Hamilton County Emergency Management

2019 Multi-Hazard Mitigation Plan

November 2019

MEMORANDUM

To: Hamilton County Stakeholders

From: Hamilton Board of Commissioners

Date: November 25, 2019

Re: Adoption of the Multi-Hazard Mitigation Plan

In partnership with the Federal Emergency Management Agency, the Town of Arcadia, the Town of Atlanta, the City of Carmel, the City of Fishers, the City of Noblesville, the Town of Sheridan, the City of Westfield, and Hamilton County created a five-year Multi-Hazard Mitigation Plan to identify hazards and possible mitigation activities to reduce such hazards. The plan meets the requirements of the Federal Emergency Management Agency for possible mitigation activities. The 2019 Multi-Hazard Mitigation Plan is hereby approved by the Hamilton County Board of Commissioners effective the 25th day of November 2019.

Christine Altman
Hamilton County
Commissioner

Steven C. Dillinger
Hamilton County
Commissioner

Mark Heirbrandt
Hamilton County
Commissioner

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Chapter 1 Introduction

1.1 Disaster Life Cycle

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

Figure 1-1 Disaster Life Cycle

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

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

1.2 Project Scope and Purpose

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

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

A FEMA-approved MHMP is required to apply for and/or receive project grants under the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), and Flood Mitigation Assistance (FMA). Although the Hamilton 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 Hamilton County MHMP Update is a multi-jurisdictional planning effort led by the Hamilton County Emergency Management Agency (EMA). This Plan was prepared in partnership with Hamilton County, the towns of Arcadia, Atlanta, Cicero, and Sheridan; and the cities of Carmel, Fishers, Noblesville, and Westfield. 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 Hamilton County MHMP satisfies the requirements of DMA 2000 in which multi-jurisdictional plans may be accepted.

Plan, activities that could count toward the Community Rating System (CRS) points are
ıe NFIP/CRS logo. The CRS is a voluntary incentive program that recognizes and encourages
dplain activities that exceed the minimum NFIP requirements. As a result, flood insurance
scounted 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 are 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, only Hamilton County and the City of Noblesville participate in the CRS program, both at a Class 7.

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

1.3 Planning Process

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

Preparation for the Hamilton County MHMP Update began in 2017 when the County EMA submitted a PDM Grant application to IDHS. The grant request was approved by FEMA and grant funds were awarded in 2018.

Once the grant was awarded, the planning process to update the 2013 MHMP took 11 months. This included a review period by IDHS and FEMA for the draft MHMP Update and time for Hamilton County and communities to adopt the final MHMP Update.

1.3.1 Planning Committee

In December of 2018, the EMA compiled a list of Planning Committee members to guide the MHMP Update planning process. These individuals were specifically invited to serve on the Committee because they were knowledgeable of local hazards; they 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 2013. **Table 1-1** lists the individuals that actively participated on the Committee and the entity they represented.

Table 1-1 MHMP Update Committee

NAME	OFFICE	REPRESENTING
Denise Aschleman	Noblesville Planning Department	City of Noblesville
Shane Booker	Hamilton County EMA	Hamilton County
Carl Colbert	White River Volunteer Fire Department	Hamilton County
Daine Crabtree	Office of Community Development	City of Westfield
Gary Duncan	Hamilton County Surveyor's Office	Hamilton County
Mark Elder	Fishers Fire Department	City of Fishers
Pam Eldridge	Hamilton County EMA	Hamilton County
Joseph Faucett	Utilities Department	City of Carmel
Matt Fearon	Hamilton County EMA	Hamilton County
Chris Gellinger	Noblesville Fire Department	City of Noblesville
Diana Glass	Hamilton County CERT	Hamilton County
Adam Harrington	Carmel Fire Department	City of Carmel

NAME	OFFICE	REPRESENTING
Steve Haston	Hamilton County EMA	Hamilton County
John Havard	Citizens Energy Group	
Randy Hill	Town Council	Town of Arcadia
Jeremy Hunt	Becks' Hybrids	
James Hunter	Cicero Police Department	Town of Cicero
Brett Keith	Carmel Fire Department	City of Carmel
Wyatt Kintner	Field Environmental Representative	Marathon Pipeline
Scott Kirby	Noblesville Police Department	City of Noblesville
Jerry Liston	Hamilton County Surveyor's Office	Hamilton County
Lance Overholder	Cicero Fire Department	Town of Cicero
Sarah Reed	Noblesville Planning Department	City of Noblesville
Robert Shock	Sheridan Police Department	Town of Sheridan
Sean Sutton	Carmel Fire Department	City of Carmel
Todd Uhrick	Town Marshall	Town of Arcadia
Pamela Van Hook	Town Council	Town of Atlanta
Zachary White	American Red Cross	
David Woodward	Carmel Clay Schools	City of Carmel

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 2013 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 the adoption of the Hamilton County MHMP Update.

1.3.2 Public Involvement

A draft of the Hamilton County MHMP Update was placed in the main branch of the Hamilton County Public Library for public review and comment. A media release indicating the posting of the draft MHMP and the ability to comment and complete the brief survey was submitted for publishing to *The Noblesville Times.* 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 comments from submitted surveys are in **Appendix 3**. No comments were received from the general public.

1.3.3 Involvement of Other Interested Parties

Several additional interested agencies (Indiana Department of Natural Resources, Hamilton County Highway, Indiana Department of Transportation, Martin Marietta), businesses (Country Mark, First Merchants Bank), academia (each school district within the county), and nonprofits (Ascension Healthcare, St. Vincent Health, and Vectren Energy) were invited to review and comment on the draft Hamilton County MHMP Update (Appendix 3). Information related to the planning process and the availability of the draft Hamilton County MHMP was directly provided to such potentially interested parties via personal conversations, informational flyer, and email correspondence. Comments and suggestions provided outside of the Planning Committee meetings were incorporated into the plan.

Successful implementation and future updates of the Hamilton County MHMP Update will rely on the partnership and coordination of efforts between such groups.

1.4 Plans, Studies, Reports, and Technical Information

During the development of the Hamilton 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 Hamilton County MHMP, and to assist the Committee in developing potential mitigation measures to reduce the social, physical, and economic losses associated with hazards affecting Hamilton County.

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

- Hamilton County Indiana Comprehensive Plan, 2006
- City of Noblesville Comprehensive Plan, 2016
- Carmel Clay Comprehensive Plan, 2016
- City of Westfield Stormwater Master Plan, 2018
- Westfield -Washington Township Comprehensive Plan - 2007
- Hamilton County MHMP, 2013
- Hamilton County Emergency Management Strategic Plan – 2018-2021
- GIS data from several local municipal and contractual contacts

Planning and building ordinances and comprehensive planning efforts for many of the other communities were also reviewed and utilized to develop portions of this MHMP or further develop potential mitigation measures to be ranked by the Planning Committee.

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

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*

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ts NFIP communities a maximum of 155 points for organizing a planning committee
ı various departments; involving the public in the planning process; and coordinating
and departments to resolve common problems relating to flooding and other known

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 economic composition of Hamilton County necessary to better understand the Risk Assessment discussed in **Chapter 3**.

Hamilton County, established in 1823, is named for Alexander Hamilton, the nation's first Secretary of the Treasury. The total area of Hamilton County is approximately 402 square miles. The location of Hamilton County within the State of Indiana is identified in **Figure 2-1**.

As of 2017, Hamilton County is home to four of the 25 most populous cities in Indiana: Carmel (5), Fishers (6), Noblesville (12), and Westfield (23). In September of 2017, Money.com listed Fishers as the Best Place to Live in America with much credit given to the up and coming businesses and restaurants as well as the green space within the community. This same distinguished title was awarded to Carmel in 2013.

2.1 Population and Demographics

Figure 2-1 Hamilton County Location

The most recent data for Hamilton County estimates that the 2017 population was 323,747, which ranks 4th in the State. Of that total, the City of Carmel accounts for 92,198 or 28.5% of the county's population, while the City of Fishers is the second-largest community with 91,832 or 28.4% of the population.

In 2017, the median age of the population in the County was 37.1 years of age. The largest demographic age groups in the County are young adults (25-44 years) with a population of 86,655, and older adults (45-64) with a population of 85,527. School-aged children (5 to 17) are the third-largest age group with a population of 67,064 individuals living in Hamilton County. The approximate median household income in 2017 was reported to be $95,080, while the poverty rate in the same year was reported at 3.8% county-wide. In total, 32.6% of households are married with children, and 28.8% of households are married without children.

Within the County, 96.2% of the adults older than 25, have reportedly completed a High School education. Further, 57.5% of those same adults have also completed a Bachelor of Arts or higher degree.

2.2 Employment

US Census data indicate that of the Hamilton County workforce, 37.6% are employed in "Other Private" positions. Professional Technical Services and Healthcare Social Services account for 11.3% and 10.8%, respectively. The total resident labor force according to estimates in 2017 is 175,574, with 4,799 unemployed and a February 2019 unemployment rate of 3.1%, which places Hamilton County as 89th of 92 counties in the State.

Table 2-1 List of Major Employers

Conseco Life Insurance Co (Carmel)	Riverview Health Hospital (Noblesville)
CNO Financial Group Inc. (Carmel)	Washington National Insurance (Carmel)
Bankers Conseco Life Ins. Co (Carmel)	Riverview Hospital (Noblesville)
RCI, LLC (Carmel)	Roche Diagnostics Corp (Fishers)
Navient Corp (Fishers)	Kar Auction Svc Inc (Carmel)

(Hoosier By the Numbers, 2019)

2.3 Transportation and Commuting Patterns

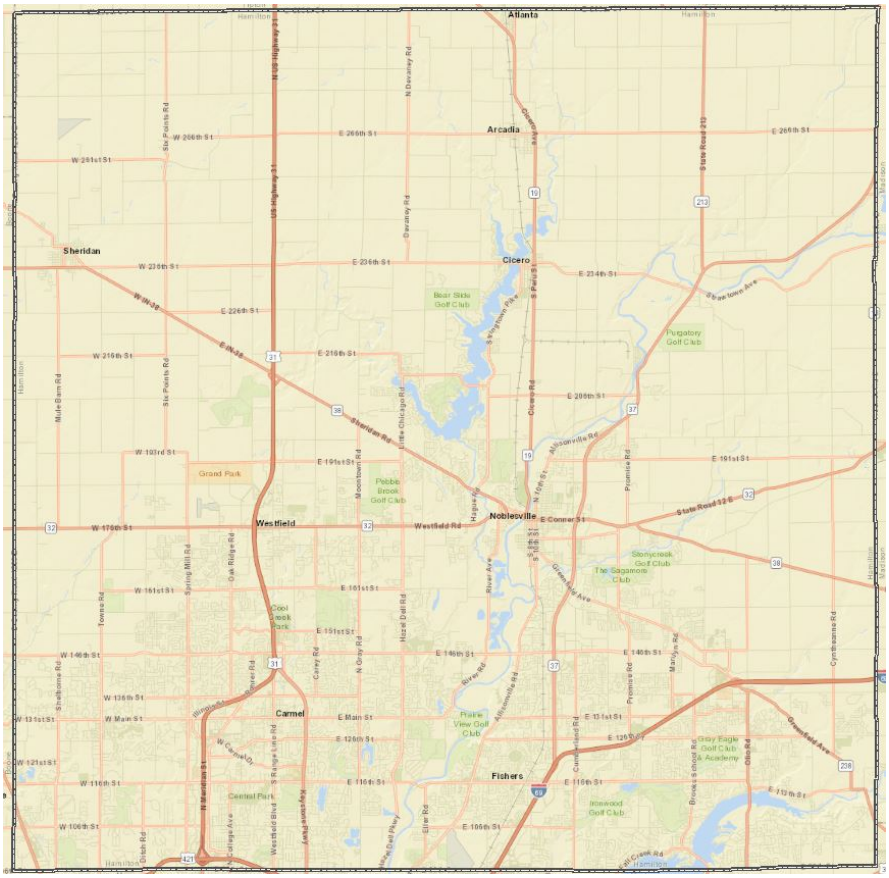


Figure 2-2 Hamilton County Transportation Routes

There are several major transportation routes passing through Hamilton County and the municipalities within. Interstates 69 and 465; US Highway 31, and State Roads 19, 32, 37, 38, 213, and 238 serve as main routes between the various municipalities. The Hoosier Heritage Port Authority also maintains a rail line traversing the county north to south. These transportation routes are identified in **Figure 2-2**..

According to STATSIndiana, nearly 27,000 people commute to Hamilton County daily. Approximately 56% of commuters travel from Marion County. Further, approximately 61,000 Hamilton County residents commute to other counties, with the majority traveling to Marion (90%).

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

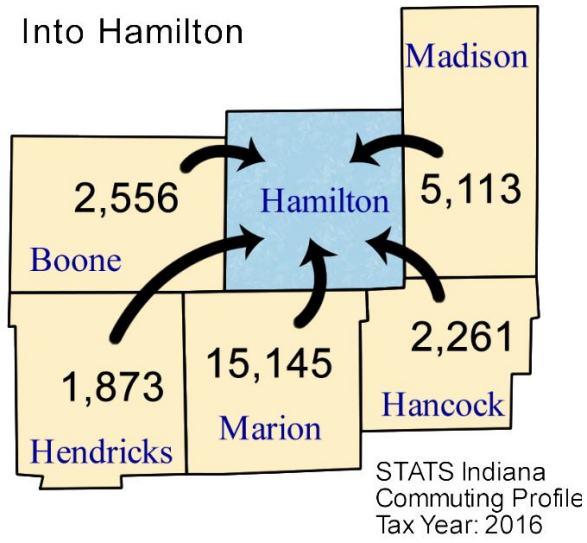


Figure 2-3 Workers Commuting into Hamilton County

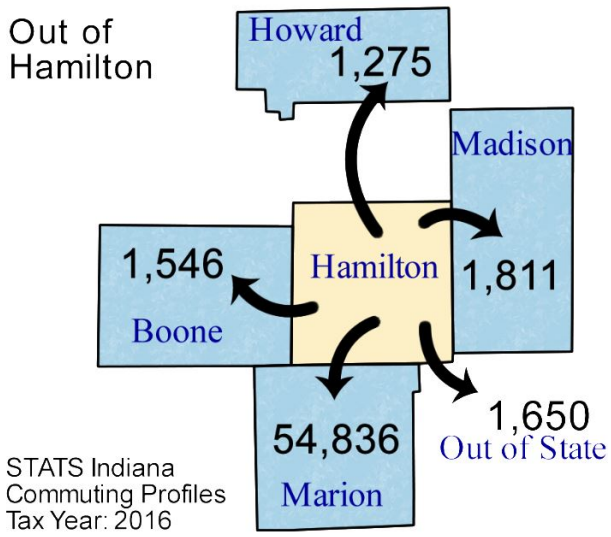


Figure 2-4 Workers Commuting out of Hamilton County

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 Hamilton County EMA provided the listing and locations of the following 833 mapped critical infrastructure points for the MHMP Update:

- 7 Agricultural facilities
- 2 Airports
- 62 Banks
- 27 Cell Towers
- 29 Churches

- 4 Dams
- 18 Daycare Centers
- 4 Event Centers
- 29 Fire Stations
- 13 Government Buildings
- 195 Hazardous Materials Facilities
- 102 Health Facilities
- 1 Jail
- 7 Libraries
- 37 Mass Evacuation Bridges
- 29 Nursing Homes
- 9 Police Stations
- 9 Postal Service Facilities
- 9 Radio Towers
- 129 Recreational Facilities
- 87 Schools
- 12 Shopping Centers
- 9 Utility Facilities

In total, approximately 1,400 identified points were provided for this planning effort. To avoid duplicate and redundant mapping, critical infrastructure points were mapped according to the primary function of that structure. For example, a school may also serve as an identified American Red Cross shelter and a recreational facility, but for this effort, it has been identified on the critical infrastructure maps only as a school.

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 Hamilton 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 Hamilton County and the individual municipalities. **Appendix 4** lists the critical structures in Hamilton County by NFIP Community. Non-critical structures include residential, industrial, commercial, and other structures not meeting the definition of a critical facility and are not required for a community to function. The development of this MHMP focused only on critical structures; non-critical structures are neither mapped nor listed.

