2023 Multi-Hazard Mitigation Plan

Morgan County

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1 Overview

1.1 Introduction

The Morgan County Multi-Hazard Mitigation Plan (MHMP) serves as a guide for the county's assessment of hazards, vulnerabilities, and risks and actively incorporates the participation of a wide range of stakeholders and the public in the planning process. This plan aids the county, cities, and towns in preventing, protecting against, responding to, and recovering from disasters that may threaten the community's economic, social, and environmental well-being. This plan documents historical disasters, assesses probabilistic disasters through Hazus-MH and Geographic Information Systems (GIS) analyses, and addresses specific strategies to mitigate the potential impacts of these disasters.

The Morgan County Emergency planning team and The Polis Center at Indiana University-Purdue University Indianapolis (IUPUI) originally developed the Morgan County MHMP in 2017. The MHMP is not a static document but must be updated over time to reflect shifting conditions. This 2023 MHMP update represents a collaborative effort to ensure that the planning document accurately reflects changes within the community and addresses each jurisdiction's unique needs.

1.1.1 Disaster Mitigation Act of 2000

With the development of the federal Disaster Mitigation Act of 2000, FEMA requires counties to have an MHMP to be eligible for Hazard Mitigation Grant Program (HMGP) funds. All jurisdictions must have in place a multi-hazard mitigation plan and update the plan within a five-year time span. This plan update addresses changes in development, progress in local mitigation efforts, and alterations in priorities. This plan update will remain effective for 5 years from the date of community adoption.

The procedures outlined in the plan are based upon guidance provided by FEMA and are consistent with the requirements and procedures defined in the Disaster Mitigation Act of 2000. The analysis includes three components: 1) profile and analysis of hazard events, 2) inventory of vulnerability assessment of community assets, and 3) development of hazard mitigation strategies.

1.2 Hazard Mitigation

Hazards are events that are potentially dangerous or harmful and are often the root causes of unwanted outcomes. Both natural and human-caused hazards threaten loss of life and property in the county and are included in the plan. As Figure 1 shows, hazard mitigation is a part of the disaster management cycle and is defined as any action taken to eliminate or reduce the long-term risk to human life and property from natural and technological hazards.

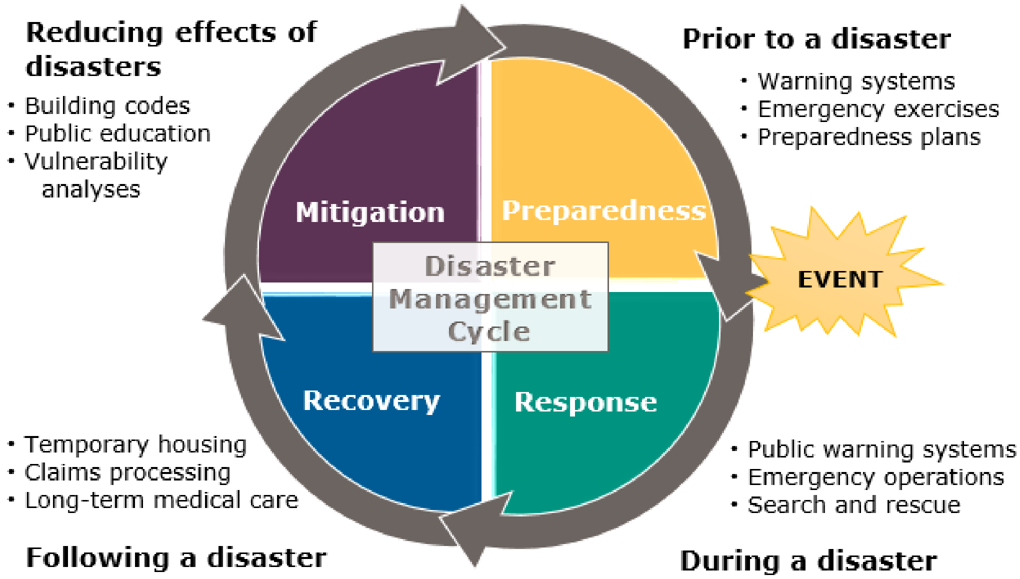


Figure 1. An Integrated Planning Process

Hazard mitigation planning and the subsequent implementation of the projects, measures, and policies developed as part of this plan are the primary mechanisms in achieving FEMA's goal of reducing hazards. Local governments have the responsibility to protect the health, safety, and welfare of their citizens. This plan recognizes the importance of mitigation for the following goals:

- Protect public safety and prevent loss of life and injury.
- Reduce harm to existing and future development.
- Prevent damage to a community's unique economic, cultural, and environmental assets.
- Minimize operational downtime and accelerate recovery of government and business after disasters.
- Reduce the costs of disaster response and recovery and the exposure to risk for first responders.
- Help accomplish other community objectives, such as leveraging capital improvements, infrastructure protection, open space preservation, and economic resiliency.

Developing and putting into place long-term strategies that reduce or alleviate loss of life, injuries, and property resulting from natural or human-caused hazards accomplish these goals. These long-term strategies must incorporate a range of community resources including planning, policies, programs, and other activities that can make a community more resilient to disaster.

2 Public Planning Process

2.1 Planning Team

The Morgan County MHMP planning team is composed of individuals representing the county and its participating jurisdictions. The Morgan County Emergency Management Agency acted as the designated responsible entity and coordinated the development of the planning team. Each community jurisdiction was encouraged to engage in the planning process, and invitations were sent to a wide range of community leaders and involved stakeholders. Some of the invited parties included representatives from local school corporations, local utility companies, Indiana Department of Homeland Security (IDHS), the local floodplain administrator, town clerks, local fire, and police departments, building and planning departments, and many more. A list of attendees can be found in Appendix A. To complete the 10-step process outlined by FEMA in the Local Mitigation Planning Handbook, the planning team participated in a series of surveys and meetings, which are documented in the Appendices. The participation status of each incorporated jurisdiction is summarized in Table 1.

Table 1. Morgan County Incorporated Jurisdictions Participation

Jurisdiction Name	Jurisdiction Type	2017 Participant	Received Invitation to Participate	2023 Participant
Morgan County	County	Yes	Yes	Yes
Martinsville	City	Yes	Yes	Yes
Bethany	Town	Yes	Yes	Yes
Brooklyn	Town	Yes	Yes	Yes
Monrovia	Town	Yes	Yes	Yes
Mooresville	Town	Yes	Yes	Yes
Morgantown	Town	Yes	Yes	Yes
Paragon	Town	Yes	Yes	Yes
Eminence Community	School Corporation	No	Yes	Yes
Martinsville Schools	School Corporation	No	Yes	Yes
Monroe-Gregg	School Corporation	No	Yes	Yes
Mooresville Consolidated	School Corporation	No	Yes	Yes
Soil & Water Conservation District	Conservation District	No	Yes	Yes

Each chapter of the MHMP was reviewed, revised, and expanded using current information and includes new feedback from taskforce members with an emphasis on updating the goals, objectives, and strategies. The mitigation planning requirements identified in 44 CFR 201.6 call for all incorporated jurisdictions participating in a multi-jurisdictional MHMP to take part in the planning process. Examples of participation include, but are not limited to, attending planning meetings, contributing research, data or other information related to hazards and strategies, and commenting on drafts of the plan. The hazard mitigation planning team members are summarized in Table 2.

Table 2. Hazard Mitigation Planning Team

Name	Title	Organization	Jurisdiction
Mark Tumey	Director	Emergency Management Agency	Morgan County
Kenneth Costin	Mayor	Martinsville	Martinsville
Don Adams	Morgan County Commissioner / Bethany Community Member	Morgan County / Bethany	Bethany
Charles Heflin	Captain	Volunteer Fire Department	Brooklyn
Kevin Collier	Councilman	Town Council	Monrovia
Tom Warthen	Council, President	Mooresville	Mooresville
Ryan Swank	Town Marshal	Police Department	Morgantown
William Davis	Chief	Volunteer Fire Department	Paragon
Wesley A Hammond	Superintendent	Eminence Community Schools	Eminence Community SC
Eric Bowlen	Principal	Martinsville High School	Martinsville Schools
Bryan Magennis	Safety Director	Monroe-Gregg School District	Monroe-Gregg SC
Rey Cook	Administrator	Mooresville Schools	Mooresville Consolidated SC
Lisa MacPhee	Director	Soil & Water Conservation District	Soil & Water Conservation District

All members of the planning committee were actively involved in attending meetings, providing available GIS data and historical hazard information, reviewing, and providing comments on the draft plans, assisting in the public input process, and coordinating the county's formal adoption of the plan. Appendix A includes the sign-in sheets listing which meetings each team member attended along with the meeting minutes. The Morgan County EMA Director reached out to surrounding county EMA Directors via email to invite them to the meetings. The EMA Directory also called the Indiana Department of Homeland Security District 5 to invite them to the meeting. Table 3 lists the counties surrounding Morgan County, the name of the EMA director and whether they participated in the process.

Table 3. Surrounding County EMAs Invited

County	Name	Attended
Brown	Barb Davis	No
Hendricks	Dawn Mason	No
Johnson	Stephanie Sichting	No
Marion	Preston Bowlin	No
Monroe	Kate Petroline	No
Owen	Jack White	No
Putnam	Dave Costin	No

2.2 Review of Existing Plans

Morgan County and the local communities utilize land use plans, emergency response plans, municipal ordinances, and building codes to direct community development. The planning process incorporated the existing natural hazard mitigation elements from these previous planning efforts. Table 4 lists the plans, studies, reports, and ordinances used in the development of the plan. Additional information related to jurisdiction capabilities is discussed in Chapter 5.

Table 4. Planning Documents Used for MHMP Planning Process

Author(s)	Year	Title	Description	Where Used
The Polis Center at IUPUI	2017	Multi-Hazard Mitigation Plan – Morgan County	Previous Multi-Hazard Mitigation Plan	Sections 1-6.
Federal Emergency Management Agency	2014	Flood Insurance Study for Morgan County, Indiana and Incorporated Areas	Flood insurance study	Section 4
The Polis Center at IUPUI	2019	2019 State of Indiana Standard Multi-Hazard Mitigation Plan	Indiana state Multi-Hazard Mitigation Plan.	Section 3
Taylor Siefker Williams Design Group	2022	Unified Development Ordinance, Morgan County, Indiana	Unified development ordinance	Section 5
HWC Engineering	2019	Morgan County, Indiana Comprehensive Plan	Comprehensive plan	Section 5
HWC Engineering	2019	Morgan County, Indiana Thoroughfare Plan	Thoroughfare plan	Section 5

2.3 Planning Process Timeline and Steps

The Morgan County planning team met on November 17, 2021, for the MHMP update kickoff. Prior to the second meeting, the team completed a survey related to the hazard rank and strategy status. The team then met on January 27, 2022, to discuss survey results. The planning team confirmed the communities' hazard priorities and clarified any conflicting survey results for the county and each community.

The planning team met again on March 10, 2022. During this meeting, the overall purpose of the plan was reiterated, and public input was sought. The group reviewed a copy of the draft plan and was provided with a presentation on the risk assessment and mitigation strategies. The draft plan was revised based on comments from the planning team. Appendix A includes meeting minutes and invitations to participate.

The public was invited to both the first and third meetings via a public notice in the local newspaper, emails, and Facebook. However, there was no participation from the public in either meeting. Appendix B includes the published announcements of the meetings.

The county continually works to engage with the public by posting community meetings and training opportunities on the county website as well as on the county's social media resources. In addition, a final copy of the plan will be available online through the county's website.

3 Community Profile

To provide a basic understanding of the characteristics of the community, this section offers a general overview of Morgan County including the physical environment, population, and identification of available services.

3.1 General County Description

Morgan County is in central Indiana and is situated approximately 30 miles southwest of the capital city of Indianapolis. According to the 2010 US Census, the county covers 409.43 square miles. According to the Census Bureau, its population was estimated to be 69,922 in 2019.The City of Martinsville is the county seat and the largest incorporated community in the county, containing approximately 16.64% of the population in 2019. Figure 2 displays a general map of Morgan County and its incorporated communities while the Morgan County townships and their respective incorporated communities are outlined in Table 5.

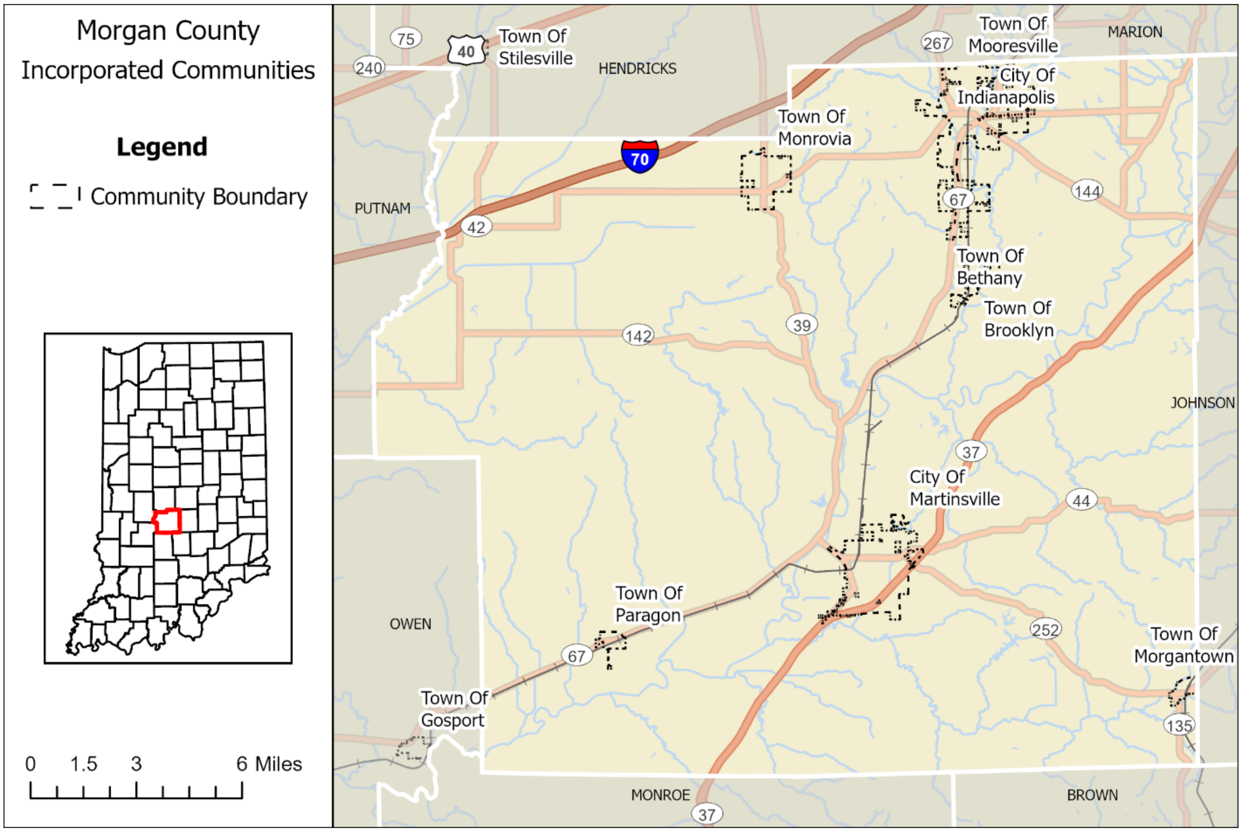


Figure 2. Morgan County Incorporated Boundaries

Table 5. Morgan County Townships and Incorporated Communities

Township	Communities located in Township
Adams	-
Ashland	-
Baker	-
Brown	Mooresville
Clay	Bethany, Brooklyn
Green	-
Gregg	-
Harrison	-
Jackson	Morgantown
Jefferson	-
Madison	-
Monroe	Monrovia
Ray	Paragon
Washington	Martinsville

3.2 Historical Setting

Morgan County was established on February 15th, 1822, along with 34 other counties after being drawn out from the Delaware New Purchase portion of the Northwest Ordinance. Morgan County was named after General Daniel Morgan, who led the colonists to a victory over the British in the Revolutionary War Battle of Cowpens.

The first settlers of Morgan County came from the South in 1822, including many southern Quakers who settled in the Mooresville area due to their opposition to slavery. Morgan County led the Indianapolis metro area in banning smoking in restaurants in the early 2000s. Morgan County is also home to the designer of the Indiana state flag.

Morgan County's boundaries have changed quite a bit since its creation. In 1861, Morgan County lost a portion of its original land due to the creation of Putnam County. Again in 1868, Hendricks County was carved out from Morgan County, leaving Morgan County in the shape it remains today.

3.3 Physical Characteristics

3.3.1 Climate and Precipitation

The Morgan County climate is characteristic of central Indiana. Winter temperatures can fall below freezing starting as early as October and extending as late as April. Based on National Centers for Environmental Information (NCEI) norms from 1981 to 2010, the average winter minimum temperature is 19.8° F, and the average high is 38.9° F. In summer, the average low is

61° F and average high is 83.1° F. Average annual precipitation is 44.73 inches. The average winter precipitation is 8.53 inches.

3.3.2 Future Climate Trends

Much like all parts of the world, Indiana is facing more and more challenges as the climate continues to shift. The Indiana Climate Change Impacts Assessment (IN CCIA) from 2018 (https://ag.purdue.edu/indianaclimate/indiana-climate-report) found that the climate in the state is predicted to change within the century. The main findings from this study are listed below:

- Temperatures are projected to rise about 5-6°F by mid-century.
- The number of extremely hot days will rise.
- Extreme cold events will decline.
- The frost-free season will lengthen.

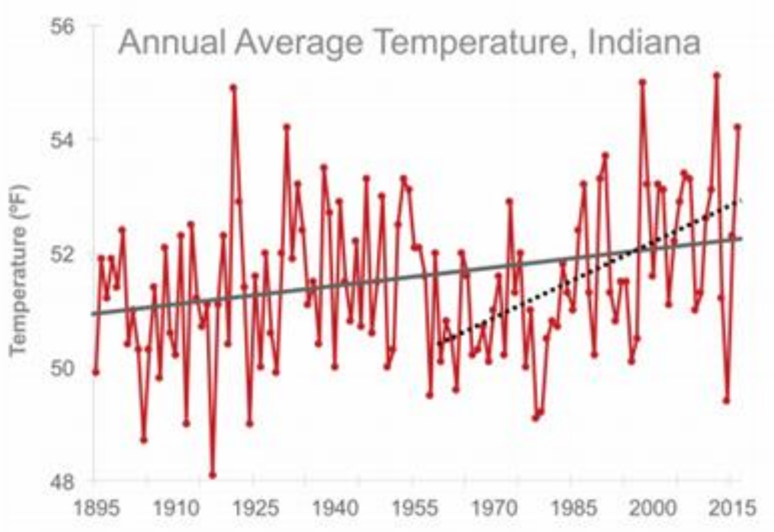


Figure 3. Annual Average Temperature (Widhalm M. H., 2018)

3.3.2.1 Predicted Changes in Temperature

The IN CCIA indicates that Indiana has warmed 1.2°F since 1895 and temperatures will rise by about 5°F to 6°F by mid-century. This has multiple impacts for Indiana, including changes to the timing and length of the frost-free season, and the occurrence of temperature extremes. These shifts will impact air quality, extend the growing season and the allergy season, and create more favorable conditions for some pests and invasive species.

Indiana's growing season is expected to increase by 33 days for Morgan County (see Figure 4). Warming temperatures in the winter months will affect the types of plants and pests that can thrive in Indiana and alter the amount of energy needed to heat and cool homes and businesses.

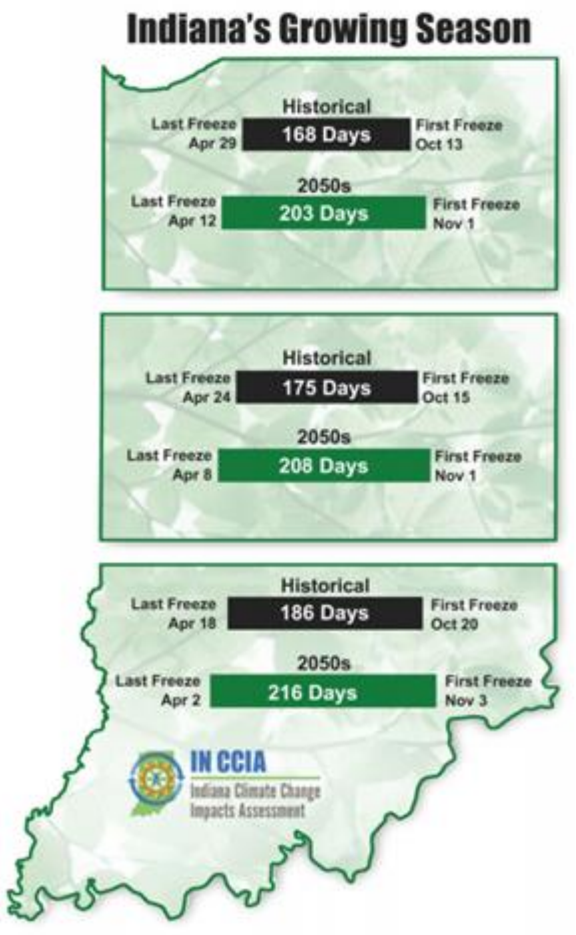


Figure 4. Indiana's Growing Season (Widhalm M. H., 2018)

3.3.2.2 Predicted Changes in Precipitation

Since 1895, average annual precipitation in Indiana has increased by about 15%, or about 4.5 inches, based on a linear trend. This trend is projected to continue, though the type of precipitation and when it falls are changing and will continue to do so.

The southern and west-central regions of the state have observed the largest increases in precipitation, while the east-central and northeast regions observed the smallest. Spring and fall increases were smallest in the north and largest in the south. The opposite was true in summer when increases were larger in the north and west.

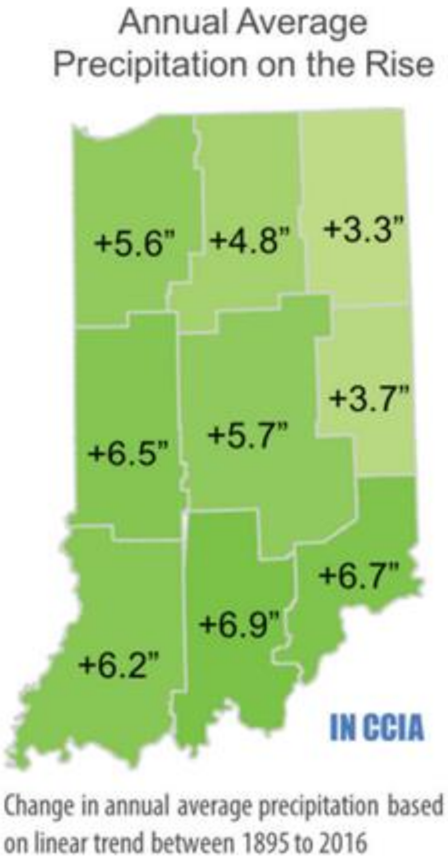


Figure 5. Average Precipitation Increase (Widhalm M. H., 2018)

With Morgan County's location in the central portion of the state, it experienced an increase of 5.7 inches of annual precipitation between 1895 to 2016. With increasing temperatures, it is expected that rain will replace snow in the cold season. Fewer snow days would save municipality and state funding for plowing and salting roadways. However, wetter winters and springs will increase the risk of flooding and combined sewer system overflows, resulting in decreased water quality.

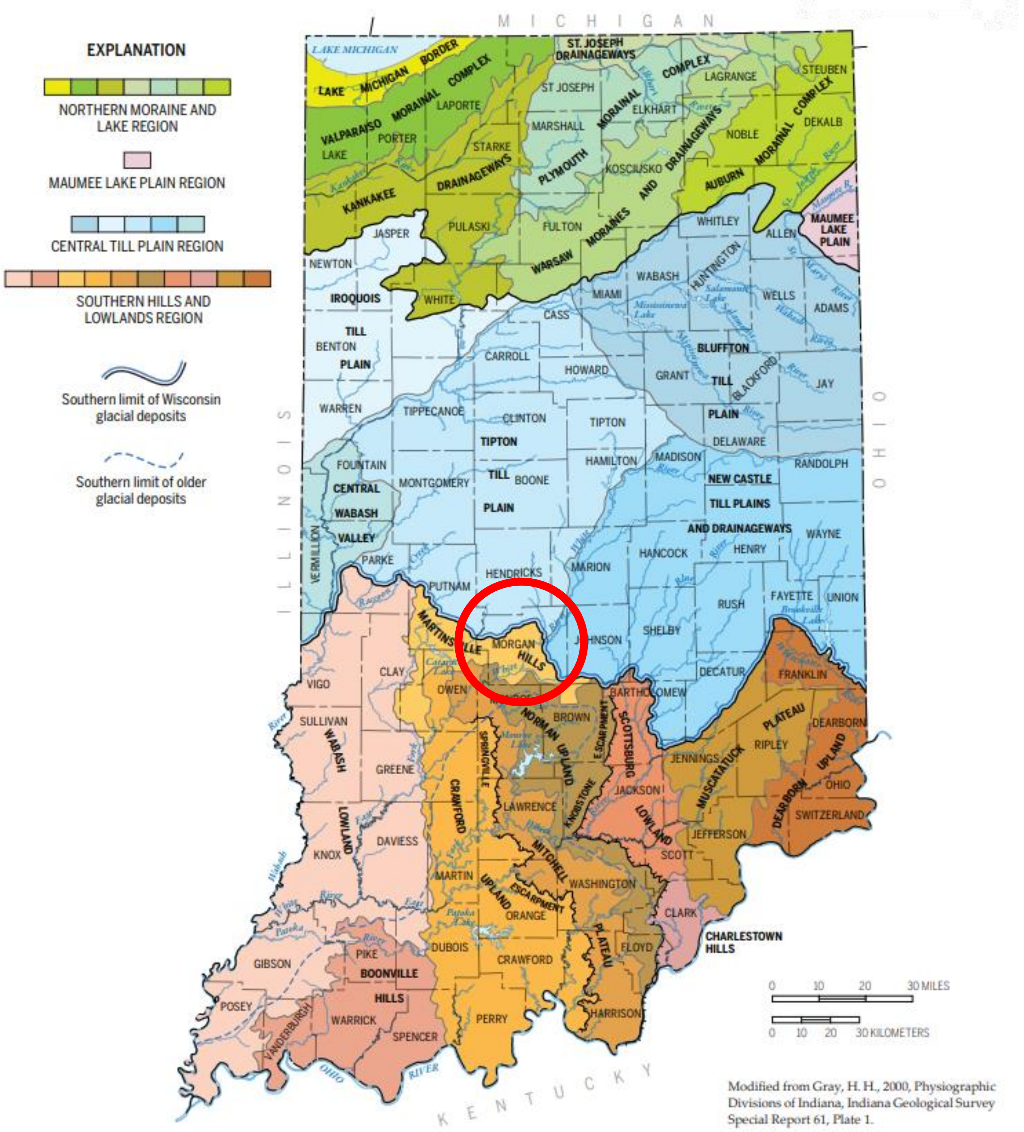
3.3.2.3 Predicted Changes in Extreme Events

Extreme and heavy rainfall events have increased in the past century, and this is expected to continue. These events contribute to soil erosion and nutrient runoff, affecting both water quality and crop productivity.

There is also an indication that the number of tornadoes affecting Indiana may increase, putting more residents and property at risk while increasing response and recovery costs.

3.3.3 Geology and Topography

The landscape of Morgan County consists of flat, rolling hills in the northern portion of the county and hillier, steeper terrain in the central and southern portions of the county- including the Martinsville Hills. According to the United States Department of Agriculture Soil Survey of Morgan County, the lowest point in Morgan County is 550 feet above sea level and the highest point in the county is about 970 feet above sea level.



Modified from Gray, H. H., 2000, Physiographic Divisions of Indiana, Indiana Geological Survey Special Report 61, Plate 1.

Figure 6. Physiographic Divisions of Indiana (Source: Indiana Geological Survey)

Morgan County's topography is dominated by the Tipton Till Plain, New Castle Till Plains and Drainageways, Martinsville Hills, and Norman Upland topographical units. The Tipton Till Plain is characterized by the widespread presence of clayey till, leaving much of the area poorly drained with extensive areas of ice-disintegration features. The New Castle Till Plains and Drainageways unit is characterized by widespread till of low relief crossed by several major tunnel-valleys. The Martinsville Hills are characterized as bedrock hills of high relief strongly modified by pre-Wisconsin glacial activity. The Norman Upland is characterized as bedrock hills of high relief.

The Indiana Geological Survey reports that the bedrock in Morgan County is primarily Mississippian and made up of shale, sandstone, siltstone, limestone, and gypsum.

3.3.4 Land Use and Ownership

3.3.4.1 Agriculture

The 2017 U.S. Census of Agriculture reports that there are 501 farms in the county covering 138,355 acres. Of this farming land, 81.58% is cropland and 18.42% is classified as "other uses." Figure 7 displays the agricultural areas in Morgan County along with confined feeding operations (CFO). CFOs are defined by the Indiana Department of Environmental Management (IDEM) as "the confinement of animals in buildings or lots with less than 50 percent vegetation or ground cover for 45 days or more over a 12-month period" and a certain number of animals, based on the type of animal. These types of operations are regulated at the state level but can also be regulated at the county level in terms of siting through a zoning ordinance. Indiana's focus on CFOs is on effective storage and application of manure and related wastes generating by those CFOs.

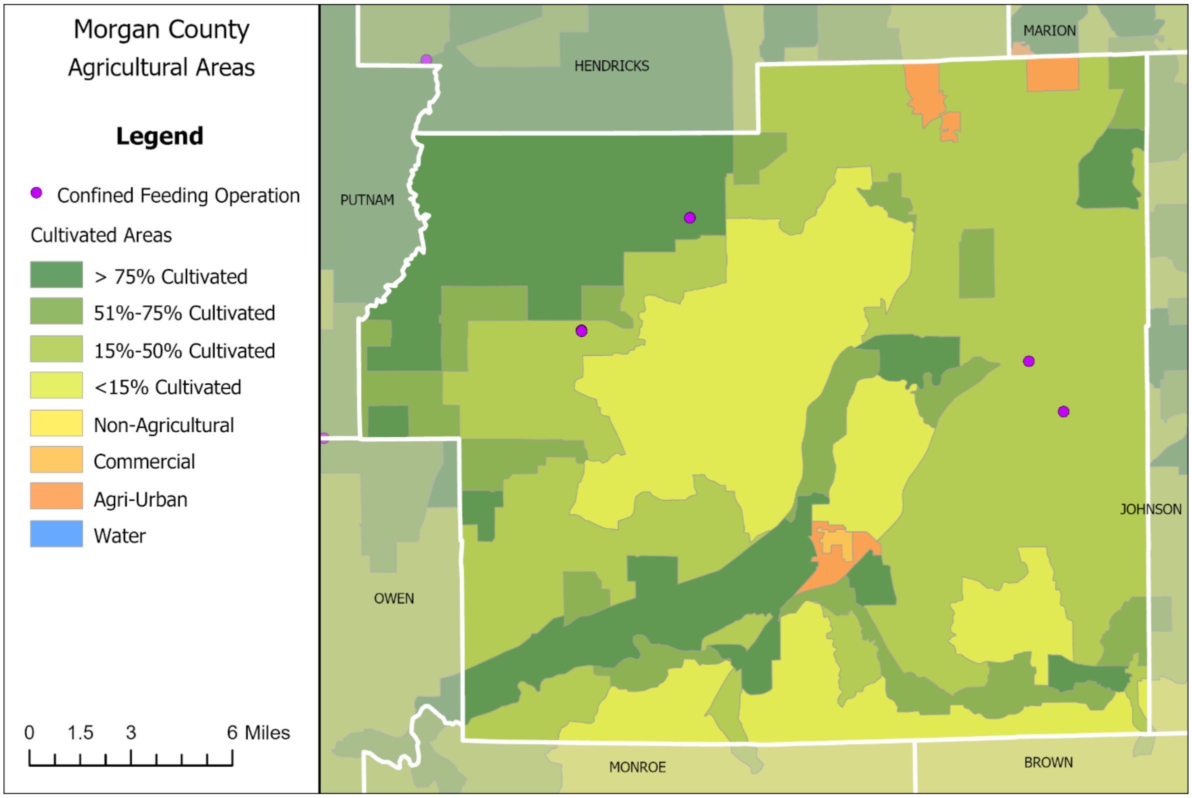


Figure 7. Morgan County Agricultural Areas

3.3.4.2 Managed Lands

The Indiana Department of Natural Resources (IDNR) maintains an inventory of managed properties. These natural and recreation areas are managed by either the IDNR Fish & Wildlife, IDNR Nature Preserves, federal, local or non-profits and is maintained by the Indiana Natural Heritage Database. By establishing conservation areas and parkland, the county can preserve plant and animal species and combat air pollution, land pollution, and water quality issues. Figure 8 depicts managed land in Morgan County.

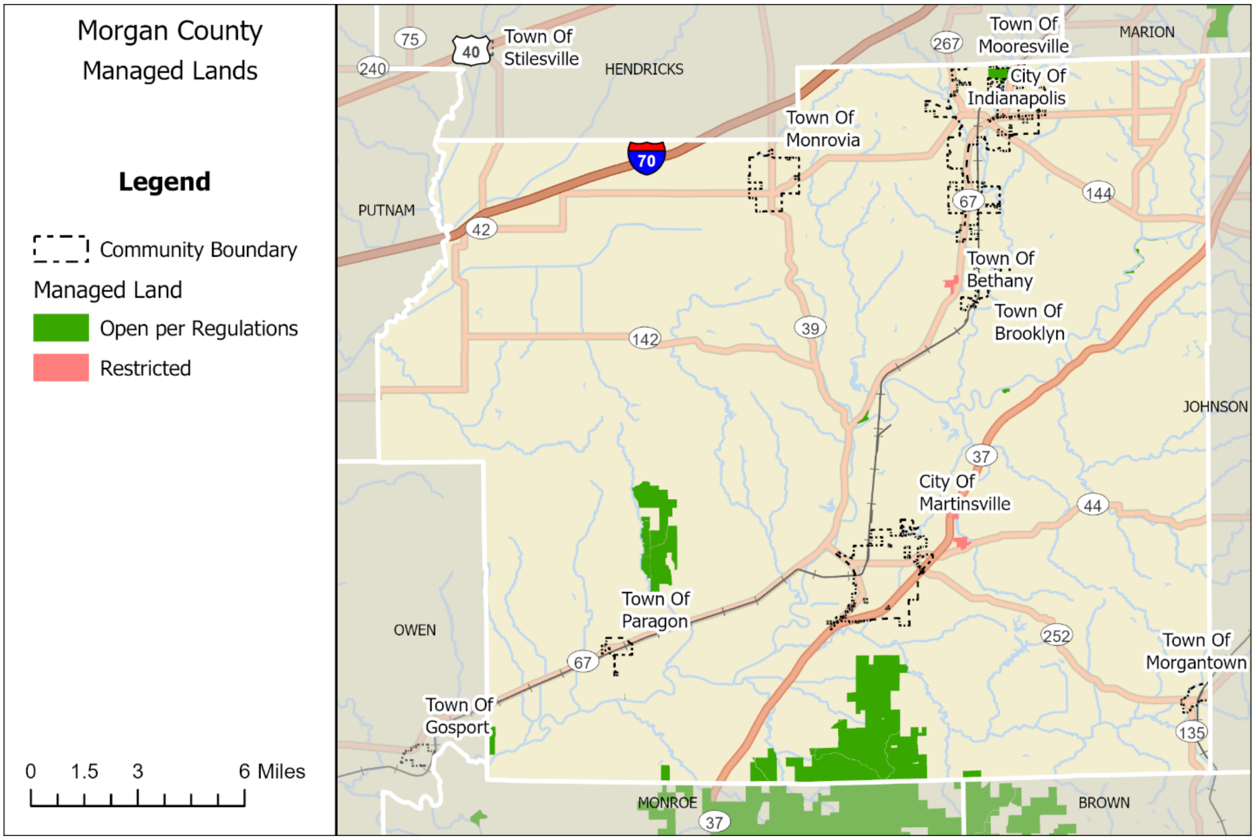


Figure 8. Morgan County Managed Lands

3.3.5 Major Waterways and Watersheds

Water resources are vital to the county because they provide enhanced recreational and economic opportunities. Important water resources include surface and groundwater from aquifers, watersheds, lakes, rivers, and wetlands. Water resources provide for riparian habitats, fish, wildlife, household, livestock, recreation, aesthetic, and industrial uses.

3.3.5.1 Watersheds

Morgan County is located within two major watersheds: the Upper White (HUC 05120201) and Eel Watersheds (05120104) as shown in Figure 9. The Eel Watershed covers the northwestern portion of the county while the Upper White Watershed encompasses the rest of the county.

3.3.5.2 Rivers and Streams

The Morgan County National Hydrography Dataset (NHD) contains over 357 miles of streams and rivers. Major streams and rivers in the county are displayed in Figure 9. The city of Martinsville was constructed near the bank of the White River. According to the Indiana Natural Resources Commission, Indian Creek is navigable from its junction with the West Fork of the White River for 3.3 river miles, while Mill Creek, Mill Creek Ditch, Mud Creek, and the West Fork of the White River are all navigable throughout the county.

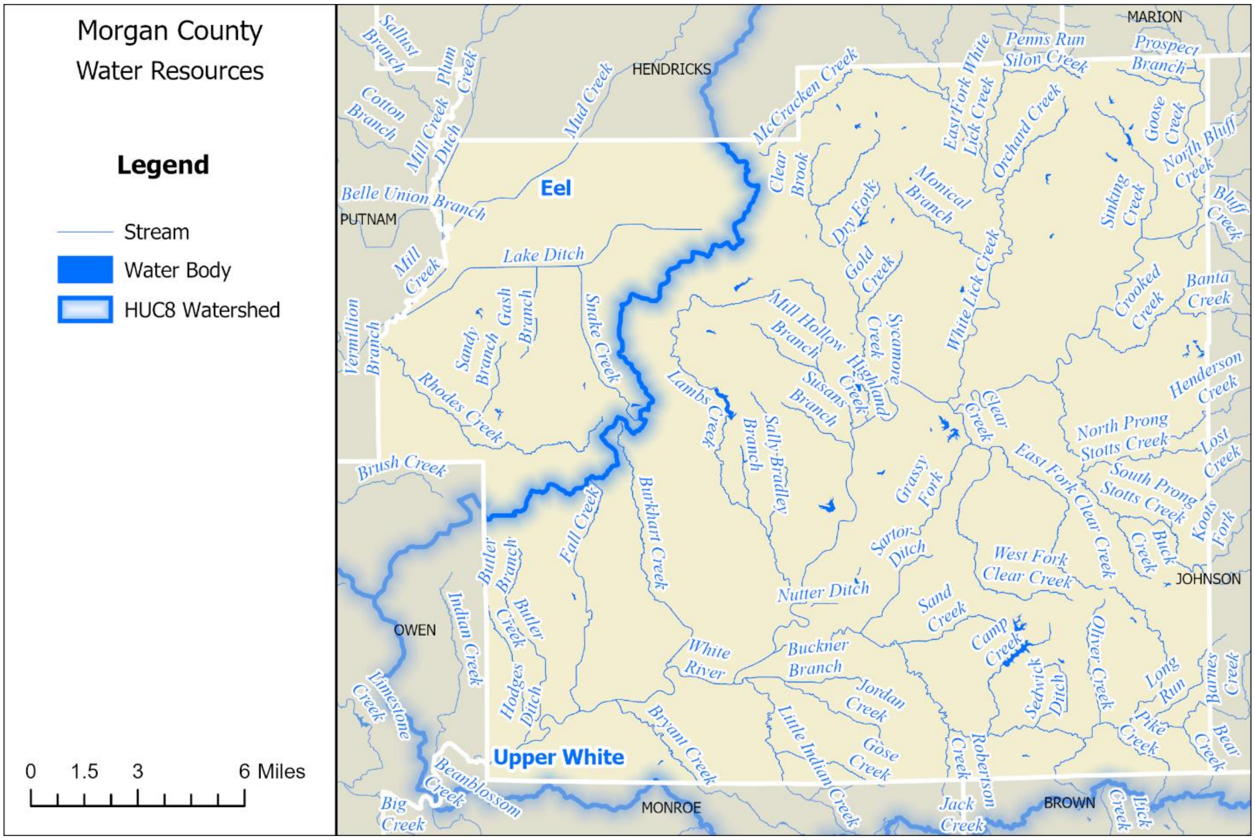


Figure 9. Morgan County Water Resources (Water resource data courtesy of IDNR)

3.3.5.3 Lakes and Reservoirs

Lakes provide drinking water and a habitat for a variety of fish and wildlife. Lakes can function as a potential source of transportation and support recreational and commercial fishing industries. The IDNR Department of Fish and Wildlife maintains a list of the lakes in Indiana and the general assembly has established the listing of Public Freshwater Lakes (PFL). The IDNR

Division of Water regulate these lakes using the Lake Preservation Act (I.C. 14-26-2) and/or Lowering of 10 Acre Lakes Act or "Ditch Act" (I.C. 14-26-5). There are no PFLs in the county.

3.3.5.4 Wetlands

The EPA and the Indiana Department of Environmental Management (IDEM) have identified Indiana's wetlands and other aquatic resources as important features to protect and wisely use for the benefit of present and future generations. Wetlands are vital features of the Indiana landscape that provide beneficial services for people and wildlife including protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters, and maintaining surface water flow during droughts and dry periods. Figure 10 displays the lakes and wetlands in Morgan County.

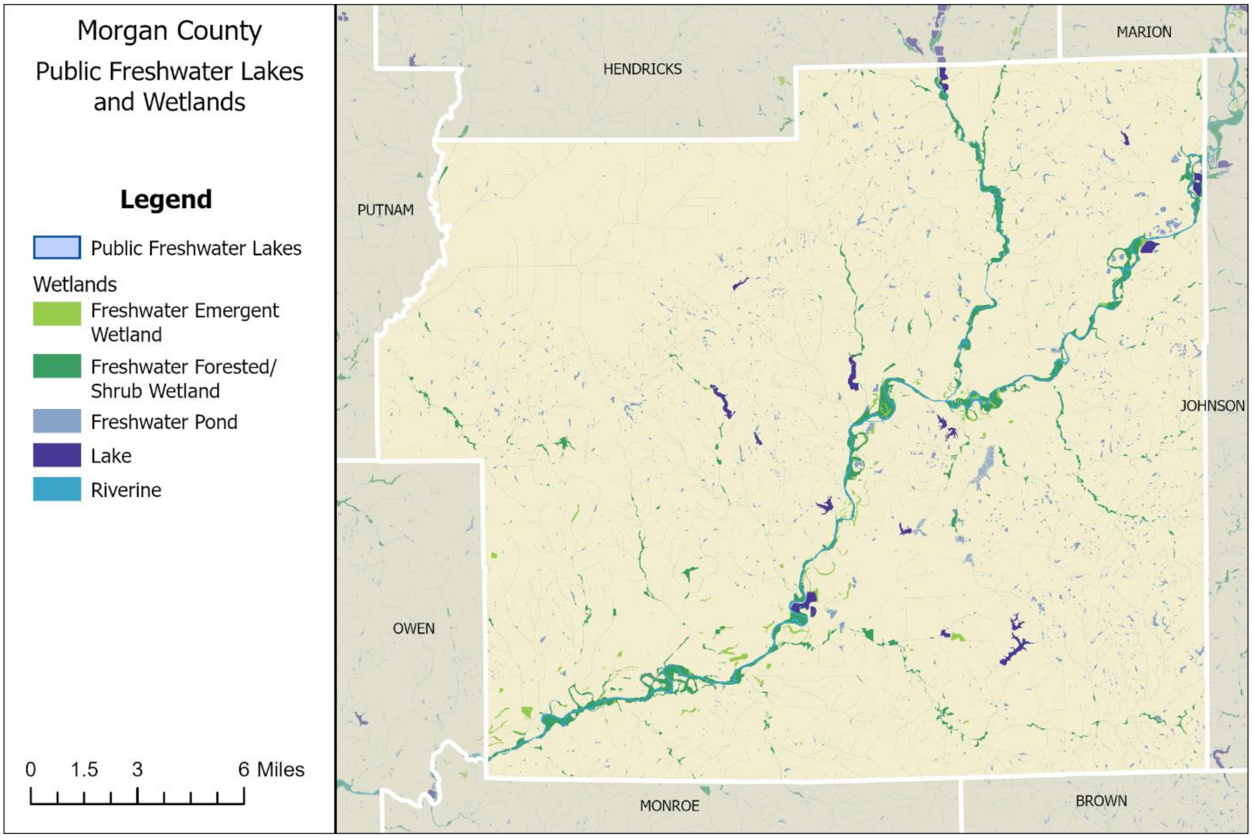


Figure 10. Public Freshwater Lakes and Wetlands (Water resource data courtesy of IDNR)

3.3.6 Population and Demographics

The US Census Bureau determined that Morgan County's population was 66,689 in 2000 and 68,894 in 2010. The American Community Survey 5-year estimates that 69,922 people resided in Morgan County in 2019. The population increased by 1.5% between 2010 and 2019 as displayed in Figure 11. The population density in 2019 was 170.8 people per square mile.

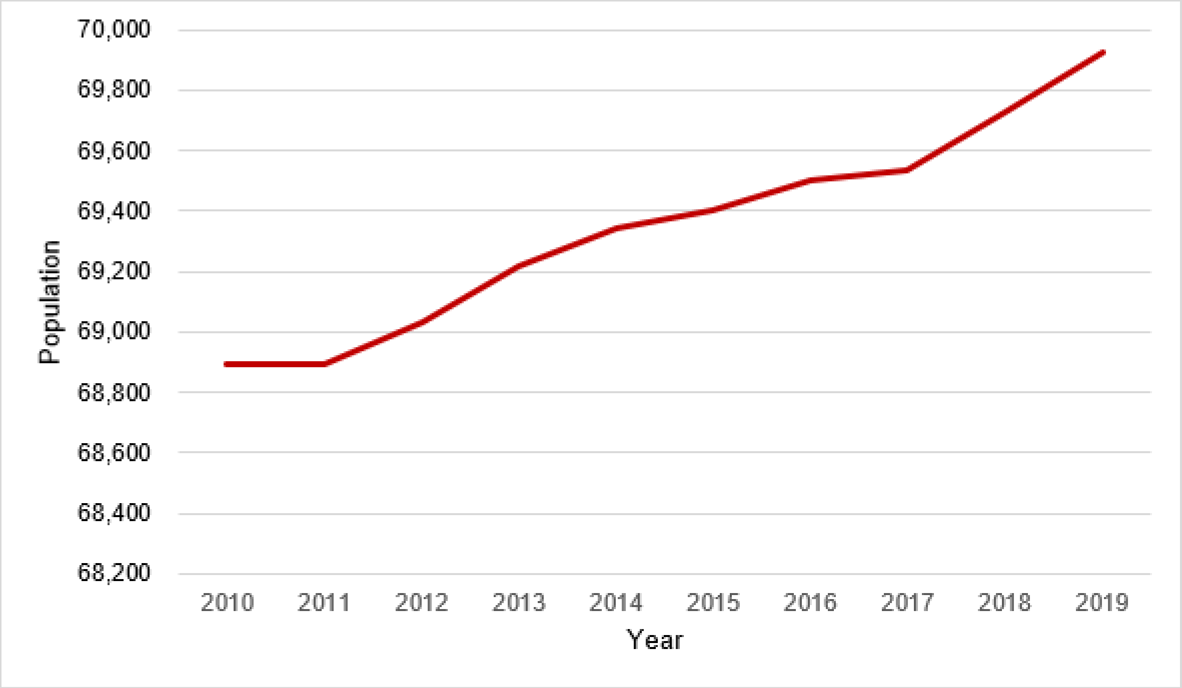


Figure 11. Morgan County Yearly Population 2010-2019 (American Community Survey 5-Year Estimates)

The 2019 median age of Morgan County is 41.5 compared to the state median of 37.6. The age distribution of Morgan County is shown in Figure 9. Of the population age 25 and older, 88.2% have completed a high school education or higher while 17.3 % have completed a bachelor's degree or higher.

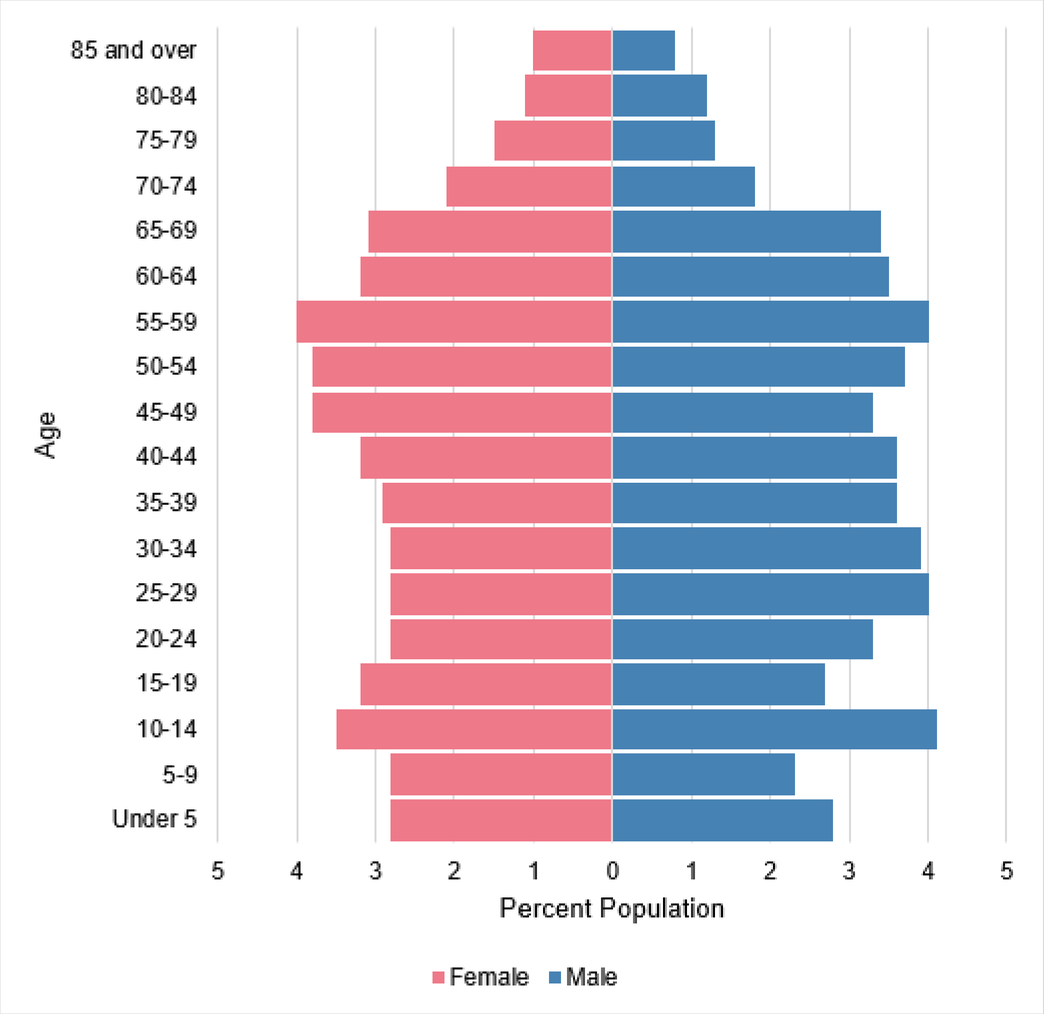


Figure 12. Distribution of Ages in Morgan County (2019 American Community Survey 5-Year Estimates)

3.3.6.1 Social Vulnerability and Inequity

Some populations may require special attention in mitigation planning because they may suffer more severely from the impacts of disasters. It is important to identify these populations, termed special needs populations, and develop mitigation strategies to help them become more disaster resilient. Although there are numerous types of vulnerable populations, there are five focus groups, which include the population age 65 and over, population 25 years and over with less than a 9th grade education, population for whom poverty status is determined, population with a disability, and the population 5 years and over that speaks a language other than English at home. Figure 13 compares Morgan County to its surrounding counties, as well as to Indiana, by the percent population of each special needs category within the county/state.

