



**MULTI-HAZARD
MITIGATION PLAN UPDATE**

Elkhart County, Indiana

Prepared for:

**Elkhart County, Indiana
Town of Bristol, Indiana
City of Elkhart, Indiana
City of Goshen, Indiana
Town of Middlebury, Indiana
Town of Nappanee, Indiana
Town of Wakarusa, Indiana**

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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 Elkhart County Multi-Hazard Mitigation Plan (MHMP) focuses on the mitigation phase of the disaster life cycle. According to FEMA, mitigation is most effective when it's based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs. The MHMP planning process identifies hazards, the extent that they affect the municipality, and formulates mitigation practices to ultimately reduce the social, physical, and economic impact of the hazards.

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 in order to apply for and/or receive project grants under the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), and Severe Repetitive Loss (SRL). FEMA may require a MHMP under the Repetitive Flood Claims (RFC) program. Although the Elkhart County MHMP meets the requirements of DMA 2000 and eligibility requirements of these grant programs, additional detailed studies may need to be completed prior to applying for these grants.

In order for National Flood Insurance Program (NFIP) communities to be eligible for future mitigation funds, they must adopt either their own MHMP or participate in the development of a multi-jurisdictional MHMP. The Indiana Department of Homeland Security (IDHS) and the United States Department of Homeland Security (US DHS)/FEMA Region V offices administer the MHMP program in Indiana. As noted above, it is required that local jurisdictions review, revise, and resubmit the MHMP every 5 years. MHMP updates must demonstrate that progress has been made in the last 5 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 Elkhart County MHMP Update is a multi-jurisdictional planning effort led by the Elkhart County Emergency Management Agency (EMA). This Plan was prepared in partnership with Elkhart County, the Town of Bristol, the City of Elkhart, the City of Goshen, the Town of Middlebury, the Town of Nappanee, and the Town of Wakarusa. 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 Elkhart County MHMP satisfies the requirements of DMA 2000 in which multi-jurisdictional plans may be accepted.



Throughout this Plan, activities that could count toward Community Rating System (CRS) points are identified with the NFIP/CRS logo. The CRS is a voluntary incentive program that recognizes and encourages community floodplain activities that exceed the minimum NFIP requirements. As a result, flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions that meet the 3 goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote education and awareness of flood insurance. Savings in flood insurance premiums are proportional to the points assigned to various activities. A minimum of 500 points are necessary to enter the CRS program and receive a 5% flood insurance premium discount. This MHMP could contribute as many as 294 points toward participation in the CRS. At the time of this planning effort, none of the Elkhart County communities participate in the CRS program.

Funding to update the MHMP was made available through a FEMA/DHS PDM grant awarded to the Elkhart County EMA and administered by IDHS. Elkhart 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 Elkhart 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 Elkhart County MHMP Update began in 2013 when the County EMA submitted a PDM Grant application to IDHS. The grant request was approved by FEMA and grant funds were awarded in 2015.

Once the grant was awarded, the planning process to update the 2007 MHMP took 16 months. This included a 12-month planning process, followed by a review period by IDHS and FEMA for the draft MHMP Update, and another month for Elkhart County, the Town of Bristol, the City of Elkhart, the City of Goshen, the Town of Middlebury, the Town of Nappanee, and the Town of Wakarusa to adopt the final MHMP Update.

1.3.1 Planning Committee and Project Team

In January of 2015, the EMA compiled a list of Planning Committee members to guide the MHMP Update planning process. These individuals were specifically

invited to serve on the Committee because they were knowledgeable of local hazards; have been involved in hazard mitigation; have the tools necessary to reduce the impact of future hazard events; and/or served as a representative on the original Planning Committee in 2007. **Table 1-1** lists the individuals that participated on the Committee and the entity they represented.

Table 1-1 MHMP Update Committee

NAME	REPRESENTING
John Allyn	Radio Amateur Civil Emergency Services
H. Jason Auvil	Elkhart County Planning
Mike Bogart	City of Elkhart Planning & Zoning Department
Jim Bradberry	Elkhart County Sheriff's Department
Mark Brinson	City of Goshen Planning Department
Nancy Brown	Elkhart County Soil & Water Conservation District
Tiffany Chin	American Red Cross of Elkhart County
Mike Compton	City of Elkhart Fire Department
Laura Coyne	Elkhart County Community Development
Egbert Dijkstra	Elkhart County Public Safety Communications
Bill Faus	City of Elkhart Emergency Services
Chris Godlewski	Elkhart County Building Department
John Heiliger	Elkhart County
Don Lehman	Nappanee Fire Department
Mike Lewis	National Weather Service
Frank Lucchese	Elkhart County Commissioner's Office
Al Mackowiak	Town of Millersburg
Diane Madison	Elkhart County Parks & Recreation
Sheila Malone	City of Elkhart Communications
Chris McFarland	Elkhart General Hospital
David McGuire	IDHS
Roger Mertz	Radio Amateur Civil Emergency Services
Kelly Metzler	Elkhart County Human Resources
Mike Pennington	Elkhart County EMA
Mark Podgorski	Goshen General Hospital
Sandy Read	Elkhart County Health Department
Terry Rodino	Elkhart County Commissioner's Office
Brad Rogers	Elkhart County Sheriff's Department
Therese Sailor	Elkhart County EMA
Mark Salee	Town of Middlebury
Steve Schweisberger	Elkhart County Surveyor's Office
Dan Sink	Goshen Fire Department
Sandy Swartendruher	Radio Amateur Civil Emergency Services
Jeff Taylor	Elkhart County Highway
Chad Taylor	City of Elkhart Fire Department
Jennifer Tobey	Elkhart County EMA
Eric Trotter	City of Elkhart Planning and Zoning Department
Jeff Troxel	Town of Wakarusa
Marc Watson	Elkhart County GIS
Crystal Welsh	City of Elkhart Community Development
Bill Wuthrich	Town of Bristol
Mike Yoder	Elkhart County Commissioner's Office

Rhonda Yoder

Goshen City Planning

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 2007 MHMP) and identified new critical infrastructure and local hazards; reviewed the State's mitigation goals and updated the local mitigation goals; reviewed the most recent local hazard data, vulnerability assessment, and maps; evaluated the effectiveness of existing mitigation measures and identified new mitigation projects; and reviewed materials for public participation. A sign-in sheet recorded those present at each meeting to document participation. Meeting agendas and summaries are included in **Appendix 2**. Members of the Committee attended the public meeting in May 2016 and assisted with adoption of the Elkhart County MHMP Update.

1.3.2 Public Involvement

A draft of the Elkhart County MHMP Update was posted online on the EMA website for public review and comment. Committee members were provided with an informational flyer to display in their respective offices.

A public meeting was held on May 12, 2016 in the Correctional Facility Training Room. Members of the Committee were present to describe details of the plan as well as to answer questions presented by attendees. The media release and power point presentation are located in **Appendix 3**.

1.3.3 Involvement of Other Interested Parties

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

1.4 PLANS, STUDIES, REPORTS, AND TECHNICAL INFORMATION

REQUIREMENT §201.6(c)(1):

The plan shall include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

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

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

- Elkhart County Comprehensive Plan (2006)
- City of Elkhart Comprehensive Plan Update (2015)
- Town of Bristol Town Ordinances (2013)
- City of Goshen Code (2007)
- Town of Wakarusa Master Plan Update (2008)



The CRS program credits NFIP communities a maximum of 100 points for organizing a planning committee composed of staff from various departments; involving the public in the planning process; and coordinating among other agencies and departments to resolve common problems relating to flooding and other known natural hazards.

CHAPTER 2

COMMUNITY INFORMATION

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

Elkhart County, organized in April 1830, is thought to be named after the Shawnee Indian chief Elkhart, cousin of Chief Tecumseh and father of princess Mishawaka. The total area of Elkhart County is approximately 468 square miles. The location of Elkhart County within the State of Indiana is identified in **Figure 2-1**.

2.1 POPULATION AND DEMOGRAPHICS



Figure 2-1 Elkhart County Location

The most recent data for Elkhart County estimates that the 2014 population was 201,971, which ranks 6th in the State. Of that total, the City of Elkhart accounts for 51,421 or 25% of the county's population while City of Goshen is the second largest community with 32,267 or 16% of the population.

In 2011, the median age of the population in the County was 35 years of age. The largest demographic age groups in the County are young adults (25-44 years) with a population of 50,923, and older adults (45-64 years) with a population of 49,485. School aged children (5-17) are the third largest age group with a population of 41,035 individuals living in Elkhart County. The approximate median household income in 2013 was reported to be \$46,123 while the poverty rate in the same year was reported at 15.5% county-wide. In total, 23.1% of households are married with children, and 31.4% of households are married without children.

Nearly 80.5% of the adults, older than 25, within Elkhart County have reportedly completed a High School education. Further, 18.2% of those same adults have also completed a Bachelor of Arts or higher degree.

2.2 EMPLOYMENT

US Census data indicates that of the Elkhart County work force, 47.5% are employed in manufacturing positions. Health Care/Social Services and Transportation/Warehousing account for 8.6% and 2.4% respectively. The total resident labor force according to estimates in 2013 is 94,513 with 7,159

unemployed and an unemployment rate of 7.6% or 40th in the State out of 92 counties.

Table 2-1 List of Major Employers

Norfolk Southern (Elkhart)	Elkhart General Hospital (Elkhart)
Always in Stone Monument Co (Goshen)	Jayco Inc (Middlebury)
Henkels & McCoy (Elkhart)	Supreme Industries Inc (Goshen)
IU Health Goshen Hospital (Goshen)	Conn-Selmer Inc (Elkhart)
Heartland Recreational Vehicle (Elkhart)	Supreme Corp (Goshen)

(Indiana Department of Workforce Development, 2015)

2.3 TRANSPORTATION AND COMMUTING PATTERNS

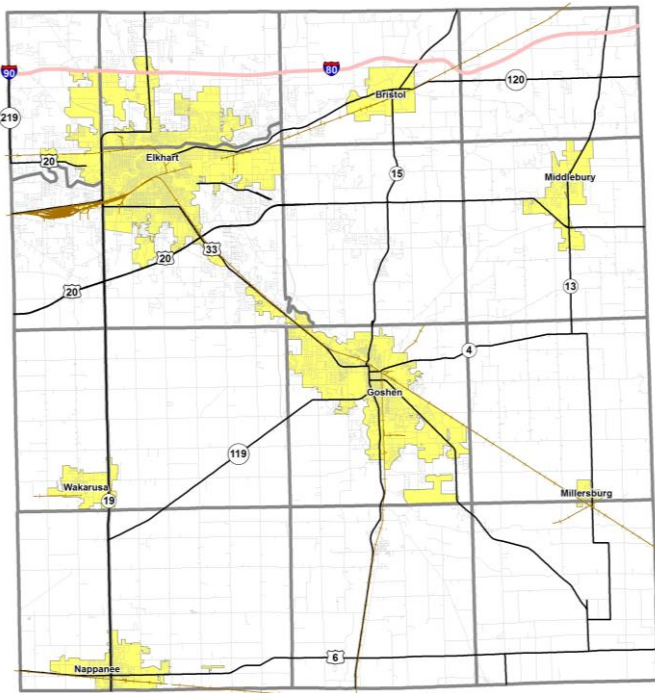


Figure 2-2 Elkhart County Transportation Routes

There are several major transportation routes passing through Elkhart County and the municipalities within. Interstate 80; US Highways 6, 20, and 33; and State Roads 4, 13, 15, 19, 112, 119, and 120 serve as main routes between the various municipalities. A number of rail lines also traverse the county. These transportation routes are identified in **Figure 2-2**.

According to the Indiana Business Research Center, more than 16%, or nearly 23,000 people commute into Elkhart County on a daily basis. Approximately 40% of these commuters travel from St Joseph County. Further, approximately 7,400 Elkhart County residents commute to other counties with the majority traveling to St Joseph County (64%).