2.5 Major Waterways and Watersheds

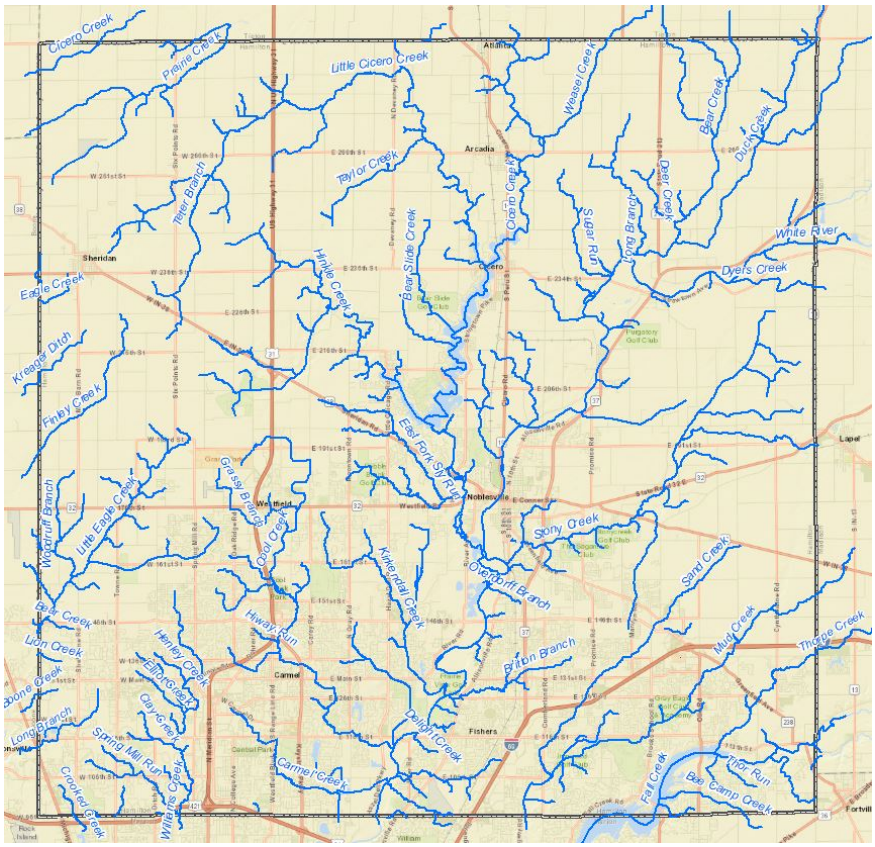


Figure 2-5 Hamilton County Waterways

According to the United States Geological Survey (USGS) there are 96 waterways in Hamilton County, which are listed in Appendix 5. The County's main waterway is the White River, and the county lies entirely within the Upper White River 8-digit Hydrologic Unit Code (HUC): 05120201. These major waterways and others are identified in **Figure 2-5**.

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. Hamilton County and several municipalities are participants in the NFIP. Any smaller communities within Hamilton County may also be provided coverage by the MHMP through the County's program. Since the development of the 2013 Hamilton County MHMP, these communities continue to participate in the NFIP program.

At the time of preparing this MHMP, the County and the City of Noblesville participate in the CRS program, both at Class 7. The CRS program is a voluntary incentive program that recognizes and encourages community floodplain activities that exceed the minimum NFIP requirements. As a result, flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions that meet the three goals of the CRS: 1) reduce flood losses; 2) facilitate accurate insurance rating, and 3) promote education and awareness of flood insurance. For CRS participating communities, flood insurance premium rates are discounted in increments of 5% for each class level achieved. **Table 2-2** lists the NFIP number, effective map date, and the date each community joined the NFIP program.

Table 2-2 NFIP Participation

NFIP COMMUNITY	NFIP NUMBER	EFFECTIVE MAP DATE	JOIN DATE
Hamilton County	180080#	11/19/14	08/19/86
Town of Arcadia	180496#	NSFHA	12/09/88
Town of Atlanta			
City of Carmel Includes Clay Township	180081#	11/19/14	05/19/81
Town of Cicero Includes Jackson Township	180320#	11/19/14	01/02/80
City of Fishers	180423#	11/19/14	06/30/76
City of Noblesville Includes Delaware, Noblesville, and Fall Creek Townships	180082#	11/19/14	03/02/81
Town of Sheridan	180516#	11/19/14	06/01/04
City of Westfield Includes Washington Township	180517#	11/19/14	03/16/81

(FEMA, 2019)

2.7 Topography

Hamilton County is bordered geographically to the east by Madison County, to the west by Boone County, to the north by Tipton County, and the south by Hancock and Marion Counties. The county's landscape consists of flat plains with many creeks and streams, the primary of which is the White River. Only along the White River are significant changes in relief common.

The highest elevation in Hamilton County is 964 feet above sea level, located approximately one-mile northwest of Sheridan in the northwestern corner of the county. Conversely, the lowest elevation of 700 feet above sea level is where the White River flows from Hamilton County to Marion County.

2.8 Climate

The Midwestern Regional Climate Center (MRCC) provided climate data that includes information retrieved from a weather station located in Whitestown (Boone County), identified as station USC00129557. As a station does not exist in Hamilton County, this is the nearest station available. The average annual precipitation is 42.75 inches per year, with the wettest month being May averaging 4.91 inches of precipitation and the driest month being February with an average of 2.55 inches of precipitation. The highest 1-day maximum precipitation was recorded in June of 1957 with 7.92 inches of rain. On average, there are 80 days of precipitation greater than or equal to 0.1 inch; 29.1 days with greater than or equal to 0.5 inch; and 9.7 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 enough 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 Hamilton County and the NFIP communities 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) historical 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 Hamilton 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 2013 Hamilton County MHMP and discussed recent events and the potential for future hazard events. The Committee identified those hazards that affected Hamilton County and the NFIP communities and selected the hazards to study in detail as part of this planning effort.

During the selection of hazards, several members discussed cyber-security. As an increasing amount of system hacking, cyberattacks, and other predatory assaults are launched at local government and business systems each day, the committee felt it was important to potentially include this as a hazard to be studied. Following

discussions, it was determined that cybersecurity is a valuable asset and should be well developed and planned. However, these plans and systems should be developed by individual municipalities and businesses and outlined within non-public documents. Therefore, cybersecurity will not be studied within this planning effort.

As shown in **Table 3-1**, these hazards include armed assailants, 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 with the 2013 Hamilton County MHMP, and within the 2014 Indiana MHMP, are included in the update.

Table 3-1 Hazard Identification

TYPE OF HAZARD	LIST OF HAZARDS	DETAILED STUDY 2013 MHMP	MHMP UPDATE
Natural	Drought	Yes	Yes
	Earthquake	Yes	Yes
	Extreme Temperature	No	Yes
	Fire	No	Yes
	Flood	Yes	Yes
	Hail/Thunder/Wind	Yes	Yes
	Land Subsidence/Landslide	No	Yes
	Snow / Ice Storm	Yes	Yes
	Tornado	Yes	Yes
Technological	Dam Failure	Yes	Yes
	Hazardous Material Incident	Yes	Yes
Human	Armed Assailant	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 CBBEL) can be obtained by assigning varying degrees of risk probability, magnitude/severity, warning time, and the duration of the incident for each event, and then calculating as index value based on a weighted scheme. For ease of communication, 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 ten years (1)
- Possible – incident is probable within the next five years (2)
- Likely - incident is probable within the next three years (3)

- Highly Likely – the incident is probable within the next calendar year (4)

3.2.2 Magnitude / Severity

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

- Negligible – few injuries OR critical infrastructure shut down for 24 hours or less OR less than 10% property damaged OR average response duration of fewer than six hours (1)
- 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 (2)
- 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 (3)
- Critical – multiple deaths OR critical infrastructure shut down of 1 month, or more OR more than 50% property damaged OR average response duration of less than one month (4)

3.2.3 Warning Time

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

- More than 24 hours (1)
- Twelve to 24 hours (2)
- Six to 12 hours (3)
- Less than six hours (4)

3.2.4 Duration

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

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

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 NFIP community in Hamilton County, and then a weighted CPRI value was computed based on the population size of each community. **Table 3-2** presents each community, population, and the weight applied to individual CPRI values to arrive at a combined value for the entire County. Weight was calculated based on the average percentage of each community's population in relation to the total population of the County. Thus, the results reflect the relative population influence of each community on the overall priority rank.

Table 3-2 Determination of Weighted Value for NFIP Communities

COMMUNITY	POPULATION (2017)	% OF TOTAL POPULATION	WEIGHTED VALUE
Hamilton County	28,036	8.7%	0.09
Town of Arcadia	1,666	0.5%	0.01
Town of Atlanta	748	0.2%	0.00
City of Carmel	92,198	28.5%	0.28
Town of Cicero	4,862	1.5%	0.02
City of Fishers	91,832	28.4%	0.28
City of Noblesville	61,882	19.1%	0.19
Town of Sheridan	3,030	0.9%	0.01
City of Westfield	39,493	12.2%	0.12
Total	**323,747**	100.0%	1.00

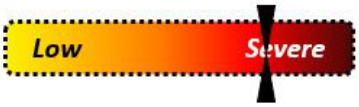
3.3 Hazard profiles

The hazards studied for this report are not equally threatening to all communities throughout Hamilton 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, in order of CPRI value, that was 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 Hazardous Materials Incident



Hazardous Materials Incident: Overview

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

Figure 3-1 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 Hamilton County and its residents if proper and immediate actions are not taken. Most releases are the result of human error or improper storage (**Figure 3-1**), 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.

To combat this likelihood, the Hamilton County EMA works with all fire departments within the county to provide resources and training needed to respond to a hazardous materials incident. In addition, each department and the Hamilton County EMA work collaboratively to ensure appropriate clean-up services are activated to remove a hazardous substance following a release.

According to the Committee, the probability of a hazardous materials release or incident is "Possible" within Arcadia and Atlanta; "Likely" within the areas of Cicero, Noblesville, Sheridan, and Westfield; and "Highly Likely" within the County, Carmel, and Fishers due to the number of facilities and transportation routes within and through these municipalities. "Negligible" to "Critical" damages are anticipated to result from an incident dependent upon the location of the incident. As with hazards of this nature, short warning time and duration of fewer than six hours to less than one day is anticipated in the event of a hazardous materials incident. A summary is shown in **Table 3-3**.

Table 3-3 CPRI for Hazardous Materials Incident

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Hamilton County	Highly Likely	Critical	< 6 Hours	< 1 Day	Severe
Town of Arcadia	Possible	Negligible	< 6 Hours	< 1 Day	Low
Town of Atlanta	Possible	Critical	< 6 Hours	< 1 Day	Elevated
City of Carmel	Highly Likely	Limited	< 6 Hours	< 6 Hours	Severe
Town of Cicero	Likely	Limited	< 6 Hours	< 6 Hours	Elevated
City of Fishers	Highly Likely	Limited	< 6 Hours	< 6 Hours	Severe
City of Noblesville	Likely	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Sheridan	Likely	Limited	< 6 Hours	< 6 Hours	Elevated
City of Westfield	Likely	Limited	< 6 Hours	< 6 Hours	Elevated

Relatively small hazardous materials incidents have occurred throughout Hamilton 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 Hamilton County, it can be anticipated that the likelihood of a future incident will also increase.

Hazardous Materials Incident: Assessing Vulnerability

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

Direct Effects:

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

Indirect Effects:

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

While the possibility of an incident occurring may be likely, the vulnerability of Hamilton 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.

Figure 3-2 Fuel Tanker Fire

In Hamilton County, nearly 200 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 incidents 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, it might require active control response measures to contain a spill or release. On the other hand, even small or moderate incidents 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 release (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 numerous railways, Interstates 69 and 465; US Highway 31, 52, and 421; State Routes 19, 32, 37, 38, 47, and 213 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 infrastructures 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 that within close proximity to a hazardous materials facility is 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.

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

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

3.3.2 Flood

Flood: Overview

Floods are the most common and widespread of all-natural disasters. Most communities in the United States have experienced some degree of flooding after spring rains, heavy thunderstorms, winter snow melts, or a combination of these incidents. A flood, as defined by the NFIP, is "a general and temporary condition of partial or complete inundation of 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 the 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 can produce 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.

Flood: Recent Occurrences

The National Climate Data Center (NCDC) reports that between May 2011 and January 2019, there were 25 flood incidents (19 floods and six flash floods) that resulted in approximately $92.5 K in property damages, and $7.0 K additional crop damages. Two adult males lost their lives in separate vehicle accidents near the same location in Arcadia during the April 20, 2013 flooding incident. In both cases, drivers attempted to cross flooded roads and were swept into Cicero Creek. During the June 27, 2015 incident, an adult male and juvenile female died due to injuries sustained from a vehicular accident after their vehicle left the flooded roadway and struck a utility pole. Two additional juveniles in the vehicle were taken to the hospital with minor injuries.

Appendix 6 provides the NCDC information regarding flood incidents that have resulted in injuries, deaths, or monetary damages to property and/or crops.

Figure 3-3 Northeast View from Logan Street Bridge, White River USGS Gage Location

Stream gages are utilized to monitor surface water elevations and/or discharges at key locations and time periods. Some gages are further equipped with National Weather Service's (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 Hamilton County, there is one active gage equipped with AHPS capabilities where during times of high water, forecasted river stages are made available: White River at Noblesville IN (**Figure 3-3**).

Any property having received two insurance claim payments for flood damages totaling at least $1,000, paid by the NFIP within any 10-year period since 1978, is defined as a repetitive loss property. These properties are important to the NFIP because they account for approximately one-third of the country's flood insurance payments. According to FEMA Region V, there are a total of 40 repetitive loss properties within Hamilton County outlined further in **Table 3-4**.

There have been several claims made for damages associated with flooding in Hamilton County. Within the City of Noblesville, there have been 186 paid losses resulting in approximately $2.1 M in payments. Further, within the City of Carmel, there were 107 payments totaling approximately $563 K. Table 3-8 also identifies the number of claims per NFIP community as well as payments made. Information regarding the flood insurance claims for residents of the Town of Atlanta is reported within the Hamilton County statistics.

Table 3-4 Repetitive Loss Properties, Claims, and Payments

COMMUNITY	# OF REPETITIVE LOSS PROPERTIES	STRUCTURE TYPE	CLAIMS SINCE 1978	$$ PAID
Hamilton County	7	Single-Family	49	$409.3 K
Town of Arcadia	0		3	$46.0 K
Town of Atlanta	0			
City of Carmel	10	Single-Family	107	$562.8 K
Town of Cicero	1	Single-Family	4	$112.9 K
City of Fishers	16	15 Single-Family; 1 Non-Residential	26	$341.4 K
City of Noblesville	5	Single-Family	186	$2.1 M
Town of Sheridan	0		2	$36.1 K
City of Westfield	1	Single-Family	7	$40.8 K
TOTAL	**40**		**378**	**$3.7 M**

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

Mandatory flood insurance purchase requirements apply to structures in the 1% AEP. Total flood insurance premiums for Hamilton County and the NFIP communities is approximately $637.7 K. Total flood insurance coverage for Hamilton County is nearly $204.0 M. **Table 3-5** further indicates the premiums and coverage totals for individual NFIP communities. Information regarding the flood insurance premiums and coverage for the Town of Atlanta are reported within the Hamilton County statistics.

Table 3-5 Insurance Premiums and Coverage

COMMUNITY	FLOOD INSURANCE PREMIUMS	FLOOD INSURANCE COVERAGE
Hamilton County	$183.9 K	$29.7 M
Town of Arcadia	$1.2 K	$0.7 M
Town of Atlanta		
City of Carmel	$262.4 K	$82.6 M
Town of Cicero	$4.4 K	$2.0 M
City of Fishers	$60.4 K	$41.3 M
City of Noblesville	$61.7 K	$23.3 M
Town of Sheridan	$285	$0.1 M
City of Westfield	$63.4 K	$24.4 M
TOTAL	**$637.7 K**	**$204.0 M**

(IDNR, 2018)

As determined by the Committee, the probability of a flood occurring throughout Hamilton County ranges from "Unlikely" in Arcadia, Atlanta, and Cicero; "Possible" in Sheridan; "Likely" within Westfield; and "Highly Likely" in all other areas of the county. Impacts from such an incident are anticipated to range from "Negligible" to "Critical" based primarily on the amount of floodplain present within or near each community and the estimated number of structures within those areas. The Committee also determined that the warning time would vary based on stream gage location, forecasting methods and local knowledge of stream activities and that the duration of such an incident is anticipated to last between less than one week in most areas and greater than one week for the unincorporated portions of the county. A summary is shown in **Table 3-6**.

Table 3-6 CPRI for Riverine Flood

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Hamilton County	Highly Likely	Critical	> 24 Hours	> 1 Week	Severe
Town of Arcadia	Unlikely	Negligible	> 24 Hours	< 1 Week	Low
Town of Atlanta	Unlikely	Negligible	> 24 Hours	< 1 Week	Low
City of Carmel	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of Cicero	Unlikely	Limited	> 24 Hours	< 1 Week	Low
City of Fishers	Highly Likely	Limited	12-24 Hours	< 1 Week	Elevated
City of Noblesville	Highly Likely	Critical	> 24 Hours	< 1 Week	Severe
Town of Sheridan	Possible	Negligible	> 24 Hours	< 1 Week	Low
City of Westfield	Likely	Limited	> 24 Hours	< 1 Week	Severe

Hamilton County is also impacted by non-riverine flooding, "flash floods" or standing water due to poor drainage. The Planning Committee felt these incidents were different in nature and significance to the point it was felt a separate CPRI determination was developed. **Table 3-7** identifies the results of the CPRI for other flood incidents.

Table 3-7 CPRI for Other Flood

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Hamilton County	Highly Likely	Critical	6-12 Hours	< 1 Week	Severe
Town of Arcadia	Possible	Negligible	< 6 Hours	< 1 Week	Elevated
Town of Atlanta	Likely	Limited	12-24 Hours	< 1 Week	Elevated
City of Carmel	Highly Likely	Negligible	< 6 Hours	< 1 Day	Elevated
Town of Cicero	Possible	Negligible	< 6 Hours	< 1 Day	Low
City of Fishers	Highly Likely	Negligible	< 6 Hours	< 1 Day	Elevated
City of Noblesville	Highly Likely	Negligible	< 6 Hours	< 1 Day	Elevated
Town of Sheridan	Possible	Negligible	< 6 Hours	< 1 Day	Low
City of Westfield	Likely	Limited	< 6 Hours	< 1 Week	Elevated

The probability of both riverine and other flooding varies by community-based on the proximity to water bodies, the number, and type of structures anticipated to be impacted, and the knowledge of local experts and responders.

