Kosciusko County Multi-Hazard Mitigation Plan Update

January 2026

Prepared for:

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EXECUTIVE SUMMARY

The Federal Emergency Management Agency (FEMA) defines the disaster life cycle as the process through which emergency managers respond to disasters when they occur; help people and institutions recover from them; reduce the risk of future losses; and prepare for emergencies and disasters. In **Figure i** each phase in the Disaster Life Cycle; Mitigate, Prepare, Respond, and Recover has a description of the phase as well as a time frame within the disaster cycle. Although each of the phases is visually tied to a specific time within the life cycle of the disaster, mitigation can take place throughout much of the disaster life cycle. The Kosciusko County Multi-Hazard Mitigation Plan (MHMP) update focuses on the mitigation activities that may be implemented throughout the disaster life cycle.

Figure i: 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.

The overall goals of the Kosciusko County MHMP, which align closely with the State of Indiana MHMP, are:

1) Lessen the impacts of disasters and enhance community resilience.
2) Minimize the loss of life and injuries caused by disasters.
3) Promote mitigation activities both prior to and following a disaster.

To achieve the stated goals the community strategy includes the following:

1) Lessen the impacts of disasters and enhance community resilience by:
   a. Supporting resilience opportunities within the community
   b. Incorporating the MHMP into local ordinances, local planning efforts, and the community comprehensive plans
   c. Evaluating and strengthening collaboration among organizations
   d. Making sure essential facilities can withstand disasters
   e. Supporting the National Flood Insurance Program (NFIP)
   f. Identifying opportunities to reduce repetitive loss incidents

2) Minimize the loss of life and injuries caused by disasters by:
   a. Improving warning systems for the residents
   b. Developing public awareness and outreach programs
   c. Improving shelter availability
   d. Improving education and training for emergency personnel and officials
   e. Developing ways to provide education, awareness, and warning of disasters to the underserved populations

3) Promote mitigation activities prior to and following a disaster by:
   a. Ensuring better communication between federal, state, and local officials
   b. Seizing opportunities to buy out properties, floodproof buildings, or improving building codes
   c. Conducting new studies and/or research opportunities to reduce impacts from disasters and prepare for future events anticipating the impacts of our changing climate.
   d. Conducting outreach efforts to educate community members about the risks and hazards in their area as well as encouraging the implementation of a variety of mitigation actions.

For NFIP communities to be eligible for future mitigation funds, they must either adopt their own MHMP or participate in the development of a multi-jurisdictional MHMP. Further, it is required that local jurisdictions review, revise, and resubmit the MHMP every five years. The planning process used to update the Kosciusko County MHMP satisfies the requirement of a multi-jurisdictional plan. The following are incorporated communities which have provided information, attended meetings, and participated in the planning process.

- Kosciusko County
- City of Warsaw
- Town of Burket
- Town of Claypool
- Town of Etna Green
- Town of Leesburg
- Town of Mentone
- Town of Milford
- Town of North Webster
- Town of Pierceton
- Town of Sidney
- Town of Silver Lake
- Town of Syracuse
- Town of Winona Lake

During planning committee meetings, those in attendance revisited existing the latest edition of the Kosciusko County MHMP and identified new critical facilities 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. Keeping in mind the ever-changing climate, the team also examined the needs of underserved populations that may be more vulnerable to the impacts of the listed hazards. Meetings were conducted with key groups such as city planners, health department specialists, representatives of organizations serving the underserved populations and various emergency responders. Their information has been incorporated into this MHMP update. This plan update will examine each of the hazards with data from the past five years, where possible.

The review of hazards and risks is based on the methodology described in the Local Mitigation Policy Guide FP 206-21-0002, effective April 19, 2023. The plan identifies the hazards assessed, the nature of each hazard including historic occurrences, vulnerabilities, and the relationship to other hazards. Using a ranking tool known as the Calculated Risk Priority Index (CPRI), the planning team scored each of the hazards. **Table i** lists the hazards in the plan, the rank and the CPRI scores. The CPRI scores reflect the hazards of most concern by the planning team members and change from one plan to another based on recent experiences, changes in community demographics, and challenges.

Table i: Summary of CPRI Scores and Ranking for All Hazards

Hazard	2025 Rank	CPRI Score
Hail, Thunder, and Windstorms	1	2.72
Hazardous Materials Incident	2	2.68
Winter Storms and Ice	3	2.37
Tornado	4	2.36
Fires and Wildfire	5	2.32
Drought	6	2.15
Flood	7	2.06
Extreme Temperature	8	1.88
Dam and Levee Failure	9	1.54
Earthquake	10	1.44
Land slide, Land Subsidence, and Fluvial Erosion	11	1.01

Lastly, the plan concludes with a discussion about mitigation actions. The MHMP lists a variety of mitigation actions the planning team members would like to accomplish within the next five years to enhance the resilience of Kosciusko County. In addition, it celebrates the mitigation successes from the previous MHMP plans and community actions which contribute to mitigating the various risks and hazards identified.

This MHMP is a living document which has a five-year life span. During the next five years, Kosciusko County and the incorporated communities that adopt this plan will work to complete the mitigation actions as well as regularly noting items for the 2030 MHMP update. The County EMA and planning team members will also use tools contained in the Appendices, or similar documents, to track progress, and note changes that may impact community resilience.

1.0 INTRODUCTION

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, shown in **Figure 1** includes four phases:

Figure 1: Disaster Life Cycle

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)

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)

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

1.1 PROJECT SCOPE & PURPOSE

REQUIREMENT §201.6(d)(3):

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

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 resources. (44 CFR §201.1(b))

A FEMA-approved MHMP is required to apply for and/or receive project grants under the Building Resilient Infrastructure and Communities (BRIC), Hazard Mitigation Grant Program (HMGP), and Flood Mitigation Assistance (FMA). Additional detailed studies may need to be completed prior to applying for these grants even though this plan meets the requirements of DMA 2000 and eligibility requirements of the above listed grant programs. Acronyms referenced throughout this plan are contained in **Appendix 1**.

The NFIP requires participating communities either to adopt their own MHMP or participate in the development of a multi-jurisdictional MHMP to be eligible for future mitigation funds. 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. Local jurisdictions are required to review, revise, and resubmit the MHMP every five years. The MHMP updates must demonstrate that progress has been made in the last five years to fulfill the commitments outlined in the previously approved MHMP. The update is not intended to be an annex to the previously approved plan; it stands on its own as a complete and current MHMP. The Kosciusko County MHMP update is a multi-jurisdictional planning effort led by the Kosciusko County EMA. This plan was prepared in partnership with Kosciusko County (referred to in this document as county), the City of Warsaw (referred to in this document as city), and the Towns of Burket, Claypool, Etna Green, Leesburg, Mentone, Milford, North Webster, Pierceton, Sidney, Silver Lake, Syracuse, and Winona Lake. The City of Nappanee participated in the Elkhart County plan and will not be participating in this multi-jurisdictional planning effort.

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 jurisdictions had an equal opportunity for participation and representation in the planning process, the process used to update the Kosciusko County MHMP satisfies the requirements of DMA 2000 in which multi-jurisdictional plans may be accepted.

The Community Rating Service (CRS) program is a voluntary incentive program that recognizes and encourages community floodplain activities that exceed the minimum NFIP requirements. As a result, flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions that meet the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote education and awareness of flood insurance. Savings on flood insurance premiums are proportional to the points assigned to various activities. A minimum of 500 points is necessary to enter the CRS program and receive a 5% flood insurance premium discount. This MHMP could contribute as many as 374 points toward participation in the CRS. At the time of this planning effort, the City of Warsaw, and the towns of Winona Lake, Mentone, Milford (Milford Junction), North Webster, Silver Lake, Syracuse, and Kosciusko County participated in the NFIP. Additionally, the towns of Milford, North Webster, Syracuse, and the county currently participate in the CRS program. Throughout this plan, activities that could count toward CRS points are identified with the NFIP/CRS logo. (**Figure 2**) **Appendix 8** breaks down how this MHMP can contribute toward participation in the CRS.

Figure 2: INFIP/CRS Logo

1.2 ANALYSIS PROCESS

REQUIREMENT §201.6(c)(1):

The plan shall document the planning process used to prepare the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Preparation for the Kosciusko County MHMP update began when IDHS notified the county of the FEMA grant award and availability of grant funds. The plan updating process began immediately after the hiring of Christopher B. Burke Engineering, LLC. and the planning process to update the 2019 MHMP. This included a review period by IDHS and FEMA for the draft MHMP update, and time for Kosciusko County and communities to adopt the final MHMP update.

1.2.1 Planning Committee and Involvement of Other Interested Parties

In June of 2024, the EMA began to compile 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 activities; have the tools necessary to reduce the impact of future hazard events; or served as a representative on the prior planning committee which met in 2017. The surrounding counties of Noble, Whitley, Wabash, Fulton, Marshall, and Elkhart were given an opportunity to provide input and feedback to the plan throughout the planning process and during draft review. No comments or corrections were received from the neighboring EMA offices. **Table 1** lists the individuals that actively participated on the committee and the entity they represented.

Table 1: Kosciusko County Planning Committee

Name	Title	Agency	Representing
Craig Allebach	Manager	Town of Winona Lake	Winona Lake
Norma Bauer	Days Director	Cardinal Services - Warsaw	Warsaw
Shelby Bonner	Operations Supt.	Indiana American Water	Utility
Jim Bumbaugh	Town Marshal	Town of Pierceton	Pierceton
Greg Church	Chief	North Webster Police Dept.	North Webster
Brad Clayton	Watershed Conservationist	The Watershed Foundation	NGO
Ed Clayton	Board Member	Tippecanoe Twp. Fire Territory	North Webster
John Conley	Chief	Silver Lake Fire Dept.	Silver Lake
Brandon Cordell	MS4 Coordinator	Warsaw Stormwater Utility	Warsaw
Mike Cox	PIO	Winona Lake Fire Dept.	Winona Lake
Brian Davison	Utility Manager	City of Warsaw Wastewater	Warsaw
Larry Hayden	Asst. Utility Manager	City of Warsaw Wastewater	Warsaw
Andy Heltsel	Assistant Planner	Kosciusko Co. Planning Dept.	County
Bill Holder	GIS Director	Kosciusko County GIS	County
Jon Justice	Operations Manager	Kosciusko County REMC	REMC
Troy Kintzel	Asst. Superintendent	Kosciusko Co. Highway Dept.	County
Susan Klinefelter	Member	Etna Green Town Council	Etna Green
David May	Officer	North Webster Police Dept.	North Webster
Todd Haines	Chief	Milford Fire Department	Milford

Name	Title	Agency	Representing
Jason McGlennen	Town Marshall	Town of Silver Lake	Silver Lake
Kevin McSherry	Chief	Burket Fire Department	Burket
Donald R. Miller	Councilman	Town of Claypool	Claypool
Monte Moore	Volunteer	American Red Cross	NGO
Aaron Ott	City Engineer	City of Warsaw	Warsaw
Lisa Parrett	Clerk Treasurer	Town of Sidney	Sidney
Mitch Rader	Councilman	Town of Leesburg	Leesburg
Nathan Rhoades	Chief	Pierceton Fire Department	Pierceton
Kristin Rude	General Manager	KABS - Cardinal Services	Transportation
Mickey Scott	Chief	Turkey Creek Fire Department	Syracuse
Kip Shuter	Director	Kosciusko County EMA	County
Justin Taylor	Planning Director	City of Warsaw	Warsaw
Amy Watts	ED Director	Lutheran Kosciusko Hospital	Hospital
David Wilkinson	Town Manager	Town of Syracuse	Syracuse
Amanda Yaprak	Clerk	Town of Mentone	Mentone
Mike Yazel	Chief	Mentone Fire Dept.	Mentone
Caitlin Yoder	Watershed Coord.	Winona Lake	Winona Lake

Members of the committee participated in the MHMP Update through various planning meetings as well as outside group meetings where mitigation opportunities are supported or addressed. During the MHMP meetings, the committee:

- Reviewed the State's mitigation goals and updated the local mitigation goals.
- Reviewed the most recent local hazard data, vulnerability assessment, and maps.
- Comparatively evaluated and ranked the hazards based on probability of occurrence, impact, warning time, and duration of the hazard event.
- Revisited existing (in the prior MHMP) critical and essential infrastructure and identified new critical infrastructure and local hazards.
- Evaluated the effectiveness of existing mitigation measures and identified new mitigation projects.
- Reviewed materials for public participation.

A sign-in sheet recorded those present at each meeting to document participation. Meeting agendas and summaries are included in **Appendix 2**. Members of the committee also reviewed a draft MHMP, provided comments and suggestions, and assisted with adoption of the Kosciusko County MHMP update.

1.2.2 Public Involvement

REQUIREMENT §201.6(c)(1):

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

The Kosciusko County EMA Director kept the public up to date by posting a draft of the Kosciusko County MHMP to the Kosciusko County website (Home / Kosciusko County, Indiana) and the EMA Facebook page (20+) Facebook or (facebook.com/KosCoEMA) for public review and comment. No comments or corrections were received from the public or the committee. The media release, web page posting, and any comments received are included in **Appendix 3**.

Neighboring Emergency Managers from Noble, Whitely, Wabash, Fulton, Marshall, and Elkhart Counties were invited to attend both the planning meetings as well as being provided with an opportunity to review the draft plan.

1.3 PLANS, STUDIES, REPORTS, AND TECHNICAL INFORMATION

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

This planning effort includes review of community specific plans and studies for incorporation in this plan update. For this planning effort, the following materials (among others) were discussed and utilized:

- MHMP Kosciusko County (2019)
- Kosciusko County Comprehensive Plan (2022)
- City of Warsaw Comprehensive Plan (2015)
- Winona Lake Comprehensive Plan (2019)
- Town of Syracuse Comprehensive Plan (2017)
- Kosciusko County GIS data
- Kosciusko County Master Parks Plan (2023-2027)
- City of Warsaw Parks & Recreation Master Plan (2022-2027)
- Town of Winona Lake Parks & Recreation Master Plan (2021-2026)
- Watershed Management Pans – Upper Middle Eel River, Walnut Creek – Tippecanoe River, and Upper Tippecanoe
- Flood Insurance Rate Maps and Flood Insurance Studies – FEMA and INFIP

The above plans and ordinances target many of the same issues and plans included in this report. The MHMP has and continues to be used to inform decision makers during preparation of various documents in the county. This MHMP planning effort sought to use existing plans to inform the planning team about mitigation actions that would support the community development, as outlined in the comprehensive plans, and to support and/or enhance existing ordinances. The Kosciusko County Building and Planning Department has jurisdiction over the unincorporated rural areas of Kosciusko County. The City of Warsaw as well as the towns of Winona Lake and

Syracuse have their own Building Departments. Kosciusko County, City of Warsaw, and the towns of Winona Lake and Syracuse have comprehensive plans.

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

- Indiana Department of Natural Resources, Division of Water – Flood insurance policies, claims, and payment information; NFIP Participation; IDNR listed Dams and associated records; Dam Breach Inundation App; and IN Floodplain Information Portal.
- Indiana Department of Natural Resources, Other Divisions – Mining Records
- Indiana Geologic Survey and Water – Earthquakes in Indiana; Liquefaction Potential Map: Karst Regions and Maps of Karst locations
- Indiana Geographic Information Office - IndianaMa*p*
- Indiana Department of Homeland Security – Current Fire and Building Code Information
- FEMA, Region V – Repetitive loss structure counts and insurance payments
- Midwest Regional Climate Center – Climate Trends; County specific climate reports
- National Weather Service – Indianapolis Weather Forecast Office – Confirmation of WSSI tool; local storm reports; weather event photos.

The CRS program credits NFIP communities with a maximum of 170 points up to 15 points for organizing a planning committee composed of staff from various departments; up to 120 points for involving the public in the planning process; and up to 35 points for coordinating among other agencies and departments to resolve common problems relating to flooding and other known natural hazards.

2.0 COMMUNITY INFORMATION

Figure 3: Kosciusko County Location

Kosciusko County, Indiana, founded in 1837, has a rich history and natural beauty. Originally inhabited by the Miami and Potawatomi tribes, the county was named after General Thaddeus Kosciuszko, a Revolutionary War hero from Warsaw, Poland. Kosciusko County has 17 townships and is a blend of picturesque landscapes and vibrant communities. Warsaw, the county seat, is renowned as the "Orthopedic Manufacturing Capital of the World," highlighting its significant contribution to the medical device industry since the late 19th century. The county's numerous glacial lakes, including the largest, Lake Wawasee, and the deepest, Lake Tippecanoe, have made it a popular destination for recreation and tourism. This blend of natural beauty and industrial prowess forms the backbone of Kosciusko County's identity and economic success.

Located in north-central Indiana, Kosciusko County features a mostly level landscape, dotted with numerous lakes primarily in the northwest region. Covering 538 square miles, the county's land is predominantly used for agriculture. The terrain consists of low rolling hills interspersed with bodies of water and drainage systems, making it suitable for both agriculture and urban development. The county's highest point, at 1,025 feet above sea level, is a hill northeast of Dewart Lake. The Tippecanoe River flows westward through the central part of the county, while the Eel River courses southwestward through the southeastern corner. The location of the county within the State of Indiana is identified in **Figure 3**.

2.1 POPULATION AND DEMOGRAPHICS

The US Census Bureau estimates the 2023 population for Kosciusko County was 80,364 which ranks 22 of 92 in the state. From 2010 to 2020, the county's population increased by approximately 2,817 people, which represents a 3.64% increase. The population reached its peak in 2022 at 80,826. However, the growth rate has shown signs of stagnation in recent years. For example, between 2021 and 2022, the population increased by only 0.63%, while the previous year saw a growth of just 0.21%. The growth rate for the past year (2023) was a slight decline at -0.25%, indicating potential stagnation or minor decrease in the near future. The City of Warsaw is the county's largest incorporated area, accounting for 20.0% of the county's population (16,111 people). Kosciusko County is a predominantly white community, making up 95.1% of the county's racial demographics. The county is 91.1% non-Hispanic and 8.9% Hispanic.

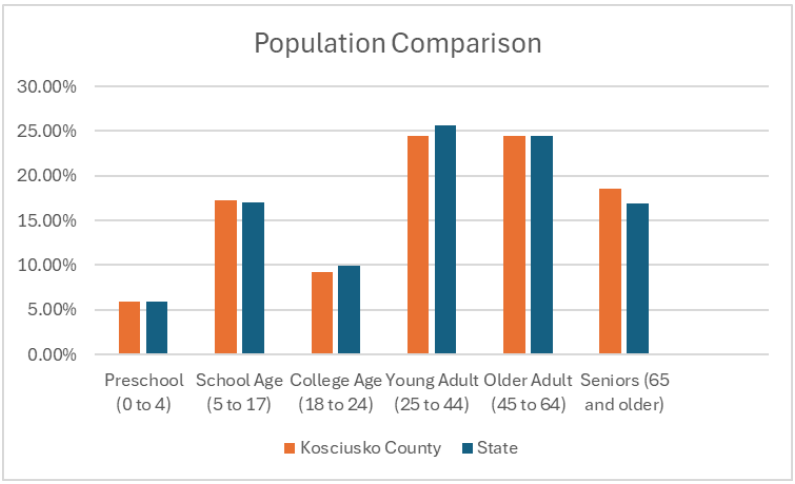


Figure 4: Age Distribution Compared to State Population

In 2022, the median age of the population in the county was 39.1 years of age. That is 0.9 years older than the statewide median age of 38.2. The largest demographic age group in the county is both the Older Adults (45 to 64) and Young Adult age groups (25 to recovered to its 44) as both make up 24.5% of the county's population. The second largest is the Seniors group (65 and older) at 18.6%. The third

largest age group is the school age group (5 to 17) at 17.3%, followed by the college age group (18 to 24) at 9.2% and finally the preschool age group (0 to 4) at 5.9%.

Figure 4 shows the age distribution totals compared to the state. Kosciusko County age distribution is similar when compared to the state with many older and younger adult populations and a smaller number of children and young adults. As the senior members of the community continue to age their vulnerability to various hazards will increase as well.

The approximate median household income in 2022 was reported to be $ 71,611 while the poverty rate in the same year was reported at 10.7% county-wide. In total, 5,670 (18.1%) households are married with children, and 10,551 (33.7%) households are married without children. There are 2,742 single parents in Kosciusko County with the remaining 8,543 (27.3%) of the population living alone.

Within the county, 87.8% of the adults older than 25 have reportedly completed a High School education. Further, 24.1% of those same adults have also completed a Bachelor of Arts or higher degree.

2.2 EMPLOYMENT

US Census data indicates that of the Kosciusko County workforce, the largest employment sector with the county is “nonfarm” sector 97.3%, followed by Private at 91.0%. The “Other Private” category represents the largest group with the Private Sector Employment category at 21.8%. “Other Private” is a catchall category which addresses any employment category not otherwise reported on the census questionnaires. Manufacturing is the third largest with 28.6%. The total resident labor force according to estimates in 2023 is 40,657 (with 1,370 unemployed) and as of March 2024, unemployment rate of 4.3%. The top 10 employers within Kosciusko County according to Hoosiers by the Numbers are:

1. Zimmer Biomet Holdings Inc (Warsaw)
2. LSC Communications (Warsaw)
3. Biomet Manufacturing LLC (Warsaw)
4. Newmar Corp (Nappanee)
5. Depuy Joint (Warsaw)
6. Bowen Center (Warsaw)
7. Dalton Corp (Warsaw)
8. Cardinal Services Inc (Warsaw)
9. Tecomet Medical (Warsaw)
10. Kosciusko Community Hospital (Warsaw)

The Kosciusko Economic Development Corporation (KEDC) is addressing housing needs by creating market-rate workforce housing near employment centers. This initiative is supported by $2M in funding from the Indiana Housing and Development Authority and Zimmer Biomet. Key projects include the rehabilitation of the former Gatke warehouse and the Millworks mixed-use development, which aim to provide a mix of housing, office, and commercial spaces. These efforts are expected to reduce commute times, attract new residents, and support local businesses, thereby enhancing the county's overall resilience and economic stability.

2.3 TRANSPORTATION AND COMMUTING PATTERNS

Several major transportation routes pass through Kosciusko County and the municipalities within. US Route 30, and State Roads 10, 13, 14, 15, 19, 25 serves as main routes. There are two railways (Norfolk Southern and Central Railroad and CSX RR) in the county. **Figure 5** shows the location of each of the transportation routes.

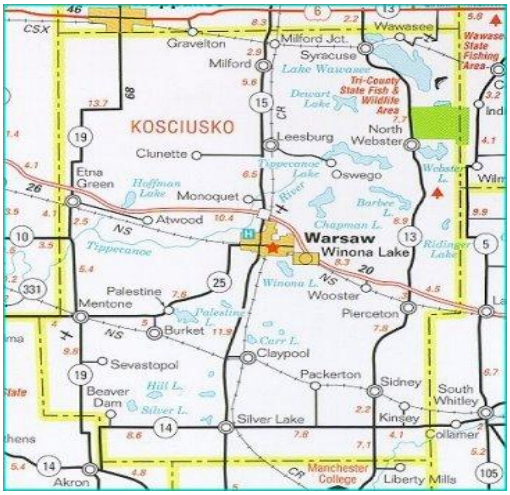


Figure 5: Transportation Routes in Kosciusko County

According to STATSIndiana, 5,047 people commute into Kosciusko County daily with approximately 29.96% travel from Whitley County. Furthermore, approximately 6,129 Kosciusko County residents commute to other counties, with Elkhart County receiving the greatest percentage of commuters from Kosciusko County at 70.46%. The impacts of disaster events on the commuting members of the workforce can have cascading impacts both within the county as well as in neighboring communities where jobs are located.

Figure 6 indicates the numbers of workers 16 and older who do not live within Kosciusko County but commute into the county for employment purposes. **Figure 7** indicates the number of Kosciusko County residents 16 and older that commute out of the county for employment.

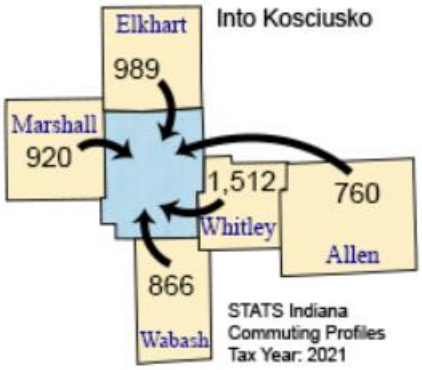


Figure 6: Commuters into Kosciusko County

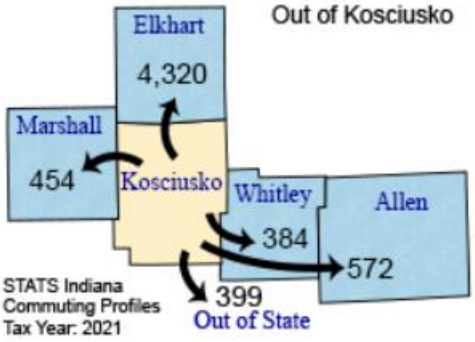


Figure 7: Commuters out of Kosciusko County

2.4 CRITICAL AND ESSENTIAL 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 and essential facilities are the assets, systems, and networks, whether physical or virtual, so vital to 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.

Figure 8: Kosciusko County Courthouse

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.

Utilizing information from the Kosciusko EMA and GIS Department offices alongside FEMA data, 394 critical and essential facilities were identified in the county. There may be additional facilities which were not identified due to insufficient data. **Figure 8** shows the Kosciusko County Courthouse as one of the critical facilities. **Table 2** provides the number and facility type of each of the critical and essential facilities identified.

Table 2: Critical and Essential Facilities

#	Facility Type	#	Facility Type
2	Airports	14	Hospital and Health Care Facilities
32	Communication Towers	25	Large Employer
31	Dams	9	Police Departments
22	Daycare Facilities	87	Schools
1	EMA	12	Wastewater Treatment Plants
11	Emergency Medical Services	11	Water Storage
14	Fire Departments	9	Water Treatment Plants
114	Hazardous Material Handler		

Information provided by the EMA, Kosciusko County GIS provider, and the MHMP planning committee members was utilized to identify the types and locations of critical structures throughout Kosciusko County. Draft maps were provided to the EMA, along with the planning committee for their review and comments. All comments were incorporated into maps and associated databases.

Exhibit 1 identifies the critical and essential facilities throughout the unincorporated parts of the county and the individual municipalities. **Appendix 4** lists the critical and essential facilities in Kosciusko County by community. Non-critical structures include residential, industrial, commercial, and other structures that do not meet the definition of a critical facility and are not required for a community to function. The development of this MHMP focused only on critical and essential structures; non-critical structures are neither mapped nor listed.

2.5 MAJOR WATERWAYS AND WATERSHEDS

According to the United States Geological Survey (USGS), there are 101 waterways in Kosciusko County, which are listed in **Appendix 5**. The county's main waterways are Lake Wawasee and the Tippecanoe River. The county lies within four 8-digit Hydrologic Unit Code (HUC): Tippecanoe, Upper Eel, St. Josephs, and Kankakee. These major waterways and others are identified on **Figure 9**.