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

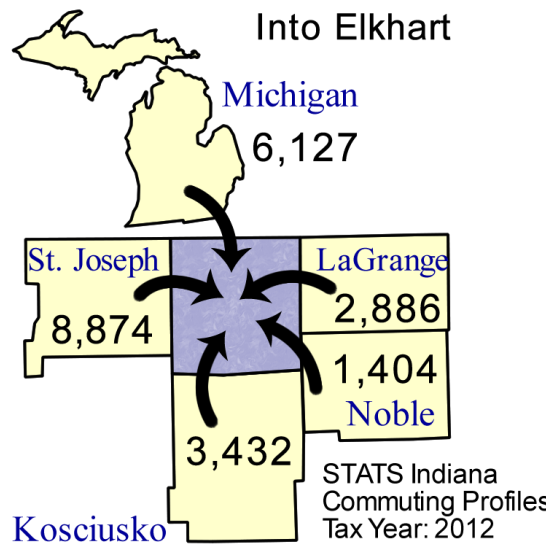


Figure 2-3 Workers Commuting into Elkhart County

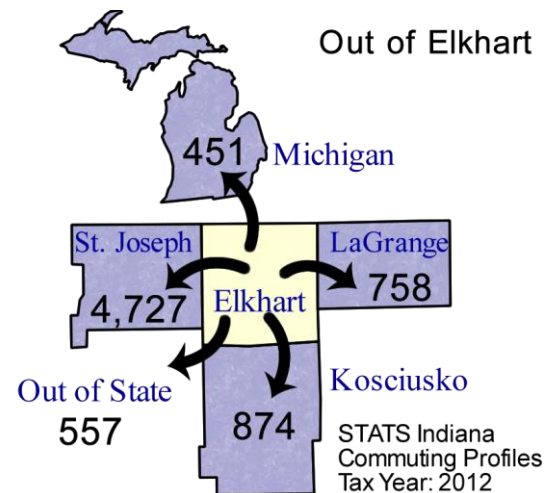


Figure 2-4 Workers Commuting out of Elkhart County

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 Elkhart County EMA provided the listing and locations of the following 658 critical infrastructure points for the MHMP Update:

- 8 Commercial and Retail Facilities
- 9 Dams
- 101 Educational Facilities
- 42 Emergency Response and Law Enforcement Facilities
- 45 Energy Facilities
- 10 Government and Military Facilities
- 197 Hazardous Materials Facilities
- 27 Healthcare Facilities
- 34 Information and Communication Facilities
- 3 Mail and Shipping Facilities
- 31 Multi-Unit Buildings
- 134 Public Attractions and Landmark Buildings
- 7 Transportation Facilities
- 10 Water Supply and Treatment Facilities

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

Exhibit 1 illustrates the critical infrastructure identified throughout Elkhart County. **Appendix 4** lists the critical structures in Elkhart County by NFIP Community. Non-critical structures include residential, industrial, commercial, and other structures not meeting the definition of a critical facility and are not required

for a community to function. The development of this MHMP focused on critical structures; thus, non-critical structures are not mapped or listed.

2.5 MAJOR WATERWAYS AND WATERSHEDS

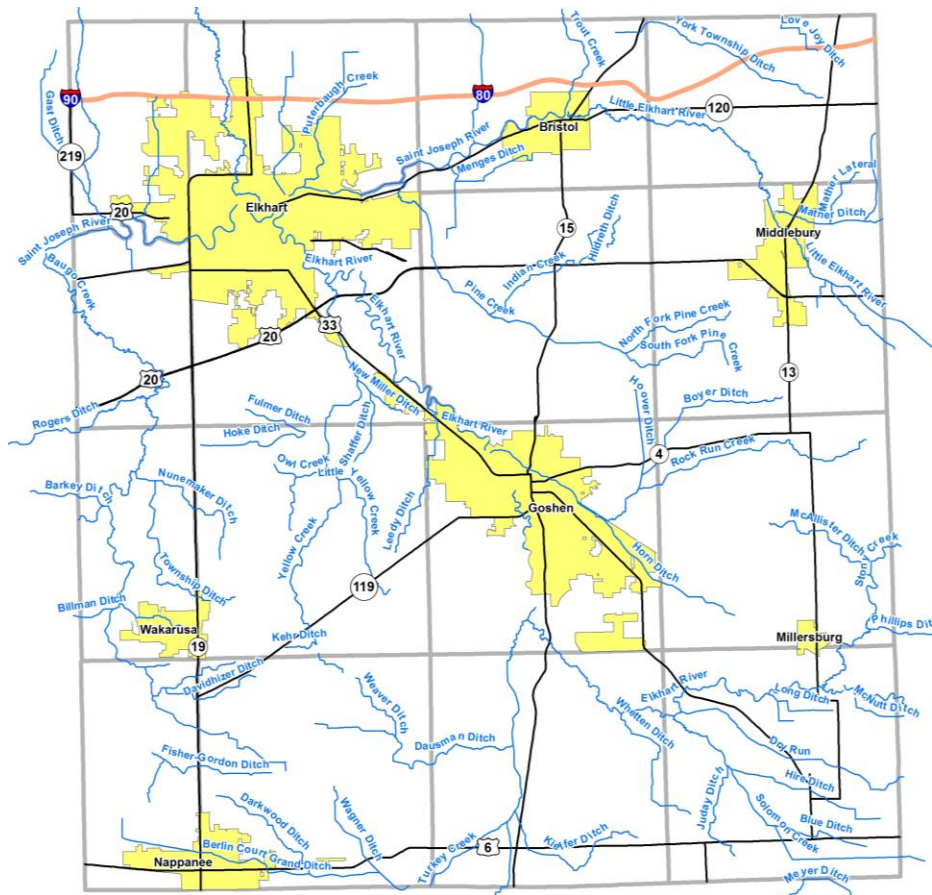


Figure 2-5 Elkhart County Waterways

According to the United States Geological Survey (USGS) there are 78 waterways in Elkhart County; they are listed in Appendix 5. The County's main waterways are the Elkhart River and the St Joseph River and the county lies within two 8-digit Hydrologic Unit Codes (HUC): the Kankakee (07120001) and the St. Joseph (04050001). These major waterways are identified on 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. Elkhart County, the Town of Bristol, the City of Elkhart, the City of Goshen, the Town of Middlebury, the Town of Nappanee, and the Town of Wakarusa are participants in the NFIP. Any smaller communities within Elkhart County may also be provided coverage by the MHMP through the County's program.

Since the development of the 2007 Elkhart County MHMP, these communities continue to participate in the NFIP program. These NFIP communities have also adopted Flood Hazard Ordinances containing language regarding compensatory floodplain storage.

At the time of preparing this MHMP, none of the NFIP entities in Elkhart County participate in the CRS program. The CRS program is a voluntary incentive program that recognizes and encourages community floodplain activities that exceed the minimum NFIP requirements. As a result, flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions that meet the 3 goals of the CRS: 1) reduce flood losses; 2) facilitate accurate insurance rating; and 3) promote education and awareness of flood insurance. For CRS participating communities, flood insurance premium rates are discounted in increments of 5% for each class level achieved. **Table 2-2** lists the NFIP number, effective map date, and the date each community joined the NFIP program.

Table 2-2 NFIP Participation

NFIP COMMUNITY	NFIP NUMBER	EFFECTIVE MAP DATE	JOIN DATE
Elkhart County	180056#	08/02/2011	11/01/1979
Town of Bristol	180060#	08/02/2011	04/16/1979
City of Elkhart	180057#	08/02/2011	08/01/1979
City of Goshen	180058#	08/02/2011	08/01/1979
Town of Middlebury	180460#	08/02/2011	08/17/1983
Town of Nappanee	180059#	08/20/2011	08/15/1983
Town of Wakarusa	180364#	08/20/2011	04/10/2012

(FEMA, 2015)

2.7 TOPOGRAPHY

Elkhart County is bordered geographically to the east by LaGrange and Noble Counties, to the west by St. Joseph and Marshal Counties, to the North by the Michigan border, and to the south by Kosciusko County. The County's landscape can be characterized as nearly level and gently sloping outwash plains in the northern part of the county, nearly level to moderately sloping outwash terraces and outwash plains in the northern and central parts and nearly level to strongly sloping till plains in the eastern and western parts. The highest elevation in Elkhart County is Buzzard Hill, reaching 1055 feet above sea level. In the western portion of Elkhart County, near the St. Joseph Rive, elevations drop to 720 feet above sea level.

2.8 CLIMATE

The Midwestern Regional Climate Center (MRCC) provided climate data that includes information retrieved from a weather station located in Goshen, identified as station 123418 Goshen College. The average annual precipitation is 36.59 inches per year, with the wettest month being June averaging 4.05 inches of precipitation and the driest month being February with an average of 1.77 inches of precipitation. The highest 1-day maximum precipitation was recorded in July of 1981 with 5.70 inches of rain. On average, there are 74.6 days of precipitation greater than or equal to 0.1 inches; 22.7 days with greater than or equal to 0.5 inches; and 8.0 days with greater than or equal to 1.0 inch of precipitation. Mean

snowfall is 39.3 inches per year. The highest monthly amount of snowfall recorded at this station is 36.6 inches in January of 1978.

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CHAPTER 3

RISK ASSESSMENT

REQUIREMENT §201.6(c)(2):

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

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

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

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

Section 3.3: Hazard Summary provides an overview of the risk assessment process; a comparative hazard ranking with other methodologies used by the Elkhart 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, technological, and political hazards from the 2007 Elkhart County MHMP and discussed recent and the potential for future hazard events. The Committee identified those hazards that affected Elkhart County and the NFIP communities and selected the hazards to study in detail as part of this planning effort. As shown in **Table 3-1** these include: dam failure; earthquake; flooding; hailstorms, thunderstorms, and windstorms; hazardous materials incident; snow storms and ice storms; and tornado.

All hazards studied with the 2007 Elkhart County MHMP are included in the update. Other hazards like those identified in the State of Indiana Homeland Security District Risk Score and Comparative Analysis developed by IDHS were considered; specifically, those natural hazards identified for District 2 (severe winter storm; violent tornado; severe thunderstorm; major flood; flash flood; major earthquake). All natural hazards identified for District 2, and those previously studied, were included for study in the Update. It was determined that while other hazards (typically technological based hazards) are applicable to Elkhart County, those hazards are addressed in non-public documents or, in regard to additional natural hazards, have little local impact and were therefore not studied in detail as a part of this planning effort.

While drought has impacted Elkhart County (2012) it was felt that efforts to mitigation or prepare for drought are currently best handled through education efforts to the local agricultural community through Purdue University Extension, or through regulatory efforts such as the burn bans issued in June and July of 2012. As this hazard has limited impact on Elkhart County, it was not studied in detail. However, if and when it is determined that drought is having an increasing impact on Elkhart County, the EMA or Planning Committee will reconvene and add this hazard to the MHMP and associated mitigation measures, emergency functions, or other documents as necessary.

Table 3-1 Hazard Identification

TYPE OF HAZARD	LIST OF HAZARDS	DETAILED STUDY	
		2007 MHMP	MHMP UPDATE
Natural	Earthquake	Yes	Yes
	Flood	Yes	Yes
	Hail/Thunder/Wind	Yes	Yes
	Snow / Ice Storm	Yes	Yes
	Tornado	Yes	Yes
Technological	Dam Failure	Yes	Yes
	Hazardous Material Incident	Yes	Yes

3.2 HAZARD RANKING

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

3.2.1 Probability



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

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

3.2.2 Magnitude / Severity



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

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

3.2.3 Warning Time



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

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

3.2.4 Duration



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

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

3.2.5 Calculating the CPRI



The following calculation illustrates how the index values are weighted and the CPRI value is calculated. $CPRI = Probability \times 0.45 + Magnitude/Severity \times 0.30 + Warning\ Time \times 0.15 + Duration \times 0.10$. 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 Elkhart County, and then a weighted CPRI value was computed based on the population size of each community.

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

Table 3-2 Determination of Weighted Value for NFIP Communities

NFIP COMMUNITY	POPULATION (2013)	% OF TOTAL POPULATION	WEIGHTED VALUE
Elkhart County	104,593	51.8%	0.52
Town of Bristol	1,650	0.8%	0.01
City of Elkhart	51,421	25.5%	0.25
City of Goshen	32,267	16.0%	0.16
Town of Middlebury	3,527	1.7%	0.02
Town of Nappanee	6,715	3.3%	0.03
Town of Wakarusa	1,798	0.9%	0.01
TOTAL	201,971	100.0	1.0

3.3 HAZARD PROFILES

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

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

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

Natural Hazards

3.3.1 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.