Flood: Assessing Vulnerability

Flood incidents may affect large portions of Hamilton County simultaneously, as large river systems and areas with poor drainage cover much of the county and several communities. Within Hamilton County, direct and indirect effects of a flood incident 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

Many Planning Committee members also participated in meetings in early 2018 to develop a Flood Response Plan (FRP) for the City of Noblesville. The FRP is developed to serve as an action plan when Action Stage flood incidents are detected in the City, upstream in the unincorporated areas of Hamilton County. As a result of flood modeling, historical incidents, and participant knowledge, areas of concern for various flood incidents were identified and mapped. **Figure 3-4** is an example of a Flood Impact exhibit included in the City of Noblesville FRP, the 1.0% AEP or 100-year Flood. Similar maps were produced for the 10-Year, 50-Year, and 500-Year incidents.

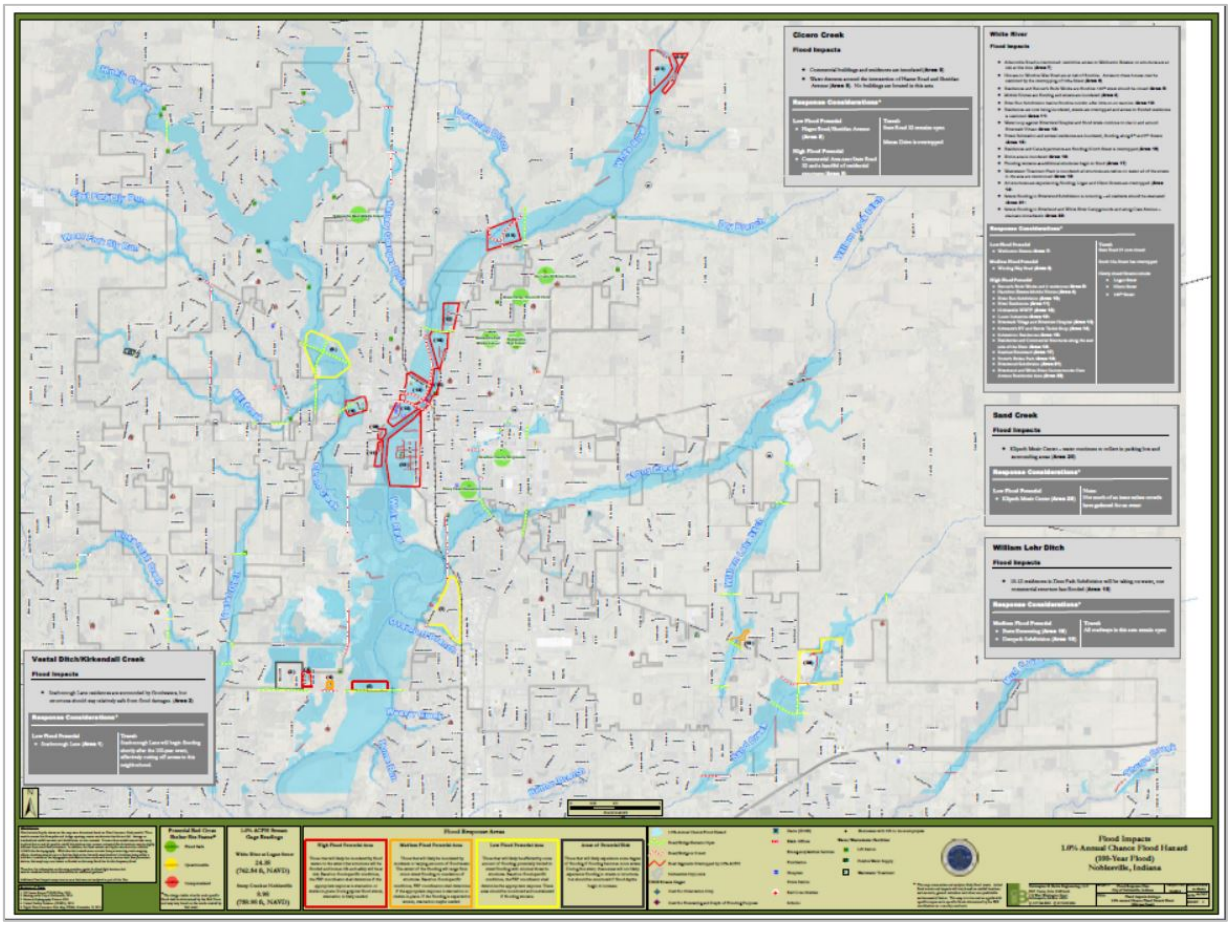


Figure 3-4 City of Noblesville FRP Flood Impacts Exhibit

Figure 3-5 is a closer view of the FRP Flood Impacts Exhibit in Figure 3-4. The areas in red are those with a High Flood Potential, areas in orange are Medium Flood Potential, and yellow are a Low Flood Potential. Additionally, the gray boxes in Figure 3-5 describe the anticipated flood impacts such as the number and type of structures to be flooded and the transportation routes to be affected at that level of a flood incident.

In the time period since the last planning effort, actions such as the development of the FRP for the City of Noblesville and the adoption of more restrictive Floodplain Ordinances by Hamilton County communities have reduced the flood risk and vulnerability. Structures have been prevented from being built in high-risk areas, and additional structures have been removed from those high-risk areas while municipal growth was directed to more appropriate areas less at-risk from riverine flooding.

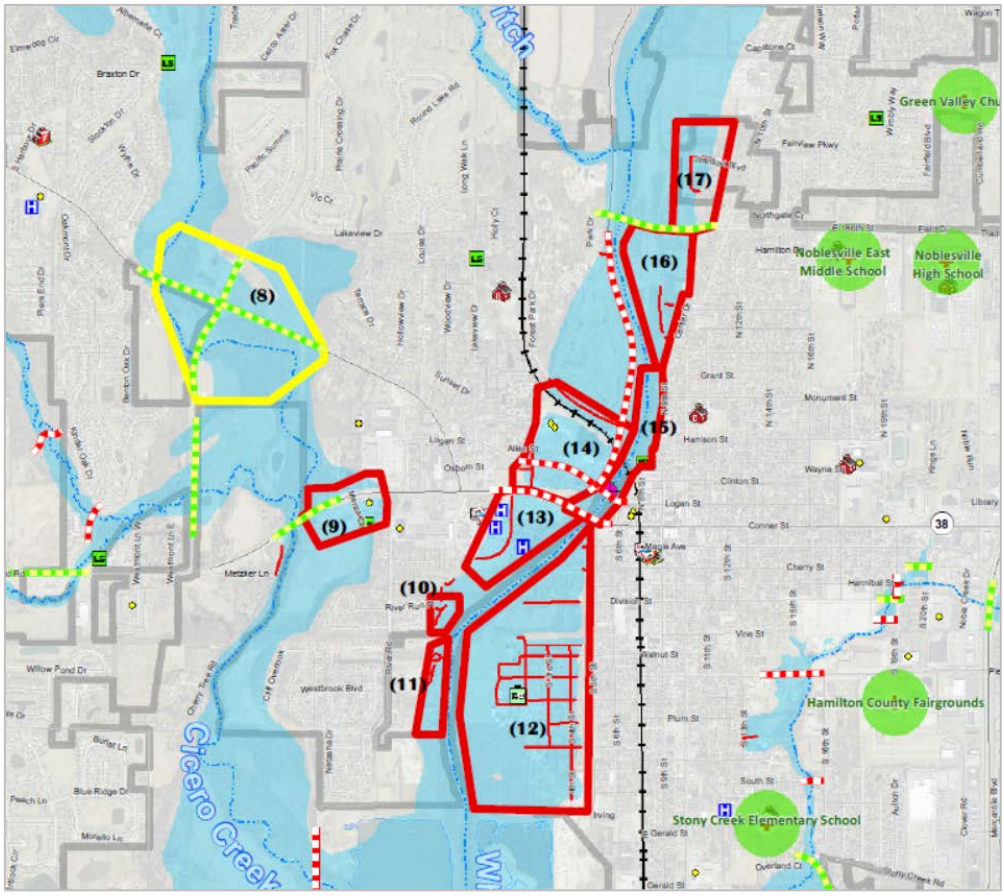


Figure 3-5 1.0% AEP Flood Potential Impact Areas, Noblesville IN

Estimating Potential Losses

Figure 3-6 Car Submerged on Flooded Street

Critical and non-critical structures located in regulated floodplains, poorly drained areas, or low-lying areas (**Figure 3-6**) are most at risk for damages associated with flooding. For this planning effort, a GIS Desktop Analysis methodology was utilized to estimate flood damages.

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

An analysis was completed utilizing the effective Digital FIRMs (DFIRMs) overlaid upon the parcel data provided by Hamilton County. 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. Structure values were calculated using:

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

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

To estimate anticipated damages associated with each flood in Hamilton County and NFIP communities, it was estimated that 25% of structures in the flood zones would be destroyed, 35% of structures would be 50% damaged, and 40% of structures would be 25% damaged. **Table 3-8** 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 the NFIP community within Hamilton County.

Table 3-8 Manual GIS Analysis Utilizing Most Recent DFIRM Data and Hamilton County Building Inventory

	FLOODWAY		1% AEP		0.2% AEP		UNNUMBERED	
	#	$	#	$	#	$	#	$
Hamilton County	341	$12.8 M	440	$18.3 M	118	$7.9 M	252	$18.5 M
Town of Arcadia	0	$0	0	$0	0	$0	0	$0
Town of Atlanta	0	$0	0	$0	0	$0	0	$0
City of Carmel	177	$28.8 M	379	$84.0 M	705	$112.4 M	31	$5.6 M
Town of Cicero	12	$1.1 M	0	$0	0	$0	0	$0
City of Fishers	19	$6.7 M	199	$50.8 M	157	$30.5 M	73	$18.4 M
City of Noblesville	130	$13.2 M	319	$43.5 M	90	$25.0 M	23	$4.5 M
Town of Sheridan	0	$0	0	$0	0	$0	0	$0
City of Westfield	71	$25.5 M	167	$38.5 M	28	$15.0 M	22	$4.5 M
Total	**123**	**$88.1 M**	**172**	**$235.1 M**	**72**	**$190.8 M**	**187**	**$51.5 M**

Structures and damages within each zone are not inclusive

Utilizing the same GIS information and process, **Table 3-9** identifies the number of critical infrastructures within each of the Special Flood Hazard Areas (SFHA) in Hamilton County. These buildings are included in the overall number of structures and damage estimate information provided in Table 3-8. Two listings, the Waterfront Condos at Morse (in the floodway within the town of Cicero), West Harbor Subdivision (in the 1% AEP within the city of Noblesville), and the Grey Stone Apartments (in the 0.2% AEP within the city of Noblesville) are included as a critical facility due to their recreational facilities such as a pool, sports courts, or sports fields.

Table 3-9 Critical Infrastructure in SFHA

COMMUNITY	FLOODWAY	1% AEP	0.2% AEP
Hamilton County	Riverwood Power Dam, Riverwood Canoe Launch, White River Campground		E&B Paving, Noblesville Generating Station, Plant 11, River Road Water Plant, RR 332 SS Noblesville
Town of Arcadia			
Town of Atlanta			
City of Carmel	Citizens Water: White River North (Tier II), River Heritage Park	St Vincent Carmel Hospital, Bickford Senior Living, CarMax #7144, Carmel WWTP 106th St Lift station Generator, Underground storage #1, River Road Park, Meadowlark Park, Plum Creek Golf Course	Prairie Trace Elementary School, 106th Street Tier II facility, Carmel WWTP, Irving Materials, Milestone Contractors, Noblesville Southwest Substation, Water Treatment Plant #1, Camelot Park
Town of Cicero	Waterfront Condos at Morse (Recreation)		
City of Fishers	Tier II Facility, Cumberland Park	Fishers Fire Department #94, Caring Home Service, Fishers Fire Radio Tower	
City of Noblesville	Morse Reservoir Dam, RHP Noblesville Family Care, RHP Noblesville Pediatrics, RHP WorkMed West	Chase bank, Federal Hill Commons, Riverwalk Village, Hamilton Town Center, Kroger, Ceres Solutions, Noblesville Wastewater, Southside Park, West Harbor Subdivision (Recreation)	Grey Stone Apartments (Recreation)
Town of Sheridan			
City of Westfield		PNC Bank, Cell Tower, Citizens Wastewater of Westfield	

Utilizing the information in Table 3-8 regarding the number of structures within each Flood Hazard Area, it is also important to note the number of flood insurance policies within each NFIP area in Hamilton County. **Table 3-10** provides a comparison between the number of structures in the SFHA and the number of flood insurance policies. It is also important to note that flood insurance is voluntary unless the property owner carries a federally subsidized mortgage; insurance coverage may be discontinued when the mortgage is completed.

Table 3-10 Number of Structures in the SFHA and Number of Flood Insurance Policies

COMMUNITY	# STRUCTURES IN SFHA	# POLICIES
Hamilton County	899	164
Town of Arcadia	0	4
Town of Atlanta	0	0
City of Carmel	1,261	305
Town of Cicero	12	7
City of Fishers	375	141
City of Noblesville	539	84
Town of Sheridan	0	1
City of Westfield	266	79
Total	**3,352**	**785**

(IDNR, 2018)

Future Considerations

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

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

Several communities have adopted ordinances that prohibit or discourage the construction of new structures within the 100-year floodplain. This keeps new construction from the most as-risk areas and reduces the vulnerability of the communities. Additional construction and development ordinances reduce the potential impacts from localized flooding or areas which are poorly drained. Despite these efforts, the overall vulnerability and monetary value of damages are 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 3-7**), 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 Hamilton County are closely tied to the river systems, special events occurring near to or on these rivers and waterways may be canceled or postponed during periods of flooding or high-water levels.

Figure 3-7 Fire Engine in Flood Waters

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 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 floodwaters. Should access roads to hazardous materials handlers become flooded, or if bridges are damaged by floodwaters, response times to more significant incidents may be increased, potentially increasing the damages associated with the release.

Increased volumes of water during a flood incident may also lead to dam failures. As the water levels rise in areas protected by dams, at some point, these structures may over-top or breach, leading to even more water released. When combined, flood and dam failure may potentially result in catastrophic damages.

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

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

3.3.3 Winter Storm & Ice

Winter Storm & Ice: Overview

A winter storm can range from a 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 3-8 Ice Covered Power Lines

Storm effects such as extreme cold, flooding, and snow and ice accumulation (**Figure 3-8**) 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.

The 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 Hamilton County. Such conditions can result in substantial personal and property damage, even death.

Winter Storm & Ice: Recent Occurrences

Since May 2011, the NCDC has recorded four winter storms, one blizzard, four heavy snow incidents, and one ice storm. NCDC reports totaled $0.50 K in property damages and did not include injuries, deaths associated with any of the incidents. Narrative descriptions indicated poor travel conditions, power outages, and debris associated with similar incidents.

The most recently recorded winter storm incident occurred on January 19, 2019. A wintry mix of snow, sleet, and freezing rain impacted Central Indiana, where, in some areas, increased amounts of freezing rain fell. Wind gusts of 40 mph in some areas resulted in near white-out conditions. In the Hamilton County area, reports of ice accumulation of 0.25 inches came from east of Westfield. Power outages were reported across the county.

On December 26, 2012, blizzard conditions caused driving conditions to deteriorate rapidly throughout the area. Approximately 5 to 13 inches of snow fell along with 30-45 mph winds resulted in visibilities less than ¼ mile in many areas.

The probability, magnitude, warning times, and duration of a snowstorm or ice storm causing disruption to residents and businesses in Hamilton County, as determined by the Planning Committee, is expected to be mostly consistent throughout the County and NFIP communities. It is “Likely” to “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 “Limited” severity, although representatives from the unincorporated areas anticipate potentially “Critical” damages due to the remoteness of some areas. 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 vary based on the ability of the municipality to prepare for and respond to the event. A summary is shown in **Table 3-11**.

Table 3-11 CPRI for Winter Storm and Ice

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Hamilton County	Highly Likely	Critical	> 24 Hours	> 1 Week	Severe
Town of Arcadia	Highly Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of Atlanta	Likely	Limited	12-24 Hours	< 1 Week	Elevated
City of Carmel	Highly Likely	Limited	> 24 Hours	< 1 Day	Elevated
Town of Cicero	Likely	Limited	> 24 Hours	> 1 Week	Elevated
City of Fishers	Highly Likely	Limited	> 24 Hours	< 1 Day	Elevated
City of Noblesville	Highly Likely	Limited	> 24 Hours	< 1 Day	Elevated
Town of Sheridan	Highly Likely	Limited	> 24 Hours	> 1 Week	Elevated
City of Westfield	Highly Likely	Limited	> 24 Hours	< 1 Week	Elevated

The Planning Committee determined that the probability for a snowstorm or ice storm to occur in Hamilton County and many of the communities within is "Highly Likely" or will occur within the calendar year. Based on historical data and the experience of the Planning Committee, snowstorms are common within Hamilton County and will continue to be an annual 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 Hamilton 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 the safety of roads
- Loss of income if unable to get to the 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.