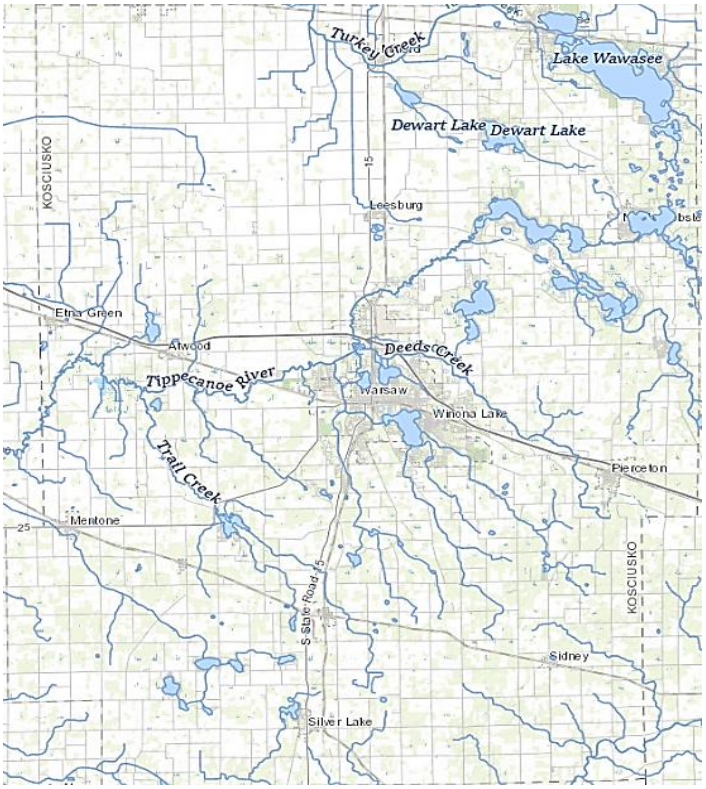


Figure 9: Map of Kosciusko County Rivers and Major Lakes

Kosciusko County, situated in northern Indiana, boasts a diverse landscape characterized by agricultural lands, residential areas, and numerous lakes and waterways. The county is particularly famous for its abundance of natural lakes, which are vital to the local ecosystem and economy. Major lakes in the area include Tippecanoe Lake, Lake Wawasee, and Syracuse Lake, among the largest and most notable. Smaller lakes like Winona Lake, Pike Lake, and Center Lake also contribute significantly to the community by offering recreational activities and serving as water sources. Additionally, the county is interspersed with various streams and creeks, which facilitate natural drainage and support the extensive agricultural areas that define much of the region.

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. According to FEMA, participation in the NFIP is voluntary. Kosciusko County, the City of Warsaw, and the towns of Winona Lake, Mentone, Milford (Milford Junction), North Webster, Silver Lake, and Syracuse participate in the NFIP. At the time of this planning effort, according to the Indiana Department of Natural Resources (IDNR), the Kosciusko County Planning Commission Director is responsible for the administration of the floodplain program in the unincorporated areas of the county as well as the towns of Milford, North Webster, Silver Lake and Syracuse. Kosciusko County, the Area Planning Commission Director is the floodplain administrator, for the Town of Mentone, the Building Commissioner is the floodplain administrator and the City of Warsaw, the City Planner is the floodplain administrator. Substantial damage determinations are carried out by the floodplain administrators and their designated personnel to remain in compliance with the community flood ordinances. The towns of Burket, Claypool, Etna Green, Leesburg, Pierceton, and Sidney do not have a floodplain administrator and are not actively participating in the NFIP.

Table 3 lists the NFIP number, Flood Hazard Boundary Map Identified, Identified Firm, Current Effective Map Date, and the date for each community joined the NFIP program.

Table 3: NFIP Participation

NFIP Community	NFIP Number	Flood Hazard Boundary Map Identified	Identified Firm	Current Effective Map Date	Regular or Emergency Date
Kosciusko County	180121	12/27/74	2/4/87	9/30/15	2/4/87
City of Warsaw	180123	5/10/74	2/4/87	9/30/15	2/4/87
Town of Burket	180367	Non-participating			
Town of Claypool	180401	Non-participating			
Town of Etna Green	180368	Non-participating			
Town of Leesburg	180386	Non-participating			
Town of Mentone	180459	7/20/79	2/4/87	9/30/15	6/10/08
Town of Milford	180382	3/21/75	2/4/87	9/30/15	1/14/88
Town of North Webster	180465		2/4/87	9/30/15	3/24/94
Town of Pierceton		Non-participating			
Town of Sidney	180476	Non-participating			
Town of Silver Lake	180311		2/4/87	9/30/15	2/7/14
Town of Syracuse	180122	8/9/74	2/4/87	9/30/15	2/4/87
Town of Winona Lake	180124	5/3/74	9/4/85	9/30/15	9/4/85

2.7 TOPOGRAPHY

Kosciusko County, Indiana is situated in the north-central region of the state of which it encompasses 554.39 square miles, with 531.38 square miles of land and 23.01 square miles of water, making it the fourth largest county in Indiana by land area. The county's terrain is predominantly flat with some gently rolling areas, especially in the northwestern part where many of the lakes are located. The land is extensively utilized for agriculture and urban development, benefiting from high-quality soil, particularly in the northern sections. Some areas also contain significant marl deposits, a mixture of calcium carbonate and clay.

The county is bordered by Elkhart County to the north, Fulton County to the south, Marshall County to the west, Noble County to the northeast, Wabash County to the south, and Whitley County to the southeast.

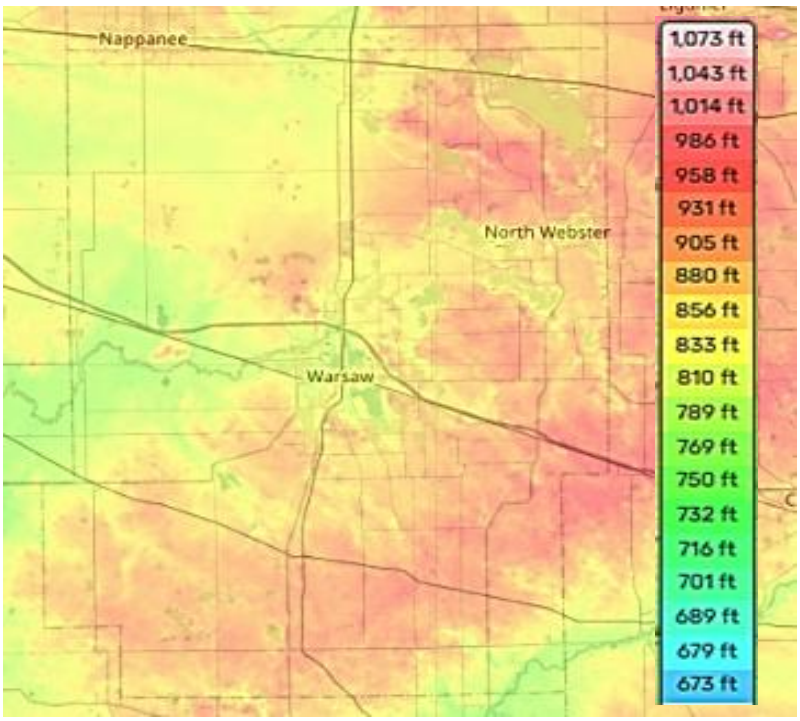


Figure 10: Topographic Map of Kosciusko County

Figure 10 shows the topographic map of Kosciusko County. This undulating terrain offers panoramic views and opportunities for outdoor activities such as hiking, camping, and wildlife observation.

2.8 CLIMATE

In Kosciusko County, the annual average maximum temperature was 65.0° F with an average annual low (minimum) temperature of 42.1° F**. Figure 11** and **Figure 12** chart the maximum and minimum temperatures and show trends utilizing data from the Midwest Regional Climate Center (MRCC). The coldest month based on this data is January at an average temperature of 16.1° F and the warmest is July with an average temperature of 83.1° F.

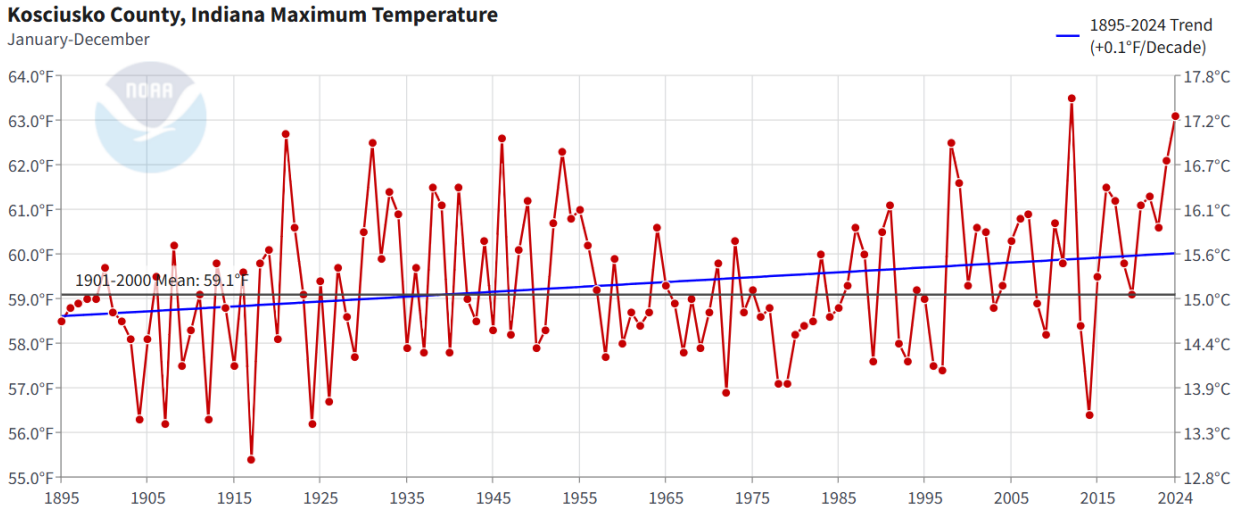


Figure 11: Annual Maximum Temperature, 1895-2024

According to the MRCC between January 2019 and June 2024 at the National Weather Service (NWS) forecast office near North Webster, the maximum daily temperature was 95° F (6/17/24), and the lowest minimum temperature was -20° F (1/30/19). The average daily high was 59.8° F, which is 2.2° F cooler than the daily mean within that time frame. Additionally, the lowest average daily minimum temperature for the same five-year period was recorded at 42.8° F in 2014, 9.7° F colder than the monthly mean minimum temperature within that time frame. Comparing the averages within the past five years, the average temperature within Kosciusko County was recorded to be 48.8° F, with 2014 being the coolest year with an average of 47.2° F and 2016 being the warmest at an average of 52.3° F.

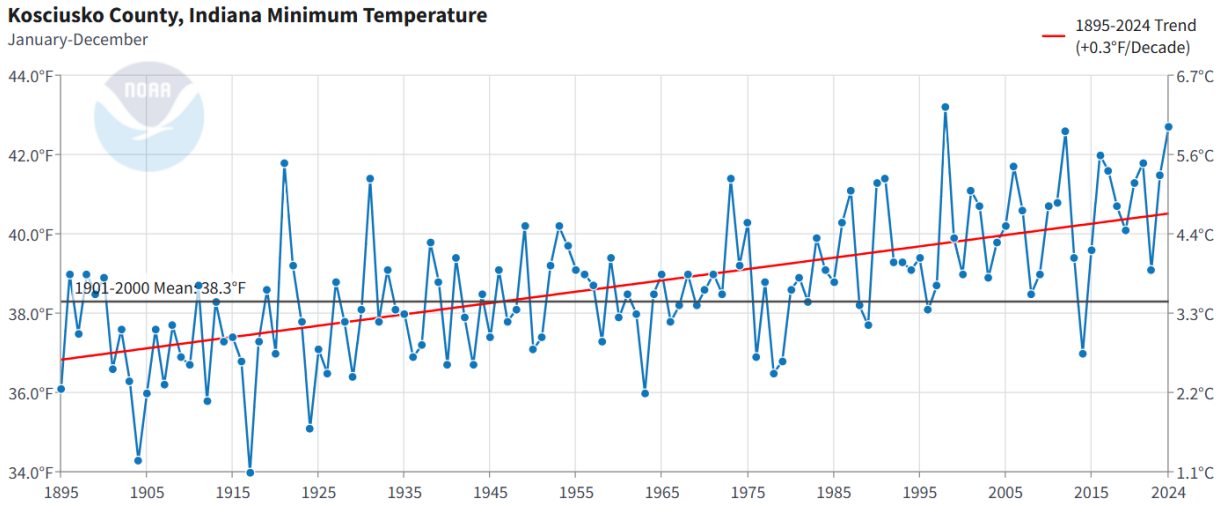


Figure 12: Annual Minimum Temperature, 1895-2024

June is typically the wettest month of the year, with February being the driest. The average annual precipitation for Kosciusko County is 44.87 inches. In the past five years Kosciusko County had a low of 35.68 inches in 2020 and the highest annual precipitation of 44.81 inches in 2021. The highest monthly precipitation rate occurred in October 2021 where 7.59 inches fell. That is 2.2 times the normal amount for the month of October of 3.48 inches. On the opposite end of the spectrum the driest month was November 2023 with 0.65 inches of precipitation.

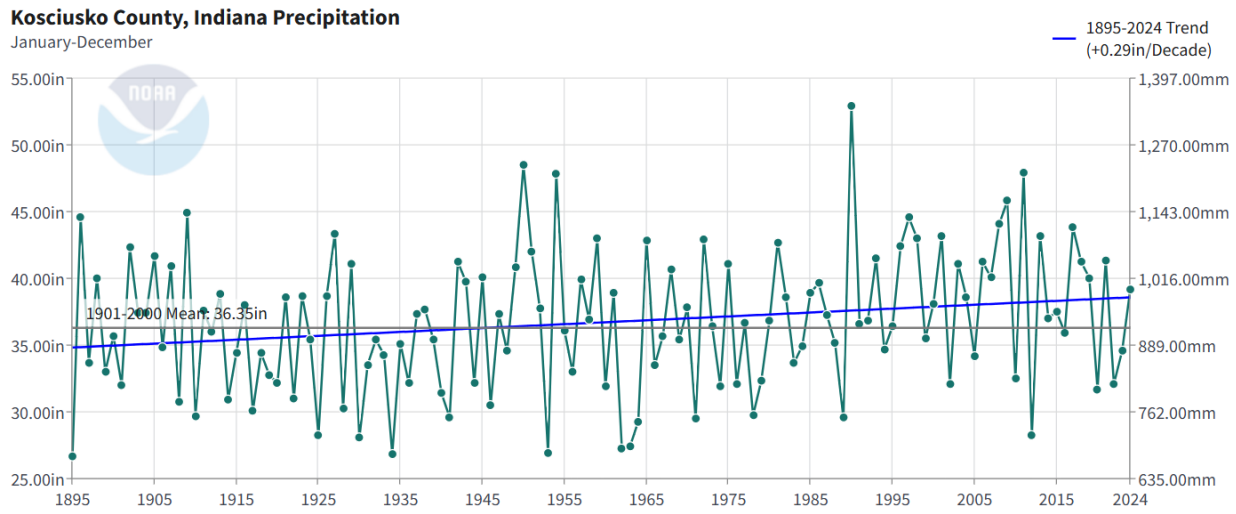


Figure 13: Annual Precipitation Trends, 1895-2024

Figure 13 illustrates the annual precipitation in Kosciusko County. Purdue University Indiana Climate Change Impacts Assessment Report analyzed the increased frequency of short duration high volume rain events, also known as extreme precipitation events, in Indiana. According to the report, an extreme rain event occurs when more than 0.86 inches of rain falls in a day. Since 1900, the number of days per year with extreme rain has been increasing by 0.2 days per decade on average. However, most of that increase has occurred since 1990. The northwestern part of the state has seen the largest increase — a rate of about 0.4 days per decade.

The trend line in **Figure 14** shows an increase in the number of days where the rainfall exceeds 99th percentile. This ever-increasing trend is resulting in more frequent flash flood and overland flood events.

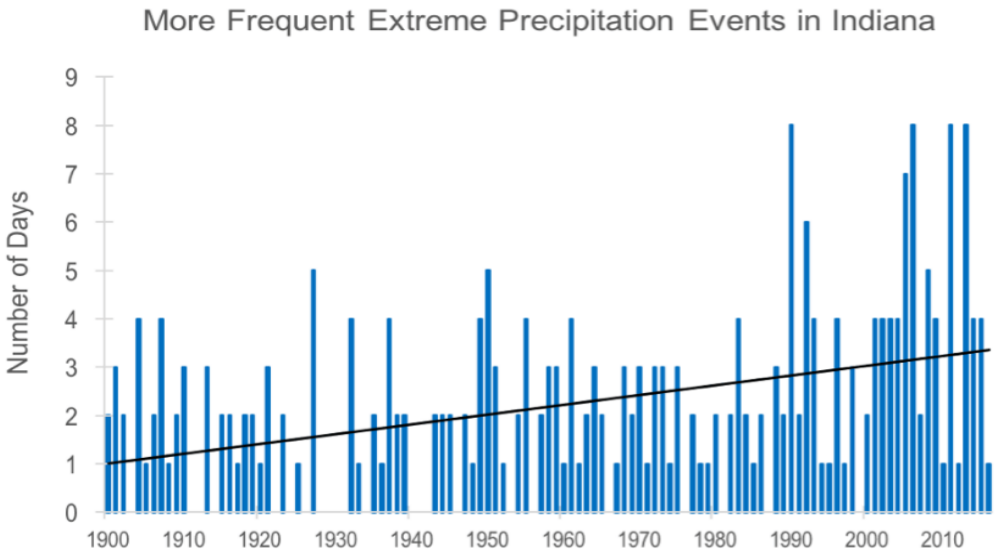


Figure 14: Extreme Precipitation Events in Indiana

According to NOAA National Centers for Environmental Information (NCEI) the State Climate Summary for Indiana the following observations have been observed based upon climate change.:

- The temperatures have risen almost 1.5° F since the beginning of the 20th Century. Temperatures in the 2000's have been higher than in any other historical period except during the early 1930's Dust Bowl era.
- Indiana has experienced an increase in the number of rain intensity is increasing and rain duration is decreasing.
- Extreme weather events are increasing, especially flooding.

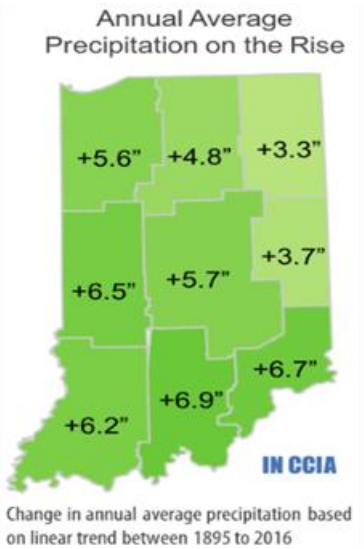


Figure 15: Annual Average Precipitation Change, Purdue University

This is verified in the Indiana Climate Change Assessment report from Purdue University. (**Figure 15**) In the report, the authors wrote, "This assessment documents that significant changes in Indiana's climate have been underway for over a century, with the largest changes occurring in the past few decades. These projections suggest that the trends that are already occurring will continue, and the rates of these changes will accelerate. They indicate that Indiana's climate will warm dramatically in the coming decades, particularly in summer. Both the number of hot days and the hottest temperatures of the year are projected to increase markedly. Indiana's winters and springs are projected to become considerably wetter, and the frequency and intensity of extreme precipitation events are expected to increase, although more research is needed in this area to better determine the details.

2.9 SOCIALLY VULNERABLE POPULATIONS

For this planning effort, under the new FEMA guidance mitigation plan updates are required to include the perspective of socially vulnerable community members and the underserved communities in the county. The Agency for Toxic Substances and Disease Registry (ATSDR) and the Centers Disease Control (CDC) with higher education facilities to develop the Social Vulnerability Index (SVI). According to ATSDR/CDC, Social Vulnerability refers to the community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human caused threats, such as toxic chemical threats. Sixteen census-derived factors are grouped into four general themes which summarize the extent of social vulnerability. **Figure 16** shows the 16 factors and how they are grouped into the four themes. The more factors impacting community members to more vulnerable those members are to the hazardous events.

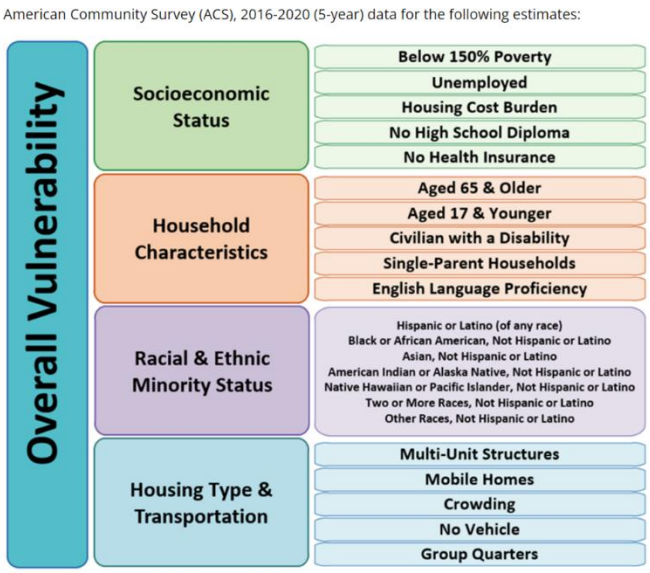


Figure 16: Social Vulnerability Factors

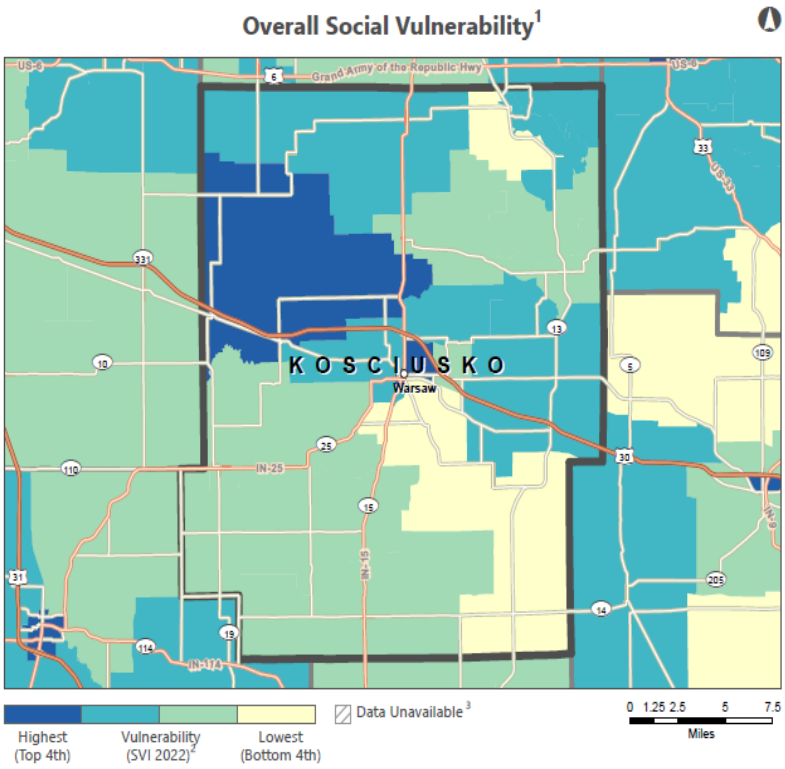


Figure 17: Kosciusko County Social Vulnerability by Census Tract

Figure 17 Is a map of the social vulnerabilty of each of the census tracts in Kosciusko County. The SVI is used in FEMA's National Risk Index, where the data is paired with expected annual losses, and community resilience to calculate a risk index for each of the hazards. This data is available both on the county level and the census tract level. Overall as a county the social vulnerability is low to medium, however, on closer examination, at the census tract level, the towns of Etna Green and Atwood as well as the nearby unincorporated areas tend to be relatively high in their social vulnerability scores. The US 30 corridor as well as much of the northwestern corner of the county range from a relatively moderate to high level in their social vulnerability scores. When struck by the same intensity event, the areas in dark blue on **Figure 17** may require, more support in responding to and recovering from the hazardous event.

The team discussed the impacts of social vulnerability on the overall community and where possible has identified mitigation efforts to help address the hazards and make these areas of the community more resilient.

2.10 COMMUNITY CAPACITY

In Indiana the Fire Prevention and Building Safety Commission is tasked with the establishment and maintenance of fire and building safety codes. The commission is also responsible for reviewing variance requests, code modification proposals, and orders enforcing the fire and building safety law. Only the commission is permitted to adopt codes for the state. Local communities may not adopt editions other than those adopted by the state. All jurisdictions of the state are required to follow the state adopted fire safety and building laws.

Local Building Officials serve as the local authority for building construction matters within their jurisdictions. In Kosciusko County, the county Local Building Official serves all the incorporated communities except the City of Warsaw and the Town of Winona Lake, have their own Local Building Officials. The towns of Syracuse and Silver Lake do not have their own designated building officials but are represented through the county's Area Plan Commission. **Appendix 9** lists the local building official as well as the a number of other key positions in each jurisdiction.

Many of the incorporated communities and the county have digitally published their ordinances for easy access. These communities include the City of Warsaw, and the towns of Winona Lake, Mentone, Milford, North Webster, Leesburg, Sidney, Pierceton, Silver Lake, Syracuse, and the county itself. However, the towns of Claypool, Etna Green, and Burket do not have their ordinances available online.

All of the community leaders take advantage of grant funding to help address non-budgeted activities. The Health Department along with the hospital and county EMS service work together to ensure health and safety needs are met. The planning committee noted that a new public information campaign is helping to publish assistance information for community members. A variety of funding opportunities is provided in **Appendix 7.** REMC, NIPSCO and Duke Energy also have grants for communities within their service areas.

The State of Indiana is presently working with subject matter experts to update the current fire and building safety codes to more recent International Code Council versions. Due to the hearing and adoptions processes this is a multi-year effort. It is hoped that within the next five years updated fire safety and building codes will be adopted to assist the community is becoming more resilient. Over the next five years communities may also be able to make their ordinances more easily accessible via the internet for public review and better understanding. In all cases, local floodplain ordinances should be updated within the next five year cycle using the state model ordinance to guide their process.

3.0 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 Kosciusko County and the communities within is based on the methodology described in the Local Mitigation Planning Handbook published by FEMA in 2023 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 on 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 table summarizing the relationship of the hazards; and a composite map to illustrate areas impacted by the hazards.

3.1 HAZARD IDENTIFICATION

3.1.1 Hazard Selection

The MHMP planning committee reviewed the list of natural and technological hazards in the 2019 Kosciusko County MHMP, discussed recent events, and the potential for future hazard events. The committee identified those hazards which affected Kosciusko County and each community selecting the hazards to study in detail as part of this planning effort. As shown in **Table 4** these hazards include drought; earthquake; extreme temperature; fires and wildfire; flood; dam and levee failure; hail, thunder, and windstorms; hazard material incident; landslide, land subsidence, and fluvial erosion; tornado; and winter storms and ice storms. Since the COVID pandemic, the Health Department continues to develop plans and policies to better respond to and reduce the spread of both routine human disease-causing organisms as well as zoonotic diseases and changes in the field. Therefore, biological hazards are not addressed in this mitigation plan. Additionally, law enforcement sensitive issues such as terrorism, explosive devices, and civil unrest detection and mitigation are addressed in separate local law enforcement-controlled plans.