Compared to the surrounding counties, Morgan County has a relatively low percentage of people who speak a language other than English at home and people living in poverty. However, Morgan County contains a higher percentage of people aged 65 and over, people who are unemployed, or people with a disability.

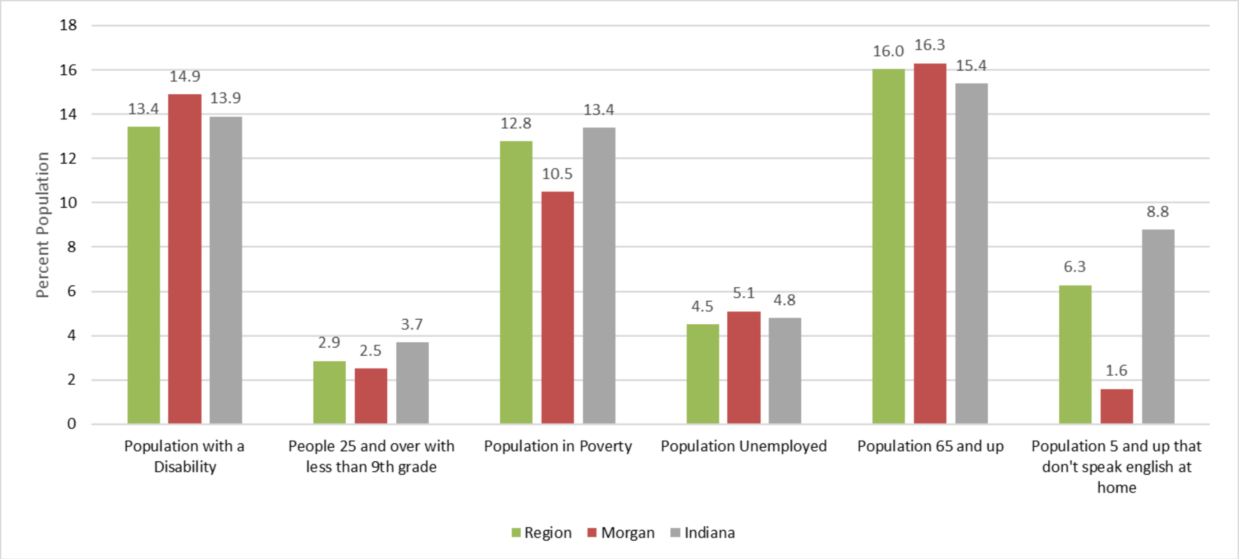


Figure 13. Special Needs Populations (American Community Survey 5-Year Estimates)

Another tool that can be used to better understand the disproportionate risks facing certain residents of Morgan County is FEMA's National Risk Index (NRI). The NRI utilizes source data for 18 different natural hazards along with social vulnerability indices and community resiliency rankings. By combining these 3 risk factors, the NRI applies an overall Risk Rating that considers the likelihood and impact of natural disasters, the social vulnerability of the area and the measured community resilience. This ranking is meant to be used to aid communities in better understanding the risk to their populations as well as a tool to help make better policies. More information about FEMA's NRI can be found at https://www.fema.gov/flood-maps/products-tools/national-risk-index.

The overall risk rating for Morgan County is shown in Figure 14. In general, the rural areas have lower NRI than the more urban areas in Morgan County. Specifically, the City of Martinsville shows a Very High risk rating and the Town of Mooresville shows a Relatively High risk rating while the rest of the county shows a Relatively Low to Very Low risk rating. Figure 15 shows the social vulnerability rank for Morgan County. This shows that most of the county has a social vulnerability ranking of relatively low to moderate.

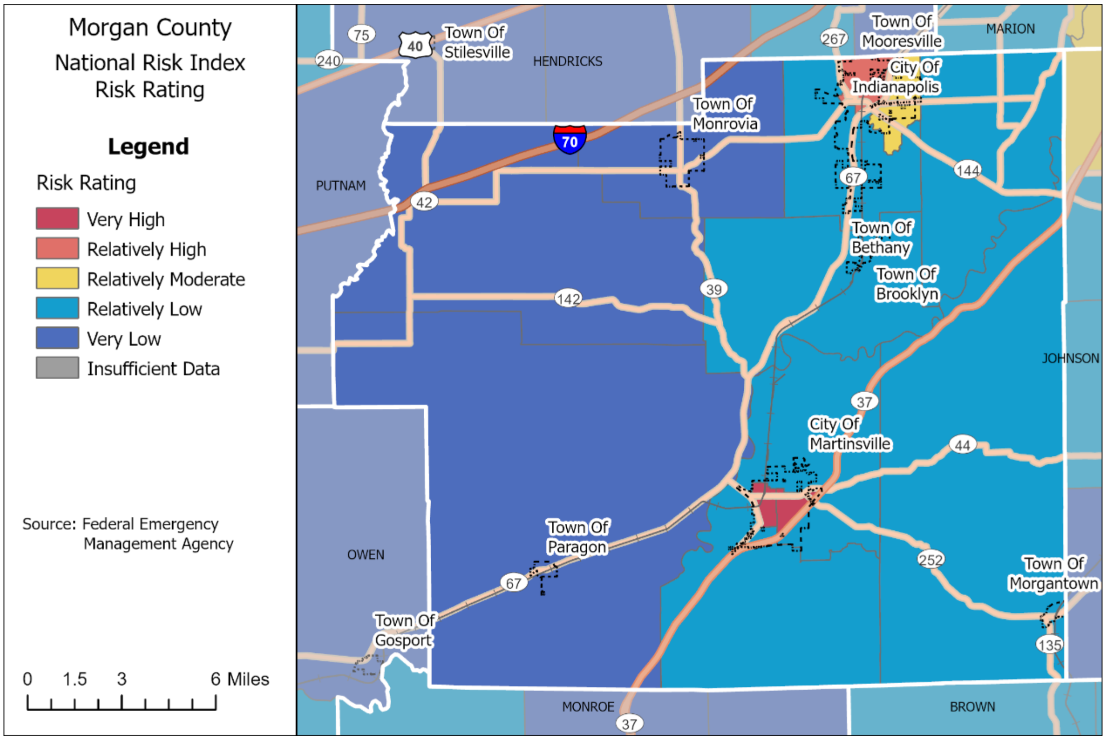


Figure 14. National Risk Index (NRI) Risk Rating

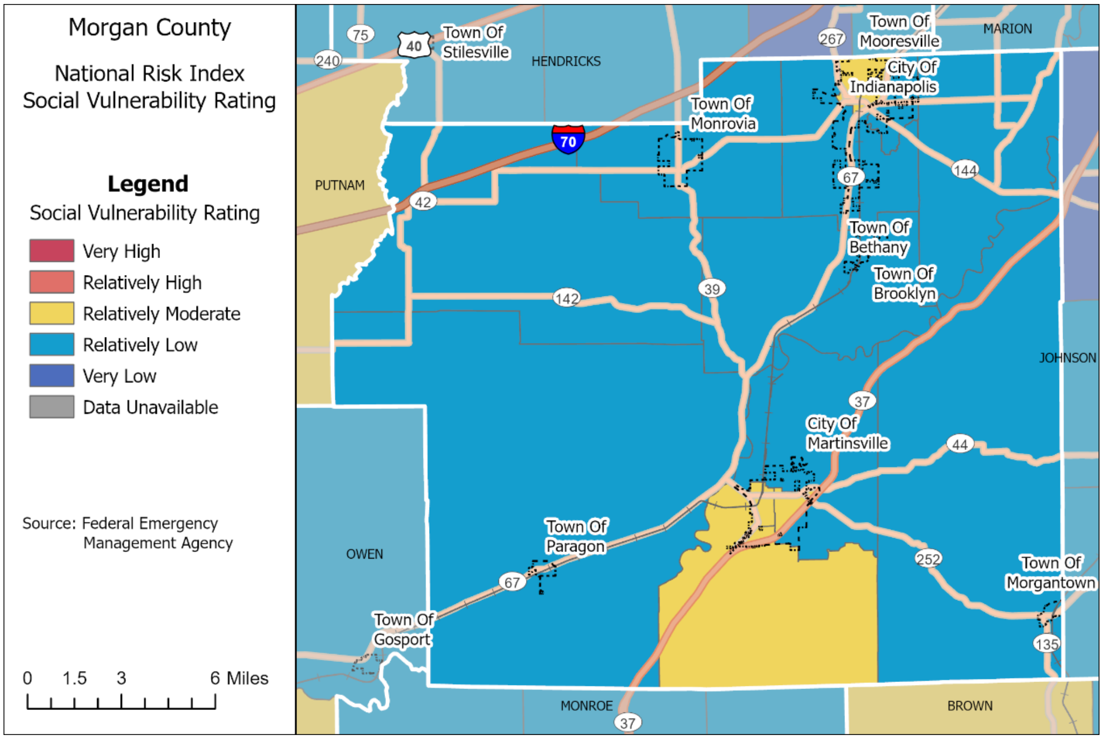


Figure 15. National Risk Index (NRI) Social Vulnerability Rating

3.3.7 Housing

Approximately, 53.5% of Morgan County households consist of married-couple families, compared to 48.2% of married-couple households in Indiana. In 2019, the county had an average household size of 2.7 people.

3.3.8 Economy and Employment

The 2019 annual per capita personal income in Morgan County was $30,721, compared to an Indiana per capita income of $27,305. The median household income is $64,335, which is higher than the state median household income of $56,303. Of the Morgan County work force, 14.4% are employed in the manufacturing industry while educational services, and health care and social assistance accounts for 19.3% of industry. The major employers in Morgan County are listed in Table 6.

Table 6. Major Employers in Morgan County (HoosierData Business Lookup)

Company Name	Location	Employees
Nice-pak Products Inc.	Mooresville	900
Toa LLC	Mooresville	601
IU Health Morgan Hospital	Martinsville	550
Franciscan Health Mooresville	Mooresville	328
Walmart Supercenter	Martinsville	250
Bri Staffing Inc.	Mooresville	201
Gray Brothers Cafeteria	Mooresville	160
Morgan County Sheriff’s Dept.	Martinsville	160
Kroger	Mooresville	150
Martinsville High School	Martinsville	150

3.3.8 Culture

According to the Indiana Historic Sites and Structures Inventory, Morgan County has 23 historic places that appear on the National Register of Historic Places and 9 historic districts as shown in Figure 16.

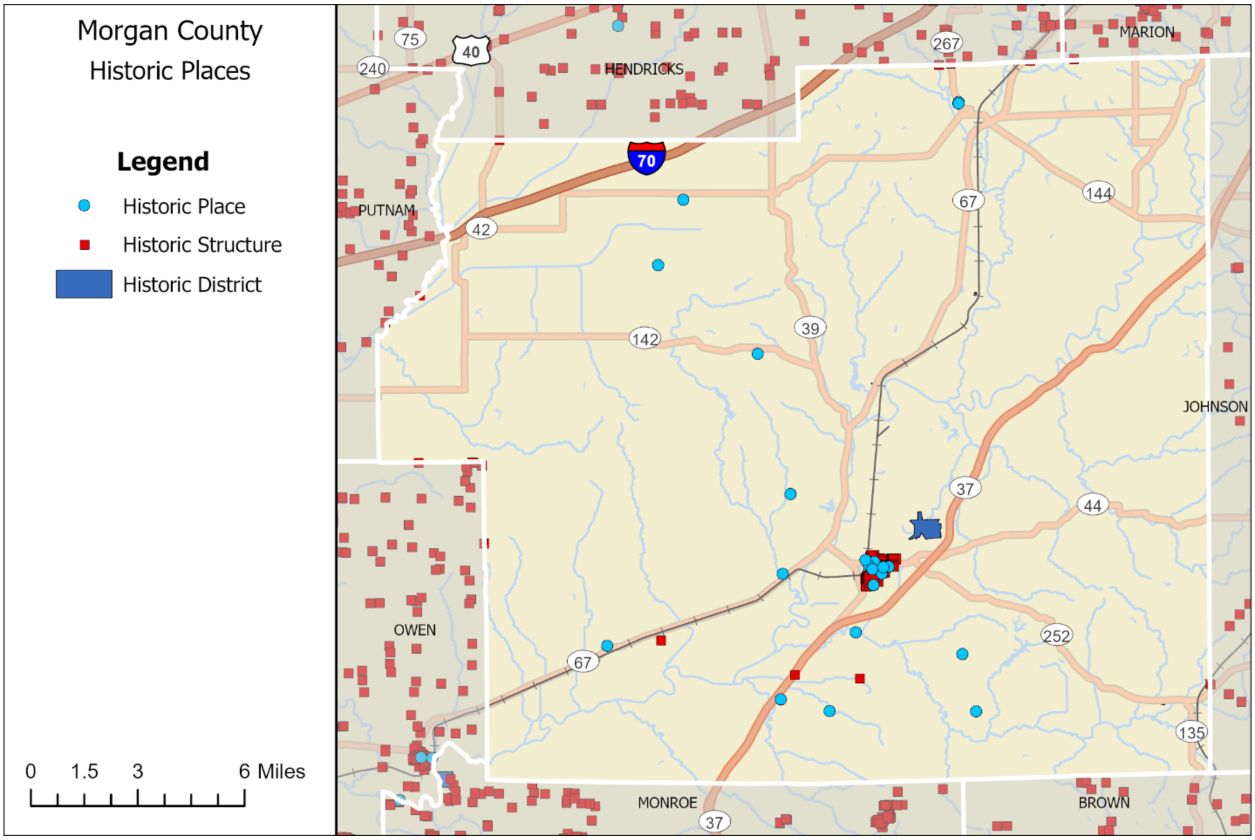


Figure 16. Historic Places in Morgan County (Indiana State Historical Architectural and Archaeological Research Database)

3.3.9 Transportation and Commuting Patterns

The county transportation system is composed of roads, highways, airports, public transit, railroads, and trails, designed to serve all residents, businesses, industries, and tourists. Figure 17 identifies the major transportation features of Morgan County.

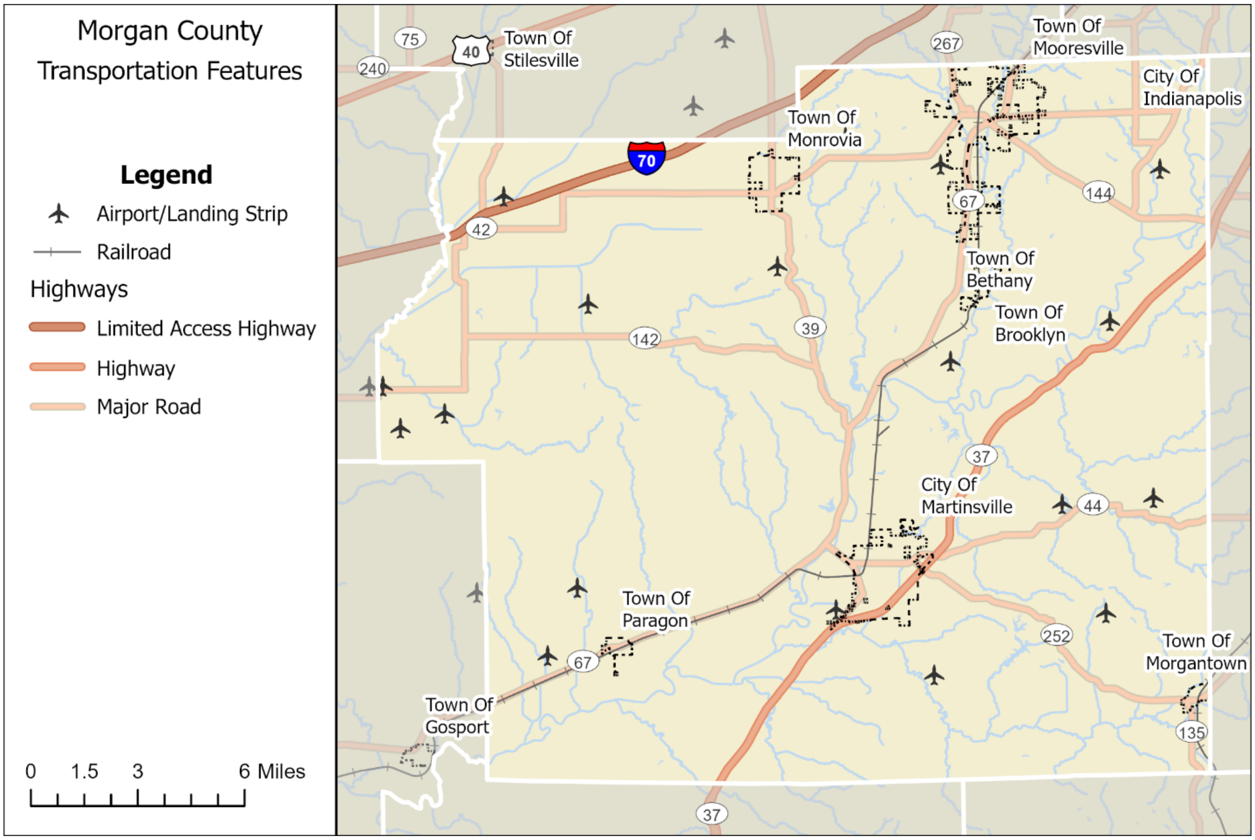


Figure 17. Morgan County Major Transportation Features (Indiana Department of Transportation)

The Indiana Department of Transportation (INDOT) Seymour District manages the state transportation resources for the southeast portion of the county and the Crawfordsville District manages the state transportation resources for the northwest portion of the county.

Morgan County has one main rail corridor: Indiana Southern Railroad (ISRR). ISRR is a short line Class III railroad that tracks 186 miles from Indianapolis to Evansville and passes through the Morgan County northeast to southwest. The ISRR passes through Mooresville, Bethany, Brooklyn, Martinsville, and Paragon.

There are no commercial airports in Morgan County. The nearest international air transportation is Indianapolis International Airport in the neighboring county. Morgan County also has multiple small and privately owned airfields that can provide air access during a disaster.

Commuting Patterns

County-to-county commuting patterns provide a gauge of the economical connectivity of neighboring communities. According to STATS Indiana 2019 data, 29,335 Morgan County residents work within the county and 18,604 work outside the county. An additional 3,914 people living in 5 other counties commute to Morgan County for work. Figure 18 indicates the number of workers 16 and older who commute to or from Morgan County for work.

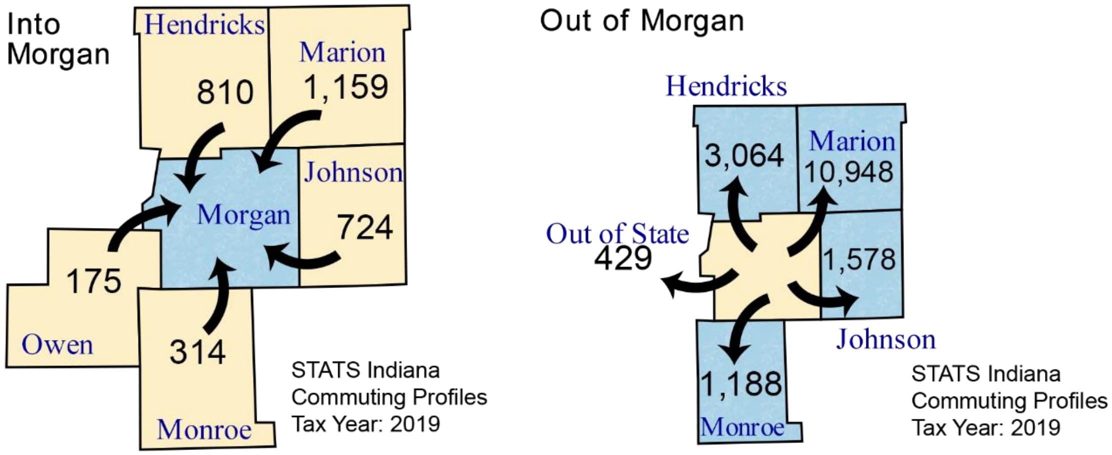


Figure 18. Commuting Patterns (STATS Indiana)

3.4 Building Codes

Indiana does not have hazard-resistant building codes, as shown in Figure 19, although one of the most effective ways to help reduce the impacts of natural disasters is the updating and enforcing of better building codes. Studies show that by increasing the standards for building codes, the overall negative impact of natural disasters can be reduced.

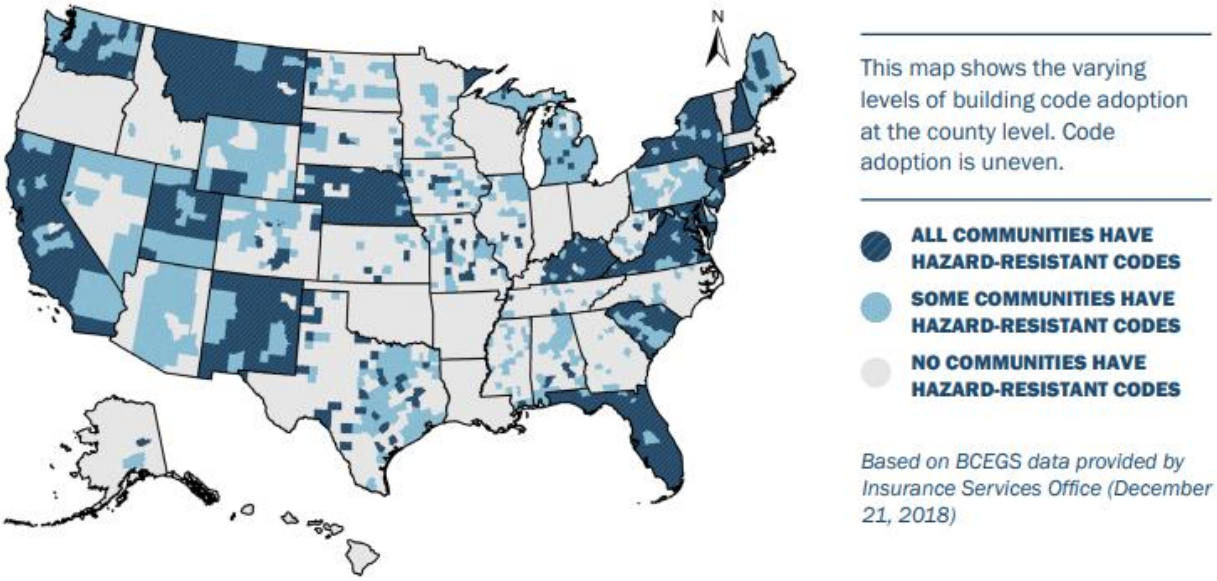


Figure 19. Nationwide Building Code Adoption (Source: FEMA, 2020)

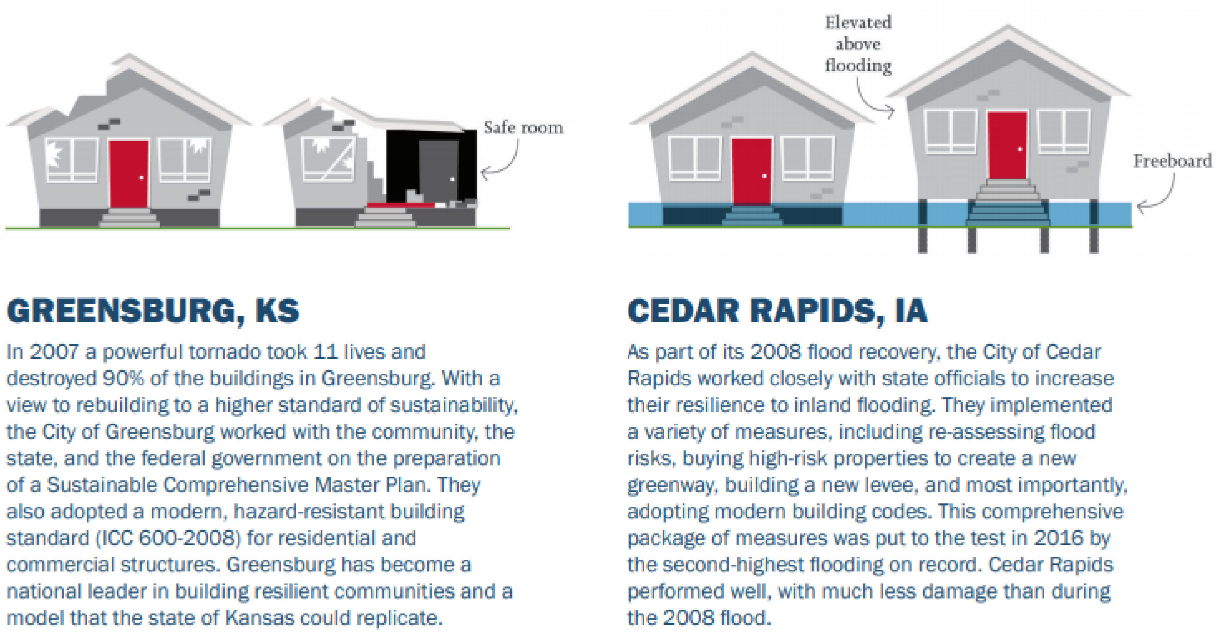
In 2005 the National Institute of Building Sciences developed a landmark study, Mitigation Saves, which revealed that for every $1 spent on hazard mitigation an average of $4 in disaster related costs could be avoided. A 2019 update of this study considered a wider range of hazards and integrated recent research on the social and economic impacts. While the benefits of mitigation vary by hazard, the study showed that on average $13 can be saved for every dollar invested in mitigation. It also examined specific mitigation actions such as building codes. Building codes are designed to establish minimum requirements that ensure life safety. The study reveals that on average building codes have only added about 1% to construction costs relative to 1990 standards. For new construction designed consistent with building codes the study showed that an average of $11 can be saved in disaster repair and recovery costs for every $1 invested. When above code designs are implemented, an average of $4 can be saved for every $1 invested. Additional research, such as the 2020 Building Codes Save study released by FEMA, continue to reveal the value of building codes. According to the FEMA study, over a 20-year period cities and counties with modern building codes would avoid at least $32 billion in losses from natural disasters when compared to jurisdictions without modern building codes.

Florida has made great strides in increasing their standards so that homes in their state are more resistant to hurricane winds and coastal flooding. While hurricanes may not be a concern in Indiana, we do face ever-increasing risks of tornadoes and straight-line wind damage. A study done by the University of Oklahoma was able to identify tornado resistant construction techniques, which would allow homes to withstand winds up to 135 mph. The team studied the aftermath of a 2013 tornado and were able to identify several improvements to the current code that would improve a building’s ability to withstand damaging winds at an overall construction cost increase of just 1-2 percent (Doak, 2017).

Figure 20 provides examples of how Greensburg, Kansas and Cedar Rapids, Iowa, have adopted more disaster-resistant building codes to protect their communities from tornadoes and flooding.

Morgan County has experienced 22 tornadoes since 1954 resulting in 47 injuries and no deaths, and almost $23 million in property damage. There have been 7 high wind events since 1995, resulting in no deaths or injuries and over $13,000 in property damage. Morgan County has experienced 85 floods since 1996. The total damages reported from these floods was around $200 million and resulted in 1 death with no injuries.

While more robust building codes cannot guarantee complete safety in the event of a disaster, they can go a long way to protecting the citizens of Morgan County.



GREENSBURG, KS

In 2007 a powerful tornado took 11 lives and destroyed 90% of the buildings in Greensburg. With a view to rebuilding to a higher standard of sustainability, the City of Greensburg worked with the community, the state, and the federal government on the preparation of a Sustainable Comprehensive Master Plan. They also adopted a modern, hazard-resistant building standard (ICC 600-2008) for residential and commercial structures. Greensburg has become a national leader in building resilient communities and a model that the state of Kansas could replicate.

CEDAR RAPIDS, IA

As part of its 2008 flood recovery, the City of Cedar Rapids worked closely with state officials to increase their resilience to inland flooding. They implemented a variety of measures, including re-assessing flood risks, buying high-risk properties to create a new greenway, building a new levee, and most importantly, adopting modern building codes. This comprehensive package of measures was put to the test in 2016 by the second-highest flooding on record. Cedar Rapids performed well, with much less damage than during the 2008 flood.

Figure 20. Example of Building Codes (FEMA)

4 Risk Assessment

The goal of mitigation is to reduce the future impacts of a hazard including loss of life, property damage, disruption to local and regional economies, and the expenditure of public and private funds for recovery. Sound mitigation practices must be based on sound risk assessment. A risk assessment involves quantifying the potential loss resulting from a disaster by assessing the vulnerability of buildings, infrastructure, and people. A risk assessment consists of three components: hazard identification, vulnerability analysis, and risk analysis.

4.1 Hazard Identification/Records

4.1.1 Existing Plans

Identifying and prioritizing the hazards the community is exposed to are the first steps before conducting a risk assessment. The previous Morgan County MHMP identified the major hazards to which Morgan County is exposed. The following sections present historical data regarding hazard incidents and resultant costs in Morgan County.

4.1.2 Historical Hazards

Historical storm event data was compiled from the NCEI. NCEI records are estimates of damage reported to the National Weather Service (NWS) from various local, state, and federal sources. It should be noted that these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to given weather events.

The NCEI data included 457 reported events in Morgan County between 1965 and December 31, 2020. The counts of these events by category are represented in Figure 21.

NCEI reports 33 events since the adoption of the Morgan County 2017 plan. These recent events and their counts are reported in Figure 22.

A table listing all events and their injury, death, and property loss statistics are included in Appendix C.

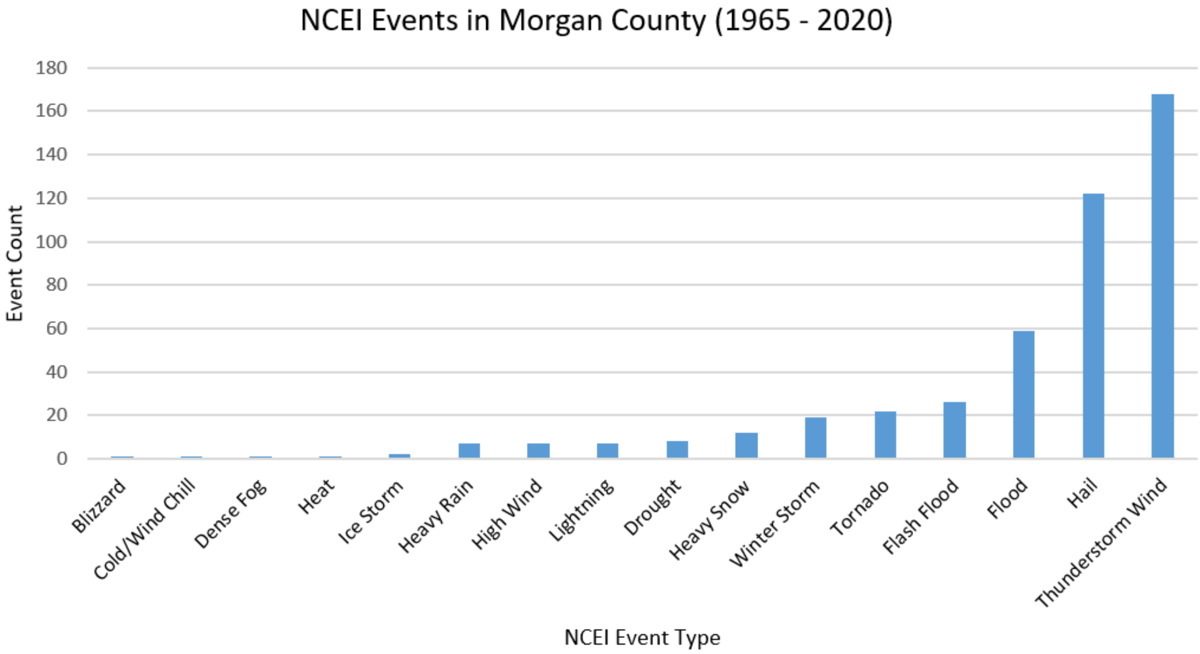


Figure 21. Count of NCEI Events in Morgan County (1965-2020)

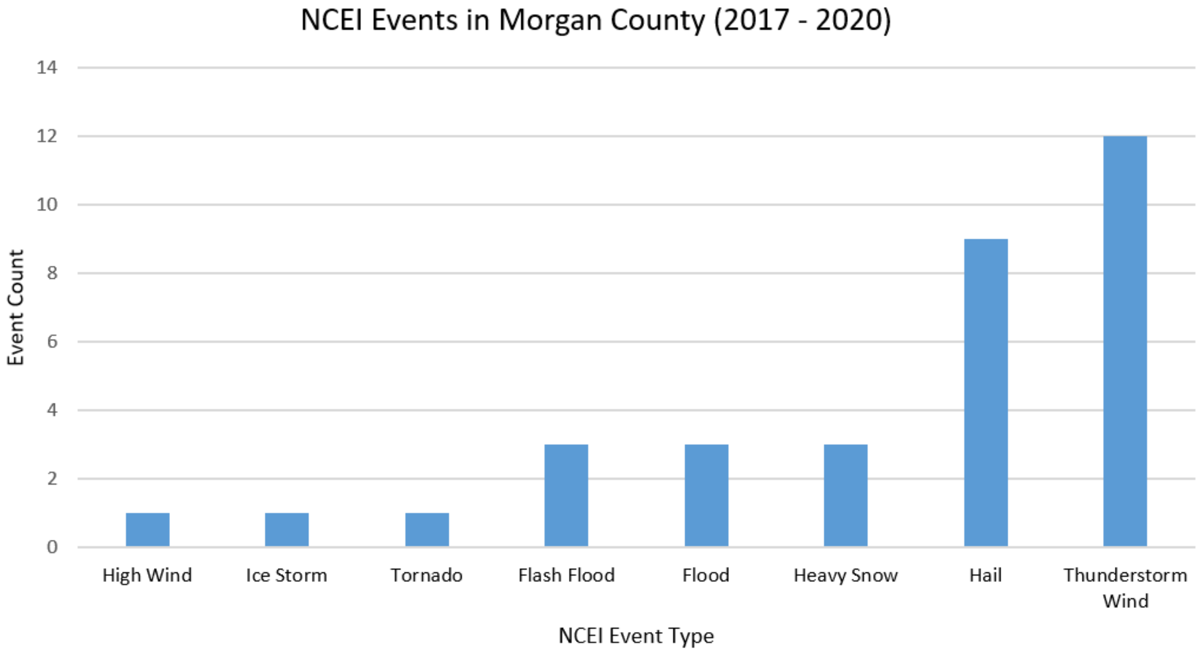


Figure 22. NCEI Events in Morgan County since Previous MHMP (2017-2020)

4.1.3 FEMA Declared Disasters

Since 2000, FEMA has declared 20 disasters for the state of Indiana. Figure 23 shows the number of disaster declarations by county. Table 7 shows the details of the major disaster declarations, including FEMA hazard mitigation funding and total assistance, for Morgan County. Morgan County has received federal aid for 8 declared disasters.

Table 7. FEMA-Declared Disasters and Emergencies for Morgan County (2000-2021)

Disaster Number	Date of Incident	Date of Declaration	Disaster Description	Type of Assistance
DR-1433	2002-09-20	2002-09-25	Severe storms and tornadoes	IA, PA, HMGP
DR-1476	2003-07-04 to 2003-08-06	2003-07-11	Severe storms, tornadoes, and flooding	IH, IA, HMGP
DR-1487	2003-08-26 to 2003-09-15	2003-09-05	Severe storms, tornadoes, and flooding	IH, IA, HMGP
DR-1520	2004-05-25 to 2004-06-25	2004-06-03	Severe storms, tornadoes, and flooding	IH, IA, HMGP
DR-1573	2005-01-01 to 2005-02-11	2005-01-21	Severe winter storms and flooding	IH, IA, HMGP
DR-1766	2008-05-30 to 2008-06-27	2008-06-08	Severe storms, tornadoes, and flooding	IH, IA, PA, HMGP
DR-4173	2014-01-05 to 2014-01-09	2014-04-22	Severe winter storm and snowstorm	PA, HMGP
DR-4515	2020-01-20 to Present	2020-04-03	COVID-19 Pandemic	IH, PA

Table key:

- PA – Public Assistance Program
- IA – Individual Assistance Program
- IH – Individual and Household Assistance Program
- HMGP – Hazard Mitigation Grant Program

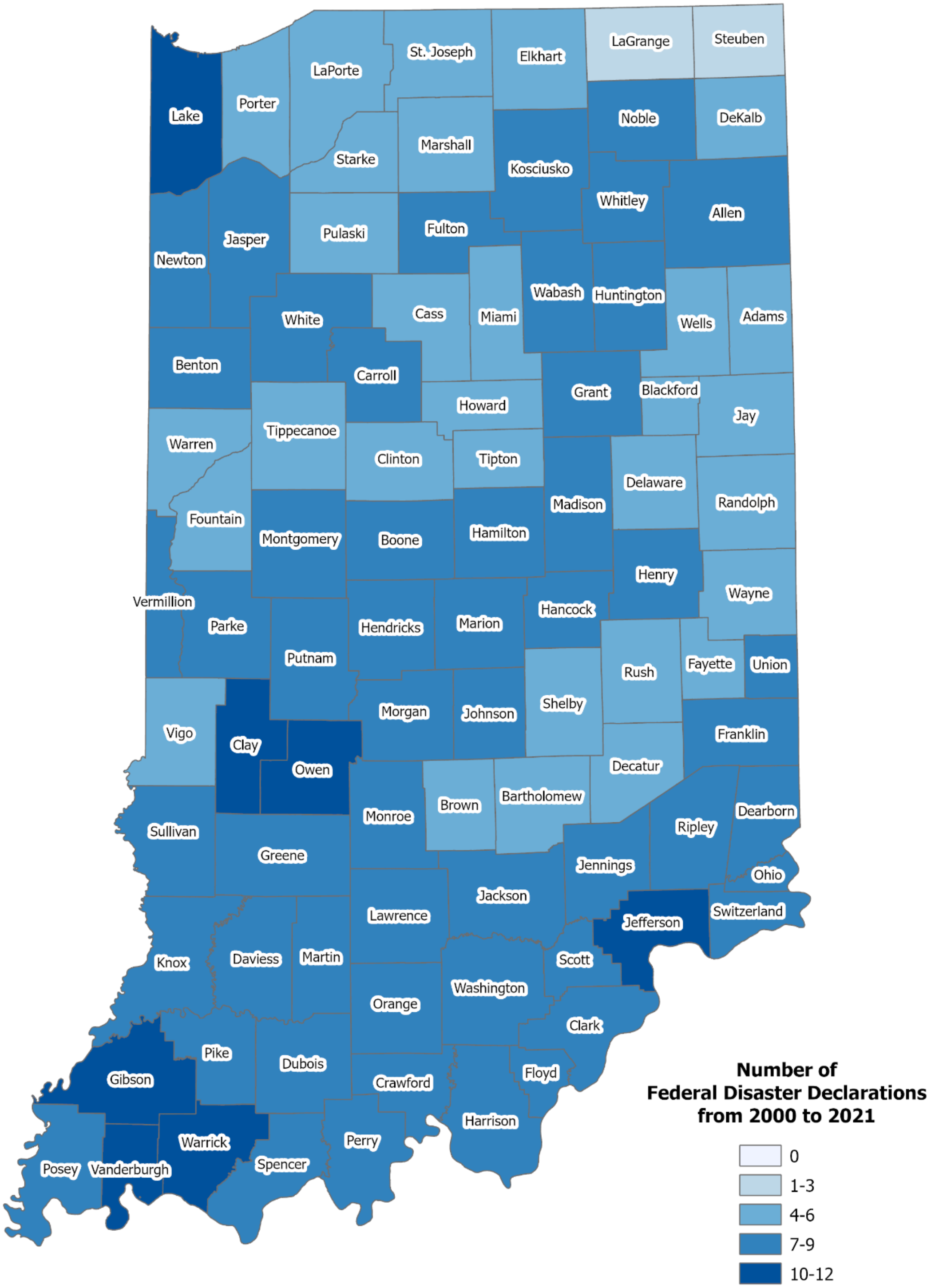


Figure 23. Disaster Declarations for Indiana

Figure 24 provides a breakdown of the public assistance to Morgan County.

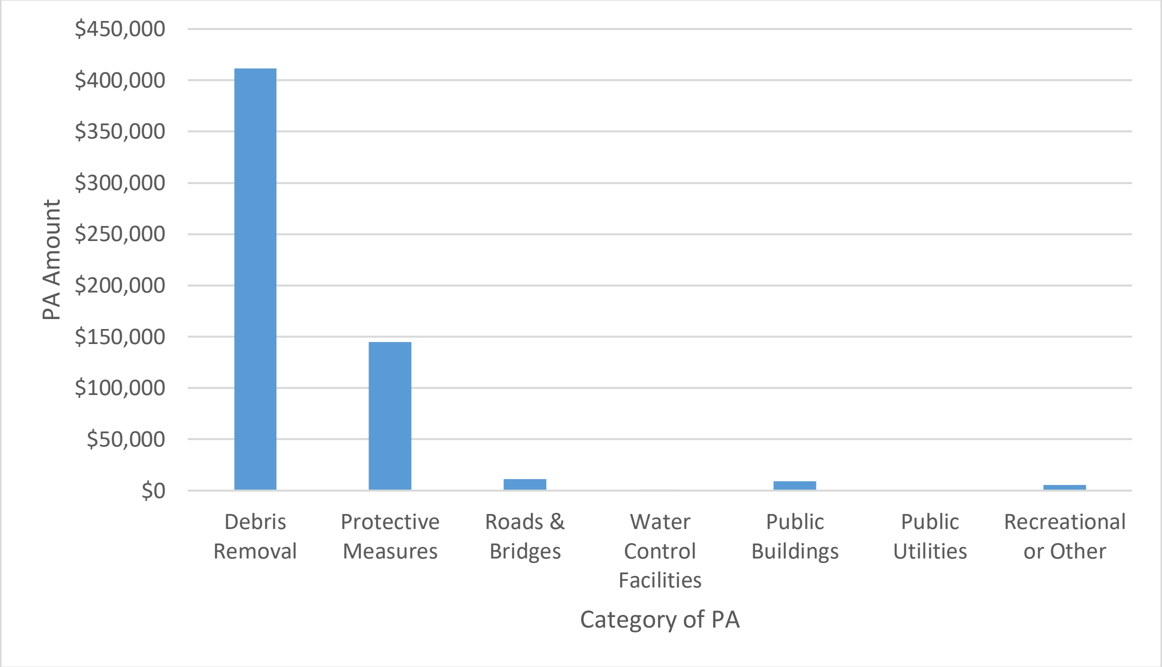


Figure 24. Indiana Disaster Public Assistance for Morgan County (2008-2018)

The type of payments following a disaster help with ranking the severity of disasters and a guide to developing mitigation activities and projects. Indiana highway departments have claimed significant damages from flooding and fluvial erosion, and rural electrical cooperatives have historically been vulnerable to ice storms and high winds.

4.1.4 Other Disaster Relief

In addition to potential state funding, homeowners and businesses can be eligible for low-interest and long-term loans through the U.S. Small Business Administration (SBA). SBA was created in 1953 as an independent agency of the federal government to aid, counsel, assist, and protect the interests of small business concerns. The program also provides low-interest, long-term disaster loans to businesses of all sizes, private nonprofit organizations, homeowners, and renters following a declared disaster. The loans can also provide resources for homeowner associations, planned unit developments, co-ops, condominiums, and other common-interest developments. SBA disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets.

Through the disaster loan program, SBA provides loan data, including FEMA and SBA disaster numbers, type (business or home), year, and various reporting amounts on the verified and approved amount of real estate and contents. Table 8 outlines the SBA data for the county.

Table 8. SBA Declaration Data for Morgan County

Year	FEMA Declaration	SBA Disaster Number	Community	Total Number Zip Codes Declared	Type	Total Verified Loss	Total Approved Loan Amount
2004	1520DR	IN-L0162	Monrovia	1	Home	$118,932	$96,800
2005	1573	IN-00001	Paragon	1	Home	$117,835	$92,800
2008	1766	IN-00019	Gosport, Martinsville, Monrovia, Mooresville, Morgantown, Paragon	6	Home	$19,372,770	$11,056,600
2008	1766	IN-00019	Martinsville, Morgantown, Paragon	3	Business	$6,023,538	$3,243,400
2015		IN-00055	Martinsville, Mooresville	2	Home	$517,124	$303,200
2015		IN-00055	Martinsville, Mooresville	2	Business	$63,225	$59,700
2019		IN-00065	Martinsville	1	Business	-	$0

4.1.5 Hazard Ranking

The Calculated Priority Rating Index (CPRI) is a process that evaluates the probability, consequence, warning time, and duration of a hazard to develop a hazard priority rank. The committee drew on the natural probability and impact ranked in the county's previous MHMP, the most recent CPRI assessment, community input from the hazard risk and probability survey in which communities were provided NCEI data summaries and the previous CPRI scores, and discussion from meeting two when developing a consensus on the hazard priority for the county for the purposes of this plan.

The following formula and table provide information on the weighted factors considered when determining a CPRI score for each hazard.

CPRI Risk Factor Score = [(Probability*.45) + (Consequence*.30) + (Warning Time*.15) + (Duration*.10)]

Table 9. Summary of Calculated Priority Risk Index (CPRI) Categories and Risk Levels

CPRI Category	DEGREE OF RISK			Assigned Weighting Factor
	Level ID	**Description**	**Index Value**	
Probability	Unlikely	Extremely rare with no documented history of occurrences or events. Annual probability of less than 0.001	1	45%
	Possible	Rare occurrences with at least one documented or anecdotal historic event. Annual probability that is between 0.01 and 0.001.	2	
	Likely	Occasional occurrences with at least two or more documented historic events. Annual probability that is between 0.1 and 0.01.	3	
	Highly Likely	Frequent events with a well-documented history of occurrence. Annual probability that is greater than 0.1.	4	
Consequence	Negligible	Negligible property damages (less than 5% of critical and non-critical facilities and infrastructure). Injuries or illnesses are treatable with first aid and there are no deaths. Negligible quality of life lost. Shutdown of critical facilities for less than 24 hours.	1	30%
	Limited	Slight property damages (greater than 5% and less than 25% of critical and non-critical facilities and infrastructure). Injuries or illnesses do not result in permanent disability and there are no deaths. Moderate quality of life lost. Shut down of critical facilities for more than 1 day and less than 1 week.	2	
	Critical	Moderate property damages (greater than 25% and less than 50% of critical and non-critical facilities and infrastructure). Injuries or illnesses result in permanent disability and at least one death. Shut down of critical facilities for more than 1 week and less than 1 month.	3	
	Catastrophic	Severe property damages (greater than 50% of critical and non-critical facilities and infrastructure). Injuries or illnesses result in permanent disability and multiple deaths. Shut down of critical facilities for more than 1 month.	4	
Warning Time	Less than 6 hours		4	15%
	6 to 12 hours		3	
	12 to 24 hours		2	
	More than 24 hours		1	
Duration	Less than 6 hours		1	10%
	Less than 24 hours		2	
	Less than one week		3	
	More than one week		4	

- **Probability** – a guide to predict how often a random event will occur. Annual probabilities are expressed between 0.001 or less (low) up to 1 (high). An annual probability of 1 predicts that a natural hazard will occur at least once per year.
- **Consequence/Impact** – indicates the impact to a community through potential fatalities, injuries, property losses, and/or losses of services. The vulnerability

assessment gives information that is helpful in making this determination for each community.

- **Warning Time** – plays a factor in the ability to prepare for a potential disaster and to warn the public. The assumption is that more warning time allows for more emergency preparations and public information.
- **Duration** – relates to the span of time local, state, and/or federal assistance will be necessary to prepare, respond, and recover from a potential disaster event.

Table 10 displays the county's CPRI results for each hazard and their resultant rank.

Table 10. Calculated Priority Risk Index for Morgan County

Natural Hazards	Probability	Consequence	Warning Time	Duration	Risk Factor
Tornadoes	4 - Highly Likely	4 - Catastrophic	4 - <6 hours	4 - >1 week	4
Harmful Organisms	4 - Highly Likely	4 - Catastrophic	3 - 6-12 hours	4 - >1 week	3.85
Hazmat Incident	4 - Highly Likely	3 - Critical	4 - <6 hours	4 - >1 week	3.7
Summer Storms	4 - Highly Likely	3 - Critical	3 - 6-12 hours	2 - <24 hours	3.35
Flash Flooding	3 - Likely	3 - Critical	4 - <6 hours	3 - <1 week	3.15
Flooding	3 - Likely	3 - Critical	4 - <6 hours	3 - <1 week	3.15
Wildfire	3 - Likely	3 - Critical	4 - <6 hours	2 - <24 hours	3.05
Winter Storm	3 - Likely	3 - Critical	2 - 12-24 hours	3 - <1 week	2.85
Dam Failure	2 - Possible	3 - Critical	4 - <6 hours	2 - <24 hours	2.6
Levee Failure	2 - Possible	3 - Critical	4 - <6 hours	2 - <24 hours	2.6
Earthquake	2 - Possible	2 - Limited	4 - <6 hours	4 - >1 week	2.5
Extreme Temperatures	3 - Likely	2 - Limited	1 - >24 hours	4 - >1 week	2.5
Ground Failure	2 - Possible	2 - Limited	4 - <6 hours	4 - >1 week	2.5
Drought	2 - Possible	2 - Limited	1 - >24 hours	4 - >1 week	2.05

The ranking methodology in the previous Morgan County plan differs from the current methodology. The previous plan marked Tornado, Flood, Flash Flood, and Severe Thunderstorms as severe hazard risks. The only noticeable change in the current hazard rank is in the elevation of rank for Harmful Organisms and Hazmat Incidents, and the lowered rank for Summer Storms and Flooding.

4.1.6 Hazard Risk Assessment by Jurisdiction

The risk assessments identify the characteristics and potential consequences of a disaster, how much of the community could be affected by a disaster, and the impact on community assets. While some hazards are widespread and will impact communities similarly (e.g., winter storms), others are localized, leaving certain communities at greater risk than others (e.g., flash flooding, exposure to a particular high-risk dam). The following table illustrates each community's risk to flooding/flash flooding, dam/levee failure, hazardous materials incidents, and ground failure and are highlighted within the risk assessment.