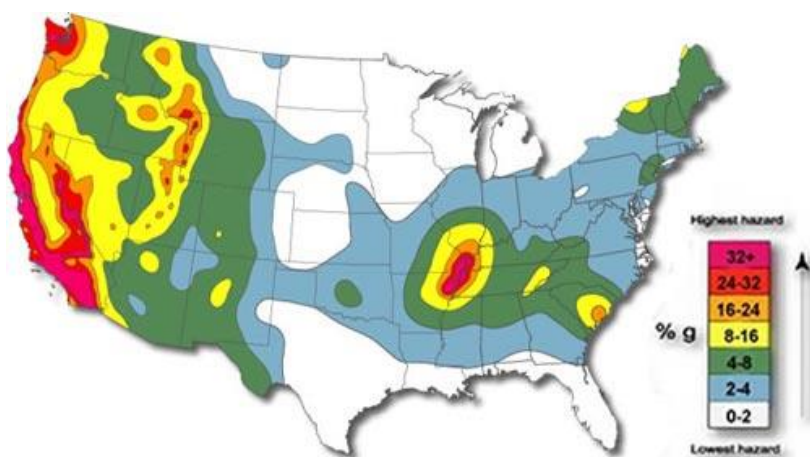


Figure 3-1 Earthquake Hazard Areas in the US

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

There are 45 states and territories in the United States at moderate to very high risk from earthquake, and they are located in every region of the country (**Figure 3-1**). California experiences the most frequent damaging earthquakes; however, Alaska experiences the greatest number of large earthquakes-most located in uninhabited areas. The largest earthquakes felt in the United States were along the New Madrid Fault in Missouri, where a three-month long series of quakes from 1811 to 1812 occurred over the entire Eastern United States, with Missouri, Tennessee, Kentucky, Indiana, Illinois, Ohio, Alabama, Arkansas, and Mississippi experiencing the strongest ground shaking.

Earthquake: Recent Occurrences

Indiana, as well as several other Midwestern states, lies in the most seismically active region east of the Rocky Mountains. The nearest fault is the Royal Center Fault, which crosses Kosciusko County to the south, according to the Indiana Geological Survey staff.

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

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



Figure 3-2 Earthquake Damaged Porch

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

Most recently, a M4.2 originated in Kalamazoo, Michigan just over 50 miles to the northwest from the City of Elkhart. Nearly 14,000 people within a 5 state region (including Indiana) felt some degree of tremors. Lasting for less than 10 seconds, people closest to the epicenter experienced moderate shaking, while those farthest out may have felt weak tremors. Damage estimates and injury reports were not found for this event.

Based on historical earthquake data and local knowledge of previous and anticipated earthquakes, the Committee determined that the probability of an earthquake occurring in Elkhart County or any of the communities is “Unlikely”. Should an earthquake occur, the impacts associated with this hazard are anticipated to be “Negligible” within all areas of the County.

As with all earthquakes, it was determined that the residents of Elkhart County would have little to no warning time (less than 6 hours) and that the duration of the event would be expected to be less than 6 hours. A summary is shown in **Table 3-3**.

Table 3-3 CPRI for Earthquake

	PROBABILITY	MAGNITUDE/ SEVERITY	WARNING TIME	DURATION	CPRI
Elkhart County	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Bristol	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
City of Elkhart	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
City of Goshen	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Middlebury	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Nappanee	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low
Town of Wakarusa	Unlikely	Negligible	< 6 Hours	< 6 Hours	Low

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 or near to Elkhart County is "Unlikely" to occur within the next 10 years.

Earthquake: Assessing Vulnerability

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

Direct Effects:

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

Indirect Effects:

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

Types of loss caused by an earthquake could be physical, economic, or social in nature. Due to the unpredictability and broad impact regions associated with an earthquake, all critical and non-critical infrastructure are at risk of experiencing earthquake related damages. Damages to structures, infrastructure, and even business interruptions can be expected following an earthquake. Examples of varying degrees of damages are shown in **Figure 3-2** and **Figure 3-3**.



Figure 3-3 Minor Earthquake Damages

Estimating Potential Losses

In order to determine the losses associated with an earthquake, the HAZUS-MH software was utilized to determine the impact anticipated from an arbitrary event, magnitude of 5.0, occurring within Elkhart County.

According to the HAZUS-MH scenario, total economic loss associated with this earthquake is anticipated to be near \$280M. The HAZUS-MH model computes anticipated economic losses for the hypothetical earthquake due to direct building losses and business interruption losses. Direct building losses are the costs to repair or to replace the damage caused to the building and contents, while the interruption losses are associated with the inability to operate a business due to the damage sustained. Business interruption losses also include the temporary living expenses for those people displaced from their homes. Total building related losses are anticipated to be \$207M, of which 7% (\$14M) of the estimated business losses are related to business interruption. 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 Elkhart 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, Elkhart County should continue to provide education and outreach regarding earthquakes and even earthquake insurance along with education and outreach for other hazards. As Elkhart County and the communities within the County continue to grow and develop, the proper considerations for the potential of an earthquake to occur may help to mitigate against social, physical, or economic losses in the future.

Earthquake: Relationship to Other Hazards

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

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 kind of flooding, after spring rains, heavy thunderstorms, or winter snow melts. A flood, as defined by the NFIP, is a general and temporary condition of partial or complete inundation of 2 or more acres of normally dry land area or of 2 or more properties from overflow of inland or tidal waters and unusual and rapid accumulation or runoff of surface waters from any sources, or a mudflow. Floods can be slow or fast rising but generally develop over a period of days.

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

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

Flood: Recent Occurrences

The NCDC reports that between September 2007 and November 30, 2015, there were 3 flood events (2 floods and 1 flash flood) that resulted in approximately \$260.0K in property damages with no additional crop damages. NCDC indicates that during the January 2008 event, flooding resulted in several road closures throughout the County, Elkhart, and Goshen. In addition, city and county parks received damages to sidewalks and retaining wall as the parks were submerged in some areas. **Figure 3-4** identifies the pavilion at Rogers Park nearly completely submerged. An event narrative from the June 2015 event reports water approximately 6 to 8 inches in depth flooding streets within the City of Elkhart. **Appendix 6** provides the NCDC information regarding flood events that have resulted in injuries, deaths, or monetary damages to property and/or crops.



Figure 3-4 January 2008 Flooding

Stream gages are utilized to monitor surface water elevations and/or discharges at key locations and time periods. Some such gages are further equipped with NWS' Advanced Hydrologic Prediction Service (AHPS) capabilities. These gages have the potential to provide valuable information regarding historical high and low water stages, hydrographs representing current and forecasted stages, and a map of the surrounding

areas likely to be flooded. Within Elkhart County, there is 1 active USGS stream gages equipped with AHPS capabilities; identified on **Exhibit 2**.

Any property having received 2 insurance claim payments for flood damages totaling at least \$1,000, paid by the NFIP within any 10-year period since 1978 is defined as a repetitive loss property. These properties are important to the NFIP because they account for approximately 1/3 of the country's flood insurance payments. According to FEMA Region V, there are 40 properties within the unincorporated areas of Elkhart County and an additional 4 properties within the Town of Bristol, 4 within the City of Elkhart, and 2 in the City of Goshen that are considered to be repetitive loss properties.

There have been numerous claims made for damages associated with flooding in Elkhart County. Within the unincorporated areas of the County, there have been 136 claims resulting in approximately \$650K in payments. Further, within the City of Elkhart, there were 67 claims totaling approximately \$260K. **Table 3-4** identifies the number of claims per NFIP community as well as payments made.

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

NFIP COMMUNITY	# OF REPETITIVE LOSS PROPERTIES	CLAIMS SINCE 1978	\$\$ PAID
Elkhart County	14	136	\$648,861
Town of Bristol	2	12	\$37,510
City of Elkhart	2	67	\$257,551
City of Goshen	1	16	\$90,299
Town of Middlebury	0	2	\$3,443
Town of Nappanee	0	0	0
Town of Wakarusa	0	0	0
TOTALS	50	233	\$1,037,664.00

(IDNR, 2015)

(FEMA Region V, 2015)

Mandatory flood insurance purchase requirements apply to structures in 1% annual chance of flooding delineated areas. Total flood insurance premiums for Elkhart County and the NFIP communities is approximately \$574.2K. Total flood insurance coverage for Elkhart County is nearly \$116M. **Table 3-5** further indicates the premiums and coverage totals for individual NFIP communities.

Table 3-5 Insurance Premiums and Coverage

NFIP COMMUNITY	FLOOD INSURANCE PREMIUMS	FLOOD INSURANCE COVERAGE
Elkhart County	\$312,710	\$67,800,700
Town of Bristol	\$8,570	\$1,436,100
City of Elkhart	\$132,283	\$21,994,000
City of Goshen	\$86,386	\$16,165,600
Town of Middlebury	\$22,113	\$4,401,200
Town of Nappanee	\$7,501	\$3,155,200
Town of Wakarusa	\$4,642	\$752,000
TOTALS	\$574,205.00	\$115,704,800.00

(IDNR, 2015)

As determined by the Committee, the probability of a flood occurring throughout Elkhart County ranges from “Unlikely” in Nappanee and Wakarusa; “Possible” in Bristol and Middlebury; and “Likely” within the County, Elkhart, and Goshen. Impacts from such an event are anticipated to range from “Critical” in Elkhart and Goshen to “Negligible” in other areas. The Committee also determined that the warning time would be 12-24 hours, and that the duration of such an event is anticipated to last less than 1 week for areas expected to experience flooding. A summary is shown in **Table 3-6**.

Table 3-6 CPRI for Flood

	PROBABILITY	MAGNITUDE /SEVERITY	WARNING TIME	DURATION	CPRI
Elkhart County	Likely	Limited	12-24 Hours	< 1 Week	Elevated
Town of Bristol	Possible	Limited	12-24 Hours	< 1 Week	Elevated
City of Elkhart	Likely	Critical	12-24 Hours	< 1 Week	Elevated
City of Goshen	Likely	Critical	12-24 Hours	< 1 Week	Elevated
Town of Middlebury	Possible	Negligible	12-24 Hours	< 1 Week	Low
Town of Nappanee	Unlikely	Negligible	12-24 Hours	< 6 Hours	Low
Town of Wakarusa	Unlikely	Negligible	12-24 Hours	< 6 Hours	Low

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

Flood: Assessing Vulnerability

Flood events may affect large portions of Elkhart County at one time as large river systems and areas with poor drainage cover much of the county and several communities. Within Elkhart County, direct and indirect effects of a flood event may include:

Direct Effects:

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

Indirect Effects:

- Increased response times for emergency personnel if roads are impassable
- Increased costs associated with personnel to carry out evacuations in needed areas
- Increased risk of explosions and other hazards associated with floating propane tanks or other debris
- Losses associated with missed work or school due to closures or recovery activities
- Cancellations of special events in impacted areas or water related activities that become too dangerous due to high water



Figure 3-5 Car Submerged on Flooded Street

Estimating Potential Losses

Critical and non-critical structures located in regulated floodplains, poorly drained areas, or low lying areas (**Figure 3-5**) 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 Elkhart County and structures

located within each flood zone were tallied using GIS analysis techniques.

The Modified Building Inventory was created in ESRI ArcGIS by converting parcels to centroids, and joining Assessor Data to these centroids. Assessor data included square footage for the structure, and any structure that was listed as less than 400 ft² in area or was classified in the Assessor's database as a non-habitable

structure was assumed to be an outbuilding. Also, buildings with an assessed value of \$0.00 or buildings that did not match the Assessor Data (parcel numbers did not match) were excluded from the analysis. Replacement 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.

In order to estimate anticipated damages associated with each flood in Elkhart 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 3-7** identifies the estimated losses associated with structures in the floodway, the 100-year floodplain, and the 500-year floodplain areas by NFIP community within Elkhart County.