Table 4: Hazards Selected

Type of Hazard	List of Hazards	MHMP	
		Previous Plan	Current Plan
Natural	Drought	Yes	Yes
	Earthquake	Yes	Yes
	Extreme Temperature	No	Yes
	Fires and Wildfire	Yes	Yes
	Flood	Yes	Yes
	Hail, Thunder, and Windstorm	Yes	Yes
	Landslide, Land Subsidence, and Fluvial Erosion	No	Yes
	Winter Storms and Ice	Yes	Yes
	Tornado	Yes	Yes
Technological	Dam and Levee Failure	Yes	Yes
	Hazardous Material Incident	Yes	Yes

3.1.2 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). CPRI is a tool by which individual hazards are evaluated and ranked according to an indexing system. The CPRI value (as modified by Burke) can be obtained by assigning varying degrees of risk probability, magnitude/severity, warning time, and the duration of the incident for each event, and then calculating as index value based on a weighted scheme. For ease of communication, simple graphical scales are used.

Probability:

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

- Unlikely – incident is possible, but not probable, within the next 10 years.
- Possible – incident is probable within the next five years.
- Likely - incident is probable within the next three years.
- Highly Likely – incident is probable within the next calendar year.

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 response. The magnitude can be specified in one of the following categories:

- Negligible – few injuries OR critical infrastructure shutdown for 24 hours or less OR less than 10% property damaged OR average response duration of less than six hours.
- Limited – few injuries OR critical infrastructure shut down for more than one week OR more than 10% property damaged OR average response duration of less than one day.
- Significant – multiple injuries OR critical infrastructure shut down of at least two weeks OR more than 25% property damaged OR average response duration of less than one week.
- Critical – multiple deaths OR critical infrastructure shut down of one month or more OR more than 50% property damaged OR average response duration of less than one month.

Warning Time:

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

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

Duration:

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

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

Calculating the CPRI:

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

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

The CPRI value provides a means to assess the impact of one hazard relative to other hazards within the community. A CPRI value for each hazard was determined for each incorporated community in Kosciusko County, and then a weighted CPRI value was computed based on the population size of each community. **Table 5** presents each community, population, and the weight applied to individual CPRI values to arrive at a combined value for the entire county. Weight was calculated based on the average percentage of each community's population in relation to the total population of the county. Thus, the results reflect the relative population influence of each community on the overall priority rank.

Table 5: Determination of Weighted Value for Communities

Community	Population (2024)	% of Total Population	Weighted Value
Kosciusko County	49,026	60.8%	0.608
City of Warsaw	16,111	20.0%	0.200
Town of Burket	125	0.2%	0.002
Town of Claypool	395	0.5%	0.005
Town of Etna Green	578	0.7%	0.007
Town of Leesburg	550	0.7%	0.007
Town of Mentone	925	1.1%	0.011
Town of Milford	1,684	2.1%	0.021

Community	Population (2024)	% of Total Population	Weighted Value
Town of North Webster	999	1.2%	0.012
Town of Pierceton	931	1.2%	0.012
Town of Sidney	129	0.2%	0.002
Town of Silver Lake	873	1.1%	0.011
Town of Syracuse	3,236	4.0%	0.040
Town of Winona Lake	5,107	6.3%	0.062
Total	**80,669**	**100%**	**1.000**

3.2 HAZARD PROFILES

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

To effectively profile hazards, it is useful to review past disaster declarations. Over the last five years, Kosciusko County has experienced one FEMA-declared disaster, and one FEMA declared emergency.

- **2020**: The COVID-19 pandemic led to an emergency declaration (EM3456) and a disaster declaration (DR 4515).

In addition, one US Small Business Administration Disaster Declaration included Kosciusko County.

- **2024**: IN-20004 Severe Storms and Tornadoes

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

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

3.2.1 DROUGHT

Overview

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

Figure 18: Urban Grass Impacted by Drought

There are four academic approaches to examining droughts; these are meteorological, hydrological, agricultural, and socio-economic. Meteorological drought is based on the degree, or measure, of dryness compared to a normal, or average amount of dryness, and the duration of the dry period. Hydrological drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply. Agricultural drought is related to agricultural impacts; and focuses on precipitation shortages, differences between actual and potential evapo-transpiration, soil water deficits, reduced ground water or reservoir levels, and crop yields. Socioeconomic drought relates the lack of moisture to community functions in the full range of societal functions, including power generation, the local economy, and food source **Figure 18** shows urban grass areas affected by drought conditions.

Recent Occurrences

Data gathered from the U.S. Drought Monitor indicated that between January 1, 2018 – November 1, 2025, there were 162 weeks where some portions of Kosciusko County was identified as being “Abnormally Dry” or at Drought Monitor Level D0. According to the Drought Monitor, there were 54 weeks within that period where any portion of Kosciusko County was in a drought state higher than a D0. **Figure 19** shows the distribution of weeks in drought over the seven-year time frame.

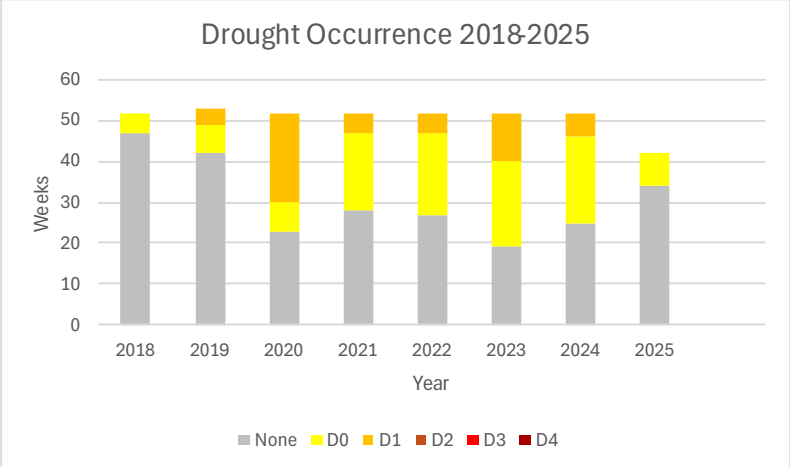


Figure 19: Drought Occurrences 2018-2025

As rain patterns change there are periodic times when the county is deemed "Abnormally Dry" or D0. Most of these instances are resolved quickly as sufficient rain arrives and the soil rehydrates. On occasion, the rain is insufficient to address the dryness and weather conditions cause the soil to further dry crops and reduce lake levels. Examples of continued dryness can be found in 2020, 2021, 2022, 2023 and 2024. During each of these years, Kosciusko County was found to be in "Moderate Drought" or D1. On July 14, 2020, USDA/NASS records showed crop conditions as of July 12 rated poor or very poor have reached or surpassed 10% for corn in Indiana and Ohio, and soy in Illinois, Indiana, and Ohio. The highest level of drought experienced in Kosciusko County is D2 or "Severe Drought". Many people will recall the summer of 2012 throughout Indiana because drought conditions had intensified and reached D2. Burn bans were common and the fire threat was so great that all July 4 fireworks events were postponed or cancelled. Most recently, October 15 through December 24, 2024, Kosciusko County once again was at D2 for 11 weeks. Although not as severe as 2012, many communities, once again, considered burn bans. **Figure 20** from the U.S. Drought Monitor, describes the rationale to classify the severity of droughts.

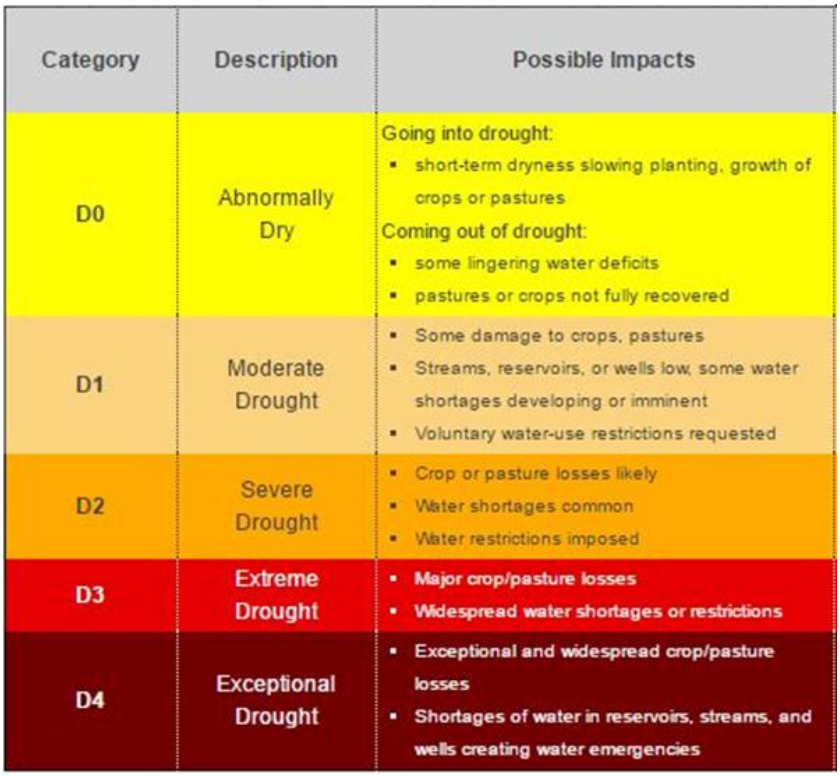


Figure 20: US Drought Monitor Drought Classification Descriptions

Table 6: Kosciusko County Percent of Time in Drought

Percent of the Year in Each Drought Category						
	None	D0	D1	D2	D3	D4
2018	90%	10%	0%	0%	0%	0%
2019	79%	13%	8%	0%	0%	0%
2020	44%	13%	42%	0%	0%	0%
2021	54%	37%	10%	0%	0%	0%
2022	52%	38%	10%	0%	0%	0%
2023	37%	40%	23%	0%	0%	0%
2024	61%	28%	11%	0%	0%	0%
2025	85%	15%	0%	0%	0%	0%

The National Climate Data Center (NCDC) does not report any events or property or crop losses within Kosciusko County from January 1, 2018, to November 1, 2025, in relation to drought. During discussions with the planning committee, effects from the drought were highlighted. Committee members recalled the dry conditions and discussed the large field/wildland fires which frequently occur during harvest season. Although NCDC does not show any reports of damage, fires during

harvest result in damage to farming equipment even if crops are preserved. **Table 6** depicts the number of weeks per year at each of the drought levels indicated above. Kosciusko County has not exceeded D2- Severe Drought during the past seven years.

The planning committee, utilizing the CPRI, determined the overall risk of drought throughout Kosciusko County is "Elevated." The impact of drought was determined to be the same for all communities and unincorporated areas throughout the county due to the possible agricultural impacts and impacts to water wells. The committee agreed that a drought is "Possible" to "Highly Likely," and the magnitude of drought is anticipated to be "Negligible" to "Significant." Further it is anticipated that with the enhanced weather forecasting abilities, the warning time for a drought is greater than 24 hours and the duration will be greater than one week. A summary is shown in **Appendix 11.**

According to the National Drought Mitigation Center, scientists have difficulty predicting droughts more than one month in advance due to numerous variables such as precipitation, temperature, soil moisture, topography, and air-sea interactions. Further anomalies may also enter the equation and create more dramatic droughts or lessen the severity of droughts. Based on the previous occurrences of significant droughts and drought related impacts felt within Kosciusko County, the committee estimated that the probability of a drought occurring in the area is "Possible" to "Highly Likely;" or occurrence is probable within the next one to five years. The damage anticipated throughout the county is predicted to be "Negligible" to "Significant." Businesses and industry that rely upon water for their processes and products would be impacted by water limitations within the cities and towns. Throughout the unincorporated areas of the county, increased crops and livestock damage would also be expected during a significant drought. In addition, the long-term stress on the forested land could result in additional tree deaths and debris during subsequent high wind events.

Assessing Vulnerability

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

Direct Effects:

- Urban, developed areas, and local wildlife areas may experience revenue losses from decreased tourism; landscaping companies, golf courses revenue losses due to lack of growth and plant death; restrictions on industry cooling and processing demands; reduced incomes for businesses dependent on crop yields, and increased potential for fires.
- Rural areas within the county may experience revenue losses from reductions in decreased livestock and crop yields as well as increased incidence of field fires.
- Loss of tree canopy due to increased susceptibility to pests and diseases.
- Citizens served by drinking water wells or surface water supplies may be impacted during low water periods and may require drilling of deeper wells or loss of water service for a period.
- According to Purdue's Indiana Climate Change Impacts Assessment, climate change will rise as temperatures rise, and rainfall patterns shift, managing multiple water needs will become increasingly difficult. This could result in more drought conditions.

Indirect Effects:

- Loss of income of employees from businesses and industry affected; loss of revenue to support services (food service, suppliers).

- Loss of revenue from recreational or tourism sectors associated with reservoirs, streams, and other open water venues.
- Lower yields from domestic gardens increase the demand for purchasing produce and increase domestic water usage for landscaping.
- Increased demand for emergency responders and firefighting resources due to grass fires and increased medical calls for people having respiratory issues because of increased dust amounts.
- Drought conditions could make it more difficult for the underserved population as many of them do not have air conditioning, which makes breathing more difficult and air quality conditions can become compromised.

Estimating Potential Losses

It is difficult to estimate the potential losses associated with a drought for Kosciusko County because of the nature and complexity of this hazard and the limited data on past occurrences. However, for the purpose of this MHMP update, a scenario was used to estimate the potential crop loss and associated revenue lost due to a drought like that experienced during the drought of record from 1988. In 2023, Kosciusko County produced approximately $19.52M bushels of corn and $4.95M bushels of soybeans, as reported by the United States Department of Agriculture (USDA) National Agricultural Statistics Service. Using national averages of $6.58 per bushel of corn and $14.40 per bushel of soybeans, the estimated soybean crop receipts for 2023 would be $199.72M. Using the range of crop yield decreases reported in 1988 and 1989, just after the 1988 drought period (50%-86%) and assuming a typical year, economic losses related to soybeans could range between $99.9M-$171.8M; depending on the crop produced and the market demand. Effects of drought on corn crops can be seen in **Figure 21.**

Figure 21: Drought Effects on Corn Crop

Purdue Agriculture News reports that as of March 2013, Indiana producers received more than $1.49B in crop insurance payments for 2012 corn, soybean, and wheat losses. This amount is nearly double that of the previous record, $522M, following 2008 losses, also due to drought. These losses are still considered to be record-setting in terms of drought effects, damage, and costs for Indiana. In comparison, in 2022 Indiana received $51M, in crop insurance from drought and weather-related events.

According to a July 5, 2012, article in The Times (Noblesville, IN), “The effects of drought also could touch agricultural businesses, such as handlers and processors, equipment dealers, and see, fertilizer and pesticide providers.” Additional losses associated with a prolonged drought are more difficult to quantify. Drought has lasting impacts on trees: death to all or portions of a tree, reduction in the tree’s ability to withstand insects and diseases, and interruption of normal growth patterns. Such effects on trees, especially urban trees, can lead to additional impacts, both environmentally and monetarily, in terms of the spread of Emerald Ash Borer insects and the weakening of tree limbs and trunks which may lead to increased damage during other hazard events such as wind and ice storms. Loss of trees also alter wildlife habitats causing wildlife to find new areas to live in, often

causing increased wildlife deaths as they navigate through more urbanized areas to reach new habitats.

Future Considerations

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

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

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

Prior to expanding municipalities, provisions and considerations should be given regarding the potential additional demand for both water usage and fire response efforts. Following such expansion or development plans, alternative water sources should be explored. Since the previous MHMP was prepared, large scale and significant development have not occurred throughout the county. The majority of Kosciusko County remains unincorporated and rural in nature.

Relationship to Other Hazards

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

3.2.2 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, electricity, 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.

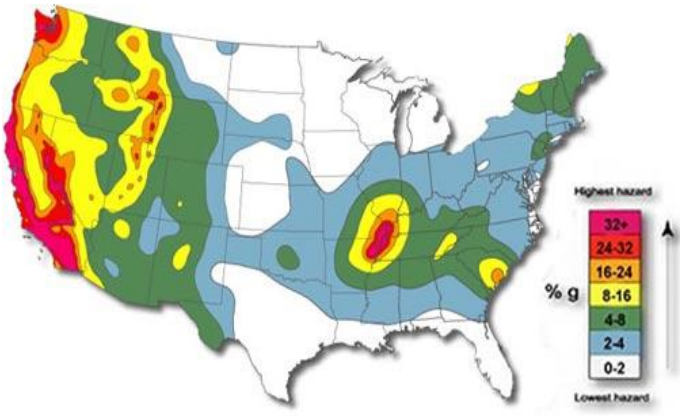


Figure 22: Earthquake Risk Areas in the US

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.

Figure 23: Areas of High Potential for Liquefaction in Kosciusko County

One method of measuring the magnitude or energy of an earthquake is the Richter Scale. This scale uses whole numbers and decimal fractions whereby each increase of a whole number represents a release of 31 times more energy than the amount associated with the previous whole number on the scale. Scientists are currently studying the New Madrid fault area and have predicted that the chances of an earthquake in the M8.0 range occurring within the next 50 years are approximately 7%-10%. However, the chances of an earthquake at a M6.0 or greater, are at 90% within the next 50 years.

There are 45 states and territories in the United States at moderate to very high risk from an earthquake, and they are located in every region of the county **(Figure 22**). 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. Several smaller historic faults are located throughout the state of Indiana. Additionally, some soils in Indiana are highly susceptible to liquefaction during earthquake conditions. Some of the older riverbeds within Kosciusko County show signs of a potential for liquefaction, especially in the northern portion of the county **Figure 23.**

Recent Occurrences

Indiana, as well as several other Midwestern states, lies in the most seismically active region east of the Rocky Mountains. **Figure 24** shows the 2014 Seismic Hazard for Indiana. The nearest known areas of concern for Kosciusko County are the Anna Fault (Ohio), the Wabash Seismic Zone to the north, and the New Madrid Fault Zone in southern Indiana.

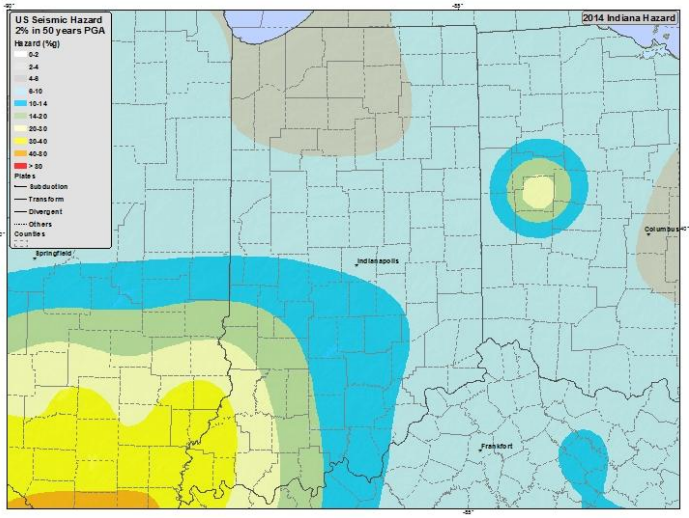


Figure 24: Indiana Seismic Zone Map

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

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 third 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."

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

From January 1, 2018 to November 1, 2025, based on historical earthquake data, local knowledge of previous earthquakes, results of HAZUS-MH scenarios, and that Kosciusko County has not been directly impacted by an earthquake, the committee determined that the probability of an earthquake

occurring in Kosciusko County or any of the communities is “Unlikely” to “Possible.” Should an earthquake occur, the impacts associated with this hazard are anticipated to be “Negligible” to “Limited” in all areas of the county, except in the Town of Burket where the impact is anticipated to be “Critical”. As with all earthquakes, it was determined that the residents of Kosciusko County would have little to no warning time (less than six hours) and that the duration of the event would be expected to be less than six hours with aftershocks lasting up to less than a week. A summary is shown in **Appendix 11**

Figure 25: Minor Earthquake Damage

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

Assessing Vulnerability

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

Figure 26: Structural Earthquake Damage

Direct Effects:

Urban areas may experience more damage due to the number of structures, the multi-story nature of the structures, and critical infrastructure (fire houses, cell phone towers, health care facilities.) located in these areas.

- Rural areas may experience losses associated with agricultural structures such as barns and silos.
- Bridges buried utilities (gas lines, waterlines, pipelines), and other infrastructure may be affected throughout the county and municipalities.
- The homeless or underserved population needs to be checked on, especially if they seek shelter under bridges or structures that are not stable.

Indirect Effects:

- Kosciusko County may be called upon to 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 or originating at locations beyond the damaged areas, but that would have to be re-routed to avoid damaged areas.

The 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 damage. Damage to structures, infrastructure, and even business interruptions can be expected following an earthquake. Examples of varying degrees of damage are shown in **Figure 25** and **Figure 26.**

Estimating Potential Losses

To determine the losses associated with an earthquake, the Hazards U.S. Multi-Hazard (HAZUS-MH) software was utilized in the Kosciusko County MHMP update. HAZUS-MH is a nationally standardized risk modeling methodology which identifies areas with high risk for natural hazards and estimates physical, economic, and social impacts of earthquakes, hurricanes, floods, and tsunamis. For this plan, an arbitrary earthquake scenario placed a magnitude 5.0 within Kosciusko County.

Per the HAZUS-MH scenario noted above the following impacts are anticipated:

- Total economic losses are anticipated to be near $2,307.83M with moderate damage to approximately 7,741 buildings, of which 446 are anticipated to be damaged beyond repair.
- There are 42 critical facilities (26 schools, seven Police Stations, and nine Fire Stations) with reduced functionality on day one, and three highway bridges with moderate damage as well as two airport facilities.
- All other transportation segments (railways, buses, and ports) would be expected to remain undamaged.
- The utilities are expected to have moderate damage for four wastewater facilities and two communication facilities.
- Residential occupancies would be anticipated to sustain the largest level of damage at 36% of the total loss. This will result in 658 households being displaced with 339 people needing to seek temporary shelter in public shelters.
- It is expected there would be a total of 515,000 tons of debris generated. It will require 20,600 truckloads (25 tons per truck) to remove the debris generated from the earthquake.

The HAZUS-MH model computes anticipated economic losses for the hypothetical earthquake due to direct building losses and business interruption losses. Direct building losses are the costs to repair or to replace the damage caused to the building and contents, while the interruption losses are associated with the inability to operate a business due to the damage sustained. Business interruption losses also include the temporary living expenses for those people displaced from their homes.

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

Future Considerations

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

It can be anticipated that while all structures in Kosciusko County will remain at risk of earthquake damage and effects, new construction or redevelopment may reduce the overall risks. As redevelopment or growth occurs, the new construction may be significantly sturdier. Further, as blighted or abandoned areas are addressed, those communities and the county are less susceptible to economic and physical damage associated with earthquakes. Since the last planning effort, no significant development has occurred within the county.

Relationship to Other Hazards

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

3.2.3 EXTREME TEMPERATURE

Overview

Extreme Heat

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

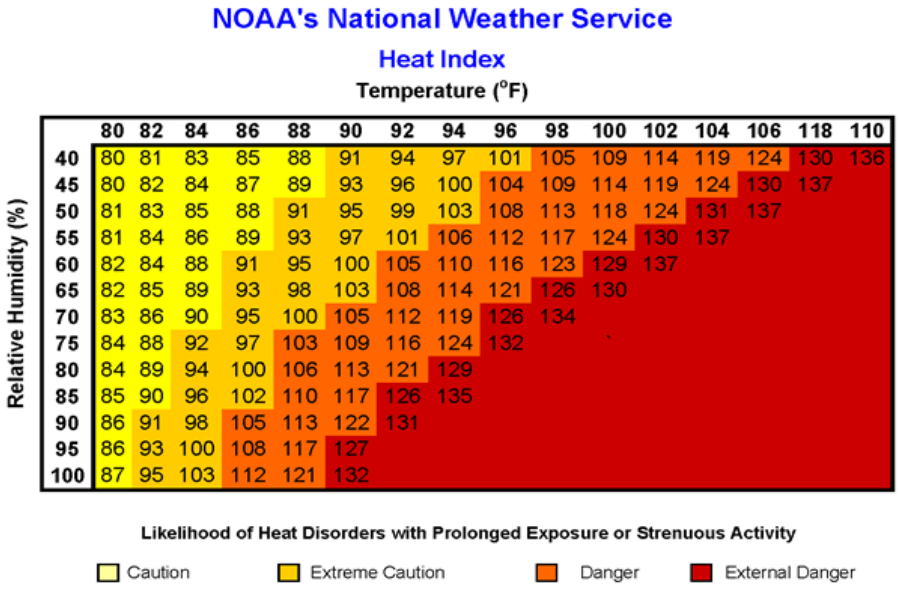


Figure 27: NWS heat Index Chart

According to the NWS, “The Heat Index or the “Apparent Temperature” is an accurate measure of how hot it really feels when the Relative Humidity is added to the actual air temperature.” To find the Heat Index Temperature, refer to the Heat Index Chart in **Figure 27**. As an example, if the air temperature is 96° F and the relative humidity is 65%, the heat index – how hot it feels – is 121° F.

The National Weather Service has three levels of Excessive Heat Notifications.

1) A Heat Advisory - means that temperatures of at least 100° F or Heat Index values of at least 105° F are expected.

2) An Excessive Heat Watch means that Heat Index values are expected to reach or exceed 110° F and not fall below 75° F for at least a 48-hour period.

3) An Excessive Heat Warning means that Heat Index values are expected to reach or exceed 110° F and not fall below 75° F for at least a 48-hour period, beginning in the next 24 hours. A warning may also be issued for extended periods with afternoon heat index values of 105° F-110° F.

Classification	Heat Index	Effect on the body
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	90°F - 103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°F - 124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F or higher	Heat stroke highly likely

Figure 28: Extreme Heat Effects by Heat Index

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

As **Figure 28** indicates, there are four cautionary categories associated with varying heat index temperatures. Each category provides a heat index range along with effects on the human body. People with underlying health issues, the very old or very young, may be impacted at lower temperatures since their systems are less likely to be able to compensate for the heat and humidity.

Extreme Cold

Figure 29: Working in Extreme Cold

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

In addition to strictly cold temperatures, the wind chill temperature must also be considered when planning for extreme temperatures. The wind chill temperature, according to the NWS, is how cold people and animals feel when outside and it is based on the rate of heat loss from exposed skin. **Figure 29** identifies the Wind Chill Chart and how the same ambient temperature may feel vastly different in varying wind speeds.

Wind chill is a guide to winter danger

New wind chill chart

Frostbite occurs in 15 minutes or less

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

Figure 30: Wind Chill Guide

Recent Occurrences

The effects of extreme temperatures extend across large regions, typically affecting several counties, or states, during a single event. According to the NCDC for the review period of January 1, 2018, through November 1, 2025, there have been no extreme heat events and five extreme cold events.