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 Hamilton County communities. For example, a March 2003 snowstorm in Denver, Colorado dropped approximately 31 inches of snow and caused an estimated $34 M 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 $17 M 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 6 counties. Snowstorms and blizzards also make road travel difficult and dangerous, as in **Figure 3-9**.

Figure 3-9 Travel Impacted During Snowstorm

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 $19 M was spent throughout the area, with approximately $6.4 M 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 $1 B 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 incidents 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 3-10 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 3-10**) as well as within the stream or river channel. The increased flooding may then lead to a dam failure within the same area, further exacerbating the damages.

Hazardous materials incidents may be caused by poor road conditions during winter storms or ice storms. Many hazardous materials are transported by rail or by tanker over highways and interstates. In the more rural areas of Hamilton County, or where open areas are more susceptible to snowdrifts 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 extremely cold temperatures, power outages may prove deadly for certain populations such as the elderly or ill.

3.3.4 Earthquake

Earthquake Overview

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

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

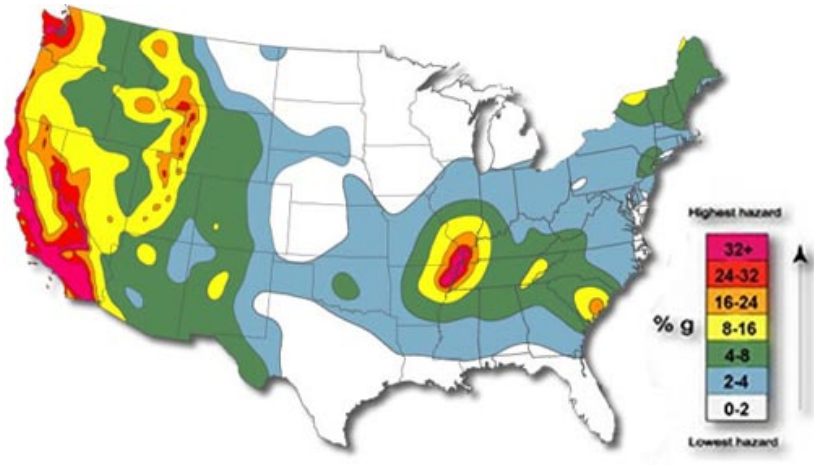


Figure 3-11 Earthquake Hazard Areas in the US

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 $200 B. Scientists are currently studying the New Madrid fault area and have predicted that the chances of an earthquake in the M 8.0 range occurring within the next 50 years are approximately 7%-10%. However, the chances of an earthquake at a M 6.0 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 earthquakes, and they are located in every region of the country (**Figure 3-11**). California experiences the most frequent damaging earthquakes; however, Alaska experiences the greatest number of large earthquakes, most of which are located in uninhabited areas. The largest earthquakes felt in the United States were along the New Madrid Fault in Missouri, when 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 Hamilton County, the nearest areas of concern are the Wabash Seismic Zone, and the Anna Ohio Fault zone, one of the most seismically active areas outside of the New Madrid Seismic Zone. Within this area, approximately 40 earthquakes have been felt since 1875 with damages ranging from reports of feeling shaking to toppled chimneys and cracked windows.

On April 18, 2008, an M 5.2 quake, reported by the Central United States Earthquake Consortium, struck southeast Illinois in Wabash County and included reports of strong shaking in southwestern Indiana, Kansas, Georgia, and the upper peninsula of Michigan. Although there were 25,000 reports of feeling the earthquake, no injuries or fatalities were reported.

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

Figure 3-12 Earthquake Damaged Porch

Most recently, an M 5.8 centered in Mineral, Virginia affected much of the East Coast on August 23, 2011. According to USA Today, ten nuclear power plants were shut down for precautionary inspections following the quake, over 400 flights were delayed, and the Washington Monument was closed indefinitely, pending detailed inspections by engineers.

Based on historical earthquake data, local knowledge of previous earthquakes, and the results of HAZUS-MH scenarios, the Committee determined that the probability of an earthquake occurring in Hamilton County or any of the communities is "Possible." Should an earthquake occur, the impacts associated with this hazard are anticipated to be "Limited" to "Critical" dependent upon the amount of infrastructure and resources within the impacted area and the estimation of that municipality's ability to respond to such an incident.

As with all earthquakes, it was determined that the residents of Hamilton County would have little to no warning time (less than six hours) and that the duration of the main earthquake incident would also be expected to be less than six hours. A summary is shown in **Table 3-12**.

Table 3-12 CPRI for Earthquake

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Hamilton County	Possible	Critical	< 6 Hours	> 1 Week	Elevated
Town of Arcadia	Possible	Critical	< 6 Hours	> 1 Week	Elevated
Town of Atlanta	Possible	Limited	< 6 Hours	> 1 Week	Elevated
City of Carmel	Possible	Critical	< 6 Hours	> 1 Week	Elevated
Town of Cicero	Possible	Critical	< 6 Hours	> 1 Week	Elevated
City of Fishers	Possible	Critical	< 6 Hours	> 1 Week	Elevated
City of Noblesville	Possible	Critical	< 6 Hours	> 1 Week	Elevated
Town of Sheridan	Possible	Critical	< 6 Hours	> 1 Week	Elevated
City of Westfield	Possible	Critical	< 6 Hours	< 1 Week	Elevated

According to 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 the next five years within or near to Hamilton County is "Possible." During the Planning Committee meetings, several attendees determined that while the hazard is largely unpredictable, it was still "Possible" to occur. This probability determination encourages planners and decision-makers to keep the potential for earthquakes in mind as land use, and development decisions are made throughout Hamilton County.

Earthquake: Assessing Vulnerability

Earthquakes generally affect broad areas and potentially many counties at one time. The ranges of damage and destruction are determined by the location of the epicenter as well as the strength of an earthquake. Within Hamilton County, direct and indirect effects from an earthquake may include:

Direct Effects:

- Urban areas may experience increased 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:

Figure 3-13 Minor Earthquake Damages

- 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

Losses caused by an earthquake could be physical, economic, or social in nature. Due to the unpredictability and broad impact regions associated with an earthquake, all critical and non-critical infrastructure are at risk of experiencing earthquake-related damages. Damages to structures, infrastructure, and even business interruptions can be expected following an earthquake. Examples of varying degrees of damages are shown in **Figure 3-12** and **Figure 3-13**. While much development has occurred in the areas of Carmel, Fishers, Noblesville, and Westfield, this new construction has followed local, state, and International Building Codes, which have higher construction standards, therefore, reducing the municipality's overall vulnerability.

Estimating Potential Losses

In order to determine the losses associated with an earthquake, the HAZUS-MH software was utilized in the 2013 Hamilton County MHMP to determine the impact associated from a M 5.1 earthquake with an epicenter near Kokomo, Indiana; the location for the 2010 earthquake. This is not only an actual location of an earthquake in Indiana but also the highest recorded magnitude of an earthquake in Indiana to produce conservative results. Additionally, it is not anticipated that this hazard is one that routinely impacts the region. Therefore, the earthquake scenario from the 2013 MHMP will again be reviewed as a part of this effort.

According to the HAZUS-MH scenario, the total economic loss associated with this earthquake is anticipated to be near $1 M, which includes $870 K of estimated business losses. Much of the damage is anticipated to be experienced within the City of Carmel and Fall Creek Township.

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

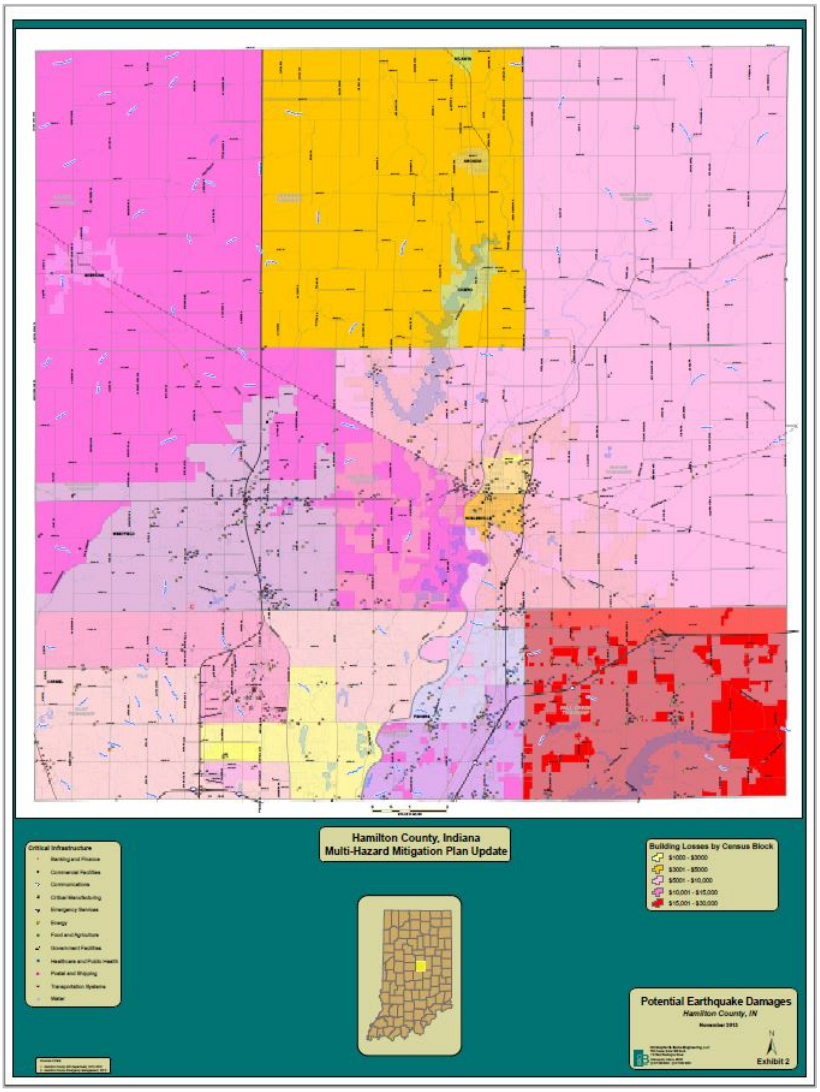


Figure 3-14 Anticipated Building Damages from Earthquake Scenario

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. **Figure 3-14**, from the 2013 Hamilton County MHMP, indicates the estimated damages by tract as a result of the hypothetical earthquake.

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 randomly 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 Hamilton 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. For that reason, Hamilton County should continue to provide education and outreach regarding earthquakes and even earthquake insurance, along with education and outreach for other hazards. As the county and the communities within the county continue to grow and develop, the proper considerations for the potential of an earthquake to occur, and the related impacts stemming from soil liquefaction may help to mitigate against social, physical, or economic losses in the future.

It can be anticipated that while all structures in Hamilton County will remain at-risk to earthquake damages and effects, new construction or redevelopment may reduce the overall risks such as those presented in Figure 3-8. As redevelopment occurs in the more urban areas of Carmel, Fishers, or Westfield, 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 or structures in these hazard areas. These types of related hazards may have greater impacts on Hamilton County communities than the actual earthquake itself. While not a direct hazard studied within this planning effort, the Planning Committee also noted the potential for earthquakes to have an impact on buried utilities such as electric and natural gas as well as potential disruptions to groundwater supplies. It is not expected that earthquakes will be caused by other hazards studied within this plan.

3.3.5 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 has become 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 tornadoes strike between 3:00 pm and 9:00 pm but can occur at any time of day or night, as shown in **Figure 3-15**. Tornadoes occur most frequently in the United States east of the Rocky Mountains. Tornadoes in Indiana generally come from the south through the east.

Figure 3-15 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 approximately 30 miles and dropped it in Arkansas. In 1975, a Mississippi tornado carried a home freezer more than a mile.

Tornado: Recent Occurrences

The classification of tornadoes utilizes the Enhanced Fujita Scale of tornado intensity and damages, described in **Table 3-13**. 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, Hamilton County has experienced three EF1 tornadoes since the last planning effort.

Table 3-13 Enhanced Fujita Scale of Tornado Intensity

EF-SCALE	WINDS	CHARACTER OF DAMAGE	RELATIVE FREQUENCY	TYPICAL DAMAGES
EF0	65-85 mph	Light damage	29%	Shallowly 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 NCDC reports approximately $100 K in property damages for the three incidents. In November 2013, the Town of Atlanta experienced a tornado that began ½ mile south-southwest of town. The path crossed into Tipton County and ended near the Hamilton/Tipton County line. Property damages of $40 K were reported, but no additional details were provided in the incident narrative.

Reports of snapped tree trunks, damaged wooden fences, and an overturned above ground pool were provided for the December 23, 2015 incident. In all, $50 K in property damages were reported, including damages to the rooftops, siding, and garages of several homes in the Noblesville area.

The Committee estimated the probability of a tornado occurring in Hamilton County would be “Possible” to “Highly Likely” and the magnitude and severity of such an incident to be “Limited” to “Critical” within various areas of the County. As with many hazardous incidents, 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 3-14**.

Table 3-14 CPRI for Tornado

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Hamilton County	Highly Likely	Significant	< 6 Hours	< 6 Hours	Severe
Town of Arcadia	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Atlanta	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
City of Carmel	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
Town of Cicero	Possible	Critical	< 6 Hours	< 6 Hours	Elevated
City of Fishers	Possible	Significant	6-12 Hours	< 6 Hours	Elevated
City of Noblesville	Possible	Significant	< 6 Hours	< 6 Hours	Elevated
Town of Sheridan	Possible	Critical	6-12 Hours	< 6 Hours	Elevated
City of Westfield	Possible	Critical	< 6 Hours	< 6 Hours	Elevated

The Indiana State Climate Office estimates that throughout Indiana, there is an average of 20 tornado touchdowns per year. Based on the number of tornado touchdowns previously reported through the NCDC and local weather agencies, the Committee determined the general probability of a future tornado occurring in Hamilton County is "Possible" (within the next five 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 Hamilton 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, Carmel, and Noblesville. 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 to utilize 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 theoretically lower wind speed. **Table 3-15** provides summary data for the hypothetical tornado, which is identified in Exhibit 3.

Table 3-15 Summary of Hypothetical Tornado Damages

	Zone 1		Zone 2		Zone 3		Total	
	#	$	#	$	#	$	#	$
County	13	$0.5M	5	$0.5M	16	$0.1M	**34**	**$2.1M**
Carmel	149	$25.0M	105	$15.7M	199	$38.8M	**453**	**$79.5M**
Noblesville	115	$16.2M	64	$5.0M	154	$14.5M	**333**	**$35.7M**
Totals	277	$41.7M	173	$21.2.0 M	369	$53.4M	**820**	**$117.3 M**

Future Considerations

Within Hamilton County, there are numerous incidents each year that draw thousands of guests. Due to this, it is imperative that the EMA place continued importance on the need to maintain, and as necessary, upgrade their outdoor warning siren coverage. Currently, much of the more populous areas of the County are covered by the audible ranges of the existing outdoor warning sirens. The existing siren locations and their coverage areas are provided in **Figure 3-16**.

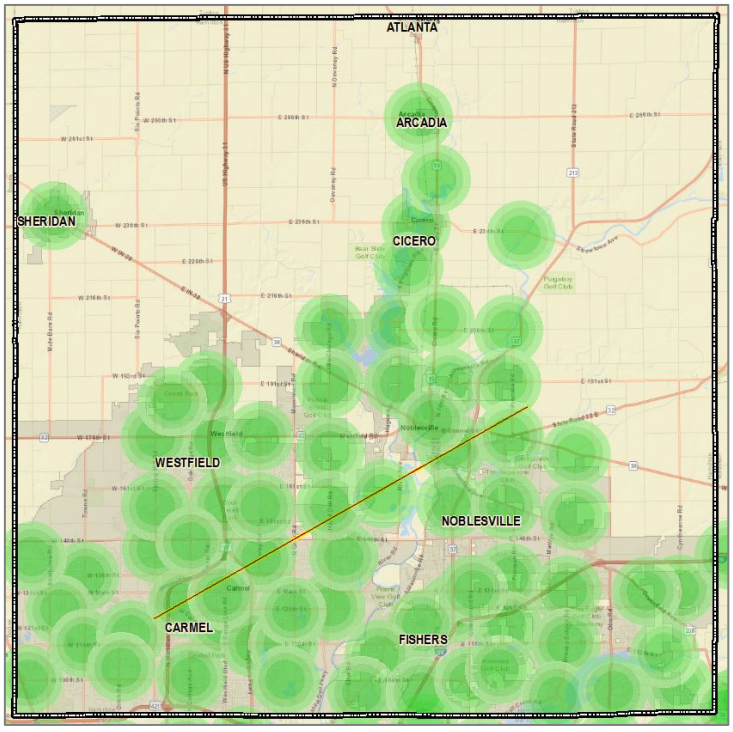


Figure 3-16 Hamilton County Outdoor Warning Sirens

While it can be anticipated that new construction associated with development may be stronger than older or existing construction, most of Hamilton 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 Hamilton County has been lessened through participation in mass notification programs and outdoor warning siren activations.

There may also be indirect effects of a tornado incident. For example, post-incident 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 incident. 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.