Table 3-7 Manual GIS Analysis Utilizing Most Recent Preliminary DFIRM Data and Elkhart County Building Inventory

	FLOODWAY		1%		0.2%		UNNUMBERED	
	#	\$	#	\$	#	\$	#	\$
Elkhart County	296	\$17.3M	483	\$28.3M	166	\$9.8M	117	\$7.0M
Town of Bristol	23	\$1.3M	9	\$0.5M	44	\$2.7M	1	\$0.05M
City of Elkhart	285	\$16.9M	377	\$24.5M	294	\$18.3M	17	\$1.3M
City of Goshen	104	\$8.2M	146	\$10.7M	50	\$3.7M	0	\$0
Town of Middlebury	21	\$1.8M	34	\$2.4M	0	\$0	0	\$0
Town of Nappanee	65	\$4.3M	18	\$1.1M	67	\$4.1M	0	\$0
Town of Wakarusa	19	\$1.3M	18	\$1.4M	0	\$0	0	\$0
TOTALS	813	\$51.1M	1,085	\$68.9M	621	\$38.6M	135	\$8.4M

Structures and damages within each zone are not inclusive

Utilizing the same GIS information and process, **Table 3-8** identifies the number of critical infrastructure within each of the Special Flood Hazard Areas (SFHA) in Elkhart County. These buildings are included in the overall number of structures and damage estimate information provided in Table 3-7.

Table 3-8 Critical Infrastructure in SFHA by NFIP Community

NFIP COMMUNITY	FLOODWAY	1%	0.2%	UNNUMBERED
Elkhart County	6 Dams	1 Dam 1 Hydro Plant	2 ITR Concession Co	Olive Church United Missionary Church
Town of Bristol				
City of Elkhart	1 Dam Elkhart Central HS	YMCA		
City of Goshen	County Admin Bldg County Corrections Electric Substation	City Fuel Center Water/Sewer Dept		
Town of Middlebury	WWTP			
Town of Nappanee			WWTP	
Town of Wakarusa				

Structures within each zone are not inclusive

Utilizing the information in Table 3-7 regarding the number of structures within each Flood Hazard Area, it is also important to note the number of flood insurance policies within each NFIP area in Elkhart County. **Table 3-9** provides the comparison between the number of structures in the SFHA and the number of flood insurance policies. It is also important to note that flood insurance is voluntary unless the property owner carries a federally subsidized mortgage; insurance coverage may be discontinued when the mortgage is completed.

Table 3-9 Number of Structures in the SFHA and Number of Flood Insurance Policies

NFIP COMMUNITY	# STRUCTURES IN SFHA	# POLICIES
Elkhart County	11,062	315
Town of Bristol	77	8
City of Elkhart	973	138
City of Goshen	300	76
Town of Middlebury	55	17
Town of Nappanee	150	16
Town of Wakarusa	37	7
Total	2,654	577

(IDNR, 2015)

Future Considerations

As the municipalities within Elkhart 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% annual chance (500-year) floodplain and/or are protected to that level along with a flood-free access to reduce the risk of damages caused by flooding and to ensure that these critical infrastructure will be able to continue functioning during major flood events.

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



Figure 3-6 Fire Engine in Flood Waters

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

Indirect effects of flooding may include increased emergency response times due to flooded or redirected streets (**Figure 3-6**), 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 Elkhart County are closely tied to the river systems, special events occurring near to or on these rivers and waterways may be cancelled or postponed during periods of flooding or high water levels.

Flood: Relationship to Other Hazards

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

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

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

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

3.3.3 Hailstorms, Thunderstorms, and Windstorms



Hailstorms, Thunderstorms, and Windstorms: Overview

Hail occurs when frozen water droplets form inside a thunderstorm cloud, and then grow into ice formations held aloft by powerful thunderstorm updrafts, and when the weight of the ice formations becomes too heavy, they fall to the ground as hail. Hail size ranges from smaller than a pea to as large as a softball, and can be very destructive to buildings, vehicles (**Figure 3-7**), and crops. Even small hail can cause significant damage to young and tender plants. Residents should take cover immediately in a hailstorm, and protect pets and livestock, which are particularly vulnerable to hail, and should be under shelter as well.

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

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



Figure 3-7 Damaging Hail on Vehicles

Hailstorm, Thunderstorm, and Windstorm: Recent Occurrences

In Elkhart County, the NCDC has recorded 20 hailstorms and 77 thunderstorms/windstorms between September 2007 and November 2015. The largest recorded hailstone was 1.25 inches in diameter and has occurred on 2 separate hailstorm events within the previously mentioned timeframe. The average diameter hailstone occurring throughout Elkhart County is 0.75 inches.

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 Elkhart County, NCDC reports 61 instances between September 2007 and November 2015 where top wind speeds were greater than 58 mph.

Total NCDC recorded damages for hailstorms, thunderstorms, and windstorms throughout Elkhart County are \$55K. The NCDC also reports 4 injuries and 1 death due to these types of incidents. Many event reports included in the NCDC did not provide descriptive information on the social, physical, and economic losses resulting from individual storms specific to Elkhart County. 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.



Figure 3-8 Damages to Martin's Supermarket in Goshen (J. Tyler Klassen/The Elkhart Truth)

Several buildings in the Goshen area (**Figure 3-8**) suffered damages as severe storms affected the area June 30-July 1, 2014. Near Mishawaka, two residents narrowly escaped injury as a large tree fell onto his home and part of the neighboring home. Thousands of people were left without power as numerous trees and limbs were downed, taking power lines and poles with them. No monetary damage amounts were reported for this event.

A similar event occurred on July 18, 2015 as thunderstorms and high winds caused damage to trees and power lines, even roads obstructed by fallen debris. Widespread damage resulted in

over 7,500 Indiana Michigan Power customers without power. This event was not reported by NCDC.

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 Elkhart County is "Highly Likely" and will typically affect broad portions of the county at one time resulting in potentially "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 12-24 hours and the duration is expected to last less than 6 hours.

Indicative of a regional hazard, the probability, magnitude, warning time, and duration of a hailstorm, thunderstorm, or windstorm are expected to be the same throughout the county. These events are highly unpredictable and the occurrences are distributed through the county. Therefore, the CPRI values reflect the equally

distributed risk and associated priority for a hailstorm, thunderstorm, or windstorm. A summary is provided in **Table 3-10**.

Table 3-10 CPRI for Hailstorm, Thunderstorm, and Windstorm

	PROBABILITY	MAGNITUDE /SEVERITY	WARNING TIME	DURATION	CPRI
Elkhart County	Likely	Limited	< 6 Hours	< 1 Day	Elevated
Town of Bristol	Likely	Limited	< 6 Hours	< 1 Day	Elevated
City of Elkhart	Likely	Limited	< 6 Hours	< 1 Day	Elevated
City of Goshen	Likely	Limited	< 6 Hours	< 1 Day	Elevated
Town of Middlebury	Likely	Limited	< 6 Hours	< 1 Day	Elevated
Town of Nappanee	Likely	Limited	< 6 Hours	< 1 Day	Elevated
Town of Wakarusa	Likely	Limited	< 6 Hours	< 1 Day	Elevated

Specific locations and frequency of hailstorms, thunderstorms, and windstorms are difficult to predict as many of these individual events are without significant warning time and may have impacts to very limited areas, or may affect broader areas. However, based on NCDC data and personal experiences of the Committee, it was determined that all areas within the County are anticipated to experience a hailstorm, thunderstorm, or windstorm within the calendar year. More likely, these communities will be impacted by several of these hazard events each year.

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 Elkhart 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



Figure 3-9 Home Damaged During Windstorm

Estimating Potential Losses

Due to the unpredictability of this hazard all critical infrastructure and non-critical structures in Elkhart County are at risk of damage including temporary or permanent loss of function. For hailstorms, thunderstorms, and windstorms, it is not possible to isolate specific critical infrastructure or non-critical structures that would be more or less vulnerable to damages. However, areas where utility lines are above ground and areas where dead or dying trees have not been removed may be at a higher risk of property damages or power outages during hailstorms, thunderstorms, and windstorms. Additionally, mobile

homes and accessory buildings such as pole barns and sheds may also be at a higher risk of damages from hailstorms, thunderstorms, and windstorms if not properly anchored to the ground. Damages from falling limbs or uprooted trees such as shown in **Figure 3-9**, are common.

Future Considerations

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

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

Hailstorm, Thunderstorm, and Windstorm: Relationship to Other Hazards

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

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

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

3.3.4 Tornado



Tornado: Overview

Tornadoes are defined as violently rotating columns of air extending from thunderstorms to the ground. Funnel clouds are rotating columns of air not in contact with the ground. However, the funnel cloud may reach the ground very quickly – becoming a tornado. If there is debris lifted and blown around by the “funnel cloud”, then it has reached the ground and is a tornado.

A tornado is generated when conditions in a strong cell are produced that exhibit a wall of cool air that overrides a layer of warm air. The underlying layer of warm air rapidly rises, while the layer of cool air drops – sparking the swirling action. The damage from a tornado is a result of the high wind velocity and wind-blown debris. Tornado season is generally April through June in Indiana, although tornadoes can occur at any time of year. Tornadoes tend to occur in the afternoons and evenings; over 80 percent of all tornadoes strike between 3:00 pm and 9:00 pm, but can occur at any time of day or night as shown in **Figure 3-10**. 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 3-10 Funnel Cloud During a Lightning Storm at Night

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

Tornado: Recent Occurrences

The classification of tornadoes utilizes the Fujita Scale of tornado intensity, described in **Table 3-11**. Tornado intensity ranges from low intensity (F0) tornadoes with effective wind speeds of 40-70 mph to high intensity (F5+) tornadoes with effective wind speeds of 261-318+ mph. According to the NCDC, Elkhart County has experienced 7 tornadoes (3-F0; 3-F1; 1-F3) between September 2007 and November 2015.

Table 3-11 Fujita Scale of Tornado Intensity

F-SCALE	WINDS	CHARACTER OF DAMAGE	RELATIVE FREQUENCY
F0 (weak)	40-72 mph	Light damage	29%
F1 (weak)	73-112 mph	Moderate damage	40%
F2 (strong)	113-157 mph	Considerable damage	24%
F3 (strong)	158-206 mph	Severe damage	6%
F4 (violent)	207-260 mph	Devastating damage	2%
F5 (violent)	261-318 mph	Incredible damage	<1%

One of the tornadoes reported by the NCDC occurred on October 18, 2007 and resulted in approximately \$11M in property damages as it neared the southeast side of Nappanee. “The tornado went through an area populated by homes, restaurants, convenience stores and 3 RV plants, all of which sustained varying degrees of damage”. In all, nearly 460 buildings were damaged; many of which were residential properties with over 50 being completely destroyed or uninhabitable.

A June 23, 2010 F1 event impacted the Wakarusa area traveling nearly 12 miles with numerous trees uprooted, broken and fallen limbs, and crop damage. The greatest property damage occurred to the Ultimaster plant on SR 19 where much of the roof was torn away and resulted in an estimated \$300K in damages.

The Committee estimated the probability of a tornado occurring anywhere in Elkhart County would be “Likely” and the magnitude and severity of such an event to be “Limited” within the County, “Significant” within Elkhart and Goshen, and “Critical” if a tornado were to strike the other communities. As with many hazardous events, the Committee anticipated a short warning time, less than 6 hours, and a short duration, also less than 6 hours. The summary is shown in **Table 3-12**.

Table 3-12 CPRI for Tornado

	PROBABILITY	MAGNITUDE /SEVERITY	WARNING TIME	DURATION	CPRI
Elkhart County	Likely	Limited	< 6 Hours	< 6 Hours	Elevated
Bristol	Likely	Critical	< 6 Hours	< 6 Hours	Elevated
Elkhart	Likely	Significant	< 6 Hours	< 6 Hours	Severe
Goshen	Likely	Significant	< 6 Hours	< 6 Hours	Severe
Middlebury	Likely	Critical	< 6 Hours	< 6 Hours	Elevated
Nappanee	Likely	Critical	< 6 Hours	< 6 Hours	Elevated
Wakarusa	Likely	Critical	< 6 Hours	< 6 Hours	Elevated

The Indiana State Climate Office estimates that throughout Indiana, there is an average of 20 tornado touchdowns per year. Based on the number of tornado touchdowns previously reported through the NCDC and local weather agencies, the Committee determined the probability of a future tornado occurring in Elkhart County is likely (within the next 3 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 Elkhart County that would be more or less vulnerable to a tornado. Direct and indirect effects from a tornado may include:

Direct Effects:

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

Indirect Effects:

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

Estimating Potential Losses

Due to the unpredictability of this hazard, all critical and non-critical structures within the County are at risk of future damage or loss of function. Estimates of potential physical losses were determined through a hypothetical exercise where F2 intensity tornadoes traveled through portions of the County. This is intended to present a “what-if” scenario of a tornado incident and associated damages. Damage estimates were derived by assuming that 25% of all structures in the path of the tornado would be completely destroyed, 35% would be 50% damaged, and 40% would have only 25% damage. These estimations were also determined utilizing 3 wind speed zones based on distance from the tornado path. **Table 3-13** provides summary data for the hypothetical tornado, which is identified on **Exhibit 3**.