Local reports did not provide any additional information regarding a period of excessive heat during this time. However, the NWS reported wind chills of -47° F in Kosciusko County on January 29 - 31, 2019. No additional reports were provided relevant to damage or losses associated with the prolonged cold temperatures.

It is difficult to predict the probability that an extreme temperature event will affect Kosciusko County residents within any given year. However, based on historic knowledge and information provided by the community representatives, an extreme temperature event is “Unlikely” to “Highly Likely” (event is possible within the next 10 year to within the next year) to occur within the county and if an event did occur, it would result in “Negligible” to “Significant” magnitude. **Appendix 11** identifies the CPRI for extreme temperatures-both heat and cold events for all communities in Kosciusko County.

Assessing Vulnerability

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

By assessing the demographics of Kosciusko County, a better understanding of the relative risk that extreme temperatures may pose to certain populations can be gained. In total, just over 23.1% of the county’s population is over 65 years of age, 5.7% of the population is below the age of 5, and approximately 14.2% of the population is living below the poverty line. People within these demographic categories are more susceptible to social or health related impacts associated with extreme heat. Families below the poverty line are less likely to have functioning air conditioning in

their homes. Because of high energy costs those who do have air conditioning may be less likely to use the units in a way to benefit their health and well-being. The same factors are key when looking at heating sources in cold temperatures. Elderly people and those living below the poverty line are more likely to rely on alternative heating sources because of the cost of energy. These alternative heating sources are frequently the cause of carbon monoxide poisoning and/or house fires.

Extreme heat can affect the proper function of organ and brain systems by elevating core body temperatures above normal levels. Elevated core body temperatures, usually more than 104° F, are often exhibited as heat stroke. For weaker individuals, an overheated core body temperature places additional stress on the body, and without proper hydration, the normal mechanisms for dealing with heat, such as sweating to cool down, are ineffective. Examples of danger levels associated with prolonged heat exposure are identified in **Figure 31**. Extreme cold may result in similar situations as normal functions are impacted as the temperature of the body is reduced. Prolonged exposure to cold may result in hypothermia, frostbite, and even death if the body is not warmed.

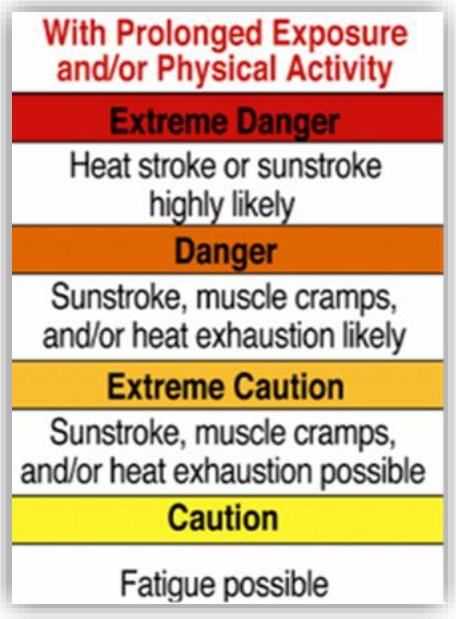


Figure 31: Heat Danger Classification

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

Direct Effects:

- Direct effects are primarily associated with health risks to the elderly, infants, people with chronic medical disorders, lower income families, outdoor workers, and athletes. Health risks can range from heat exhaustion or mild hypothermia to death due to heat stroke, amputations due to frost bite or death due to severe hypothermia.

Indirect Effects:

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

Estimating Potential Losses

It is difficult to estimate the potential losses due to extreme temperatures as damage is not typically associated with buildings but instead with populations and people.

This hazard is not typically as damaging to structures or critical infrastructure as it is to populations, so monetary damages associated with the direct effects of the extreme temperature are not possible to estimate accurately.

Indirect effects:

- Increased expenses for facilities such as healthcare or emergency services due to the increased number of calls and people seeking assistance, impacting resources and staffing levels needed to respond adequately.

- Loss of revenue for manufacturing facilities where temperatures are normally elevated may need to alter work hours or limited production during the heat of the day.
- Increased peak demand for energy suppliers during the hottest and/or coldest portions of the day.
- Loss of access to water during extreme cold due to pipes freezing. This may limit industrial processes as well as personal hygiene, sanitation and hydration of livestock and people. These effects may disproportionately impact vulnerable populations (elderly and children) within Kosciusko County.

Future Considerations

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

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

New construction associated with development of residential areas often brings upgraded and more efficient utilities such as central heating and air units further reducing vulnerabilities to the aging populations in those municipalities mentioned above. Conversely, new developments associated with industrial or large commercial structures in the inner-urban centers often result in increased heat over time, which may cause additional stress to labor-related populations. Since the last planning effort, there has not been significant residential and commercial development within the county.

Extreme Temperatures: Relationship to Other Hazards

While extreme temperatures may be extremely burdensome on the power supplies in Kosciusko County, the committee concluded that this type of hazard is not expected to cause any hazards studied. It is anticipated that due to prolonged extreme temperatures, primarily long periods of elevated temperatures, citizens may become increasingly agitated and irritable, and this may lead to a disturbance requiring emergency responder intervention.

3.2.4 FIRES AND WILDFIRE

Overview

A wildfire, also known as a forest fire, vegetation fire, or a bushfire, is an uncontrolled fire in wildland areas and is often caused by lightning; other common causes are human carelessness and arson. Small wildfires may be contained in areas less than one acre, whereas larger wildfires can extend to areas that cover several hundred or even thousand acres. Generally, ambient weather conditions determine the nature and severity of a wildfire event. Very low moisture and windy conditions can help to exacerbate combustion in forested or brush areas (**Figure 32**) and turn a small brush fire into a major regional fire event in a very short period. Wildfires can be very devastating for residents and property owners.

Figure 32: Forest Fire

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

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

Combating wildfire or a structure fire is extremely dangerous. If weather conditions change suddenly, the fire may change course and/or increase in strength potentially overtaking neighboring structures and firefighters, causing severe injury or death. Fires can travel at speeds greater than 45 mph. Members of the homeless community, hunters and/or campers may also be in the area of the fires with no means to escape. Fire response capabilities are limited by the ever-dwindling number of volunteer firefighters able to respond, especially during “normal working hours”. This further increases the risks for first responders and community members alike.

Recent Occurrences

Within the NCDC, for the period of January 1, 2018 to November 1, 2025, there are no reports of wildfires. However, the county EMA Director mentioned a field fire on West 200 South in Harrison

Township. On October 22, 2024, more than 100 acres of corn stubble were ignited by a homeowner burning trash during a burn ban. Burket Fire Department along with 5 others responded to the fire which was driven by high winds. Fortunately, the fire did not result in any injuries.

Many 10 acre or larger field/grass and woods fires take place regularly. In 2006 in Pike County, Indiana two field fires burned over 350. On November 20, 2022, a 110-acre brush fire was brough under control by several volunteer fire departments and Indiana DNR staff at Brown County State Park. Grass fires in the median and along Interstate 65 recently closed the southbound lanes for several hours while fire departments attempted to extinguish the wind driven fires. Within the same time parameter, there were only five reported events within the State of Indiana, two in Lake County occurring in 2020 and 2021, respectively. Two were also reported in Brown County within 2022 and one was reported in Shelby County. During each of these events over 500 acres were burned.

The impact of wildfires can be quite extensive and reach well beyond the borders of the jurisdiction fighting the fire. This is well demonstrated by the summerlong wildland fires in Canada in 2023. Over 16.5 million acres, an area the size of the entire state of Florida, burned between March and September. The fires resulted in smoke plumes which reached central Indiana at levels requiring people with asthma and other respiratory difficulties to remain indoors.

The NCDC does not report structure fires; therefore, local sources were utilized to provide information regarding residential and business fires. These fires are the typical hazard affecting Kosciusko County in the last several years. **Figure 33** shows the remains of a house fire in Kosciusko County. Kosciusko County has very little managed land with the greatest percentage of land being used for cultivated crops and pasture/hay. Due to the expansive acreage of agricultural land within Kosciusko County, and the potential for urban areas to be at risk due to abandoned homes, blighted areas, or industrial activities, the planning committee determined the probability to range from “Unlikely” to “Highly Likely” with most of the county being in the “Likely” to “Highly Likely”. The magnitude ranged from “Negligible” to “Critical” **Appendix 11** identifies the CPRI rankings for fire in Kosciusko County.

Figure 33:Debris Remaining After Residence Fire

Information provided in **Table 7** highlights the number of fire calls to which the Kosciusko County fire departments responded during January 2018 through December 2024. Damage to structures, contents, crops, forests, and vehicles is significant for each municipality on an annual basis. Social losses, such as being unable to work following a residential structure fire or losses associated with a business fire should also be considered as an impact.

Table 7: Kosciusko County Fire Calls

Department	2019	2020	2021	2022	2023	2024
Atwood Vol. Fire Dept.	119	94	89	105	93	110
Burket Vol. Fire Dept.	176	216	305	310	212	247
Claypool Vol. Fire Dept.	68	82	100	105	79	73

Department	2019	2020	2021	2022	2023	2024
Etna Twp. Fire & Rescue Services (Etna Green)	152	143	150	138	117	107
Mentone Fire Department	71	114	93	109	100	112
Milford Fire Department	113	128	163	173	122	141
Tippecanoe Twp. Fire Territory (North Webster)	557	642	609	883	603	821
Pierceton Volunteer Fire Department	392	474	454	418	353	437
Plain Twp. Fire Department (Leesburg)	139	144	150	139	150	189
Sidney-Jackson Twp. Vol. Fire Department	121	128	137	141	148	138
Silver Lake Vol. Fire Department, Inc.	66	72	89	112	91	83
Turkey Creek Vol. Fire Territory (Syracuse)	1,436	1,344	1,575	1,515	1,302	1,359
Warsaw – Wayne Fire Territory	3,128	2,285	3,658	3,726	3,713	4,325
Winona Lake Fire Department	170	177	208	214	204	205
Total	**6,380**	**6,043**	**7,780**	**8,088**	**7,287**	**8,347**

Assessing Vulnerability

Physical, economic, and/or social losses impact not only the property owner whose property was damaged by the fire, but also the community. Typically, a structural fire is limited to one or two structures, as the fire response focuses on extinguishment as well as containment thus preventing the fire from spreading to neighboring structures. This type of action works to reduce the magnitude and severity. Nonetheless, the loss of or damage to historic structures, town squares, etc. takes a toll on the community spirit as well as the financial and physical loss.

Much of the county is rural, which is also susceptible to brush and/or crop fires, especially in times of drought. Since agriculture is a big source of income for the community, field fires, especially during harvest season, or barn fires after crops have been stored have an immense impact.

Direct and indirect effects of fires and wildfires within Kosciusko County may include:

Direct Effects:

- Loss of structures (residential, high-rise buildings, as well as agricultural)
- Loss of vital equipment (industrial and agricultural)
- Loss of forests
- Loss of natural resources and wildlife

Indirect Effects:

- Loss of revenue as businesses may be closed
- Loss of revenue from reduced tourist activities in the county
- Increased emergency response times based on safety of roads
- Loss of income if dependent on crop production or timber harvest
- Long-term mental health impacts on individuals and communities, stemming from trauma and loss experienced during the fires.

Estimating Potential Losses

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

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

Future Considerations

As populations increase and community growth increases, the need to respond to fire will remain an important municipal effort. As new construction or re-development occurs, especially new or existing critical infrastructure, it is important to ensure that these new structures are equipped to deal with the potential risks associated with this hazard. Those may include increased risk for wooden or flammable outer structures and potential lengthy power outages. With the adverse impacts of extreme temperatures and drought upon the heavily forested areas, consideration must be given to mitigating fire risks for structures that are built in the rural areas to limit losses should a wildland fire take place.

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

Firefighting responses can be slow due to limited number of volunteers available at various times of the day. Increasing numbers of people working outside of the community in which they reside limits volunteer presence to outside of normal working hours. Recruitment initiatives will need to be considered as the firefighting needs and staffing levels change.

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

Relationship to Other Hazards

Fires may certainly result in a hazardous materials incident if storage structures are within the path of the fire. Material storage containers farther away from the burn path may become damaged by high winds and embers resulting in a spill or release of materials. Fires may result from lightning either alone or associated with a thunderstorm. Typical wind speeds during a thunderstorm may also exacerbate the impacts from any ignitions from the lightning.

3.2.5 FLOOD

Overview

A flood, as defined by the NFIP, is a general and temporary condition of partial or complete inundation or two or more acres of normally dry land area or of two or more properties from overflow of inland or tidal waters, or 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. Flash flooding is a term often used to describe flood events that are due to heavy or excessive rainfall in a short period of time, generally less than six hours. Unlike traditional flooding which can be slower developing, these raging torrents rip through river beds, streets and roads, and overland taking anything in its way with the force of the water. Flash floods typically occur within minutes up to a few hours after an excessive rain event.

Figure 34: Flooding in Kosciusko County. TWF

Flooding and associated flood damage are most likely to occur during the spring because of heavy rain combined with melting snow. (**Figure 34**) However, provided the right saturated conditions, intense rainfall of short duration during rainstorms can produce damaging flash flood conditions. There are no exceptions to when floods may occur. There are times they are less likely, but given the right atmospheric conditions, even then, a flood or flash flood can take place. The change in climate has a direct impact on flash flooding with the increase in volume of rain in shorter duration of the events.

The traditional benchmark for riverine or coastal flooding is a 1% Annual Exceedance Probability (AEP), formerly known as the 100-year flood. This is a benchmark used by FEMA to establish a standard of flood protection in communities throughout the country. The 1% AEP is referred to as the “regulatory” or “base” flood. Another term commonly used, the “100-year flood”, can be misleading. It does not mean that only one flood of that size will occur every 100 years, but rather there is a 1% chance of a flood of that intensity and elevation happening in any given year. In other words, the regulatory flood elevation has a 1% chance of being equaled, or exceeded, in any given year and it could occur more than once in a relatively short time period. The area impacted by the 1% AEP flood event is called the Special Flood Hazard Area (SFHA).

Recent Occurrences

The NCDC indicates that between January 1, 2018 to November 1, 2025, two flood events were reported and no flash flood events. There was a flood event on February 21, 2018, and on April 2, 2025. The February 2018 event reported $56,000 in property damage whereas the April 2025 flood event was reported to have $1,000 of property damage. Neither event resulted in any additional crop damage reported. There was no flash flood events reported during the same seven-year time frame.

Figure 35: Kosciusko County USGS River Gages

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's National Water Prediction Service (NWPS) 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 Kosciusko County, there are three active gages, pictured in **Figure 35**: one located on the Tippecanoe River at North Webster, one located on the the Tippecanoe River at Oswego, and the final gage located on Pike Lake at Warsaw. Additional information related to these gages can be found in **Table 8**.

Table 8: Kosciusko County USGS Gages

Site Number	Site Name	Major	Action	Flood	Recent	Historic
03330241	Tippecanoe River at North Webster	7 Ft.	5 Ft.	6 Ft.	7.12 Ft. (2018)	7.12Ft. (2018)
03330500	Tippecanoe River at Oswego	9 Ft.	7 Ft.	7.5 Ft.	7.78 Ft. (2025)	9.40 Ft. (1943)
03331040	Pike Lake in Warsaw	Information not available			6.99 Ft. (2025)	6.99 Ft. (2025)

A watershed management plan (WMP) is a strategy for achieving water quality goals by characterizing the watershed, setting goals and actions steps, and developing an implementation plan to address documented problems. Ultimately, the purpose of the WMP is to guide resource managers, watershed coordinators, policy makers, community organizations, and other relevant stakeholders in restoring and protecting the waterbodies within a given watershed. The three plans created relevant to Kosciusko County are:

- Upper Middel Eel River WMP
- Walnut Creek – Tippecanoe River WMP
- Upper Tippecanoe River WMP

Flood insurance is a key for flood recovery. Any property having received two insurance claim payments for flood damages totaling at least $1,000, paid by the NFIP within any 10-year period since 1978, is defined as a repetitive loss property. These properties are important to the NFIP because they account for approximately one-third of the country's flood insurance payments. According to FEMA Region V, there are a total of 56 repetitive loss structures in Kosciusko County. In the unincorporated areas of Kosciusko County there are 26 single family residences which are repetitive loss structures. In additional there is one mobile or manufactured home in the

unincorporated county identified as a repetitive loss structure. There are 17 single family homes, and one multifamily structure (2-4 families in the structure) reported as repetitive loss structures for the Town of Leesburg, one single family home in North Webster and one single family home in the Town of Syracuse. The City of Warsaw has nine single family structures identified as repetitive loss structures.

Table 9 identifies the number of repetitive losses and claims per community, as provided by FEMA.

Table 9: Repetitive Properties, and Claims

Community	# Repetitive Loss Properties	Structure Type	Total # of Claims
Kosciusko County	27	26 Single Family Residences 1 Mobile/Manufactured Home	75 Single Family Residence 2 Mobile/Manufactured Home
Town of Leesburg	18	17 Single Family Residences 1 Multifamily Structure	49 Single Family Residence 2 Multifamily Structure
Town of Mentone	0	0	0
Town of Milford	0	0	0
Town of North Webster	1	1 Single Family Residence	2 Single Family Residence
Town of Silver Lake	0	0	0
Town of Syracuse	1	1 Single Family Residence	2 Single Family Residence
City of Warsaw	9	9 Single Family Residences	28 Single Family Residence
Town of Winona Lake	0	0	0
TOTAL	**56**	**54 Single Family Residences 1 Mobile/Manufactured Home 1 Multifamily Residence**	**156 Single Family Residence 2 Mobile/Manufactured Home 2 Multiple Family Residence**

There have been 160 claims made for damage associated with flooding in Kosciusko County since 1978. **Table 10** further indicates the premiums and coverage totals for individual communities.

Table 10: Insurance Premiums and Coverage

Community	Flood Insurance Premiums	Flood Insurance Coverage
Kosciusko County	$181,533	$72.13M
Town of Leesburg	Included in Kosciusko County	Included in Kosciusko County
Town of Mentone	$523	$0.08M
Town of Milford	0	$0M
Town of North Webster	$769	$0.49M
Town of Silver Lake	$1,362	$0.45M
Town of Syracuse	$5,600	$2.81 M
City of Warsaw	$51,578	$21.09M
Town of Winona Lake	$18,160	$6.96M
TOTAL	**$259,525**	**$104.01M**

As determined by the committee, the probability of riverine based flooding occurring throughout Kosciusko County is “Unlikely” to “Highly Likely”. This is largely based on the presence of rivers and streams near a majority of the communities. The committee also determined that accurate warning time would range from six to 12 hours to greater than 24 hours based on the terrain, flashy nature

of the waterways in the county, forecasting methods, and local knowledge of stream activities. Finally, the duration of such an event is anticipated to last from less than a day to over a week. A summary of riverine flooding CPRI is shown in **Appendix 11.**

Assessing Vulnerability

Flood events may affect substantial portions of Kosciusko County at one time as river systems and areas with limited drainage cover much of the county and the incorporated communities. With an increase in high volume rain events, the low-lying roads within the county are vulnerable to frequent inundation isolating and/or restricting access to some parts of the county. Wooded areas and farm fields have provided ample supply of debris causing clogs and damage to culverts, and bridges, in the past.

Whenever significant flooding impacts the communities in Kosciusko County, the concern about riverbank erosion, also known as fluvial erosion, is elevated. Fluvial Erosion Hazard (FEH) represents the risk associated with natural stream movements and losses associated with buildings and infrastructure. In some cases, this may be represented by a gradual movement of a stream across a farm field. In other, more extreme instances, homes or other infrastructure may be lost as riverbanks or bluffs sluff into the water below. This will be discussed in greater detail within the landslide, land subsidence, and fluvial erosion discussion.

Log and ice jam flooding is a concern for the more populated areas. Although log jams can occur at any time of the year, ice jams are predominantly and early or late winter occurrence when air temperature rises after freezing temperatures which allow lake and river ice to form. Flooding occurs when pieces of ice either jam up against stationary sheets of ice or against structures in the river such as bridge pylons. The jammed ice can form a dam causing water levels behind it to rise causing localized flooding and pushing large pieces of ice out of the stream. The force of the moving ice pieces is enough to break off nearby trees and/or damage building foundations and small outbuildings. Log jams similarly accumulate causing water levels to rise. Bridges and culverts are most frequently impacted since water flow is easily blocked at these locations forcing water outside of the riverbanks into neighborhoods and businesses.

There are no flood inundation maps developed to identify areas impacted by a variety of flood stages on the Tippecanoe River nor any of the smaller streams and lakes. **Figure 36** shows the distribution of the larger lakes and rivers throughout the county. The county is part of the northeastern Indiana region dotted with numerous ancient glacial kettle lakes.

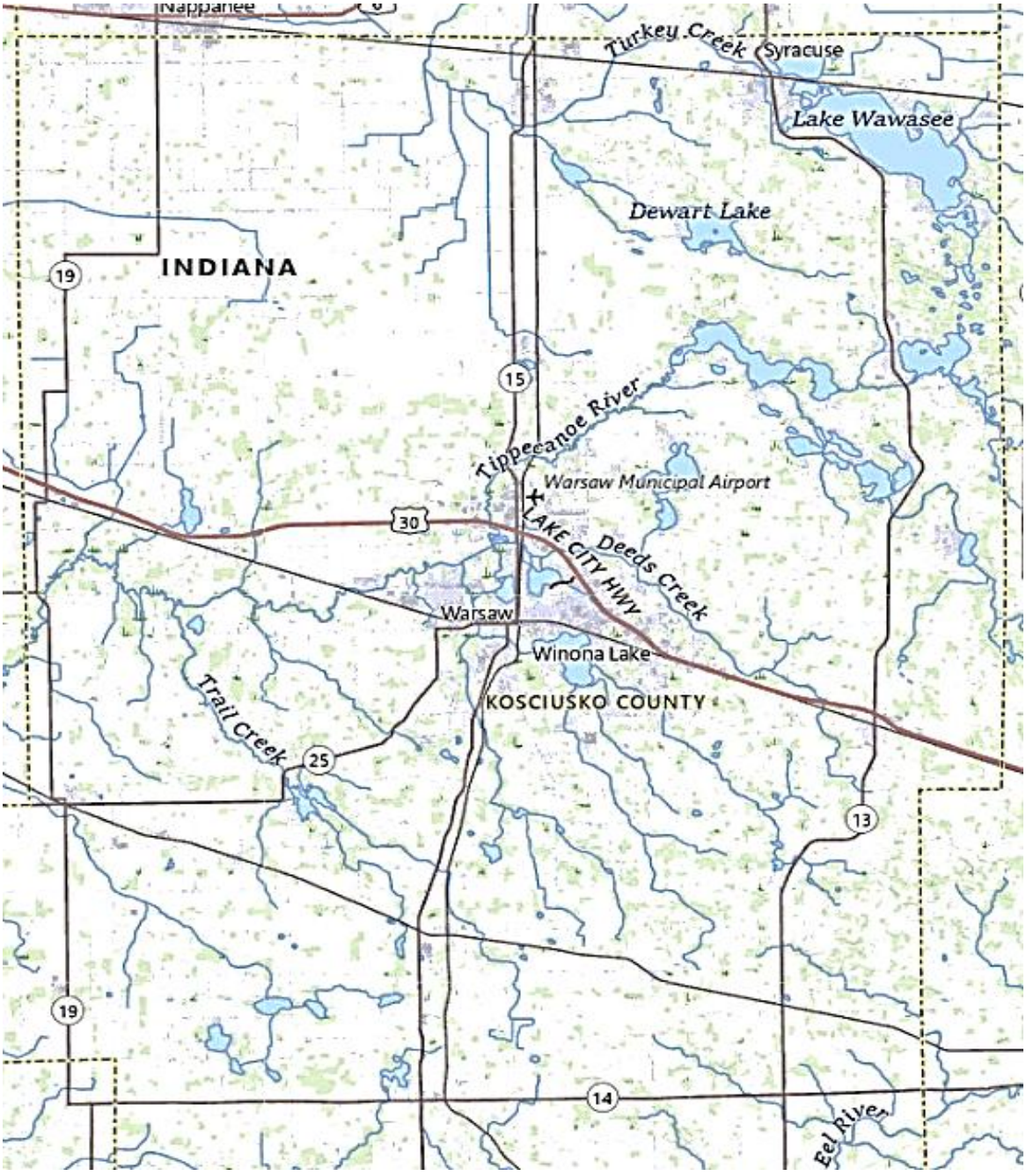


Figure 36: Distribution of Lakes and Rivers in Kosciusko County

The towns of Burket and Sidney have no Special Flood Hazard Area (SFHA) designated within their corporate limits. **Figure 37** shows a portion of the floodplain delineation within the City of Warsaw. Frequently flood risk areas are located within disadvantaged and underserved population census blocks. With less financial capacity to mitigate flooding becomes an additional burden on the communities. Flash flooding, being less predictable, does not allow the advanced warning to be able to protect property and seek shelter out of harm's way, thus increasing vulnerability. An aggregate of the FEMA NFIP Flood Maps for Kosciusko County effective September 30, 2015, is found in **Figure 38.**

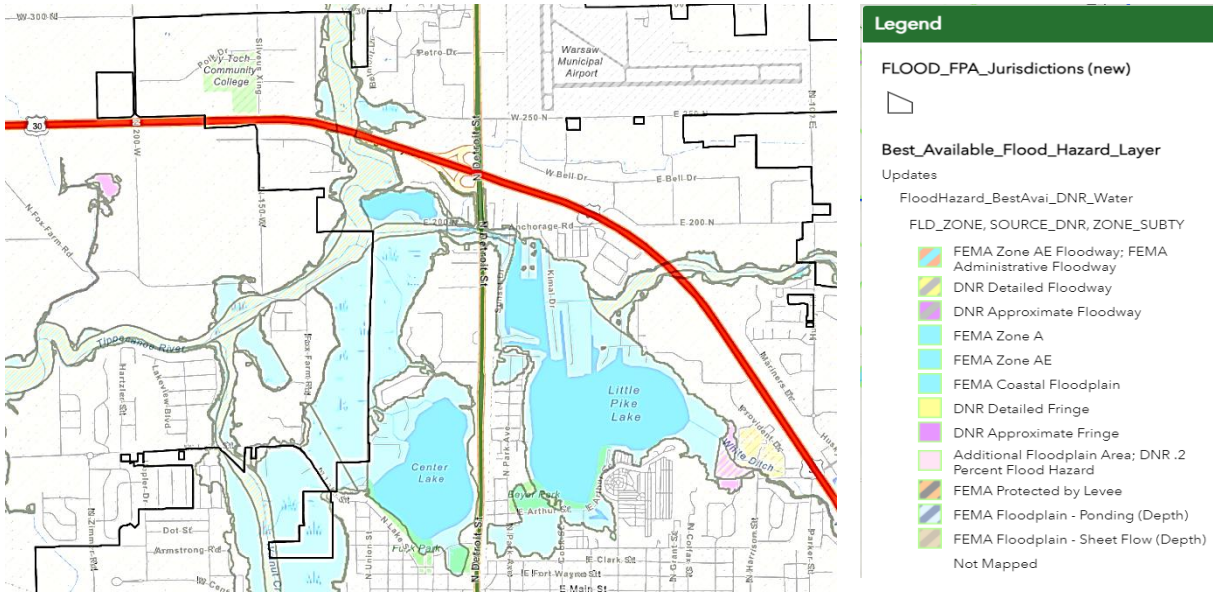


Figure 37: A Portion of the Floodplain Map for Warsaw, IN

Within Kosciusko County, direct and indirect effects of a flooding event may include:

Direct Effects:

- Decreased income and value of properties and contents due to damage by increased water.
- Increased costs associated with additional response personnel, evacuations, and sheltering needs.
- Increased potential impacts to infrastructure and buildings located within the SFHA.
- Increased cleanup costs for more frequent flash flood impacts.
- Loss of topsoil and deposition of sand due to flood inundation of farm fields.