Table 11. Localized Hazards for Incorporated Jurisdictions

	Flooding	Flash Flooding	Dam Failure	Levee Failure	Hazardous Incident	Ground Failure
Morgan County	Likely	Highly Likely	Possible	Possible	Highly Likely	Possible
Martinsville	Likely	Likely	Possible	Possible	Highly Likely	Possible
Bethany	Likely	Likely	Unlikely	Unlikely	Possible	Unlikely
Brooklyn	Likely	Likely	Unlikely	Unlikely	Likely	Unlikely
Monrovia	Possible	Likely	Possible	Unlikely	Highly Likely	Unlikely
Mooresville	Likely	Likely	Unlikely	Possible	Highly Likely	Possible
Morgantown	Possible	Likely	Unlikely	Unlikely	Likely	Unlikely
Paragon	Likely	Likely	Unlikely	Unlikely	Likely	Unlikely
Eminence Community SC	Possible	Likely	Unlikely	Unlikely	Likely	Unlikely
Martinsville Schools	Highly Likely	Highly Likely	Likely	Likely	Likely	Possible
Monroe-Gregg SC	Likely	Likely	Possible	Possible	Highly Likely	Possible
Mooresville Consolidated SC	Highly Likely	Likely	Possible	Possible	Likely	Possible
Soil & Water Conservation District	Highly Likely	Highly Likely	Likely	Likely	Highly Likely	Likely

In addition to participation from each incorporated jurisdiction within Morgan County, four school corporations and the Soil and Water Conservation District participated in the plan update process. Their facilities are spread across all of Morgan County and as such, representatives from each school corporation ranked their overall vulnerability to hazards on a county basis. An elementary school fell within the 100-year flood, which is mapped in section 4.3.1 of this plan. Any hypothetical hazard boundaries created for the risk analysis are mapped in sections 4.3.2 through 4.3.11. As part of the comprehensive risk analysis, essential and critical facilities are examined and mapped if they fall within the hypothetical boundary. Any school facilities for the various school corporations would have been mapped under the hazard if applicable. In general, the school facilities face the same vulnerability to hazards as Morgan County.

4.2 Vulnerability Assessment

4.2.1 Asset Inventory

The vulnerability assessment builds upon the previously developed hazard information by identifying the community assets and development trends. Determining the hazard rank is pertinent to determining the area of vulnerability. The county infrastructure and facilities inventories are a critical part of understanding the vulnerability at risk of exposure to a hazard event.

The assets presented in the analysis results are broken into two main groupings, Facilities Inventory and Building Inventory. The facilities inventory is reviewed and updated by the county before the analysis begins. The building inventory is created by the analysis team using assessor data combined with either parcel centroids or building footprints depending on what was provided by the county. The creation and update process for these two asset groups are described below.

4.2.1.1 Facilities Inventory

Of the approximately 15 facility categories, five are essential: schools, police and fire stations, medical facilities and emergency operation center(s). The remaining facilities are referred to as critical and include a variety of facility types that are critical to the everyday operations of the county. The local planning team updates these critical facilities using the previous plan GIS data as the starting point. The facilities and their counts for the county are listed in Table 12. At the beginning of the planning process these facilities were reviewed by the planning team and updates were provided as needed to the analysis team. These updated facilities are provided to the county as well as being maintained in a statewide database by The Polis Center.

Table 12. Localized Hazards for Incorporated Jurisdictions

Facility Type	Number of Facilities
Care Facilities	27
Emergency Operations Centers	1
Fire Stations	17
Police Stations	6
Schools	28

4.2.1.2 Building Inventory

In 2018, Microsoft released 125 million building footprints for the United States that were generated from imagery using machine learning (https://github.com/Microsoft/USBuildingFootprints) and in 2021, Microsoft released an updated nationwide dataset. This data is licensed through the Open Data Commons Open Database License. The Polis Center extracted the building footprints for the state of Indiana and created point centroids of each building. Each building centroid was then joined spatially to the state's land parcels provided by the Indiana Geographic Information Office in March 2021. This process provided the parcel identifier for each building and was then linked to the statewide Real Property Tax Assessment Data provided by the Indiana Department of Local Government Finance (IDLGF) from late 2020. Indiana counties annually submit an extract of property appraisal data to the IDLGF that contains detailed building information such as square footage, construction type, year built, foundation type, and building replacement cost. The IDLGF data allows Polis to identify the occupancy class of each building based on the parcel within which it is located. Approximately 1% of the buildings were not located in a parcel and were not included. Table 13 provides the summary of building counts & replacement costs joined to the IDLGF data for White County summarized by occupancy type. NOTE: The assessor records often do not include nontaxable parcels and associated building improvements; therefore, the total number of buildings and the building replacement costs for government, religious/non-profit, and education may be underestimated.

Table 13. Building Counts and Estimated Replacement Costs for Morgan County

Occupancy Code	Count	Replacement Cost
Residential	25,306	$4,989,591,846
Commercial	1,001	$2,061,524,261
Industrial	185	$606,757,732
Agriculture	2,504	$640,360,874
Religious	245	$814,310,777
Government	152	$158,077,689
Education	46	$288,173,479
Total	**29,439**	**$9,558,796,661**

4.2.2 Hazus-MH

Potential impacts from flooding and earthquake hazards were quantified using FEMA's Hazus-MH Risk Assessment tool (https://www.fema.gov/hazus) and other forms of Geographic Information Systems (GIS) analysis that leveraged this data.

It is important to note that Hazus-MH is not a substitute for detailed engineering studies. Rather, it serves as a planning aid for communities interested in assessing their risk to flood, earthquake, and hurricane-related hazards. This documentation does not provide full details on the processes and procedures completed in the development of this project.

4.2.3 Past and Future Development

Recent or proposed development, especially in Special Flood Hazard Areas (SFHAs), must be carefully evaluated to ensure that no adverse impacts occur as a result. Development, whether it is a 100-lot subdivision or a single lot big box commercial outlet, can result in large amounts of fill and other material being deposited in flood storage areas or other vulnerable locations.

As the county's population shifts and develops, the residential and urban areas may extend further into the county, placing more pressure on existing transportation and utility infrastructure while increasing the rate of farmland conversion. Morgan County addresses specific mitigation strategies in Chapter 5 to alleviate such issues.

Because Morgan County is vulnerable to a variety of natural and technological threats, the county government, in partnership with the state government, is committed to preparing for the management of these type of events for better emergency management and county response.

According to the Indiana Department of Local Government Finance, 4,118 of Morgan County's parcels have experience some sort of construction since 2015. Of those, 316 or 7.7% are located within the special flood hazard areas (see section 4.3.1). While this construction might have increased the vulnerability of the county to those hazards, they are only a small portion of the recent years' development. Other analyses revealed that 136 or 3.3% are in the tornado path area (see section 4.3.4), and 474 or 11.5% in the toxic plume area (see section 4.3.8).

4.3 Hazard Profiles

The following hazard profiles outline the hazard risk exposure for the county. The hazard is first described and then reviewed in the historical context of the county. In many cases, an analysis subsequently follows the hazard context that analyzes the facility and building inventory risk.

4.3.1 Flash Flood and Riverine Flood

4.3.1.1 Hazard Definition for Flooding

Flooding is a significant natural hazard throughout the US. The type, magnitude, and severity of flooding are functions of the amount and distribution of precipitation over a given area, the rate at which precipitation infiltrates the ground, the geometry of the catchment, and flow dynamics and conditions in and along the river channel. Floods in Morgan County can be classified as one of two types: flash floods or riverine floods, which are both common in Indiana.

Flash floods generally occur in the upper parts of drainage basins and are generally characterized by periods of intense rainfall over a short duration. These floods arise with very little warning and often result in locally intense damage and, sometimes, loss of life due to the high energy of the flowing water. Flood waters can snap trees, topple buildings, and easily move large boulders or other structures. Six inches of rushing water can upend a person, while another 18 inches might carry off a car. Generally, flash floods cause damage over relatively localized areas, but they can be quite severe in the areas in which they occur. Urban flooding is a type of flash flood. Urban flooding involves the overflow of storm drain systems and can be the result of inadequate drainage combined with heavy rainfall or rapid snowmelt. Flash floods can occur at any time of the year in Indiana, but they are most common in the spring and summer months.

Riverine floods refer to floods on large rivers at locations with large upstream catchments. Riverine floods are typically associated with precipitation events that are of relatively long duration and occur over large areas. Flooding on small tributary streams may be limited, but the contribution of increased runoff may result in a large flood downstream. The lag time between precipitation and time of the flood peak is much longer for riverine floods than for flash floods, generally providing ample warning for people to move to safe locations and, to some extent, secure property against damage. Riverine flooding on the large rivers of Indiana generally occurs during either the spring or summer.

4.3.1.2 Stream Gauges

The USGS, in cooperation with many state agencies and local utility and surveyor offices, help maintain stream gages, which provide the capability to obtain estimates of the amount of water flowing in streams and rivers. IDNR and IDEM use the stream gage data for water quantity and quality measurements. Local public safety officials use the data at these sites, along with the resources from the NWS, to determine emergency management needs during periods of heavy rainfall. The location of stream gages in the county are shown in Figure 25.

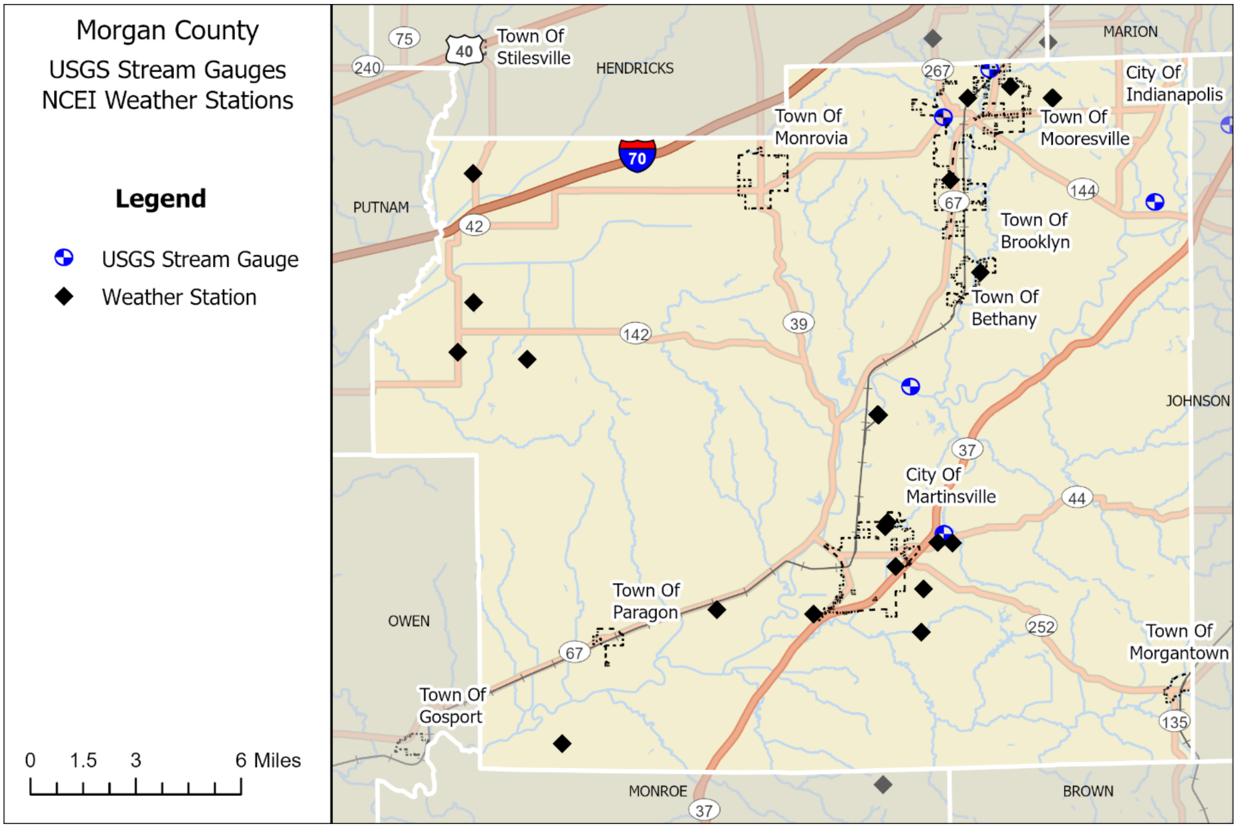


Figure 25. USGS Stream Gages and NCEI Weather Stations

4.3.1.3 Flood History in Morgan County

Morgan County has experienced a total of 59 flooding events since 1996. From 2009 through 2020 there have been 6 reported incidents of flash flooding and 13 reports of flooding. A flash flood event on December 21, 2013, led to several homes in Martinsville being inundated, and at least 17 having to be evacuated. A flash flood event on July 12, 2015, led to several water rescues and home evacuations in Mooresville, and caused $80,000 in damages. A combination of areal and flash flooding occurred on April 3, 2018, leading to several closed roads and an evacuation of the Royal Motel near the Martinsville Airport. A flash flood event impacted much of the county- especially the northern portion- on June 19, 2021, leading to several water rescues and inundated homes and caused $100,000 in damages. Additional details for NCEI events are included in Appendix C.

The Morgan County Planning team answered a mitigation strategy worksheet to help identify problem areas in the county for each hazard type. The team stated that many flooding problems in the county were due to the terrain issues and the White River floodplain. These survey answers can be found in Appendix F.

4.3.1.4 Geographic Location for Flooding

Most river flooding occurs in early spring and is the result of excessive rainfall and/or the combination of rainfall and snowmelt. Severe thunderstorms may cause flooding during the summer or fall but tend to be localized. According to the Morgan County Flood Insurance Study (FIS), major flooding in the county primarily occurs along the White Lick Creek valley, and West Fork White River valley.

Flash floods, brief heavy flows in small streams or normally dry creek beds, also occur within the county. Flash flooding is typically characterized by high-velocity water, often carrying large amounts of debris. Urban flooding involves the overflow of storm drain systems and is typically the result of inadequate drainage following heavy rainfall or rapid snowmelt.

4.3.1.5 Hazard Extent for Flooding

The Special Flood Hazard Areas (SFHA) are defined as the areas that will be inundated by the flood event having a 1% chance of being equaled or exceeded in any given year. The 1% annual chance flood is also referred to as the base flood or 100-year flood. The SFHAs in Morgan County are identified in Figure 26.

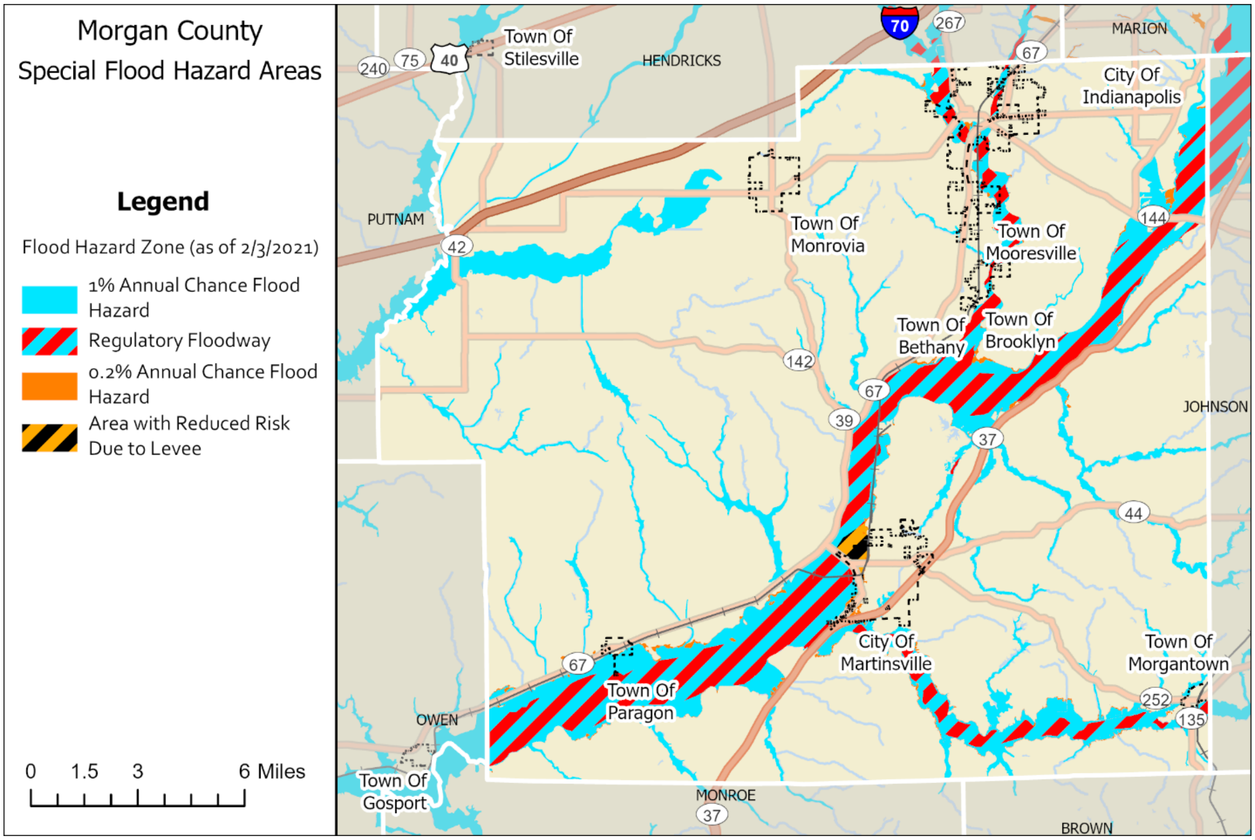


Figure 26. Special Flood Hazard Areas (SFHA) in Morgan County

NFIP Analysis

If a structure is in a high-risk area, the 1% annual chance flood hazard, and the owner has a mortgage, they are required to purchase flood insurance through a federally regulated or insured lender. Flood insurance is not federally required in moderate- to low-risk areas, but it is still a good idea. The National Flood Insurance Program (NFIP) is a program in which, if a community enforces a floodplain management ordinance, the federal government will make flood insurance available to protect against flood loss.

Since the NFIP plays such a vital role in mitigating flood risk, understanding the status of hazard maps and reported losses occurring can provide insight on new strategies to mitigate the impacts and losses of future events. The communities in Morgan County that participate in the NFIP, their NFIP number, current effective map date, and program entry date are provided in Table 14.

Table 14. NFIP Participation and Mapping Dates

NFIP Community	NFIP Number	Effective Map Date	Join Date
Morgan County	180176	10/2/2014	6/1/1981
Brooklyn	180402	10/2/2014	9/17/1980

NFIP Community	NFIP Number	Effective Map Date	Join Date
Martinsville	180177	10/2/2014	12/4/1979
Mooresville	180334	10/2/2014	9/5/1979
Morgantown	180178	10/2/2014	5/25/1978
Paragon	180338	10/2/2014	12/10/1978
Communities without SFHA			
Bethany	-	-	-
Monrovia	-	-	-

FEMA provides annual funding through the National Flood Insurance Fund (NFIF) to reduce the risk of flood damage to existing buildings and infrastructure. This grant is the Flood Mitigation Assistance (FMA). The long-term goal is to significantly reduce or eliminate claims under the NFIP through mitigation activities.

FEMA defines a repetitive loss structure as a structure covered by a contract of flood insurance issued under the National Flood Insurance Program (NFIP), which has suffered flood loss damage on two occasions during a 10-year period that ends on the date of the second loss, in which the cost to repair the flood damage is 25% of the market value of the structure at the time of each flood loss.

The Indiana State NFIP Coordinator and FEMA Region V were contacted to determine the location of repetitive loss structures. FEMA Region V reported 4 repetitive structures in Martinsville, 5 in Mooresville, and 15 in unincorporated areas of Morgan County. Table 15 documents the Morgan County repetitive losses as of 7/7/2022.

Table 15. Repetitive Losses for Morgan County

	Morgan County	Martinsville	Mooresville
Repetitive Loss Properties	15	4	5
Total Losses	37	10	20
Total Building Payments	$774,638	$289,253	$267,758
Total Contents Payments	$167,137	$27,749	$185,925
Single Family	14	4	1
Two-Four Family	0	0	0
Non-Residential Business	1	0	2
Other Residential	0	0	0
Other Non-Residential	0	0	2

To help understand flood risk, the total structures in the SFHA are compared to the total number of policies in the community. This is based on approximate building locations, and therefore should not be used as an absolute comparison. However, this information may be used to target further mitigation through further engagement with the NFIP. In addition, this may be a tool to help understand if there would be an interest in becoming involved in a discount program with the Community Rating System (CRS). Table 16 provides a comparison of number of buildings in the 1% flood probability boundary to the number of policies as of 6/30/2022, and then provides a percent of insured structures represented by those policies. The last column in the table provides an estimate of the exposure that is insured.

Table 16. Comparison of Estimated Building Exposure to Insured Buildings

Community	Buildings in 100 Year Floodplain[1]	Exposure of Buildings in Floodplain	Number of Policies	Value of Insurance Claims/Pmts	Approximate % Buildings Insured	Approximate % Exposure Insured
Morgan County	319	$106,356,001	87	$22,798,600	27%	21%
Martinsville	152	$111,279,698	92	$27,063,900	61%	24%
Bethany	-	-	-	-	-	-
Brooklyn	10	$11,041,453	5	$1,980,000	50%	18%
Monrovia	-	-	-	-	-	-
Mooresville	34	$69,309,897	17	$6,901,200	50%	10%
Morgantown	2	$353,181	1	$29,000	50%	8%
Paragon	-	-	2	$525,000	-	-
Unknown	-	-	3	$799,000	-	-

4.3.1.6 Risk Identification for Flood Hazard

In Meeting #2, the planning team determined that the probability of flooding and flash flooding is likely with critical consequences. Flooding and flash flooding both have a warning time of less than 6 hours. Flooding and flash flooding's duration was determined to be less than 1 week. The calculated CPRI for flooding is 3.15, while the CPRI for flash flooding is 3.05.

4.3.1.7 Vulnerability Analysis for Flash Flooding

Flash flooding could affect any location within this jurisdiction; therefore, the entire county's population and buildings are vulnerable to a flash flood. These structures can expect the same impacts as discussed in a riverine flood. However, of the 16 reported flash flooding events since 2008 in Morgan County, half were reported in the City of Martinsville.

4.3.1.8 Hazus-MH Analysis Using 100 Year (1% chance) Flood Boundary

Hazus-MH was used to estimate the damages incurred for a 1% annual chance flood event in Morgan County using the SFHA and a 10-meter DEM (digital elevation model) to create a flood depth grid. Hazus-MH was then used to perform a user-defined facility (UDF) analysis of Morgan County. The UDFs were defined by intersecting the Hazus-MH generated flood depth grid with the Morgan County building inventory. These data were then analyzed to determine

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[1] The count and exposure of buildings in the floodplain reported in this table is based on an account of all structures in the floodplain that were represented in the county property assessment data.

the depth of water at the location of each building point and then related to depth damage curves to determine the building losses for each structure.

Hazus-MH estimates the SFHAs would damage 517 buildings county-wide at a cost of over $77 million. In the modeled scenario, the unincorporated areas of Morgan County contained the most damaged buildings with 319 buildings damaged at a cost of almost $48 million. The total estimated numbers and cost of damaged buildings by community are given in Table 17 and Table 18. Figure 27 depicts the Morgan County buildings that fall within the SFHA. Figure 28 through Figure 31 display community maps of buildings that fall within the SFHA.

Table 17. Estimated Number of Buildings Damaged by Community and Occupancy Class

	Morgan County	Martinsville	Brooklyn	Mooresville	Morgantown
Agricultural	77	-	-	-	-
Commercial	16	25	-	18	-
Educational	1	1	1	-	-
Government	14	-	-	1	1
Industrial	18	-	-	5	-
Religious	4	1	-	-	-
Residential	189	125	9	10	1
Total	**319**	**152**	**10**	**34**	**2**

Table 18. Estimated Cost of Buildings Damaged by Community and Occupancy Class

	Morgan County	Martinsville	Brooklyn	Mooresville	Morgantown
Agricultural	$9,096,577.55	-	-	-	-
Commercial	$11,350,676.69	$4,940,715.54	-	$11,744,714.73	-
Educational	$145,568.16	$210,265.12	$0	-	-
Government	$934,092.45	-	-	$159,487.41	$124,899.78
Industrial	$8,140,866.51	-	-	$1,458,946.32	-
Religious	$374,769.05	$309,616.35	-	-	-
Residential	$17,772,176.46	$9,322,211.84	$524,594.49	$1,139,171.26	$85,344.62
Total	**$47,814,726.86**	**$14,782,808.85**	**$524,594.49**	**$14,502,319.72**	**$210,244.40**

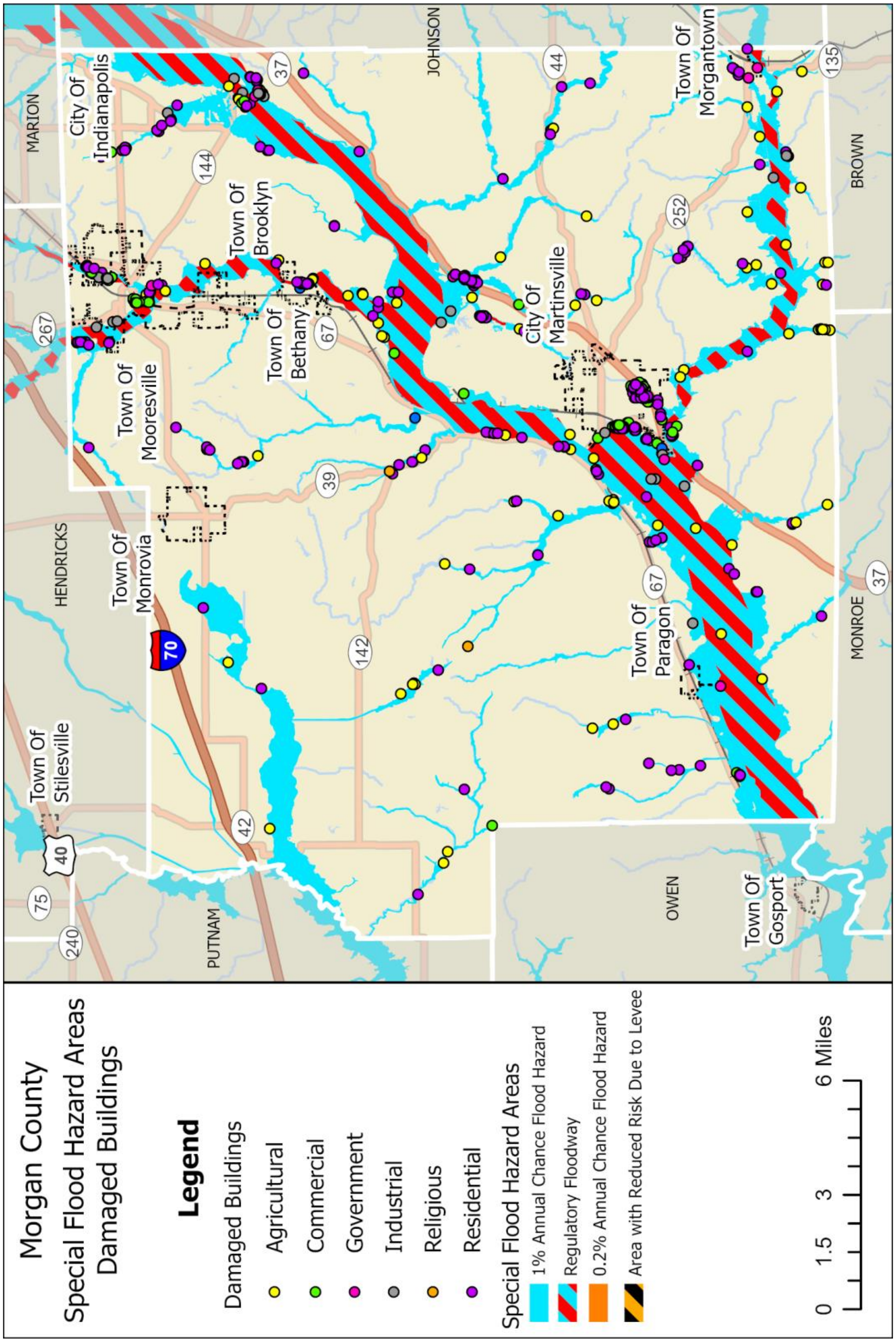


Figure 27. Estimated Buildings Damaged in SFHA (Morgan County)

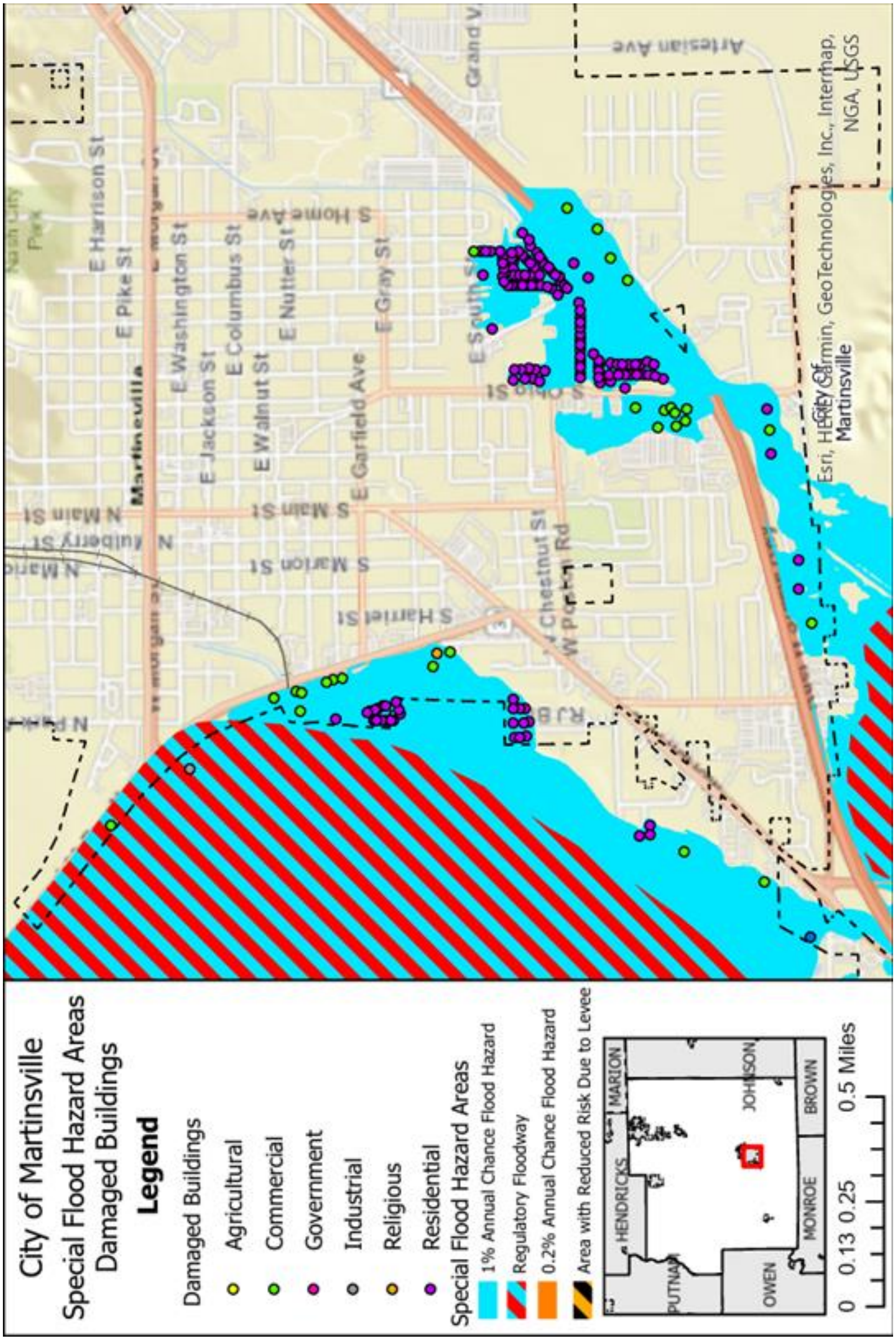


Figure 28. Estimated Buildings Damaged in SFHA (City of Martinsville)

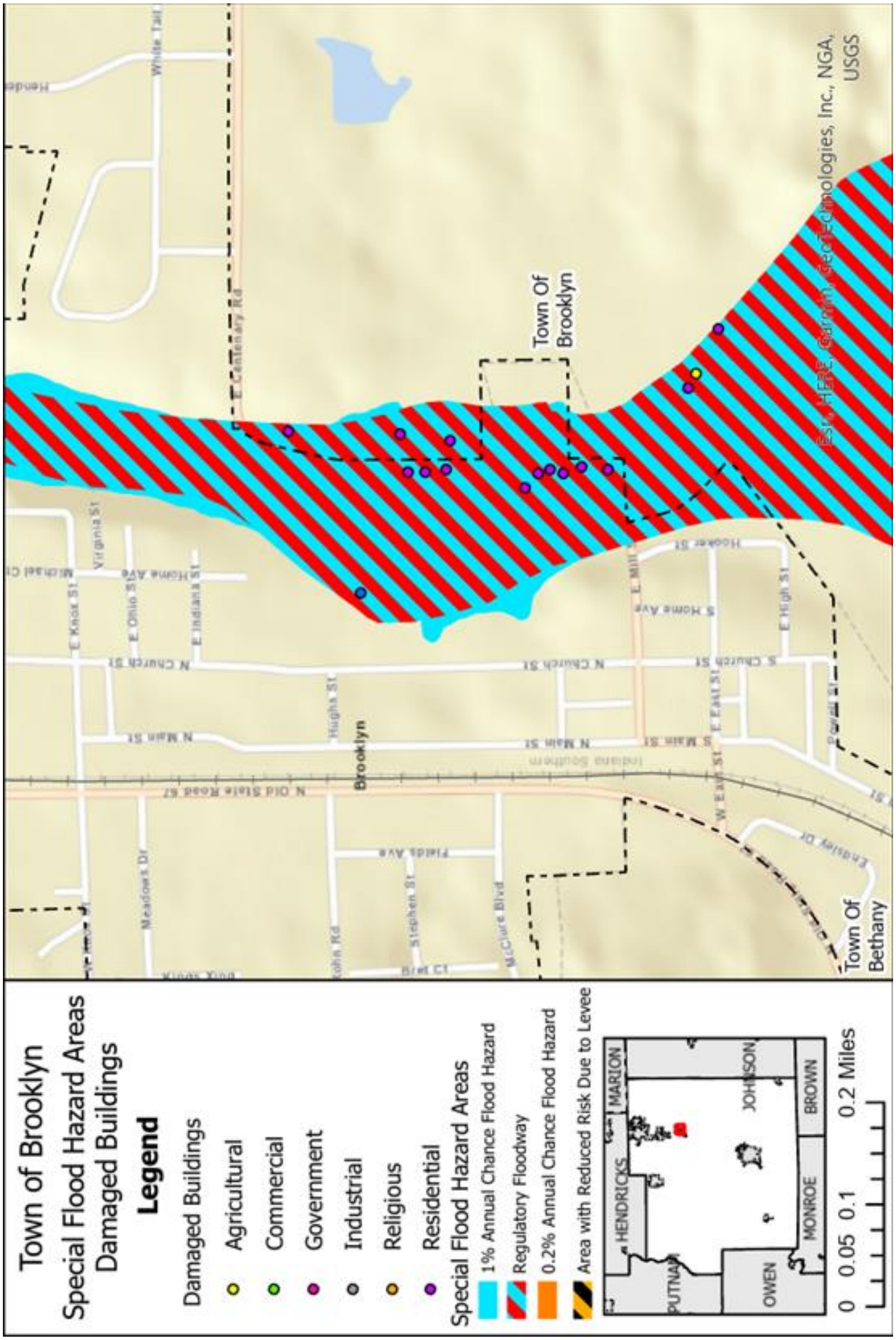


Figure 29. Estimated Buildings Damaged in SFHA (Town of Brooklyn)

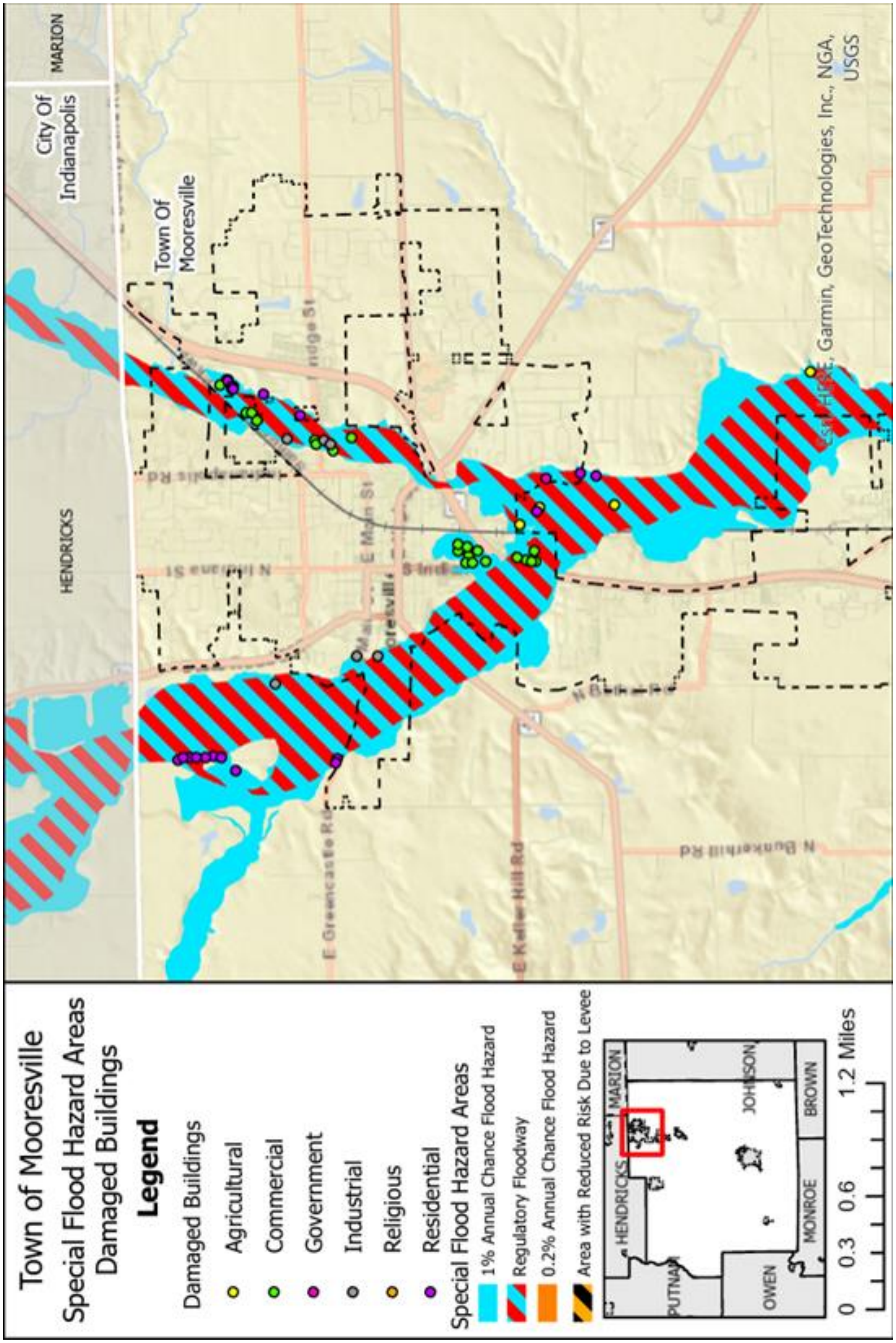


Figure 30. Estimated Buildings Damaged in SFHA (Town of Mooresville)

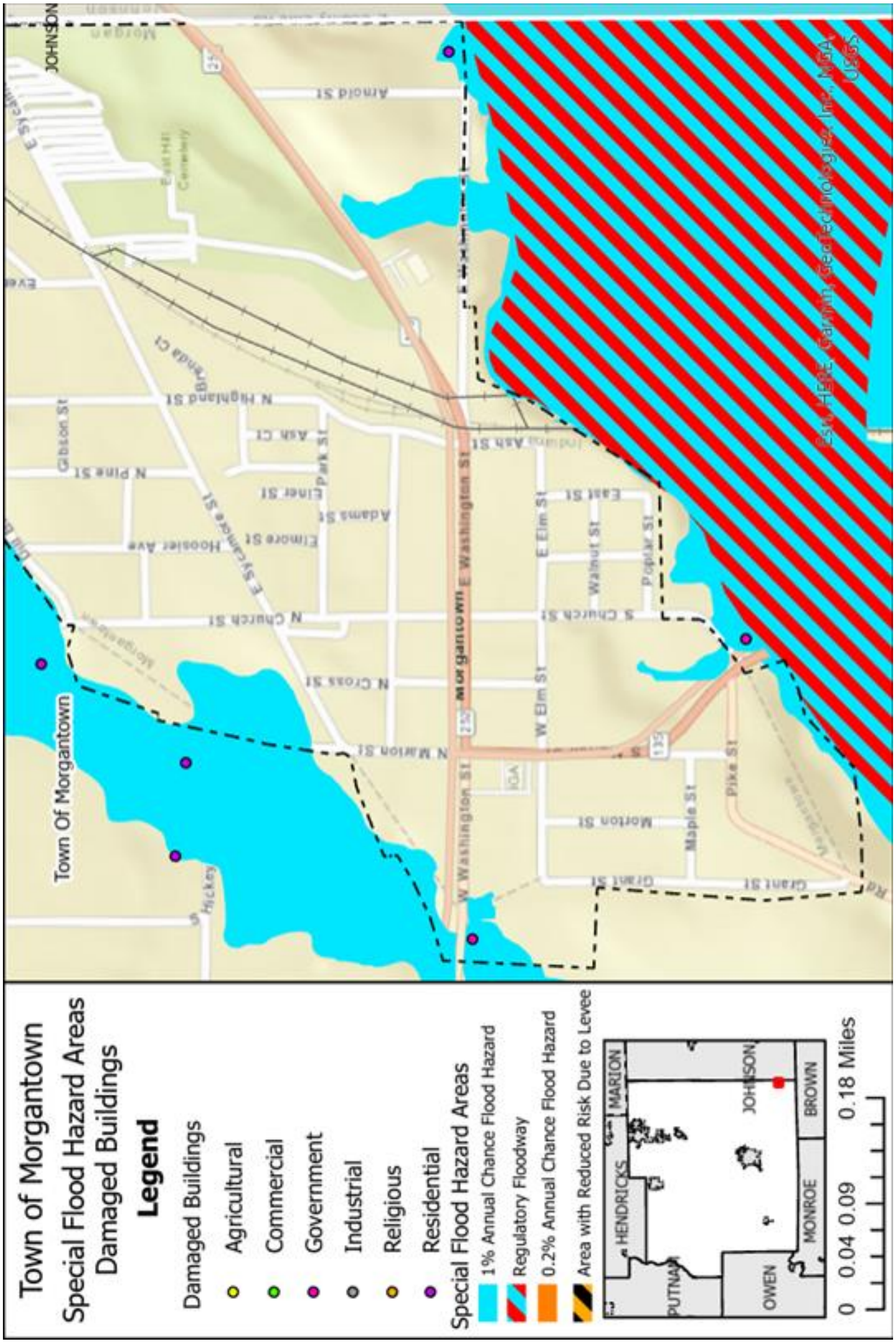


Figure 31. Estimated Buildings Damaged in SFHA (Town of Morgantown)

Overlay Analysis of Essential Facilities

Essential and other critical facilities can become damaged during the 1% annual chance flood. Damages to these types of facilities can severely impact the ability of the community to respond and recover from disasters. Damaged facilities located within towns or cities have been mapped in the following figures. In Morgan County, one school and three care facilities are located within the Special Flood Hazard Area.

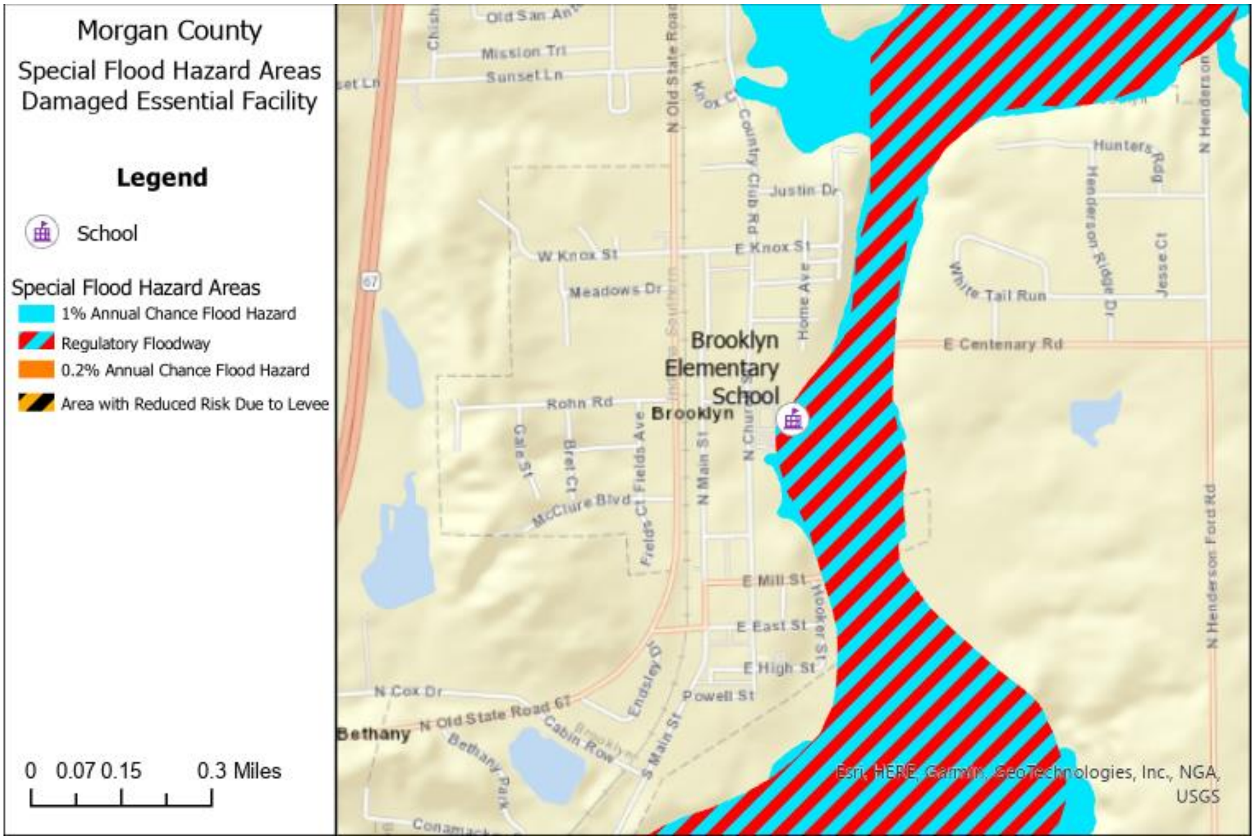


Figure 32. School in SFHA (Town of Brooklyn)

Figure 33. Care Facilities in SFHA (Town of Mooresville)

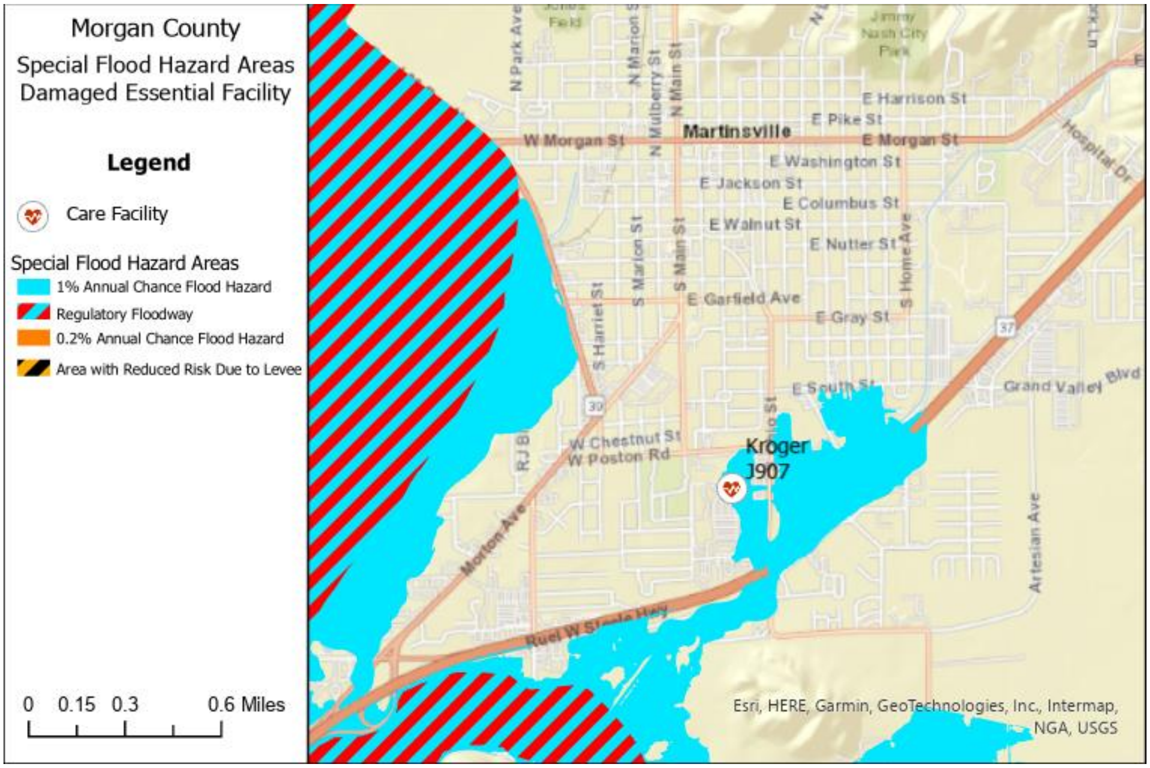


Figure 34. Care Facility in SFHA (City of Martinsville)

4.3.1.9 IDNR Best Available Data Layer

The IDNR's Division of Water created a dataset for Indiana that incorporates the detailed-level floodplain data in the FEMA FIRMs and enhanced it with a lower level, but still quality, floodplain data for most of all streams in the state known as the "best available" floodplain layer. FEMA's dataset remains the official dataset of the NFIP; the "best available" layer assists in floodplain management applications and determining limits of jurisdiction for the Indiana Flood Control Act. The map in Figure 35 was created using the best available data layer from IDNR along with the county's building inventory. To show the possible buildings affected in the best available layer, only the buildings within the flood boundary have been mapped. A comparison of the buildings located within the flood boundary for both the regulated SFHA and the DNR best available data are listed in Table 19.