Table 3-13 Summary of Hypothetical Tornado Damages

ZONE	ESTIMATED # STRUCTURES	ESTIMATED DAMAGE (\$)
Zone A	365	\$30.7M
Zone B	376	\$18.7M
Zone C	596	\$29.0M
TOTAL	1,337	\$78.4M

Additionally, within Zone A, the tornado would have damaged an elementary school and a hazmat facility. Zone B damages would include a shopping mall, a middle school, a fire department, a communication tower, and a hazmat facility. Within the outer zone, 6 hazmat facilities, an electric substation, a medical facility, and a UPS facility would potentially receive damage.

Future Considerations

Within Elkhart County, there are numerous events each year that draw many thousands of Indiana residents as well as international guests. Due to this, it is imperative that the EMA and elected officials place continued importance on the need to maintain and, as necessary, upgrade the outdoor warning siren coverage. Currently, the City of Elkhart and the City of Goshen (primary population areas within the County) are covered by outdoor warning sirens. As populations continue to grow, or funding is obtained, the County will assess the current number and locations of outdoor warning sirens, and potentially install additional sirens in prioritized areas. The existing siren locations and the coverage areas for outdoor warning sirens are provided in Exhibit 4.

In an effort to inform all residents of Elkhart County, the response agencies provide warning information through the NIXLE community warning system. While this is a system through which individuals need to register to receive updates, a continuous awareness campaign is needed.

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

Tornado: Relationship to Other Hazards

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

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

3.3.5 Winter Storm & Ice



Winter Storm & Ice: Overview

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



Figure 3-11 Ice Covered Power Lines

Storm effects such as extreme cold, flooding, and snow and ice accumulation (**Figure 3-11**) can cause hazardous conditions and hidden problems for people in the affected area. People can become stranded on the road or trapped at home, without utilities or other services, including food, water, and fuel supplies. The conditions may overwhelm the capabilities of a local jurisdiction. Winter storms are considered deceptive killers as they may indirectly cause transportation accidents, and injury and death resulting from exhaustion/overexertion, hypothermia and frostbite from wind chill, and

asphyxiation; and house fires occur more frequently in the winter due to lack of proper safety precautions.

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

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

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

Winter Storm & Ice: Recent Occurrence

Since the completion of the August 2007 Elkhart County MHMP, the NCDC has recorded 1 blizzard, 2 ice storms, 4 lake effect snow, 7 heavy snow, 15 winter storms, and 21 winter weather events. While no monetary damage estimates, injuries, or deaths were reported with these events, narrative descriptions indicated poor travel conditions, power outages and debris associated with similar events.

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

One event, an ice storm, not reported within the time from for NCDC occurred on December 28, 2015. Nearly 5,500 Elkhart County customers were without power due to cars crashing into poles and lines downed by frozen limbs or from the weight of the ice on the line. Numerous car crashes were caused by icy conditions but the work of the street and highway department was credited for keeping driving conditions passable.

The probability, magnitude, warning times, and duration of a snow storm or ice storm causing disruption to residents and businesses in Elkhart County, as determined by the Planning Committee, is expected to be consistent throughout the County and NFIP communities. It is “Highly Likely” that this type of hazard will occur in this area and will typically affect the entire county, and possibly several surrounding counties, at one time, resulting in primarily “Limited” severity within the municipalities. Within the unincorporated areas of the County, the magnitude is anticipated to be critical due to the potential closure of transportation routes and access to resources. The warning time for severe temperatures or several inches of snow associated with a winter storm is usually 6-12 hours while the duration of the incident is anticipated to last less than 1 week. A summary is shown in **Table 3-14**.

Table 3-14 CPRI for Winter Storm and Ice

	PROBABILITY	MAGNITUDE /SEVERITY	WARNING TIME	DURATION	CPRI
Elkhart County	Highly Likely	Critical	6 – 12 Hours	< 1 Week	Severe
Bristol	Highly Likely	Limited	6 – 12 Hours	< 1 Week	Severe
Elkhart	Highly Likely	Limited	6 – 12 Hours	< 1 Week	Severe
Goshen	Highly Likely	Limited	6 – 12 Hours	< 1 Week	Severe
Middlebury	Highly Likely	Limited	6 – 12 Hours	< 1 Week	Severe
Nappanee	Highly Likely	Limited	6 – 12 Hours	< 1 Week	Severe
Wakarusa	Highly Likely	Limited	6 – 12 Hours	< 1 Week	Severe

The Planning Committee determined that the probability for a snow storm or ice storm to occur in Elkhart County or any 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, snow storms and ice storms are common within Elkhart County and will continue to be an annual occurrence.

Winter Storm & Ice: Assessing Vulnerability

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

Direct Effects:

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

Indirect Effects:

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



Figure 3-12 Travel Impacted During Snow Storm

Estimating Potential Losses

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

For planning purposes, information collected in snow storms impacting other communities around the nation is also useful in assessing the potential social, physical, and economic impact that a winter storm could have on Allen County communities. For example, a March 2003 snow storm in Denver, Colorado dropped approximately 31 inches of snow and caused an estimated \$34M in total damages. In addition, a February 2003 winter storm dropped an estimated 15-20 inches of snow in parts of Ohio. The Federal and Ohio Emergency Management Agencies and U.S. Small Business Administration surveyed damaged areas and issued a preliminary assessment of \$17M in disaster related costs. These costs included snow and debris removal, emergency loss prevention measures, and public utilities repair. The agencies found over 300 homes and businesses either damaged or destroyed in 6 counties. Snow storms and blizzards also make road travel difficult and dangerous, as in **Figure 3-12**.

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

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

Future Considerations

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

power outages and potentially impassable transportation routes, making it difficult to obtain supplies or for passage of response vehicles.

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

Winter Storm & Ice: Relationship to Other Hazards



Figure 3-13 Flooding Caused by Snow Melt

Winter storms and ice storms can lead to flooding as the precipitation melts and enters local receiving water bodies. This increased volume of water on already saturated, or still frozen ground can quickly result in flooding related damages to structures and properties (**Figure 3-13**) 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 suburban/rural areas of Elkhart County, or where open areas are more susceptible to drifted roads, the possibility of a traffic related hazardous materials incident may increase.

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

TECHNOLOGICAL HAZARDS

3.3.6 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 Elkhart County, there are 7 DNR regulated dams: 1 high hazard dam (Goshen Pond Dam) and 6 low hazard dams as shown on Exhibit 2. There have been no recorded dam failures within Elkhart County. Goshen Pond Dam is shown in **Figure 3-14**.



Figure 3-14 Goshen Pond Dam (James Buck)

Based on the information provided to them, the Committee determined the probability of a dam failure is “Unlikely” with an anticipated effect of “Negligible” (areas not anticipated to be within the inundation area) to “Critical” (based on the number of structures or populations downstream of the dam) damages. **Table 3-15** provides a summary of the Planning Committee’s expectations during a dam failure.

Table 3-15 CPRI for Dam Failure

	PROBABILITY	MAGNITUDE /SEVERITY	WARNING TIME	DURATION	CPRI
Elkhart County	Unlikely	Critical	< 6 Hours	< 6 Hours	Elevated
Town of Bristol	Unlikely	Limited	< 6 Hours	< 6 Hours	Low
City of Elkhart	Unlikely	Significant	< 6 Hours	< 6 Hours	Elevated
City of Goshen	Unlikely	Significant	< 6 Hours	< 6 Hours	Elevated
Town of Middlebury	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of Nappanee	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low
Town of Wakarusa	Unlikely	Negligible	> 24 Hours	< 6 Hours	Low

Dam Failure: Assessing Vulnerability

Within Elkhart 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

Indirect Effects:

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

Due to the conditions beyond the control of the dam owner or engineer, there may be unforeseen structural problems, natural forces, mistakes in operation, negligence, or vandalism that may cause a dam to fail. Fortunately, the Goshen Pond dam does have an Incident & Emergency Action Plan (IEAP) prepared along with estimated dam failure inundation mapping. This plan was produced by Lawson-Fisher Associates in 2014.

Estimating Potential Losses

The potential dam failure inundation area for the Goshen Pond Dam was overlaid onto recent aerial photography 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, volume of water that is released, and the width of the floodplain valley to accommodate the dam break flood wave. There are nearly 300 residential and 170 commercial structures located within the potential inundation area. Further, 44 government facilities, 2 educational facilities and 11 industrial structures are within the potential inundation area. Critical structures located within the potential inundation area include 4 hazmat handlers, Riverdale Elementary and the Elkhart County Administration Building.

Future Considerations

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

It is also very important to all downstream communities and property owners that all IEAPs are kept up-to-date as well as 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 dam breach, it can be expected that a dam failure would lead to flooding and within the inundation areas downstream of the dam. Downstream 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 failure.

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

3.3.7 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 3-15 Drums of Potentially Hazardous Waste

As materials are mobilized for treatment, disposal, or transport to another facility, all infrastructure, facilities, and residences in close proximity to the transportation routes are at an elevated risk of being affected by a hazardous materials release. Often these releases can cause serious harm to Elkhart County and its residents if proper and immediate actions are not taken. Most releases are the result of human error or improper storage (**Figure 3-15**), and corrective actions to stabilize these incidents may not always be feasible or practical in nature.

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

Hazardous Materials Incident: Recent Occurrences

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

A recent, moderate event occurred on March 8, 2014 when chlorine gas escaped from the Elkhart Wastewater Treatment Plant due to a “crimped washer on a full chlorine gas cylinder”. Procedures were followed, three employees were able to leave the area, and no neighboring businesses or residents needed to be evacuated.

According to the Committee, the probability of a hazardous materials release or incident is “Highly Likely” within all areas and “Limited” damages are anticipated to result from an incident throughout Elkhart County. As with hazards of this nature, a short warning time (less than 6 hours) and a short duration (less than 1

day), are anticipated in the event of a hazardous materials incident. A summary is shown in **Table 3-16**.

Table 3-16 CPRI for Hazardous Materials Incident

	PROBABILITY	MAGNITUDE /SEVERITY	WARNING TIME	DURATION	CPRI
Elkhart County	Highly Likely	Limited	< 6 Hours	< 1 Day	Severe
Bristol	Highly Likely	Limited	< 6 Hours	< 1 Day	Severe
Elkhart	Highly Likely	Limited	< 6 Hours	< 1 Day	Severe
Goshen	Highly Likely	Limited	< 6 Hours	< 1 Day	Severe
Middlebury	Highly Likely	Limited	< 6 Hours	< 1 Day	Severe
Nappanee	Highly Likely	Limited	< 6 Hours	< 1 Day	Severe
Wakarusa	Highly Likely	Limited	< 6 Hours	< 1 Day	Severe

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

Hazardous Materials Incident: Assessing Vulnerability

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

Direct Effects:

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

Indirect Effects:

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

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

One local result of SARA Title III is the formation of the Local Emergency Planning Commission (LEPC). This commission has the responsibility for preparing and implementing emergency response plans, cataloging Material Safety Data Sheets (MSDS), chemical inventories of local industries and businesses, and reporting materials necessary for compliance.

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

Estimating Potential Losses



Figure 3-16 Fuel Tanker Fire

In addition, the very nature of these events makes predicting the extent of their damage very difficult. A small-scale spill or release might have a minor impact and would likely require only minimal response efforts. Another slightly larger incident might result in the disruption of business or traffic patterns, and in this situation might require active control response measures to contain a spill or release. On the other hand, even small or moderate events could potentially grow large enough that mass evacuations or shelter in place techniques are needed, multiple levels of response are utilized, and additional

hazards such as structural fires and/or additional hazardous materials releases (or explosions) may occur. Given the unpredictable nature of hazardous materials incident, an estimate of potential losses was not estimated.