3.3.6 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. When the weight of the ice formations becomes too heavy, they fall to the ground as hail. Hail size ranges from smaller than a pea to as large as a softball and can be very destructive to buildings, vehicles (**Figure 3-17**), 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.

Figure 3-17 Damaging Hail on Vehicles

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 lightning 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 tornadoes, 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

In Hamilton County, the NCDC has recorded 46 hailstorms and 49 thunderstorms/windstorms between May 2011 and January 2019. The largest recorded hailstone was 2.00 inches in diameter and occurred on April 10, 2013, in Fishers.

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 Hamilton County, NCDC reports 41 instances between May 2011 and January 2019, where top wind speeds were greater than 60 mph.

Total NCDC recorded damages for hailstorms, thunderstorms, and windstorms throughout Hamilton County are $200.75K in property damages, an additional $1.0K in crop damages, and no injuries or deaths have been reported regarding these incidents. Many incident reports included in the NCDC did not provide descriptive information on the social, physical, and economic losses resulting from individual storms specific to Hamilton County. Even in instances where monetary damages were reported, narrative descriptions of the incident rarely extended beyond reports of damages to broken tree limbs, downed power lines, or roof damages.

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 3-4 times over 20 years, the average life of a residential roof. Further, thunderstorms and windstorms are considered a high-frequency hazard and may occur numerous times per year.

The Committee determined the probability of a hailstorm, thunderstorm, or windstorm occurring in Hamilton County is “Possible” to “Highly Likely” and will typically affect broad portions of the county at one time resulting in potentially “Negligible” to “Critical” 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 greater than 24 hours for most of the communities and range from six to 24 hours for others. The duration of such an incident is expected to last less than one week.

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 incidents 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 3-16**.

Table 3-16 CPRI for Hailstorm, Thunderstorm, and Windstorm

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Hamilton County	Highly Likely	Critical	> 24 Hours	< 1 Day	Severe
Town of Arcadia	Highly Likely	Negligible	12-24 Hours	< 1 Day	Elevated
Town of Atlanta	Possible	Limited	6-12 Hours	< 1 Day	Elevated
City of Carmel	Highly Likely	Negligible	> 24 Hours	< 6 Hours	Elevated
Town of Cicero	Likely	Limited	> 24 Hours	< 1 Week	Elevated
City of Fishers	Highly Likely	Negligible	> 24 Hours	< 6 Hours	Elevated
City of Noblesville	Highly Likely	Critical	> 24 Hours	< 1 Week	Severe
Town of Sheridan	Highly Likely	Negligible	> 24 Hours	< 6 Hours	Elevated
City of Westfield	Highly Likely	Negligible	> 24 Hours	< 6 Hours	Elevated

Specific locations and frequency of hailstorms, thunderstorms, and windstorms are difficult to predict as many of these individual incidents 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 most 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 incidents each year.

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 Hamilton 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

Due to the unpredictability of this hazard, all critical infrastructure and non-critical structures in Hamilton 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, maybe 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 3-18**, are common.

Figure 3-18 Home Damaged During Windstorm

Future Considerations

As the populations of the communities in Hamilton 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 Hamilton 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 incident. 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 Drought

Drought: Overview

Figure 3-19 Drought Affected Soil

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 climatic 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.

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 evapotranspiration, soil water deficits, reduced groundwater or reservoir levels, and crop yields. Socioeconomic drought relates the lack of moisture to community functions in the full range of societal functions, including power generation, the local economy, and food sources. **Figure 3-19** shows soil 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 3-20 US Drought Monitor Drought Severity Classification

Data gathered from the U.S. Drought Monitor indicated that between January 1, 2013, and September 30, 2018, there were 13 weeks where some portion of Hamilton County was in a "Moderate Drought" and 40 weeks where conditions were considered "Abnormally Dry." Conditions worse than a D1 or Moderate Drought were not reported during this timeframe. **Figure 3-20**, from the U.S. Drought Monitor, describes the rationale to classify the severity of droughts.

During this planning effort, Hamilton County experienced the greatest number of weeks in a drought between October and December 2015. The week of October 20, 2018, the entire county was experiencing "D0-Abnormally Dry" drought conditions. The following week, October 27, 2018, approximately half of the county was within the "D1-Moderate Drought" intensity. This drought lasted until the week of January 12, 2016, when the entire state was considered to be out of drought conditions. **Figure 3-21** identifies those areas and categories of drought throughout Indiana for October 27, 2015, the peak of the 2015 drought. Hamilton County is located partially in the "D1-Moderate Drought" area and partially in the "D0-

Abnormally Dry" area. D1 includes some crop or pasture damages, and shortages of water in streams and reservoirs may be developing.

The National Data Climate Center (NCDC) reports four drought incidents impacting Hamilton County between May 2011 and January 31, 2019. Each of the incidents occurred within 2012, and no monetary damages were reported.

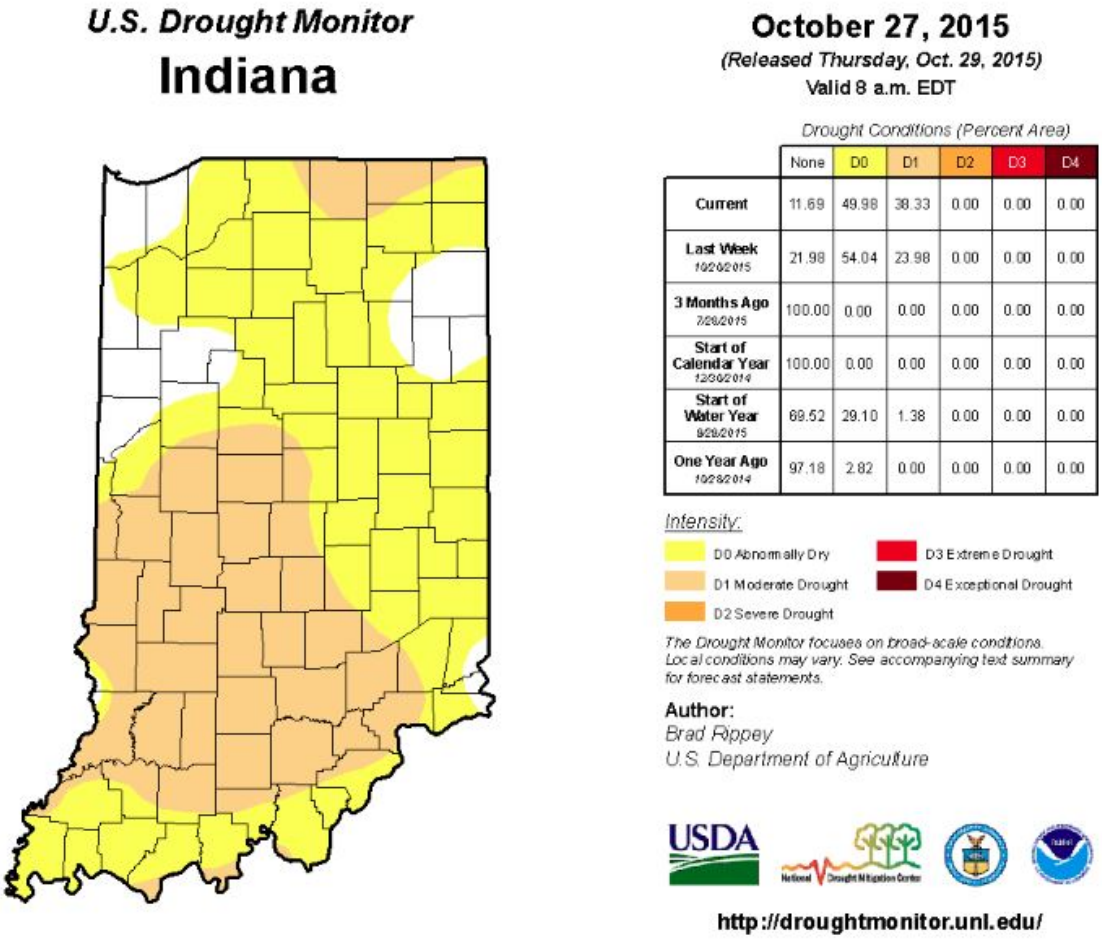


Figure 3-21 October 2015 Indiana Drought Map

Utilizing the CPRI, the Planning Committee determined the overall risk of drought throughout Hamilton County is "Likely" (to occur within the next three years). The impact of drought was determined to be consistent throughout the county, largely based on similar water supply sources and land use considerations. The committee agreed that the magnitude of drought is anticipated to range from "Limited" to "Critical." The unincorporated areas of Hamilton County are largely agricultural with row crop and livestock production, both of which are highly impacted by drought. For this reason, the Planning Committee determined the unincorporated county will have "Critical" severity. Further, it is anticipated that with the enhanced weather forecasting abilities, the warning time for a drought is greater than 24 hours and the duration will be greater than one week. A summary is shown in **Table 3-17**.

Table 3-17 CPRI for Drought

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Hamilton County	Likely	Critical	> 24 Hours	> 1 Week	Elevated
Town of Arcadia	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of Atlanta	Likely	Limited	> 24 Hours	> 1 Week	Elevated
City of Carmel	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of Cicero	Likely	Limited	> 24 Hours	> 1 Week	Elevated
City of Fishers	Likely	Limited	> 24 Hours	> 1 Week	Elevated
City of Noblesville	Likely	Limited	> 24 Hours	> 1 Week	Elevated
Town of Sheridan	Likely	Limited	> 24 Hours	> 1 Week	Elevated
City of Westfield	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 droughts and drought-related impacts felt within Hamilton County, the Committee estimated that the probability of a drought occurring in the area is "Likely"; or probable within the next three years.

Damages, from "Limited" to "Critical" are anticipated throughout the county as many municipalities and residents rely on surface water for fire response efforts to face a higher risk during times of drought. Throughout the unincorporated county, increased crop and livestock damages would be expected as a result of a prolonged drought.

Drought: Assessing Vulnerability

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

Direct Effects:

- Densely 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 unincorporated 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 industries 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, thereby increasing the demand on purchasing produce and increased domestic water usage for landscaping
- Increased demand on emergency responders and firefighting resources

Development in many areas results in the change from agricultural land uses to other land uses such as residential, commercial, or industrial. This has been the case for communities in Hamilton County. For example, in the last several years, Westfield has rapidly expanded in nearly all directions, Noblesville had expanded to the east and the north, and Fishers has expanded to the east. This results in a net loss of agricultural land use, lowering the vulnerabilities of crop losses associated with a drought. Conversely, to meet the needs of the municipal developments, these municipalities have had to increase their services, such as providing water, which has caused them to realize an increase in the vulnerability in this regard.

Figure 3-22 Crops Affected by Drought

Estimating Potential Losses

It is difficult to estimate the potential losses associated with a drought for Hamilton County because of the nature and complexity of this hazard and the limited data on past occurrences. However, for 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 2018, Hamilton County produced approximately 8.0M bushels of corn and 4.1M bushels of soybeans, as reported by the United States Department of Agriculture (USDA) National Agricultural Statistics Service. Using national averages of $3.45 per bushel of corn and $9.55 per bushel of soybeans, the estimated crop receipts for 2018 would be $66.8M. 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 $33.4M-$57.5M, depending on the crop produced and the market demand. The effects of drought on corn crops can be seen in **Figure 3-22**.

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

According to a July 5, 2012 article in *The Times* (Noblesville, IN), "The effects of drought also could touch agricultural businesses, such as handlers and processors, equipment dealers, and seed, 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. Examples include the spread of Emerald Ash Borer insect and the weakening of tree limbs and trunks which may lead to increased damages during other hazard incidents such as wind and ice storms.

Future Considerations

Advancements in plant hybrids and crop management may help to ease the impacts of short-lived droughts. Seeds and plants may be more tolerant of dryer seasons, and therefore fewer crop losses may be experienced.

As the more urban areas of the county such as Carmel, Noblesville, and Westfield continue to grow in population and expand in size, protocols may need to be developed which create a consistency throughout the communities and the unincorporated portions of the county to issue burn bans and water usage advisories during times of drought.

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 5.7 inches for the area of Hamilton County. This increase in precipitation may lessen the likelihood or overall impact of a drought in Hamilton County. However, the Assessment also notes seasonal shifts in precipitation, which may lead to short-term seasonal droughts. In either scenario, changes in precipitation are not anticipated to relieve the area of a probability of a drought occurring. The report also discusses the potential for corn yields to decline by as much as 20% by 2050 due in part to drought stress and increased temperatures. Changes in agricultural practices such as in-field water management, soil health improvements, and cropping decisions may prevent some of those losses.

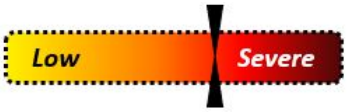
Many of the Hamilton County communities rely on groundwater wells for drinking water and similar local water supplies for fire-fighting efforts. Prior to these municipalities expanding, provisions and considerations should be given regarding the potential additional demand for both water usage and fire response efforts. Following such expansion or development plans, alternative water sources should be explored. Many of the communities are serviced by Indiana American Water Company, and such provisions may already exist as communities set to expand utility services such as water.

Drought: Relationship to Other Hazards

Drought will not be caused by any other hazard studied during this planning effort. 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 (northern reaches) 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.

3.3.8 Fire



Fire: Overview

A wildfire, also known as a forest fire, vegetation fire, or a bushfire, is an uncontrolled fire in wildland areas, most often caused by lightning; 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 thousands of acres. Generally, ambient weather conditions determine the nature and severity of a wildfire incident. Very low moisture and windy conditions can help to exacerbate combustion in forested or brush areas (**Figure 3-23**) and turn a small brush fire into a major regional fire incident in a very short period. Wildfires can be very devastating for residents and property owners.

Figure 3-23 Wildfire in Forested Area

A structural fire is an incident where a fire starts within a structure and is largely contained in 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 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 fire incident. Additionally, combating a wildfire or a structure fire may be extremely dangerous. If weather conditions change suddenly, the fire may change course and quickly overtake firefighters and other

responders, causing severe injuries or deaths. Fires can travel at speeds greater than 45 mph. Therefore, these hazard incidents 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 Hamilton County between January 1950 and December 2018. Within the same time parameter, there were only two reported incidents within the State of Indiana, both within Pike County and both within 2006. During each of these incidents over 350 acres were burned.

Figure 3-24 Roof damage to Carmel High School (Photo from Carmel Fire Department)

The NCDC does not report structural fires; therefore, local sources were utilized to provide historical information. *WTHR* provided information and updates following an accidental explosion at Carmel High School on December 26, 2018. Maintenance scheduled to occur while students were on break may have led to the second-floor mechanical room explosion and the after-effects (**Figure 3-24**). Two men, one Carmel Clay Schools employee and one maintenance contractor, were the only reported injuries. It is estimated that nearly 100 students were in the building when the explosion occurred.

In January 2013 a $35M Fishers apartment complex near East 131st and Cumberland Road was partially destroyed in an early morning fire. The building was not yet occupied, but some of the units were already leased. Several nearby residents called 911 to report the fire in the early morning hours. No firefighters were reported injured, but the structure was said to look like a block of ice after nearly 10 hours of fire suppression in frigid temperatures. **Figure 3-25** is a photo of the scene.

Figure 3-25 January 2013 Fishers Apartment Fire

Due to the expansive acreage of cropland and woods in the

northern areas of Hamilton County, and the potential for large urban areas to be at risk because of abandoned homes, blighted areas, or high-density residential areas, the Planning Committee determined the probability to be "Possible" or "Likely" throughout the County. **Table 3-18** identifies the CPRI rankings for a large fire in Hamilton County.

Table 3-18 CPRI for Fire

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Hamilton County	Likely	Limited	< 6 Hours	< 1 Day	Elevated
Town of Arcadia	Possible	Limited	< 6 Hours	< 1 Day	Elevated
Town of Atlanta	Possible	Limited	< 6 Hours	< 1 Day	Elevated
City of Carmel	Likely	Limited	< 6 Hours	< 1 Day	Elevated
Town of Cicero	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
City of Fishers	Possible	Limited	< 6 Hours	< 1 Day	Elevated
City of Noblesville	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Sheridan	Likely	Limited	< 6 Hours	< 1 Week	Elevated
City of Westfield	Possible	Limited	< 6 Hours	< 6 Hours	Elevated

Information provided by the City of Carmel, City of Noblesville, and City of Westfield Fire Departments in **Table 3-19** includes fire run statistics between 2016 and 2018. As can be inferred from 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. As many other municipalities face fires daily, it can be assumed these figures are relevant throughout Hamilton County.

Table 3-19 Hamilton County Example Annual Fire Run Statistics

	2016	2017	2018
Carmel	2,534	2,239	2,448
Noblesville	1,307	1,270	1,458
Westfield	875	1,081	1,156

Fire: Assessing Vulnerability

A fire typically affects a large regional area with potential for physical, economic, and/or social losses. In the more urban areas of Hamilton County, such as Carmel, structures are more densely located or have multiple stories increasing the risk of the spread of fire. Typically, however, 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 of "Limited" throughout the County and municipalities.

In addition to those areas, much of the northern reaches of Hamilton County is rural and agricultural in land use, which may be more susceptible to brush or crop fires, especially in times of drought. Furthermore, the forested areas in the riparian zones along waterways such as the White River may be at an increased risk for woodland fires. As development has occurred throughout Hamilton County since the las planning effort, vulnerabilities to this hazard have not shifted in location, merely shifted in the land use affected. For example,

as Westfield has expanded, the land use has changed from agricultural to residential or urban. This has not necessarily made this area more or less vulnerable to fire but changed the category from crop fire to residential fire.

