS training
- Seek training opportunities for identified staff
- Use GIS layers developed for the MHMP update to run "what-if scenarios"
- Update GIS information as needed

5.4 LAND USE PLANNING & ZONING

Incorporate hazard information, risk assessment, and hazard mitigation practices into the Comprehensive Plan to better guide future growth and development

- Review list of hazards applicable to individual communities
- Draft language and prepare exhibits to incorporate into the appropriate sections of the Terre Haute / Vigo County Comprehensive Land Use Plan, individual municipalities' plans, neighborhood redevelopment plans, etc.
- Adopt amendments or new plans as developed

5.5 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

5.6 TRANSPORTATION

Investigate developing hazardous materials routes to utilize when I-70 is closed

- Review requirements for hazardous materials routes or transportation ways
- Review maps and traffic patterns throughout Vigo County to outline potential routes
- Determine route with least potential risks involved (number of crossings, high traffic patterns, residential areas, etc.)
- Provided response agencies such as Dispatch, Highway, Street, and Sheriff with new patterns

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 Vigo 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 incorporated community. Depending on grant opportunities and fiscal resources, mitigation practices may be implemented independently, by individual 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 Vigo 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 2027, 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 Vigo 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 Vigo 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 Vigo 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 Vigo County website.

Updates or modifications to the Vigo 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.

CHAPTER 7: REFERENCES

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