Table 19. Estimated Number of Buildings Damaged by Community and Occupancy Class

	FEMA SFHA	DNR Best Available
Agricultural	80	80
Commercial	59	61
Educational	3	3
Government	16	16
Industrial	23	25
Religious	6	6
Residential	347	491
Total	**534**	**682**

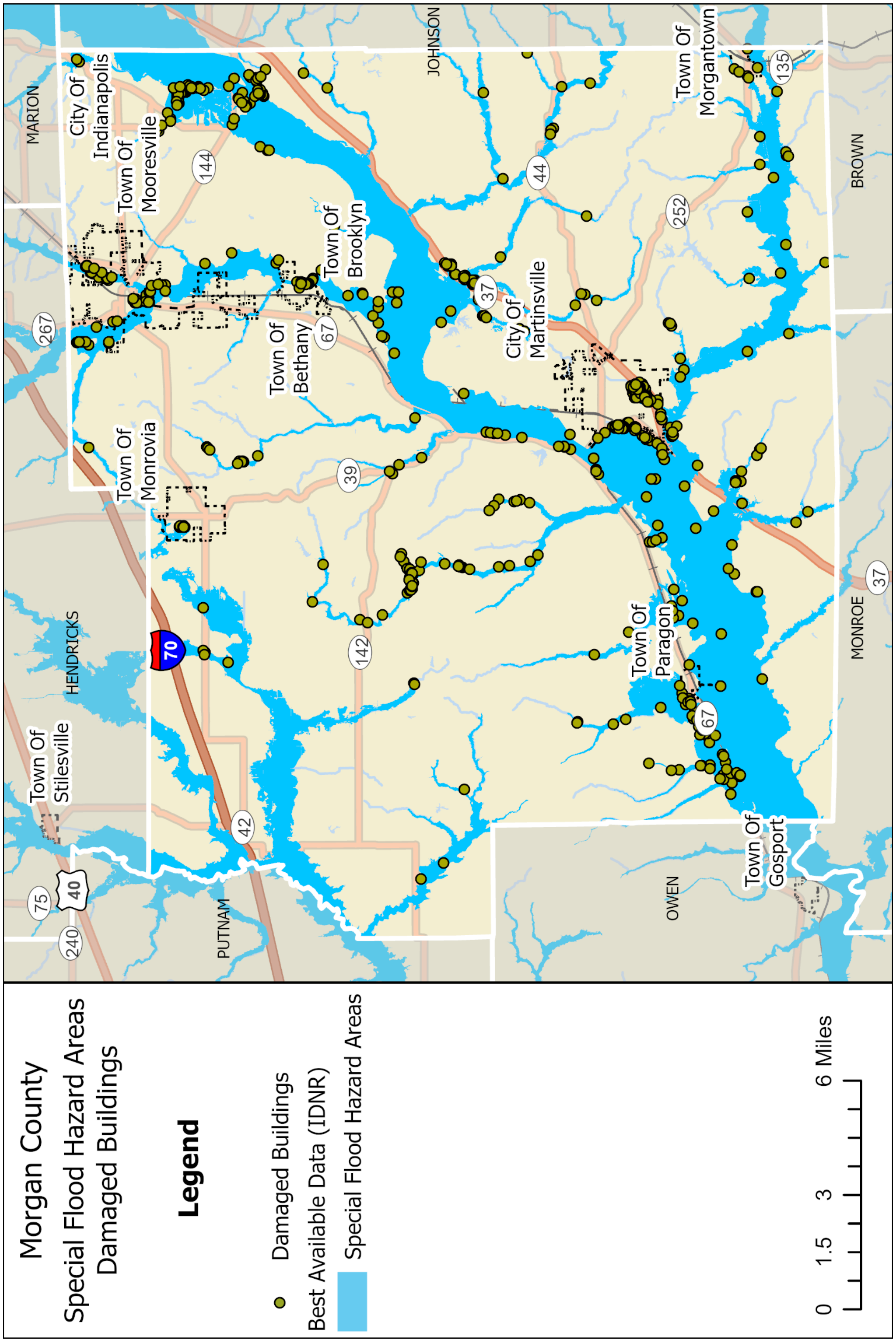


Figure 35. Estimated Buildings Damaged in IDNR Best Available Data

4.3.1.10 Community Development Trends and Future Vulnerability

Controlling floodplain development is the key to reducing flood-related damages. Areas with recent development within the county may be more vulnerable to drainage issues. Storm drains and sewer systems are usually most susceptible. Damage to these can cause the backup of water, sewage, and debris into homes and basements, causing structural and mechanical damage as well as creating public health hazards and unsanitary conditions.

Another key strategy in natural hazard mitigation is the conversion of frequently flooded land to wetlands. Wetlands promote human well-being in many ways including improvements to water purification, increased water supply, climate regulation, flood regulation, and opportunities for recreation and tourism. According to a report by the US EPA, a one-acre wetland can store approximately three-acre feet of water, which is equal to one million gallons. Furthermore, trees and other wetland vegetation slow the speed of flood waters, ultimately lowering flood heights and naturally mitigating potential flood-related destruction.

Flash flooding could affect any location within this jurisdiction; therefore, the entire county's population and buildings are vulnerable to a flash flood. These structures can expect the same impacts as discussed in a riverine flood.

4.3.1.11 Relationship to other Hazards

Severe storms and blizzards – Summer storms lead to logjams, and snowmelt can contribute to flooding and, under the right circumstances, flash flooding.

Dam Failure – Flood events can compromise the structural integrity of dams.

Public Health – Public health can be affected as a result of wastewater spills due to flooding or power failures.

Water Main Breaks – Surges in water pressure as a result of water pumps starting after power outages can lead to water main breaks.

4.3.2 Earthquake

4.3.2.1 Hazard Definition for Earthquake

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 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. Ninety-five percent of earthquakes occur at the plate boundaries; however, some earthquakes occur in the middle of plates, as is the case for seismic zones in the Midwestern US.

Ground shaking and tremors from strong earthquakes can collapse buildings and bridges; disrupt gas, electric, and communication (e.g., phone, cable, Internet) services; and sometimes trigger landslides, flash floods, and fires. Buildings with foundations resting on unconsolidated landfill and other unstable soil and trailers or homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths, injuries, and extensive property damage.

Magnitude, which is determined from measurements on seismographs, measures the energy released at the source of the earthquake. Intensity measures the strength of shaking produced by the earthquake at a certain location and is determined from effects on people, human structures, and the natural environment. Table 20 and

Table 21 list earthquake magnitudes and their corresponding intensities.

Table 20. Abbreviated Modified Mercalli Intensity Scale

Intensity	Description
I	Not felt except by a very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Table 21. Earthquake Magnitude vs. Modified Mercalli Intensity Scale

Earthquake Magnitude	Typical maximum Modified Mercalli Intensity
1.0 – 3.0	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 and higher	VIII or higher

4.3.2.2 Earthquake History in Morgan County

The most seismically active area in the Central US is referred to as the New Madrid Seismic Zone. Scientists have learned that the New Madrid fault system may not be the only fault system in the central US capable of producing damaging earthquakes. The Wabash Valley Fault System in Indiana shows evidence of large earthquakes in its geologic history, and there may be other currently unidentified faults that could produce strong earthquakes.

At least 47 earthquakes, M3.0 or greater, have occurred in Indiana since 1817. The last such event in Indiana was a M3.8 centered northeast of Montezuma on June 17, 2021. The most recent earthquakes with an epicenter in Morgan County occurred in the late 1890s and early 1900s. However, in 1990, an earthquake with a 3.58 magnitude had an epicenter just west of the Morgan County boundary. There were no reports of injuries or damages.

Most of the seismic activity in Indiana occurs in the southwestern region of the state. Earthquakes originate just across the boundary in Illinois and can be felt in Indiana.

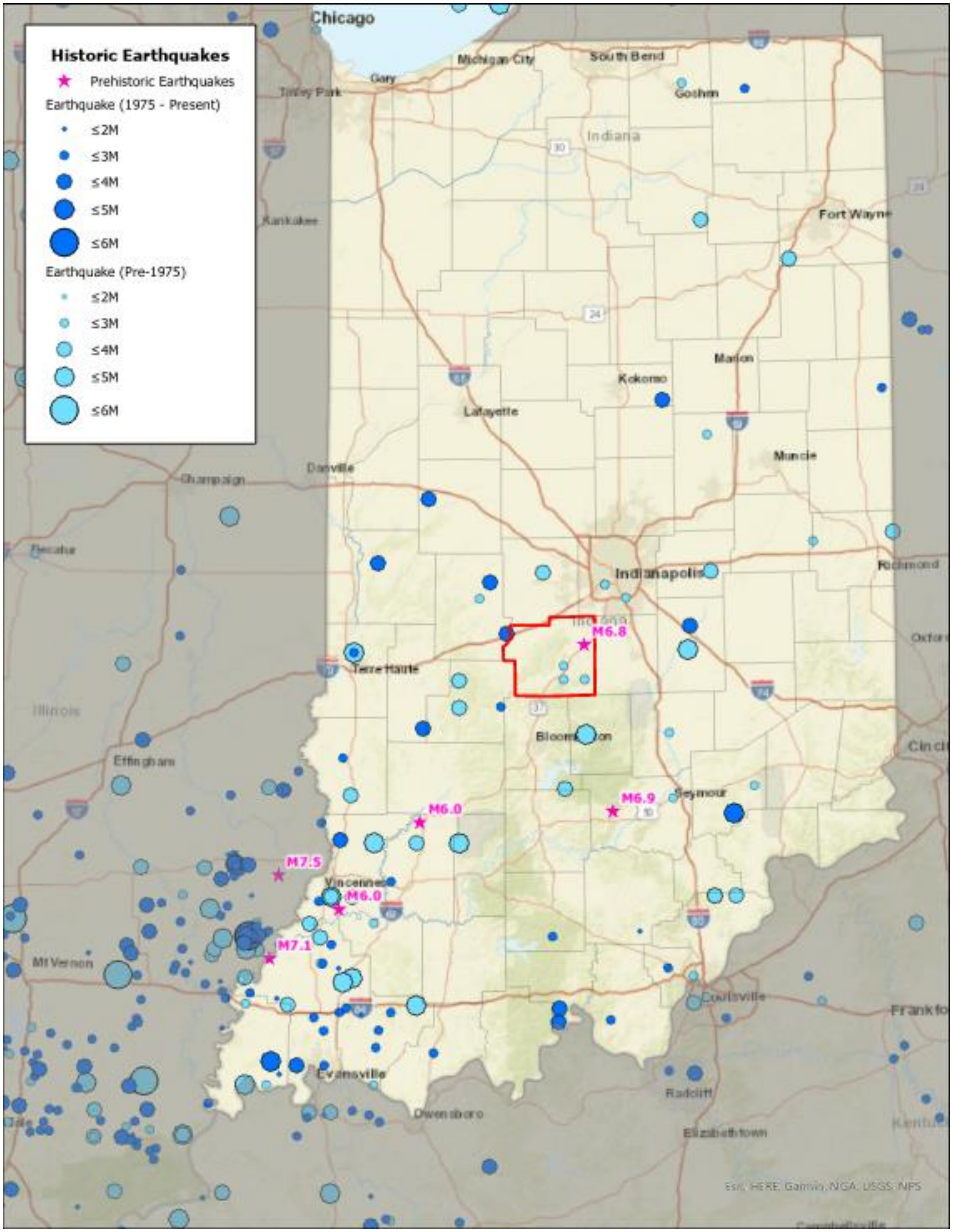


Figure 36. Indiana Earthquake Epicenters Map

4.3.2.3 Geographic Location for Earthquake

Morgan County occupies a region susceptible to two earthquake threats: the threat of an earthquake along the New Madrid or the Wabash Valley fault systems. Return periods for large earthquakes within the New Madrid System are estimated to be 500 years. Moderate quakes between magnitude 5.5 and 6.0 can recur within approximately 150 years or less. The Wabash Valley Fault System is a sleeper that threatens the southwest quadrant of the state and may generate an earthquake large enough to cause damage as far north and east as Central Michigan.

4.3.2.4 Hazard Extent for Earthquake

The extent of the earthquake is countywide. One of the most critical sources of information that is required for accurate assessment of earthquake risk is soils data. A National Earthquake Hazards Reduction Program (NEHRP) compliant soils map was used for the analysis which was provided by IGS. The map identifies the soils most susceptible to failure and ranks their liquefaction potential. Morgan County is primarily made up of soils ranking as moderate to high potential for liquefaction. Some areas in the southern and central portion of the county ranked low in probability.

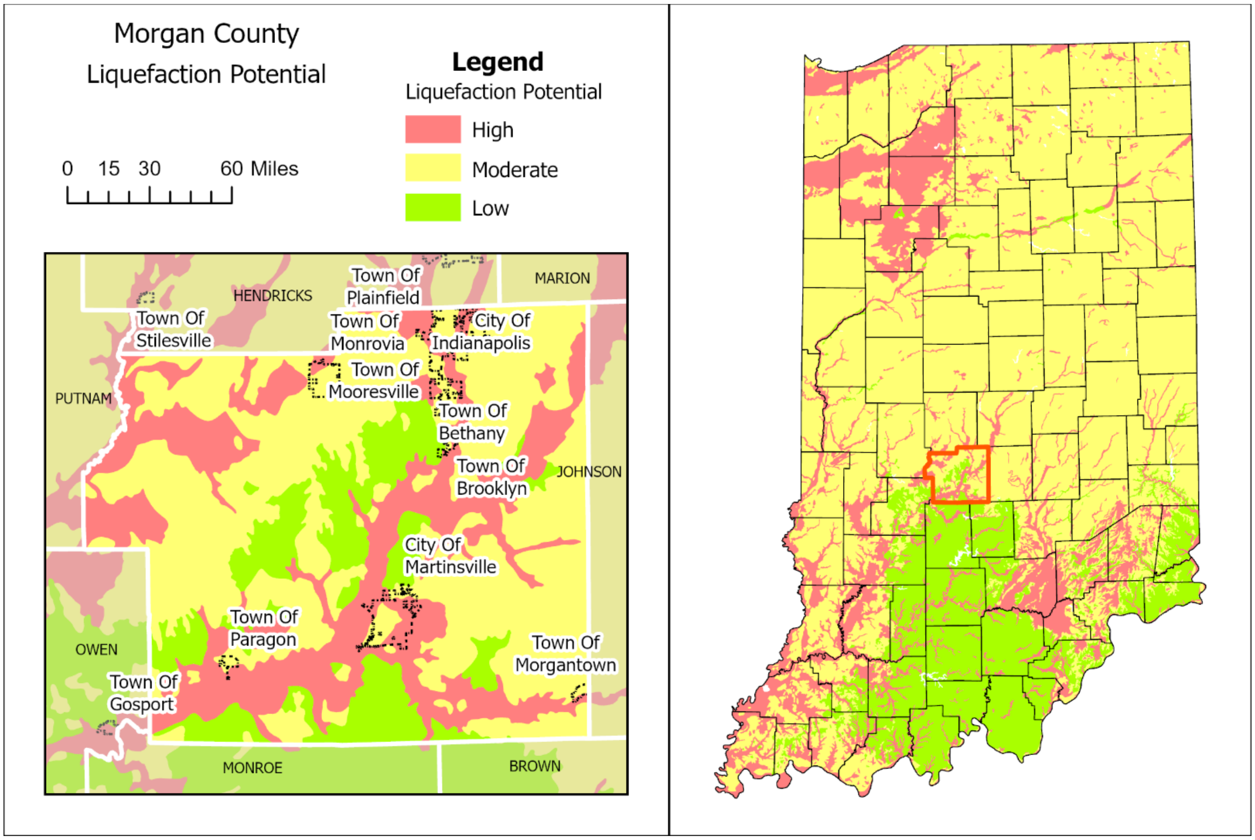


Figure 37. NEHRP State of Indiana Liquefaction Potential

4.3.2.5 Risk Identification for Earthquake

In Meeting #2, the planning team determined that the probability of an earthquake as possible with limited consequence. Earthquakes were determined to have a warning time of less than six hours with a duration more than 1 week. The calculated CPRI for earthquakes in Morgan County is 2.5.

4.3.2.6 Vulnerability Analysis for Earthquake

During an earthquake, the types of infrastructure that could be impacted include roadways, runways, utility lines and pipes, railroads, and bridges. Because an extensive inventory of the infrastructure is not available to this plan, it is important to emphasize that any number of these structures could become damaged in the event of an earthquake. The impacts to these structures include broken, failed, or impassable roadways and runways; broken or failed utility lines, such as loss of power or gas to a community; and railway failure from broken or impassable tracks. Bridges also could fail or become impassable, causing traffic risks, and ports could be damaged, which would limit the shipment of goods. Typical scenarios are described to gauge the anticipated impacts of earthquakes in the county in terms of numbers and types of buildings and infrastructure.

The Hazus-MH Earthquake Analysis model estimates damages and losses to buildings, lifelines, and essential facilities from deterministic and probabilistic scenarios.

The building damage total loss amount is developed by the building inventory attributes inputs. Depending on the material of construction, type of foundation, year of construction the expense in rebuilding the expense will be affected.

Three events were modeled. The first scenario is the New Madrid Scenario. This event represents a large-magnitude, high-impact regional event situated in the Mississippi Valley region approximately 100 miles from the southwestern corner of the state. The magnitude of this event (M7.6) approximates the size of the largest of the three earthquakes in the 1811-1812 New Madrid sequence. The second scenario is the Wabash Valley Scenario. This event represents a “worst case” scenario of a large-magnitude (M7.3) event occurring along the Wabash Valley fault system, just outside the state of Indiana in southeastern Illinois. The model uses a liquefaction data map to account for the local soil conditions for estimating ground motion and liquefaction. The third scenario is a 500-year probabilistic scenario, which seeks to represent the cumulative hazard facing each area of the state based on a probabilistic likelihood of ground shaking associated with all the sources that could potentially affect a given area. In principle, this analysis evaluates the average impacts of a multitude of possible earthquake sources with a magnitude that would be typical of that expected for a 500-year return.

Table 22, Building Damage Summary by Earthquake Event, displays damages for all three scenarios run by Hazus-MH. In addition to the dollar amount of building losses, the table displays the number of buildings damaged and to what extent. Figure 38 through Figure 40 display the Earthquake Scenarios total building losses for each scenario broken down by census tract.

Table 22. Building Damage Summary by Earthquake Event

Scenario	Building Loss in Dollars	Moderate	Extensive	Complete
New Madrid (M7.6)	$1,730,000	13	0	0
Wabash Valley (M7.3)	$25,580,000	114	7	0
Probabilistic (500-Year)	$9,160,000	42	2	0

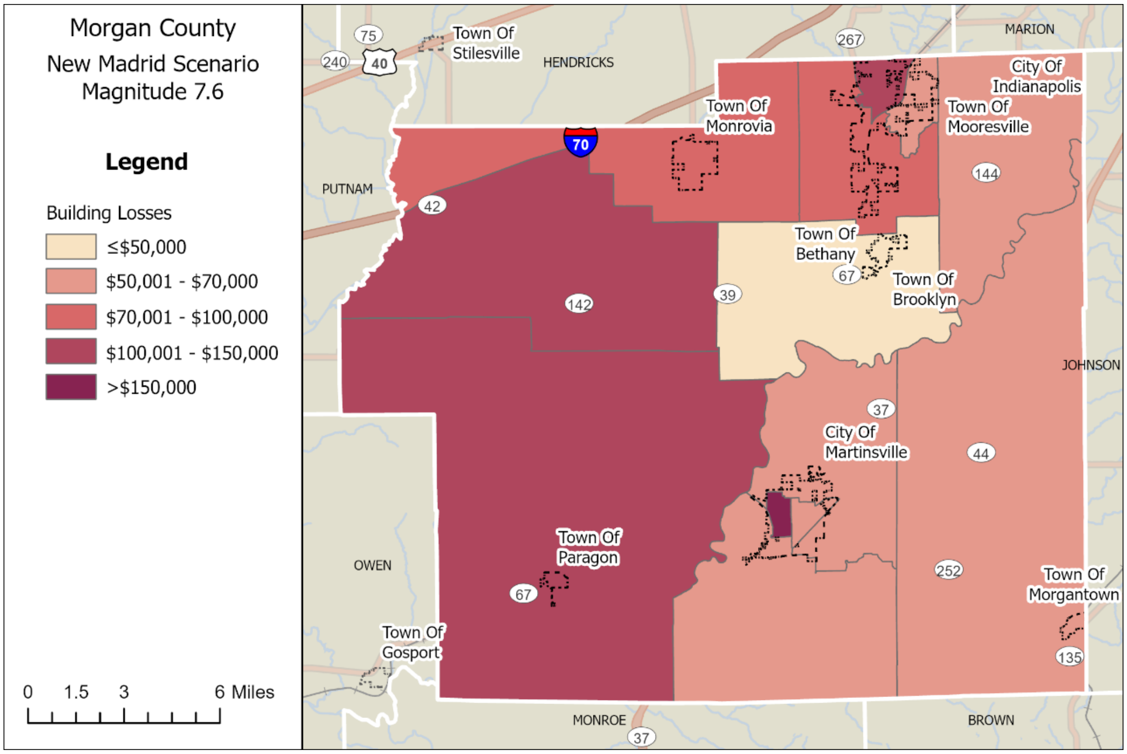


Figure 38. New Madrid Earthquake Scenario – Total Building Losses

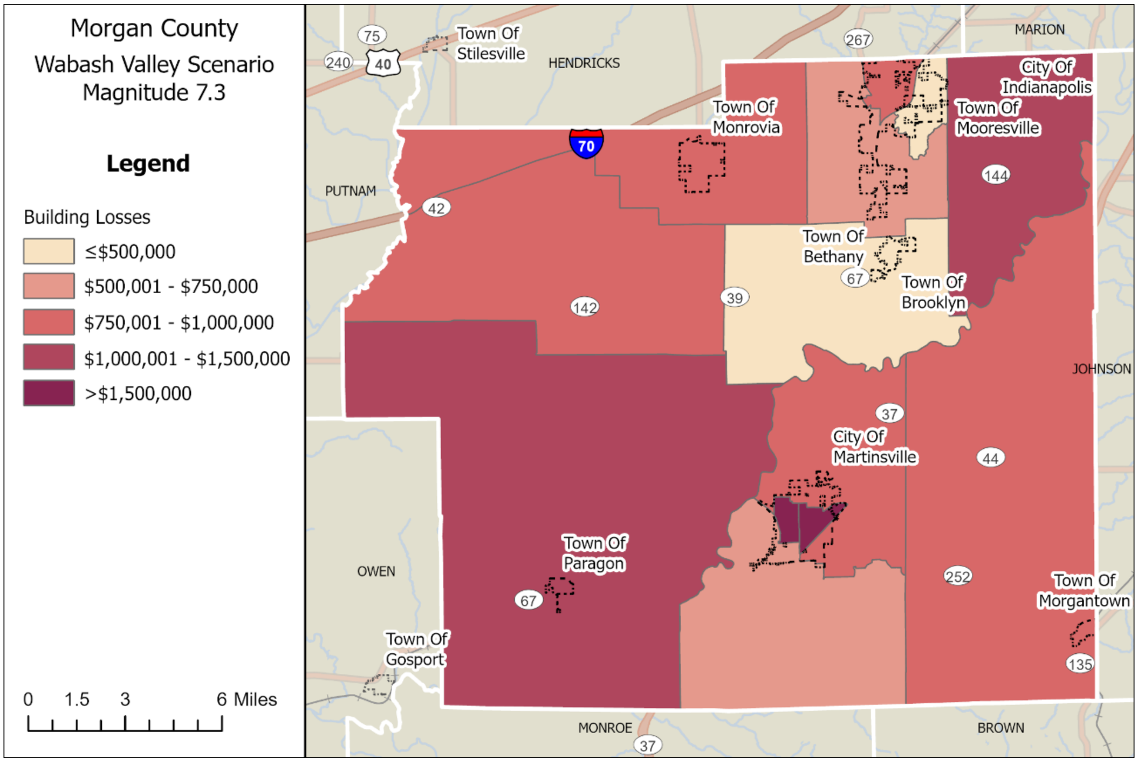


Figure 39. Wabash Valley Earthquake Scenario – Total Building Losses

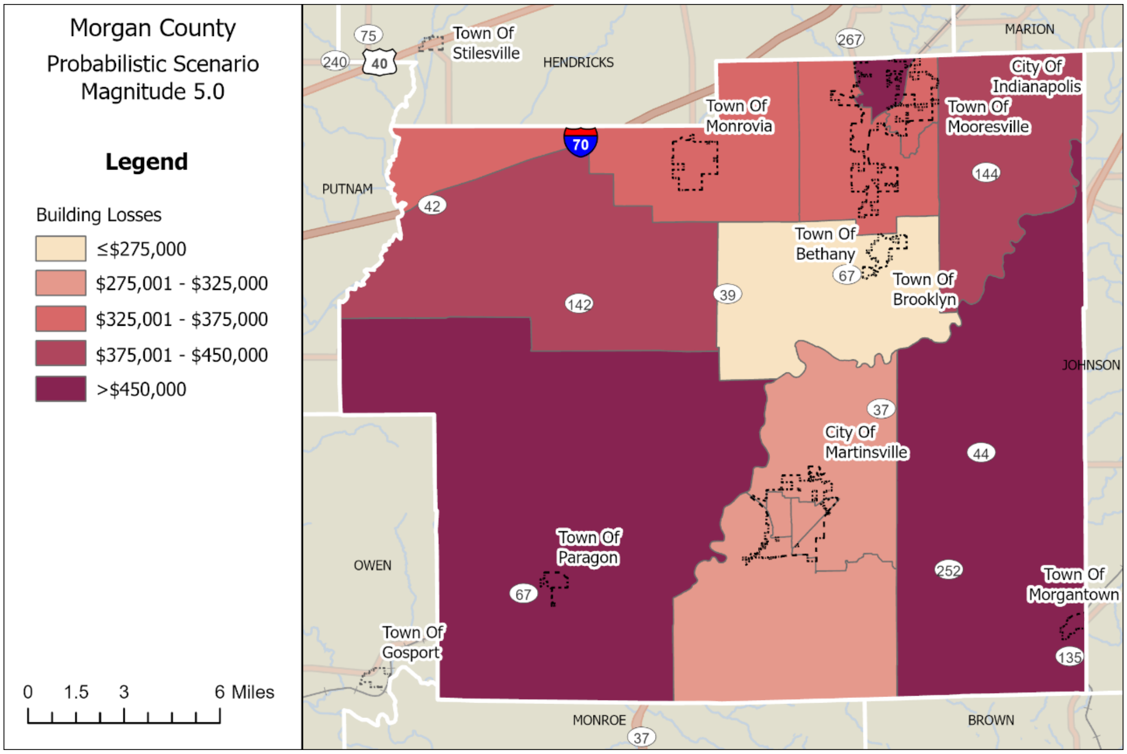


Figure 40. 500-Year Probabilistic Earthquake Scenario – Total Building Losses

Building losses account for only a portion of the total economic impact that could be realized from the modeled scenarios. Additional building related impacts could include lost wages, rental income, and other elements of business interruption; damages to building contents, social impacts.

4.3.2.7 Community Development Trends and Future Vulnerability

Community development will occur outside of the low-lying areas in floodplains with a water table within five feet of grade that is susceptible to liquefaction. New construction, especially critical facilities, will accommodate earthquake mitigation design standards.

The possibility of the occurrence of a catastrophic earthquake in the central and eastern United States is real as evidenced by history and described through this section. The impacts of significant earthquakes affect large area, terminating public services and systems needed to aid the suffering and displaced. These impaired systems are interrelated in the hardest struck zones. Power lines, water and sanitary lines, and public communications may be lost; highway, railways, rivers, and ports may not allow transportation to the affected region. Furthermore, essential facilities such as fire and police departments and hospitals, may be disrupted if not previously improved to resist earthquakes.

As with hurricanes, mass relocation may be necessary, but the residents who are suffering from the earthquake can neither leave the heavily impacted areas nor receive aid or even communication in the aftermath of a significant event.

4.3.2.8 Relationship to other Hazards

Ground Failure – According to the National Academies of Sciences Engineering Medicine, the major cause of earthquake damage is ground failure. Some ground failures induced by earthquake are the result of liquefaction of saturated sands and silts, the weakening of sensitive clays, or by the crumbling and breaking away of soil and rock on steep slopes. Ground failure has been known to cause buildings to collapse and to severely hinder communication and transportation systems.

Utility Failure – Earthquakes frequently damage utilities, particularly underground facilities, and older storage tanks, but nearly every utility can be vulnerable to the shaking that earthquake induce. Seismic damage to buried utilities are often influenced by ground conditions and subsurface strain distribution. Since utilities are typically part of a larger network system, damages to key locations in a network can potentially set off a chain reaction that affects significant portions of the utility system. Earthquake damage to utilities can also potentially create secondary hazards such as fires or hazmat situations since some utilities may handle volatile or flammable substances.

4.3.3 Ground Failure

4.3.3.1 Hazard Definition for Ground Failure

Indiana has three types of ground failure. Ground failure is a general reference to landslides, fluvial erosion, and subsidence to include karst sinkholes, and underground coal mine collapse.

Landslides

Landslides are a serious geologic hazard common to almost every state in the US. It is estimated that, nationally, they cause up to $2 billion in damages and from 25 to 50 deaths annually. Globally, landslides cause billions of dollars in damage and thousands of deaths and injuries each year.

The term landslide is a general designation for a variety of downslope movements of earth materials. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly. Gravity is the force driving landslide movement. The main causes of landslides include:

- Significant ground vibration
- Slope failure due to excessive downward movement, gravity
- Groundwater table changes (often due to heavy rains)

Preventive and remedial measures include modifying the landscape of a slope, controlling the groundwater, constructing tie backs, spreading rock nets, etc. The expansion of urban and recreational development into hillside areas has resulted in an increasing number of properties subject to damage because of landslides. Landslides commonly occur in connection with other major natural disasters such as earthquakes, wildfires, and floods.

Karst

Southern Indiana has a network of underground caves formed by the natural physical interaction of groundwater with its bedrock, forming what is known as karst landscape. According to the Indiana Geological & Water Survey, karst topography is a distinctive type of landscape largely shaped by the dissolving action of groundwater, which is naturally acidic, on carbonate bedrock, which in this area is mostly limestone. This geological process, which takes thousands of years, is characterized by unique features such as sinkholes, fissures, caves, disappearing streams, springs, rolling topography, and underground drainage systems. Structures built above a karst formation could potentially be subject to land subsidence and collapse into a resulting sinkhole.

Underground Coal Mines

According to the Indiana Geological Survey's GIS Atlas, there are areas of underground coal mines which could lead to ground failure. Roof failure has always been a major concern in underground coal mining. Most underground mines in southwest Indiana are older mines since abandoned and thus susceptible to collapse.

Fluvial Erosion

Streams naturally migrate (change course and move laterally) over time, this movement is called a Fluvial Erosion Hazard (FEH). The rate and intensity of movement is dependent upon many factors including drainage area, geology, and human actions. FEH represents a significant concern in areas where human development and infrastructure, are established near natural waterways. In mild cases, this may be seen as the gradual loss of a farm field or the undermining of a fence row when gradual channel migration consumes private land. In more severe cases, the FEH risk may threaten properties and/or structures to the degree that they become uninhabitable or even lost to natural channel processes.

4.3.3.2 Ground Failure History in Morgan County

The planning team did not identify any major ground failure events including landslide and land subsidence events.

4.3.3.3 Geographic Location for Ground Failure

The geographic location for ground failure varies depending on the type of ground failure. Karst areas for Morgan County are mapped in Figure 41.

A 2015 study by the Indiana Geological & Water Survey determined the probability of sinkhole formation throughout southern Indiana. Their analysis is based on the density of known sinkholes, as well as several geologic, topographic, and hydrologic variables that indicate the future vulnerability to sinkhole formation. Figure 42 shows the results of this study, showing that areas with the highest probability of sinkhole development generally occur throughout central southern Indiana, with less chance of sinkhole occurrence toward the eastern and western parts of southern Indiana.

Underground coal mines in Morgan County are illustrated in Figure 43. There are no underground coal mines in the county.

Figure 44 highlights streams found to be “actively migrating” which can indicate an increased FEH risk. Actively migrating streams are found in across the county.

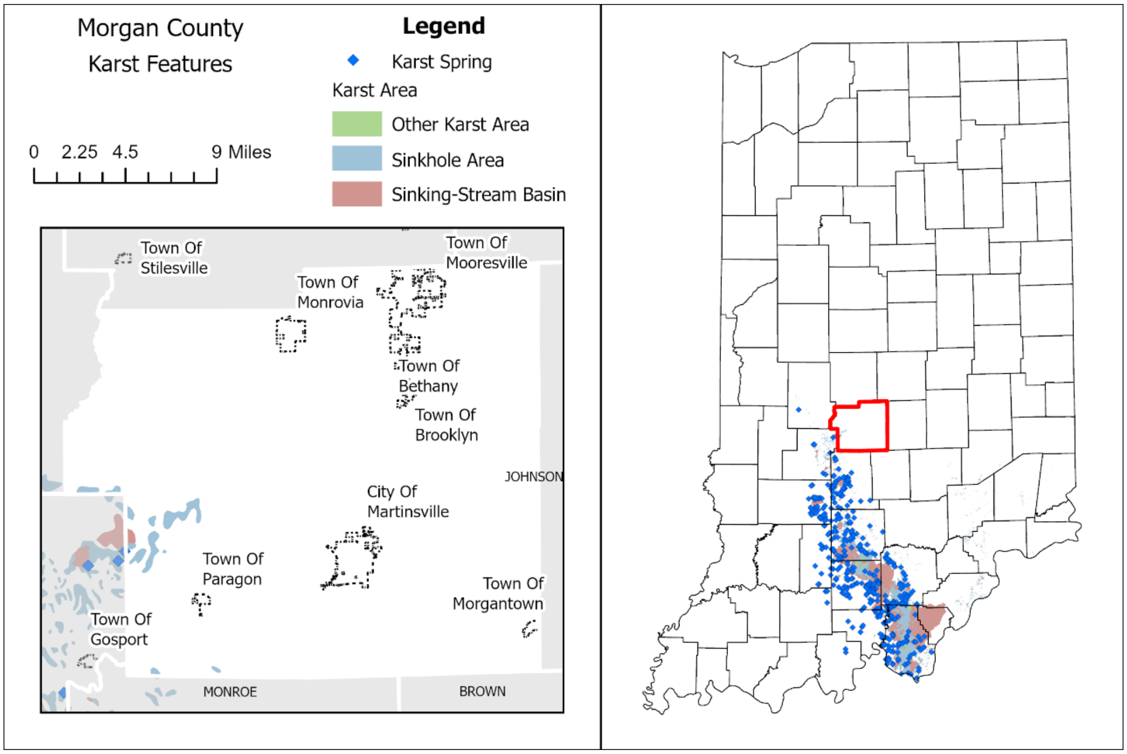
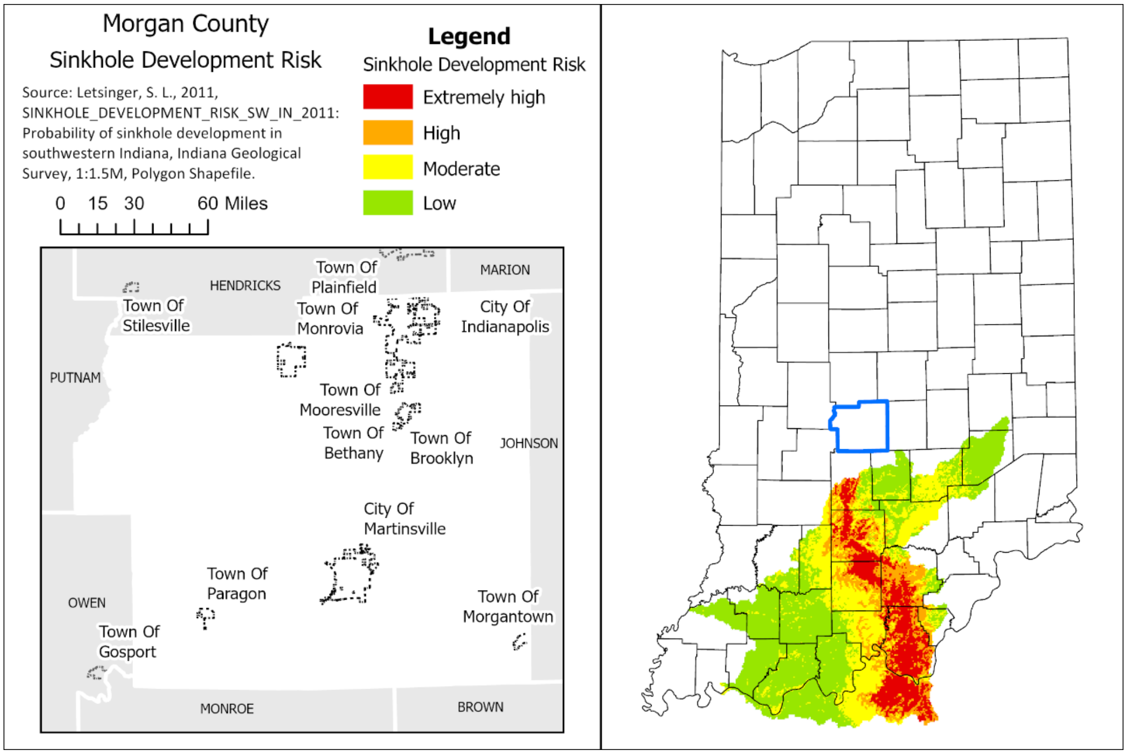


Figure 41. Morgan County Karst Features



Source: Letsinger, S. L., 2011, SINKHOLE_DEVELOPMENT_RISK_SW_IN_2011: Probability of sinkhole development in southwestern Indiana, Indiana Geological Survey, 1:1.5M, Polygon Shapefile.

Figure 42. Risk of Sinkhole Development

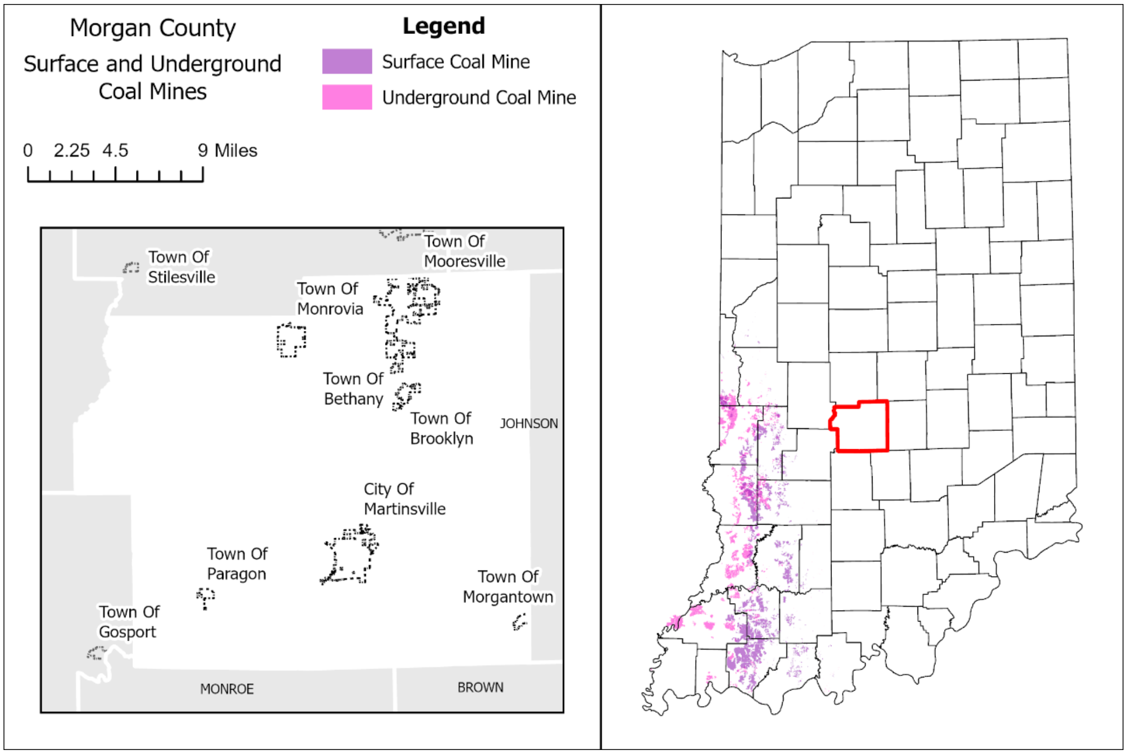


Figure 43. Surface and Underground Coal Mines

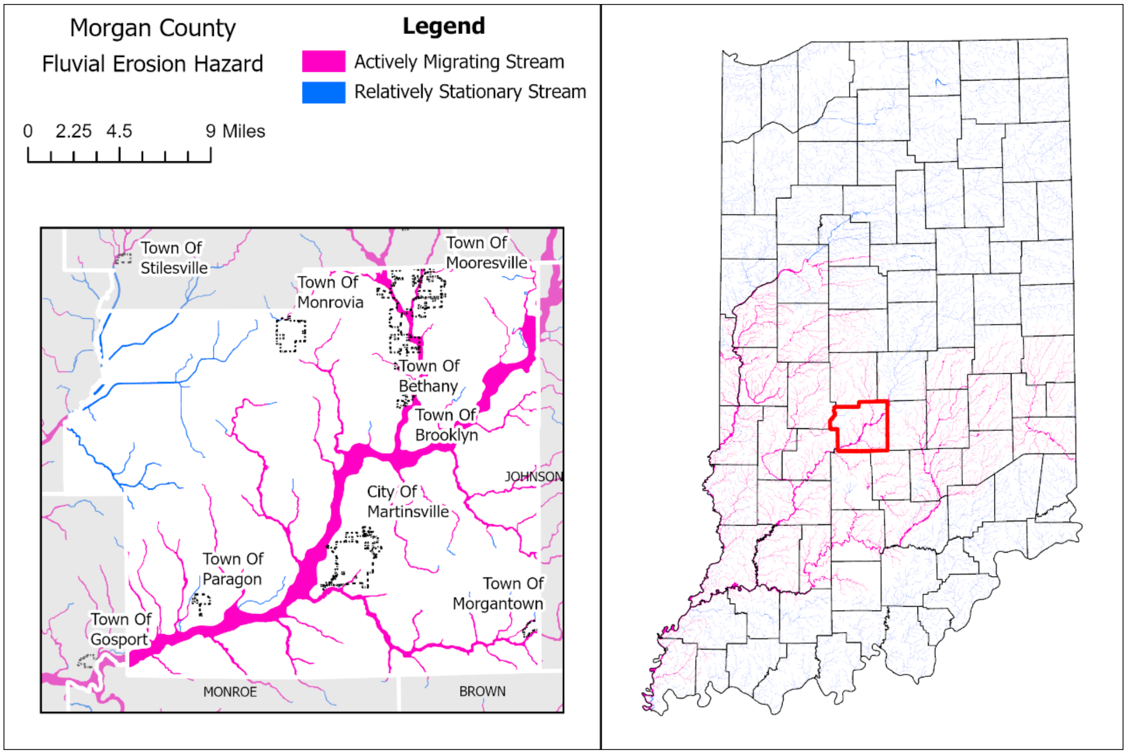


Figure 44. Morgan County FEH Risk

4.3.3.4 Hazard Extent for Ground Failure

The extent of the ground failure hazard is closely related to development near the regions that are at risk. The extent will vary within these areas depending on the potential of elevation change, as well as the size of the underground structure. The hazard extent of ground failure is related to various concentrated areas as shown on the maps.

4.3.3.5 Risk Identification for Ground Failure

In Meeting #2, the planning team determined that the probability of ground failure is possible with limited consequences. The warning time for ground failure is less than 6 hours with a duration of more than 1 week. The calculated CPRI for ground failure is 2.5.

4.3.3.6 Vulnerability Analysis for Ground Failure

The US Geological Survey's Landslide Overview Map of the Conterminous United States shows two large zones in south-central Indiana as having moderate susceptibility for landslides, but with low incidence of landslides. In contrast, the majority of northern Indiana has a very low (less than 1.5% of the area involved) incidence of landslides and only the northwest is shown as having a moderate level of susceptibility.

As seen in USGS Landslide Overview Map figure, Morgan County predominantly lies in the moderate susceptibility with low landslide incidence zone.

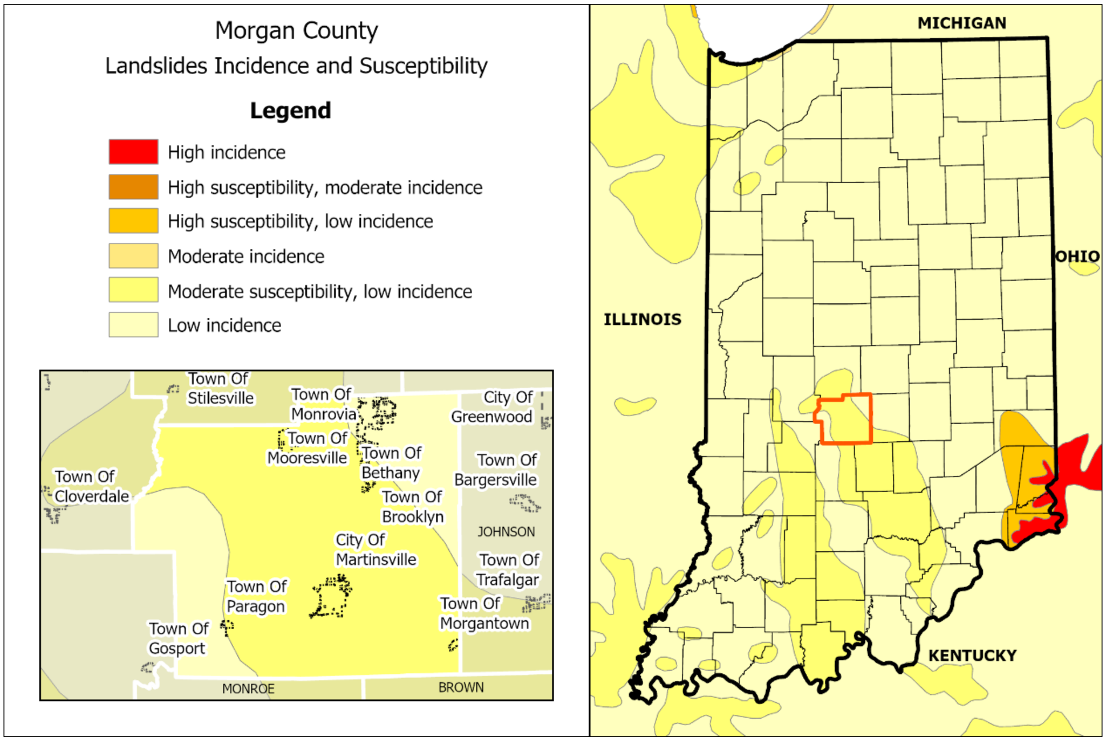


Figure 45. USGS Landslide Overview Map

4.3.3.7 Community Development and Future Vulnerability

All future communities, buildings, and infrastructure will remain vulnerable to ground failure in the areas of Morgan County where underground mine features exist, where the structures are located near streams and rivers, and in areas of significant elevation change. In areas with higher levels of population, the vulnerability is greater than in open areas with no infrastructure demands. Abandoned underground mine subsidence may affect several locations within the county; therefore, buildings and infrastructure are vulnerable to subsidence. Continued development will occur in many of these areas. Currently, Morgan County reviews new developments for compliance with the local zoning ordinance. Newly planned construction should be reviewed with the historical mining maps to minimize potential subsidence structural damage.

4.3.3.8 Relationship to other Hazards

Flooding – Flooding is typically the leading cause to ground failure, particularly along streams. Ground failure and flooding combine to impact property and infrastructure such as roads and bridges.

4.3.4 Summer Storms and Tornadoes

4.3.4.1 Hazard Definition for Summer Storm

Thunderstorms

Severe thunderstorms are defined as thunderstorms with one or more of the following characteristics: strong winds, large damaging hail, or frequent lightning. Severe thunderstorms most frequently occur in Indiana during the spring and summer but can occur any month of the year at any time of day. A severe thunderstorm's impacts can be localized or widespread in nature. The National Oceanic and Atmospheric Administration's National Weather Service classifies a thunderstorm as severe when it meets one or more of the following criteria:

- Hail with a one-inch diameter or higher
- Wind speeds equal to or greater than 58 miles an hour
- Thunderstorms that produce a tornado

The National Weather Service does not consider lightning frequency a criterion for issuing a severe thunderstorm warning; however, frequent and dangerous lightning is considered a severe weather hazard. The NOAA consistently ranks lightning as one the top weather killers in the United States.

Lightning

Lightning is caused by the discharge of electricity between clouds or between clouds and the surface of the earth. In a thunderstorm there is a rapid gathering of particles of moisture into clouds and forming of large drops of rain. This gathers electric potential until the surface of the cloud (or the enlarged water particles) is insufficient to carry the charge, and a discharge takes place, producing a brilliant flash of light. The power of the electrical charge and intense heat associated with lightning can electrocute on contact, split trees, ignite fires, and cause electrical failures. Most lightning casualties occur in the summer months, during the afternoon and early evening.

Hail

Hail is a product of a severe thunderstorm. Hail consists of layered ice particles which are developed when strong updrafts within the storm carry water droplets above the freezing level. They remain suspended and continue to grow larger, until their weight can no longer be supported by the winds. The NWS uses the following descriptions when estimating hail sizes: pea size is ¼ inch, marble size is ½ inch, dime size is ¾ inch, quarter size is 1 inch, golf ball size is 1 ¾ inches, and baseball size is 2 ¾ inches. Individuals who serve as volunteer “storm spotters” for the NWS are located throughout the state and are instructed to report hail dime size (¾ inch) or greater. Hailstorms can occur throughout the year; however, the months of maximum hailstorm frequency are typically between May and August. Although hailstorms rarely cause injury or loss of life, they can cause significant damage to property, particularly roofs and vehicles.

Windstorms

Windstorms can and do occur in all months of the year; however, the most severe windstorms usually occur during severe thunderstorms in the warm months. Associated with strong thunderstorms, downbursts are severe localized downdrafts from a thunderstorm or rain shower. This outflow of cool or colder air can create damaging winds at or near the surface. Downburst winds can potentially cause as much damage as a small tornado and are often confused with tornadoes due to the extensive damage that they inflict. As these downburst winds spread out, they are frequently referred to as straight-line winds. Straight-line winds can cause major structural and tree damage over a relatively large area.

Summer storms, including thunderstorms, hailstorms, and windstorms affect Morgan County on an annual basis. Thunderstorms are the most common summer hazardous event in the county, occurring primarily during the months of May through August, with the severest storms most likely to occur from mid-May through mid-July. Typically, thunderstorms are locally produced by cumulonimbus clouds, are always attended by lightning, and are often accompanied by strong wind gusts, heavy rain, and sometimes hail and tornadoes.

4.3.4.2 Hazard Definition for Tornado

The Glossary of Meteorology defines a tornado as a violently rotating column of air with wind speeds between 40-300 mph, in contact with the ground, either pendant from a cumuliform cloud or underneath a cumuliform cloud, and often (but not always) visible as a funnel cloud. They develop under three scenarios: (1) along a squall line; (2) in connection with thunderstorm squall lines during hot, humid weather; and (3) in the outer portion of a tropical cyclone. Funnel clouds are rotating columns of air not in contact with the ground; however, the column of air can reach the ground very quickly and become a tornado.

Since 2007, tornado strength in the United States is ranked based on the Enhanced Fujita scale (EF scale), replacing the Fujita scale introduced in 1971. The EF scale uses similar principles to the Fujita scale, with six categories from 0-5, based on wind estimates and damage caused by the tornado. The EF Scale is used extensively by the NWS in investigating tornadoes (all tornadoes are now assigned an EF Scale number), and by engineers in correlating damage to buildings and techniques with different wind speeds caused by tornadoes.

Tornado damage curves for the Fujita Scale are shown in the following table. The approximate width of the damage and minimum percent damage provide a better understanding of the capabilities of the tornado funnels as the sizes increase.

Table 23. Tornado Path Widths and Damage

Enhanced Fujita Scale	Path Width (feet)	Maximum Expected Damage
EF5	3,000	100%
EF4	2,400	100%
EF3	1,800	80%
EF2	1,200	50%
EF1	600	10%
EF0	300	0%

4.3.4.3 Summer Storm and Tornado History in Morgan County

Summer Storm History

The history of summer storms in Morgan County was determined by analyzing the hail, high wind, lightning, strong wind, and thunderstorm wind events for the county in the NCEI database. From 1966 to 2011 there were 243 summer storm-related reports. From 2012 through 2020, there have been 58 summer storm-related reports, not including reports of tornadoes. None of these events have any reported injuries or deaths but did result in property damage costs. A severe thunderstorm on December 23, 2015, knocked over a grain elevator and downed several trees- winds were estimated to have been as strong as 65 knots. A hailstorm on July 7, 2017, dropped 1.5” hailstones for 10-15 minutes, breaking several windshields. A severe thunderstorm on March 28, 2020, brought significant damage to Mooresville due to a microburst. Straight-line winds estimated at 75 knots damaged numerous roofs and snapped several trees, causing $150,000 in damage. Additional NCEI events and details about their associated impacts can be found in Appendix C. Figure 46 displays the locations for historic hail and wind events in the county.