Direct and indirect effects of a such an incident within Hamilton 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 the safety of roads
- Loss of income is dependent on crop production

Estimating Potential Losses

Given the nature and complexity of a potentially large hazard, such as a fire, 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 historical information as provided in Table 3-19. 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, the need to respond to large fires 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. These 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 hazards.

With an increase in temperatures associated with predicted climate change, areas may be more susceptible to fires in the urban, rural, or forest settings. The anticipated increase in precipitation may combat the vulnerability; however, there may be instances when the two weather instances are not aligned, and a period

of extreme heat is matched with a period of no rain, increasing the vulnerability of an ignition. During these periods, response agencies need to be on high alert.

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 of any ignitions from lightning.

3.3.9 Extreme Temperature

Extreme Temperatures: Overview

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

According to the NWS, "The Heat Index or the 'Apparent Temperature' is an accurate measure of how hot it really feels when the Relative Humidity is added to the actual air temperature." To find the Heat Index Temperature, refer to the Heat Index Chart in **Figure 3-26**. As an example, if the air temperature is 96°F and the relative humidity is 65%, the heat index – how hot it feels – is 121°F. The Weather Service will initiate alert procedures when the Heat Index is expected to exceed 105°-110°F for at least two consecutive days.

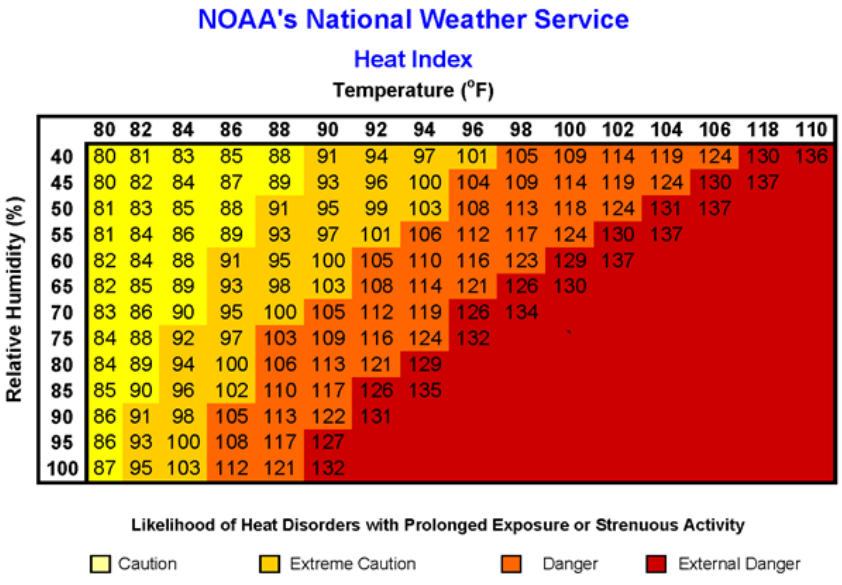


Figure 3-26 Heat Index Chart

It is important to also to note that these heat index values were

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

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

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

Extreme cold is defined as a temporary, yet sustained, the 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 adversely affect infrastructure function as well.

Wind chill is a guide to winter danger

New wind chill chart

Frostbite occurs in 15 minutes or less

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

Figure 3-27 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 3-27** 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 incident. According to the NCDC, there have been no reported occurrences of extreme heat or extreme cold between May 2011 and January 31, 2019. Local reports describe temperatures in late January 2019, where temperatures were expected to drop to between 20 and 40° below zero. During this time, the City of Noblesville opened The Lodge at Forest Park, and the Trustee's Office will serve as temporary warming shelters through a partnership with the Noblesville Township Trustee's Office.

It is difficult to predict the probability that an extreme temperature incident will affect Hamilton County residents within any given year. However, based on historic knowledge and information provided by the NFIP representatives, an extreme temperature incident is "Likely" (possible within the next three years) to occur, and if an incident did occur, it would result in impacts of a "Limited" magnitude. **Table 3-20** identifies the CPRI for extreme temperature incidents for all NFIP communities in Hamilton County.

Table 3-20 CPRI for Extreme Temperatures

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Hamilton County	Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of Arcadia	Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of Atlanta	Likely	Limited	> 24 Hours	> 1 Week	Elevated
City of Carmel	Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of Cicero	Likely	Limited	> 24 Hours	< 1 Week	Elevated
City of Fishers	Likely	Limited	> 24 Hours	< 1 Week	Elevated
City of Noblesville	Likely	Limited	> 24 Hours	< 1 Week	Elevated
Town of Sheridan	Likely	Limited	> 24 Hours	< 1 Week	Elevated
City of Westfield	Likely	Limited	> 24 Hours	< 1 Week	Elevated

As shown in the table, index values remain nearly identical throughout each NFIP community due to the regional extent and diffuse severity of this hazard incident. The anticipation of experiencing "Limited" severity impacts due to Extreme Temperature incidents is due to the ability of residents to prepare for such incidents with adequate warning.

Extreme Temperatures: Assessing Vulnerability

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

By assessing the demographics of Hamilton County, a better understanding of the relative risk that extreme temperatures may pose to certain populations can be gained. In total, nearly 11.9% of the County's population is over 65 years of age, more than 6.0% of the population is below the age of 5, and approximately 4% 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.

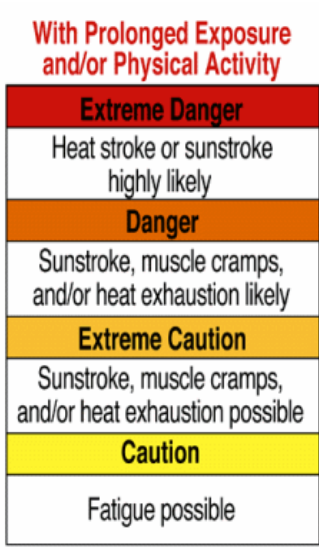


Figure 3-28 Danger Levels with Prolonged Heat Exposure

Extreme heat can affect the proper function of organ and brain systems by elevating core body temperatures above normal levels. Elevated core body temperatures, usually in excess of 104°F, are often exhibited as heat stroke. For weaker individuals, an overheated core body temperature places additional stress on the body, and without proper hydration, the normal mechanisms for dealing with heat, such as sweating to cool down, are ineffective. Examples of danger levels associated with prolonged heat exposure are identified in **Figure 3-28**.

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 Hamilton 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 difficult 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 Hamilton 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 the 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 results in increased heat over time, which may cause additional stress to labor-related populations.

Extreme Temperatures: Relationship to Other Hazards

While extreme temperatures may be extremely burdensome on the power supplies in Hamilton County, the Committee concluded that this type of hazard is not expected to cause any hazards studied, with the exception of a potential civil disturbance. 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.

3.3.10 Active Assailant

Active Assailant: Overview

Federal agencies, including the Federal Bureau of Investigations (FBI), the US DHS, FEMA, and others have agreed upon the definition of an Active Assailant: an individual actively engaged in killing or attempting to kill people in a confined and populated area." In many cases, specific victims are not targeted, simply a high-profile location, an area where numerous people have gathered, or a facility with which the assailant is familiar, but harbors ill feelings toward. Often, assailants may utilize firearms, but attacks have also been carried out using vehicle ramming, chemicals, and other weapons designed for mass casualties or mass fatalities.

Recent violent incidents in schools or the workplace have ranged from extreme acts of bullying to armed intruders resulting in multiple injuries, fatalities, and mass chaos. While all acts of school or workplace violence do not have the same cause, many factors leading up to the incident are similar. Some stressors in school-related attacks may include:

- Rejection from peers or family members
- Bouts of significant depression
- Mental illness
- Physical, mental, or sexual abuse
- Changes in policies regarding punishment and disciplinary actions

In addition, factors leading to a workplace attack may include:

- Prolonged work hours or occupations with a high risk of injury
- Little or no recognition of job performance
- Loss of employment
- Bouts of significant depression
- Mental illness
- Drug or alcohol abuse
- Poor social, interpersonal, or communication skills

Armed Assailant: Recent Occurrences

While several incidents of school or workplace violence have occurred throughout the United States, few incidents have occurred within Hamilton County. However, in 2018, a Noblesville West Middle School student brought a loaded gun to school and fired several rounds into a classroom injuring the teacher and a student.

One of the most notable incidents of school violence happened on April 20, 1999, in Littleton, Colorado at Columbine High School. Two heavily armed students opened fire and set off explosives resulting in the deaths of 25 students and teachers and injuries to several more. Several additional examples of school shootings can be referenced in the years since Columbine. In some cases, students and staff are injured, and in others, there are fatalities.

Workplace violence has also become more prevalent as numerous instances of disgruntled employees or former employees have sought revenge of some sort by targeting co-workers or employers. In February 2010, three University of Alabama Huntsville professors were shot and killed by a University colleague. More recently, in February 2019, five employees and five police officers were wounded by a gunman in Aurora, Illinois.

Table 3-21 CPRI for Active Assailant

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Hamilton County	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Arcadia	Possible	Limited	< 6 Hours	< 1 Day	Elevated
Town of Atlanta	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
City of Carmel	Possible	Limited	< 6 Hours	< 1 Day	Elevated
Town of Cicero	Possible	Limited	< 6 Hours	< 1 Day	Elevated
City of Fishers	Possible	Limited	< 6 Hours	< 1 Day	Elevated
City of Noblesville	Possible	Limited	< 6 Hours	< 1 Day	Elevated
Town of Sheridan	Possible	Limited	< 6 Hours	< 1 Day	Elevated
City of Westfield	Possible	Limited	< 6 Hours	< 1 Day	Elevated

As determined by the Planning Committee and shown in **Table 3-21**, the probability of an active assailant is "Possible" (within the next five years) throughout Hamilton County. This is due to the overall number of residents, employers, and schools within the municipalities and in the unincorporated areas of the county. As mentioned above, thus far, only one incident such as this has occurred within Hamilton County.

Active Assailant: Assessing Vulnerability

Schools and major employers within Hamilton County and the individual communities may be the most at risk as a target due to the number of students and/or personnel present at each facility. Direct and indirect effects of an incident of school or workplace violence may include:

Direct Effects:

- Students, staff, workers, or other populations experiencing injury or death
- Inability for those involved to return to school or work

Indirect Effects:

- Revenue or production loss for businesses involved in or near to the incident scene
- The expense of increased social needs following the incident

Estimating Potential Losses

This hazard is not typically as damaging to structures as it is to populations, so monetary damages associated with the direct effects of the violent acts are difficult to estimate. Indirect effects of such an incident include anxiety and stress related to experiencing the incident or having a family member involved in such an incident, the need for additional counselors to assist people affected by such a hazard, and the potential loss of revenue due to business shut down during or immediately following an incident. In addition to the business or facility directly involved, additional businesses nearby may need to be shut down or evacuated for the safety of their personnel.

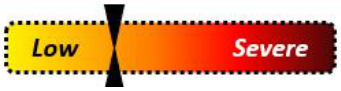
Future Considerations

In September of 2019, the Hamilton County emergency response agencies (Sheriff Departments, State Police, Emergency Medical Services, etc.) conducted a “live shooter” training at a bank facility in Fishers. This training allowed the responders to work through a field exercise while developing skills such as working as a unit and incident command when dealing with the often-overwhelming assistance offered during such incidents.

Active Assailant: Relationship to Other Hazards

An active assailant incident will not cause other hazards to occur. It is also not likely that other hazards will directly lead to an incident such as this.

3.3.11 Dam Failure



Dam Failure: Overview

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

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

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

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

Dam Failure: Recent Occurrences

Within Hamilton County, there are two DNR-regulated High Hazard dams, as shown in Exhibit 2. These are the Keystone Woods Lake Dam and Morse Reservoir Dam, which is shown in **Figure 3-29**. In addition to these dams, there are four Significant Hazard and five Low Hazard dams. There have been no recorded dam failures within Hamilton County.

Figure 3-29 Morse Reservoir Dam

Based on the information provided to them and their local knowledge, experience, and expertise, the Committee determined the probability of a dam failure is "Unlikely" in those areas where a dam exists, or in areas anticipated to be directly impacted by a dam breach. In areas of the county without a dam, or those not anticipated to be affected by a dam breach, the probability, according to the Planning Committee, was also determined to be "Unlikely." With similar regard, the magnitude ranges from "Critical" and "Significant" (areas within the potential inundation area) to "Negligible" (areas not anticipated to be within the inundation area) damages. For a dam failure that occurs on a sunny day, the warning time is anticipated to be less than six hours (those areas without a dam will have a much longer warning time); and the duration is anticipated to last less than one week. **Table 3-22** provides a summary of the Planning Committee's expectations during a dam failure.

Table 3-22 CPRI for Dam Failure

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Hamilton County	Unlikely	Significant	< 6 Hours	< 1 Week	Elevated
Town of Arcadia	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of Atlanta	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
City of Carmel	Unlikely	Critical	< 6 Hours	< 1 Day	Elevated
Town of Cicero	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
City of Fishers	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
City of Noblesville	Unlikely	Significant	< 6 Hours	< 1 Day	Elevated
Town of Sheridan	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
City of Westfield	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low

Dam Failure: Assessing Vulnerability

The actual magnitude and extent of damages due to a dam 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. Fortunately, since the last planning effort, new development downstream of the Morse Reservoir Dam has been restricted as the potential inundation area largely follows the delineated SFHA. In addition, structures downstream of the dam, inside or outside of the SFHA, must provide inundation mapping to show the new development is above the maximum elevation of the potential inundation mapping. This has lowered the risk and vulnerability to any new development since the last planning effort.

Within Hamilton 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

The Morse Reservoir Dam has an Incident and Emergency Action Plan (IEAP) with a detailed potential dam failure inundation area identified. An example of such a potential dam failure inundation map, created for the Morse Reservoir Dam is illustrated in **Figure 3-30**. Unfortunately, the Keystone Woods Lake Dam does not have an IEAP prepared.

Due to the conditions beyond the control of the dam owner or engineer, there may be unforeseen structural problems, natural forces, mistakes in operation, negligence, or vandalism that may cause a dam to fail.

Estimating Potential Losses

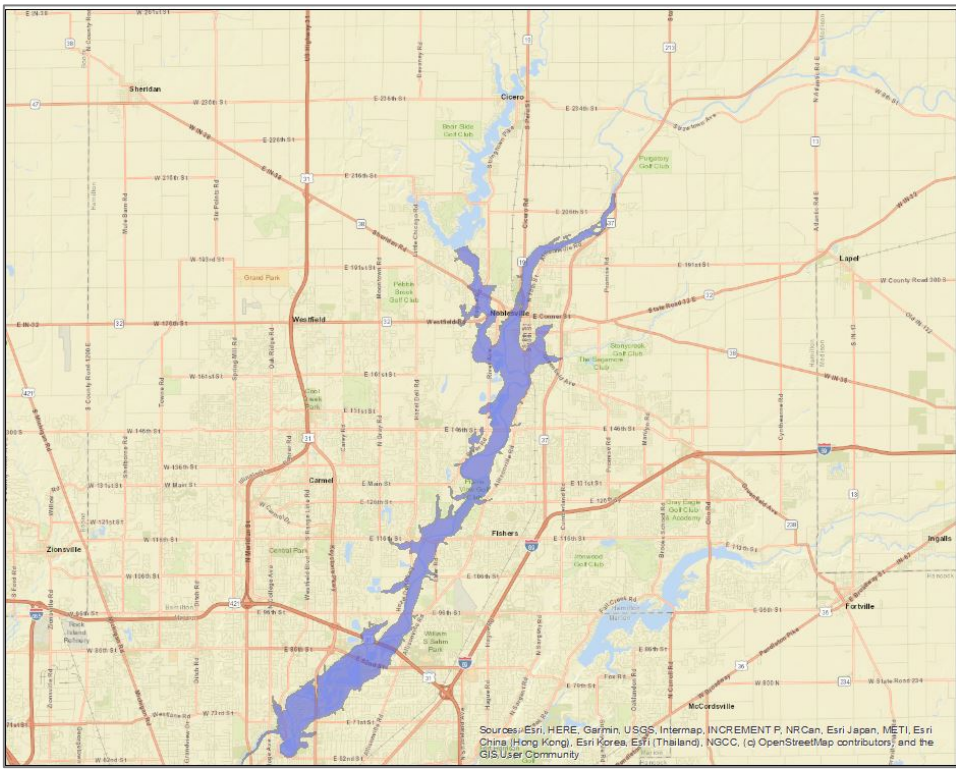


Figure 3-30 Potential Dam Failure Inundation Area, Morse Reservoir

To provide an example of anticipated damages, the potential dam failure inundation area map (created during the development of the IEAP) for the Morse Reservoir and was reviewed to estimate the number of critical and non-critical structures that may be affected by a dam failure. 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 estimated number of structures, and the estimated damages for each High Hazard dam with an IEAP prepared are outlined in

Table 3-23.

Table 3-23 Estimated Morse Reservoir Dam Failure Damages

NFIP COMMUNITY	ESTIMATED DAMAGES	
	#	$
Carmel	3,168	$443.3M
Fishers	111	$16.0M
Noblesville	6,338	$441.6M
Hamilton County	1,314	$63.0M

Future Considerations

As areas near existing dams continue to grow in population, it can be anticipated that the number of critical and non-critical structures will also increase accordingly. The 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 one of the high hazard dams in Hamilton 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.