Future Considerations

Additional facilities, both critical and non-critical in nature may be affected if a hazardous materials release were to occur along a transportation route (**Figure 3-16**). Several routes including railways, Interstate 80; US Highways 6, 20, and 33; and State Routes 4, 13, 15, 19, 112, 119, and 120 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 especially should be discouraged from being located within these areas. Further, by restricting construction in these zones, the number of

potentially impacted residents may also be greatly reduced, lowering the risk for social losses, injuries, and potential deaths. Future construction of hazardous materials facilities should be located away from critical infrastructure such as schools, medical facilities, municipal buildings, and daycares, reducing the risk to highly populated buildings and potentially populations with special needs or considerations such as children, elderly, and medically unfit.

Hazardous Materials Incident: Relationship to Other Hazards

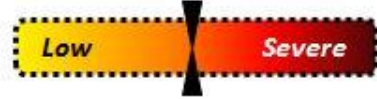
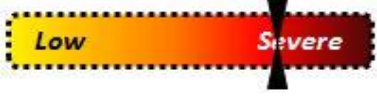
Dependent on the nature of the release, conditions may exist where an ignition source such as a fire or spark is in close proximity to a flammable or explosive substance. As the fire spreads throughout the facility or the area, structural and/or property damages will increase. Response times to a hazardous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

3.4 HAZARD SUMMARY

For the development of this MHMP, the Committee utilized the CPRI method to prioritize the hazards they felt affected Elkhart 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 3-17 summarizes the CPRI values for the various hazards studied within this MHMP. The hazards that ranked as "Elevated" risk were dam failure; flooding; hailstorm, thunderstorm, and windstorm; and tornado. The hazards with a "Severe" risk were hazardous materials incident and snow and ice storm. Earthquake was ranked by the Committee as "Low" risk to Elkhart County.

Table 3-17 Combined CPRI

TYPE OF HAZARD	LIST OF HAZARDS	WEIGHTED AVERAGE CPRI
Natural	Earthquake	
	Flood	
	Hailstorm / Thunderstorm / Windstorm	
	Tornado	
	Winter Storm/Ice	
Technological	Dam Failure	
	Hazardous Materials Incident	

It can be important to understand the cause and effect relationship between the hazards selected by the Committee. **Table 3-18** 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 3-18 Relationship of Hazards

EFFECT → ↓ CAUSE	Earthquake	Flooding	Hailstorm, Thunderstorm, Windstorm	Tornado	Snow and Ice Storm	Dam Failure	Hazardous Materials
Earthquake						X	X
Flooding						X	X
Hailstorm, Thunderstorm, Windstorm		X				X	X
Tornado						X	X
Snow and Ice Storm		X				X	X
Dam Failure		X					X
Hazardous Materials							

As a method of better identifying the potential relationships between hazards, Exhibit 3 can be referenced to indicate the proximity of one or more known hazard areas such as the delineated floodplains and the locations of EHS facilities. For this reason, the City of Elkhart or any other community may be impacted by more than 1 hazard at a time, depending on certain conditions. It can be anticipated that if a flood were to occur within these areas, there would be a potentially increased risk of this facility experiencing a hazardous materials incident.

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

CHAPTER 4

MITIGATION GOALS AND PRACTICES

This section identifies the overall goal for the development and implementation of the Elkhart 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 2007 Elkhart County MHMP and determined that each of these remain valid and effective. In summary, the overall goal of the Elkhart County MHMP is to reduce the social, physical, and economic losses associated with hazard incidents through emergency services, natural resource protection, prevention, property protection, public information, and structural control mitigation practices.

4.2 MITIGATION PRACTICES

REQUIREMENT §201.6(c)(3)(ii):

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

REQUIREMENT §201.6(c)(3)(iii):

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

In 2005, the Multi-Hazard Mitigation Council conducted a study about the benefits of hazard mitigation. This study examined grants over a 10-year period (1993-2003) aimed at reducing future damages from earthquake, wind, and flood. It found that mitigation efforts were cost-effective at reducing future losses; resulted in significant benefits to society; and represented significant potential savings to federal treasury in terms of reduced hazard-related expenditures. This study found that every \$1 spent on mitigation efforts resulted in an average of \$4 savings for the community. The study also found that FEMA mitigation grants are cost-effective since they often lead to additional non-federally funded mitigation activities, and have the greatest benefits in communities that have institutionalized hazard mitigation programs. 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 Elkhart County. Mitigation measures that were included in the 2007 Elkhart County MHMP are noted as such.

Emergency Services

- The numerous outdoor warning sirens are routinely tested and maintain as necessary to provide coverage for much of the populated areas of the City of Elkhart and the City of Goshen. *(2007 Measure)*
- The County is routinely investigating potential options for mass alerts for hazardous events. *(2007 Measure)*
- Weather radios are encouraged throughout the County during presentations, events, and on the EMA website. *(2007 Measure)*
- Stream gages are utilized for flood forecasting and flood warnings for various stream levels. *(2007 Measure)*
- The Elkhart County EMA has a mobile command center which can be utilized during large gatherings or localized events.
- The hospitals within the 7 county region have developed a coalition to determine interoperations capabilities for event preparation, response, and recovery.

Natural Resource Protection

- Elkhart County, the Town of Bristol, the City of Elkhart, the City of Goshen, the Town of Middlebury, the Town of Nappanee, and the Town of Wakarusa are in good standing with the NFIP Program and have flood protection ordinances which meet minimum requirements.

- The MS4 communities enforce erosion and sediment control practices during construction activities to prevent the restriction of conveyances from sedimentation. *(2007 Measure)*

Prevention

- Information related to hazard mitigation has been incorporated, where appropriate, into individual Comprehensive Land Use Plans and other long-range plans. *(2007 Measure)*
- Several representatives participate in the Indiana Association of Floodplain and Stormwater Managers (INAFSM) or are certified as a Certified Floodplain Manager (CFM).
- Elkhart County has developed GIS databases which are used in land use planning decisions and can be utilized in HAZUS-MH “what-if” scenarios. *(2007 Measure)*
- The Elkhart County LEPC provides routine training regarding the proper storage, transport, and disposal of hazardous materials. *(2007 Measure)*
- Electric providers routinely complete preventative maintenance on trees within the ROW and utility corridor. *(2007 Measure)*
- Local developers routinely bury new and retrofitted utilities to minimize exposure to hazards. *(2007 Measure)*

Property Protection

- All communities 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 Elkhart County, large public events, speaking opportunities within schools, etc. *(2007 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. *(2007 Measure)*
- A draft Incident and Emergency Action Plan (IEAP) has been developed for the Goshen Pond Dam, a high hazard dam *(2007 Measure)*

4.2.2 Proposed Mitigation Practices

After reviewing existing mitigation practices, the Committee reviewed the list of mitigation ideas for each of the hazards studied as a part of this planning effort 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** – the proposed 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** – the proposed mitigation project will be technically feasible, reduce losses in the long-term, and will not create more problems than they solve.
- **Administrative** – the proposed mitigation projects may require additional staff time, alternative sources of funding, and have some maintenance requirements.
- **Political** – the proposed mitigation projects will have political and public support.
- **Legal** – the proposed mitigation projects will be implemented through the laws, ordinances, and resolutions that are in place.
- **Economic** – the proposed mitigation projects can be funded in current or upcoming budget cycles.
- **Environmental** – the proposed mitigation projects may have negative consequences on environmental assets such as wetlands, threatened or endangered species, or other protected natural resources.

Table 4-1 lists a summary of all proposed mitigation practices identified for all hazards, as well as information on the local status, local priority, benefit-cost ratio, project location, responsible entity, and potential funding source, associated with each proposed practice. The proposed mitigation practices are listed in order of importance to Elkhart County for implementation. Projects identified by the Committee to be of “high” local priority may be implemented within 5 years from final Plan adoption. Projects identified to be of “moderate” local priority may be implemented within 5-10 years from final Plan adoption, and projects identified by the Committee to be of “low” local priority may be implemented within 10+ years from final Plan adoptions. However, depending on availability of funding, some proposed mitigation projects may take longer to implement.

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 Elkhart County.

The intent of this planning effort was to identify the hazards and the extent to which they affect Elkhart County and to determine what type of mitigation strategies or practices may be undertaken to mitigate for these hazards. A FEMA-approved MHMP is required in order to apply for and/or receive project grants under the HMGP, PDM, FMA, and SRL. FEMA may require a MHMP under the Repetitive Flood Claims (RFC) program. Although this MHMP meets the requirements of DMA 2000 and eligibility requirements of these grant programs additional detailed studies may need to be completed prior to applying for these grants. **Section 5.0** of this plan includes an implementation plan for all high priority mitigation practices identified by the Committee.



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

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Table 4-1 Proposed Mitigation Practices

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Management of High Hazard Dams 1. Review regular inspection and maintenance records of high hazard dams regardless of ownership 2. Complete the IEAP Annual Exercise 3. Protect existing critical facilities in dam break inundation areas	☒ Emergency Services ☐ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☐ Earthquake ☐ Flood ☐ Hail/Thunder/Wind ☐ Tornado ☐ Winter Storm/Ice ☒ Dam Failure ☐ HazMat Incident	Ongoing – 1. IDNR receives inspection reports and IEAP updates Proposed Enhancements – 1. Ensure inspections are and reported and required improvements and repairs are completed in a timely manner 2. Complete IEAP annual exercise for existing High Hazard dams 3. Utilize inundation areas to evaluate the appropriateness of proposed locations of new critical infrastructure	High	High	Dam Owners <i>(City of Goshen)</i> EMA IDNR	Existing budget
Hazardous Materials Response Team 1. Maintain LEPC reporting and training efforts as required through SARA Title III and ensure current facility maps and response plans are on file for Tier II facilities. 2. Increase digital capabilities to share facility maps, response plans, and associated files between various response agencies	☒ Emergency Services ☐ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☒ Earthquake ☒ Flood ☒ Hail/Thunder/Wind ☒ Tornado ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	Ongoing – 1. Records are maintained for most Tier II facilities Proposed Enhancement – 1. Efforts should be strengthened to ensure tier II requirements are met. 2. The local HMRT should be maintained with adequate staff and supplies such as collaborative digital capabilities for planning, response and recovery	High	Moderate	LEPC EMA Fire Departments <i>(County, Elkhart, Goshen, Townships)</i> Tier II Facility Owners	Existing Budget
Stormwater Management 1. Minimize impacts of flooding by diverting or retaining Stormwater on site using green infrastructure practices 2. Maintain channels and regulated drains to prevent localized flooding	☐ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☐ Public Information ☐ Structural Control	☐ Earthquake ☒ Flood ☐ Hail/Thunder/Wind ☐ Tornado ☒ Winter Storm/Ice ☒ Dam Failure ☐ HazMat Incident	Ongoing – 1. Elkhart County, City of Elkhart, City of Goshen, and Town of Bristol have developed and routinely review the SWQMPs Proposed Enhancement – 1. Continue to implement practices outlined in the SWQMP and enforce applicable stormwater ordinances	High	Moderate	Stormwater Departments <i>(County, Elkhart, Goshen, Bristol)</i> Planning Departments <i>(County, Elkhart, Goshen)</i>	Existing Budget
Tree Maintenance 1. Maintain trees on public property and right-of-ways and encourage maintenance on private property to reduce the risk of downed utility lines and falling limbs	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☐ Structural Control	☒ Earthquake ☒ Flood ☒ Hail/Thunder/Wind ☒ Tornado ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	Ongoing – 1. Utility providers perform routine maintenance along ROW Proposed Enhancement – 1. Encourage private landowners to perform maintenance or avoid planting improper trees and shrubs	High	Moderate	County Highway Municipal Street Departments <i>(Elkhart, Goshen)</i> Utility Providers <i>(NIPSCO)</i>	Existing Budget Power Suppliers