Indirect Effects:

- Increased response times for emergency personnel when roads are impassable.
- Increased costs associated with personnel carrying out evacuations in needed areas.
- Increased risk of explosions and other hazards associated with floating propane tanks or other debris.
- Decreased revenue due to cancellation of special events in impacted areas or water related activities that become too dangerous due to high water.
- Increased expenditures for debris removal costs and return local drainage to normal function.
  Difficulty notifying the underserved populations which may not have access to radio, television, or social media of evacuations.

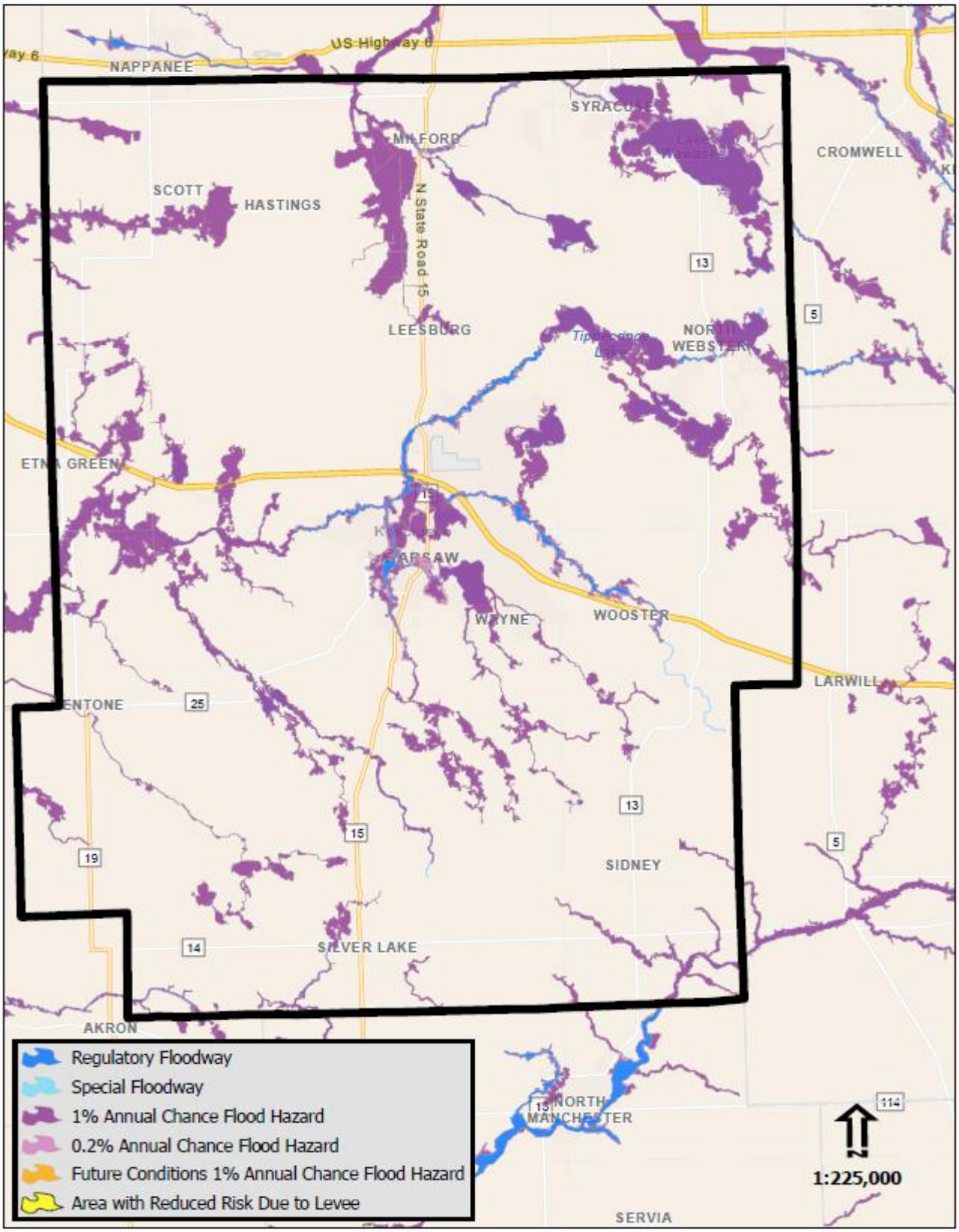


Figure 38: FEMA NFIP Aggregate flood maps effective 9/30/2015

Estimating Potential Losses

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

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

In the assessment, any structure listed as less than 400 ft^2 in area or classified in the Assessor's database as a non-habitable structure was assumed to be an outbuilding. It was assumed that a building was located on a parcel if the value listed in the "Assessed Value (Improvements)" showed a value greater than zero dollars. Parcels that intersected any portion of the FEMA flood zones were considered to be flood prone, and subsequently, further analyzed separately from parcels without structures. Structure values were calculated using:

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

To estimate anticipated damage associated with each flood zone in Kosciusko County and communities, it was estimated that 25% of structures in the flood zones would be destroyed, 35% of structures would be 50% damaged, and 40% of structures would be 25% damaged. **Table 11** identifies the estimated losses associated with structures in the floodway, the 1% AEP, and the 0.2% AEP areas by community within Kosciusko County.

Table 11: Kosciusko County Building Inventory Utilizing Best Available Data

Community	Floodway		1% AEP Outside of Floodway		1% AEP Unstudied excluding Floodway		0.2% AEP excluding 1% AEP and Floodway	
	#	$	#	$	#	$	#	$
Kosciusko County	1,474	$263.74M	3,782	$469.24M	1,823	$254.32M	77	$10.51M
City of Warsaw	115	$17.45M	510	$66.04M	4	$0.56M	172	$25.17M
Town of Leesburg	0	0	0	0	5	$0.64M	0	0
Town of Mentone	5	$0.78M	0	0	2	$0.39M	0	0
Town of Milford	32	$4.59M	4	$0.49M	0	0	1	$0.12M
Town of North Webster	24	$3.64M	118	$14.61M	4	$0.51M	0	0
Town of Pierceton	0	0	0	0	0	0	0	0
Town of Silver Lake	0	0	0	0	61	$7.5M	0	0
Town of Syracuse	58	$9.71M	254	$31.62M	32	$5M	5	$0.62M
Town of Winona Lake	36	$4.61M	189	$23.74M	56	$6.89M	0	0
TOTAL	**1,744**	**$304.52M**	**4,857**	**$605.74M**	**1,987**	**$275.81M**	**255**	**$36.42M**

Utilizing the same GIS information and process, critical infrastructure within each of the flood hazard areas in Kosciusko County was assessed and are included in **Table 12**. These buildings are included in the overall number of structures and damage estimate information provided in **Table 13**.

Table 12: Critical Infrastructure in the Flood Zones

Community	Floodway	1% AEP Studied excluding Floodway	1% AEP Unstudied excluding Floodway	0.2% AEP excluding 1% AEP and Floodway
Kosciusko County	Cell Tower, Amerigas Propane Pleasant Valley School Elrod Day Care Cell Tower Rock Lake Control Structure Loon Lake Control Structure Yellow Creek Lake Control Structure Palestine Lake Dam Pierceton Lake Control Structure Sawmill Lake Control Structure Hoffman Lake Control Structure	Ridinger Lake Control Structure Shoe Lake Control Structure Tippecanoe Lake Control Structure Syracuse Lake Control Structure	Silver Lake Control Structure Hill Lake Control Structure Dewart Lake Control Structure Papakeechie Lake Carr Lake Control Structure	
City of Warsaw	Warsaw Meadows Comm Tower - Hand Industries Cell Tower Comm Tower - Brightspeed Little Pike Lake Control Structure Big Pike Lake Control Structure	Center Lake Control Structure (South Structure) Winona Lake Control Structure		
Town of Leesburg				
Town of Mentone				
Town of Milford				
Town of North Webster		Webster Lake Dam - West Webster Lake Dam - East		
Town of Pierceton				
Town of Silver Lake				
Town of Syracuse	Comm Tower - Wawasee Schools			

Community	Floodway	1% AEP Studied excluding Floodway	1% AEP Unstudied excluding Floodway	0.2% AEP excluding 1% AEP and Floodway
	Highwater Marine, Syracuse Operations Polarkraft			
Town of Winona Lake				

Utilizing the information in **Table 11** regarding the number of structures within each of the flood hazard areas, it is also important to note the number of flood insurance policies within each area in Kosciusko County. **Table 13** provides the comparison between the number of structures in the 1.0% AEP 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 13: Structures in the 1.0% AEP and Number of Flood Insurance Policies

Community	# Structures In Studied and Unstudied 1.0% AEP Including Floodway	# Policies
Kosciusko County	7,079	352
City of Warsaw	629	92
Town of Leesburg	5	0
Town of Mentone	7	1
Town of Milford	36	0
Town of North Webster	146	2
Town of Pierceton	0	0
Town of Silver Lake	61	2
Town of Syracuse	344	9
Town of Winona Lake	281	28
Total	8,588	486

Future Considerations

Kosciusko County discourages critical facilities such as schools, medical facilities, community centers, municipal buildings, and other critical infrastructure from being located within the 1% AEP floodplain. New structures must also be protected to that level along with flood-free access to reduce the risk of damage caused by flooding and to ensure that these critical infrastructures will be able to continue functioning during major flood events. Flooding due to poor drainage, low-lying land, or flash flooding is also an important consideration. It will be important for recognition of potential flood impacts to residents and businesses in these areas to be coupled with proper planning for future development and redevelopment of the flood zones. This would also include studying the Best Available Data Layer and inundation areas mapped through the development of the Indiana Floodplain Portal as well as studies of all the streams with one square mile or drainage area or greater (**Figure 38**).

As the municipalities within Kosciusko County grow in population and redevelop, it can be anticipated that the number of critical and non-critical infrastructure will also increase accordingly. Kosciusko County updated and adopted the County Floodplain Ordinance in 2018 which includes

the unincorporated portions of the county as well as the towns of Claypool, Etna Green, Milford, North Webster, Pierceton, Silver Lake, and Syracuse. In 2015, the City of Warsaw as well as the Towns of Mentone and Winona Lake adopted floodplain ordinances. All the floodplain ordinances discourage the construction of critical facilities such as schools, medical facilities, community centers, municipal buildings, and other critical infrastructure occur outside of the SFHA and be properly elevated to prevent damage by floods.

Figure 39: Fire Engine in Flood Waters

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

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

Despite these efforts, the overall vulnerability and monetary value of damage 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 39**)**,** 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. Several communities within Kosciusko County host numerous special events near or on the rivers and waterways. These special events may have to be cancelled or postponed due to flooding or high-water levels.

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 loosened and migrated 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 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 damage associated with the release.

Increased volumes of water during flood events may also lead to dam failure. As the water levels rise in areas protected by dams, at some point, these structures will overtop or will breach, leading

to even more water being released. These two hazards, flood, and dam failure, when combined, may certainly result in catastrophic damage.

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

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

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

3.2.6 HAIL, THUNDER, 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 40**) and crops. Even small hail can cause considerable damage to young and tender plants. Residents should take cover immediately in a hailstorm, and protect pets and livestock, which are particularly vulnerable to hail, and should be under shelter as well.

Figure 40: Damaaging Hail on Vehicles

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

Recent Occurrences

In Kosciusko County, the NCDC has recorded 10 hail events, 92 thunderstorms/windstorm events, four high wind or strong wind reports, and three lightning reports between January 1, 2018, to November 1, 2025. Of all the reported instances of hail, three dates had multiple reports. The average diameter hail stone occurring throughout Kosciusko County ranges from 0.75 inches to 1.0 inch with the largest one for this period of interest being one and quarter inches. According to the Midwest Regional Climate Center (MRCC) hail is considered severe if a thunderstorm produces hail stones larger than one inch in diameter, or larger than the size of a quarter.

Significant windstorms are characterized by the top wind speeds achieved during the incident. Such high wind events characteristically occur in conjunction with thunderstorms and have historically occurred year-round with the greatest frequency and damage occurring in May, June, and August. Within Kosciusko County, NCDC reports 20 instances between January 1, 2018 to November 1, 2025 where top wind speeds were greater than 60 mph. The strongest winds reported during this time were 70 mph on March 30, 2025. A microburst (determined by the NWS) on September 20, 2024, resulted in major damage on the north, east, and south sides of Chapman Lake. One home was destroyed, 10 sustained major damage, 29 minor damage and 86 homes were affected by the

event. Although a local disaster was declared, the SBA was not able to make a declaration because damage fell just short of the required threshold.

The NCDC recorded damage for hail, thunder, and windstorms throughout Kosciusko County. Of the 10 Hail events reported only $2,500 of personal property damage was reported. In a similar manner to the 92 thunderstorms and high wind reports, $1.2M in property damage was reported. No additional crop damage or deaths associated with these events were reported. There were two injuries reported on August 29, 2022, when a tree was down on vehicle with injuries. Many event reports included in the NCEI did not provide descriptive information on the social, physical, and economic losses resulting from individual storms specific to Kosciusko County. In local storm reports on the NWS. Where damages were reported, narrative descriptions of the event rarely extended beyond reports of damage to broken tree limbs, downed power lines, or roof damage.

Appendix 6 provides the NCEI information regarding hail, thunder, and windstorms events and any reported property damage, crop damage, deaths or injuries.

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

The committee determined the probability of a hail, thunder, or windstorm occurring anywhere throughout Kosciusko County is “Possible” to “Highly Likely” and will typically affect broad portions of the county at one time resulting in potentially “Negligible” to “Significant” damage. As advancements in technologies such as weather radar systems and broadcast alerts are continually made, the warning time for such incidents may increase. Currently, the committee feels that the warning time is anticipated to be less than six hours to 12-24 hours, and the duration is expected to last less than six hours to less than a week.

Indicative of a regional hazard, the probability, magnitude, warning time, and duration of a hailstorm, thunderstorm, or windstorm are expected to be similar throughout the county. These events are highly unpredictable, and the occurrences are distributed throughout the country, sometimes impacting one community more often or more severely than another. Therefore, the CPRI values reflect the distributed risk and associated priority for hail, thunder, or windstorm. A summary is provided in **Appendix 11**.

Specific locations and frequency of hail, thunder, and windstorms are difficult to predict as many of these individual events are without significant warning time and may have impacts on 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 hail, thunder, or windstorm within the calendar year. More likely, these communities will be impacted by several of these hazard events each year. The magnitude is anticipated to be similar based on the number of critical infrastructure and populations of each of the municipalities, or “Significant.”

Assessing Vulnerability

The effects of hail, thunder, or windstorm may be minimal to extensive in nature and may affect small or broad ranges of land area. Within Kosciusko County, direct and indirect effects from hail, thunder, or windstorms may include:

Direct Effects:

- Damage to infrastructure (power lines)

- Damage to individual property (homes, cars)
- Physical injuries may be experienced by those unable to find shelter during storm events, such as homeless people, hikers, and outdoor workers

Indirect Effects:

- Downed power lines due to falling tree limbs
- Losses associated with power outages
- Damage sustained from blowing debris
- Cancellation or interruption of special events

Estimating Potential Losses

Figure 41: Home Damaged During Windstorm

Due to the unpredictability of this hazard all critical infrastructure and non-critical structures in Kosciusko County are at risk of damage including temporary or permanent loss of function. For hail, thunder, and windstorms, it is not possible to isolate specific critical infrastructure or non-critical structures that would be vulnerable to damage. However, areas where utility lines are above ground and areas where dead or dying trees have not been removed may be at higher risk of property damage or power outages during hail, thunder, and windstorms. Additionally, mobile homes and accessory buildings such as pole barns and sheds may also be at a higher risk of damage from hail, thunder, and windstorms if not properly anchored to the ground. Damage from falling limbs or uprooted trees such as that shown in **Figure 41.** Homeless individuals and families who have alternative means of sheltering may experience greater losses from the instability of tents and alternative structures.

Future Considerations

As the population of the communities in Kosciusko County develops and redevelops, it can be anticipated that the number of structures will also increase. To reduce the vulnerability of damage resulting from hail, thunder, or windstorms, measures such as proper anchoring are vital. This includes not only roof anchors but also mobile home anchors. Proper tree maintenance, 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 hail, thunder, and windstorms due to the diffuse nature and regional impacts of this hazard.

Indirect effects resulting from hail, thunder, or windstorm can include power outages caused by downed tree limbs or flying debris, damage resulting from prolonged power outages, and damage to structures or property because of debris. Damage to temporary housing arrangements which results in loss of personal property and potential injuries is also a concern during storms.

Relationship to Other Hazards

Hail, thunder, and windstorms may be the precursor for other hazards. For example, hazardous materials incidents can be the result of hail, thunder, or windstorms. 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 Kosciusko County.

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

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

3.2.7 LANDSLIDE, LAND SUBSIDENCE, AND FLUVIAL EROSION

Overview

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

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

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

Recent Occurrences

The potential for landslides or land subsidence within Kosciusko County was discussed by the planning committee. IndianaMap shows that there are no Karst Sinkhole areas anywhere in the county. To the knowledge of the planning committee, there are no active underground mining operations within Kosciusko County. Additionally, to date, there have not been any landslides or land subsidence events reported in the county. There have been some concerns about FEH along the rivers, during and immediately after flood events. **Figure 42** shows the FEH corridor along the Tippecanoe River near Warsaw. The FEH corridor matches the floodway which is mostly cropland and forestry. There are no residential structures located in the FEH corridor.

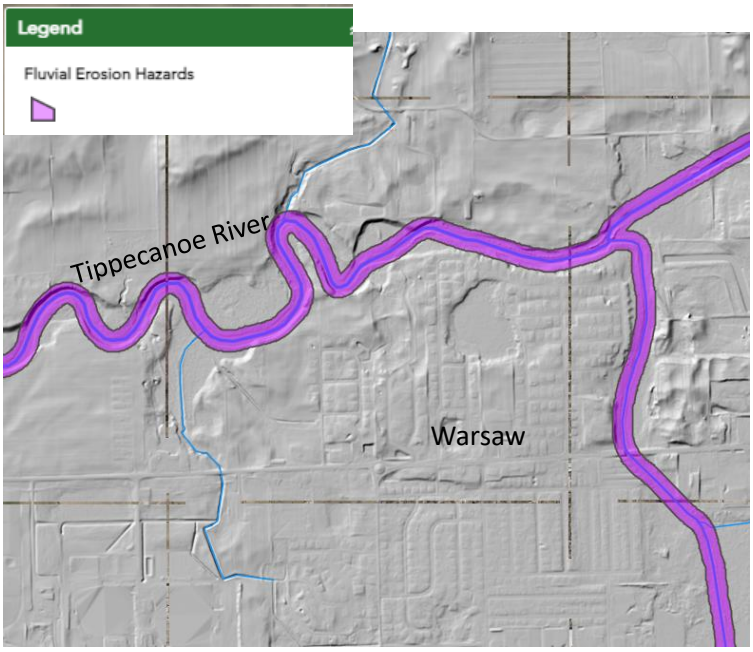


Figure 42: Fluvial Erosion Hazard along the Tippecanoe River near Warsaw, IN

The committee determined the probability of a landslide, land subsidence, and fluvial erosion occurring in Kosciusko County is "Unlikely" to "Possible." Any event is expected to result in potentially "Negligible" to "Critical" damage with the majority in the Negligible" to "Limited" amounts. Currently, the committee feels that the warning time is expected to range from be less than six hours

up to greater than 24 hours and similarly, the duration is expected to last less than six hours to greater than one week. These events are highly unpredictable and the risk, although very low according to the committee, is distributed throughout the county. Therefore, the CPRI values reflect the distributed risk and associated priority for a landslide, land subsidence, and fluvial erosion event. A summary is provided in **Appendix 11.**

Assessing Vulnerability

Although Kosciusko County has no known presence of karst geology and is at a low risk of landslides, land subsidence, and FEH, there are portions of the county are considered at relatively moderate risk for landslides according to the National Risk Index. The risk index considers expected annual loss as well as vulnerabilities by census tract and community resilience. The Expected Annual Loss from the Risk Index for Landslide in Kosciusko County is shown in **Figure 43**. The Risk index varies from no expected annual loss near the City of Warsaw and the white areas on the map to very low and relatively low loss through most of the center of the county. Darker shades of orange indicate relatively moderate losses are expected annually in the south and southwestern parts of the county as well as the north/ northwestern portion. Although northern Indiana rivers have been relatively stable with little fluvial erosions, the high volume short duration rain events may be adversely impacting rivers causing them to shift to restore stability and reduce the energy which is the source of the FEH issues along the rivers and streams The planning committee rated the Landslide, Land Subsidence, and FEH as “Unlikely” according to the planning committee with “Negligible” severity.

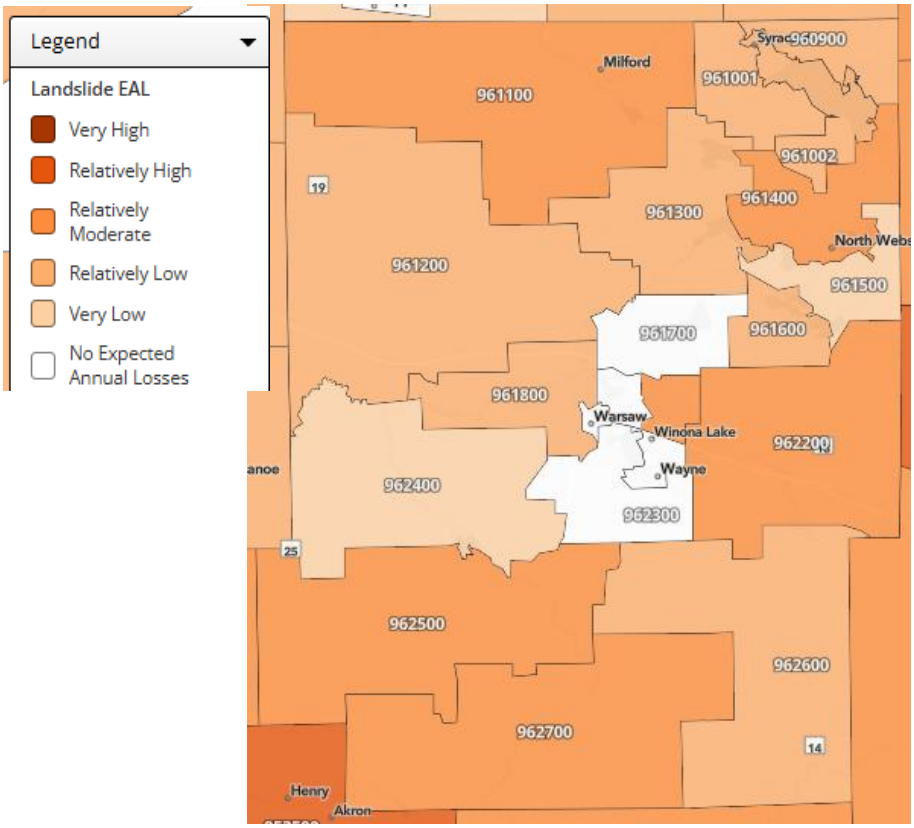


Figure 43: Risk Index for Landslide in Kosciusko County

Within Kosciusko County, direct and indirect effects may include:

Direct Effects:

- Damage to infrastructure (power lines, roads, bridges)
- Damage to individual property (homes, cars)
- Loss of cropland immediately adjacent to the rivers

Indirect Effects:

- Increased response time for emergency vehicles
- Losses associated with affected land (crop loss)
- Potential contamination of groundwater resources
- Loss of business due to roadway access and power loss.

Estimating Potential Losses

According to the National Risk Index, expected annual losses have been calculated for the areas in Kosciusko County for landslide as can be seen in **Figure 43**.

Areas where FEH meander belt widths (FEH Zones) have been identified may be at a higher risk of property damage caused by such events. To prepare a community based basic "what-if" scenario, the Indiana FEH GIS layers were overlaid onto parcel data provided by the county. **Table 14** identifies the number of structures which could potentially be damaged within the FEH areas.

Table 14: Summary of Structures in the FEH Zone

Community	Potential Damage # Structures
Kosciusko County	1,584
City of Warsaw	35
Town of Mentone	3
Town of Milford	20
Town of North Webster	16
Town of Syracuse	41
Town of Winona Lake	9

Future Considerations

As the population in Kosciusko County grows, it can be anticipated that the number of critical and non-critical structures will also increase. To reduce the vulnerability of damage from a landslide, land subsidence, or fluvial erosion incident, area GIS layers along with the floodplain information should be integrated into the building permit or approval process. In recent years, no significant development has occurred within these areas of Kosciusko County. However, depending on the location, any development may increase the vulnerability to this hazard.

As future growth takes place, the indirect effects resulting from a landslide or land subsidence event can cause challenges for the community if transportation routes are damaged, and businesses must close due to access issues and loss of power. Cascading impacts in smaller counties can have long lasting effects on the local economy, community growth, health, and welfare.

Relationship to Other Hazards

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

areas previously not impacted by flood due to debris clogging drainage ways and loss of earthen berms near the waterways.

Similarly, these types of events may be caused by hail, thunder, or windstorms and their effects on the soils; an earthquake may release the ground enough to set a slide in motion; or a flood may add increased soil saturation or weight to at-risk areas increasing the potential for an event and resulting damages.

3.2.8 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.

Figure 44: Funnel Cloud During Lightning Storm at Night

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 from 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% 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 44.** Tornadoes occur most frequently in the United States east of the Rocky Mountains. Tornadoes in Indiana generally come from the south through the east. 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.

Recent Occurrences

The classification of tornadoes utilizes the Enhanced Fujita Scale of tornado intensity and damage. Tornado intensity ranges from low intensity (EF0) tornadoes with effective wind speeds of 65-85 mph to high intensity (EF5+) tornadoes with effective wind speeds of 200+ mph. (**Table 15)**

Table 15: Enhanced Fujita Scale for Tornados

EF-Scale	Windspeed, mph	Character of Damage	Relative Frequency	Typical Damages
EF0	65-85	Light damage	29%	Shallow rooted trees blown over; damage to roofs, gutters, siding
EF1	86-110	Moderate damage	40%	Mobile homes overturned, roofs stripped, windows broken
EF2	111-135	Considerable damage	24%	Large trees snapped, light-object missiles generated, cars lifted
EF3	136-165	Severe damage	6%	Severe damage to large buildings, trains overturned
EF4	166-200	Devastating damage	2%	Whole houses destroyed; cars thrown
EF5	200+	Incredible damage	<1%	High-rise buildings significantly damaged, strong framed homes blown away

According to the NCDC, Kosciusko County experienced four tornadoes between January 1, 2018, and November 1, 2025. Two of the tornadoes were reported on the same day in two separate communities. On April 2, 2025, an EF1 tornado near the Town of Etna Green caused $10,000 in property damage as several homes had roof and garage damage. There were no injuries or deaths with any of the tornado events.