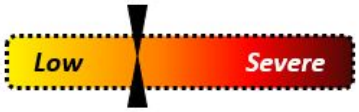
It is also very important to all downstream communities and property owners that dam IEAPs are developed, kept up-to-date, and routinely exercised to ensure the greatest safety to those within the hazard area.

Dam 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. 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.

Several other independent hazards may also lead to a dam. 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.

3.3.12 Landslide/Subsidence



Landslide/Subsidence: Overview

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

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

Landslide/Subsidence: Recent Occurrences

The potential for any of landslides or land subsidence within Hamilton County was discussed by the Planning Committee. To the knowledge of the Planning Committee, there are no Karst areas, antiquated underground mines, or many existing areas where a landslide could occur. To date, there has not been any landslides or subsidence incidents in Hamilton County.

The Committee determined the probability of a landslide or subsidence occurring in Hamilton County is "Unlikely" to "Possible," resulting in potentially "Negligible" to "Limited" damages. Currently, the Committee feels that the warning time is anticipated to be less than six hours and the duration is also expected to last less than six hours to less than one day. These incidents 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 incident. A summary is provided in **Table 3-24.**

Table 3-24 CPRI for Landslide/Subsidence

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Hamilton County	Possible	Limited	< 6 Hours	< 6 Hours	Elevated
Town of Arcadia	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Atlanta	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
City of Carmel	Possible	Negligible	< 6 Hours	< 6 Hours	Low
Town of Cicero	Possible	Limited	< 6 Hours	< 1 Day	Elevated
City of Fishers	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
City of Noblesville	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Sheridan	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
City of Westfield	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low

Landslide/Subsidence: Assessing Vulnerability

Without the presence of Karst geology or antiquated underground mines, Hamilton County is at low risk of land subsidence or sinkholes. Further, as there is rather subtle topographic relief within most of the county, the Planning Committee does not consider landslides to be of much concern.

The effects of a landslide or subsidence incident may be minimal to extensive in nature and may affect small or broad ranges of land area. Due to collaborative efforts between municipal planning and zoning departments and land mining companies, the risk or vulnerability to impacts from landslides or subsidence has not been increased to areas of new development since the last planning effort.

Within Hamilton 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

Figure 3-31 Home Swallowed by Land Subsidence

Estimating Potential Losses

Due to the unpredictability of this hazard all critical infrastructure and non-critical structures in Hamilton County are at risk of damage, including temporary or permanent loss of function. For landslide and subsidence, it is difficult to isolate specific critical infrastructure or non-critical structures that would be vulnerable to damages. However, areas, where karst geology or older underground mines have been identified, may be at a higher risk of property damages caused by such incidents (**Figure 3-31)**. To prepare a basic "what-if" scenario, the Indiana karst geology and older underground mines GIS layers were overlaid onto aerial photography and parcel data provided by the County. There are no such areas within Hamilton County.

Future Considerations

As the populations of the communities in Hamilton 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 landslide or land subsidence, soil GIS layers should be integrated into the building permit or approval process.

Indirect effects resulting from a landslide or land subsidence incident can include power outages caused by downed tree limbs, increased response times for emergency personnel if transportation routes are damaged, and the potential shutdown 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 incident, 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 snowmelt.

Similarly, these types of an incident 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 incident and resulting damages.

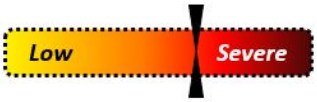
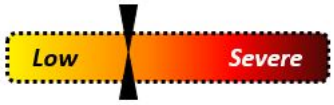
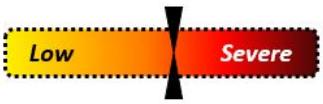
3.4 Hazard Summary

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

Table 3-25 summarizes the CPRI values for the various hazards studied within this MHMP.

- The hazards that ranked as "Low" included Dam Failure and Land Subsidence.
- "Elevated" risks included Active Assailant; Drought, Earthquake; Extreme Temperature; Fire; Flood; Hail, Thunder, and Windstorm; Hazardous Materials Incident.
- None of the hazards resulted in a "Severe" risk.

Table 3-25 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 Failure	
	Hazardous Materials Incident	
Human	Active Assailant	

It can be important to understand the cause and effect relationship between the hazards selected by the Committee. **Table 3-26** can be utilized to identify those relationships. For example, a winter storm (along the side of the table) can result in a flood (along the top of the table). In a similar fashion, a hazardous materials incident (along the top of the table) can be caused by an earthquake; flood; tornado; or a winter storm or ice storm (along the side of the table)

Table 3-26 Hazard Relationship Table.

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

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

Chapter 4 Mitigation Goals and Practices

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

4.1 Mitigation Goal

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

The Committee reviewed the mitigation goals as outlined within the 2011 Hamilton County MHMP and determined that each of these remain valid and effective. In summary, the overall goal of the Hamilton 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 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 earthquakes, wind, and floods. It found that mitigation efforts were cost-effective at reducing future losses; resulted in significant benefits to society and represented significant potential savings to federal treasury in terms of reduced hazard-related expenditures. This study found that every $1 spent on mitigation efforts resulted in an average of $4 savings for the community. The study also found that FEMA mitigation grants are cost-effective since they often lead to additional non-federally funded mitigation activities and have the greatest benefits in communities that have institutionalized hazard mitigation programs.

A more recent (2017) study by the National Institute of Building Sciences, reviewed over 20 years of federally funded mitigation grants, not only from FEMA but also from the US Economic Development Administration (EDA) and the US Department of Housing and Urban Development (HUD). From this broadened review, it has been determined that for every $1 spent on mitigation, $6 are saved on disaster costs. In addition, by designing and construction buildings that 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 Hamilton County. Mitigation measures that were included in the 2011 Hamilton County MHMP are noted as such.

Emergency Services

- Hamilton County has a first response HazMat Team
- The County has developed a centralized system for testing the existing outdoor warning sirens.
- The County, and nearly all communities utilize a mass notification system such as NIXLE/Everbridge or IPAWS for mass alerts for weather or hazardous incidents. *(2011 Measure)*
- Many communities utilize Community Emergency Response Teams (CERTs) or similar programs such as a COAD
- Stream gages are utilized for flood forecasting and flood warnings for various stream levels.
- Noblesville and Fishers water rescue teams have been established within the County, and several additional partnerships exist with other agencies for assistance as necessary
- Many communities have developed snow removal routes to keep primary streets clean during and after snowstorms.
- Several mobile message boards are available within the county to be deployed as needed.

Natural Resource Protection

- Hamilton County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, and Westfield are in good standing with the NFIP Program and have flood protection ordinances that meet or exceed the minimum requirements.
- Groups such as the Hamilton County Surveyor's Office and several municipal Engineering and Stormwater Departments are actively studying areas that routinely flood and implementing recommendations and projects proposed by those studies. *(2011 Measure)*
- Current facility maps and response plans are on file for all Tier II HazMat facilities
- Brownfield redevelopment planning is ongoing in Arcadia, Atlanta, and Sheridan, with additional sites added as determined.

Prevention

- Information related to hazard mitigation has been incorporated, where appropriate, into individual Comprehensive Land Use Plans and other long-range plans.
    - Noblesville Comprehensive Plan - 2016: includes goals and objectives to reduce flood risks, protect the floodway and floodplain through the continued use of the Flood Hazard District, and preserve much of the floodway and floodplain as open space.
    - Similar ideals and planning objectives are included in the Carmel Clay Comprehensive Plan and the Westfield 2007 Comprehensive Plan
- Hamilton County and the other communities have developed a consortium of municipal GIS databases that are used independently and collectively in land use planning decisions and can be utilized in HAZUS-MH "what-if" scenarios. *(2011 Measure)*
- The Hamilton County LEPC provides routine training regarding the proper storage, transport, and disposal of hazardous materials.
- Electric providers routinely complete preventative maintenance on trees within the ROW and utility corridor.
- Local developers routinely bury new and retrofitted utilities to minimize exposure to hazards.
- Hamilton County has developed a Flood Fight Plan, which includes protocols to provide sandbags to county residents and materials to municipalities to provide to their residents.

Property Protection

- Hamilton County and the municipalities follow the International Building Code, which includes requirements to minimize damages from natural hazards.

Public Information

- Outreach materials are routinely provided within office and agencies throughout Hamilton County, large public incidents, speaking opportunities within schools, etc. *(2011 Measure)*

Structural Control

- Stormwater conveyances and regulated drains are maintained on a routine basis to prevent localized flooding, increased erosion, and material deposition as a result of rainfall or snowmelt. *(2011 Measure)*
- Hamilton County, Carmel, Cicero, Fishers, Noblesville, and Westfield are regulated through IDEM's MS4 program and as such, implement programs to reduce pollutants entering streams and waterbodies. *(2011 Measure)*
- High hazard dams within the county are routinely inspected as required by IDNR *(2011 Measure)*
- Marathon Pipeline has internal structural controls and protocols included in a Seismic Response Plan whereby pipelines are shutdown within proximity to an identified epicenter, and all facilities and assets are inspected.

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 4-1 lists a summary of all proposed mitigation practices identified for all hazards, as well as information on the local status, local priority, benefit-cost ratio, project location, responsible entities, and potential funding sources, associated with each proposed practice. The proposed mitigation practices are listed in order of importance to Hamilton 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 the availability of funding, some proposed mitigation projects may take longer to implement.

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

The update of this MHMP is a necessary step of a multi-step process to implement programs, policies, and projects to mitigate the effect of hazards in Hamilton County. The intent of this planning effort was to identify the hazards and the extent to which they affect Hamilton 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, PDM, and FMA. Although this MHMP meets the requirements of DMA 2000 and eligibility requirements of these grant programs, additional detailed studies may need to be completed prior to applying for these grants. **Section 5.0** of this plan includes an implementation plan for all high priority mitigation practices identified by the Committee.

The CRS program credits NFIP communities a maximum of 97 points for setting goals to reduce the impact of flo own natural hazards, identifying mitigation projects that include activities for prevention, pr natural resource protection, emergency services, structural control projects, and public in

Table 4-1 Proposed Mitigation Practices

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Public Education & Outreach 1. Provide multi-lingual hazard preparedness literature (warning sirens, radio stations, go-kits, insurance protection, lightning rods, etc.) during Severe Weather Awareness Week, at public facilities and incidents and to populations within known hazard areas such as floodplains, downstream of a dam, near hazmat facilities, etc. *(2011 Measure)*	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☒ Drought ☒ Earthquake ☒ Extreme Temperature ☒ Fire ☒ Flood ☒ Hail/Thunder/Wind ☒ Landslide/Subsidence ☒ Tornado ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident ☒ Active Assailant	**Ongoing –** 1. Literature is provided at several public facilities and office locations as well as large public incidents throughout the county. Populations within the special flood hazard areas are educated through required flood insurance purchases and various websites and literature pieces. **Proposed Enhancement –** 1. Encourage enhancement of messages provided to various cultural groups and neighborhoods; Educate landowners within dam inundation areas and near hazardous materials facilities of potential dangers and what to do in an emergency. Include information such as encourage the voluntary purchase of flood insurance; formalize neighborhood campaigns where representatives familiar with culture and language provide residents with emergency information and protocols.	High	High	EMA Red Cross City/Town Offices *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield* Incident Liaisons	Existing Budget Grant

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 COAD program *(2011 Measure)* 2. Evaluate and utilize flood forecasting capabilities including stream gages, flood forecast maps, and flood alerts along the White River 3. Improve outdoor warning siren coverage to alert populations of severe weather conditions *(2011 Measure)* 4. Investigate and propose an ordinance to require developers to pay to install additional sirens for new developments or pay into siren fund as part of new developments *(2011 Measure)* 5. Increase awareness and participation in the various mass notification system and various social media outlets *(2011 Measure)* 6. Coordinate with private business owners utilizing large dynamic message boards for businesses to provide messages during hazardous incidents and recovery efforts.	☒ 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 Failure ☒ HazMat Incident ☒ Active Assailant	**Ongoing –** 1. Approximately 200 residents trained 2. Eleven stream gages (1 AHPS enabled) are located within Hamilton County 3. Sirens provide coverage for most populated areas 5. Communities use Reverse 911, IPAWS, and numerous social media outlets 6. Numerous large dynamic message boards exist throughout the county **Proposed Enhancements –** 1. Increase participation in COAD program 2. Increase number of stream gages, or additional gages AHPS enabled, are needed to better serve the county 3. Additional sirens in unincorporated areas, Arcadia, Atlanta, White River Township, Sheridan area 4. Propose and adopt an ordinance 5. Enroll additional participants in existing systems, encourage communities to develop systems if not covered, and use social media to develop redundancies in warning efforts 6. Develop partnerships with message board owners and coordinate messages for use during hazard incidents	High *(COAD, stream gages, warning sirens, siren fund)* Moderate *(mass notification, message boards)*	High	EMA COAD/CERT Red Cross Floodplain Administrators *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield* Business Owners USGS	Existing Budgets Grants

Emergency Response & Recovery 1. Prepare a detailed Flood Response Plan to improve response and reduce losses from a flood incident *(2011 Measure)* 2. Inventory needs for mobile data terminals and/or upgrades in response vehicles and purchase and install as feasible 3. Create a database of at-risk populations and establish procedures to evacuate the populations in known hazard areas (flood, dam, hazmat) 4. Coordinate communications, documentation, and record keeping between NFIP communities and agencies including a database of accurate and community specific information following each hazard incidents 5. Investigate most efficient and protected method to back up county and municipal records 6. Investigate reciprocal agreements between neighboring communities/counties for structural inspections following hazardous incidents 7. Purchase additional snow removal equipment and pre-treatment equipment and supplies 8. Implement an immunization program for at-risk staff such as emergency responders, building inspection staff, and include families	☒ 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 Failure ☒ HazMat Incident ☒ Active Assailant	**Ongoing –** 1. Some communities have basic plans or protocols 2. Many vehicles are equipped with terminals 4. Information is provided in varying degrees 5. Back up of records does occur following various protocols 6. Many communities have Mutual Aid for medical, fire, and police response efforts 7. Each community has snow-fighting protocols **Proposed Enhancement –** 1. Prepare community specific detailed plans for flood response efforts 2. Inventory and prioritize remaining hardware or software needs and install where necessary 3. Develop protocols for listing and maintaining database 4. Create a more consistent reporting and documentation effort 5. Establish location of remote back up storage in accordance with COG/COOP outline 6. Investigate ability to enter into similar agreements for activities related to structural inspections or other activities following hazard incidents 7. Inventory and prioritize additional snow-fight equipment and purchase as funding becomes available 8. Review level of services currently provided and determine where additions need to be made	High *(Flood plans, data terminals, at-risk population database, recordkeeping, records back up, sandbagging/snow equipment)* Moderate *(reciprocal agreements, snow fight equipment)*	High	EMA Sheriff Department Police Departments *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield* Fire Departments *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield* Highway Department Street Departments *Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield* IT Departments *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield* Building Departments *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield* Health Department	Existing Budget Grant

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Management of High Hazard Dams 1. Review regular inspection reports and maintenance records of high hazard dams and encourage owners to make necessary repairs 2. Encourage Keystone Woods Lake Dam owners to develop an IEAP and associated inundation mapping. 3. Prohibit development downstream of dams	☒ 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 Failure ☐ HazMat Incident ☐ Active Assailant	**Ongoing –** 1. IDNR receives inspection reports 2. Morse Reservoir, the other high hazard dam in Hamilton County, has an IEAP 3. County ordinance prohibits development downstream of dams **Proposed Enhancements –** 1. Ensure inspections are completed and required improvements and repairs are completed in a timely manner 2. Encourage and assist Keystone Woods Lake Dam owners in completing an IEAP 3. Propose and adopt similar ordinances in all other communities	High *(inspections, IEAP)* Low *(prohibit development)*	High	Dam Owners *Keystone Woods Lake Dam* EMA IDNR Planning Departments *Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield*	Existing Budget
Building Protection 1. Protect existing critical facilities in floodplains noted in Table 3-9 *(2011 Measure)* 2. Institute a buy-out or floodproofing program for routinely flooded structures *(2011 Measure)* 3. Install additional dry hydrants throughout the county 4. Purchase additional fire equipment for first responders and prioritize staffing needs *(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 Failure ☒ HazMat Incident ☐ Active Assailant	**Ongoing –** 1. Studies have been completed to determine protection needs for some facilities in Noblesville 2. Noblesville has previously purchased and removed structures from the floodplain 3. Some hydrants exist in the unincorporated areas **Proposed Enhancements –** 1. Complete studies for all other communities and facilities 2. Continue to purchase and remove structures from the floodplain (60 additional identified in Noblesville, focus on Riverwood and Claire areas) 3. Install additional dry hydrants in prioritized areas 4. Prioritize equipment and staffing needs for each station to best serve the county	High *(protect existing facilities in floodplains, buyout program, dry hydrants)* Moderate *(fire equipment)*	Moderate	Building Departments *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield* EMA Facility Owners Fire Department liaisons *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield*	Grant Existing Budget