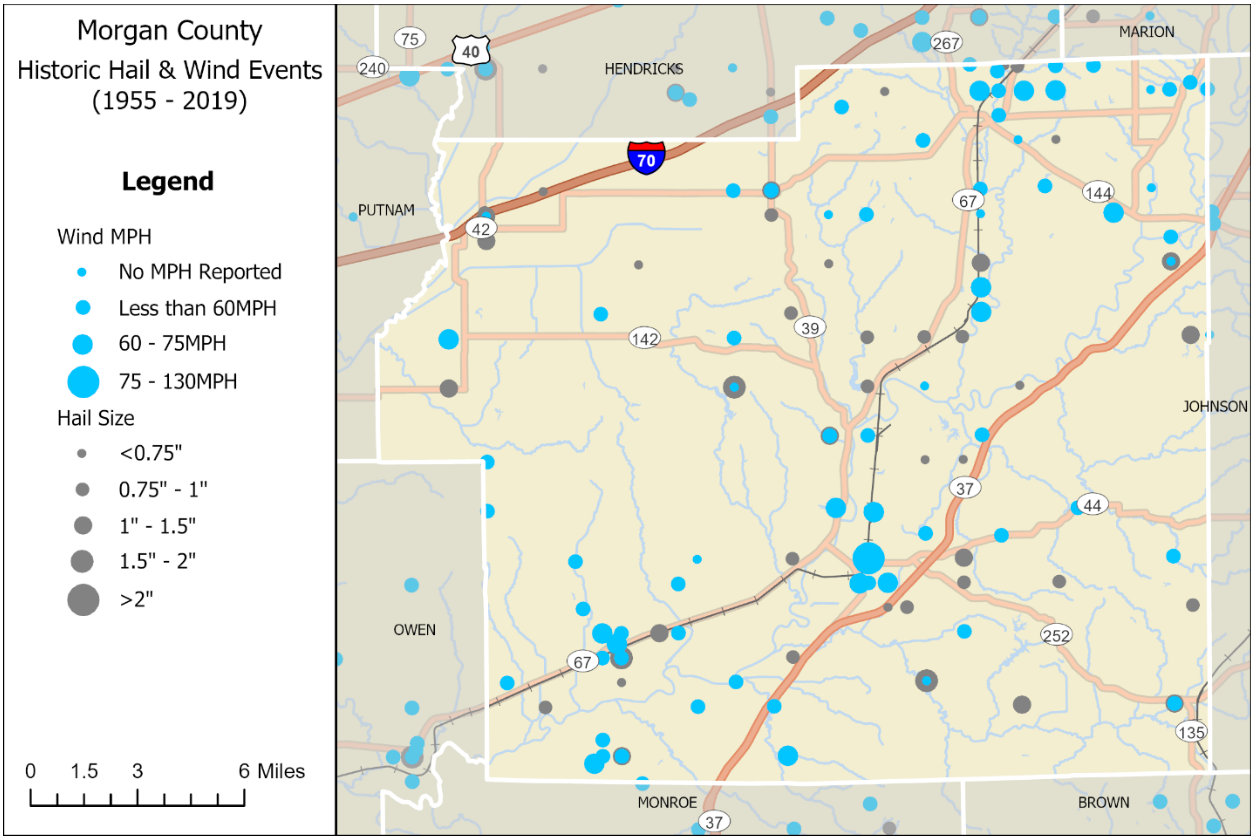


Figure 46. Morgan County Historic Hail and Wind Events

Tornado History

According to the NCEI there have been 14 occurrences of tornadoes within Morgan County from 1967 to 2011. Since 2011 there have only been 2 occurrences in Morgan County, one occurring in June of 2014 and the other taking place in April of 2020. The April 8, 2020 tornado struck the town of Mooresville, and was given an EF1 rating. The tornado impacted the downtown region of the town and caused significant roof and tree damage. One building in downtown Mooresville had its roof uplifted, and others nearby also experienced structural damage. This tornado caused $500,000 in damage and was also embedded in an area of straight-line winds as high as 80 mph. Morgan County NCEI recorded tornadoes are identified in Table 24. Additional details for NCEI events are included in Appendix C. Figure 47 displays historical tornadoes for Morgan County.

*Table 24. Morgan County Tornadoes**

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Morgan Co.	7/30/1992	Tornado	F2	0	0	$25K	-
Morgan Co.	7/30/1992	Tornado	F0	0	0	-	-
Morgan Co.	11/22/1992	Tornado	F3	0	0	$2.5M	-

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Mooresville	4/19/1996	Tornado	F1	0	5	$2.0M	-
Martinsville	9/20/2002	Tornado	F3	0	28	$15.0M	$30K
Little Pt	5/30/2004	Tornado	F0	0	0	$10K	-
Little Pt	5/30/2004	Tornado	F1	0	0	$20K	-
Banta	6/3/2008	Tornado	EF0	0	0	$20K	-
Whitaker	6/27/2008	Tornado	EF0	0	2	$50K	-
Eminence	8/4/2009	Tornado	EF1	0	0	$85K	$0.50K
Lewisville	6/12/2010	Tornado	EF0	0	0	$25K	-
Plano	6/24/2014	Tornado	EF1	0	0	$10K	-
Mooresville	4/8/2020	Tornado	EF1	0	0	$500K	-

* NCEI records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

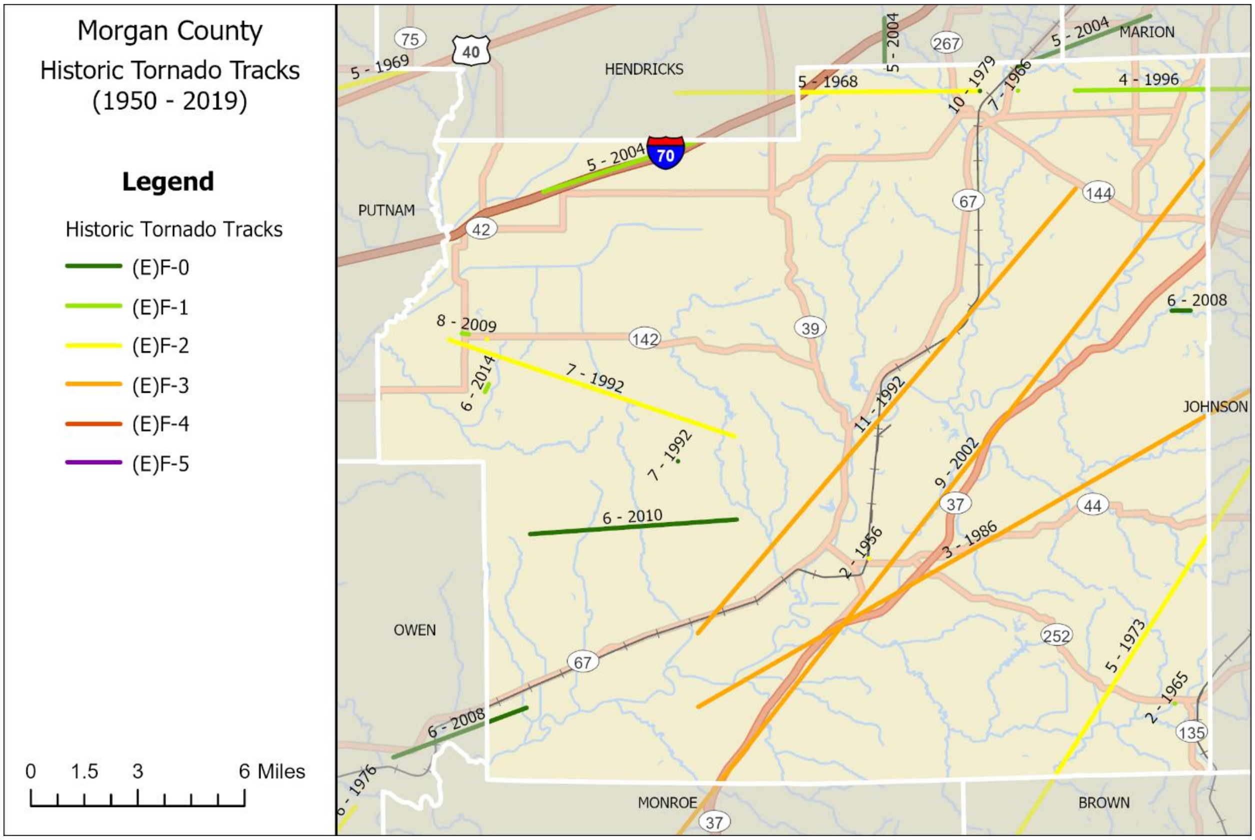


Figure 47. Historical Tornado Tracks and Touchdowns for Morgan County

4.3.4.4 Geographic Location for Summer Storm and Tornado

The entire county has the same risk for occurrence of summer storms and tornadoes. They can occur at any location within the county.

4.3.4.5 Hazard Extent for Summer Storm and Tornado

The extent of the summer storm and tornado hazards vary both in terms of the extent of the path of the event and the wind speed.

4.3.4.6 Risk Identification for Summer Storm and Tornado

In Meeting #2, the planning team determined that the probability of a summer storm is highly likely with critical consequences. The warning time for a summer storm is 6 to 12 hours with a duration of less than 24 hours. The calculated CPRI for summer storm is 3.35. The planning team ranked the tornado hazard as highly likely with catastrophic consequences. The warning time for a tornado is less than 6 hours with a duration of more than 1 week. The calculated CPRI for a tornado is 4.0.

4.3.4.7 Vulnerability Analysis for Summer Storm and Tornado

During a tornado the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county’s entire infrastructure is equally vulnerable, it is important to emphasize that any number of these items could become damaged during a tornado. The impacts to these items include broken, failed, or impassable roadways, broken or failed utility lines (e.g., loss of power or gas to community), and railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic.

All facilities are vulnerable to severe thunderstorms. These facilities will encounter many of the same impacts as any other building within the jurisdiction including structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, fires caused by lightning, and loss of building functionality, such as a damaged police station would no longer be able to serve the community.

During a severe thunderstorm, the types of infrastructure that could be impacted include roadways, utility lines and pipes, railroads, and bridges. Since the county’s entire infrastructure is equally vulnerable, it is important to emphasize that any number of these structures could become damaged during a severe thunderstorm. The impacts to these structures include impassable roadways, broken or failed utility lines, causing loss of power or gas to the community, or railway failure from broken or impassable tracks. Additionally, bridges could fail or become impassable, causing risks to traffic.

GIS Tornado Analysis

The following analysis completed for the plan update utilizes an example scenario to gauge the anticipated impacts of tornadoes in the county in terms of numbers and types of buildings and infrastructure.

GIS overlay modeling was used to determine the potential impacts of an EF-4 tornado. The analysis used a hypothetical tornado path that runs for 25 miles through the southern half of the county, going through the town of Paragon and the city of Martinsville. This scenario includes impacts to the major employers of the county. The selected widths were modeled after a recreation of the Fujita-Scale guidelines based on conceptual wind speeds, path widths, and path lengths. There is no guarantee that every tornado will fit exactly into one of these six categories. Figure 48 depicts tornado damage curves as well as path widths.

Table 25. Tornado Path Widths and Damage Curves

Fujita Scale	Path Width (feet)	Maximum Expected Damage
EF-5	3000	100%
EF-4	2400	100%
EF-3	1800	80%
EF-2	1200	50%
EF-1	600	10%
EF-0	300	0%

Within any given tornado path there are degrees of damage. The most intense damage occurs within the center of the damage path with a decreasing amount of damage away from the center of the path. This natural process was modeled in GIS by adding damage zones around the tornado path.

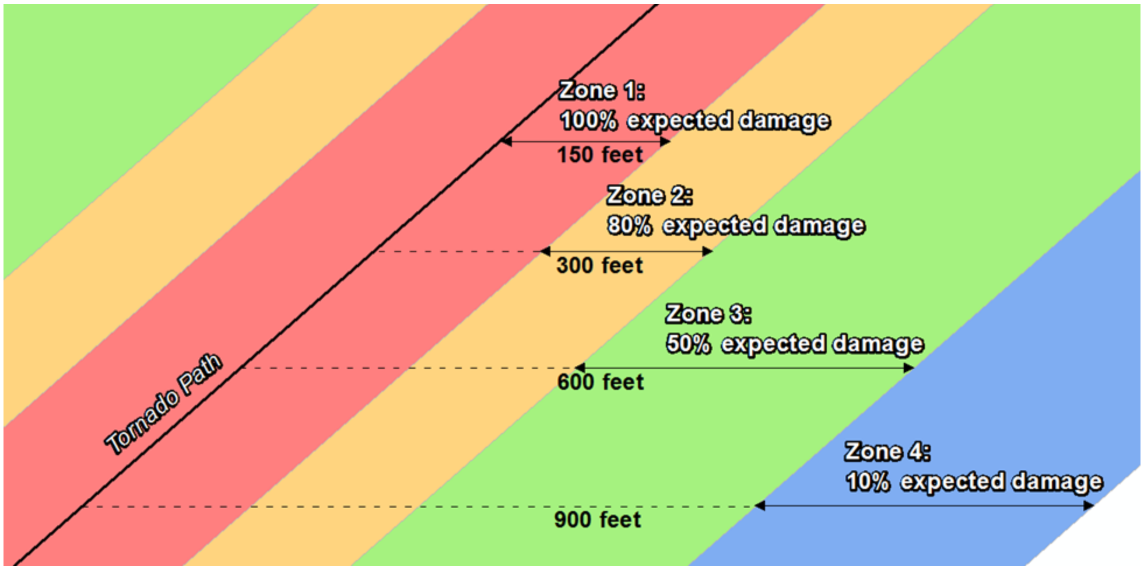


Figure 48. EF-4 Tornado Analysis, Using GIS Buffers

Table 26. EF-4 Tornado Zones and Damage Curves

Fujita Scale	Zone	Buffer (feet)	Damage Curve
EF-4	4	900-1200	10%
EF-4	3	600-900	50%
EF-4	2	300-600	80%
EF-4	1	0-300	100%

Table *27.* Estimated Building Losses by Occupancy Type by Zone Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	$21,001,521	$16,830,884	$43,839,475	$49,646,629
Commercial	$11,363,967	$58,720,167	$8,784,518	$49,655,232
Industrial	-	-	-	-
Agriculture	$2,804,597	$1,592,401	$5,019,154	$4,533,786
Religious	$336,604	$2,580,136	$1,986,624	$95,863,191
Government	$192,154	$192,154	-	-
Education	-	$1,254,038	-	-
Total	**$35,698,842**	**$81,169,780**	**$59,629,771**	**$199,698,838**

The results of the analysis are depicted in and **Error! Reference source not found.**. The GIS analysis estimates that 992 buildings will be damaged. The estimated building losses are nearly $150.5 million. The building losses are an estimate of building replacement costs multiplied by the percentages of damage. The overlay was performed against the Building Inventory created at an earlier stage using the Assessor data in combination with Parcel records. NOTE: The assessor records often do not include nontaxable parcels and associated building improvements therefore, the total number of buildings and the building replacement costs for government, religious/non-profit, and education may be underestimated.

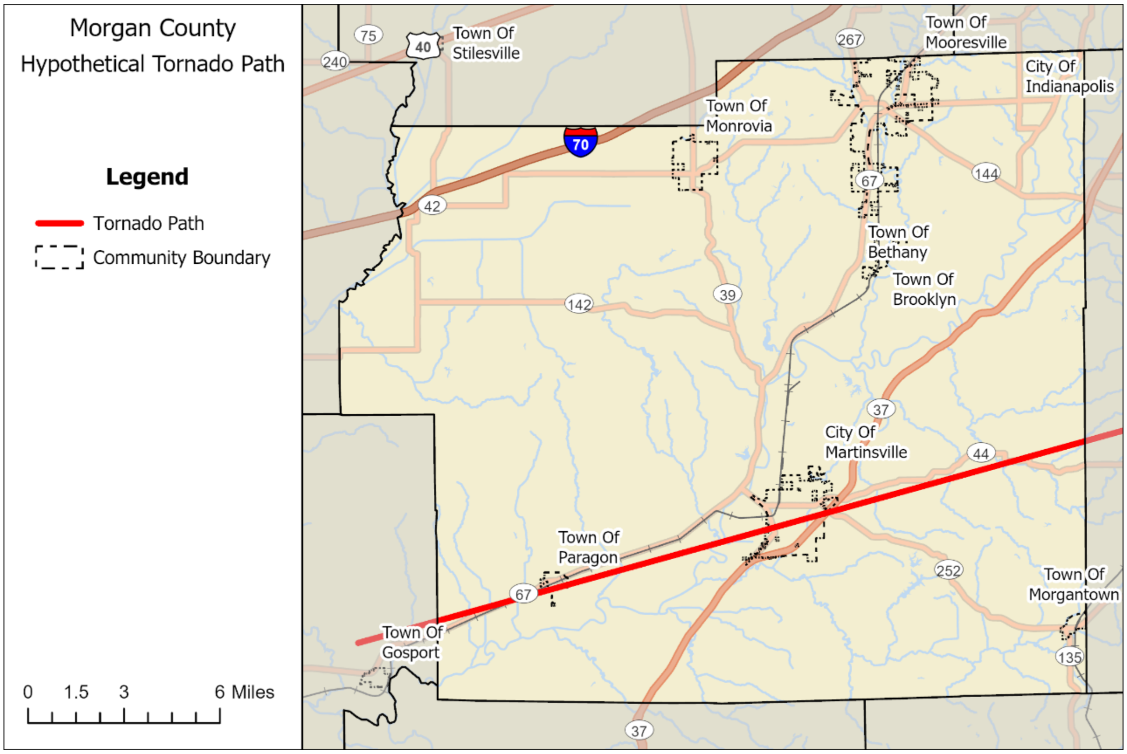


Figure 49. Modeled F4 Tornado Damage Hypothetical Path

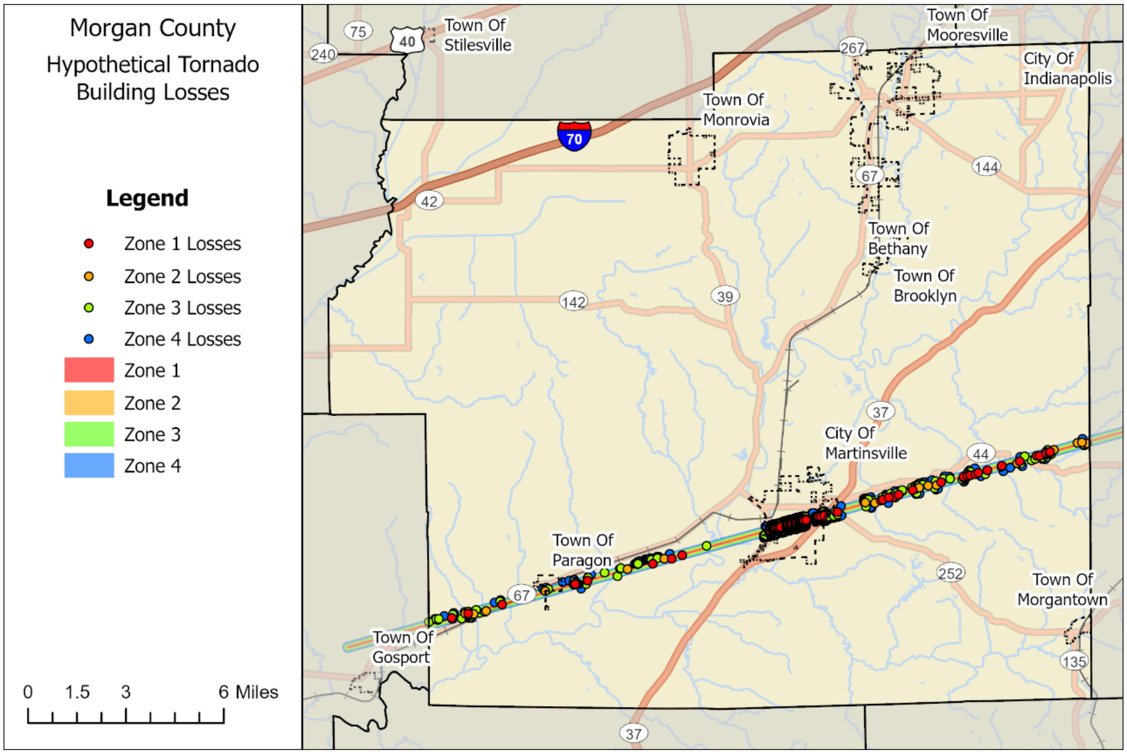


Figure 50. Tornado Path with Damaged Buildings

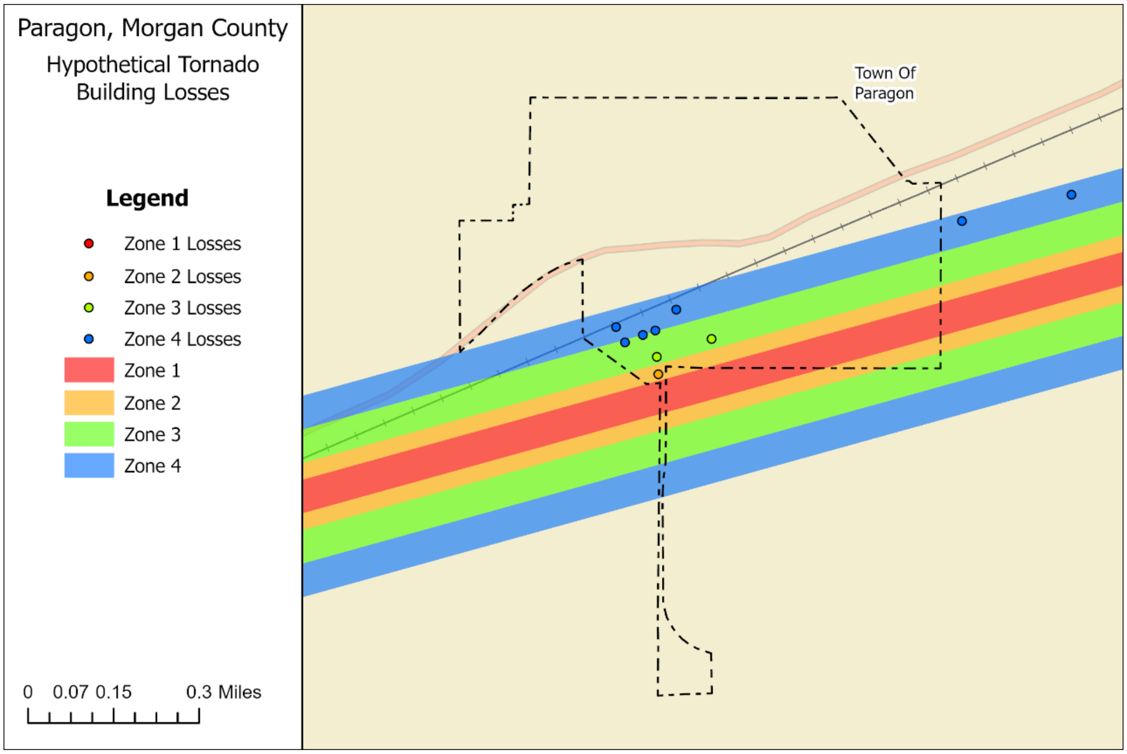


Figure 51. Tornado Path: Paragon

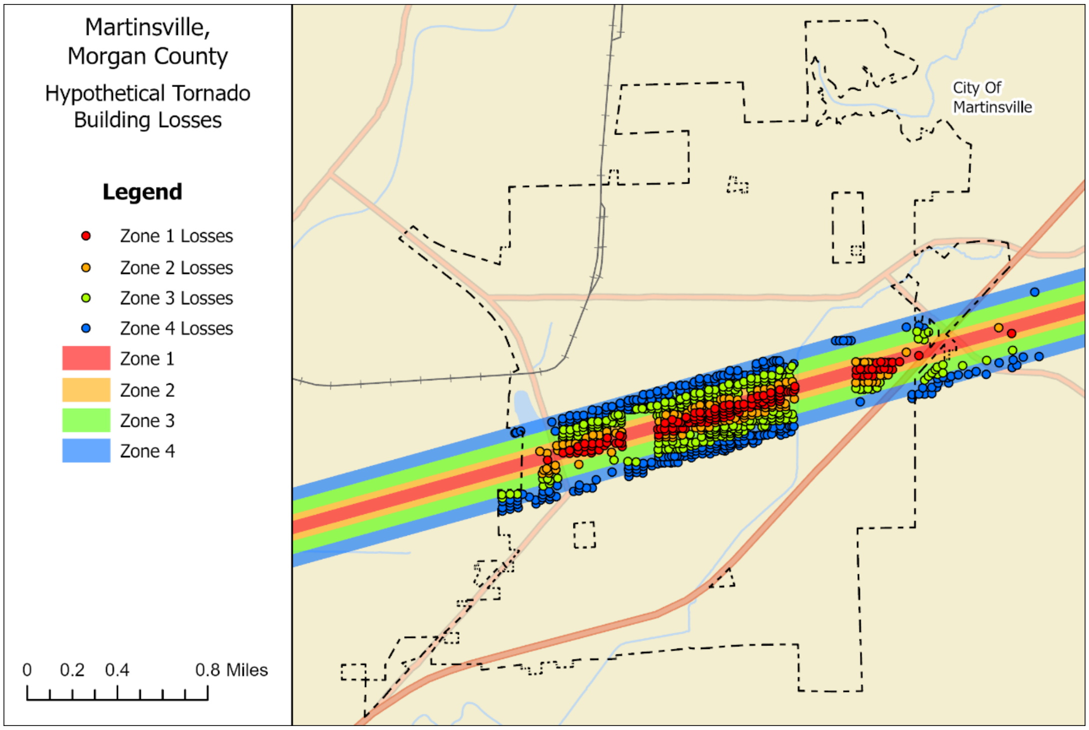


Figure 52. Tornado Path: Martinsville

Table 27. Estimated Building Losses by Occupancy Type by Zone

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	$21,001,521	$16,830,884	$43,839,475	$49,646,629
Commercial	$11,363,967	$58,720,167	$8,784,518	$49,655,232
Industrial	-	-	-	-
Agriculture	$2,804,597	$1,592,401	$5,019,154	$4,533,786
Religious	$336,604	$2,580,136	$1,986,624	$95,863,191
Government	$192,154	$192,154	-	-
Education	-	$1,254,038	-	-
Total	**$35,698,842**	**$81,169,780**	**$59,629,771**	**$199,698,838**

Table 28: Estimated Number of Damaged Buildings by Occupancy Type by Zone

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	142	120	287	335
Commercial	8	12	5	17
Industrial	-	-	-	-
Agriculture	12	6	17	15
Religious	1	1	2	9
Government	1	1	-	-
Education	-	1	-	-
Total	**164**	**141**	**311**	**376**

Facility and Infrastructure Damage

The essential facilities damaged in the hypothetical tornado path are shown in Figure 53 and listed in Table 29. Critical facilities damaged in the hypothetical path can be found in Appendix E.

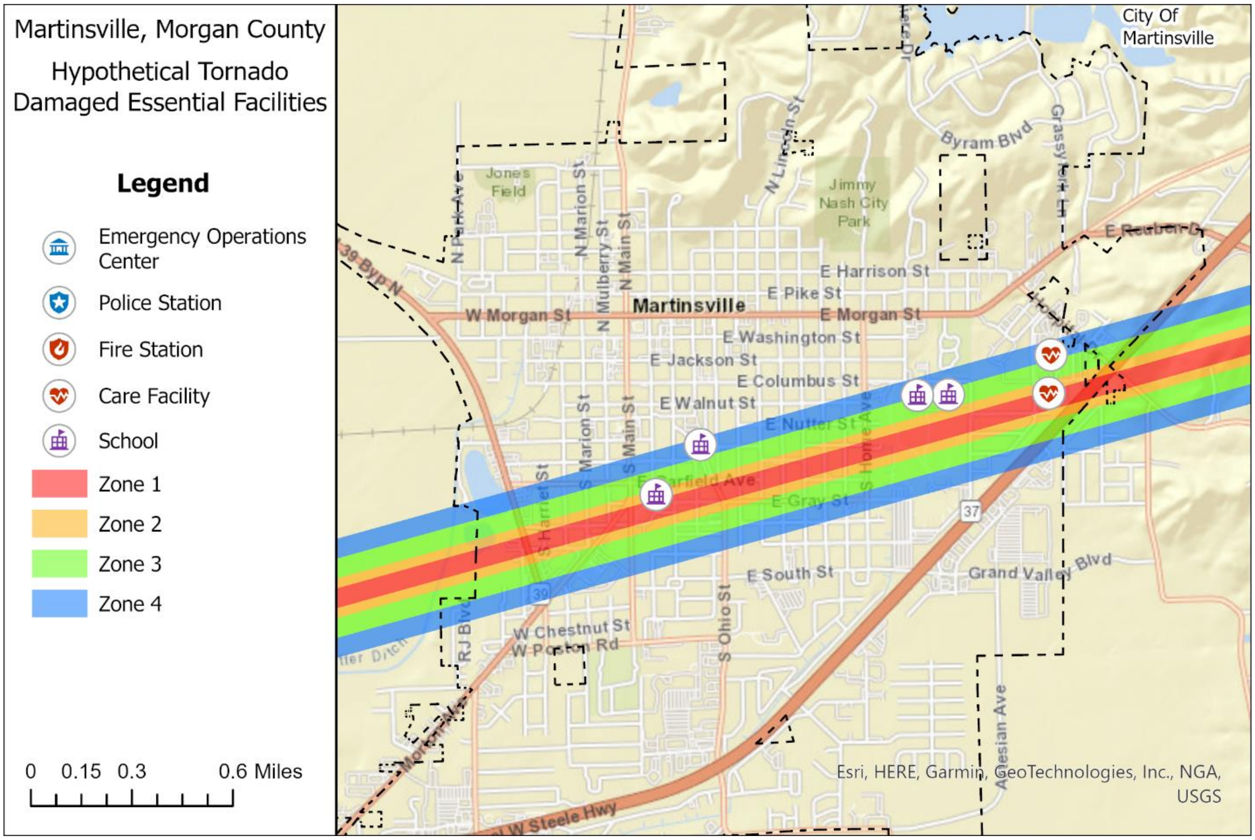


Figure 53. Hypothetical Damages to Essential Facilities, Martinsville

Table 29. Essential Facilities in Hypothetical Tornado Path

Facility Type	Facility Name	Address	Community
School	John R. Wooden Middle School	109 E Garfield St	Martinsville
School	Bell Intermediate School	1459 E Columbus St	Martinsville
School	South Elementary School	500 E Mahalasville Rd	Martinsville
School	Charles L Smith Elem School	1359 E Columbus St	Martinsville
Care	Fresenius Medical Care Morgan County	2200 John R Wooden Dr	Martinsville
Care	IU Health Morgan Hospital	2209 John R Wooden Dr	Martinsville

4.3.4.8 Community Development Trends and Future Vulnerability

The entire population and buildings have been identified as at risk because summer storms and tornadoes can occur anywhere within the state of Indiana at any time of the day. Furthermore, any future development in terms of new construction within the county will be at risk. The building exposure for Morgan County is included in Table 13. All critical facilities in the county and communities within the county are at risk. Preparing for severe storms will be enhanced if officials sponsor a wide range of programs and initiatives to address the overall safety of county residents. New structures need to be built with more sturdy construction, and those structures already in place need to be hardened to lessen the potential impacts of severe weather.

Community warning sirens to provide warnings of approaching storms are also vital to preventing the loss of property and ensuring the safety of Morgan County residents.

Team Identified Vulnerability & Potential Strategy

The planning team answered a series of surveys and worksheets to help better identify hazards and potential solutions to those problems.

4.3.4.9 Relationship to other Hazards

Flooding – Thunderstorms with heavy amounts of rainfall can cause localized flooding, which can impact property and infrastructure such as roads.

Public Health – Public health can be impacted as a result of wastewater spills due to flooding.

Wildland Fire – Lighting strikes may ignite a wildland fire. Windstorms that result in downed timber increase the fuel load in a forest that may increase the risk of wildfire.

Structural Fire – Lighting strikes may ignite a structural fire.

4.3.5 Drought

4.3.5.1 Hazard Definition for Drought

The meteorological condition that creates a drought is below normal rainfall. However, excessive heat can lead to increased evaporation, which will enhance drought conditions. Droughts can occur in any month. Drought differs from normal arid conditions found in low rainfall areas. Drought is the consequence of a reduction in the amount of precipitation over an undetermined length of time (usually a growing season or more).

The Palmer Drought Severity Index (PDSI), developed by W.C. Palmer in 1965, is a soil moisture algorithm utilized by most federal and state government agencies to trigger drought relief programs and responses. The objective of the PDSI is to provide standardized measurements of moisture, so that comparisons can be made between locations and periods of time—usually months. The PDSI is designed so that a -4.0 in Indiana has the same meaning in terms of the moisture departure from a climatological normal as a -4.0 does in South Carolina.

The U.S. Drought Monitor (USDM) provides a national assessment on drought conditions in the United States. The following table is a reference from the classification scheme provided by the USDM, and the correlation between PDSI and the category, descriptions, and possible impacts associated with those level events. This classification is often used to refer to the severity of droughts for statistical purposes. The USDM provides weekly data for each county, noting the percent of land cover in the condition of the drought category identified below.

Table 30. USDM Index

Category	Description	Possible Impacts	Palmer Drought

			Severity Index
D0	Abnormally Dry	Going into drought: -short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits	-1.0 to -1.9
D1	Moderate Drought	-Some damage to crops, pastures -Streams, reservoirs, or wells low, some water shortages developing or imminent -Voluntary water-use restrictions requested	-2.0 to -2.9
D2	Severe Drought	-Crop or pasture losses likely -Water shortages common -Water restrictions imposed	-3.0 to -3.9
D3	Extreme Drought	-Major crop/pasture losses -Widespread water shortages or restrictions	-4.0 to -4.9
D4	Exceptional Drought	-Exceptional and widespread crop/pasture losses -Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less

In the past decade, the US has continued to consistently experience drought events with economic impacts greater than $1 billion; FEMA estimates that the nation's average annual drought loss is $6 billion to $8 billion. For Indiana alone, the National Drought Mitigation Center reported hundreds of drought impacts in the past decade ranging from water shortage warnings to reduced crop yields and wildfires.

4.3.5.2 Drought History in Morgan County

Since the last MHMP, the National Drought Mitigation Center and the Indiana Drought Monitor have recorded several incidences of drought in Morgan County.

Morgan County experienced a period of drought from the beginning of July through October 2011. At the drought's peak, 100% of land area in Morgan County was at category D1 for two weeks. The 2011 drought caused crops to become stressed and livestock deaths. The United States Department of Agriculture designated Morgan County as a drought disaster area along with several counties in and around Indiana. To help recover from the drought, small businesses in Morgan County were eligible for aid from the Small Business Administration (SBA) from July 2011 through February 2012.

Like the rest of Indiana, Morgan County was affected by the 2012 Central US drought. At the peak of the drought, 100% of the county was at category D3. Low water levels limited recreational activities at Salamonie Lake. Eventually, the water levels got low enough that a previously submerged town became visible in Salamonie Lake. In response to the disaster, the United States Department of Agriculture streamlined the disaster designation process. More than half of Indiana counties, including Morgan County, were declared eligible for SBA loans, and Morgan County enacted an open burn ban.

Since the 2012 drought, the National Drought Mitigation Center reported drought impacts in 2015 and 2020. In October 2015, soybeans, winter wheat, and pastures were affected by dryness. During the fall of 2020, D1 drought conditions lasted for four weeks, with 100% of the county covered in category D1. The drought also impacted harvesting of crops.

4.3.5.3 Geographic Location for Drought

Droughts are regional in nature. All areas of the county are vulnerable to the risk of drought.

4.3.5.4 Hazard Extent for Drought

Droughts can be widespread or localized events. The extent of the droughts varies both in terms of the extent of the heat and the range of precipitation.

4.3.5.5 Risk Identification for Drought

In Meeting #2, the planning team determined that the probability of a drought is possible with limited consequences. The warning time for a drought is greater than 24 hours with a duration of more than 1 week. The calculated CPRI for drought is 2.05.

4.3.5.6 Vulnerability Analysis for Drought

Drought impacts, as described in the drought history previously, are a distributed threat across the entire jurisdiction; therefore, the county is vulnerable to this hazard and can expect the same impacts within the affected area.

4.3.5.7 Community Development Trends and Future Vulnerability

Drought impacts, as described in the drought history section, are a threat across the entire jurisdiction; therefore, the county is vulnerable to this hazard and can expect varying impacts within the affected area. Future development will remain vulnerable to drought events. Typically, some urban and rural areas are more susceptible than others. Excessive demands for water in populated urban areas place a limit on water resources. In rural areas, crops and livestock may suffer from extended periods of drought.

4.3.5.8 Relationship to other Hazards

Wildfires - A drought situation can significantly increase the risk of wildfire.

Extreme Temperatures - A drought situation can significantly increase with long periods of high temperatures.

4.3.6 Winter Storms: Blizzards, Ice Storms, Snowstorms

4.3.6.1 Hazard Definition for Winter Storm

Severe winter weather consists of various forms of precipitation and strong weather conditions. This may include one or more of the following: freezing rain, sleet, heavy snow, blizzards, icy roadways, extreme low temperatures, and strong winds. These conditions can cause human-health risks such as frostbite, hypothermia, and death.

Ice Storms

Ice or sleet, even in the smallest quantities, can result in hazardous driving conditions and can be a significant cause of property damage. Sleet can be easily identified as frozen raindrops. Sleet does not stick to trees and wires. The most damaging winter storms in Indiana have been ice storms. Ice storms are the result of cold rain that freezes on contact with objects having a temperature below freezing. Ice storms occur when moisture-laden gulf air converges with the northern jet stream, causing strong winds and heavy precipitation. This precipitation takes the form of freezing rain, coating power lines, communication lines, and trees with heavy ice. The winds then will cause the overburdened limbs and cables to snap, leaving large sectors of the population without power, heat, or communication. Falling trees and limbs also can cause building damage during an ice storm. In the past few decades, numerous ice-storm events have occurred in Indiana.

Snowstorms

Significant snowstorms are characterized by the rapid accumulation of snow, often accompanied by high winds, cold temperatures, and low visibility. A blizzard is categorized as a snowstorm with winds of 35 miles an hour or greater and/or visibility of less than one-quarter mile for three or more hours. The strong winds during a blizzard blow about falling and already existing snow, creating poor visibility and impassable roadways. Blizzards have the potential to result in property damage.

Indiana has been struck repeatedly by blizzards. Blizzard conditions not only cause power outages and loss of communication, potentially for days, but can also make transportation difficult. The blowing of snow can reduce visibility to less than one-quarter mile, and the resulting disorientation makes even travel by foot dangerous, if not deadly.

Damages from blizzards can range from significant snow removal costs to human and livestock deaths. Because of the blinding potential of heavy snowstorms, drivers are also at risk of collisions with snowplows or other road traffic. Stranded drivers can make uninformed decisions, such as leaving the car to walk in conditions that put them at risk. Drivers and homeowners without emergency plans and kits are vulnerable to the life-threatening effects of heavy snowstorms such as power outages, cold weather, and inability to travel, communicate, obtain goods or reach their destinations. Heavy snow loads can cause structural damage, particularly in areas where there are no building codes or for residents living in manufactured home parks.

4.3.6.2 Winter Storm History in Morgan County

The NCEI database identified 13 winter storm, heavy snow, ice storm, winter weather, or blizzard events for Morgan County since 2011. The last official blizzard that occurred in the county was on December 26, 2012, when 6-12" of snow accumulated followed by 30-45 mph wind gusts, leading to treacherous travel conditions and significant drifting of snow. In February of 2014, a winter storm brought upwards of 7" of snow to the county, cancelling school and leading to impassable roadways in some spots. A winter storm in January of 2019 brought up to nearly 7" of snowfall to the county, leading to difficult driving conditions and the first Winter Storm Warning in 5 years. Additional details for NCEI events are included in Appendix C.

4.3.6.3 Geographic Location for Winter Storm

Severe winter storms are regional in nature. Most of the NCEI data is calculated regionally or in some cases statewide.

4.3.6.4 Hazard Extent for Winter Storm

The extent of the historical winter storms varies in terms of storm location, temperature, and ice or snowfall. A severe winter storm can occur anywhere in the jurisdiction.

4.3.6.5 Risk Identification for Winter Storm

In Meeting #2, the planning team determined that the potential for a winter storm is likely with critical consequences. The warning time for a winter storm is 12-24 hours with a duration of less than 1 week. The calculated CPRI for a winter storm is 2.85.

4.3.6.6 Vulnerability Analysis for Winter Storm

Winter storm impacts are equally distributed across the entire jurisdiction; therefore, the entire county is vulnerable to a winter storm and can expect the same impacts within the affected area. A table of the building exposure in terms of types and numbers of buildings for the entire county is listed in Table 13. The impacts to the general buildings within the county are similar to the damages expected to the critical facilities. These include loss of gas or electricity from broken or damaged utility lines, damaged or impassable roads and railways, broken water pipes, and roof collapse from heavy snow.

During a winter storm, the types of infrastructure that could be impacted include essential and critical facilities, roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable it is important to emphasize that any number of these items could become damaged during a winter storm. Potential impacts include broken gas and/or electricity lines or damaged utility lines, damaged or impassable roads and railways, and broken water pipes.

4.3.6.7 Community Development Trends and Future Vulnerability

Any new development within the county will remain vulnerable to these events. Because the winter storm events are regional in nature, future development will be equally impacted across the county.

4.3.6.8 Relationship to other Hazards

Flooding – Melting from heavy snows can cause localized flooding which can impact property and infrastructure such as roads.

Wildland or Structural Fire – Heavy storms that result in large amounts of downed timber can result in an increase of dead or dying trees left standing, thus providing an increased fuel load for a wildfire. There is an additional risk of increased frequency of structural fires during heavy snow events, primarily due to utility disruptions and the use of alternative heating methods by residents.

Public Safety – Drivers stranded in snowstorms may make uninformed decisions that can put them at risk; residents who are unprepared or vulnerable may not be able to obtain goods or reach their destinations. EMS providers may be slowed by road conditions to respond to emergencies. Ice storms may result in power outages due to downed power lines, putting people at risk for cold temperature exposure and reducing the ability to spread emergency messages to the public via television, radio or computer.

4.3.7 Extreme Temperatures

4.3.7.1 Hazard Definition for Extreme Temperatures

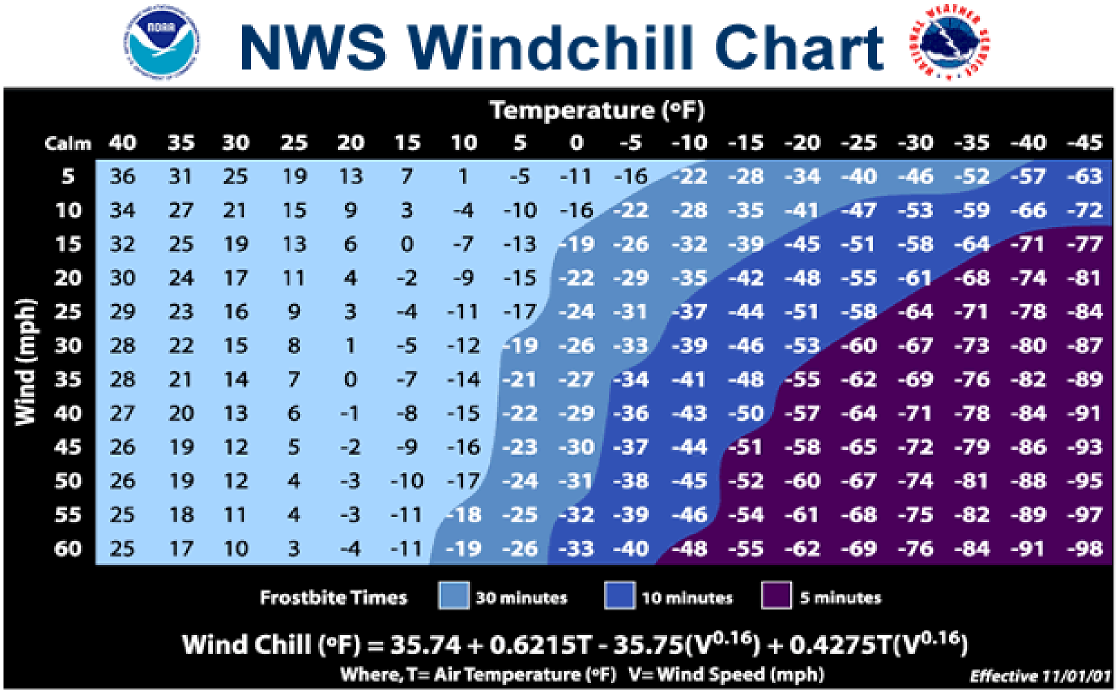
Extreme Cold

What constitutes an extreme cold event and its effects varies by region across the US. In areas unaccustomed to winter weather, near freezing temperatures are considered “extreme cold.” Extreme cold temperatures are typically characterized by the ambient air temperature dropping to approximately zero degrees Fahrenheit or below.

Exposure to cold temperatures—indoors or outdoors—can lead to serious or life-threatening health problems, including hypothermia, cold stress, frostbite or freezing of the exposed extremities, such as fingers, toes, nose, and earlobes. Certain populations—such as seniors age 65 or older, infants and young children under five years of age, individuals who are homeless or stranded, or those who live in a home that is poorly insulated (such as mobile homes) — or without heat are at greater risk to the effects of extreme cold.

The magnitude of extreme cold temperatures is generally measured through the Wind Chill Temperature (WCT) Index. WCT are the temperatures felt outside and is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body is cooled at a faster rate causing the skin's temperature to drop.

In 2001, the NWS implemented a new WCT Index, designed to more accurately calculate how cold air feels on human skin. The index, shown in Figure 54, includes a frostbite indicator, showing points where temperature, wind speed, and exposure time will produce frostbite in humans.



NWS Windchill Chart

Wind (mph)	Temperature (°F)																	
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times 🟦 30 minutes 🟦 10 minutes 🟪 5 minutes

Wind Chill (°F) = $35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Figure 54. NWS Wind Chill Temperature Index

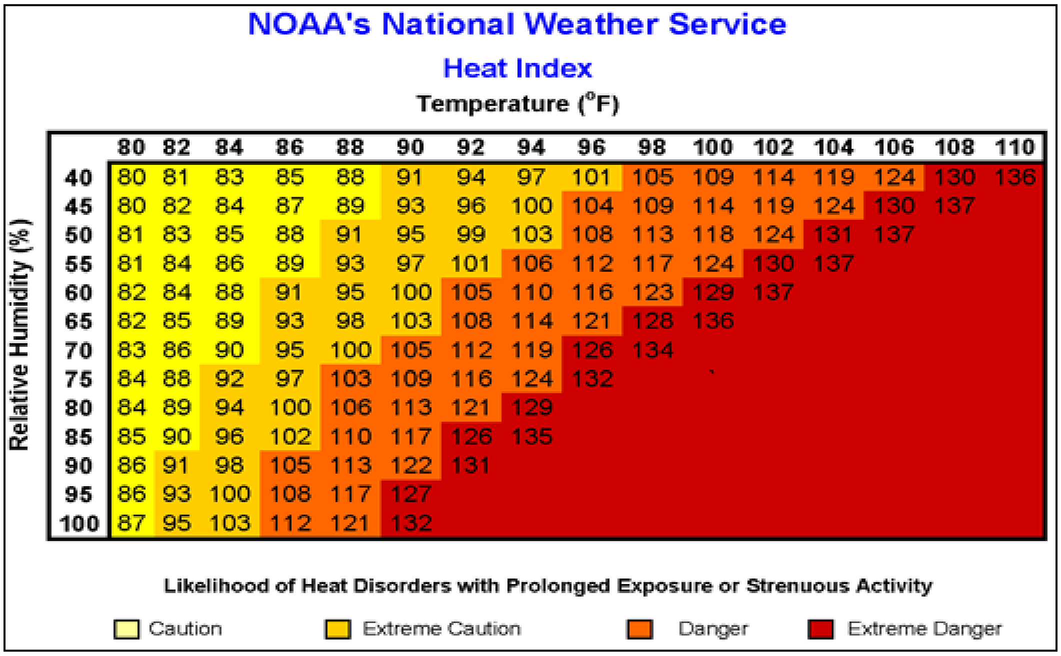
Extreme Heat

Human beings need to maintain a constant body temperature if they are to stay healthy. Working in high temperatures induces heat stress when more heat is absorbed into the body than can be dissipated out. Heat illness such as prickly heat, fainting from heat exhaustion, or heat cramps are visible signs that people are working in unbearable heat. In the most severe cases, the body temperature control system breaks down altogether and body temperature rises rapidly. This is a heat stroke, which can be fatal. The NWS issues a heat advisory when, during a 24-hour period, the temperature ranges from 105°F to 114°F during the day and remains at or above 80°F at night.

Heat is the leading weather-related killer in the United States, even though most heat-related deaths are preventable through outreach and intervention. According to the National Oceanic and Atmospheric Administration, the summer of 2016 was one of the five hottest on record dating to the late 19th century.

Unusually hot summer temperatures have become more frequent across the contiguous 48 states in recent decades (see the High and Low Temperatures indicator), and extreme heat events (heat waves) are expected to become longer, more frequent, and more intense in the future. As a result, the risk of heat-related deaths and illness is also expected to increase. Temperatures that hover 10 degrees Fahrenheit or more above the average high temperature for a region, and last for several weeks, constitute an extreme heat event (EHE). An extended period of extreme heat of three or more consecutive days is typically referred to as a heat wave. Most summers see EHEs in one or more parts east of the Rocky Mountains. They tend to combine both high temperatures and high humidity, although some of the worst heat waves have been catastrophically dry.

Heat alert procedures are based primarily on Heat Index Values. The Heat Index—given in degrees Fahrenheit—is often referred to as the apparent temperature and is a measure of how hot it really feels when the relative humidity is factored with the actual air temperature. The National Weather Service Heat Index Chart can be seen in Figure 55.



Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Figure 55. National Weather Service Heat Index
Source: Office of Atmospheric Programs. (2006). Excessive Heat Events Guidebook.
Unites States Environmental Protection Agency. Washington, D.C.

4.3.7.2 Extreme Temperature History in Morgan County

The NCEI reported no known occurrences of extreme temperatures in Morgan County since the previous plan. In 1996, low temperatures between zero and 15 degrees below zero were recorded for 4 consecutive days. Winds led to wind chills in the 20 to 50 below zero range.

4.3.7.3 Geographic Location for Extreme Temperature

Extreme temperatures are regional in nature. All areas of the Morgan County are vulnerable to the risk of extreme cold or extreme heat.

4.3.7.4 Hazard Extent for Extreme Temperature

Extreme temperatures are normally widespread events.

4.3.7.5 Risk Identification for Extreme Temperature

In Meeting #2, the planning team determined that the probability of an extreme temperature hazard is likely with limited consequences. Extreme temperatures were determined to have a warning time of more than 24 hours with a duration of more than one week. The calculated CPRI for extreme temperatures in Morgan County is 2.5.

4.3.7.6 Vulnerability Analysis for Extreme Temperature

Extreme temperature impacts are an equally distributed threat across the entire jurisdiction; therefore, the county is vulnerable to this hazard and can expect the same impacts within the affected area. According to FEMA, approximately 175 Americans die each year from extreme heat.