The committee estimated the probability of a tornado occurring in Kosciusko County would be "Unlikely" to "Highly Likely" for most communities participating, and the magnitude of such an event to be "Negligible" to "Critical". The overall index is "Elevated" for most throughout the county. As with many hazardous events, the committee anticipated a short warning time of typically less than six hours to be greater than 24 hours, and a short duration, averaging less than six hours to greater than one week. The summary is shown in **Appendix 11.**

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.

Assessing Vulnerability

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

Direct Effects:

- Increase damage to older construction including residential and business structures, mobile homes, and accessory structures (pole barns, silos, sheds)
- Damage to structures in the immediate pathway (businesses, residences, warehouses)
- Loss of alternative housing stock nearby
- Damage to above ground utility lines and structures

Indirect Effects:

- Loss of revenue for affected businesses
- Expenses related to community clean-up and debris removal from public rights of way and public facilities
- Inability for property owners to work while addressing damage from the tornado and debris removal from high winds
- Affected business owners may experience loss of revenue if they are unable to continue operations following the event and employes may experience a loss of wages during the period of recovery

Estimating Potential Losses

Due to the unpredictability of this hazard, all critical and non-critical structures within the county are at risk of future damage or loss of function. Estimates of potential physical losses were determined through a hypothetical exercise where an EF2 intensity tornado traveled through portions of the county and the communities. 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 destroyed, 35% of the structures would be 50% damaged, and 40% of the structures would sustain 25% damage. These estimations were also determined utilizing three wind speed zones based on distance from the tornado path. Zone 1 is near the center of the

tornado path, while Zone 3 is the farthest from the path and with a theoretically lower wind speed. **Table 16** provides summary data for the hypothetical tornado, which is identified on **Exhibit 3**.

Table 16: Summary of Hypothetical Tornado Damages

	Zone 1		Zone 2		Zone 3		Total	
	#	$	#	$	#	$	#	$
Kosciusko County	224	$32.46M	130	$17.29M	153	$19.67M	507	$69.42M
City of Warsaw	169	$28.25M	85	$13.27M	63	$10.39M	317	$51.91M
Town of Mentone	57	$8.22M	43	$5.33M	41	$5.0M	141	$18.55M
Town of North Webster	67	$8.29M	55	$7.11M	46	$6.27M	168	$21.67M
Totals	**517**	**$77.22M**	**313**	**$43M**	**303**	**$41.33M**	**1133**	**$161.55M**

Utilizing the same GIS information and process, critical infrastructure within each of the hypothetical tornado zones are included in **Table 17.** These buildings are included in the above table showing the number of structures and damage estimate information.

Table 17: Critical Infrastructure within Hypothetical Tornado

Community	Zone 1	Zone 2	Zone 3
Kosciusko County		The Children's House	AmeriGas Propane
City of Warsaw	Meijer Store Warsaw #267 Purity Cylinder Gases Zimmer Biomet Inc - West Campus Cell Tower	Buhrt Engineering Inc - Plant 2 & 3 Lassus Bros. Oil Station 45 Warsaw Schools Bus Garage Warsaw Community Schools Transportation Applied Thermal Technologies Flexaust (Dayflex)	Flexaust Inc
Town of Mentone	Mentone Elementary School Mentone Treatment Plant Mentone Police Department Mentone Fire Dept Mentone Ems Mentone Day Care	Mentone Water Tower	North Webster Elementary School North Webster PD
Town of North Webster	Brightspeed	Jackson Oil & Solvents Inc Pencil Box Preschool	New Community Church of North Judson Inc

Future Considerations

Within Kosciusko County, there are numerous events each year as well as regular tourist attractions that attract thousands of guests. Due to this, it is imperative that the EMA place continued importance on the need to maintain their outdoor warning siren coverage and/or support alternative notification methods for people who may not be tuned in to local media. Because of the dispersed population concentration, coverage is limited to the more densely populated portions of the county. The existing outdoor warning siren locations are identified in **Figure 45.**

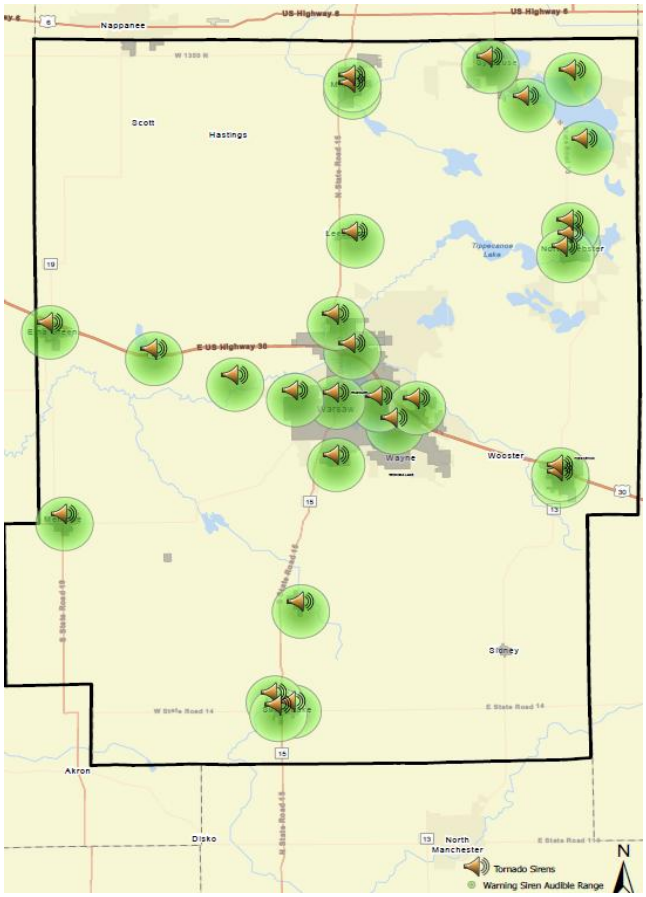


Figure 45: Outdoor Warning Siren Locations in Kosciusko County

While it can be anticipated that new construction associated with development may be stronger than older or existing construction, existing older structures, barns, pole buildings, silos, and mobile homes remain threatened by tornados. The unincorporated portions of Kosciusko County will remain vulnerable, especially where the outdoor warning siren coverage is not present. It is impossible to predict the path of a tornado and therefore all current and future development will continue to be at risk for damage. Risks to the citizens of Kosciusko County may be lessened through participation in mass notification programs, use of weather radios, and turning on the emergency alert feature on cell phones. Having multiple means of warning citizens, businesses and visitors about incoming weather events is critical to continued economic growth and well-being of the communities and the county.

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 damage 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 dam failure as the increased wind speeds, and debris caused by the tornado may directly impact the dam or cause indirect damage by clogging outlet structures and/or emergency spillways. 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, gas leaks, and substantial amounts of debris.

3.2.9 WINTER STORM AND 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. Winter storms are typically accompanied by cold temperatures and blowing snow, which can severely reduce visibility. A winter storm is defined as one that drops four or more inches of snow during a 12-hour period, or six or more inches during a 24-hour span. An ice storm occurs when freezing rain falls from clouds and freezes immediately in contact with a variety of surfaces. 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 46: Ice Covered Powerlines

Storm effects such as extreme cold, flooding, snow and ice accumulation can cause hazardous conditions and hidden problems for people in the affected area. **Figure 46** shows the added weight on trees and ice coated powerlines. People can become stranded on the road or trapped at home, without utilities or other services, including food, water, and fuel supplies. The conditions may overwhelm the capabilities of a local jurisdiction. Winter storms are considered deceptive killers as they may indirectly cause transportation accidents, and injury and death resulting from exhaustion/overexertion, hypothermia and frostbite from wind chill, and asphyxiation. House fires occur more frequently in the winter due to the use of alternative heat sources, such as space heaters, and lack of proper safety precautions.

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

A winter storm watch indicates that severe winter weather may affect your area. A winter storm warning indicates that severe winter weather conditions are on the way. In the event of a blizzard, a winter storm warning will be issued and include the details of the blizzard - that large amount of falling or blowing snow and sustained winds of at least 35 mph are expected for several hours. Being in Northern Indiana, winter storms are somewhat common in Kosciusko County and the surrounding region. Winter weather conditions can result in substantial personal and property damage, even death.

On October 15, 2018, NWS consolidated their watch and warning products. In doing so, blizzards and lake effect snow are no longer separate watches and warnings but instead are detailed as a part of winter storm watches and warnings. Many winter storm products are available from NWS such as the Winter Storm Severity Index (WSSI). When a storm is forecast, the NWS can help communities better understand the potential impacts of storm using WSSI. **Figure 47** shows the description of the WSSI impacts. More detailed information with regards to the timing of the storms, etc., is provided as the event gets closer to the forecast area.

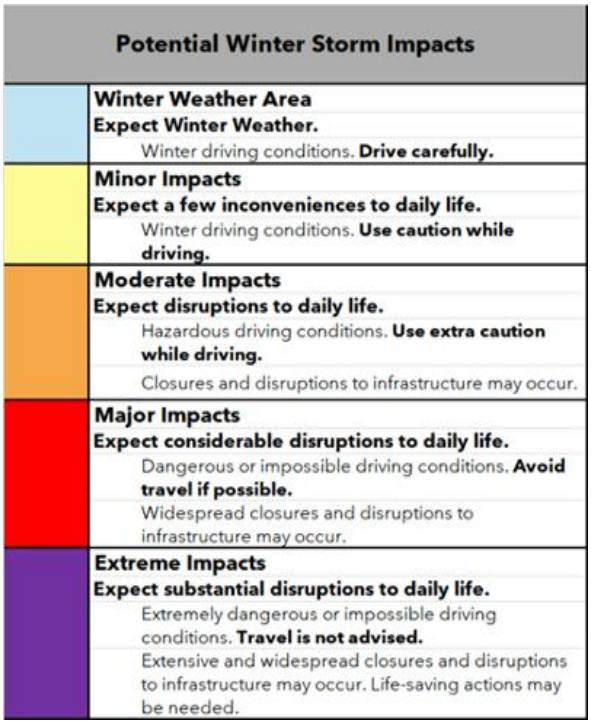


Figure 47: Winter Storm Impacts, NWS

Recent Occurrences

From January 1, 2018 to November 1, 2025 the NCDC has recorded 26 winter weather events, zero ice storms, and seven winter storms. NCDC reports indicated no property damage, no additional crop damage and no injuries, or deaths associated with any of the events. Many narrative descriptions indicated poor travel conditions, power outages and debris associated with similar events.

The probability, magnitude, warning times, and duration of a winter storm or ice causing disruption to residents and businesses in Kosciusko County, as determined by the planning committee, is expected to be mostly consistent throughout the county and communities. It is “Possible” to “Highly Likely”. that this type of hazard will occur in this area and will typically affect the entire county, and possibly several surrounding counties at one time, resulting in primarily “Limited” to “Significant” damage. The typical warning time for severe temperatures or several inches of snow associated with a winter storm is usually 12-24 hours up to greater than 24 hours while the duration of the incident is anticipated to be less than one week to greater than one week. A summary is shown in **Appendix 11.**

The planning committee determined that the probability for a winter storm or ice to occur in Kosciusko County and the communities within is “Possible” to “Highly Likely”. Based on historical data and the experience of the planning committee, winter storms or ice have become less common in Kosciusko County with the changing climate, but actions have been taken to mitigate many impacts from winter storms and ice. Lake effect snowstorms can be less predictable, depositing greater amounts of snow in a contiguous county and lesser amounts in Kosciusko County or the opposite. The committee considered only the larger, more detrimental events for this effort.

Assessing Vulnerability

Winter storms and ice typically affect a large regional area with potential for physical, economic, and/or social losses. Direct and indirect effects of winter storms or ice within Kosciusko County may include:

Direct Effects:

- Businesses may experience loss of production as employees may not be able to get to work and residents traveling to other areas for work results in loss of income due to their inability to reach their normal worksites
- Rural (County) roads may be impassable
- Expenses related to snow removal or brine/sand applications
- Weight of ice and wet snow impacts older structures roofs as well as powerlines
- Large ice and snow events interrupt economic activity within the community

Indirect Effects:

- Loss of revenue as businesses are closed
- Increased emergency response times based on safety of roads
- Loss of income if workers are unable to get to their place of employment
- Delayed impacts due to supply chain disruptions – products not received or shipped on time cause lost wages and revenues
- Cancellation of special events and reduced tourist activities impact the local economy

Figure 48: Travel Impacted During Snowstorm

Estimating Potential Losses

Given the nature and complexity of a regional hazard such as a winter storm and ice, 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 winter storm and ice incidents.

For planning purposes, information collected about winter storm and ice 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 communities. For example, a March 2003 snowstorm in Denver, Colorado dropped approximately 31 inches of snow and caused an estimated $34M in total damage. In addition, a February 2003 winter storm dropped an estimated 15-20 inches of snow in parts of Ohio. The Federal and Ohio Emergency Management Agencies and U.S. Small Business Administration surveyed damaged areas and issued a preliminary assessment of $17M in disaster related costs. These costs included snow and debris removal, emergency loss prevention measures, and public utilities repair. The agencies found over 300 homes and businesses either damaged or destroyed in six counties. Snowstorms and blizzards also make road travel difficult and dangerous, as seen in **Figure 48**.

Looking a bit closer to home, In December 2008, Allen County had a wintry combination of freezing rains, snow and ice. This storm was the largest disaster for Indiana Michigan Power with 110,000 Allen County customers without power. Approximately 1,600 additional crew members were brought in to restore electrical service to the county. According to the Journal Gazette $10 – $12M was spent to clean up the debris, make repairs and labor costs for this event.

While the above examples indicate the wide-ranging and large-scale impact that winter storms and ice can have on a community or region, winter storms or ice generally tend to result in less direct

economic impacts than many other natural hazards. According to the Workshop on the Social and Economic Impacts of Weather, which was sponsored by the U.S. Weather Research Program, the American Meteorological Society, the White House Subcommittee on Natural Disaster Relief, and others, winter storms resulted in an average of 47 deaths and more than $1B in economic losses per year between 1988 and 1995. However, these totals account for only 3% of the total weather-related economic loss and only 9% of fatalities associated with all weather-related hazards over the same period.

Future Considerations

As populations increase and communities continue to grow, the need to respond to winter storms or ice will remain an important municipal effort. As new construction or re-development occurs, especially new or existing critical infrastructure, it is important to ensure that these new structures are equipped to deal with the potential risks associated with this hazard. Those may include lengthy power outages and potentially impassable transportation routes, making it difficult to obtain supplies or for passage of response vehicles. These hazard events will typically affect the entire county, perhaps multiple counties, and therefore all development, current and future, will be at risk for damage associated with winter snow and ice. In addition, there may be a need for additional warming shelters for the underserved populations to take refuge, get warm and provide safe respite for stranded commuters on their way to or from work. This not only includes daytime available spaces but also overnight accommodation as the winter storms is often accompanied by very cold temperatures and wind chills.

Winter storms or ice 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 or ice. According to a report by the National Center for Environmental Predictions, the cold and snowy winter in late 1977 and early 1978, which impacted several heavily populated regions of the country, was partially responsible for reducing the nation's Gross Domestic Product (GDP) from an estimated growth rate of between 6% and 7% during the first three quarters of 1977 to approximately -1% in the last quarter of 1977 and 3% during the first quarter of 1978.

Relationship to Other Hazards

Figure 49: Flooding Caused by Snow Melt

Winter storms and ice can lead to flooding as the precipitation melts and enters locally receiving waters. This increased volume of water on already saturated, or still frozen ground can quickly result in flood-related damage to structures and properties (**Figure 49)** as well as within the stream or river channel. Kosciusko County has an increased risk of flooding following heavy precipitation events. The increased flooding may then lead to a dam failure within the same area, further exacerbating the damage.

Hazardous materials incidents may be caused by poor road conditions during winter storms or ice. Many hazardous materials are transported by rail or by tanker over highways and interstates. In

the more rural areas of Kosciusko County, where open areas are more susceptible to snow drifts on roads, the possibility of a traffic related hazardous materials incident may increase due to road obstruction and lack of visibility.

Power outages and other infrastructure failures may also occur during a winter storm. Weight from snow and ice accumulation can directly or indirectly cause power lines to fail. During extreme cold temperatures, power outages may prove deadly for certain populations such as the homeless, the elderly or ill. Power outages in the winter are especially dangerous as families try to generate heat using alternative heat sources. Alternative heating sources may not be safely used or may be placed too close to combustible materials resulting in fires and burn injuries or death.

3.2.10 DAM AND LEVEE FAILURE

Overview

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

A dam impounds water in the upstream area, referred to as the reservoir. The amount of water impounded is measured in acre-feet. An acre-foot is the volume of water that covers an acre of land to a depth of one foot. As a function of upstream topography, even a 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 (NID), the majority are privately owned. Each regulated 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 of regulated 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 severe 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.

In Indiana, not all dams are regulated. To be regulated by the Indiana Department of Natural Resources (IDNR). To be under the IDNR jurisdiction, the dam must meet at least one of the following criteria:

- The dam has a drainage area above the dam of more than one square mile.
- The dam is 20 feet in height or greater.
- The dam impounds a volume of more than 100 acre-feet of water.

A dam's classification may be changed to a High-hazard classification through a successful petition by a downstream property owner. Federally owned and operated dams are not under IDNR's jurisdiction. Examples of Federally regulated dams include Federal Energy Regulatory Commission (FERC) and US Army Corps of Engineers (USACE) structures. Although regulations are similar, there are additional requirements based on the regulating agency.

A levee is a flood control structure engineered and designed to hold water away from a building. Levees protect buildings from flooding as well as from the force of water, from scour at the foundation, and from impacts of floating debris. Flood protection levees are the principal causes of levee failure, like those associated with dam failure include overtopping, surface erosion, internal erosion, and slides within the levee embankment or the foundation walls. Levees are designed to protect against a particular flood level and may be overtop in a more severe event. When a levee

system fails or is overtopped, the result can be catastrophic and often more damaging than if the levee were not there, due to increased elevation differences and water velocity. The water flowing through the breach continues to erode the levee and increases the size of the breach until it is repaired or water levels on the two sides of the levee have equalized. The FEMA and US Army Corps of Engineers (USACE) remind people living and working behind levees that there is always a residual risk when living or working in a facility located behind a levee. Levees reduce the risk of flooding, but do not eliminate that risk.

Recent Occurrences

Within Kosciusko County, there are 31 DNR listed structures. Most of the structures are considered lake control structures which are not idenfitified as dams.

Kosciusko County, has four high hazard dams, two are considered a significant hazard dam, and two low hazard dams. One structure is listed as a low head dam, and the remainder are considered lake control structures. **Table 18** provides a listing of the dams, their hazard classification, and notes about the dam's status. According to local information, there have not been any recent dam failures within Kosciusko County.

Table 18: Dams Impacting Kosciusko County

Dam Name	State ID	Owner Type	State Regulated Dam	Hazard Potential Classification	IEAP
Flatbelly Lake Dam	43-1	State	Yes	High	
Webster Lake Dam - East	43-5A	Private	Yes	High	Yes
Webster Lake Dam - West	43-5B	Private	Yes	High	Yes
Papakeechie Lake	43-7	Private	Yes	High	
Goldeneye Pond Dam	43-2	State	Yes	Significant	
Palestine Lake Dam	43-3	State	Yes	Significant	
Big Chapman Lake (Little Chapman) Control Structure	43-10	State		Low	
Little Chapman Lake Control Structure	43-11	State		Low	
Dewart Lake Control Structure	43-12	Private		Low	
Fish Lake Control Structure	43-13	State		Low	
Hill Lake Control Structure	43-14	Private		Low	
Hoffman Lake Control Structure	43-15	State		Low	
Loon Lake Control Structure	43-16	State		Low	
Big Pike Lake Control Structure	43-17	State		Low	
Little Pike Lake Control Structure	43-18	State		Low	
Pierceton Lake Control Structure	43-19	County Surveyor		Low	
Ridinger Lake Control Structure	43-20	State		Low	
Rock Lake Control Structure	43-21	State		Low	
Sawmill Lake Control Structure	43-22	State		Low	

Dam Name	State ID	Owner Type	State Regulated Dam	Hazard Potential Classification	IEAP
Sellers Lake Control Structure	43-23	County Surveyor		Low	
Shoe Lake Control Structure	43-24	Private		Low	
Silver Lake Control Structure	43-25	State		Low	
Tippecanoe Lake Control Structure	43-26	State		Low	
Winona Lake Control Structure	43-27	State		Low	
Yellow Creek Lake Control Structure	43-28	State		Low	
Syracuse Lake Control Structure	43-29	Local Government		Low	
Price Lake	43-30	State		Low	
Shock Lake Dam	43-31	State	Yes	Low	
Warsaw Water Supply Dam (In-Channel)	43-6	Utility		Low	
Carr Lake Control Structure	43-8	State		Low	
Center Lake Control Structure (South Structure)	43-9	Local Government		Low	

According to the NLD managed by the USACE, there are no certified levees systems within Kosciusko County. The Indiana Silver Jackets Team completed a survey of levee-like features also known as non-levee embankments. The non-levee embankments are not certified or engineered structures. They are earthen structures which act like levees, however, cannot protect the features behind the structures adequately. In fact, non-levee embankments impose lateral constraints on flood flows, reducing the floodplain storage capacity and increasing the flood velocity. These non-

Figure 50: Non-Levee Embankments in Kosciusko County

levee embankments can cause stream erosion and downstream flooding. Many farms along the rivers rely on these embankments to keep flooded waters out of their fields. **Figure 50** shows the location of a non-levee embankment in Kosciusko County.

Based on the information provided to them and their local knowledge, experience, and expertise, the committee determined the probability of a dam failure is “Unlikely” to “Possible.” The magnitude of a dam failure can have “Negligible” to “Significant” damages. The warning time ranges from under six hours up to more than 24 hours. **Appendix 11** provides a summary of the planning committee’s expectations during a dam failure.

Assessing Vulnerability

The actual magnitude and extent of damage due to a dam failure depends on the nature of the breach, the volume of water that is released, and the width of the floodplain valley to accommodate the flood wave. Due to the conditions beyond the control of the dam owner or engineer, there may be unforeseen structural problems, natural forces, mistakes in operation, negligence, or vandalism that may cause a structure to fail. Only two of the four high hazard dams in the county have developed Incident and Emergency Action Plans (IEAP), the Webster Lake dams. An IEAP is a comprehensive plan that outlines the necessary actions to be taken in the event of an incident or emergency at the dam. **Figure 51** shows the location of the two gate structures at North Webster. The red dots are the dam outlets, and the pink line is the outflow from the dam. The full potential inundation area is depicted in the IEAP from the dam owner.

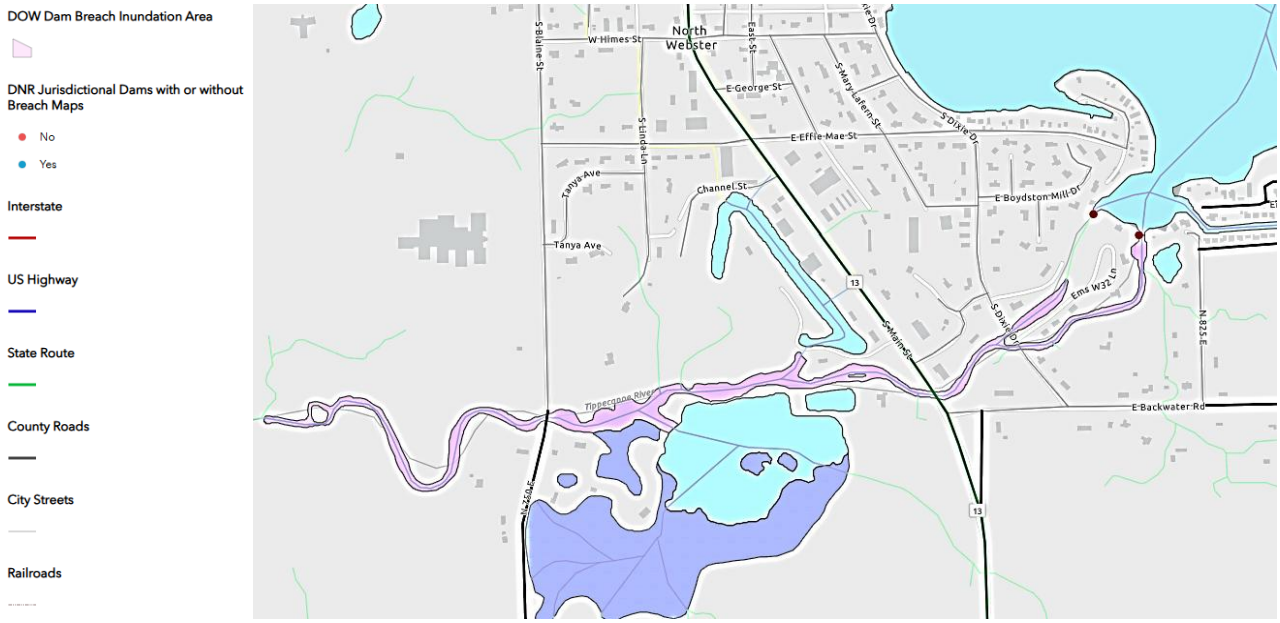


Figure 51:Outflow Map, DNR

IEAPs are now required for high hazard dams by state law, however, these plans are not mandated for the significant or low hazard structures. Dam owners are, however, encouraged to prepare an IEAP to help identify whom to notify and what actions may need to take place in the event of an incident or emergency event affecting the dam. The IDNR website shows some areas which may be inundated during a dam failure.

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

Direct Effects:

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

Indirect Effects:

- Environmental damage includes loss of land in the immediate scour area, sudden release of water can alter landscapes, erode soil, destroy habitats, and lead to the loss of wildlife
- Water quality impacts if contamination is in the water potentially cause human health problems as well as fish and wildlife injury or death
- Increased response times due to damaged or re-routed transportation routes and/or bridges
- Long lasting economic impacts on the community due to business closures, and relocation of impacted property owners
- Economic impacts also include the cost of property damage, cleanup and recovery
- Social impacts, such as displacement of people and disruption of communities

Estimating Potential Losses

As of July 1, 2022, the State of Indiana is requiring high hazard dams to have IEAPs developed. These plans have detailed potential dam failure inundation areas identified along with at-risk structures identified. The actual magnitude and extent of damage depend on the type of dam break, the volume of water that is released, and the width of the floodplain valley to accommodate the dam break flood wave. All dam owners are encouraged to develop an IEAP.