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Community Rating System 1. Reduce flood insurance premiums through increased participation or advancement in the NFIP's CRS Program. *(2011 Measure)* *(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 Failure ☐ HazMat Incident ☐ Active Assailant	**Ongoing –** 1. Hamilton County and Noblesville currently participate in the CRS program **Proposed Enhancement –** 1. Participation from additional NFIP communities within the county focusing on Carmel, Fishers and Westfield	High	Moderate	Floodplain Administrators *County, Carmel, Fishers, Noblesville, Westfield*	Existing Budget
Flood Studies 1. Conduct detailed flood protection studies for problem areas and/or areas with repetitive flooding problems *(2011 Measure)* 2. Prioritize areas and support flood depth mapping (RiskMAP) to better show the flood risk potential *(2011 Measure)* 3. Prioritize and conduct watershed studies or stormwater master plans *(2011 Measure)* *(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 Failure ☐ HazMat Incident ☐ Active Assailant	**Ongoing –** 1. Studies have been completed for various areas throughout the county 3. Various studies have been completed **Proposed Enhancements –** 1. Evaluate local areas with repetitive flooding and prepare county prioritized listing for additional studies 2. Support flood depth mapping for prioritized areas when selection occurs 3. Continue to implement recommendations from studies as funding and resources allow	High	Moderate	County Surveyor Engineering Departments *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield* Floodplain Administrators *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield*	Existing Budget Grant

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Geographic Information Systems 1. Enhance county-wide GIS to incorporate data on a consistent platform *(2011 Measure)* 2. 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 *(2011 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 Failure ☒ HazMat Incident ☒ Active Assailant	**Ongoing –** 1. A GIS consortium has been developed **Proposed Enhancement –** 1. Coordinate consistent layers and attributes county-wide 2. Additional training for GIS staff	High	Moderate	GIS Contacts *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield*	Existing Budget
Land Use Planning & Zoning 1. Incorporate hazard information, risk assessment, and hazard mitigation practices into the Comprehensive Land Use Plan and Development Review 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 Failure ☒ HazMat Incident ☐ Active Assailant	**Ongoing –** 1. Hazard information has been incorporated into some areas of municipal Comprehensive Land Use Plans **Proposed Enhancement –** 1. Increase the number of hazards considered, more definitively outline higher risk areas and those that should be avoided for future development	High	Moderate	Planning / Building Departments *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield*	Existing Budget
Transportation 1. Review/revise transportation survey to determine typical types and quantities of chemicals being transported throughout Hamilton 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 Failure ☒ HazMat Incident ☐ Active Assailant	**Ongoing –** 1. The initial study completed several years ago **Proposed Enhancement –** 1. Complete updated commodity flow study for Hamilton County focusing on US Routes, State Routes, 146th Street, Michigan Road, and Olio Road	High	Moderate	Rail Owners INDOT Highway Department LEPC	Existing Budget Grant

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Floodplain Management 1. Prohibit development of new critical infrastructure in floodplains *(2011 Measure)* 2. Allow Floodplain Administrators and other related staff to prepare for and obtain the Certified Floodplain Manager (CFM) certification *(2011 Measure)* *(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 Failure ☐ HazMat Incident ☐ Active Assailant	**Ongoing –** 1. Some municipalities have incorporated this into codified ordinances 2. CFMs are employed in the County, Carmel, Fishers, and Noblesville **Proposed Enhancements –** 1. Ensure all municipalities have this language in their Floodplain Ordinances 2. Encourage staff in other NFIPs to become CFMs	High *(prohibit development)* Moderate *(CFMs)*	Moderate	County Surveyor Floodplain Administrators *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield*	Existing Budget Grant
Hazardous Materials Response 1. Inventory equipment and training needs to increase number of certified emergency response personnel for each Department 2. Inventory needs of each department, prioritize, and procure additional equipment as funding is available 3. Complete ALOHA analysis and develop evacuation routes for all Tier II facilities *(2011 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 Failure ☒ HazMat Incident ☐ Active Assailant	**Ongoing –** 1. Noblesville Fire Department has a HazMat Response Team 3. ALOHA analysis completed for Noblesville Tier II facilities **Proposed Enhancement –** 1. Determine the need for an increased number of Technician Level at each Department 2. Develop a list of prioritized needs and purchase as funding becomes available 3. Complete ALOHA analysis for the remainder of Tier II facilities	High *(personnel, training)* Moderate *(ALOHA)*	Moderate	LEPC EMA Fire Department liaisons *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield* Tier II Facility Owners	Existing Budget Grant

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
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 *(2011 Measure)* 2. Clearly advertise the location of safe rooms and community shelters for large gatherings of people *(2011 Measure)* 3. Construct an animal relevant evacuation plan and pet-friendly shelter 4. Investigate and provide possible incentives for (private) buildings with approved safe rooms *(2011 Measure)* 5. Harden public facilities to serve as effective shelters 6. Establish safer areas in recreational and mobile home parks	☒ 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 Failure ☒ HazMat Incident ☐ Active Assailant	**Ongoing –** 1. Shelters locations are spaced throughout the county as available and as needed (24 locations) **Proposed Enhancement –** 1. Continue to evaluate shelter locations and needs 2. Develop education materials for large gatherings 3. Investigate and consider possible incentives to increase the number of approved safe rooms 4. Investigate options and determine best for county 5. Inventory public facilities, determine needs, and harden as prioritized, potentially beginning with the Hamilton County Fairgrounds 6. Establish a safer area or protocols for each recreational or mobile home park	High *(shelter agreements advertise for large gatherings, animal plan)* Moderate *(incentives, harden facilities, shelters in mobile home parks)*	Low	EMA Large Gathering Liaisons COAD, CERT Red Cross Building Departments *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield*	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 *(2011 Measure)* 2. Secure a fuel reserve, or ensure contractual emergency provisions so critical infrastructure may run on power backup for extended periods of time 3. Designate a fuel reserve transportation route through each community 4. Investigate the potential to utilize wind or solar generators 5. Install battery back-ups for integral intersections within municipalities *(2011 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 Failure ☒ HazMat Incident ☐ Active Assailant	**Ongoing –** 1. Many critical facilities have generators or have added since the last plan 2. Some communities have verbal agreements for fuel supplies **Proposed Enhancements –** 1. Re-inventory generator capabilities and needs and prioritize within each community to determine needs for future purchases 2. Secure a fuel reserve via a contract service agreement 3. Designate and map a fuel reserve transportation route through each community 4. Review the possibility for solar field near County Law Enforcement Complex 5. Purchase and install battery back-ups in prioritized intersections	High *(inventory, fuel reserve)* Moderate *(fuel route)* Low *(wind or solar, battery back-ups)*	Low	EMA Community Contacts *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield* Facility Owners	Existing Budget Grant

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Water Conservation 1. Propose and adopt a water conservation ordinance and contingency plans to implement during water shortages 2. Establish standard procedures for issuing an open burn ban during periods of dry weather	☒ 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 Failure ☐ HazMat Incident ☐ Active Assailant	**Ongoing –** . **Proposed Enhancement –** 1. Review existing ordinances, and if needed, propose water conservation ordinance 2. Establish procedures for further restrictions to include fireworks, campfires, and recreational fires	Moderate	Low	EMA Planning Departments *County, Arcadia, Atlanta, Carmel, Cicero, Fishers, Noblesville, Sheridan, Westfield*	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 the implementation of each of these proposed practices may involve several preparatory or intermediary steps. However, to maintain clarity, not all preparatory or intermediary steps are included.

5.1 Building Protection

Protect existing critical facilities in floodplains noted in Table 3-9

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

Institute a buyout or floodproofing program for routinely flooded structures

- Identify areas routinely flooded and the structures within them
- Prioritize areas and structures according to those most at risk
- Seek grant funding or other funding source to implement a buyout program for interested property owners

Install dry hydrants throughout the county

- Inventory existing dry hydrants throughout the county and develop GIS layer usable by first responders and the GIS consortium
- Prioritize areas not covered by municipal hydrant services or by existing dry hydrants
- Develop partnerships with landowners in prioritized areas and install dry hydrants as agreements are established and funding is secured

5.2 Community Rating System

Reduce flood insurance premiums through increased participation or advancement in the NFIP's CRS Program

- Review guidance materials and gather supporting documentation
- Calculate credits and contact ISO representative
- Submit materials for entry (Carmel, Fishers, Westfield) or advancement (County, Noblesville) within the CRS program
- Maintain and record information as necessary for annual recertification

5.3 Emergency Preparedness & Warning

Improve disaster preparedness and emergency response at the local level through the CERT or COAD program

- Develop annual training programs for existing volunteers
- Review geographic locations of existing volunteers and prioritize neighborhoods, regions, or large employers for recruitment based on areas not yet covered
- Provide announcement and press release to partner agencies to increase the reach of the information
- Develop and implement a training program for new volunteers

Evaluate and utilize flood forecasting capabilities including stream gages, flood forecast maps, and flood alerts along the White River

- Review existing capabilities and determine areas of need for increased warning time
- Prioritize areas and determine options for increased forecasting abilities
- Develop partnerships, secure funding and implement recommendations
- Provide updated information to appropriate response agencies

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

- Review existing outdoor warning siren coverage
- Determine areas in need of primary or additional coverage (Arcadia, Atlanta, White River Township, and Sheridan areas)
- Investigate potential funding sources and determine the local level of interest
- Install additional outdoor warning sirens as feasible

Investigate and propose an ordinance to require developers to pay to install additional sirens for new developments or pay into a siren fund as part of a new development

- Research and review existing “siren ordinances.”
- Determine language appropriate for Hamilton County and municipalities and develop Hamilton County Siren Ordinance
- Propose ordinance for adoption throughout Hamilton County municipalities
- Implement an education component for local developers once ordinance has been adopted

5.4 Emergency Response and Recovery

Prepare detailed Flood Response Plans for all communities to improve response and reduce losses from a flood incident.

- Work with municipal Floodplain Administrators to prioritize municipalities most at risk for flood damages
- Review existing plans or protocols within each community and surrounding area
- Secure funding needed and develop municipal specific Flood Response Plan

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

- Work with municipal liaisons to inventory existing terminals, software, and accessories throughout all response agencies (fire, police/sheriff, EMS)
- Determine needs to adequately cover each community and to allow cross-communication between the agency and between community
- Prioritize purchases, upgrades, or training and implement them as feasible.

Create a database of at-risk populations and establish procedures to evacuate the populations in known hazard areas (SFHA, potential dam failure inundation areas, hazmat facility buffers)

- Develop protocols for database management such as access, updates, and the information requested
- Determine which at-risk populations are located in hazard areas such as SFHA, potential dam failure inundation areas, and within hazmat facility buffers
- Develop evacuation procedures based on the type of hazard incident and needs of populations involved
- Coordinate with facility liaisons to review procedures annually

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

- Review current protocols for post-incident communications
- Utilize existing IDHS software or develop a county-wide database
- Review the database with each municipality to review what information should be collected and reported in a consistent manner

Investigate the most efficient and protected method to back up county and municipal records

- Review current protocols and procedures for the county and municipal backup of records
- Research options for additional securities, redundant systems, or enhanced protections
- Begin enhanced backup and protection of municipal records

5.5 Flood Studies

Conduct detailed flood protection studies for problem areas and/or areas with repetitive flooding

- Review the listing of flood-prone or problem areas and prioritize based on previous damages, at-risk populations, or potential for damage to critical infrastructure
- Secure funding, municipal bond, or funds from existing budgets to complete floodplain studies
- Update the Floodplain Prioritization Study to direct future analyses

Prioritize areas and support FEMA-approved flood depth mapping to better show the flood risk potential

- Review areas in process of RiskMAP development
- Support mapping efforts by providing information on local studies and efforts to reduce flooding and associated damages
- Utilize flood depth mapping in land-use decisions

Prioritize and conduct watershed studies or stormwater master plans

- Work with municipalities and the unincorporated county to develop a listing of areas not studied
- Develop a prioritized listing of watersheds in need of additional studies
- Perform studies as funding becomes available
- Implement recommendations and strategies within completed studies to reduce flood risk

5.6 Floodplain Management

Prohibit development of new critical infrastructure in floodplains

- Review ordinances of each municipality to determine allowable development in floodplains
- Research language of existing ordinances which prohibit development in at-risk areas

- Propose and adopt language to prohibit the development of new critical infrastructure within the floodplain

5.7 Geographic Information Systems

Enhance countywide GIS to incorporate data on a consistent platform

- Review current GIS layers and attribute information
- Include additional data as obtained relative to each critical infrastructure
- Update and maintain one critical infrastructure layer for the entire county, and develop a protocol for updating critical infrastructure information
- Coordinate access to layers for each community within the county through the GIS consortium

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 appropriate staff from each municipality to be trained in HAZUS-MH
- Utilize HAZUS-MH to determine potential damages in various scenarios
- Utilize scenarios and findings in land use planning decisions

5.8 Hazardous Materials Response Team

Inventory equipment and training needs to increase the number of certified emergency response personnel available for responding to hazmat incidents

- Inventory personnel of each fire department and determine the number of staff at each certification level
- Determine the ideal number of personnel to adequately cover the county and municipalities
- Prioritize personnel or stations targeted to received additional training dependent on budgets

Inventory needs of each department, prioritize, and procure additional equipment as funding is available

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

5.9 Land Use Planning and Zoning

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

- Review the list of hazards and determine which are applicable to individual communities
- Draft language and prepare exhibits to incorporate into the appropriate sections of the Hamilton County Comprehensive Land Use Plan, individual municipalities' plans, neighborhood redevelopment plans, etc.
- Adopt amendments as appropriate

5.10 Management of High Hazard Dams

Review regular inspection reports and maintenance records of high hazard dams

- Coordinate with high hazard dam owners and IDNR to receive copies of regular inspection reports and maintenance records
- Continue coordination and collaboration to ensure inspections are completed, the dam and surrounding area is maintained, and risks are assessed accordingly

Encourage Keystone Woods Lake Dam owners to develop an IEAP

- Meet with dam owners to review example IEAPs and inundation mapping to better understand the IEAP products and information
- Collaborate to develop an IEAP for the dams
- Prepare an exercise to provide training to appropriate planning and response agencies within the area.
- Partner with the dam owners and IDNR to provide outreach materials to property owners within the inundation area

5.11 Power Backup Generators

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

- Utilize listing of critical infrastructure and coordinate with facility owners or operators to determine the presence or absence of generator, fuel capacity, and fuel reserve

- Determine if additional needs are required to ensure compatibility with a generator (wiring) and encourage installation or procurement of necessary equipment
- Encourage private facility owners to install the necessary equipment
- Secure or allocate funding for upgrades to public facilities as feasible

Secure a fuel reserve or ensure contractual emergency provisions to ensure that critical infrastructure may run on power backup for extended periods of time.

- Determine where county and municipal vehicles (and generators) routinely receive fuel
- Review contract language to ensure municipal and critical facilities have the ability to receive fuel prior to other clients
- If necessary, add such language to contracts

5.12 Public Education and Outreach

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

- Review existing materials provided by federal, state, and local programs
- Determine if materials need to be revised, additional hazards need to be covered, or if distribution methods need to be revised
- Develop or provide additional materials targeting at risk populations or areas based on hazards

5.13 Safer Rooms and Community Shelters

Develop temporary and/or long-term shelter agreements within the county. Potential for tiered levels of accessible shelters or domestic animal shelters, especially in smaller communities

- Review locations and capabilities of existing shelters within the county
- Determine if adequate coverage is provided in populated areas or in centralized areas of the unincorporated areas within the county
- Determine if alternative shelters are available (those which may not be Red Cross certified but may be suitable for short term shelter at the agreement of the client)
- Determine need for sheltering of domestic animals; develop appropriate plans and shelter agreements

Clearly advertise the location of safe rooms and community shelters for large gatherings of people

- Partner with incident representatives to assess methods possible to advertise safe locations in case of emergencies
- Incorporate advertisement of safe locations into early planning and coordination steps of events such as sporting events, community festivals, and large outdoor events

Construct an animal relevant evacuation plan and pet-friendly shelter

- Review any existing animal relevant plans developed through partnering agencies
- Research animal plans in other areas of Indiana
- Develop an animal plan for each municipality for small events as well as a larger Hamilton County plan in the event of a larger hazard incident

5.14 Transportation

Review/revise transportation survey to determine typical types and quantities of chemicals transported through Hamilton County

- Review existing commodity studies to determine where updates or revisions are needed
- Work with INDOT to determine parameters for new commodity study
- Focus on heavier traffic areas such as US Routes, State Routes, 146th Street, Michigan Road, and Olio Road

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 Hamilton 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 programs, projects, and policies from multiple departments within each NFIP community. Depending on grant opportunities and fiscal resources, mitigation practices may be implemented independently, by individual NFIP communities, or through local partnerships. Therefore, the successful implementation of this MHMP will require the participation and cooperation of the entire Committee to successfully monitor, evaluate, and update the Hamilton 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 10** 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 infrastructures, 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 2023, 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 Hamilton 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 Hamilton 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 for 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. As active participants in this effort and because of this effort, all community representatives are encouraged to include information from this update in various community plans.

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 Hamilton 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 on the Hamilton County website.

Updates or modifications to the Hamilton 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 28 points for adopting the Plan; establishing a [illegible]ementing, reviewing, and updating the Plan; and submitting an annual evaluation report.

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