Prolonged exposure to extreme heat may lead to serious health problems, including heat stroke, heat exhaustion, or sunburn. Certain populations — such as seniors age 65 and over, infants and young children under five years of age, pregnant women, the homeless or poor, the obese, and people with mental illnesses, disabilities, and chronic diseases — are at greater risk to the effects of extreme heat and extreme cold. Depending on severity, duration, and location these populations may not have ready access to cooling or warming centers.

4.3.7.7 Community Development Trends and Future Vulnerability

Because extreme temperatures are regional in nature, future development will be impacted across the county. Although urban and rural areas are equally vulnerable to this hazard, those living in urban areas may have a greater risk from the effects of a prolonged heat wave. The atmospheric conditions that create extreme heat tend to trap pollutants in urban areas, adding contaminated air to the excessively hot temperatures and creating increased health problems. Furthermore, asphalt and concrete store heat longer, gradually releasing it at night and producing high nighttime temperatures. This phenomenon is known as the “urban heat island effect.” Local officials should address extreme temperature hazards by educating the public on steps to take before and during the event and locations of cooling and warming centers.

4.3.7.8 Relationship to other Hazards

Drought and Wildfire - Dry, hot conditions can reduce the protective moisture of woodlands and increase the risk of wildfire.

Public Safety - Anyone exposed to extreme heat can develop heat exhaustion and heat stroke. The elderly, children and those who engage in outdoor work or recreation may be most susceptible to the danger of extreme heat.

4.3.8 Hazardous Material Release

4.3.8.1 Hazard Description for Hazardous Material Release

The State of Indiana has numerous active transportation lines that run through many of its counties. Active railways transport harmful and volatile substances between our borders every day. The transportation of chemicals and substances along interstate routes is commonplace in Indiana. The rural areas of Indiana have considerable agricultural commerce, creating a demand for fertilizers, herbicides, and pesticides to be transported along rural roads. Finally, Indiana is bordered by two major rivers and Lake Michigan. Barges transport chemicals and substances along these waterways daily. These factors increase the chance of hazardous material releases and spills throughout the State of Indiana.

The release or spill of certain substances can cause an explosion. Explosions result from the ignition of volatile products such as petroleum products, natural and other flammable gases, hazardous materials and chemicals, dust, and bombs. An explosion potentially can cause death, injury, and property damage. In addition, a fire routinely follows an explosion, which may cause further damage and inhibit emergency response. Emergency response may require fire, safety and law enforcement, search and rescue, and hazardous materials units.

4.3.8.2 Hazardous Incident History in Morgan County

Morgan County has not experienced a significantly large-scale hazardous material incident at a fixed site or during transport resulting in multiple deaths or serious injuries, although there have been many minor releases that have put local firefighters, hazardous materials teams, emergency management, and local law enforcement into action to try to stabilize these incidents and prevent or lessen harm to Morgan County residents.

4.3.8.3 Geographic Location for Hazardous Material Release

The hazardous material hazards are countywide and are primarily associated with the transport of materials via highway, railroad, and/or river barge.

4.3.8.4 Hazard Extent for Hazardous Material Release

The extent of the hazardous material (referred to as hazmat) hazard varies in terms of the quantity of material being transported as well as the specific content of the container. Hazardous material impacts are an equally distributed threat across the entire jurisdiction; therefore, the entire county is vulnerable to a hazardous material release and can expect the same impacts within the affected area. The main concern during a release or spill is the population affected. This plan will therefore consider all buildings located within the county as vulnerable.

4.3.8.5 Risk Identification for Hazardous Material Release

In Meeting #2, the planning team determined that the probability of a hazardous materials release was highly likely with critical consequences. Hazardous materials releases were determined to have a warning time of less than six hours with a duration longer than 1 week. The calculated CPRI for hazardous material release in Morgan County is 3.7.

4.3.8.6 Vulnerability Analysis for Hazardous Materials Release

The hazardous material release hazards are countywide and primarily are associated with the transport of materials by highway and/or railroad. During a hazardous material release, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. The release or spill of certain substances can cause an explosion. Explosions result from the ignition of volatile products such as petroleum products, natural and other flammable gases, hazardous materials/chemicals, dust, and bombs. An explosion potentially can cause death, injury, and property damage. In addition, a fire routinely follows an explosion, which may cause further damage and inhibit emergency response.

4.3.8.7 GIS Hazmat Analysis

The U.S. EPA’s ALOHA (Areal Locations of Hazardous Atmospheres) model was utilized to assess the area of impact for an anhydrous ammonia release on the exit ramp from 37 north bound just southwest of the City of Martinsville.

ALOHA generates a threat zone area where a hazard (such as toxicity or thermal radiation) has exceeded a user-specified Level of Concern (LOC). ALOHA will display up to three threat zones overlaid on a single picture. Through the development of Acute Exposure Guideline Levels (AEGLs) are exposure guidelines designed to help responders deal with emergencies involving chemical spills or other catastrophic events where members of the public are exposed to a hazardous airborne chemical.

AEGLs are intended to describe the health effects on humans due to once-in-a-lifetime or rare exposure to airborne chemicals. The National Advisory Committee for AEGLs is developing these guidelines to help both national and local authorities, as well as private companies, deal with emergencies involving spills or other catastrophic exposures.

- **Zone 1 (AEGL 1):** Above this airborne concentration of a substance, it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure

- **Zone 2 (AEGL 2):** Above this airborne concentration of a substance, it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape
- **Zone 3 (AEGL 3):** Above this airborne concentration of a substance, it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

As the substance moves away from the source, the level of substance concentration decreases. Each color-coded area depicts a level of concentration measured in parts per million (ppm). Figure 56 is an illustration of the toxic threat plume footprint as determined by ALOHA.

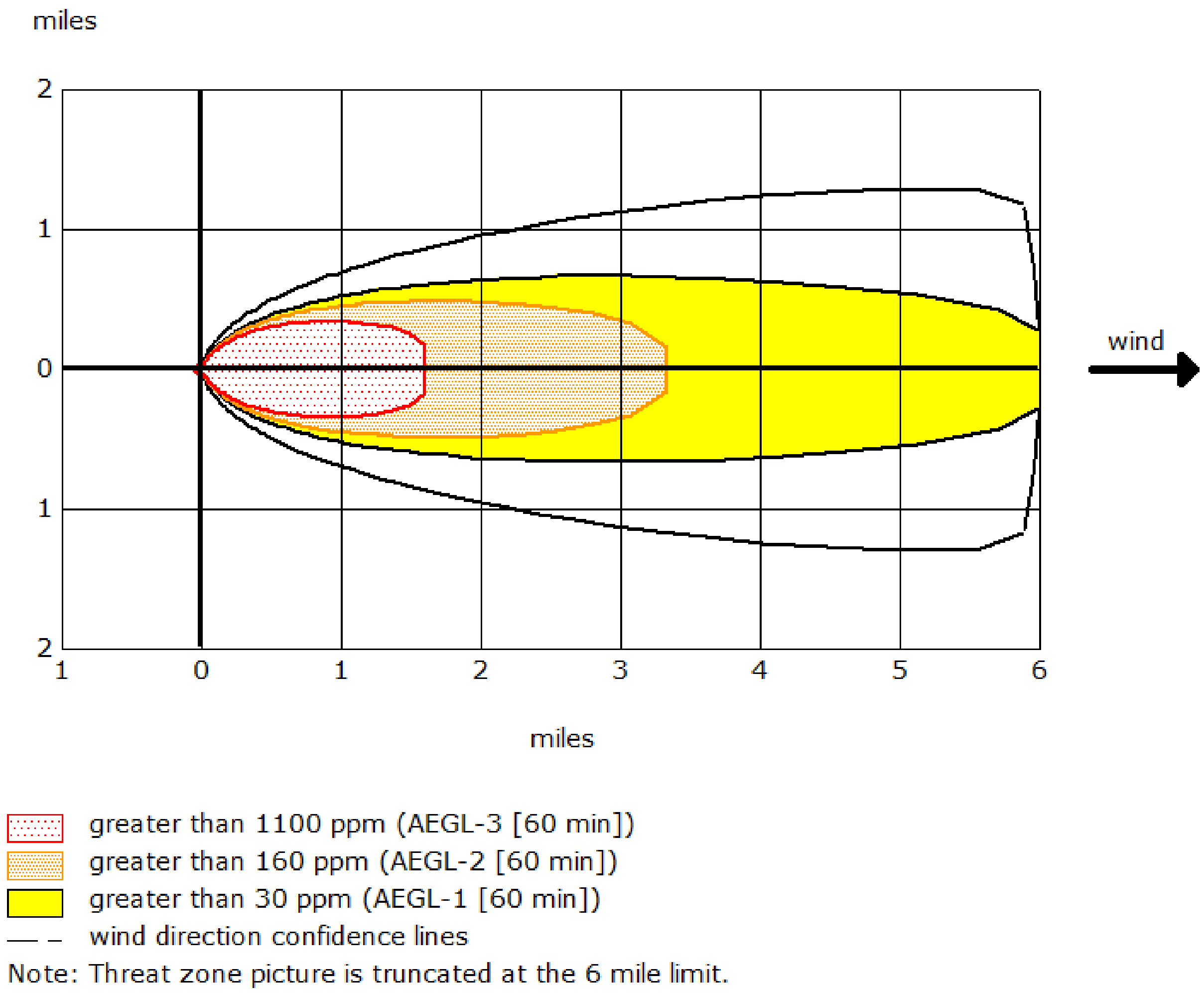


Figure 56. Toxic Threat Plume Footprint Generated by ALOHA

For this scenario, moderate atmospheric and climatic conditions with a slight breeze from the west were assumed, and the ALOHA atmospheric modeling parameters were based on the actual conditions at the location when the model was run including wind speed of 9 mph. The temperature was 63°F with 89% humidity and cloudy skies.

This modeled release was based on a leak from 2.5 feet-diameter hole in the tank. According to the ALOHA parameters, approximately 63,525 pounds of material would be released per minute. Figure 57 shows the location of the release.

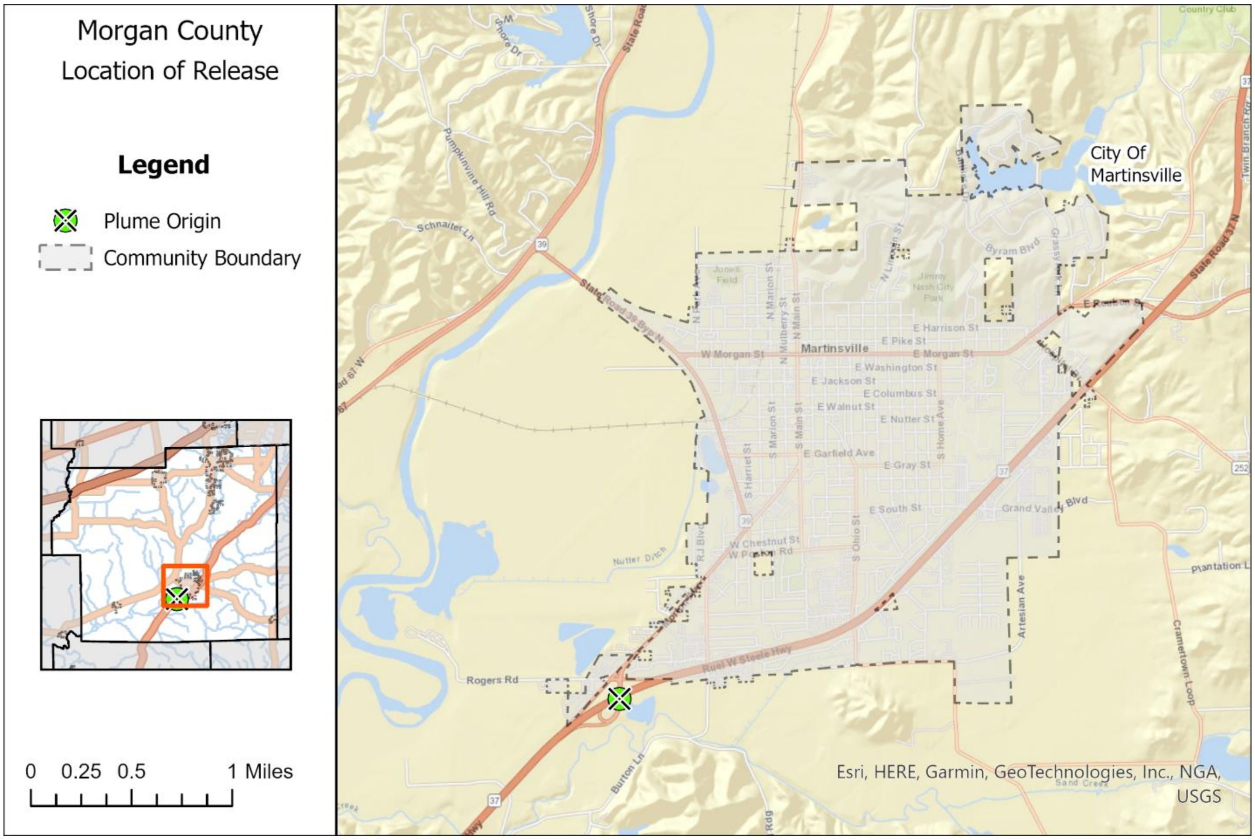


Figure 57. Location of Release

The Morgan County Building Inventory was added to ArcMap and overlaid with the threat zone footprint. The Building Inventory was then intersected with each of the three footprint areas to classify each point based upon the plume footprint in which it is located. Figure 58 depicts the Morgan County Building Inventory after the intersect process.

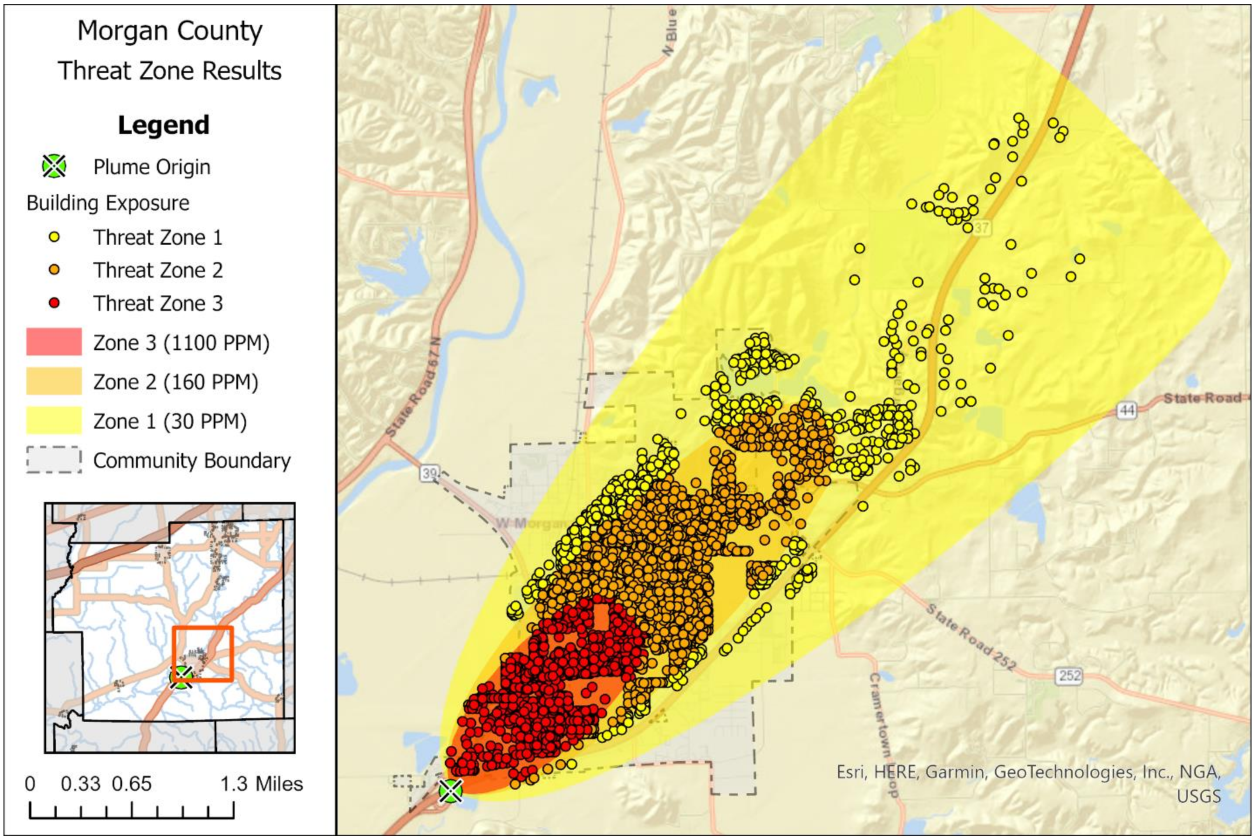


Figure 58. Location of Release and Building Inventory by Threat Zone

The results of the analysis against the Building Inventory counts are depicted in Table 31.

Table 31. Estimated Exposure for all Threat Zones

	Number of Buildings within the Hazmat Plume		
Occupancy	**AEGL 3 (most severe)**	**AEGL 2**	**AEGL 1 (least severe)**
Agriculture	-	1	19
Commercial	105	123	102
Education	1	-	-
Government	1	21	9
Industrial	-	11	2
Religious	8	30	7
Residential	837	1,698	528
Total	**952**	**1,884**	**667**

Essential Facilities

All facilities affected by the plume have been mapped and labeled in Figure 59. Table 32 lists all affected essential facilities. Appendix E contains a map and list of critical facilities that fall in the plume.

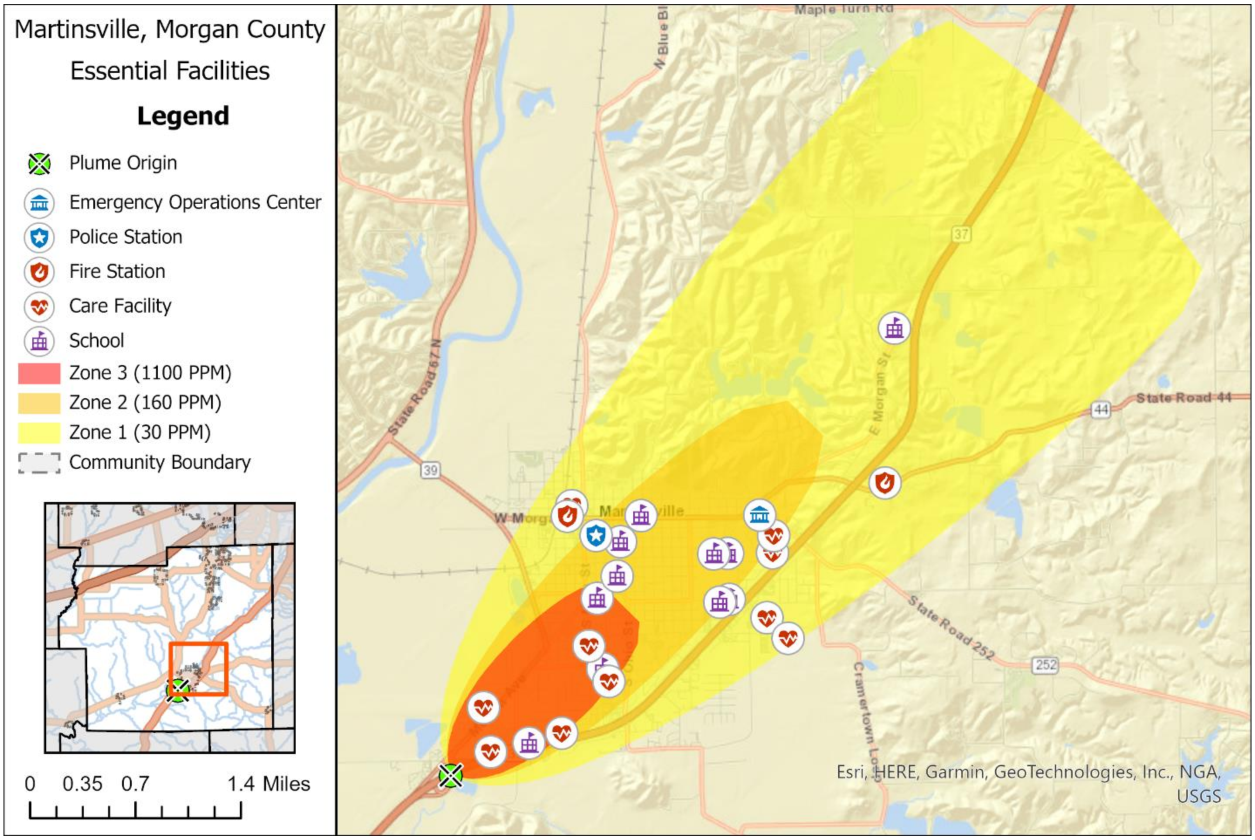


Figure 59. Essential Facilities Located in Threat Zone

Table 32. Essential Facilities

Facility Type	Facility Name
School	Bell Intermediate School
School	Charles L Smith Elem School
School	Footsteps Montessori Preschool
School	H Robert Hammons School
School	John R. Wooden Middle School
School	Martinsville High School
School	Martinsville School Administration
School	Poston Road Elementary School
School	Prince Of Peace Lutheran School
School	South Elementary School
School	Tabernacle Christian Schools
Emergency Center	Morgan County EMA
Fire Station	Martinsville Fire Dept
Fire Station	Washington Twp Fire Dept
Police Station	City Of Martinsville Police Dept
Care Facility	Fresenius Medical Care Morgan County

Facility Type	Facility Name
Care Facility	Grand Valley Gardens
Care Facility	Heritage Home Health Services Llc
Care Facility	IU Health Morgan Hospital
Care Facility	Kroger J907
Care Facility	Martinsville Wic Program
Care Facility	Save-A-Lot
Care Facility	Transitional Services Sub Llc
Care Facility	Wal Mart 1356
Care Facility	Waters Of Martinsville

4.3.8.8 Community Development Trends and Future Vulnerability

Because the hazardous material hazard events may occur anywhere within the county, future development will be impacted, especially development along major roadways. The major transportation routes and the industries located in Morgan County pose a threat of dangerous chemicals and hazardous materials release.

4.3.8.9 Relationship to other Hazards

Flood- Hazmat incidents are likely when flood incidents occur. Hazardous material storage containers can become compromised due to flooding.

4.3.9 Dam and Levee Failure

4.3.9.1 Hazard Definition for Dam and Levee Failure

Dams are structures that retain or detain water behind a large barrier. When full or partially full, the difference in elevation between the water above the dam and below creates large amounts of potential energy, creating the potential for failure. The same potential exists for levees when they serve their purpose, which is to confine flood waters within the channel area of a river and exclude that water from land or communities land-ward of the levee. Dams and levees can fail due to either 1) water heights or flows above the capacity for which the structure was designed; or 2) deficiencies in the structure such that it cannot hold back the potential energy of the water. If a dam or levee fails, issues of primary concern include loss of human life/injury, downstream property damage, lifeline disruption (of concern would be transportation routes and utility lines required to maintain or protect life), and environmental damage.

Many communities view both dams and levees as permanent and infinitely safe structures. This sense of security may well be false, leading to significantly increased risks. Both downstream of dams and on floodplains protected by levees, security leads to new construction, added infrastructure, and increased population over time. Levees are built to hold back flood waters only up to some maximum level, often the 100-year (1% annual probability) flood event. When that maximum is exceeded by more than the design safety margin, the levee will be overtopped or otherwise fail, inundating communities in the land previously protected by that levee. It has been suggested that climate change, land-use shifts, and some forms of river engineering may be increasing the magnitude of large floods and the frequency of levee failure situations.

In addition to failure that results from extreme floods above the design capacity, levees and dams can fail due to structural deficiencies. Both dams and levees require constant monitoring and regular maintenance to assure their integrity. Many structures across the U.S. have been under-funded or otherwise neglected, leading to an eventual day of reckoning in the form either of realization that the structure is unsafe or, sometimes, an actual failure. The threat of dam or levee failure may require substantial commitment of time, personnel, and resources. Since dams and levees deteriorate with age, minor issues become larger compounding problems, and the risk of failure increases.

Low-Head Dams

Another type of dam low-head, or in-channel, dams can present a safety hazard to the public because of their ability to trap victims in a submerged hydraulic jump formed just downstream from the dam. Recent deaths and injuries around these structures in the state, have brought the attention of this issue to the surface for local, state, and federal officials. Current initiatives led by the Indiana Silver Jackets—a multi-agency coalition that leverages efforts to address natural hazards—have focused on the identification of these dams statewide, as well as various efforts to notify the public on their dangers.

Non-Levee Embankments

Along with accredited levees regulated by federal agencies, there are also what are referred to as Non-Levee Embankments (NLE), which typically parallel to the direction of natural flow. An embankment is an artificial mound of soil or broken rock that supports railroads, highways, airfields, and large industrial sites in low areas, or impounds water. NLEs are often highways or railroads built on fill in low lying areas and thus tend to impose lateral constraints on flood flows, and typically contain the following characteristics:

- NLEs are elevated linear features adjacent to waterways and within the floodplain.
- They are typically man-made and include agricultural embankments built by landowners and road and railroad embankments banks.
- They are levee-like structures but are not certified or engineered to provide flood protection.

The National Committee on Levee Safety estimates that the location and reliability status of 85% of the nation’s NLEs are unknown. In Indiana, majority of NLEs are unidentified and are typically not maintained. NLEs impose lateral constraints on flood flows, reducing the floodplain storage capacity and increasing the flood velocity. As a result, downstream flooding and the potential for stream erosion can increase. As such, NLE's can give a false sense of security and protection to the people residing near NLEs. For these reasons, it is extremely important to map where these features are located.

Living with levees is a shared responsibility. While levees are in operation, maintaining levee systems are the levee sponsor responsibility. Local officials are adopting protocols and procedures for ensuring public safety and participation in the NFIP.

4.3.9.2 Dam and Levee Failure History in Morgan County

According to the Morgan County Hazard Analysis, there are no records or local knowledge of any dam or certified levee failure in the county.

4.3.9.3 Geographic Location for Dam and Levee Failure

A review of the IDNR dam database revealed 46 state regulated dams located in Morgan County. Table 32 summarizes the dam information and Figure 60 maps the dams on a county level. High hazard and in channel dams are individually mapped in the vulnerability section. A review of the Army Corp of Engineers (USACE) data shows the Martinsville levee system protecting the City of Martinsville. The levee is 2.79 miles long including 1.39 miles of embankment. There are, however, 248 non-levee embankments in the county that could be of concern to the planning team. They are mapped in Figure 61.

Table 33. Indiana Department of Natural Resources Dam Inventory

Dam Name	Hazard Rank	Emergency Action Plan?
Falcon Crest Lake Dam	High	Yes
Lake Deturk Dam	High	Yes
Patton Park Lake Dam	High	Yes
Wildwood Shores Lake Dam	High	Yes
Van Rooy Lake Dam	High	No
Whip-Poor-Will Dam	High	Yes
Whippoorwill Dam	High	Yes
Bradford Woods Lake Dam	High	Yes
Hart Lake Dam	High	Yes
Wildwood Conservancy District Dam	High	Yes
Lake Edgewood Dam	High	Yes
St. John Commons Dam	High	Yes
Lake Bodona Dam	High	Yes
Nebo Lake Dam	High	Yes
Bailey Lake Dam	High	Yes
Painted Hills Lake Dam	High	Yes
Upper Spring Lake Dam	High	Yes
Lower Woodland Lake Dam	Low	No

Dam Name	Hazard Rank	Emergency Action Plan?
West Fork White River Dam (In-Channel)	Low	No
Tall Oaks Lake Dam	Low	No
Fankboner Lake Dam	Low	No
Stockton Lake Dam	Low	No
Whitley Lake Dam	Low	No
John Meding Lake Dam	Low	No
Kivett Lake Dam	Low	No
Tackett Lake Dam	Low	No
Armstrong Lake Dam	Low	No
Lake Dillman Dam (Upper)	Low	No
Parker Lake	Low	No
Janke Lake Dam	Low	No
Satter Dam	Low	No
Luther'S Dam	Low	No
Foxcliff Lake Dam #1	Low	No
Paragon Lake Dam	Low	No
Yours, Mine & Ours Lake Dam	Low	No
Lake Dillman Dam (Lower)	Low	No
Durham Drive Lake	Low	No
Truman Harless Lake Dam	Low	No
Pritchard Park Dam	Significant	No
Echo Lake Dam	Significant	No
Paradise Lake Dam No. 1 (Lower)	Significant	No
Amy Lake Dam	Significant	No
Dalton Dam	Significant	No
Leona Lake Dam	Significant	No
Vandenbark Dam	Significant	No
Paradise Lake Dam No. 2 (Upper)	Significant	No

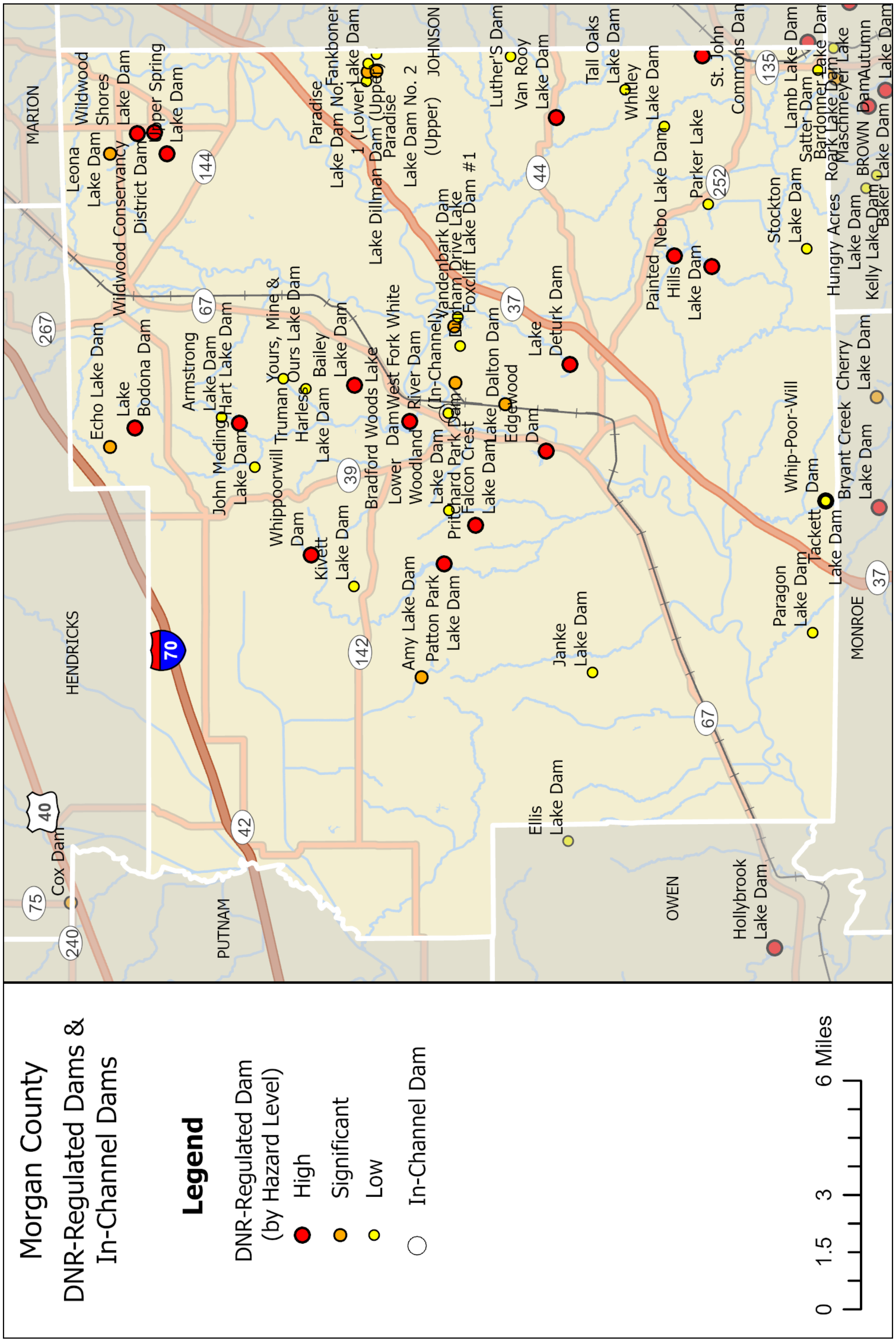


Figure 60. Morgan County DNR Regulated Dams with Hazard Classification

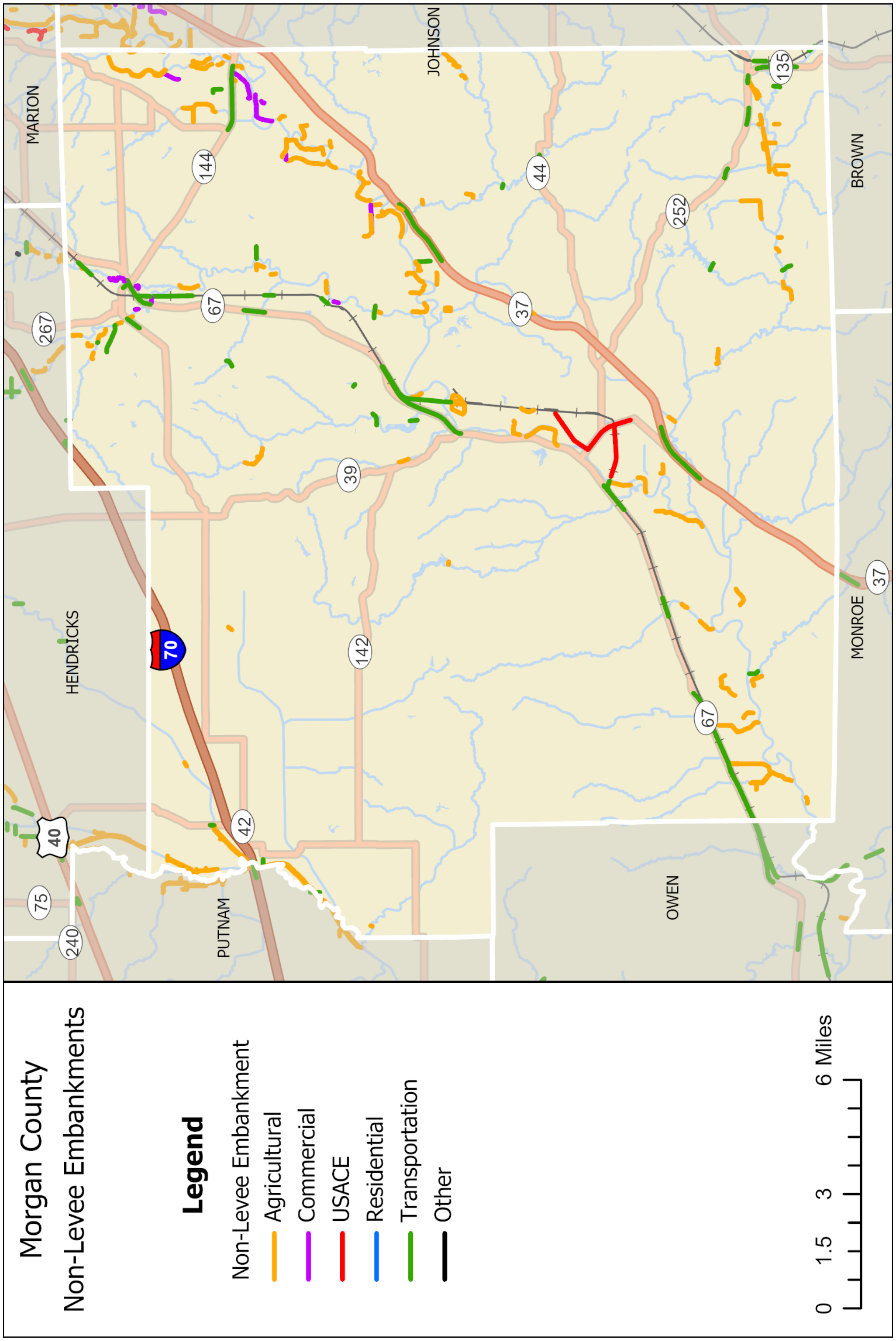


Figure 61. Morgan County Non-Levee Embankments

4.3.9.4 Hazard Extent for Dam and Levee Failure

When dams are assigned the low (L) hazard potential classification, it means that failure or incorrect operation of the dam will result in no human life losses and no economic or environmental losses. Losses are principally limited to the owner's property. Dams assigned the significant (S) hazard classification are those dams in which failure or incorrect operation results in no probable loss of human life; however, it can cause economic loss, environmental damage, and disruption of lifeline facilities. Dams classified as significant hazard potential dams are often located in predominantly rural or agricultural areas but could be in populated areas with a significant amount of infrastructure. Dams assigned the high (H) hazard potential classification are those dams in which failure or incorrect operation has the highest risk to cause loss of human life and significant damage to buildings and infrastructure.

According to IDNR and the National Inventory of Dams, 17 dams were classified as high hazard, and 16 of them recorded as having an Emergency Action Plan (EAP). An EAP is not required by the State of Indiana but is strongly recommended in the 2007 Indiana Dam Safety & Inspection Manual.

Accurate mapping of the risks of flooding behind levees depends on knowing the condition and level of protection the levees provide. FEMA and the U.S. Army Corps of Engineers are working together to make sure that flood hazard maps clearly reflect the flood protection capabilities of levees, and that the maps accurately represent the flood risks posed to areas situated behind them. Levee owners—usually states, communities, or in some cases private individuals or organizations—are responsible for ensuring that the levees they own are maintained according to their design. In order for a dam or levee to be considered a creditable flood protection structure on FEMA's flood maps, levee owners must provide documentation to prove the levee meets design, operation, and maintenance standards for protection against the one-percent-annual-chance flood.

4.3.9.5 Risk Identification for Dam and Levee Failure

In Meeting #2, the planning team determined that the probability of dam or levee failure is critical, with dam failure having limited consequences and levee failure having negligible consequences. The warning time for dam or levee failure is less than 6 hours with a duration of less than 24 hours. The calculated CPRI for dam or levee failure is 2.6.

4.3.9.6 Vulnerability Analysis for Dam and Levee Failure

As mentioned above, 16 dams within Morgan County are high-hazard dams with an EAP. Information about these dams is detailed below.

Bailey Lake Dam is a privately owned dam located southwest of the Town of Bethany. It was built in 1973, has a height of 23 feet, and a surface area of 6.5 acres. Its inundation area is shown in Figure 62. Structures located within the inundation zone are mostly residential. No essential facilities are within the inundation zone.

Falcon Crest Lake Dam is a privately owned dam located northwest of the City of Martinsville. It was built in 1992, has a height of 32.3 feet, and a surface area of 20 acres. Its inundation area is shown in Figure 63. The few structures located within its inundation zone are mostly residential. No essential facilities are within the inundation zone.

Bradford Woods Lake Dam is a privately owned dam located north of the City of Martinsville. It was built in 1960, has a height of 59 feet, and a surface area of nearly 106 acres. Its inundation area is shown in Figure 64. Very few structures and no essential facilities are located within its inundation zone.

Hart Lake Dam is a local government owned dam located between the Towns of Monrovia and Mooresville. It was built in 1950, has a height of 34 feet, and a surface area of 21 acres. Its inundation area is shown in Figure 65. A few residential structures and no essential facilities are located within its inundation zone.

Lake Bodona Dam is privately owned dam located between the Towns of Mooresville and Monrovia. It was built in 1945, has a height of 28 feet, and a surface area of almost 11 acres. Its inundation area is shown in Figure 66. A single residential structure and no essential facilities are located within its inundation zone.

Lake Deturk Dam is a local government owned dam located north of the City of Martinsville. It was built in 1972, has a height of 30 feet and a surface area of 29 acres. Its inundation area is shown in Figure 67. Many residential and a few agricultural structures are located within its inundation zone. No essential facilities are located within the inundation zone.

Lake Edgewood Dam is a privately owned dam located northwest of the City of Martinsville. It was built in 1959, has a height of 29 feet, and a surface area of 53 acres. The dam’s inundation area generally goes south towards the City of Martinsville. While the northwestern tip of the City is protected by a levee, it is unclear that the levee will protect that area from a dam breach. The inundation area expands south, west of the city, following the West Fork White River. A digital version of the inundation area was not available; however, the general path of the inundation area was hand-drawn on the map. Figure 68 shows the location of the dam and nearby buildings.

Nebo Lake Dam is a privately owned dam located between the City of Martinsville and the Town of Morgantown. It was built in 1954, has a height of 60 feet, and a surface area of 46 acres. Its inundation area is shown in Figure 69. Two residential buildings, a handful of agricultural buildings, and no essential facilities are located within the inundation zone.

Painted Hills Lake Dam is a privately owned dam located between the City of Martinsville and the Town of Morgantown. It was built in 1970, has a height of 62 feet, and a surface area of 110 acres. Its inundation area is shown in Figure 69. A handful of agricultural buildings and no essential facilities are located within the inundation zone.

Patton Park Lake Dam is a privately owned dam located northwest of the City of Martinsville. It was built in 1935, has a height of 28 feet, and a surface area of 97 acres. Its inundation area is shown in Figure 70. A few buildings, mostly residential, and no essential facilities are located within the inundation zone.

St. John Commons Dam is a privately owned dam located just north of the Town of Morgantown. It was built in 2002, has a height of 29 feet, and a surface area of 15 acres. The dam's inundation area goes south towards the northern edge of the Town of Morgantown, then follows the edge of the town southwest until it ends just north of the retention ponds southwest of town. A digital version of the inundation area was not available; however, the general path of the inundation area was hand-drawn on the map. Figure 71 shows the location of the dam and nearby buildings. A few residential and agricultural buildings appear to be in the inundation area.

Upper Spring Lake Dam is a privately owned dam located east of the Town of Mooresville. It was built in 1964, has a height of 21 feet, and a surface area of almost 6 acres. Its inundation area is shown in Figure 72. A few buildings, both residential and agricultural, and no essential facilities are located within the inundation zone.

Whippoorwill Dam is a privately owned dam located south of the Town of Monrovia. It was built in 1945, has a height of 40 feet, and a surface area of 20 acres. Its inundation area is shown in Figure 73. A handful of residential buildings and no essential facilities are located within the inundation zone.

Whip-Poor-Will Dam is a privately owned dam located south of the City of Martinsville near the Monroe County line. It was built in 1956, has a height of 28 feet, and a surface area of 5 acres. Its inundation area is shown in Figure 74. No buildings or essential facilities are located within the inundation zone.

The Wildwood Shores Lake Dam and Wildwood Conservancy District Dam are located southeast of the Town of Mooresville. The Wildwood Shores Lake Dam is a privately owned dam built in 1974 with a height of 23 feet and a surface area of 4 acres. The Wildwood Conservancy District Dam is a local government owned dam built in 1964 with a height of 34 feet and a surface area of 23 acres. Their inundation area is shown in Figure 75. A few residential buildings and no essential facilities are located within their inundation zone.