Utilizing GIS maps and orthoimagery, the infrastructure and other features below this dam can be identified. This imagery will also show properties that would be isolated due to the inundation of the roadways leading into and out of the area as well as those properties which would be inundated. According to the IDNR Indiana Floodplain Information Portal shown in **Figure 52** there is an area downstream of the dam that would be impacted by the dam breach. There are six residential structures that may be affected and two county roads. By using the same methodology used to determine damages in the flood description, it is estimated a dam breach may result in $42K in damages.

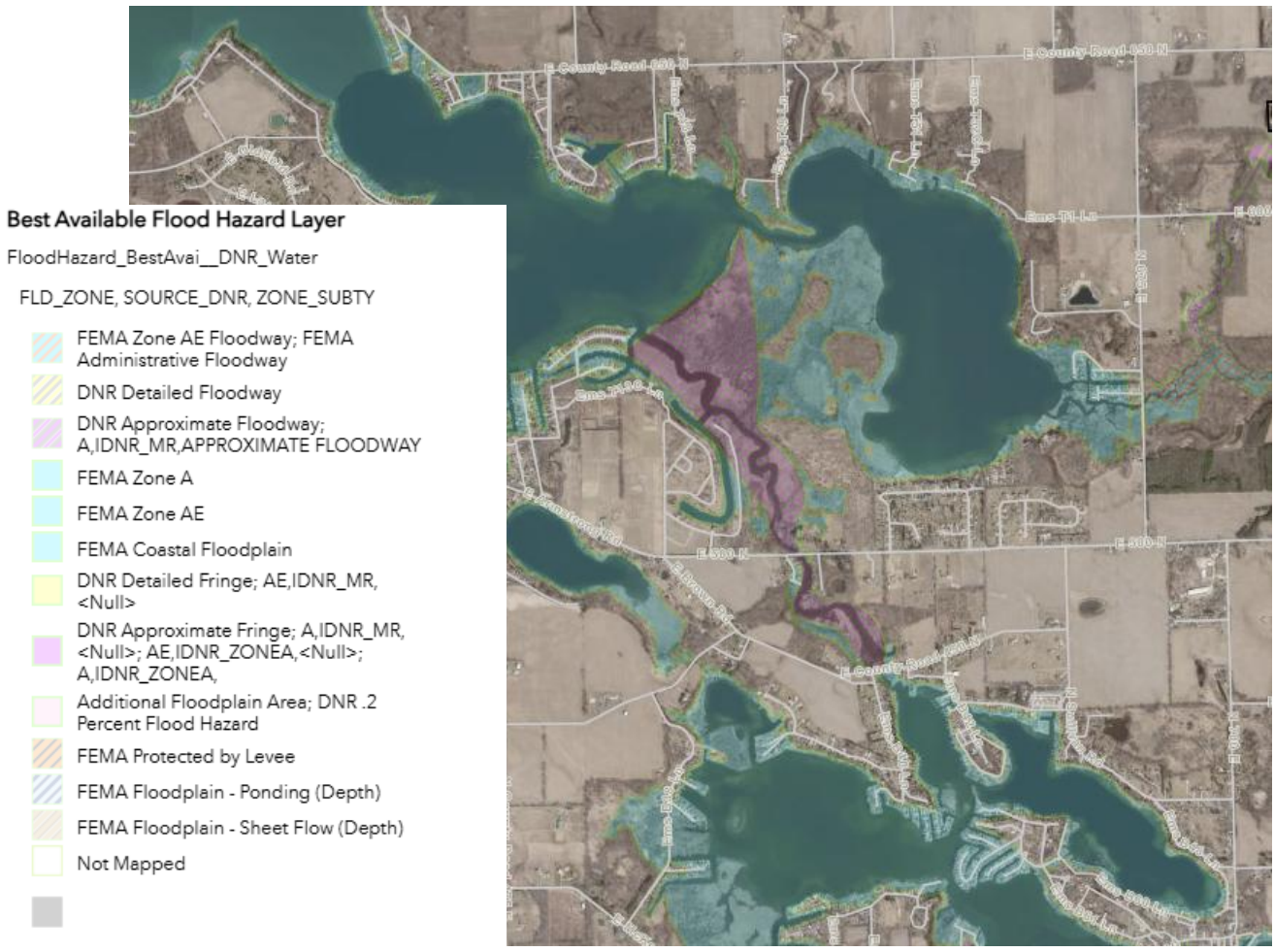


Figure 52: The flood inundation area from Lake Tippecanoe

Future Considerations

As areas near existing dams continue to grow in population, it can be anticipated that the number of critical and non-critical structures could also increase accordingly. Location of these new facilities should be carefully considered, and precautions should be taken to ensure that schools, medical facilities, municipal buildings, and other critical infrastructure are located outside of the delineated or estimated dam failure inundation areas. Also, flood-free access should be provided for these facilities. Large areas of new development have not yet occurred downstream of the dams in Kosciusko County. Until such development or re-development downstream of a dam is prohibited, those areas remain vulnerable to losses and damage associated with failure of that structure.

It is also particularly important to all downstream communities and property owners that dam IEAPs are developed, kept up-to-date, and routinely exercised to ensure the greatest safety to those within the hazard area. Although not mandated, this is the best management practice for significant and low hazard dams as well.

Relationship to Other Hazards

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

washed away. Entire roads may be undermined by the forces of water and debris. Other infrastructure such as utility poles and lines may be damaged as the water and debris flows along. Buried utility pipes may become exposed due to scouring; all of which may lead to utility failures within the area downstream of the dam failure.

Due to flood and debris flow damage, hazardous materials facilities and transportation routes may be damaged resulting in releases. If LP gas tanks are located nearby, they may be torn from their mountings and would become part of the flowing debris as well as leaking their contents from the ruptured service lines.

3.2.11 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 responses to a release may require fire, safety/law enforcement, search and rescue, and hazardous materials response units.

Figure 53: Potentially Hazardous Waste Drums

As materials are transported for treatment, disposal, or transport to another facility, all infrastructure, facilities, and residences near the transportation routes are at an elevated risk of being affected by hazardous materials release. Often these releases can cause serious harm to Kosciusko County and its residents if proper and immediate actions are not taken. Most releases are the result of human error or improper storage (**Figure 53)**, 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.

Recent Occurrences

During conversations with committee members and through information provided by local news outlets, it was noted that numerous small and moderately sized incidents involving manufacturing facilities and transportation routes have occurred since the development of the original MHMP. However, the number of Superfund Amendments and Reauthorization Act (SARA) Title III Tier II facilities utilizing, storing, and/or manufacturing chemicals has decreased over the years as facilities reduce the amount hazardous materials on site. Both Tier II and other chemical facilities as well as businesses and industries rely on just in time delivery which results in an increase in the number of delivery vehicles transporting hazardous materials across the county. Heavier traffic on routes such as US30 and State Roads 13, 25,14 and 15, increases the potential for incidents. **(Figure 54**) Railroads cross through the county from east to west in the far north, east to west through the central region of the county as well as in the southern end of the county. Additionally, there is one rail line bisecting the eastern and western half of the county bringing cargo from the south-central part of the state to Elkhart and other northern Indiana cities. Kosciusko County has basic hazardous

materials response capabilities. For larger incidents, technician level teams are available in Elkhart, South Bend and Ft. Wayne Fire Departments under mutual aid agreements.

According to the committee, the probability of a hazardous materials release or incident is "Unlikely" to "Highly Likely" in most areas due to the number transportation routes within and through county. Sidney, Silver Lake, North Webster, and Etna Green felt a hazardous materials incident would be "Unlikely". "Negligible" to "Significant" damage is anticipated to result from an incident. The level of damage is dependent upon the location and size of the incident. As with hazards of this nature, a short warning time of less than six hours and a short duration, also less than six hours to less than a week, is anticipated in the event of a hazardous materials incident. A summary is shown in **Appendix 11.**

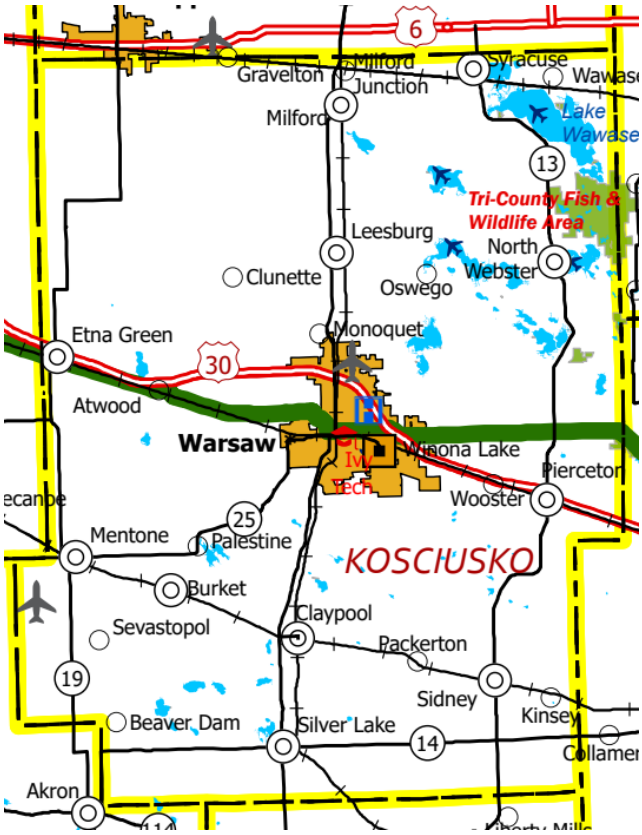


Figure 54: Transportation Routes in Kosciusko County

Relatively small hazardous materials incidents have occurred throughout Kosciusko County in the past and may, according to the committee, occur again. As the number of hazardous materials producers, users, and transporters increases within or near Kosciusko County, it can be anticipated that the likelihood of a future incident will also increase. The nature of incidents may change as facilities utilize new materials and energy sources in their processes.

Assessing Vulnerability

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

Direct Effects:

- Acute or chronic health issues due to chemical exposure
- Closure of impacted railroad crossings
- Possible crops or livestock damage from chemical exposure
- Damage to infrastructure from leaks, accidents, or recovery operations
- Expense of decontamination and reconstruction of affected structures

Indirect Effects:

- Loss of revenue or production while testing, recovery and/or reconstruction occurs.
- Anxiety or stress related to the event.
- Potential evacuation of neighboring structures or facilities.
- Expenses are incurred due to response, testing, and cleaning of the affected areas.

While the possibility of an incident occurring may be possible, the vulnerability of Kosciusko County has been lowered due to the enactment of 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.

Figure 55:Hazardous Materials Incident

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

In Kosciusko County, facilities are subject to SARA Title III provisions due to the presence of listed hazardous materials in quantities at or above the minimum threshold established by the regulation. 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 an emergency and the response it would require, and to better prevent serious effects to the community involved. (**Figure 55**)

Estimating Potential Losses

In addition, the very nature of these events makes predicting the extent of their damage very difficult. A small-scale spill or release might have a minor impact and would require only minimal response efforts. Another slightly larger incident may 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. However, even small, or moderate events could potentially grow large enough that mass evacuations or shelter in place protective actions are needed. In these cases, multiple levels of response are utilized, and additional hazards such as structural fires and/or additional hazardous materials releases (or explosions) may occur. Given the unpredictable nature of hazardous materials incident, an estimate of potential losses was not generated.

Future Considerations

Additional facilities, both critical and non-critical in nature, may be affected if a hazardous materials release were to occur along a transportation route. All of the state roads are traveled by carriers of hazardous materials. As businesses and industries increase in the area, the increased use of these routes will increase the number of transportation related incidents.

By restricting development within the known hazardous materials facility buffer zones, future losses associated with a hazardous materials release can be reduced. Critical infrastructure should be especially discouraged from being located within these areas. Further, by restricting construction in these zones, the number of potentially impacted residents may also be reduced, lowering the risk for social losses, injuries, and potential deaths. Future construction of hazardous materials facilities

should be located away from critical infrastructure such as schools, medical facilities, municipal buildings, and daycares. Such construction would likely reduce the risk to highly populated buildings and populations with physical or social, emotional, or behavioral challenges or considerations such as children, elderly, and medically fragile individuals.

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

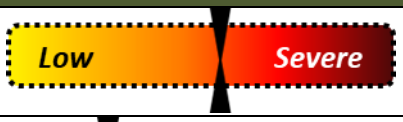
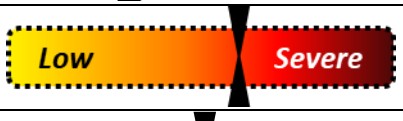
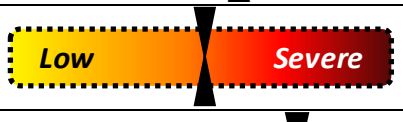
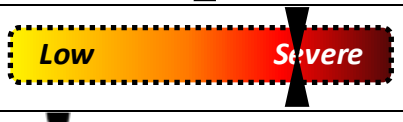
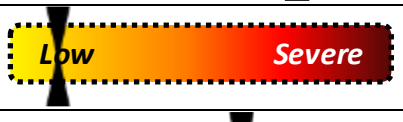
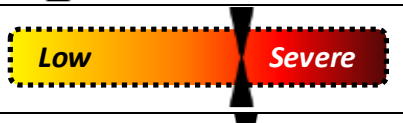
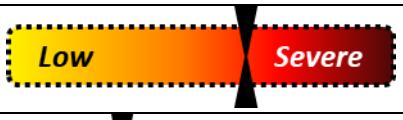
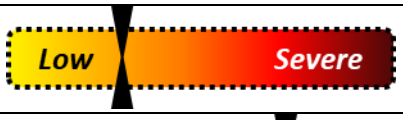
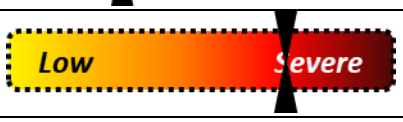
Relationship to Other Hazards

Dependent on the nature of the release, conditions may exist where an ignition source such as a fire or spark ignites a flammable or explosive substance. As the fire spreads throughout the facility or the area, structural and/or property damage 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. Depending on the nature of the incident, further delays may take place until qualified Hazardous Materials Responders with the appropriate response and monitoring equipment can be transported to the incident location. While this may increase structural losses, it may decrease social losses such as injuries or even deaths.

3.3 Hazard Summary

For the development of this MHMP, the committee utilized the CPRI method to prioritize the hazards they felt affected Kosciusko County. Hazards were assigned values based on the probability or likelihood of occurrence, the magnitude or severity of the incident, as well as warning time and duration of the incident itself. A weighted CPRI was calculated based on the percent of the county's population present in the individual communities. **Table 19** summarizes the CPRI values for the various hazards studied within this MHMP.

Table 19: All CPRI Scores Combined

Type of Hazard	List of Hazards	Weighted Average CPRI	Ranking
Natural	Drought		6
	Earthquake		10
	Extreme Temperatures		8
	Fire and Wildfire		5
	Flood		7
	Hail, Thunder, and Windstorm		1
	Landslide, Land Subsidence, and Fluvial Erosion		11
	Tornado		4
	Winter Storm and Ice		3
Technological	Dam and Levee Failure		9
	Hazardous Materials Incident		2

It is important to understand the cause-and-effect relationship between the hazards selected by the committee. **Table 20** 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 20: Hazard Reference Table

EFFECT → / CAUSE ↓	Drought	Earthquake	Extreme Temperatures	Fire and Wildfire	Flood	Hail, Thunder, and Windstorm	Landslide, Land Subsidence, and FEH	Tornado	Winter Storm and Ice	Dam and Levee Failure	Hazardous Materials Incident
Drought											
Earthquake				X			X			X	X
Extreme Temperatures											X
Fire and Wildfire											X
Flood							X			X	X
Hail, Thunder, and Windstorm				X	X		X			X	X
Landslide, Land Subsidence, and FEH					X						X
Tornado				X						X	X
Winter Storm and Ice					X					X	X
Dam and Levee Failure					X		X				X
Hazardous Materials Incident				X							

As a method of better identifying the potential relationships between hazards, the community exhibits can be referenced to indicate the proximity of one or more known hazard areas such as the delineated floodplains and the locations of EHS facilities. For this reason, many of the communities in Kosciusko County may be impacted by more than one hazard at a time, depending on certain conditions. It can be anticipated that if a flood were to occur within these areas, there would be a potentially increased risk of a facility experiencing a hazardous materials incident. These areas may also be at greater risk of a dam or non-levee embankment failure.

Future development in areas where multiple known hazard areas (dam failure inundation areas, floodplains and surrounding hazardous materials facilities) overlap should undergo careful design, review, and construction protocol to reduce the risk of social, physical, and economic losses due to a

hazard incident. While it may certainly be difficult, critical infrastructure should not be constructed within these regions.

The ever-changing climate can also have a significant impact on these hazards. According to NOAA National Centers for Environmental Information the State Climate Summary for Indiana the following observations have been attributed to climate change:

- Temperatures have risen almost 1.5˚F since the beginning of the 20th Century. In the 2000's, temperatures have been higher than in any other historical period except during the early 1930's Dust Bowl era.
- Indiana has experienced an increase in the number of high intensity rain events with precipitation volumes increasing and duration of the events decreasing.
- Extreme events such as flooding are increasing, also.

4.0 MITIGATION GOALS AND PRACTICES

This section identifies the overall goal for the development and implementation of the Kosciusko 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 prior Kosciusko County MHMP and determined that the goals remain valid and effective. In summary, the overall goal of the Kosciusko 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. The three specific goals to achieve the overall goal of the plan are:

1. Lessen the impacts of disasters and enhance community resilience.
2. Minimize the loss of life and injuries caused by disasters.
3. Promote mitigation activities both prior to and following a disaster.

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 earthquakes, wind, and floods. It found that mitigation efforts were cost-effective at reducing future losses; resulted in significant benefits to society; and represented significant potential savings to the federal treasury in terms of reduced hazard-related expenditures. This study found that every $1 spent on mitigation efforts resulted in an average of $4 savings for the community. The study also found that FEMA mitigation grants are cost-effective since they often lead to additional non-federally funded

mitigation activities and have the greatest benefits in communities that have institutionalized hazard mitigation programs.

A more recent (2017) study by the National Institute of Building Sciences, reviewed over 20 years of federally funded mitigation grants, not only from FEMA but also from the US Economic Development Administration (EDA) and the US Department of Housing and Urban Development (HUD). From this broadened review, it has been determined that for every $1 spent on mitigation, $6 is saved on disaster costs. In addition, by designing and construction buildings which exceed select items in the 2015 International Code, $4 can be saved for every $1 invested in those changes.

Six primary mitigation practices defined by FEMA are:

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

4.2.1 EXISTING MITIGATION PRACTICES

As part of this planning effort, the committee received a copy of the prior MHMP's mitigation actions. Team members reviewed those actions and were asked to consider all other mitigation actions based on the hazards discussed in the first meeting. At the second planning committee meeting, the committee discussed the strengths and weaknesses of existing mitigation practices and made recommendations for improvements, as well as suggested new practices. The committee also examined practices employed by neighboring communities assessing the viability of those actions within Kosciusko County. The following is a summary of existing hazard mitigation practices within Kosciusko County. Mitigation measures that were included in the 2019 Kosciusko County MHMP are noted as such. A list of the former mitigation actions included in the previous MHMP and their status may be found in **Appendix 12**.

Emergency Services

- Two stream gages are utilized for flood forecasting and flood warnings for various streams.
- Training and table-top exercises are conducted by the LEPC and include response agencies such as police, fire, and local EMS agencies.
- The county has outdoor warning sirens and maintains them in operational condition. The sirens are operated on and are regularly tested using a centralized system.
- Kosciusko County has established shelters throughout the County and utilizes public spaces for warming and cooling during normal operating hours.

Natural Resource Protection

- Kosciusko County, the City of Warsaw and the towns of Mentone, Milford, North Webster, Silver Lake, Syracuse, and Winona Lake are in good standing with the NFIP Program and have flood protection ordinances which meet the minimum requirements.
- Current facility maps and response plans are on file for all Tier II HazMat facilities.

Prevention

- The Kosciusko County LEPC provides training regarding the proper storage, transport, and disposal of hazardous materials.
- Kosciusko County, through the work of the County EMA, EMA has been designated NWS StormReady.

Property Protection

- Recommendations from completed flood protections studies are implemented as funding becomes available.
- Drainage system maintenance, including repair and replacement of culverts, occurs routinely throughout the county.

Public Information

- Outreach materials and hazard preparedness materials are routinely provided online, within offices and agencies in Kosciusko County, at large public events, speaking opportunities within schools, etc. Some materials are provided through social media outlets, and agency websites; and used during Severe Weather Awareness Week to raise awareness.
- The EMA and response agencies utilize websites and social media to convey messages to the public prior to, during and following hazardous events.

Structural Control

- County drainage ditches have been cleared and are maintained to prevent localized flooding, increased erosion, and material deposition because of rainfall or snowmelt.
- Utilities throughout the county perform routine tree canopy maintenance along rights of way to reduce damages from trees to electrical lines as well as nearby structures.

4.2.2 PROPOSED MITIGATION PRACTICES

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

- **Social** – mitigation projects will have community acceptance, they are compatible with present and future community values, and do not adversely affect one segment of the population.
- **Technical** – mitigation projects will be technically feasible, reduce losses in the long-term, and will not create more problems than they solve.

- **Administrative** – mitigation projects may require additional staff time, alternative sources of funding, and have some maintenance requirements.
- **Political** – mitigation projects will have political and public support.
- **Legal** – mitigation projects will be implemented through the laws, ordinances, and resolutions that are in place.
- **Economic** – mitigation projects can be funded in current or upcoming budget cycles.
- **Environmental** – mitigation projects may have negative consequences on environmental assets such as wetlands, threatened or endangered species, or other protected natural resources.

Table 21 lists a summary of all proposed mitigation practices identified for all hazards, as well as information on the local status, local priority, benefit-cost ratio, project location, responsible entities, and potential funding sources associated with each proposed practice. Funding information for these actions can be found in **Appendix 7.** The proposed mitigation practices are listed in order of importance to Kosciusko County for implementation. Projects identified by the committee to be of "high" local priority may be implemented within five years from final plan adoption. Projects identified to be of "moderate" local priority may be implemented within five to 10 years from final plan adoption, and projects identified by the committee to be of "low" local priority may be implemented within 10+ years from final plan adoptions. However, depending on availability of funding, some proposed mitigation projects may take longer to implement.

As part of the process to identify potential mitigation projects, the planning committee weighed the benefit derived from each mitigation practice against the estimated cost of that practice. This basic benefit-cost ratio was based on experience and professional judgement and was utilized to identify the mitigation practices as having a high, moderate, or low benefit-cost ratio. Preparing detailed benefit-cost ratios was beyond the scope of this planning effort and the intent of the MHMP.

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

The CRS program credits NFIP communities with a maximum of 97 points for setting goals to reduce the impact of flooding and other known natural hazards (two points); identifying mitigation projects that include activities for prevention, property protection, natural resource protection, emergency services, structural control projects, and public information (up to 95 points).

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Table 21: Proposed Mitigation Measures

Mitigation Practice	Mitigation Strategy	Hazard Addressed	Status	Priority	Benefit-Cost Ratio	Responsible Entity
Emergency Preparedness and Warning 1. Evaluate and strengthen the communication abilities of emergency services throughout the county.	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☐ Structural Control	All Hazards	**Proposed Enhancements** 1. Establish a countywide activation program using RAVE at dispatch.	High	High to Moderate	911/ Communications Center
2. Procure new outdoor warning sirens		Earthquake, Flood, Tornado, Dam Failure, Hail, Thunder, and Windstorms	2. Purchase additional outdoor warning sirens to be placed at North Webster (2), Mentone (1), Silver Lake (replace 1), Winona Lake (1), Franklin Township (1) Sidney (1), Etna Green (1). Additional locations may be identified as development and replacement needs occur.	High		EMA Fire Chiefs from all cities, towns, and townships
3. Implement a program to develop a database of special needs residents		All Hazards	3. Identify equipment needed and purchase to develop and maintain listing of community members who may have special needs during emergencies and disasters.	Medium		911/ Communications Center Health Dept.
4. Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county		All Hazards	4. Consider introducing an outdoor warning siren fee whenever new subdivisions are constructed.	Medium		County, City and Town Planning and Zoning
5. Minimize the amount of infrastructure exposed to hazards. Bury new power lines		All Hazards	5. Encourage burial of power lines in all new construction.	Medium		County, City and Town Planning and Zoning
6. Raise public awareness on hazard mitigation. Develop a plan to prepare for population migration in the event of a disaster in northern Indiana		All Hazards	6. Prepare a plan to address population migration in the event of a large disaster in southern Indiana. Include short-term and long-term housing considerations.	Medium		EMA
7. Install inertial valves at critical facilities		Earthquake	7. Encourage the installation of inertial valves at critical facilities.	Low		County, City and Town Planning and Zoning
Emergency Response and Recovery 1. Raise public awareness on hazard mitigation.	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☐ Property Protection ☒ Public Information ☐ Structural Control	Earthquake, Extreme Temperatures, Fire, Flood, Hail, Thunder, and Windstorm, Snow and Ice, Tornado, Dam and Levee Failure	**Proposed Enhancements** 1. Consider the development of an identification program to identify properties with alternative power sources not controlled through the electric meter. Include ways to label and identify power shut offs in the event of an emergency.	High	High	EMA City and Town and Township Fire Chiefs
2. Establish a mutual aid response agreement		All Hazard	2. Further develop automatic mutual aid to ensure adequate response levels for emergencies.	Medium		EMA City and Town and Township Fire Chiefs
Backup Power and Generators 1. Procure emergency generators or transfer switches for schools, fire stations, community centers, and shelters	☒ Emergency Services ☐ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☐ Public Information ☐ Structural Control	Earthquake, Hail, Thunder, and Windstorm, Snow and Ice, Tornado	**Proposed Enhancements** 1. Identify public facilities needing back up power generators and hookup to include the community center and fire station in North Webster.	High	Moderate	EMA
2. Procure emergency generators or transfer switches for schools, fire stations, community centers, and shelters		Earthquake, Hail, Thunder, and Windstorm, Snow and Ice, Tornado	2. When new public facilities are constructed or updated, the installation of generators hook up capabilities for backup power during outages and other events.	High		County, City and Town Planning and Zoning
3. Procure emergency generators or transfer switches for schools, fire stations, community centers, and shelters		Earthquake, Hail, Thunder, and Windstorm, Snow and Ice, Tornado	3. Update the generator at Etna Green Fire Department to address current and future power needs.	Medium		Etna Green Town Board and Fire Chief