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Geographic Information Systems 1. Update and coordinate GIS layers with location and attributes of critical infrastructure 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. 3. Update HAZUS-MH Earthquake model with local soil data for more accurate damage estimates	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☒ Earthquake ☒ Flood ☒ Hail/Thunder/Wind ☒ Tornado ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	Ongoing – 1. GIS is used by several communities Proposed Enhancement – 1. Coordinate consistent layers county-wide 2. Additional training for GIS staff 3. Update with local information	High <i>(coordinate layers)</i> Moderate <i>(training, soil layers)</i>	High	GIS or Planning Departments <i>(County, Elkhart, Goshen, Nappanee)</i>	Existing Budget
Transportation 1. Improve enforcement of designated hazardous materials transportation routes, permits, etc. 2. Require warning at each intersection between rail and road to reduce the potential for train/vehicular crashes	☒ Emergency Services ☐ Nat. Res. Protection ☒ Prevention ☐ Property Protection ☒ Public Information ☒ Structural Control	☐ Earthquake ☐ Flood ☐ Hail/Thunder/Wind ☐ Tornado ☐ Winter Storm/Ice ☐ Dam Failure ☒ HazMat Incident	Ongoing – 1. Hazmat routes are established 2. Some crossings have warning devices Proposed Enhancement – 1. Ensure better enforcement of routes 2. Inventory crossings and install devices as able	High <i>(transportation routes)</i> Moderate <i>(train warnings)</i>	High	Railroad Owners Municipal Street Departments <i>(Bristol, Elkhart, Goshen, Nappanee, Wakarusa)</i> Highway Department	Existing Budget
Safe Rooms and Community Shelters 1. Clearly advertise or announce locations of safe rooms and community shelters for large gatherings of people. (football games, 4H Fair, etc.) 2. Develop temporary and/or long-term shelter agreements within the County 3. Encourage safe rooms and community shelters in vulnerable locations 4. Provide educational materials and information related to safe room features and standards	☒ Emergency Services ☐ Nat. Res. Protection ☐ Prevention ☐ Property Protection ☒ Public Information ☒ Structural Control	☒ Earthquake ☒ Flood ☒ Hail/Thunder/Wind ☒ Tornado ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	Ongoing – 1. Some areas provide announcements prior to or during large gatherings 2. Local representatives work with Salvation Army to establish initial temporary shelters and fulfill needs Proposed Enhancement – 1. Increase announcements and postings indicating the location of safe areas during large gatherings and events 2. Increase the number of “pet friendly” shelters and shelters that are capable of housing moderate medically needy clients 3. During pre-construction meetings for buildings in vulnerable locations, encourage the development of a safe room or safer area 4. Create and distribute materials	High <i>(advertise)</i> Moderate <i>(shelter agreements, safe rooms, educational materials)</i>	Low	EMA Large gathering liaisons Salvation Army Red Cross	Existing budget

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Emergency Preparedness & Warning 1. Inventory mobile and permanent electronic messaging boards and develop protocol to provide current hazard information. 2. Coordinate with private business owners utilizing large dynamic message boards for business to provide messages during hazardous events and recovery efforts. 3. Improve planning and coordination among event coordinators, facility owners, and emergency response teams 4. Evaluate and utilize flood forecasting capabilities including stream gages, flood forecast maps, and flood alerts 5. Convey flood height warnings from the USGS river gages in terms the general public can understand 6. Evaluate outdoor warning sirens coverage to determine if adequate to alert population of severe weather conditions 7. Develop a centralized system for testing, maintenance, and operation of outdoor warning sirens 8. Increase awareness and participation in the NIXEL notification system 9. Propose and adopt an ordinance to require developers for new developments to pay into a siren fund. 10. Require weather radios in all critical infrastructure and encourage use by residents and businesses. 11. Improve disaster preparedness and emergency response at the local level through the CERT program 12. Prepare and distribute educational materials regarding installation methods and benefits of lightning rods	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☒ Earthquake ☒ Flood ☒ Hail/Thunder/Wind ☒ Tornado ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	Ongoing – 1. Limited number of mobile electronic messaging boards. 4. Flood forecasting utilized somewhat 8. NIXLE is being utilized 11. CERT trainings are held as feasible Proposed Enhancements – 1. Complete inventory and develop protocol 2. Coordinate with private business owners 3. Improve planning and coordination following events 4. Evaluate and increase flood forecasting abilities 5. Discuss flood height warnings in easy to understand terms 6. Complete evaluation of siren coverage 7. Develop centralized system for testing and maintenance of outdoor warning sirens 8. Increase participate in NIXLE 9. Adopt outdoor warning siren ordinance to establish fund 10. Increase use of weather radios 11. Increase number of CERT certified representatives 12. Distribute appropriate materials in appropriate locations	High <i>(message boards, Event coordinators, forecasting, flood height warnings, outdoor warning sirens)</i> Moderate <i>(NIXEL, siren fund)</i> Low <i>(radios, CERT, lightning rods)</i>	High	EMA Red Cross Floodplain Administrator <i>(County, Elkhart, Goshen, Bristol, Nappanee, Wakarusa)</i> Planning Department <i>(County, Elkhart, Goshen, Bristol, Nappanee, Wakarusa)</i>	Existing budget Grant

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 events and to populations within known hazard areas such as floodplains, downstream of a dam, near hazmat facilities, etc. <i>(2007 Measure)</i> 2. Educate the population in known hazard areas 3. Insert safety brochure or information in local utility bills or community newsletters 4. Post information/warning signs in local parks and other public gathering places explaining what to do in case of a hazard event.	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☒ Earthquake ☒ Flood ☒ Hail/Thunder/Wind ☒ Tornado ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	Ongoing – 1. Literature is provided at several public facilities and office locations as well as large public events throughout the County. Populations within the special flood hazard areas are educated through required flood insurance purchases and various website and literature pieces. Proposed Enhancement – 1. Encourage the enhancement of the messages provided to various cultural groups and neighborhoods; 2. Educate landowners within the dam inundation areas of the potential dangers and what to do in an emergency situation. Such as encourage voluntary purchase of federally-subsidized flood insurance; formalize a neighborhood or local campaign where community representatives familiar with the culture and language provide residents with emergency information and protocols. 3. Provide hazard related information through utility bill inserts or a community newsletter 4. Post information in public places that describes what should be done and where to go during a hazard event	High <i>(hazard literature)</i> Moderate <i>(known hazard areas, inserts)</i> Low <i>(post information)</i>	High	EMA Red Cross Municipal Offices <i>(County, Elkhart, Goshen, Bristol, Middlebury, Nappanee, Wakarusa)</i> Parks Departments <i>(County, Elkhart, Goshen, Bristol, Middlebury, Nappanee)</i>	Existing budget Grant

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Building Protection 1. Develop reciprocal agreements for structural inspections following hazardous events 2. Prohibit development of new critical infrastructure in known hazard areas 3. Protect existing critical structures in floodplains 4. Relocate, buyout, or floodproof (non-residential) existing non-critical structures that are subject to repetitive flooding. <i>(2007 Measure)</i> 5. Incorporate structural and non-structural seismic strengthening actions into capital improvement projects to ensure these facilities remain operational following an earthquake 6. Develop and inventory and complete an inspection of public and commercial buildings that may be particularly vulnerable to earthquake damage <i>(Will assist with NFIP compliance)</i>	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☒ Earthquake ☒ Flood ☒ Hail/Thunder/Wind ☒ Tornado ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	Ongoing – 2. There are additional requirements for construction within floodplains throughout Elkhart County. Proposed Enhancements – 1. Develop and utilize reciprocal agreements for inspections 2. Continue to prohibit development within floodplains. 3. Study and implement protection measures 4. Prioritize structures located in floodplains or other known hazard areas and work with facility owners to relocate, buyout, or floodproof these structures to a minimum of 500-year protection with flood-free access. 5. Review building codes and determine what upgrades can be made to critical structures 6. Complete an inventory of vulnerable structures	High <i>(structural inspections)</i> Moderate <i>(prohibit development, protect structures, relocate)</i> Low <i>(structural actions, inventory)</i>	Moderate	Building / Infrastructure owners EMA Floodplain Administrator <i>(County, Elkhart, Goshen, Bristol, Middlebury, Nappanee, Wakarusa)</i> Public Works <i>(County, Elkhart, Goshen, Bristol, Middlebury, Nappanee, Wakarusa)</i> Planning <i>(County, Elkhart, Goshen, Bristol, Nappanee, Wakarusa)</i> County Surveyor / Drainage Board	Grant Existing budget Municipal Bond

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Emergency Response & Recovery 1. Add mobile data terminals to emergency response vehicles 2. Maintain a database of accurate and community specific information following each hazard event including extent, magnitude, cost, response, and recovery efforts 3. Inventory positions and level of training needed to increase the personnel available to identify and assess a hazmat situation 4. Inventory the needs of local hospitals regarding towing capabilities for response trailers 5. Develop and implement a voluntary immunization program for all emergency responders, inspection staff, and families 6. Increase supply reserves for basic personal protective equipment to be utilized following a hazard event or resulting mass casualty 7. Establish procedures to alert and evacuate the population in known hazard areas	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☒ Earthquake ☒ Flood ☒ Hail/Thunder/Wind ☒ Tornado ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	Ongoing – 1. Some vehicles have mobile terminals 4. Hospitals have determined their current capabilities, needs, etc. Proposed Enhancement – 1. Complete inventory of mobile data terminal needs 2. Establish standard protocols for documentation and sharing of hazard information 3. Determine need for training 4. Complete inventory 5. Develop enhanced immunization program 6. Increase the supply 7. Establish procedures	High <i>(data terminals, database, inventory personnel, trailers)</i> Moderate <i>(immunizations, supply reserves)</i> Low <i>(evacuations)</i>	Moderate	DHS Sheriff Department Police Department <i>(Elkhart, Goshen, Bristol, Nappanee, Wakarusa)</i> Fire Departments <i>(County, Municipal, Townships)</i> Health Department	Existing budget Grant
Land Use Planning & Zoning 1. Establish hazard overlay zones in the zoning ordinance to restrict development, especially critical structures, in known hazard areas or require setbacks of noncritical structures 2. Encourage the use of innovative planning tools such as open space planning, cluster development, low impact development, greenways development, and conservation easements to limit development in known hazard areas. 3. Conduct a Safe Growth Audit of development plans and codes 4. 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	☒ Earthquake ☒ Flood ☒ Hail/Thunder/Wind ☒ Tornado ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	Ongoing – 1. Development is somewhat restricted in areas 2. Innovative planning tools are being utilized in some situations 4. Hazard information has been incorporated into some areas of the Comprehensive Land Use Plan Proposed Enhancement – 1. Increase the number of hazards considered, more definitively outline higher risk areas and those that should be avoided for future development 2. Provide stronger encouragement of innovation, especially in hazard areas 3. Conduct an audit within each community 4. Review plans and incorporate hazard planning in each area	High <i>(overlay zone, innovative planning)</i> Moderate <i>(audit)</i> Low <i>(incorporate hazard information)</i>	Moderate	Planning Departments <i>(County, Elkhart, Goshen, Bristol, Nappanee, Wakarusa)</i>	Existing Budget