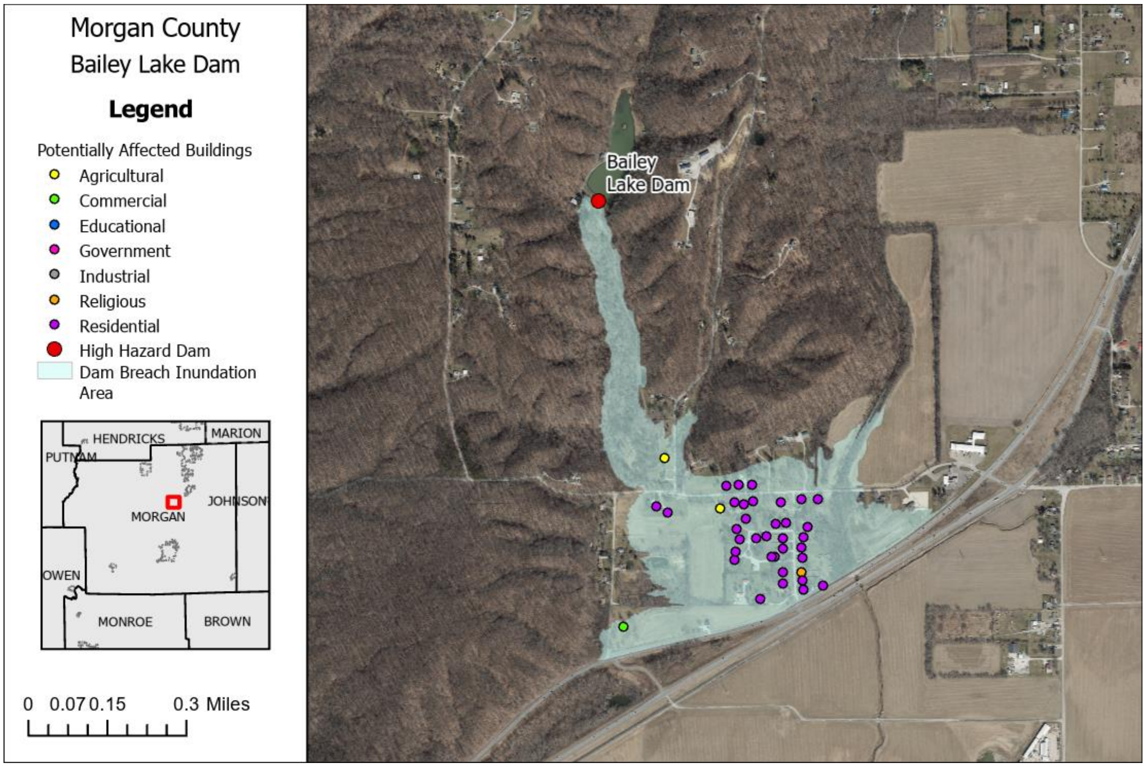


Figure 62. Bailey Lake Dam

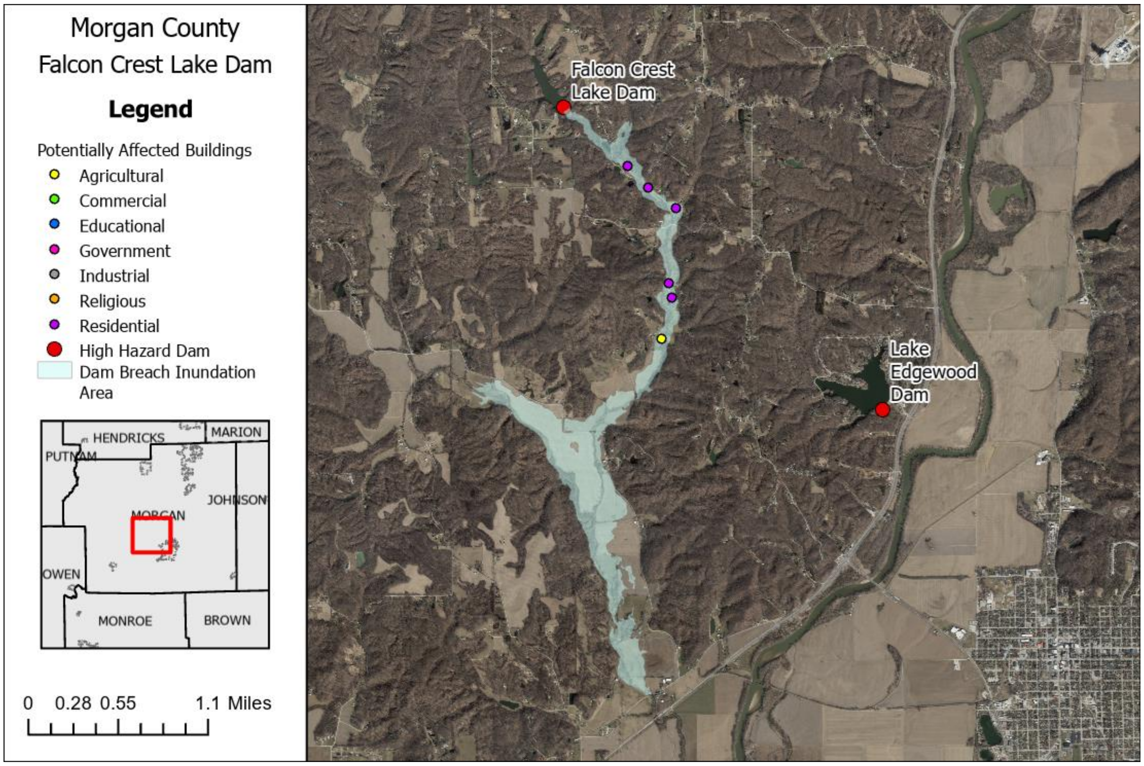


Figure 63. Falcon Crest Lake Dam

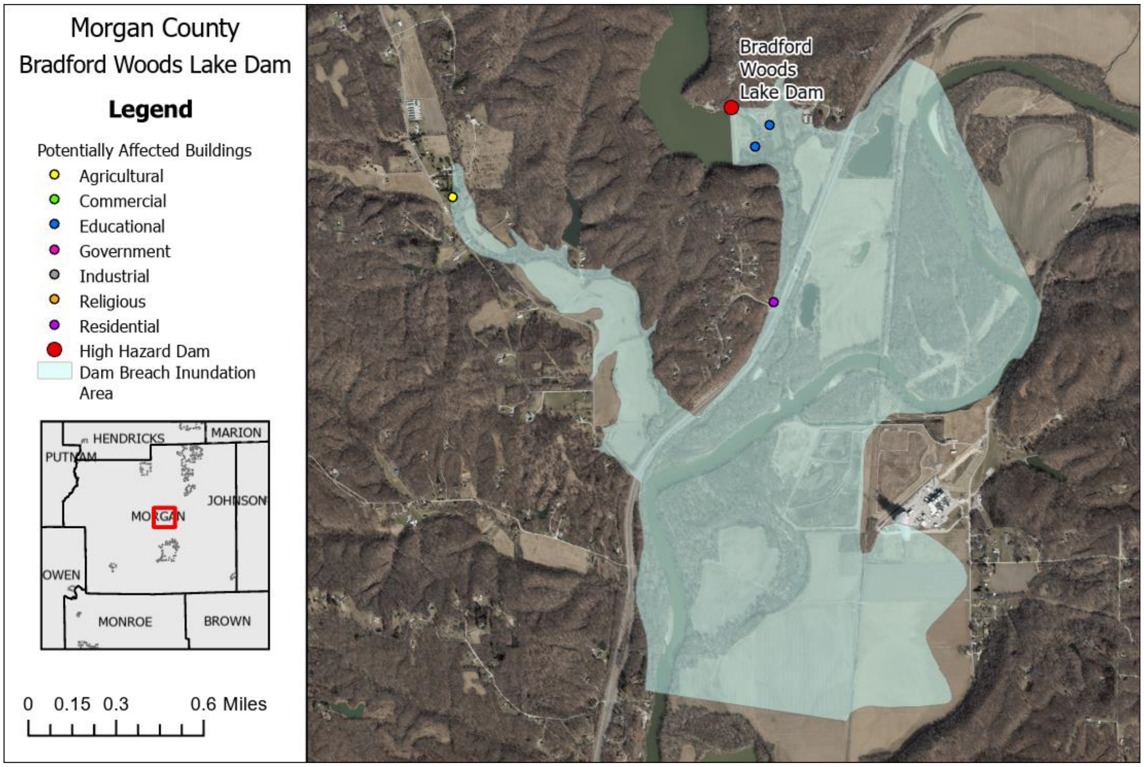


Figure 64. Bradford Woods Lake Dam

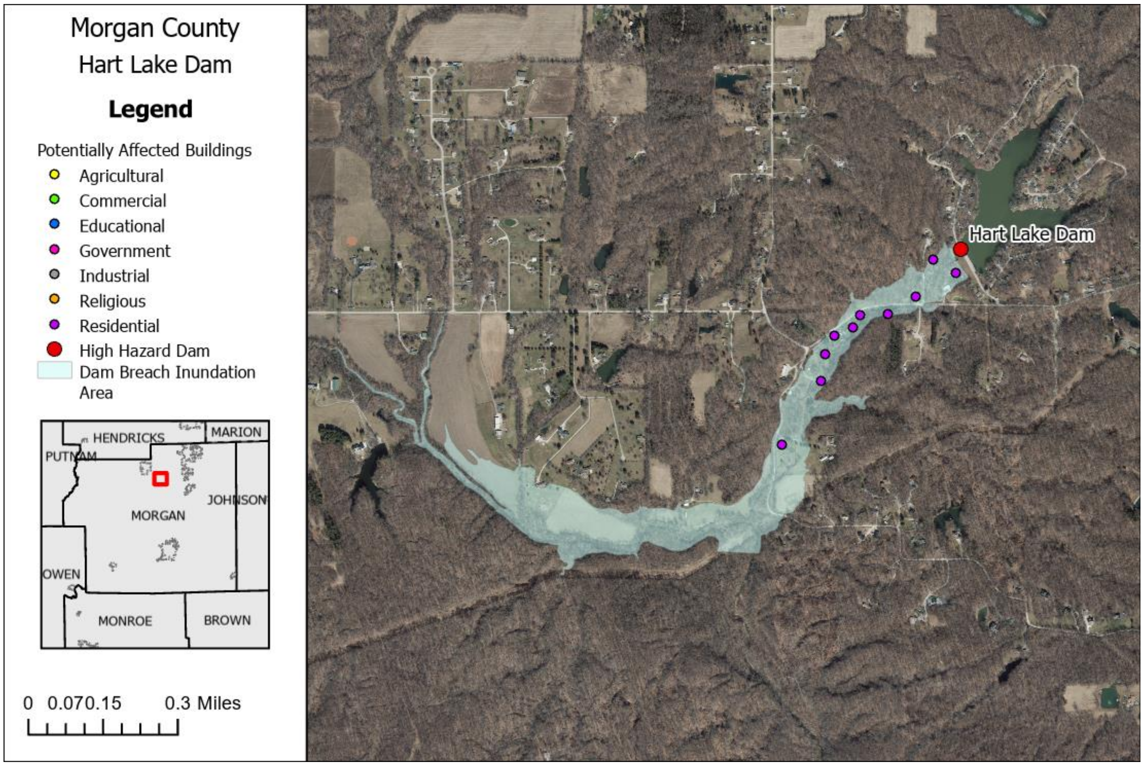


Figure 65. Hart Lake Dam

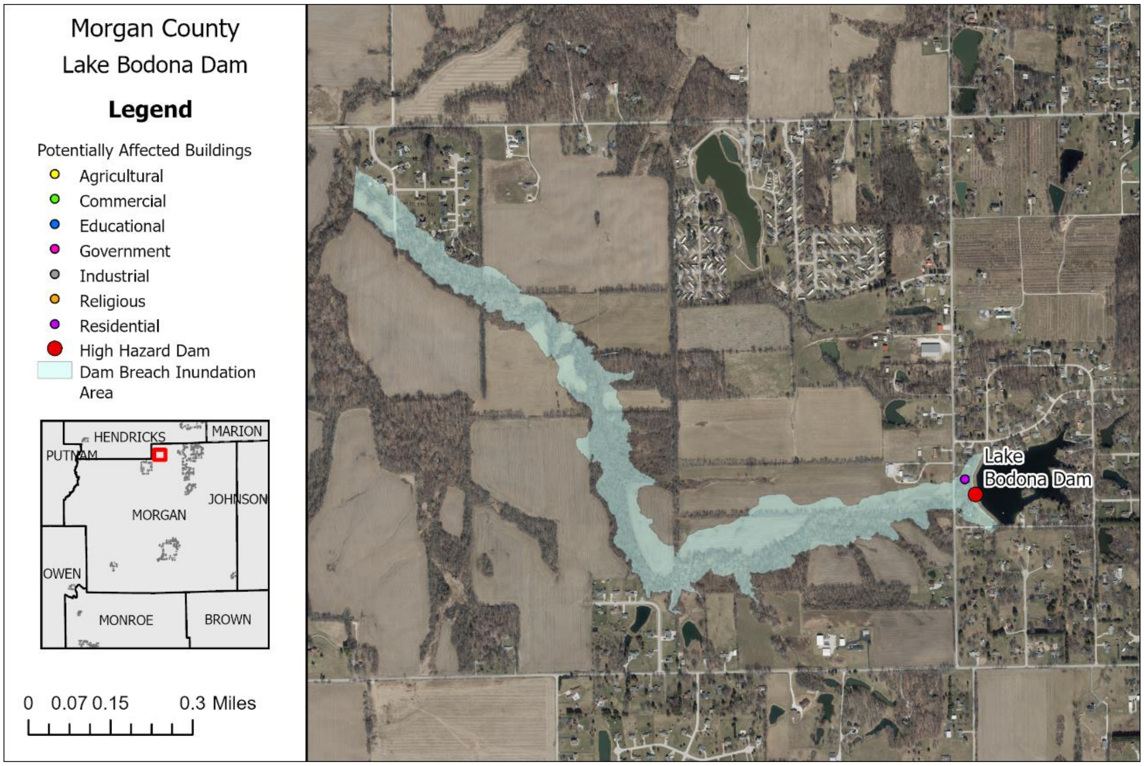


Figure 66. Lake Bodona Dam

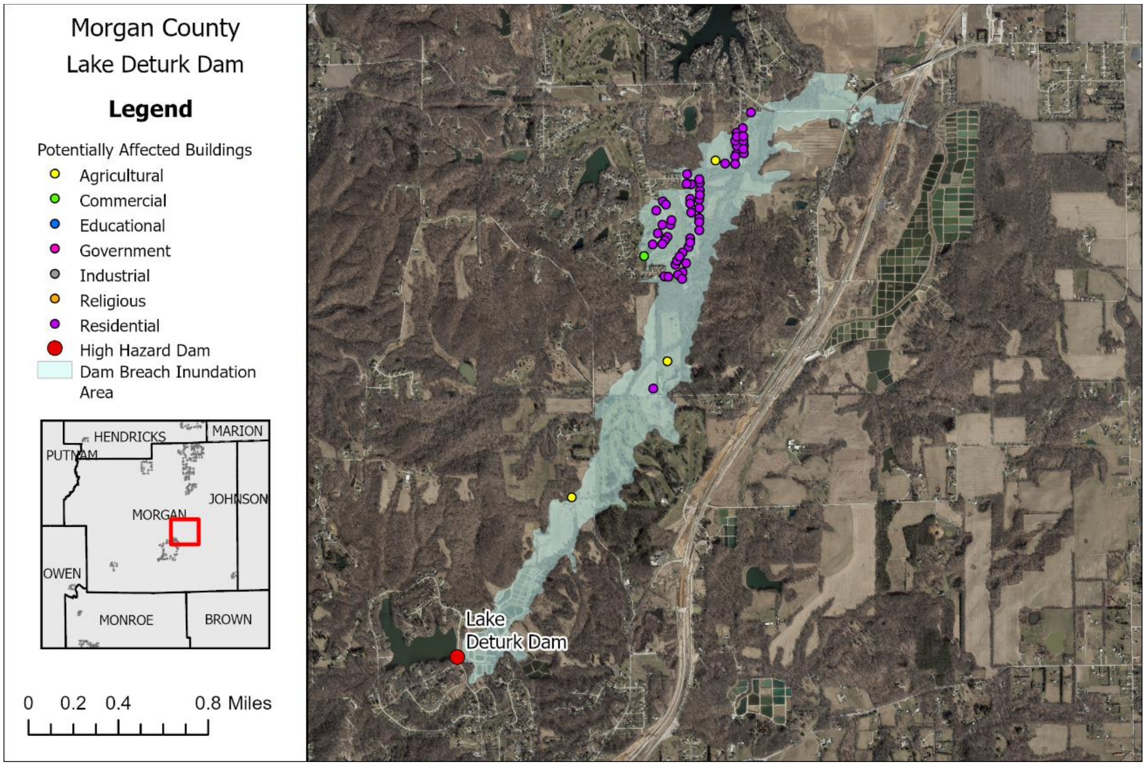


Figure 67. Lake Deturk Dam

Figure 68. Lake Edgewood Dam

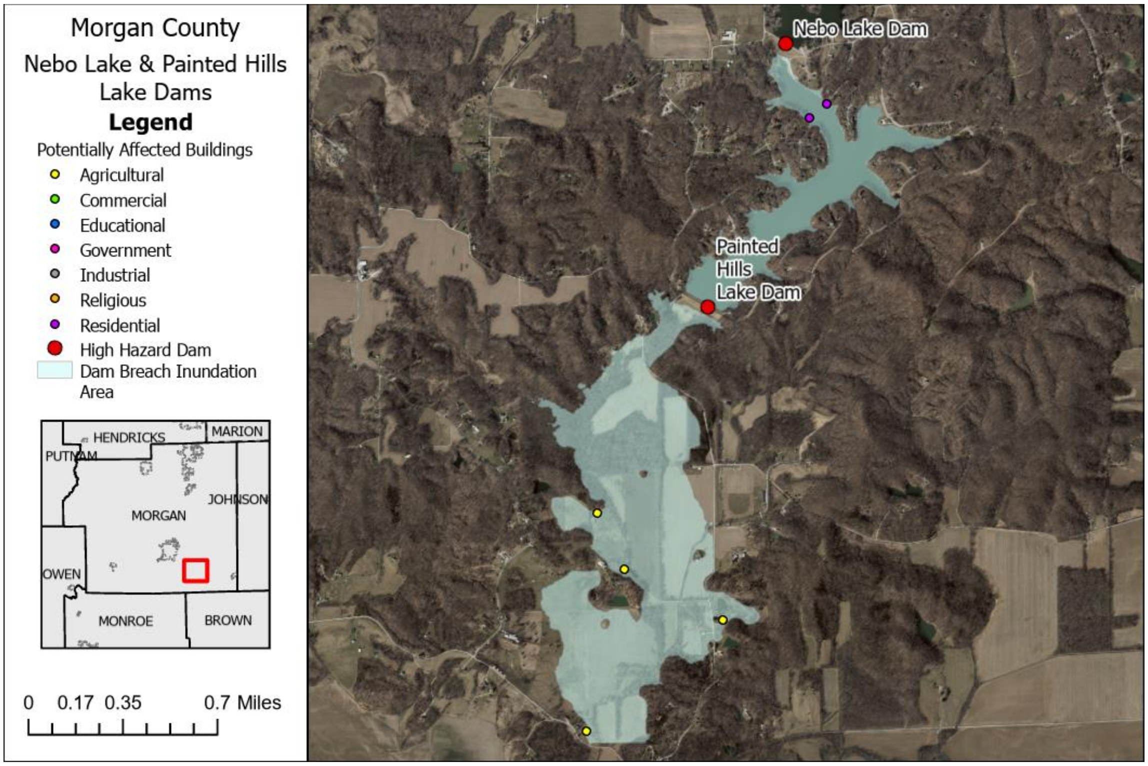


Figure 69. Nebo Lake & Painted Hills Lake Dams

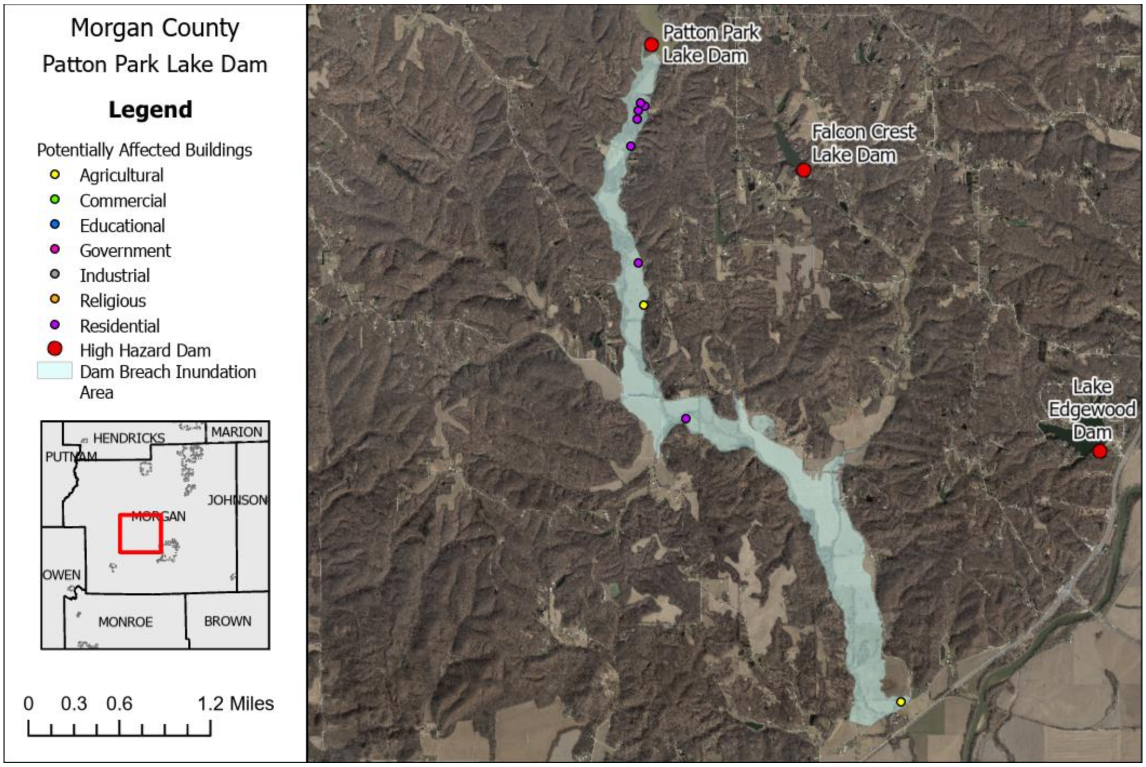


Figure 70. Patton Park Lake Dam

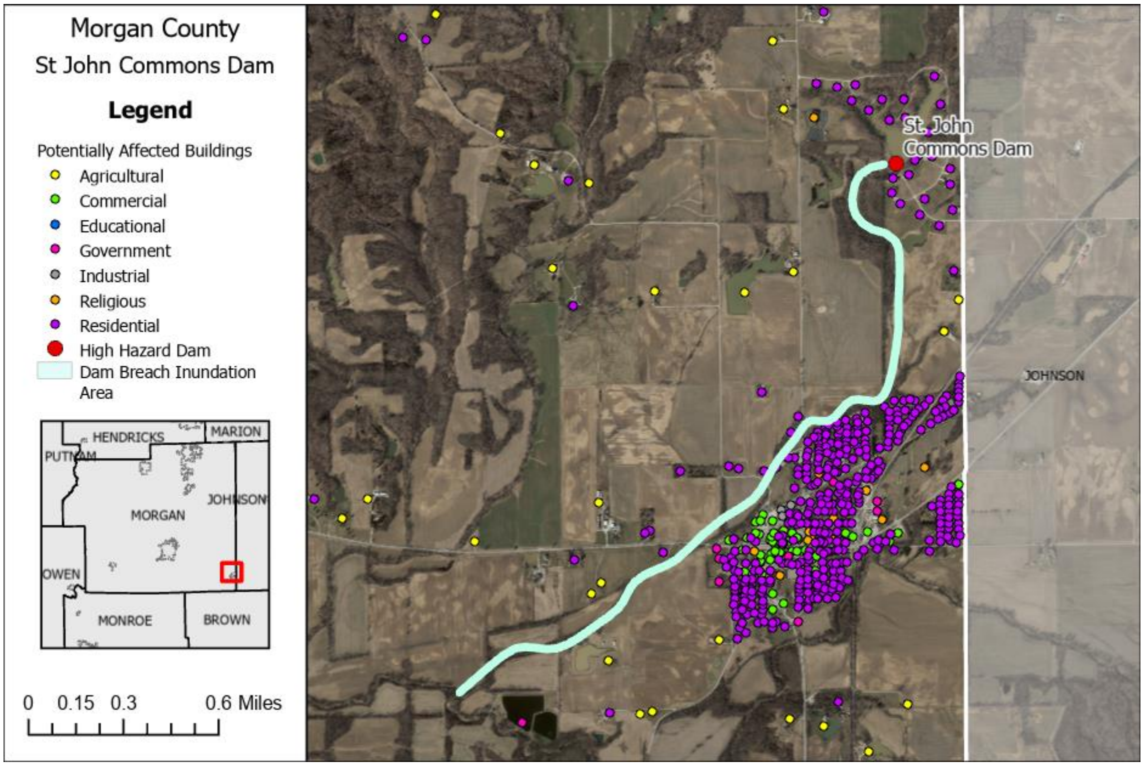


Figure 71. St John Commons Dam

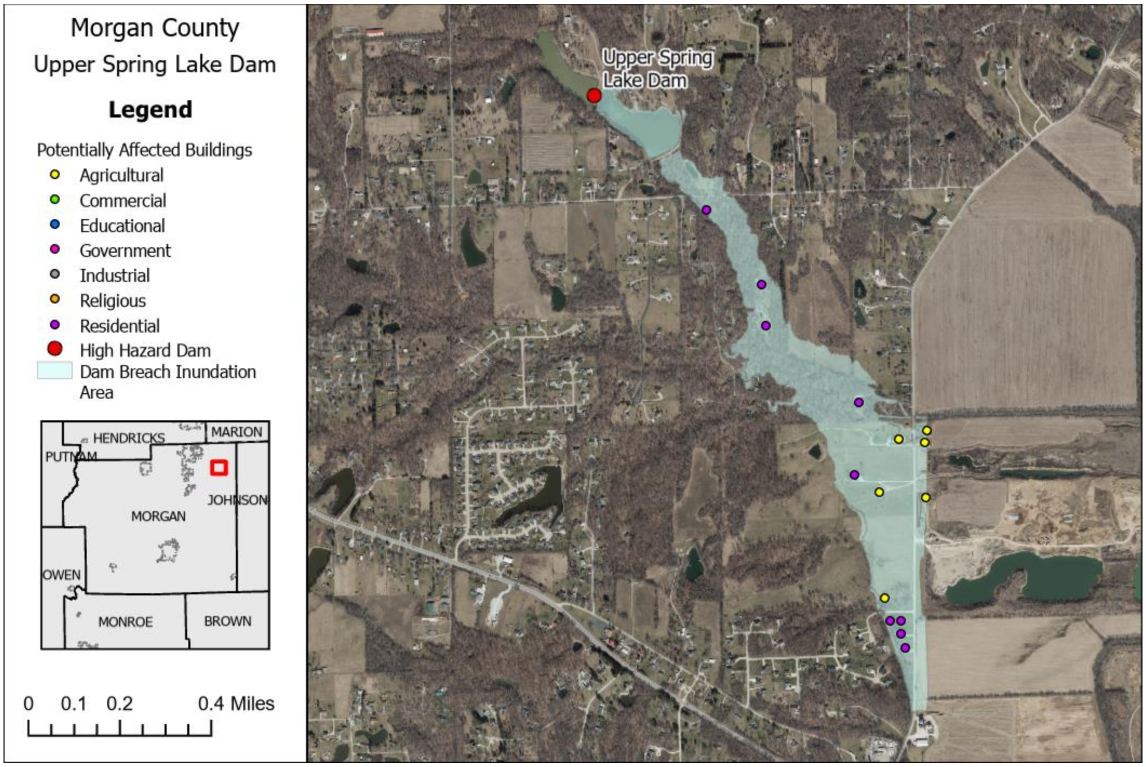


Figure 72. Upper Spring Lake Dam

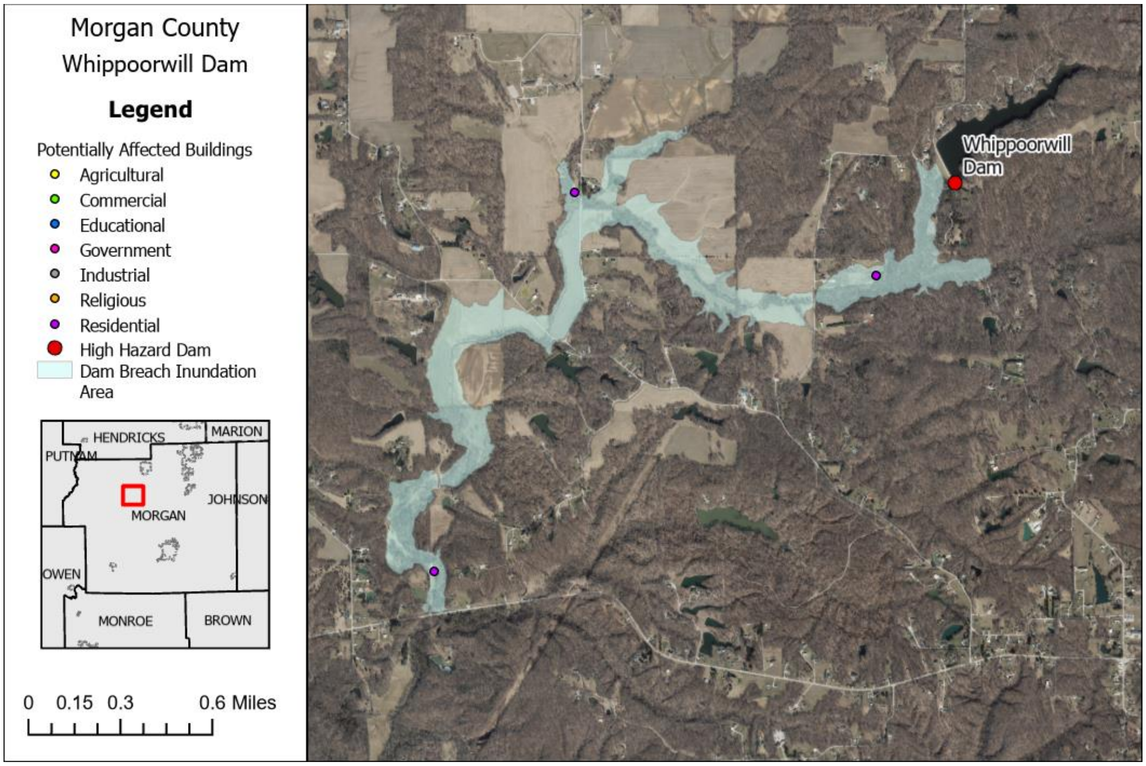


Figure 73. Whippoorwill Dam

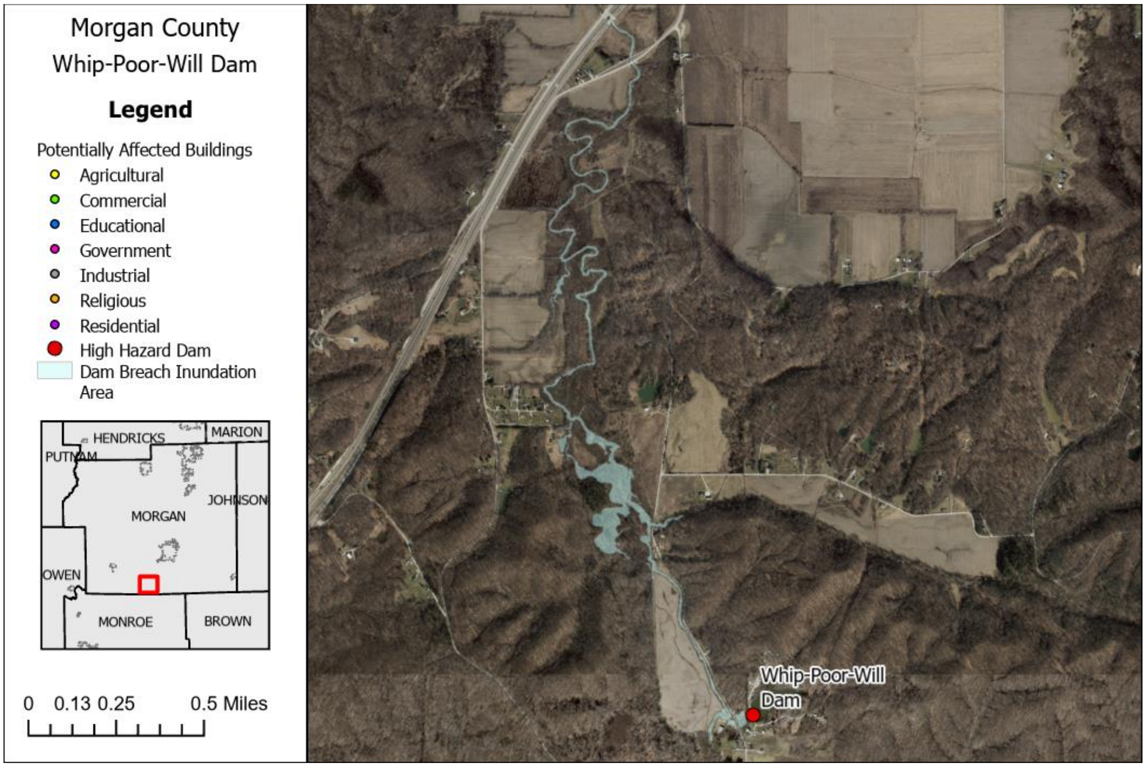


Figure 74. Whip-Poor-Will Dam

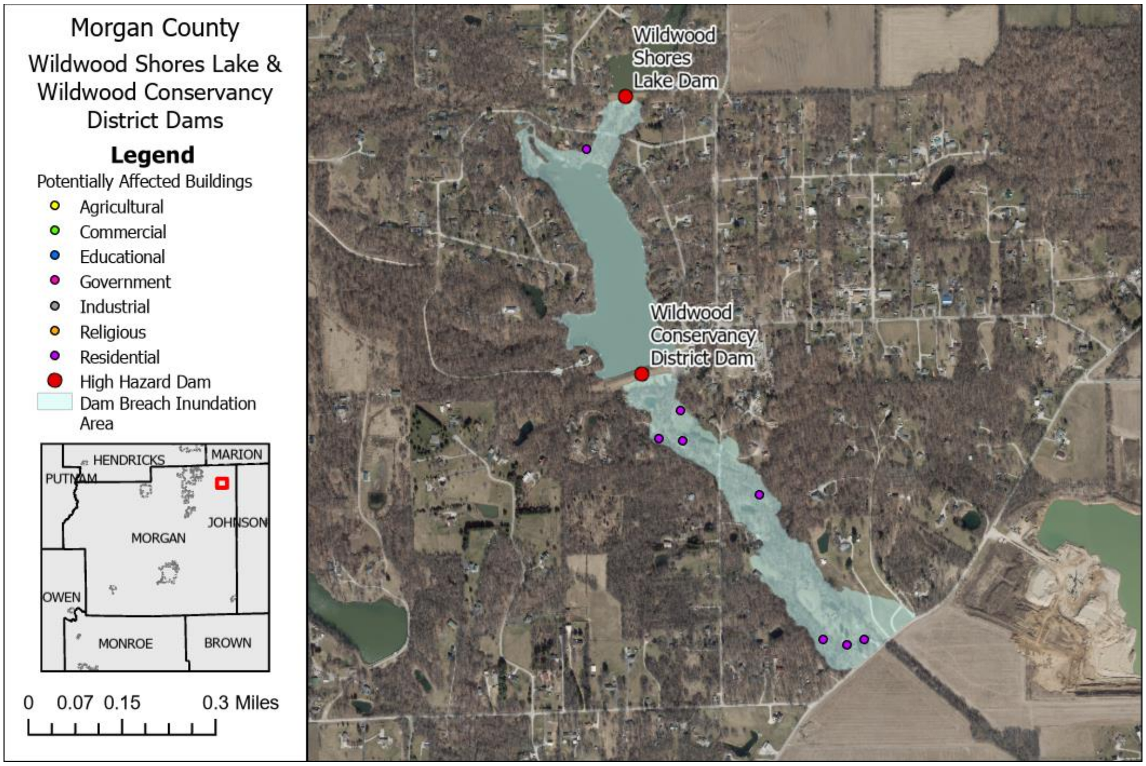


Figure 75. Wildwood Shores Lake & Wildwood Conservancy District Dams

In addition to the high hazard dam, there is an in-channel dam listed in the IDNR dam database. In-channel dams pose a different type of threat to the county as they can easily trap incautious river goers in their strong currents.

The extent of potential levee failure varies across the county. To be considered creditable flood protection structures on FEMA's flood maps, levee owners must provide documentation to prove the levee meets design, operation, and maintenance standards for protection against the "one-percent-annual chance" flood. If this accreditation is maintained, portions that would be mapped as Special Flood Hazard Area appear on a FIRM map as Zone X, protected by levee. A review of the USACE and FEMA data identified the Martinsville levee in Morgan County. Figure 26 shows the area in Martinsville that is protected by the levee. As mentioned previously, Morgan County has several Non-Levee Embankments that were mapped as part of a statewide project. While these NLEs cannot be regulated, they none the less can affect the flow of flood waters. Morgan County showed no significant NLEs near major areas of population or essential facilities.

4.3.9.7 Community Development Trends and Future Vulnerability

The county recognizes the importance of maintaining its future assets, infrastructure, and residents. Inundation maps can highlight the areas of greatest vulnerability in each community. The Morgan County Planning Commission reviews new development for compliance with the local zoning ordinance.

4.3.9.8 Relationship to Other Hazards

Flooding – Flooding is typically the leading cause of dam or levee failure incidents.

Drought – Property owners living around dams may have problems accessing boating equipment during times of drought.

4.3.10 Wildfire

4.3.10.1 Hazard Definition for Wildfire

The hazard extent of wildfires is greatest in the heavily forested areas of southern Indiana. The IDNR Division of Forestry assumes responsibility for approximately 7.3 million acres of forest and associated wild lands, including state and privately-owned lands. Indiana’s wildfire seasons occur primarily in the spring—when the leaf litter on the ground dries out and before young herbaceous plants start to grow and cover the ground (green up)—and in the fall—after the leaves come down and before they are wetted down by the first heavy snow. During these times, especially when weather conditions are warm, windy, and with low humidity, cured vegetation is particularly susceptible to burning. When combined, fuel, weather, and topography, present an unpredictable danger to unwary civilians and firefighters in the path of a wildfire. Human action can not only intervene to stop the spread of wildfires but can also mitigate their onset and effects. Forest and grassland areas can be cleared of dry fuel to prevent fires from starting and can be burned proactively to prevent uncontrolled burning.

4.3.10.2 Wildfire History in Morgan County

There have been no recently recorded wildfires or damages from wildfires reported in Morgan County.

4.3.10.3 Geographic Location for Wildfire

Wildfires can affect any area of the county that may be experiencing a drought.

4.3.10.4 Hazard Extent for Wildfire

Wildfires can be widespread or localized events.

4.3.10.5 Risk Identification for Wildfire

In Meeting #2, the planning team determined that the probability of a wildfire is likely with critical consequences. The warning time for a wildfire is less than 6 hours with a duration of less than 24 hours. The calculated CPRI for wildfire is 3.05.

4.3.10.6 Vulnerability Analysis for Wildfire

Residential, commercial, and recreational areas are all vulnerable to wildfires. Areas of concentrated vegetation such as national parks or forests can be exceptionally vulnerable to wildfire.

4.3.10.7 Community Development Trends and Future Vulnerability

Because wildfire hazard events may occur anywhere within the county, future development will be impacted. Major future development areas will be supplied with water distribution, including hydrants for fire protection.

4.3.10.8 Relationship to other Hazards

Flooding and Erosion – Wildfires can eliminate vegetation and pose an increased risk to flooding and erosion effects.

Drought and Extreme Heat – Dry, hot conditions can reduce the protective moisture of woodlands and increase the risk of wildfire.

Hazardous Material Release – Storage tanks carrying chemicals including chlorine, anhydrous ammonia, and fuel tanks located at farms pose an increased risk to wildfire ignition.

4.3.11 Infectious Agents or Harmful Organisms

4.3.11.1 Hazard Definition for Infectious Agents or Harmful Organisms

The spread of harmful organisms and infectious agents are occasionally overlooked, potential natural hazards that can be exacerbated following other natural disasters. This hazard can include invasive species, such as the Emerald ash borer, or vector-borne diseases, such as West Nile fever.

Emerald Ash Borer

The Emerald ash borer (EAB), Agrilus planipennis, is an exotic beetle thought to have arrived in the United States by 2002 and was discovered near Detroit, Michigan. Indiana was one of the next states recognized to have the beetle, having been discovered in northern Indiana in 2004. The adult beetles do not pose harm to the ash trees, as they nibble on ash foliage. The immature, or larvae stage, feed on the inner bark of the ash trees, disrupting its ability to transport nutrients and water. The EAB is responsible for killing millions of ash trees in North America. It has cost municipalities, property owners, nursery owners, and forest industries millions of dollars.

Vector-Borne Illness

Vector-borne diseases are caused by infectious microorganisms that are transmitted to people via living organisms including blood-sucking arthropods such as mosquitos, ticks, fleas, and spiders. Natural disasters, particularly meteorological events such as cyclones, hurricanes, and flooding, can influence transmission of vector-borne disease. The crowding of infected and vulnerable hosts, a debilitated public health infrastructure, and disruptions of ongoing control processes are risk factors for transmission of vector-borne disease. The Indiana State Department of Health (ISDH) identifies sleeping sickness (Eastern equine encephalitis virus), La Crosse encephalitis (La Crosse virus), St. Louis encephalitis (St. Louis encephalitis virus), West Nile fever (West Nile virus), and dengue fever (dengue virus), as mosquito-borne diseases that Hoosiers should take steps to protect themselves against.

The health department has also reported more than 200 cases of tick-borne illness in Indiana in 2016 alone. The ISDH highlighted Lyme disease, Rocky Mountain spotted fever (RMSF), and Erlichiosis as tick-borne diseases particularly prevalent in Indiana. Over the past few years, Indiana has experienced a rise in tick-borne infections. There were 36 cases of RMSF in 2014 but 80 in 2018. There were approximately 26 cases of Lyme disease in 2006, 112 cases in 2014, and 155 cases in 2018. Increased summer tick populations frequently follow mild winters, and back-to-back mild winters can cause a notable surge in tick numbers, along with the diseases they carry. In June of 2017, a young Indiana girl died after contracting Rocky Mountain spotted fever from a tick bite. Recently, a new tick-transmitted virus has made headlines through the state. The Centers for Disease Control confirmed two cases of Heartland virus in Indiana. Both infected patients survived.

4.3.11.2 Infectious Agents or Harmful Organisms History in Morgan County

Emerald Ash Borer

EAB has been detected in Morgan County, Indiana. As of 2017, the entire state of Indiana lies within the Federal quarantine boundaries , which limits moving firewood and other ash wood materials in infested areas. However, The US Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) has proposed remove the federal domestic EA quarantine regulations as they have proved ineffective. Indiana lifted its EAB quarantine in October 2016.

Vector-Borne Illness

Mosquitoes carrying West Nile virus have been found in Morgan County. Most people who get infected with West Nile virus will have either no symptoms or mild symptoms, but a few individuals may contract a more severe form of the disease.

4.3.11.3 Geographic Location for Infectious Agents or Harmful Organisms

Emerald Ash Borers are most found in forested areas but can also negatively impact neighborhoods or any other areas that have trees.

Mosquitos are drawn to areas of standing water and are commonly most active at dusk and dawn; however, all areas are affected by mosquito populations.

4.3.11.4 Hazard Extent for Infectious Agents or Harmful Organisms

An exposure analysis identifies the existing and future assets located in identified hazard areas. The areas with reported identification of the EAB in Morgan County are identified in Figure 76 with magenta dots. The points shown are collected from DNR annual surveys and from the DNR Division of Entomology and Plant Pathology field staff. According to the Department of Natural Resources, a live larva must be collected from an ash tree and identified by a trained specialist to confirm the presence of EAB at the marked location. There may be more locations with EAB that have not been identified.

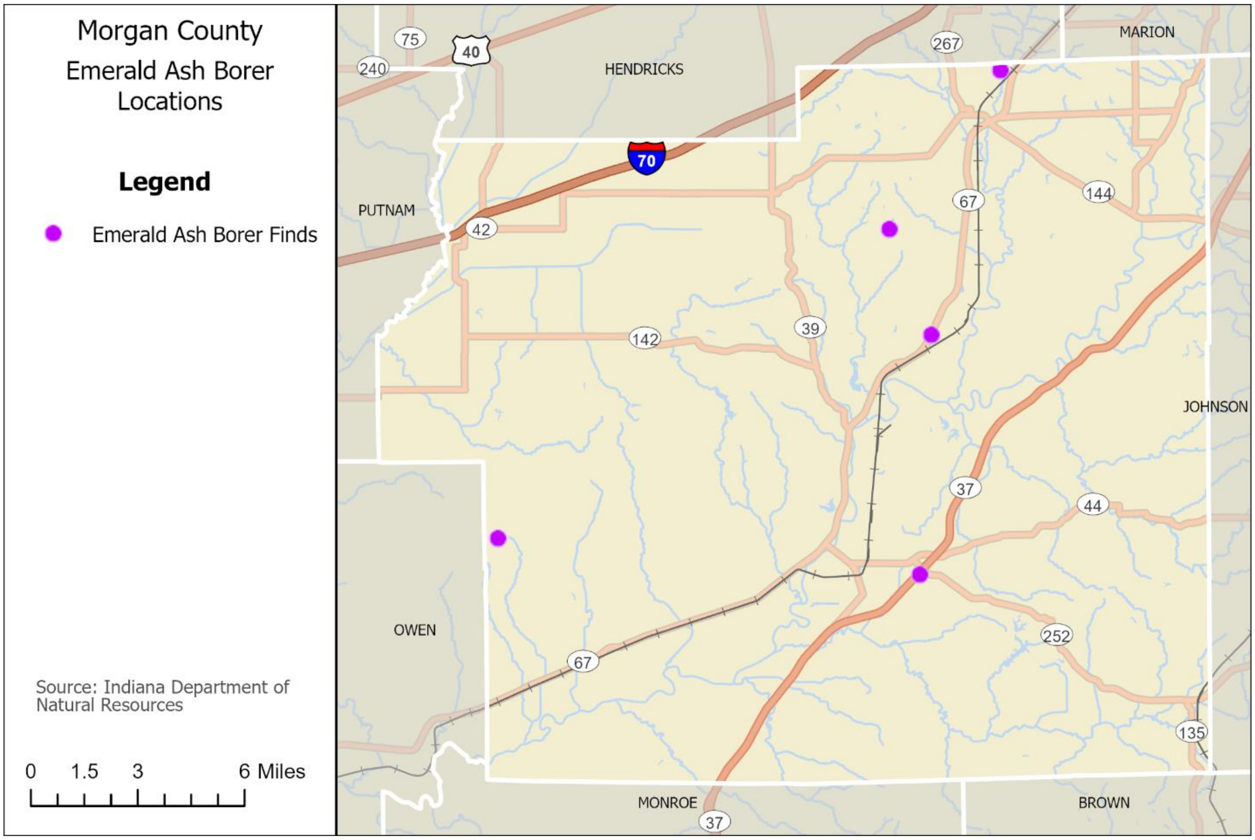


Figure 76. Emerald Ash Borer in Morgan County

4.3.11.5 Risk Identification for Infectious Agents or Harmful Organisms

In Meeting #2, the planning team determined that the probability of an infectious agent or harmful organism hazard as highly likely with catastrophic consequences. The warning time for an infectious agent or harmful organism hazard is about 6 to 12 hours with a duration of more than 1 week. The calculated CPRI for harmful organisms is 3.85.

4.3.11.6 Vulnerability Analysis for Infectious Agents or Harmful Organisms Hazard

All communities can be potentially at risk for an epidemic and experience increased risk during hazards the cause displacement, contamination of the water supply, and/or deprivation of essential utilities, or when residents are not exposed to educational resources outlining preventive steps.

4.3.11.7 Community Development Trends and Future Vulnerability

Future development will remain vulnerable to these events. EABs have killed millions of ash trees in Indiana, Michigan, Illinois, Ohio, and Ontario and will continue to do so until the insects are effectively contained or eliminated, or a strain of more resistant trees is developed.

According to the National Institute of Allergy and Infectious Diseases, tick-borne illnesses will continue to remain a problem as people build homes in wilderness areas where ticks and their animal hosts live; however, urban environments can also host ticks and the pathogens they can transmit.

Eliminating areas of standing water may help diminish the disease-carrying mosquito population by removing or treating stagnant bodies of water areas that serve as mosquitos' breeding grounds.

4.3.11.8 Relationship to other Hazards

The risk for infectious disease transmission is primarily associated with displacement and the characteristics of the displaced population, the proximity of sterile water and function restrooms, the nutritional status of the displaced, the level of immunity to vaccine-preventable infections, and the availability of access to healthcare services.

Flooding – Increased risk of vector-borne diseases. EAB-damaged trees may pose a risk for increased logjam events. In the aftermath of flooding, a plethora of standing water combined with a possibly weakened health infrastructure and an interruption of ongoing control programs increases the risk factors for vector-borne disease transmission. While initial flooding may wash away existing mosquito-breeding sites, standing water caused by heavy rainfall or overflow of rivers can create new breeding sites.

Earthquake – In the aftermath of earthquakes, some populations have experienced infection outbreaks associated with increased exposure to airborne dust from landslides.

Tornadoes – Natural disasters like tornadoes, which impact communities on a large-scale and cause displacement, have been associated with an increased risk in disease.

Utility Failure – Power outages and the disruption of water treatment and supply plants can affect the proper functioning of health facilities and has also been linked with an increase in diarrheal illness.

5 Mitigation Goals and Strategies

The goal of mitigation is to protect lives and build disaster-resistant communities through minimizing disruptions to local and regional economies, reducing the future impacts of hazards including property damage, and supporting best use practices for public and private funds spent on recovery assistance. This chapter discusses the general mitigation vision and mitigation goals to reduce or avoid long-term vulnerabilities to the hazards identified in the proceeding chapter. Successful mitigation actions and projects are based on well-constructed risk assessments, which are provided in Chapter 4.

5.1 Community Capability Assessment

The capability assessment identifies current activities used to mitigate hazards. The capability assessment identifies the policies, regulations, procedures, programs, and projects that contribute to the lessening of disaster damages. The assessment also provides an evaluation of county capabilities to determine whether the activities may be improved to reduce the impact of future hazards more effectively. The following sections highlight the existing plans and mitigation capabilities within all the communities.

5.1.1 Planning and Regulatory

Planning and regulatory capabilities include the plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards. In the following subsection, the team details the NFIP program and local plans, codes, and ordinances in place that serve to make the county more resilient to disasters.

5.1.1.1 National Flood Insurance Program (NFIP)

According to FEMA, the NFIP is a federal program created by Congress to mitigate future flood losses nationwide through community-enforced building and zoning ordinances and to allow access to affordable, federally backed flood insurance protection for property owners. Providing an insurance alternative to disaster assistance, the NFIP is designed to alleviate the escalating costs of repairing flood damage to buildings and their contents. If communities participate in the NFIP through adopting and enforcing a floodplain management ordinance to reduce future flood risks to new construction in SFHAs, the federal government has agreed to make flood insurance available within the community as a financial protection against flood losses. To remain eligible for future mitigation funds, NFIP communities must adopt either their own MHMP or participate in the development of a multi-jurisdictional MHMP.

Morgan County, the City of Martinsville, and the Towns of Brooklyn, Mooresville, Morgantown, and Paragon participate in the NFIP. The total number of policies and coverage of insurance in-force are identified in Table 16.

To assure coverage is available for all policy holders, the county and its NFIP communities will assure the continued compliance of the state floodway and NFIP requirements.

The Indiana Flood Control Act grants the IDNR regulatory control over floodway areas in any state waterway (streams less than 1 square mile in drainage area). Within the Flood Control Act, the General Assembly created a permitting program. Two of the fundamental provisions of the Act’s regulatory programs consist of the following:

1. An abode or place of residence may not be constructed or placed within a floodway.
2. Any structure, obstruction, deposit, or excavation within a floodway must receive written approval from the Director of the Department of Natural Resources for the work before beginning construction.

The DNR is the Cooperating Technical Partner for the FEMA Floodplain Mapping program and provides floodway site determinations upon request. The DNR performs both the Community Assistance Call (CAC) and Community Assistance Visit (CAV) for the NFIP program. The CAV and CAC serve as each NFIP communities’ assurance that the community is adequately enforcing its floodplain management regulations and prices opportunities for technical assistance by the DNR on behalf of FEMA.

The NFIP’s Community Rating System (CRS) recognizes and encourages community floodplain management activities that exceed the minimum NFIP standards. Depending upon the level of participation, flood insurance premium rates for policyholders can be reduced. Besides the benefit of reduced insurance rates, CRS floodplain management activities enhance public safety, reduce damages to property and public infrastructure, avoid economic disruption and losses, reduce human suffering, and protect the environment. Technical assistance on designing and implementing some activities is available at no charge. Participating in the CRS provides an incentive to maintaining and improving a community's floodplain management program over the years. Neither Morgan County nor its jurisdictions participate in the CRS program.

5.1.1.2 Plans and Ordinances

Morgan County and its incorporated communities have several plans and ordinances in place to ensure the safety of residents and the effective operation of communities. These include the Soil Survey of Morgan County, Morgan County Comprehensive Plan, and the Morgan County Land Use & Development Code- Zoning Ordinance. Information was collected through surveys with plan team representatives of the county, cities, and towns. The results of these surveys can be found in Appendix F. The review of this information was used to inform the development of mitigation strategies for this plan update.

Table 34. Jurisdictions Planning Mechanisms

Capabilities	County	Martinsville	Bethany	Brooklyn	Monrovia	Mooresville	Morgantown
Planning							
Comprehensive Plan	2019	Yes	Yes	Yes	Yes	2021	Yes
Emergency Operations Plan	Yes	Yes	Yes	Yes	Yes	2021	-
Watershed Plan	White River Lambs Creek WMP (2003), Lower White Lick Creek WMP (2005), Indian Creek WMP (2009)						
Ordinances							
Zoning Ordinance	Yes	Yes	Yes	Yes	-	Yes	Yes
Building Codes/ Ordinance	Yes	Yes	Yes	Yes	-	Yes	Yes
Floodplain Ordinance*	Yes	Yes	N/A	No	-	Yes	Yes
Storm Water Ordinance	Yes	Yes	No	No	-	Yes	No
Erosion Ordinance	Yes	Yes	N/A	No	-	Yes	No
Burning Ordinance	No	Yes	N/A	Yes	Yes	Yes	Yes

Capabilities	Paragon	Eminence Community SC	Martinsville Schools	Monroe-Gregg SC	Mooresville Consolidated SC	Soil & Water Conservation District
Planning						
Comprehensive Plan	County	No	2022	No	No	2019
Emergency Operations Plan	County	Yes	2022	2021	2022	-
Watershed Plan	White River Lambs Creek WMP (2003), Lower White Lick Creek WMP (2005), Indian Creek WMP (2009)					
Ordinances						
Zoning Ordinance	County	No	No	N/A	No	No
Building Codes/ Ordinance	County	County	No	N/A	Yes	No
Floodplain Ordinance*	County	No	No	N/A	No	No
Storm Water Ordinance	Yes	No	No	N/A	No	No
Erosion Ordinance	County	No	No	N/A	No	No
Burning Ordinance	Yes	No	No	N/A	No	No

** The floodplain ordinance date is based upon the currently effective map date provided by the FEMA status book report for Communities Participating in the National Flood Program.*

Many of these plans or policies can help implement the goals, objectives, and strategies in Morgan County's MHMP. The Morgan County Emergency Management Director is responsible for meeting within each jurisdiction yearly throughout the next five years. During these meetings, the local Emergency Management Director will review all Local Planning Mechanisms and collaborate with the Cities and Towns to ensure the MHMP is becoming as integrated into local plans as possible. These Local Planning Mechanisms are meant to work cooperatively together in order to ensure the health, safety, and welfare of Morgan County and its corresponding jurisdictions.

The 2019 update of the Morgan County Comprehensive Plan recognizes the presence of regulatory floodway within the county and remarks that areas within the central and southern portions of the county are particularly steep and therefore development within those areas should be avoided. It also states that the county seeks to preserve natural resources by directing development away from prime agricultural land, floodplains and dense tree canopy. Toward that end, the plan identifies action steps that include in the short term requiring any allowed residential, commercial or industrial development in flood hazard areas to be effectively protected against inundation; discouraging the expansion of public utilities and infrastructure, such as sanitary sewers, into areas with steep slopes and floodplains, so as to minimize future development therein; and, in the medium term, implementing additional protection measures for development adjacent to floodplains, including erosion and sediment control practices, development limitations, and stormwater quality runoff provisions for new development or other protections.   The January 2022 Morgan County Unified Development Ordinance outlines a variety of guidelines related to landfill and hazardous waste storage, potential fire hazards, and the development within the special flood hazard area.   The Unified Development Ordinance also refers to the Morgan County Floodplain Ordinance.   Morgan County also recognized the importance of flood hazards in its 2019 Thoroughfare Plan, noting floodplains and historical circumstances result in poor alignment throughout the transportation network with many jogs and off-set intersections.   It also acknowledges the potential value of floodplains to develop recreational amenities, for example between County Line Road and the existing Waverly Park as well as other locations connecting the county to the White River.

5.2 General Mitigation Goals

In Section 4 of this plan, the risk assessment identified a number of natural hazards that Morgan County experiences. The MHMP planning team members understand that although hazards cannot be eliminated altogether, Morgan County can work toward building disaster-resistant communities. Following are a list of goals, objectives, and actions identified in the previous Morgan County MHMP. These goals remain valid and represent long-term, broad visions of the overall vision the county would like to achieve for mitigation. The objectives are strategies and steps that will assist the communities in attaining the listed goals.

Goal 1: Lessen the impacts of hazards to new and existing infrastructure

- Objective (a): Retrofit critical facilities and structures with structural design practices and equipment that will withstand natural disasters and offer weather-proofing.
- Objective (b): Equip public facilities and communities to guard against damage caused by secondary effects of hazards.
- Objective (c): Minimize the amount of infrastructure exposed to hazards.
- Objective (d): Evaluate and strengthen the communication and transportation abilities of emergency services throughout the community.
- Objective (e): Improve emergency sheltering in the community.

Goal 2: Create new or revise existing plans/maps for the community

- Objective (a): Support compliance with the NFIP.
- Objective (b): Review and update existing, or create new, community plans and ordinances to support hazard mitigation.
- Objective (c): Conduct new studies/research to profile hazards and follow up with mitigation strategies.

Goal 3: Develop long-term strategies to educate community residents on the hazards affecting their county

- Objective (a): Raise public awareness on hazard mitigation.
- Objective (b): Improve education and training of emergency personnel and public officials.

5.3 Mitigation Actions and Projects

Upon completion of the risk assessment and development of the goals and objectives, the planning committee was provided a list of the six mitigation measure categories from the FEMA State and Local Mitigation Planning How to Guides. The types of mitigation actions are listed as follows:

- **Prevention**: Government, administrative, or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations.
- **Property Protection**: Actions that involve the modification of existing buildings or structures to protect them from a hazard or removal from the hazard area. Examples include acquisition, elevation, structural retrofits, storm shutters, and shatter-resistant glass.

- **Public Education and Awareness**: Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.
- **Natural Resource Protection**: Actions that, in addition to minimizing hazard losses, preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- **Emergency Services**: Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.
- **Structural Projects**: Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, levees, floodwalls, seawalls, retaining walls, and safe rooms.