Mitigation Practice	Mitigation Strategy	Hazard Addressed	Status	Priority	Benefit-Cost Ratio	Responsible Entity
Land Use, Ordinances, and Zoning 1. Develop a public education program regarding generator maintenance and circuit policing	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☐ Structural Control	All hazards	**Proposed Enhancements** 1. Establish an ordinance for zoning to establish a minimum setback for generators.	High		County Attorney
2. Enforces ordinances to prevent construction in floodplains.		Flood	2. Enforce ordinances to prevent construction in floodplains including the floodway, 1.0% areas and the 0.2% area.	Low		Floodplain Administrators for County, City and Towns
Public Education and Outreach 1. Provide hazard preparedness literature (such Improve emergency sheltering in Kosciusko County)	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☐ Structural Control	All Hazards	**Proposed Enhancements** 1. Identify shelter locations and educate community members of the location(s) - Winona Lake	High	Moderate	Winona Lake Fire Dept.
2. Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county.		All Hazards	2. Develop and conduct an education and outreach campaign informing community members about RAVE and encourage enrollment in the program.	High		911/Communications Center
3. Create literature to distribute to the public regarding hazards affecting Kosciusko County		All Hazards	3. Work with the Kosciusko County Leadership Academy to develop Countywide education and outreach campaigns for all hazards.	Medium		EMA
Safer Rooms and Community Shelters 1. Establish safe rooms throughout the county, especially in trailer home parks and at the fairgrounds	☒ Emergency Services ☐ Nat. Res. Protection ☐ Prevention ☐ Property Protection ☐ Public Information ☒ Structural Control	Tornadoes, High Winds	**Proposed Enhancements** 1. Encourage participation in the IDHS and/or similar storm safe room grant programs.	Medium	Moderate	EMA
Communications 1. Reduce the risk to life and property by enhancing and improving emergency communications	☒ Emergency Services ☐ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	All Hazards	**Proposed Enhancements** 1. Add new communications tower or signal boosting capabilities for Sidney, Claypool school, County highway and north of Town	Medium		Town of Sidney Board, Town of Claypool Board, County Highway Superintendent, 911 Center
Community Rating System 1. Support compliance with the NFIP for each jurisdiction in Kosciusko County.	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☐ Structural Control	Flood	**Proposed Enhancements** 1. Educate homeowners about the NFIP insurance and the Increased Cost of Compliance (ICC) benefit of that insurance program.	High	High	EMA Floodplain Administrators – County, City and Towns
2. Raise public awareness on hazard mitigation.		Flood	2. Improve outreach efforts under the CRS program by adding flood brochures at the area planning office and encourage Kosciusko County, City of Warsaw, and the towns of Mentone, Milford, and Silver Lake to join the CRS program.	Medium		Floodplain Administrators – County, City and Towns
Floodplain Management 1. Dredge waterways and maintain tiles. Dredge lake inlets, rivers, and streams	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☒ Structural Control	Flood	**Proposed Enhancements** 1. Maintain all waterways and tiles cooperatively with The Watershed Foundation (TWF) and County Surveyor.	High	High to Moderate	County Surveyor TWF
1. Prevent Repetitive flood loss on structures in flood prone areas		Flood	2. Investigate Etna Green intersection drainage improvements.	High		Town of Etna Green County Highway

Mitigation Practice	Mitigation Strategy	Hazard Addressed	Status	Priority	Benefit-Cost Ratio	Responsible Entity
3. Update, repair, replace and add water level gages		Flood	3. Explore needs for additional gages, for example Silver Lake	Medium		Silver Lake EMA
4. Maintain Tippecanoe River Debris Clean up volunteers		Flood	4. Explore ways to maintain fall removal from small waterways in the county. Consider incorporating waterway maintenance in the blueways maintenance plan.	Medium		City of Warsaw County Parks and Rec.
5. Protect Natural Resources. Stabilize shorelines to prevent bank erosion		Flood Landslide/Subsidence	5. Encourage residents to use natural shoreline stabilization methods where possible.	Medium		Town Boards, City of Warsaw Mayor County Planning Office
6. Increase the number of river gages on rivers and streams, This Information is for allocation of funding		Flood	6. Explore sharing gage information from Kosciusko County Lake and stream gages with the National Weather Service (Lilly data)	Medium		EMA
7. Maintain Tippecanoe River Debris Clean up volunteers		Flood	7. Encourage Tippecanoe River Debris cleanup efforts with Tippecanoe River Adventures and similar organizations.	Medium		Floodplain Administrators County, City and Towns
8. Prevent Repetitive flood loss on structures in flood prone areas		Flood	8. Investigate working with county highway and city and town street departments identifying frequent flooding locations needing improvements, implementing solutions where possible.	medium		County Highway City and Town Street Depts. County Surveyor
9. Elevate the following roads: Hoppus Road and Miner Road near the Town of Claypool.		Flood	9. Identify options and funding sources to address Miner Road issues. This is a very large project with challenges.	Low		County Surveyor County Highway
10. Rebuild the manmade levees along Spoils Bank and control structures on lake dams (Winona Lake, Syracuse, Oswego, North Webster, etc.)		Flood	10. Explore the potential replacement of manmade levees along spoils bank near center Lake and other locations. North Webster would like to dredge and use spoils on banks.	Low		County Surveyor County, City and Town Floodplain Administrators
11. Elevate the following roads: Hoppus Road and Miner Dr.		Flood	11. Identify and remove beaver dam near Hoppus Road.	Low		County Surveyor County Highway
Hazardous Materials 1. Raise public awareness on hazard mitigation. Develop a secondary impact assessment to determine potential damage to pipelines.	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☒ Public Information ☐ Structural Control	Hazardous Materials Incident	**Proposed Enhancements** 1. Develop an impact assessment considering primary and secondary impacts from pipeline leaks or rupture.	High	High	EMA LEPC
2. Conduct new studies/research to profile hazards and follow up with mitigation strategies.		Hazardous Materials Incident	2. Apply for grant funds to complete a commodity flow study.	Medium		EMA LEPC
3. Develop a hazmat response team		Hazardous Materials Incident	3. Re-establish the hazardous materials team. Warsaw now has 12 new technician level firefighters.	Medium		Warsaw City Fire Dept.

Mitigation Practice	Mitigation Strategy	Hazard Addressed	Status	Priority	Benefit-Cost Ratio	Responsible Entity
Management of Dams 1. Review and update existing or create new community plans and ordinances to support hazard mitigation.	☒ Emergency Services ☐ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☐ Public Information ☒ Structural Control	Dam Failure	**Proposed Enhancements** 1. Create new ordinances to prevent construction in the Webster Lake Dam inundation area.	High	High	Floodplain Administrator County Attorney
Stormwater 1. Construct new storm sewers and a retention pond at bridge locations.	☐ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☐ Public Information ☒ Structural Control	Flood	**Proposed Enhancements** 1. Replace storm sewers and retention facilities in accord with the bridge plans.	High	Moderate to High	Stormwater Utility County Surveyor
2. Construct new storm sewers and a retention pond		Flood	2. Maintain storm sewer and replace as needed.	Medium		Stormwater Utility
3. Increase culvert sizes, replace culverts, and debrush as much as possible		Flood	3. Update culvert sizes where needed and debrushing where needed.	Medium		County Highway City and Town Street Depts.
Transportation 1. Construct new storm sewers and a retention pond	☒ Emergency Services ☒ Nat. Res. Protection ☒ Prevention ☒ Property Protection ☐ Public Information ☒ Structural Control	All Hazards	**Proposed Enhancements** 1. Complete replacement of bridge 123 on the Eel River, as well as 2 small structures on Huck Trail. Continue with the 2028 and 2029 plans.	High		County Highway
2. Conduct a study to determine bridge infrastructure strength		All Hazards	2. Conduct bridge inspections that incorporate strength evaluations as well as maintenance.	High		County Highway

5.0 IMPLEMENTATION PLAN

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

5.1 EMERGENCY PREPAREDNESS AND WARNING

Establish a countywide activation program using RAVE at dispatch.

- Assemble a team to identify challenges for countywide activation capabilities.
- Prepare operating protocols to identify activation roles, responsibilities, and procedures to ensure consistent activation and messaging.
- Train personnel on the protocols and system utilization.

Purchase additional sirens to be placed North Webster (two), Mentone (one), Silver Lake (replace one), Winona Lake (one), Franklin Township (one), Sidney (one), Etna Green (one). Additional locations may be identified as development and replacement needs occur.

- Determine potential funding sources and secure funding for the acquisition of the outdoor warning sirens.
- Identify the best locations to ensure siren signal propagation reaches the desired populations.
- Acquire and install the outdoor warning sirens, as funding permits.

5.2 EMERGENCY RESPONSE AND RECOVERY

Consider the development of an identification program to identify properties with alternative power sources not controlled through the electric meter. Include ways to label and identify power shut offs in the event of an emergency.

- Research how other communities have or are addressing safety concerns when homes have alternative energy supplies available to the property.
- Using the results from research and best available practices, identify a consistent means to identify alternative power sources and shutoff requirements.
- Prepare a program to reach out to alternative power supply owners to educate them on the safety issues and encourage their participation in helping to identify their sources and shutoff measures.

5.3 ENERGY SECURITY - POWER BACKUP GENERATORS

Identify public facilities needing back up power generators and hookup to include the community center and Fire Station in North Webster.

- Create a current inventory of public facilities which have or may require power backup generators and /or hook up systems for a mobile generator hookup.
- Prioritize the inventory and identify any location specific funding mechanisms which may be able to assist in purchasing and installing the hookups and power generating equipment.

- Apply for grants, conduct fundraisers, etc., purchase the units and materials and have the units installed, as funding permits.

Encourage the installation of generators hook up capabilities for backup power during outages and other events whenever new public facilities are constructed or updated.

- Work with community planners and redevelopment agencies to prepare educational materials to encourage inclusion of power backup capabilities for new public facilities.
- Prepare a menu of power back up technologies available and the capacity to assist planners with identifying viable options.
- Include new facilities in the countywide inventory when systems are installed.

5.4 LAND USE, ORDINANCES AND ZONING

Establish an ordinance for zoning to establish a minimum setback for generators.

- Identify what the minimum setback for generators should be based on community information, and best available practices being used by other communities.
- Educate the county attorney and commissioners on why a minimum setback is needed and how the community will benefit from this action.
- Encourage the drafting of an ordinance to be heard and implemented by the county commissioners.

5.5 PUBLIC EDUCATION AND OUTREACH

Identify shelter locations and educate community members of the location(s)

- Update or create an inventory of shelter locations, amenities, and potential services available at each location. The inventory should also include: any information regarding access limitations.
- Prepare a list of sites, when they will be available, and the exact location for those who may not be familiar with the area.
- Create an educational campaign to include flyers, informational sessions, and presence at community events to share the information.

Develop and conduct an education and outreach campaign informing community members about RAVE and encourage enrollment in the program.

- Identify multiple means to reach all community members, including those who may not speak English, or those who may not be technologically connected.
- Develop consistent educational materials to explain what RAVE is, how it works and the importance of enrollment in the program.
- Distribute the information and consider making assistance available during fairs, community gatherings, etc. where people can get assistance registering for the program.

5.6 COMMUNITY RATING SYSTEM

Educate homeowners about the NFIP insurance and the Increased Cost of Compliance (ICC) benefit of that insurance program.

- Review best available practices used by successful communities to identify ways to share the messaging effectively.
- Consider using materials prepared by IDHS, FEMA and the Indiana Insurance Commissioner's office to augment locally developed outreach methods.
- Attend various events as well as reaching out to insurance providers in the community to make everyone aware of the benefits of this coverage.

5.7 FLOODPLAIN MANAGEMENT

Continue to maintain all waterways and tiles cooperatively with The Watershed Foundation (TWF) and County Surveyor.

- Work with Indiana DNR to educate community leaders and assisting entities about acceptable methods of waterway maintenance and how each can play a role in the regular work being conducted.
- Identify areas of interest to avoid duplication of efforts by the various organizations so funding for these efforts may be maximized.
- Identify resources needed and schedules for regular maintenance to take place and allow scheduling of special events when needed.

Include Etna Green intersection drainage improvements.

- Examine frequently flooded intersections, creating an inventory of sites and a priority ranking.
- Identify funding available for drainage improvements and apply for funding to be most effective in addressing the flooding issues.
- Make improvements and monitor the outcomes of the improvements to ensure the repair does not cause challenges elsewhere downstream.

5.8 HAZARDOUS MATERIALS

Develop an impact assessment considering primary and secondary impacts from pipeline leaks or rupture.

- Understand the products currently moving through the pipeline and future anticipated changes to commodities flowing through.
- Determine whether this assessment is something that can be conducted locally or if a contractor would be a better choice. In all cases, ensure data is gathered from a variety of independent sources as well as the pipeline owners.
- Using local soil and water characteristics as well as land use, home ownership and other factors assess both common place small leaks as well as a catastrophic failure scenario.

5.9 MANAGEMENT OF HIGH HAZARD DAMS

Create new ordinances to prevent construction in the Webster Lake Dam inundation area.

- Ensure the Webster Lake inundation area data is up to date and reflects both sunny days as well as flood related catastrophic failure.

- Using the most recently modeled data, create an ordinance similar to the floodplain ordinance that identifies those areas of isolation as well as the areas where homes will be damaged or destroyed.
- Maintain a map of the flood inundation zones with the floodplain maps for community members and building and planning officials to use.

5.10 STORMWATER

Construct storm sewers and retention facilities in accord with the bridge plans.

- Using the County Highway Department bridge inspection plans and infrastructure plans, schedule and allocate funds for the replacement of older storm sewers and retention facilities which are nearing or have passed the viable lifetime.
- Take into consideration the change in rain events (greater volumes of water over shorter time periods) to ensure the new structures are able to withstand higher volumes and velocities.
- Adjust priorities as needed to ensure public safety and cost effectiveness.

5.11 TRANSPORTATION

Complete replacement of bridge 123 on the Eel River, as well as two small structures on Huck Trail. Continue with the 2028 and 2029 plans.

- Secure funding to complete Bridge 123 replacement as well as other structures.
- Hire or utilize local staff to complete needed work on the smaller structures.
- Working within budgetary constraints, continue replacements and repairs as outlined on the Highway Department schedule.

Conduct bridge inspections that incorporate strength evaluations as well as maintenance.

- Secure funding in the annual budgets to fund independent bridge inspections and report reviews.
- Utilize most recent INDOT and US DOT guidance to conduct bi-annual bridge inspections.
- Review inspection reports. Determine if current schedules need to be adjusted based on report results. Make necessary adjustments to priorities based on reports.

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

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

- Has the nature, magnitude, and/or type of risk changed? If so, what new mitigation actions are needed to address this change?
- Are the current resources appropriate for implementation? If not, what additional resources are needed to address the shortfall?
- Are there implementation problems, such as technical, political, legal, or coordination issues with other agencies? How can these issues be addressed?
- Have the outcomes occurred as expected? If not, is something else needed to achieve the desired outcome?
- Have the agencies and other partners participated as originally proposed? IF not, determine why and how the action outcomes can be met?

During the annual meetings, the Implementation Checklist provided in **Appendix 10** will be helpful to track any progress, successes, and problems experienced.

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

DMA 2000 requires local jurisdictions to update and resubmit their MHMP within five years (from the date of FEMA approval) to continue to be eligible for mitigation project grant funding. In Kosciusko County, 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 Kosciusko 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. The plan update process will incorporate new planning guidance and best practices as planning requirements are updated.

Prior to submission of the updated MHMP, at a public meeting, such as the county commissioners meeting, a representative of the planning team will present information about the plan to residents of Kosciusko County and will 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 invitation to review and comment on the plan update.

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.

Over the past five years the county and its communities have developed other planning mechanisms such as the Kosciusko County Comprehensive Plan: Plan for Smart Growth. This plan was considered in the creation of this plan. There are some goals that align with the goals of this plan. The plan mentions stormwater with their goals to restrict development in flood designated areas and improving flood control through ensuring adequate drainage. It also mentions the addition of dry hydrants in rural areas of the county to help firefighters put out fires. Lastly, the plan discusses economic development in detail. The plan sets goals to diversify their economy and work with the Community Development Commission. If the community can strengthen their economy, then they may be able to afford more mitigation actions which can in turn save the county money. This plan aims to mitigate potential hazards and in turn, create a resilient community. The goals set in the comprehensive plan will aid the county and its communities in preventing and lessening the impacts of hazardous events.

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

The MHMP will be used to update stormwater, subdivision and zoning ordinances based upon recommendations from the plan. For example, information in this plan provides documentation to encourage local officials to make changes to reduce release rates, protect floodplains, provide no net loss in special flood hazard areas, and manage erosion and sediment control. These measures would help mitigate flooding. New ordinances and studies could be initiated by the recommendations, such as flood studies, flood response studies, and watershed management studies to protect against floods. The information included in this plan can be very helpful in preparing comprehensive plans, transportation plans, and emergency plans to mitigate hazard material impacts and response to hazards such as tornados. These plans also illustrate the importance of planning on the unserved populations and how to develop mitigation efforts that include them in future plans.

In Kosciusko County this is a similarly timed process. As the county embarks upon their ordinance updates, information is shared with the City of Warsaw and the incorporated communities. Each community then evaluates the materials provided by the county and will seek adoption or incorporation on a similar schedule. This process has worked well in the past and is the anticipated method of future incorporation of materials into plan and ordinance updates. In a similar fashion the updating of comprehensive community plan, park plans, etc. will be able to incorporate at risk population information as well as mitigation action opportunities. **Table 22** is an example of the process the communities use to incorporate planning elements into other community plans and ordinances.

Table 22: MHMP Incorporation Process

Step	Description of Process Action
1	Adopt MHMP at Commissioner Meeting, City Council Meeting, or Town Board Meeting
2	Identify document update cycles for each of the following: a) Comprehensive Plan b) Capital Improvement Plan c) Zoning Ordinances d) Floodplain Ordinance e) Stormwater Plans f) Other plans not listed above
3	Present applicable data to the planning team and team leaders for inclusion
4	Highlight applicable mitigation actions to be included in the plan
5	Assist with incorporation and adoption of the plans, as needed.

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 Kosciusko 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 Kosciusko County website. Periodic reminder notices will be placed on social media to continue to solicit feedback and input on changes for the future plans.

Updates or modifications to the Kosciusko County MHMP require public notice, reconvening the planning committee in accordance with FEMA local mitigation planning guidance and meeting with the incorporated community leaders prior to submitting revisions to the individual jurisdictions for approval and re-adoption.

The CRS program credits NFIP communities with a maximum of 28 points for adopting the plan (two points); establishing a procedure for implementation, reviewing, and updating the plan; and submitting an annual evaluation report (up to 26 points).

REFERENCES

ASFPM Certified Floodplain Manager Program Information. (n.d.). Retrieved 2019, from Association of State Floodplain Managers: http://www.floods.org

American Legal Publishing (2025). Leesburg Indiana Code of Ordinances (2024) Retrieved from: https://codelibrary.amlegal.com/codes/leesburgin/latest/overview

American Legal Publishing (2025). Sidney Indiana Code of Ordinances (2024) Retrieved from: https://codelibrary.amlegal.com/codes/sidneyin/latest/overview

Britt, R. R. (2005, June 22). *New Data Confirms Strong Earthquake Risk to Central U.S.* Retrieved December 2015, from livescience: http://www.livescience.com/3871-data-confirms-strong-earthquake-risk-central.html

Cincinnati Business Courier. (2003, March 11). Ohio Winter Storm Losses Hit $17.5 Million. Cincinnati, Ohio, United States. Retrieved from https://www.bizjournals.com/cincinnati/stories/2003/03/10/daily24.html

Department of Homeland Security. (2025). *National Risk Index for Natural Hazards*. Retrieved from Federal Emergency Management Agency: https://www.fema.gov/flood-maps/products-tools/national-risk-index

Department of Homeland Security. (n.d.). *Hazard Mitigation Assistance*. Retrieved 2019, from Federal Emergency Management Agency: www.fema.gov/hazard-mitigation-assistance

Department of Homeland Security. (n.d.). *Hazard Mitigation Planning*. Retrieved 2019, from Federal Emergency Management Agency: www.fema.gov/hazard-mitigation-planning

Department of Homeland Security. (n.d.). HAZUS-MH (v1.3). Federal Emergency Management Agency.

Department of Homeland Security. (n.d.). *National Flood Insurance Program Community Rating System*. Retrieved 2022, from Federal Emergency Management Agency: www.fema.gov/national-flood-insurance-program-community-rating-system

Federal Emergency Management Agency (FEMA), Local Mitigation Planning Policy Guide, FP 206-21-0002, Released April 19, 2022, Effective April 19, 2023, OMB Collection #1660-0062, Retrieved from https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-policy-guide_042022.pdf

Federal Emergency Management Agency (FEMA), Natural Mitigation Saves Interim Report Fact Sheet, June 2018

Federal Emergency Management Agency (FEMA), NFIP Community Status Book, https://www.fema.gov/cis/IN.csv, accessed 7/30/25

Fires Roar Across Central Indiana. (2010, September 23). *www.upi.com*.

Hansen, M. C. (2005). Educational Leaflet No. 9. *Earthquakes in Ohio* . Ohio Department of Natural Resources, Division of Geological Survey.

Hoosiers By the Numbers, Major Employers for Kosciusko County, https://www.hoosierdata.in.gov/major_employers.asp?areaID=149 , accessed 5/12/25

Indiana Department of Environmental Management. (2022). Integrated Water Monitoring and Assessment Report. *303(d) List of Impaired Waters*. Retrieved from Nonpoint Source Water Pollution. https://www.in.gov/idem/nps/watershed-assessment/water-quality-assessments-and-reporting/section-303d-list-of-impaired-waters/

Indiana Department of Homeland Security. (n.d.). *Mitigation & Recovery*. Retrieved 2022, from Indiana Department of Homeland Security: https://www.in.gov/dhs/emergency-management-and-preparedness/mitigation-and-recovery/

Indiana Department of Natural Resources. (2025). Dam Inspections and records. *Kosciusko County, Indiana*, Retrieved from https://dowunity.dnr.in.gov/#/Community

Indiana Department of Natural Resources. (2024). Flood Insurance Information. *Kosciusko County*, Retrieved from https://dowunity.dnr.in.gov/#/Community

Indiana Department of Natural Resources (2024), Indiana Floodplain Information Portal, Retrieved from https://secure.in.gov/dnr/water/surface-water/indiana-floodplain-mapping/indiana-floodplain-information-portal/

IDNR, Fluvial Erosion Hazards Map, https://indnr.maps.arcgis.com/apps/webappviewer/index.html?id=43e7b307a0184c7c851b5068941e2e23 , accessed 7/21/25

Indiana Department of Transporatation (2025) Road and Railroad Maps – INDOT , retrieved 2025, from https://www.in.gov/indot/files/RailSystemMap_Med_StWide_11x17_RH_Final.pdfIndiana

Geological Survey. (n.d.). *Earthquakes in Indiana*. Retrieved 2014, from Indiana Geological Survey: https://igws.indiana.edu/earthquakes/

Indiana Geological and Water Survey, Map of Indiana showing Known Faults and Historic Earthquake Epicenters having Magnitude 3.0 and Larger,Retrieved 2025, from https://igws.indiana.edu/bookstore/details.cfm?Pub_Num=MM84

Indiana University. (2022). *IndianaMap*. Retrieved from Indiana Geological & Water Survey: https://www.indianamap.org/

Indiana University. (n.d.). *Indiana Earthquakes*. Retrieved from Indiana Geological & Water Survey: https://igws.indiana.edu/earthquakes/recent

Insurance Institute for Business & Home Safety. (n.d.). Retrieved from Insurance Institute for Business & Home Safety: www.disastersafety.org

Kosciusko County, Indiana. (2023). Geographic Information Systems data.

Mack, J. (2015, May 5). *Michigan Earthquake: "Big Deal" for a Couple of Reasons, US Geological Survey Scientist says.* Retrieved 2016, from www.mlive.com:

http://www.mlive.com/news/kalamazoo/index.ssf/2015/05/feds_on_michigan_earthquake_un.html#incart_river_index_topics

Midwest Regional Climate Center. (2025). *Midwest Climate: Climate Summaries*. Retrieved 2025, from Midwest Regional Climate Center: https://mrcc.purdue.edu/mw_climate/climateSummaries/climSumm.jsp

Muni Code Library (February 2025), *Town of Milford Ordinanances,* Retrieved 2025, from https://milford-in.municipalcodeonline.com/book?type=ordinances.

Muni Code Library (February 2025), *Town of Syracuse Ordinanances,* Retrieved 2025, from https://library.municode.com/in/syracuse/codes/code_of_ordinances

National Drought Mitigation Center. (n.d.). *US Drought Monitor*. Retrieved 2025, from https://droughtmonitor.unl.edu/

National Land Cover Database (2019). Retrieved 2025, from Multi-Resolution Land Characteristics Consortium: https://www.mrlc.gov/viewer/

National Oceanic and Atmospheric Administration. (n.d.). *Safety*. Retrieved from National Weather Service: https://www.weather.gov/safety/

National Oceanic and Atmospheric Administration. (n.d.). *Storm Events Database*. Retrieved 2025, from National Centers for Environmental Information: https://www.ncdc.noaa.gov/stormevents/

National Weather Service Indianapolis , Heat Information Page, https://www.weather.gov/ind/heatinfo, accessed 12/14/24

National Weather Service, Flood gages and crests, https://water.weather.gov/ahps2/, accessed 7/18/25

No Adverse Impact. (n.d.). Retrieved 2022, from Assocation of State Floodplain Managers: https://www.floods.org/resource-center/nai-no-adverse-impact-floodplain-management/

Peng, Jin; 2017, Morphological Filters In Floodplain For Demextracted Data – Using Minimum Bounding Circle & Youden Index – Non-levee embankment description

Phases of disaster management - Community Emergency Response Guide | Emergency Management (fairfaxcounty.gov) https://www.fairfaxcounty.gov/emergencymanagement/cerg accessed 2/9/24

Public Law 106-390. (2000, October 30). *Disaster Mitigation Act of 2000*.

Purdue Climate Change Research Center, Purdue University. (2021). Retrieved from Indiana Climate Change Impacts Assessment: https://ag.purdue.edu/indianaclimate/

Purdue University. (2013, March 12). Indiana Crop Insurance Payouts Top $1 Billion . *Purdue Agricultural News*.

STATS Indiana. (2025). Indiana IN Depth. *Kosciusko County*. Retrieved from http://www.stats.indiana.edu/profiles/profiles.asp?scope_choice=a&county_changer=18001

The Guardian, Canadian Wildfires 2023, https://www.theguardian.com/world/2023/nov/09/canada-wildfire-record-climate-crisis, last accessed 12/14/23

Topographic -map.com, Topographic map of Kosciusko County, https://en-us.topographic-map.com/map-qqwstj/Kosciusko-County/?center=41.3004%2C-86.82051, accessed 12/13/24

United States Department of Agriculture. (n.d.). *Indiana Field Office County Estimates*. Retrieved 2025, from National Agriculture Statistical Service: https://www.nass.usda.gov/Statistics_by_State/Indiana/Publications/County_Estimates/index.php

United States Department of Agriculture, Soil Conservation Service. (n.d.). *Soil Survey of Kosciusko County, Indiana.*

United States Department of Agriculture, Crop Loss Data, https://www.rma.usda.gov/-/media/RMA/State-Profiles/2022/Indiana-2022-State-Profile-Form_updated-1-10-23_PDF.ashx?la=en, accessed 6/14/25

US Drought Monitor – Retrieved 2025, from https://www.drought.gov/states/indiana/county/Kosciusko

US Geological Survey, Seismic hazards map, https://www.usgs.gov/media/images/2014-seismic-hazard-map-indiana, accessed 6/14/25.

US Geological Survey Water Watch (nd) Retrieved from https://waterwatch.usgs.gov/m=real&r=in.