MITIGATION PRACTICE	MITIGATION STRATEGY	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	RESPONSIBLE ENTITY	FUNDING SOURCE
Power Back-Up Generators 1. Investigate potential fuel reserves to ensure critical infrastructure can run on power back-up generators for extended periods of time 2. Encourage power back-up generators in all critical infrastructure 3. Retrofit public facilities and/or critical infrastructure with appropriate wiring and electrical capabilities (including transfer switch) for utilizing a large generator for power back-up	☒ Emergency Services ☐ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☒ Earthquake ☒ Flood ☒ Hail/Thunder/Wind ☒ Tornado ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	Ongoing – 1. Fuel is obtained with a verbal agreement 2. Many critical infrastructure have generators Proposed Enhancements – 1. Investigate and develop contractual agreements with fuel providers 2. Encourage new critical infrastructure is constructed with generator capabilities as feasible 3. Retrofit facilities as prioritized and as funding is available	High <i>(fuel reserve)</i> Low <i>(generators, retrofit)</i>	Low	EMA Building Owners	Existing budget Grant
Community Rating System 1. Reduce flood insurance premiums through increased participation or advancement in the NFIP's CRS Program. <i>(2007 Measure)</i> <i>(Will assist with NFIP compliance)</i>	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☒ Earthquake ☒ Flood ☒ Hail/Thunder/Wind ☒ Tornado ☒ Winter Storm/Ice ☒ Dam Failure ☒ HazMat Incident	Ongoing – Proposed Enhancement – 1. Participation from Elkhart County or other municipalities	Moderate	Moderate	Floodplain Administrator <i>(County, Elkhart, Goshen, Bristol, Middlebury, Nappanee, Wakarusa)</i>	Existing budget Grant
Floodplain Management 1. Conduct detailed flood protection studies for focused flooding problem areas and/or areas with repetitive flooding problems 2. Support FEMA flood depth mapping (RiskMAP) to better understand the flood risk potential 3. Complete a Floodplain Prioritization Study for unstudied streams in Elkhart County 4. Encourage restoration of the natural stream corridor in new and redevelopment projects 5. Conduct detailed hydraulic analyses of areas with repetitive flooding problems, unstudied, understudied, and unnumbered Zone A streams to determine exact floodplain boundaries. <i>(2007 Measure)</i> 6. Complete fluvial erosion hazard mapping to identify and protect critical infrastructure that may be impacted by natural stream movement <i>(Will assist with NFIP compliance)</i>	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	☐ Earthquake ☒ Flood ☐ Hail/Thunder/Wind ☐ Tornado ☒ Winter Storm/Ice ☒ Dam Failure ☐ HazMat Incident	Ongoing – 1. Flood studies are completed as funding becomes available. 2. RiskMAP studies are currently underway Proposed Enhancements – 1. Complete analyses as appropriate to determine exact floodplain boundaries and flood depth grid mapping to include all flood prone areas within the County. Implement flood protection study recommendations as feasible 2. Participate in RiskMAP process and utilize products for future planning, growth, and ordinance development 3. Complete a prioritization study 4. Provide incentives for restoration 5. Conduct additional studies 6. Investigate fluvial hazard mapping process	Moderate <i>(flood protection studies, depth mapping, prioritization study, restoration)</i> Low <i>(analyses, fluvial erosion)</i>	Moderate	Floodplain Administrator <i>(County, Elkhart, Goshen, Bristol, Middlebury, Nappanee, Wakarusa)</i> Planning <i>(County, Elkhart, Goshen, Bristol, Nappanee, Wakarusa)</i> County Surveyor / Drainage Board	Existing budget Grant

CHAPTER 5

IMPLEMENTATION PLAN

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

5.1 BUILDING PROTECTION

Develop reciprocal agreements for structural inspections following hazardous events

- Investigate the current staffing capabilities for each community to complete structural inspections following hazard events.
- Determine staffing needs based on investigations
- Develop agreements for municipal staff members to complete post hazard event inspections in a partner municipality

5.2 EMERGENCY PREPAREDNESS & WARNING

Inventory mobile and permanent electronic messaging boards and develop protocol to provide current hazard information.

- Inventory each community's mobile and permanent message boards
- Determine need for additional mobile boards based on current availability and locations where boards could be utilized
- Secure funding and purchase additional boards

Coordinate with private business owners utilizing large dynamic message boards for business to provide messages during hazardous events and recovery efforts.

- Inventory private message boards and determine contact person
- Develop partnership through which messages may be displayed related to pre or post hazard event information

Improve planning and coordination among event coordinators, facility owners, and emergency response teams

- Develop contact list for large facility or event coordinators within the County and municipalities
- Provide contacts with example event plans related to hazard preparedness, warning, and response activities
- Conduct tabletop exercises through which event coordinators and response agencies may practice coordination and efforts

Evaluate and utilize flood forecasting capabilities including stream gages, flood forecast maps, and flood alerts

- Inventory current capabilities of active stream gages, and those with the AHPS abilities
- Review floodplain maps and possibilities for flooding within each municipality
- Prioritize locations for needed additional gages or capabilities for flood forecasting and warning between municipalities
- Develop protocols for warnings between municipalities

Convey flood height warnings from the USGS river gages in terms the general public can understand

- Review current warnings received from NWS or AHPS gages
- Produce materials in lay terms
- Provide materials to those in hazard areas and in languages needed to adequately convey the proper message

Evaluate outdoor warning sirens coverage to determine if adequate to alert population of severe weather conditions

- Review existing outdoor warning siren locations and coverage areas
- Prioritize uncovered areas based on presence of critical infrastructure, population, or large employers
- Secure funding and install additional sirens as prioritized

Develop a centralized system for testing, maintenance, and operation of outdoor warning sirens

- Review existing individual testing protocols and maintenance scheduled
- Review existing capabilities of each system and determine which agency or municipality has the best system for collaborating or creating a redundant system
- Develop and practice protocols for the new testing, maintenance, and operation procedures

5.3 EMERGENCY RESPONSE AND RECOVERY

Add mobile data terminals to emergency response vehicles

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

Maintain a database of accurate and community specific information following each hazard event including extent, magnitude, cost, response, and recovery efforts

- Determine data collection and reporting for each municipality
- Create one database in which all information can be stored for reporting purposes
- Develop fact sheets for the new system and specifics about how and what details need to be collected
- Utilize during a table top exercise

Inventory positions and level of training needed to increase the personnel available to identify and assess a hazmat situation

- Review existing staffing of each response agency
- Determine if additional staffing or training is needed to provide better coverage for response
- Hire additional staff or provide additional training as funding is available

Inventory the needs of local hospitals regarding towing capabilities for response trailers

- Coordinate with hospitals and inventory which facilities have response trailers
- Determine towing needs to utilize trailers properly
- Coordinate with staff for use of tow vehicle or secure funding to purchase a tow vehicle

5.4 GEOGRAPHIC INFORMATION SYSTEMS

Update and coordinate GIS layers with location and attributes of critical infrastructure.

- Review current GIS layers and attribute information
- Include additional data as obtained relative to each critical infrastructure
- Coordinate access to layers for each community within the County

5.5 HAZARDOUS MATERIALS RESPONSE TEAM

Increase digital capabilities to share facility maps, response plans, and associated files between various response agencies

- Determine existing capabilities and their system's ability to coordinate or collaborate with other agency's system
- Develop additional sharing capabilities

Maintain LEPC reporting and training efforts as required through SARA Title III and ensure current facility maps and response plans are on file for Tier II facilities.

- Ensure reports and training exercises are completed as required.
- Prepare listing of all Tier II facilities within Elkhart County.
- Obtain facility maps and response plans

5.6 LAND USE PLANNING AND ZONING

Establish hazard overlay zones in the zoning ordinance to restrict development, especially critical structures, in known hazard areas or require setbacks of noncritical structures

- Review existing known hazard areas
- Coordinate between response agencies and planning departments to develop proposed overlay zones
- Propose and adopt an ordinance establishing hazard overlay zones

Encourage the use of innovative planning tools such as open space planning, cluster development, low impact development, greenways development, and conservation easements to limit development in known hazard areas.

- Review proposed hazard overlay zones or areas most at risk
- Review existing innovative planning tools and determine which are appropriate for each hazard overlay zone
- Provide educational materials to developers, contractors, planners, etc. to highlight the practices and how they assist in reduction of potential impact from hazard events

5.7 MANAGEMENT OF HIGH HAZARD DAMS

Review regular inspection and maintenance records of high hazard dams regardless of ownership

- Coordinate with all dam owners and IDNR to request dam inspections and maintenance records are provided to the EMA
- Review inspections and maintenance records to ensure potential hazards are being mitigated as much as possible
- If necessary, collaborate with dam owners to seek funding for needed actions such as inspections or maintenance to protect the downstream community

Complete the IEAP Annual Exercise

- Collaborate with the dam owner, engineer, and IDNR who assisted with the development of the draft IEAP
- Conduct an annual exercise of the IEAP
- Review actions and the success of the exercise
- Follow up with changes to the IEAP based on the exercise

Protect existing critical facilities in dam break inundation areas

- Review draft IEAP potential inundation mapping to determine which critical facilities are located within the hazard area
- Coordinate with structure owners to alert them of their location within a potential inundation area
- Prioritize structures for studies or flood protection measures
- Complete protection measures as funding allows

Complete an IEAP for existing and new high hazard dams.

- Contact the dam owner and provide information on developing an ERP for the dam.
- Encourage detailed inundation mapping to better assess the risk area downstream of the dam.
- Prepare the IEAP and provide training to appropriate planning and response agencies within the area.
- Partner with the dam owner and IDNR to provide outreach materials to property owners within the inundation area.

5.8 POWER BACK-UP GENERATORS

Investigate potential fuel reserves to ensure critical infrastructure can run on power back-up generators for extended periods of time

- Review current partnerships for fuel
- Determine potential fuel needs for each agency or municipality
- Develop and sign agreements for fuel to be delivered or available during hazard preparedness, response, and recovery efforts.

5.9 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 events and to populations within known

hazard areas such as floodplains, downstream of a dam, near hazmat facilities, etc. (2007 Measure)

- Distribute literature at large public events throughout Elkhart County.
- Provide literature at all municipal offices as appropriate.
- Evaluate additional media outlets and utilize as appropriate (social media, print, billing inserts, etc.)

5.10 SAFE ROOMS AND COMMUNITY SHELTERS

Clearly advertise/announce location of safe rooms and community shelters for large gatherings of people (Football games, 4H Fair, etc.)

- Collaborate with local entities responsible for large outdoor gatherings (sporting events, festivals, etc.)
- Determine location of nearest shelter area and personnel responsible for ensuring the shelter is available during the outdoor event.
- Announce or advertise the location of shelter during the event.

5.11 STORMWATER MANAGEMENT

Minimize impacts of flooding by diverting or retaining Stormwater on site using green infrastructure practices

- Evaluate and prioritize areas prone to adverse flooding and/or ponding
- Investigate options for mitigation practices
- Maintain strength of current ordinances or revise the ordinances to allow for various green infrastructure practices

Maintain channels and regulated drains to prevent localized flooding

- Improve routine inspections of channels and regulated drains
- Prioritize evaluations of channels and regulated drains
- Allocate necessary funding to complete high priority actions

5.12 TRANSPORTATION

Improve enforcement of designated hazardous materials transportation routes, permits, etc.

- Review existing hazmat routes within the County
- Provide information to law enforcement agencies regarding hazmat transportation routes

- Determine if more stringent penalties are needed to reduce the occurrence of vehicles traveling beyond the approved routes

5.13 TREE MAINTENANCE

Maintain trees on public property and right-of-ways and encourage maintenance on private property to reduce the risk of downed utility lines and falling limbs

- Review protocols for tree maintenance
- Prioritize areas in need of maintenance or areas with the highest potential for the greatest impact of falling limbs
- Complete proactive tree maintenance as staffing and funding allow
- Provide educational materials regarding proper tree and shrub planting to reduce the risk of impact to overhead power lines

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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 Elkhart County, it is important that implementation of this MHMP be monitored, evaluated, and updated. The EMA Director is ultimately responsible for the MHMP. As illustrated in Section 4.2 Mitigation Practices, this Plan contains mitigation program, projects, and policies from multiple departments within each NFIP community. Depending on grant opportunities and fiscal resources, mitigation practices may be implemented independently, by individual NFIP communities, or through local partnerships. Therefore, the successful implementation of this MHMP will require the participation and cooperation of the entire Committee to successfully monitor, evaluate, and update the Elkhart 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 7** will be helpful to track any progress, successes, and problems experienced.

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

DMA 2000 requires local jurisdictions to update and resubmit their MHMP within 5 years (from the date of FEMA approval) to continue to be eligible for mitigation project grant funding. In early 2021, 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 Elkhart 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 Elkhart County and to provide them an opportunity for review and comment of the draft MHMP. A media release will be issued providing information related to the update, the planning process, and details of the public meeting.

6.2 INCORPORATION INTO EXISTING PLANNING MECHANISMS

REQUIREMENT §201.6(c)(4)(ii):

[The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as the comprehensive or capital improvements, when appropriate.

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

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

6.3 CONTINUED PUBLIC INVOLVEMENT

REQUIREMENT §201.6(c)(4)(iii):

[The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

Continued public involvement is critical to the successful implementation of the Elkhart County MHMP. Comments gathered from the public on the MHMP will be received by the EMA Director and forwarded to the MHMP Committee for

discussion. Education efforts for hazard mitigation will be the focus of the annual Severe Weather Awareness Week as well as incorporated into existing stormwater planning, land use planning, and special projects/studies efforts. Once adopted, a copy of this Plan will be available for the public to review in the EMA Office and the Elkhart County website.

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



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

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