Implementation of the mitigation plan is critical to the overall success of the mitigation planning process. The first step is to decide, based upon many factors, which action will be undertaken first. In order to pursue the top priority first, an analysis and prioritization of the actions is important. The plan team assessed the status and priority of the existing strategies using the FEMA mitigation evaluation criteria using the STAPLE + E criteria. Table 35 lists the factors to consider in the analysis and prioritization of actions. Some actions may occur before the top priority due to financial, engineering, environmental, permitting, and site control issues. Public awareness and input of these mitigation actions can increase knowledge to capitalize on funding opportunities and monitoring the progress of an action.

Table 35. STAPLE+E Criteria

Criteria	Description
S – Social	Mitigation actions are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the community's social and cultural values.
T – Technical	Mitigation actions are technically most effective if they provide a long-term reduction of losses and have minimal secondary adverse impacts.
A – Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
P – Political	Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support for the action.
L – Legal	It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.

Criteria	Description
E – Economic	Budget constraints can significantly deter the implementation of mitigation actions. It is important to evaluate whether an action is cost-effective, as determined by a cost benefit review, and possible to fund.
E – Environmental	Sustainable mitigation actions that do not have an adverse effect on the environment, comply with federal, state, and local environmental regulations, and are consistent with the community's environmental goals, have mitigation benefits while being environmentally sound.

Understanding the dynamics of STAPLE + E leads to the project's success. Developing questions evolving around the evaluation criteria, similar to those outlined below, helps the team prioritize the projects.

Social:

- Will the proposed action adversely affect one segment of the population?
- Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?

Technical:

- How effective is the action in avoiding or reducing future losses?
- Will it create more problems than it solves?
- Does it solve the problem or only a symptom?
- Does the mitigation strategy address continued compliance with the NFIP?

Administrative:

- Does the jurisdiction have the capability (staff, technical experts, and/or funding) to implement the action, or can it be readily obtained?
- Can the community provide the necessary maintenance?
- Can it be accomplished in a timely manner?

Political:

- Is there political support to implement and maintain this action?
- Is there a local champion willing to help see the action to completion?
- Is there enough public support to ensure the success of the action?
- How can the mitigation objectives be accomplished at the lowest cost to the public?

Legal:

- Does the community have the authority to implement the proposed action?
- Are the proper laws, ordinances, and resolution in place to implement the action?
- Are there any potential legal consequences?
- Is there any potential community liability?

- Is the action likely to be challenged by those who may be negatively affected?
- Does the mitigation strategy address continued compliance with the NFIP?

Economic:

- Are there currently sources of funds that can be used to implement the action?
- What benefits will the action provide?
- Does the cost seem reasonable for the size of the problem and likely benefits?
- What burden will be placed on the tax base or local economy to implement this action?
- Does the action contribute to other community economic goals such as capital improvements or economic development?
- What proposed actions should be considered but be "tabled" for implementation until outside sources of funding are available?

Environmental:

- How will this action affect the environment (land, water, endangered species)?
- Will this action comply with local, state, and federal environmental laws and regulations?
- Is the action consistent with community environmental goals?

5.3.1 Hazard Mitigation Actions

Morgan County and its included municipalities share a common Hazard Mitigation Plan and worked closely to develop it. These communities work together with their city councils and the Morgan County Emergency Management Director to insure that the hazards and mitigation actions included in this plan are accurate and addressed in their jurisdictions. The jurisdictions responsible for each action consist of the following:

- Morgan County
- Martinsville
- Bethany
- Brooklyn
- Monrovia
- Mooresville
- Morgantown
- Paragon
- Eminence Community School Corporation
- Martinsville Schools
- Monroe-Gregg School Corporation
- Mooresville Consolidated School Corporation
- Soil & Water Conservation District

Table 36 lists all mitigation actions for Morgan County and its jurisdictions. Each of these mitigation action charts detail the hazard, the mitigation action to address the identified hazard, its current stage of implementation, the timeframe for implementation going forward, the jurisdictions who have identified they will work to implement the action, the responsible parties to carry through with implementation, and comments on how the plan will be implemented through existing planning mechanisms and funding to make implementation happen.

Additionally, the Morgan County planning team assigned the mitigation actions priority rankings for implementation (1=High Priority; 2= Moderate Priority; 3= Low Priority). Mitigation actions given a “high” priority ranking will ideally be implemented within 5 years of the MHMP plan adoption date. Mitigation actions ranked as a “medium” priority may be addressed within 5-10 years from the MHMP plan adoption date, and “low” priority mitigation actions may take over 10 years before action completion. Although higher ranking priorities may constitute a greater county concern than lower ranking priorities, the availability of funds may cause some mitigation actions to take longer to implement.

All of the mitigation actions identified in the 2017 Morgan County Hazard Mitigation Plan have been carried over into the 2023 plan based on the advisement of the Morgan County Emergency Management Director and the consensus of the steering committee. Not all of the 2017 mitigation actions have been fully completed, and they are identified in this plan to reflect their ongoing implementation.

The status designations include the following:

- **Identified** – actions are in the preliminary stages and have not yet started
- **Complete** – the action is complete
- **Ongoing** – actions require continuing application
- **In Progress** – actions are currently being acted upon
- **Deferred** – no progress has been made
- **Deleted** – the action is no longer relevant

The mitigation action types encompass the following areas:

- **Prevention** – expand mapping, loss-prevention programs, buyouts, regulations
- **Property Protection** – identify vulnerable areas and populations, retrofit vulnerable buildings, structural improvement
- **Public Education** – information sessions, presentations, disclosure, website information, brochures, educational resources, and hazard awareness
- **Natural Resource Protection** – conservation, erosion control, stream corridor restoration, wetland restoration, resource management

- **Emergency Services** – emergency alerts, evacuation plans, expand emergency operations
- **Structural Improvement** – acquisitions and elevations of structures in flood prone areas, structural retrofits, retaining walls, retention structures, culverts, and safe rooms.

5.3.2 Mitigation Actions by Community

This is a multi-jurisdictional plan that covers Morgan County, its school districts, its soil & water conservation district, and the communities of Martinsville, Bethany, Brooklyn, Monrovia, Mooresville, Morgantown, and Paragon. The Morgan County risks and mitigation activities identified in this plan also incorporate the concerns and needs of townships and other entities participating in this plan.

Table 36. Mitigation Actions

#	Hazards	Mitigation Action Type	Goals & Objectives Met	Action	Community	Status	Priority	Coordinating Agency	Potential Funder	Comments
1	Flood, Thunderstorm, Fluvial Erosion			Maintain erosion issues at White Lick Creek south of Mill Street	Brooklyn	Completed	-	Morgan County Planning, IDEM	Regional Water Management District, Local resources, IDNR	-
2	Flood			Review, revise and publish the zoning ordinances regarding parking lots and other hard surfaces to enforce impermeable surfaces and rain gardens	Morgan County	Completed	-	Morgan County EMA, Morgan County Planning	Local resources	The Town of Waverly has already addressed this issue
3	Dam/Levee			Establish IEAPs for existing dams in Morgan County, including the dams surrounding Mooresville and St. John Commons Dam	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Completed	-	IDNR, IDHS/FEMA, Morgan County Public Works	IDNR, IDHS/FEMA	-
4	Dam/Levee			Establish an IEAP for existing Patton Park Dam. IEAP should include a published evacuation plan	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Completed	-	IDNR, IDHS/FEMA, Morgan County Public Works	IDNR, IDHS/FEMA	-

#	Hazards	Mitigation Action Type	Goals & Objectives Met	Action	Community	Status	Priority	Coordinating Agency	Potential Funder	Comments
5	Flood			Upgrade and/or harden storm sewer systems	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Completed	-	Morgan County EMA, Local community engineers	Community Development Grants, Capital Improvement Funds	-
6	Hazmat			Conduct a commodity flow study to determine the materials being transported on I-69	Morgan County, Mooresville, Brooklyn, Martinsville	Completed	-	Morgan County EMA, LEPC	INDOT Grants, IDHS Grants	-
7	Flood, Thunderstorm			Culvert/drainage improvements needed at Replace Burton Lane bridge over Indian Creek and Bridge at SR252	Morgan County, Mooresville, Brooklyn, Martinsville, Morgantown, Paragon	Completed	-	-	-	-
8	Flood, Thunderstorm, Fluvial Erosion			Develop county ordinance to curtail the problems associated with fluvial erosion	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Completed	-	-	-	-
9	Dam/Levee			Develop a Martinsville Levee Operations and Maintenance Plan	Martinsville	Completed	-	-	-	Although the plan has been developed, the need for continued maintenance is ongoing

#	Hazards	Mitigation Action Type	Goals & Objectives Met	Action	Community	Status	Priority	Coordinating Agency	Potential Funder	Comments
10	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Drought, Ground Failure, Dam/Levee			Install Reverse 911	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Completed	-	-	-	-
11	Hazmat			Develop a call-in reporting system	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Completed	-	-	-	-
12	Tornado, Earthquake, Thunderstorm, Winter Storm			Harden the Morgan County E911 Emergency Center at Lincoln	Morgan County	Completed	-	-	-	This facility also has back-up generators
13	Tornado, Thunderstorm			Review and revise zoning ordinances to require tie-downs for mobile homes	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Completed	-	-	-	-
14	Flood			Review and revise zoning ordinances banning new construction in flood plains, limiting building on hillsides	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown,	Completed	-	-	-	-

#	Hazards	Mitigation Action Type	Goals & Objectives Met	Action	Community	Status	Priority	Coordinating Agency	Potential Funder	Comments
					Paragon					
15	Flood			Require a watershed maintenance fee	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Completed	-	-	-	-
16	Earthquake, Hazmat			Establish incident management teams (IMT) and Community Emergency Response Team (CERT)	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Completed	-	-	-	-
17	Tornado, Thunderstorm, Winter Storm			Work with utility companies to trim trees and bury power lines	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Completed	-	-	-	-
18	Flood	Property Protection	1b	Institute buyout program for flood-prone land areas along Lingle Road in Whitaker and Countyline and Edgewood	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Identified	High	Morgan County EMA, IDHS	Local resources, IDHS/FEMA	-

#	Hazards	Mitigation Action Type	Goals & Objectives Met	Action	Community	Status	Priority	Coordinating Agency	Potential Funder	Comments
19	Flood	Prevention	2b	Develop a plan for ongoing stream/river maintenance at Springmill and Killian Road	Mooresville	Identified	High	Mooresville Public Works, Mooresville Planning, IDNR, INDOT	Mooresville Public Works, Mooresville Planning	-
20	Flood, Thunderstorm	Structural Projects	1c	Culvert/drainage improvements needed 1) North side of Dill Blvd under Morgantown 2.North County Line and Westwood 3) Between N. Old State Road 67 and Merriman Road	Morgan County, Mooresville, Brooklyn, Martinsville, Morgantown, Paragon	Identified	High	Morgan County Public Works, Morgan County Building Code Dept, IDNR	Regional Water Management District, Local resources, IDNR	-
21	Flood, Ground Failure	Prevention	2c	Map flood and erosion problems along McCracken Creek, north of Patton Park Lake and along Orchard Creek	Mooresville	Identified	High	Morgan County Building Code Dept, Morgan County Planning, IDHS/FEMA, IDNR	IDNR, IDHS/FEMA	-
22	Flood	Prevention	2c	Map flood hazard Silon Creek to confluence with East White Lick Creek	Monrovia	Identified	High	Morgan County Building Code Department, Morgan County Public Works, IDHS/FEMA	IDNR, IDHS/FEMA	The Morgan County Planning Team considers this their number one priority

#	Hazards	Mitigation Action Type	Goals & Objectives Met	Action	Community	Status	Priority	Coordinating Agency	Potential Funder	Comments
23	Flood	Prevention	2b	Establish setback ordinances for future development	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Identified	High	Morgan County Building Code Dept	IDNR	-
24	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Dam/Levee	Structural Projects	1a	Ensure safe structures by installing safe rooms and/or firewalls in critical facilities	Monrovia	Identified	High	Morgan County EMA, Morgan County Schools	Local resources, IDHS/FEMA, Communitry Development Grants	Currently, no schools in the county have safe rooms
25	Flood, Ground Failure	Property Protection	1c	River & stream maintenance and bank stabilization for log jam removal	Soil & Water Conservation District	Identified	High	Soil & Water Conservation District	IDNR	Funds appropriated
26	Flood, Thunderstorm, Winter Storm, Fluvial Erosion	Prevention	2c	Erosion reduction study needed as FEH is impacting waste water treatment plant and the bridge over White River at Blue Bluff Road	County	Identified	Medium	Morgan County Public Works, Morgan County Engineering, IDNR, Christopher Burke Engineering, CEES	Morgan County Public Works, IDNR	-
27	Flood, Thunderstorm	Structural Projects	1c	Pump station for interior drainage, suggested near Jones Park (at the intersection of N. Park Ave and W	Martinsville	Identified	Medium	Morgan County Public Works, Martinsville Plannign	Martinsville Public Works, IDNR	-

#	Hazards	Mitigation Action Type	Goals & Objectives Met	Action	Community	Status	Priority	Coordinating Agency	Potential Funder	Comments
				Douglas Street)						
28	Dam/Levee	Prevention	2b	Coordinate with surrounding counties to ensure any high hazard dam located in a neighboring county but with inundation in Morgan County, has an IEAP	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Identified	Medium	IDNR, IDHS/FEMA, Morgan County Public Works	IDNR, IDHS/FEMA	-
29	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Dam/Levee	Structural Projects	1e	Mobile home safe rooms are needed	Morgantown	Identified	Medium	Morgan County EMA	-	-
30	Tornado, Earthquake, Thunderstorm, Winter Storm	Emergency Services	1a	Harden critical facilities including the National Guard Armory, EMS buildings, fire stations, police stations, state buildings, jail, Mooresville and Martinsville High Schools and South Elementary School	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon, All school districts	Identified	Medium	Morgan County EMA, Mooresville, Martinsville	Local resources, FEMA, Community Development Grants	-

#	Hazards	Mitigation Action Type	Goals & Objectives Met	Action	Community	Status	Priority	Coordinating Agency	Potential Funder	Comments
31	Earthquake	Property Protection	1a	Install inertial valves in public buildings	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Identified	Medium	Morgan County EMA	IDHS/FEMA, Community Development Grants	-
32	Flood, Dam/Levee	Emergency Services	2c	Work with neighboring counties to establish a No Adverse Impact statement	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Identified	Medium	Neighboring counties, Morgan County EMA	Grants	-
33	Flood	Structural Projects	1c	Elevate roads that frequently flood and impact school bus routes	All school districts	Identified	Medium	Public Works departments	INDOT	-
34	Flood	Property Protection	1b	Institute buyout program for flood-prone land areas along SR 67	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Identified	Low	Morgan County EMA, IDHS	Local resources, IDHS/FEMA	-
35	Earthquake	Emergency Services	1a	Reinforce schools with straps for shelving and no-slip bases for computers	All school districts	Identified	Low	Morgan County EMA, local hospitals, Morgan County Schools	FEMA, Community Development Grants	-

#	Hazards	Mitigation Action Type	Goals & Objectives Met	Action	Community	Status	Priority	Coordinating Agency	Potential Funder	Comments
36	Earthquake	Emergency Services	1a	Reinforce hospitals with straps for shelving and no-slip bases for computers	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Identified	Low	Morgan County EMA, local hospitals, Morgan County Schools	FEMA, Community Development Grants	-
37	Flood	Property Protection	1a	Repair backflow valves in older buildings	Martinsville	Identified	Low	Morgan County EMA	Local resources, IDHS/FEMA, Communitry Development Grants	-
38	Hazmat	Prevention	2b	Identify current and establish alternate approved routes for transporting hazardous materials	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Identified	Low	Morgan County EMA, INDOT	INDOT	-
39	Flood	Structural Projects	1d	Improve emergency access to Blue Bluff Rd	County	Identified	Low	Morgan County Public Works	Morgan County Public Works	-
40	Flood	Property Protection	1b	Institute buyout program for flood-prone land areas and relocate critical facilities as necessary	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	In Progress	High	Morgan County EMA, IDHS	Local resources, IDHS/FEMA	Some buyout have been completed in the Town of Brooklyn along 67 and along Clear Creek/Grassy Fork Creek; additional buyouts are

#	Hazards	Mitigation Action Type	Goals & Objectives Met	Action	Community	Status	Priority	Coordinating Agency	Potential Funder	Comments
										needed.
41	Flood	Prevention	3a	Purchase and set up permanent signage directing residents to shelters and warning of flash flood areas	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	In Progress	High	Morgan County EMA, INDOT, Morgan County Highway	Local resources, IDHS/FEMA, INDOT	Some flood gates and signs have been purchased but more are needed. County working with INDOT on I69 flooding issues
42	Flood, Thunderstorm, Winter Storm	Structural Projects	1c	Reinforce the bank along Interstate 69 / Hwy 37 merge for erosion control	Morgan County	In Progress	High	Morgan County Planning	Morgan County Public Works, IDNR	In progress until I-69 construction is completed.
43	Dam/Levee	Protection Protection	1c	Lake Deturk Dam and Painted Hills Lake Dam improvements along Grassyfork Lane	Martinsville	In Progress	High	Morgan County Public Works, Surrounding counties	Martinsville Public Works, IDNR, Surrounding counties	-
44	Tornado, Thunderstorm	Emergency Services	1d	Install weather alert radios for critical facilities	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	In Progress	High	Morgan County EMA	Local resources	-

#	Hazards	Mitigation Action Type	Goals & Objectives Met	Action	Community	Status	Priority	Coordinating Agency	Potential Funder	Comments
45	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm	Emergency Services	1e	Devise a plan for alternative fuel resources for back-up generators	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	In Progress	Low	Morgan County EMA, Local resources, Morgan County Planning, Morgan County Engineering	Local resources	-
46	Earthquake, Hazmat, Fire/Explosion	Prevention	2b	Establish maps to show locations of pipes and water systems; move pipelines as necessary	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	In Progress	Low	Morgan County EMA	Morgan County Building Code Dept	-
47	Hazmat	Public Education and Awareness	3a	Develop community outreach and education for airplane crash risk	Mooresville, Monrovia	In Progress	Low	Morgan County EMA, FAA, Indianapolis Airport, INDOT	Morgan County EMA, FAA, Indianapolis Airport, INDOT	-
48	Flood, Thunderstorm	Structural Projects	1c	Culvert/drainage improvements needed 1) Along railroads at Old SR 67 2) Sartor Ditch under Hwy 37 and South Outer Road 3) I69 overpass	Morgan County, Mooresville, Brooklyn, Martinsville, Morgantown, Paragon	Ongoing	High	Morgan County Public Works, Morgan County Building Code Dept, IDNR	Regional Water Management District, Local resources, IDNR	Studies have been completed. I-69 construction in Morgan County is slated to last until 2023, which will impact drainage.

#	Hazards	Mitigation Action Type	Goals & Objectives Met	Action	Community	Status	Priority	Coordinating Agency	Potential Funder	Comments
49	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Drought, Ground Failure, Dam/Levee	Emergency Services	1d	Install new warning sirens within the county and increase the saturation of communication towers	Morgan County, Brooklyn, Martinsville, Paragon	Ongoing	High	Morgan County EMA	Local resources, IDHS/FEMA, Communitry Development Grants	The communities of Monrovia, Martinsville and Morgantown have recently installed warning sirens
50	Tornado, Flood, Thunderstorm, Winter Storm, Drought	Public Education and Awareness	3a	Develop family emergency plans during Severe Weather Week in schools	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Ongoing	High	Morgan County EMA, Red Cross, IDHS/FEMA	Local resources, donations, IDHS/FEMA	In 2010, Morgan County distributed IDHS coloring books to local schools
51	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Drought, Ground Failure, Dam/Levee	Public Education and Awareness	3a	Public outreach to secure materials for emergency preparedness kits (to include water heaters, bookshelves, doors, locks, and personal items such as diapers and blankets)	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Ongoing	High	Morgan County EMA, IDHS/FEMA	Local resources, IDHS/FEMA	In 2010, Morgan County distributed IDHS coloring books to local schools
52	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Drought,	Emergency Services	1e	Establish shelters throughout the county, especially near mobile home areas	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Ongoing	High	Morgan County EMA	Local resources, IDHS/FEMA, Community Development Grants	Currently working on agreements with local schools and shelters but no written

#	Hazards	Mitigation Action Type	Goals & Objectives Met	Action	Community	Status	Priority	Coordinating Agency	Potential Funder	Comments
	Ground Failure, Dam/Levee									agreements at this time
53	Drought, Wildfire	Public Education and Awareness	3a	Raise public awareness of drought conditions, e.g. field fires, burn bans and water conservation	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Ongoing	High	Local Fire Depts	Grants, Local Fire Depts	-
54	Flood	Prevention	2c	Conduct a study on residential flooding near Arnold Street and the county line	Morgantown	Ongoing	Medium	Morgan County Building Code Department, IDNR	IDHS/FEMA, IDNR	IDNR has completed preliminary analysis
55	Flood	Prevention	1c	Maintain ditches and retention areas near White River, Indian Creek, and White Lick Creek	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Ongoing	Medium	Morgan County EMA, County Engineer, IDNR	IDHS/FEMA, IDNR	-
56	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm, Hazmat, Drought, Ground Failure, Dam/Levee	Emergency Services	1d	Establish an emergency listing for transportation and medical needs	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Ongoing	Medium	Morgan County EMA, Local Resources, CERT	Local resources, CERT	-

#	Hazards	Mitigation Action Type	Goals & Objectives Met	Action	Community	Status	Priority	Coordinating Agency	Potential Funder	Comments
57	Tornado, Flood, Thunderstorm, Winter Storm, Dam/Levee	Emergency Services	1d	Create emergency evacuation plans for each jurisdiction	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Ongoing	Medium	Morgan County EMA, Morgan County Planner, INDOT	IDHS/FEMA, INDOT	Morgan County has already identified and mapped only the 'at-risk' areas
58	Tornado, Flood, Earthquake, Thunderstorm, Winter Storm	Property Protection	1e	Purchase backup generators and/or transfer switches	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Ongoing	Medium	Morgan County EMA, Local resources	Local resources, IDHS/FEMA	Generators were purchased for some critical facilities in the county (911, jail) and for Martinsville
59	Hazmat	Emergency Services	3b	Develop training and storage assistance for chemical hazards (in particular water sewer and pool houses). Program to include public awareness	Monrovia	Ongoing	Medium	Morgan County EMA, LEPC	Grants, Local Fire Depts, LEPC	-
60	Hazmat	Emergency Services	3b	Regularly assess the medical capabilities of hospitals and increase staff training	Morgan County, Mooresville, Brooklyn, Martinsville, Monrovia, Morgantown, Paragon	Ongoing	Medium	Morgan County EMA, local hospitals, LEPC	Local hospitals, IDHS	-
61	Flood	Emergency Services	3b	Organize rescue water craft and water-saving devices to insure availability to resident	Morgan County, Mooresville, Brooklyn, Martinsville, Morgantown, Paragon	Ongoing	Low	Morgan County EMA, local hospitals	Local Fire Depts	-

#	Hazards	Mitigation Action Type	Goals & Objectives Met	Action	Community	Status	Priority	Coordinating Agency	Potential Funder	Comments
62	Wildfire	Emergency Services	3b	Provide wildfire response training to fire departments.	Morgan County, Mooresville, Brooklyn, Martinsville, Morgantown, Paragon	Identified	Low	Local Fire Depts	Grants, Local Fire Depts	-
63	Wildfire	Prevention	1b	Provide brush trucks and wildland fire gear and hand tools to fire departments.	Morgan County, Mooresville, Brooklyn, Martinsville, Morgantown, Paragon	Identified	Low	Local Fire Depts	Grants, Local Fire Depts	-

6 Chapter 6 – Plan Maintenance and Implementation

6.1 Implementation and Maintenance

The Morgan County MHMP is intended to serve as a guide for dealing with the impact of both current and future hazards for all people and institutions within the jurisdiction. As such it is not a static document but must be modified to reflect changing conditions if it is to be an effective plan. The goals, objectives and mitigation strategies will serve as the action plan. Even though individual strategies have a responsible party assigned to it to ensure implementation, overall responsibility, oversight, and general monitoring of the action plan has been assigned to the Morgan County Emergency Management Director.

Goals identified by the county will be addressed by the County Commission and the Town and City Councils will be responsible for implementing their corresponding strategies.

It will be the community's responsibility to gather a Local Task Force to update the Multi-Hazard Mitigation Plan on a routine basis. Every year, the County Emergency Management Director will call a meeting to review the plan, mitigation strategies and the estimated costs attached to each strategy. All participating parties of the original Local Task Force and cities will be invited to this meeting. Responsible parties will report on the status of their projects. It will be the responsibility of the committee to evaluate the plan to determine whether:

- Goals and objectives are relevant.
- Risks have changed.
- Resources are adequate or appropriate.
- The plan as written has implementation problems or issues.
- Strategies have happened as expected.
- Partners participating in the plan need to change (new and old).
- Strategies are effective.
- Any changes have taken place that may affect priorities.
- Any strategies should be changed.

In addition to the information generated at the Local Task Force (LEPC and CEMP) meetings, the County Emergency Management Director will also annually evaluate the Multi-Hazard Mitigation Plan and update the plan in the event of a hazardous occurrence. After the fourth annual update meeting, the Morgan County Emergency Management Director will finalize a new Local Task Force to begin the required five-year update process. This will be accomplished in coordination with Morgan County jurisdictions and the entire Multi-Hazard Mitigation Plan shall be updated and submitted to FEMA for approval (within 5 years of plan adoption). These revisions will include public participation by requiring a public hearing and published notice in addition to multiple Local Task Force meetings to make detailed updates to the plan.

Public participation for updates is as critical as in the initial plan. Public participation methods that were used in the initial writing will be duplicated for any future update processes – direct mailing list of interested parties, public meetings, press releases, surveys, questionnaires, and resolutions of participation and involvement. Additional methods of getting public input and involvement are encouraged, such as placing copies of the plan in the Morgan County Emergency Management Director's office and the offices of the participating incorporated communities in addition to placing the plan on the Morgan County and social media websites. Furthermore, jurisdictions will be encouraged to place a notice on their websites stating the plan is available for review at the city offices. Notifications of these methods could be placed in chamber newsletters and local newspapers. Committee responsibilities will be the same as with updates.

Chapters 5 focuses on mitigation strategies for natural hazards and jurisdiction-specific mitigation strategies for both natural and man-made/technological hazards. The Multi-Hazard Mitigation Plan proposes a number of strategies, some of which will require outside funding in order to implement. If outside funding is not available, the strategy will be set aside until sources of funding can be identified. In these situations, Morgan County and cities will also consider other funding options such as the county's/cities'/towns' general funds, bonding and other sources. Based on the availability of funds and the risk assessment of that hazard, the county will determine which strategies should be continued and which should be set aside. Consequently, the action plan and the risk assessment serves as a guide to spending priorities but will be adjusted annually to reflect current needs and financial resources.

The last step requires an evaluation of the strategies identified in the goals and policies framework, selecting preferred strategies based on the risk assessment, prioritizing the strategy list, identifying who is responsible for carrying out the strategy, and the timeframe and costs of strategy completion. Morgan County and its jurisdictions have incorporated the preferred strategies including identification of the responsible party to implement, the timeframe and the cost of the activity with the goals and policies framework.

6.2 Local Plan Integration

There was no opportunity to incorporate the previous plan when various local ordinances or plans were updated. However, the Hazard Mitigation Planning Team and the Local Task Force members shall recognize this document as an important planning tool for their communities and will recommend its use as a reference as their communities complete other related plans. The county Emergency Management Director will contact the Morgan County Community Development Executive Director and the City of Martinsville Department of Development & Redevelopment Director to ensure they will use this plan as they update their Comprehensive Plan as well as any other relevant community ordinances such as zoning, floodplain, capital improvement plans, etc. The county Emergency Management Director shall also contact the head of other departments as they work other stand-alone plans that might relate to this one or its strategies such as those for park and recreation, sustainability, etc. As each planning mechanism is updated, the Local Task Force will reevaluate the status of the mitigation strategies and determine whether any changes in them is needed.

The Emergency Management Advisory Council (EMAC) will continue to serve as the advisory body that provides general supervision and control over the emergency management and the disaster programs for the county and its multiple jurisdictions. The quarterly meetings will continue to be available to the public and other mitigation team members through the EMAC and other mitigation projects avenues such as RiskMAP.

6.3 Adoption, Implementation and Maintenance

6.3.1 County Adoption

One of the first steps in implementing the plan is to make sure that it is officially adopted in a public hearing. The task force and public provided comment on the draft plan. The task force reviewed comments, modifications were made and a final draft was sent to FEMA for review, comment and approval. After FEMA approved the plan, the county board adopted the plan. A public hearing was held to obtain any additional comments that the public or others wished to make. A copy of the county and the community jurisdictions resolutions to adopt are located in Appendix G.

6.3.2 City and Town Adoption

The Multi-Hazard Mitigation Plan for Morgan County is a multijurisdictional plan. All communities in the county – towns and cities – were involved in the various stages of the planning process and a mitigation strategies have been identified for each jurisdiction. Each of Morgan County's cities and towns passed resolutions to participate in the county plan. Following official adoption of the plan by the county each city and township was notified. Each chose whether or not to adopt the plan as well. Each were encouraged to adopt enabling them to apply for HMGP funds independently not under the umbrella of the county. Copies of the city and towns resolutions choosing to adopt the plan are in Appendix G.

6.3.3 Implementation and Maintenance Guidelines.

The Morgan County Multi-Hazard Mitigation Plan is intended to serve as a guide/reference to mitigate the impact of both current and future hazards for all county residents and institutions. As such, it is not a static document but must be modified to reflect changing conditions if it is to be an effective plan. The goals, objectives and mitigation strategies will serve as a work or action plan. Individual strategies have a party assigned to it to help ensure implementation, oversight and general monitoring of the action plan; however, oversight has been assigned to the County Emergency Manager. The following guidelines will help implement the goals, objectives and strategies of the plan. An implementation committee will be used to assist in this process. The existing task force, the planning commission, other appropriate county committee, or any other group of stakeholders could serve as the implementation committee to review implementation opportunities identified in the plan. Implementation of strategies should be a collaborative effort of the participating jurisdictions. This committee should operate by group consensus and create recommendations for implementation to bring forward to the proper governing entity for consideration. Guidelines for the committee include:

1. Commitment to the plan and overall mitigation vision.
2. Protect sensitive information.
3. Take inventory of strategies in progress.
4. Determine strategies that no longer are needed or new strategies that have emerged.
5. Set priorities. Assign responsibilities to complete.
6. Seek funding.
7. Meet minimum bi-annually – one meeting to set the course of action and a second to monitor progress.
8. Report to all respective boards for action.
9. Advisory capacity.

Assigning strategies and implementation activities in this plan to certain entities does not guarantee completion. The strategies and activities addressed in this plan will be addressed as funding and other resources become available and approval by the responsible jurisdiction takes place.

The County Emergency Manager has the overall responsibility of tracking the progress of mitigation strategies. The County Emergency Manager will request updates from responsible agencies and cities on their mitigation actions after each disaster and at least annual to coincide with plan evaluation. Post disaster monitoring will evaluate the effectiveness of mitigation actions that have been completed and determine implementation of planned strategies. Monitoring may lead to developing a project that may be funded by FEMA's Hazard Mitigation Assistance Programs.

6.3.3.1 Continued Public Involvement

Annual reviews to change the plan will be led by the County Emergency Manager using the implementation committee. It will be their responsibility to review the plan and mitigation. FEMA strongly encourages annual reviews of the planning documents on the anniversary of the plan approval. Responsible parties and the implementation committee will report on the status of their projects. Committee responsibility will be to evaluate the plan to determine whether:

- Goals, objectives and strategies are relevant.
- Risks that have changed including the nature, magnitude, and/or type of risks.
- Resources are adequate or appropriate.
- The plan as written has any implementation problems or issues.
- Deadlines are being met as expected.
- Partners participating in the plan are appropriate.
- Strategies are effective.
- New developments affecting priorities.
- Strategies that should be changed.

Updates every five years are led by the County Emergency Management Agency Director in coordination with incorporated communities to complete a rewrite for submitting to FEMA. A task force, similar to the one created to complete the plan, will be formed and used in the planning process to rewrite the plan. These revisions will include public participation by requiring a public hearing and published notice. Future updates should address potential dollar losses to vulnerable structures identified. Any major changes in the plan may include additional public meetings besides just a public hearing.

Public participation for updates is as critical as in the initial plan. Public participation methods that were used in the initial writing should be duplicated for any updates – direct mailing list of interested parties, public meetings, press releases, surveys, questionnaires, and resolutions of participation and involvement. Additional methods of getting the public input and involvement are encouraged such as placing copies of the plan in public libraries for public comment or placing the plan on county and city websites. Notifications of these methods could be placed in newsletters and the local newspapers. Committee responsibilities will be the same with updates as the original plan.

The action plan proposes a number of strategies, some of which will require outside funding to implement. If outside funding is not available, the strategy may be set aside until sources of funding can be identified or modified to work within the funding restrictions. In these situations, the county and entities will also consider other funding options such as the county's general fund, bonding and other sources. Based on the availability of funds and the risk assessment of the hazard, the county will determine which strategies should they continue to work on and which should be set aside. Consequently, the action plan and the risk assessment serves as a guide to spending priorities but will be adjusted annually to reflect current needs and financial resources. It is not a legal binding document.

Updates require an evaluation of the strategies identified in the goals and policies framework, selecting preferred strategies based on the risk assessment, prioritizing the strategy list, identifying who is responsible for carrying out the strategy, and the timeframe and costs of strategy completion. Morgan County has incorporated the preferred strategies including identification of the responsible party to implement, the timeframe and the cost of the activity in the plan framework.

This plan will be integrated into other county plans such as the County Comprehensive Plan, the County Water Plan, the County Transportation Plan, and all Emergency Operations Plans. Chapter one can serve as an executive summary to be attached to those plans as necessary. The County Board encourages jurisdictions to address hazards in their comprehensive plans, land use regulations, zoning ordinances, capital improvement and/or building codes by including some of the mitigation strategies in their plans. Many of the plans or policies can include strategies from the Hazard Mitigation Plan. They are meant to blend and complement each other so that strategies are duplicated and occur in different plans as appropriate.

Bibliography & Quick Reference

References are separated from the county specific resources. The Quick Reference is a guide to the federal & state programs discussed within the plan.

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Quick Reference State & Federal Programs

State Resources

All Agency, Indiana Drainage Handbook: http://www.in.gov/dnr/water/4893.htm

DNR, NFIP and Floodplain management resources: floodmaps.in.gov

DNR, lake and river construction regulations: http://www.in.gov/dnr/water/4963.htm

DNR authority under the Flood Control Act is further described: 312 IAC 10: Floodplain Management

DNR, LARE resource: “LARE Project Reports.” http://www.in.gov/dnr/fishwild/3303.htm

DNR, SHAARD: “SHAARD Database.” http://www.in.gov/dnr/historic/4505.htm

DNR, State historical county survey: http://www.in.gov/dnr/historic/2824.htm

DNR, Invasive Species, Gypsy Moth and EAB: http://www.in.gov/dnr/3123.htm to report, call: (317) 232-412

Evaluating Earthquake Losses due to Ground Failure and Identifying their Relative Contribution can be accessed through the following link: http://www.iitk.ac.in/nicee/wcee/article/13_3156.pdf.

IDEM, State Rule 5, Land Management: http://www.in.gov/idem/permits/water/wastewater/wetwthr/storm/rule5.html

IDEM, Meth Cleanup Information: http://www.in.gov/idem/health/2385.htm

IDNR, Water Shortage Plan: https://www.in.gov/dnr/water/files/watshplan.pdf

Indiana State Police, Meth Resources: https://socratadata.iot.in.gov/Government/ISP-Meth-Lab-Locations-Map/ktyc-iiu7

Indiana State Department of Health, HIV Outbreak: http://www.in.gov/isdh/files/2015_County_Profiles.pdf

INDOT, Traffic Wise, Real-time traffic Conditions: http://pws.trafficwise.org/pws/

INDOT, Preservation Initiative: http://www.in.gov/indot/3371.htm

Purdue, Invasive Species, EAB Resources: https://extension.entm.purdue.edu/EAB/

Federal Resources

EPA, Local Emergency Planning Committees: https://www.epa.gov/epcra/energize-your-local-emergency-planning-committees-lepc

EPA, Excessive Heat Events Guidebook: https://www.epa.gov/heat-islands/excessive-heat-events-guidebook

ESRI Map: https://www.arcgis.com/apps/PublicInformation/index.html?appid=4ae7c683b9574856a3d3b7f75162b3f4

Extreme Heat: https://www3.epa.gov/climatechange/pdfs/print_heat-deaths-2014.pdf

FEMA Training Guide: https://training.fema.gov/emiweb/is/is393a/is393.a-lesson4.pdf

FEMA, Commuter Emergency Plans: http://www.fema.gov/media-library/assets/documents/90370

FEMA, Safe Room Guidance: https://www.fema.gov/media-library/assets/documents/3140

FEMA, Local Mitigation Planning Handbook: https://www.fema.gov/media-library/assets/documents/31598

US Fish and Wildlife, endangered and threatened species:
https://www.fws.gov/midwest/endangered/saving/outreach.html

US Fish and Wildlife, Bat Children Resources:

https://www.fws.gov/midwest/endangered/mammals/inba/curriculum/InbaKidsCavesOhMy.pdf

USGS, FIM maps: http://water.usgs.gov/osw/flood_inundation/

USGS, NHD Data: https://nhd.usgs.gov/data.html

US Fish and Wildlife, Endangered and Threatened Species:
https://www.fws.gov/midwest/endangered/saving/outreach.html

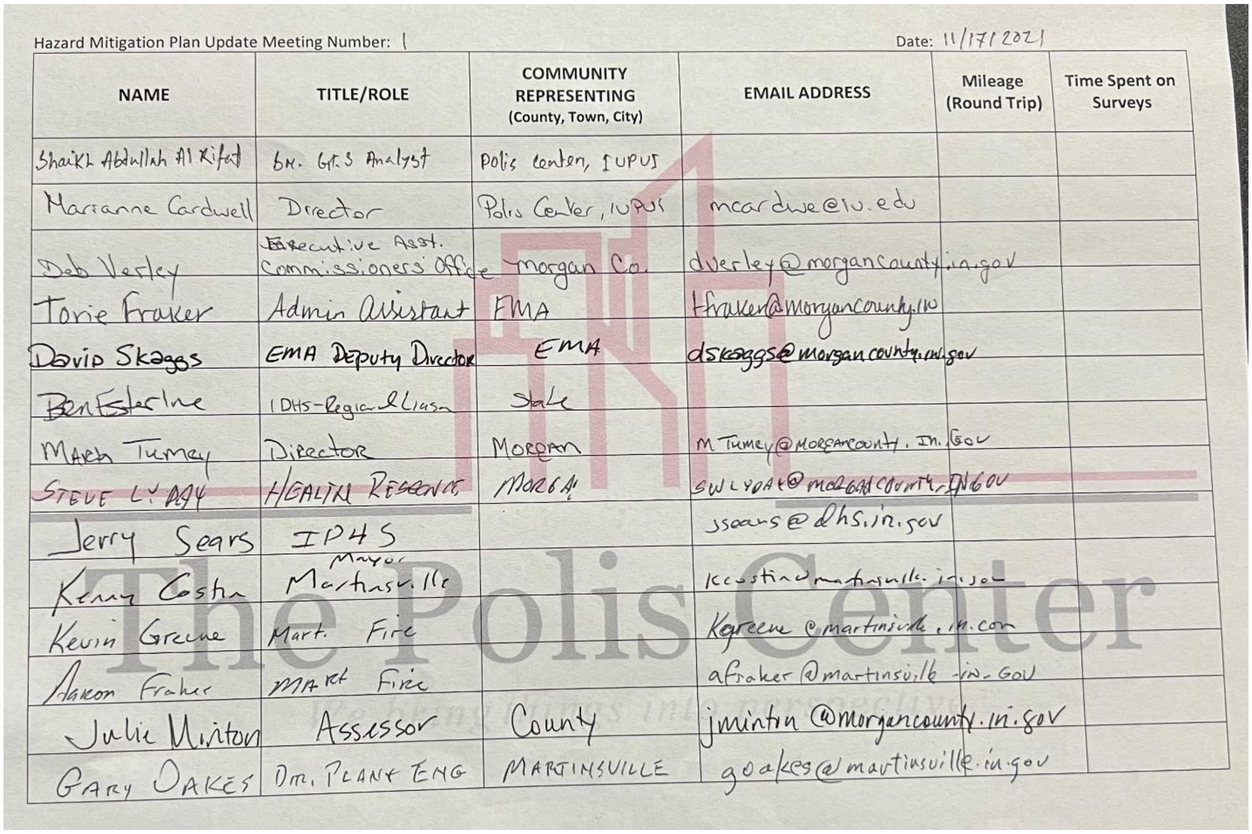
Tornado Buffers: http://www.spc.noaa.gov/faq/tornado/ef-scale.html

Indiana State Department of Health County Profiles: http://www.in.gov/isdh/files/2015_County_Profiles.pdf

Appendix A: Multi-Hazard Mitigation Planning Team Meeting Documentation

Meeting 1

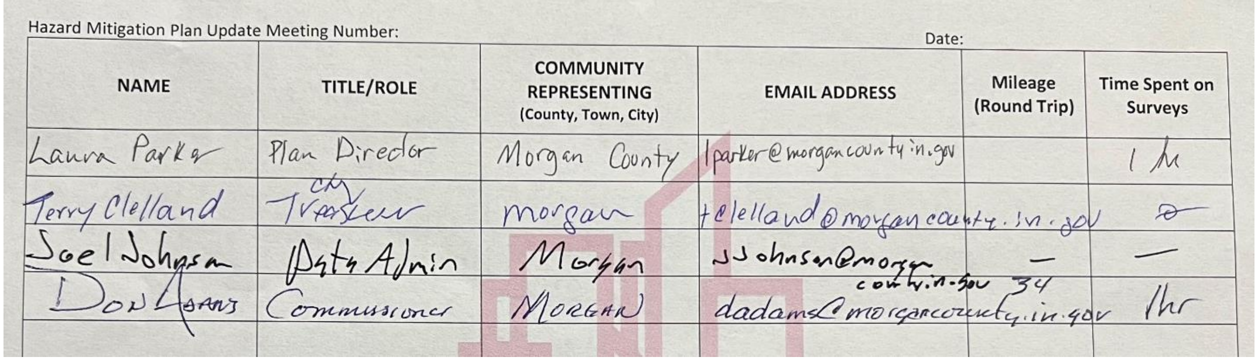
In-person attendees:



Hazard Mitigation Plan Update Meeting Number: 1

Date: 11/17/2021

NAME	TITLE/ROLE	COMMUNITY REPRESENTING (County, Town, City)	EMAIL ADDRESS	Mileage (Round Trip)	Time Spent on Surveys
Shaikh Abdullah Al Rifat	Sr. GIS Analyst	Polis Center, IUPUI			
Marianne Cardwell	Director	Polis Center, IUPUI	mcardwe@iu.edu		
Deb Verley	~~Ex~~ Executive Asst. Commissioners' Office	Morgan Co.	dverley@morgancounty.in.gov		
Torie Fraker	Admin Assistant	EMA	tfraker@morgancounty.in		
David Skaggs	EMA Deputy Director	EMA	dskaggs@morgancounty.in.gov		
Ben Esterline	IDHS-Regional Liason	State			
Mark Tumey	Director	MORGAN	MTumey@MORGANCOUNTY.IN.GOV		
STEVE LYDDAY	HEALTH RESERVE	MORGAN	SWLYDAY@MORGANCOUNTY.IN.GOV		
Jerry Sears	IDHS		jsears@dhs.in.gov		
Kenny Costin	Mayor Martinsville		kcostin@martinsville.in.gov		
Kevin Greene	Mart. Fire		Kgreene@martinsville.in.com		
Aaron Fraker	MART Fire		afraker@martinsville.in.GOV		
Julie Minton	Assessor	County	jminton@morgancounty.in.gov		
GARY OAKES	DIR. PLANT ENG	MARTINSVILLE	goakes@martinsville.in.gov		



Hazard Mitigation Plan Update Meeting Number:

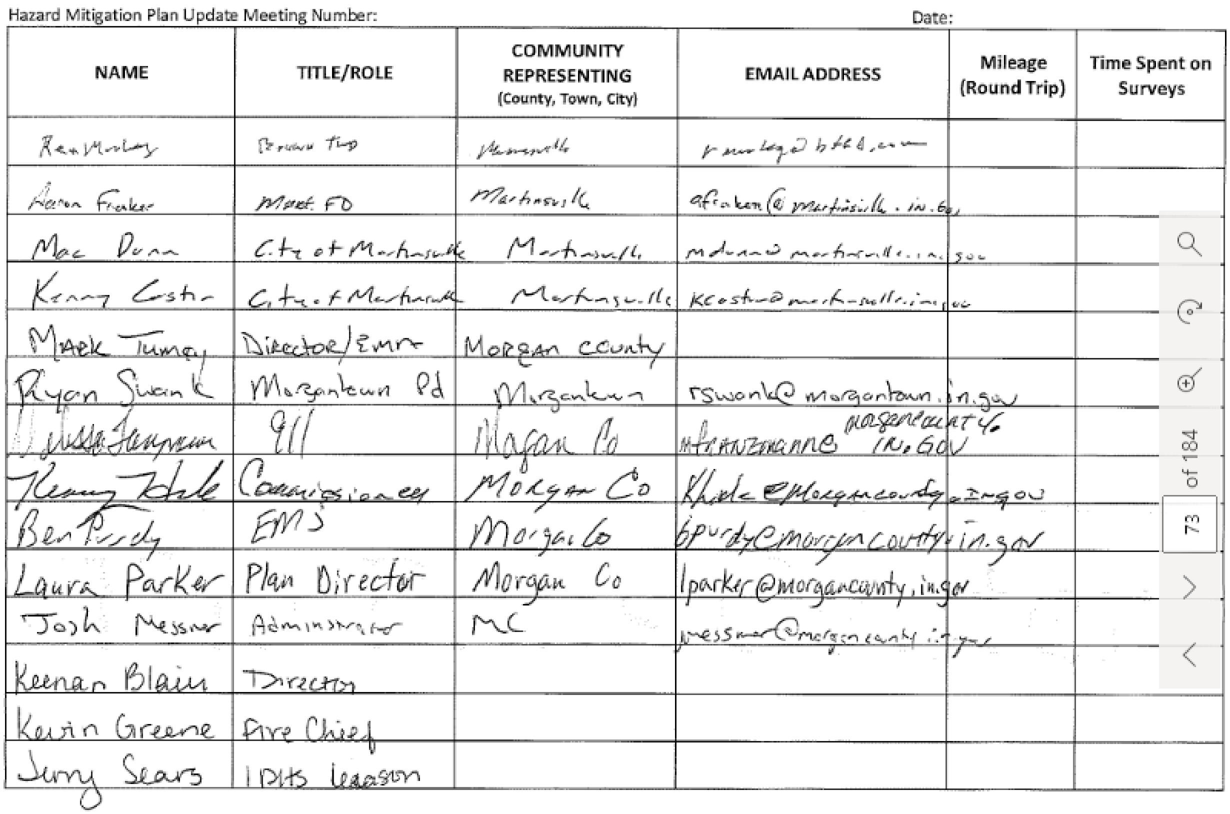
Date:

NAME	TITLE/ROLE	COMMUNITY REPRESENTING (County, Town, City)	EMAIL ADDRESS	Mileage (Round Trip)	Time Spent on Surveys
Laura Parker	Plan Director	Morgan County	lparker@morgancounty.in.gov		1 hr
Terry Clelland	City Treasurer	morgan	tclelland@morgancounty.in.gov		0
Joel Johnson	Data Admin	Morgan	jjohnson@morgan county.in.gov	—	—
Don Adams	Commissioner	MORGAN	dadams@morgancounty.in.gov	34	1hr

Zoom attendees:

Name	Title/Role	Community Representing	Email Address	Time Spent on Surveys
Keenan Blair	Director	Morgan County EMS	kdblair@morgancounty.in.gov	1 hr
Ben Purdy	Deputy Director	Morgan County EMS	bpurdy@morgancounty.in.gov	1 hr
Bryan Collier	Commissioner	Morgan County		
Tom Warthen	Council, President	Town of Mooresville	twarthen@mooresville.in.gov	
Mac Dunn	Superintendent	City of Martinsville		
Matt Dalton	Fire Chief	Mooresville FD		
Rich Meyers	Sheriff	Morgan County		

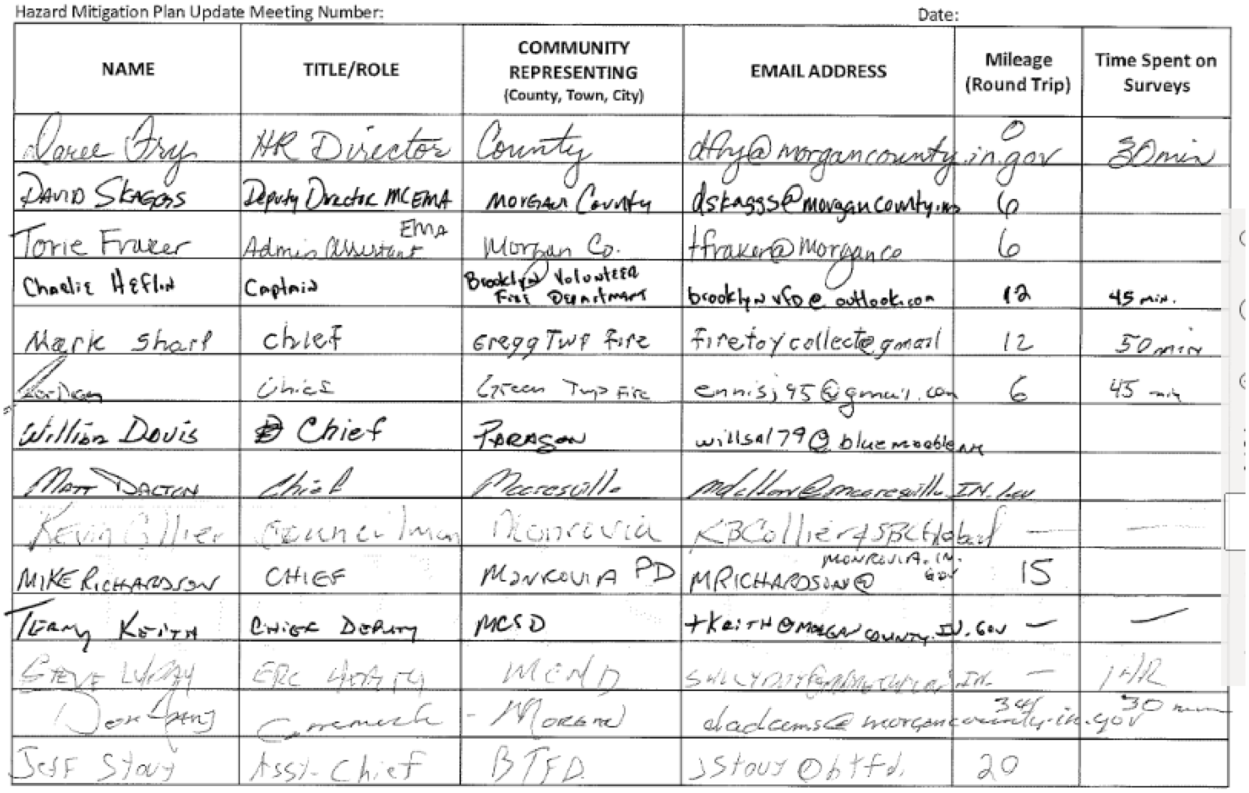
Meeting 2



Hazard Mitigation Plan Update Meeting Number:

Date:

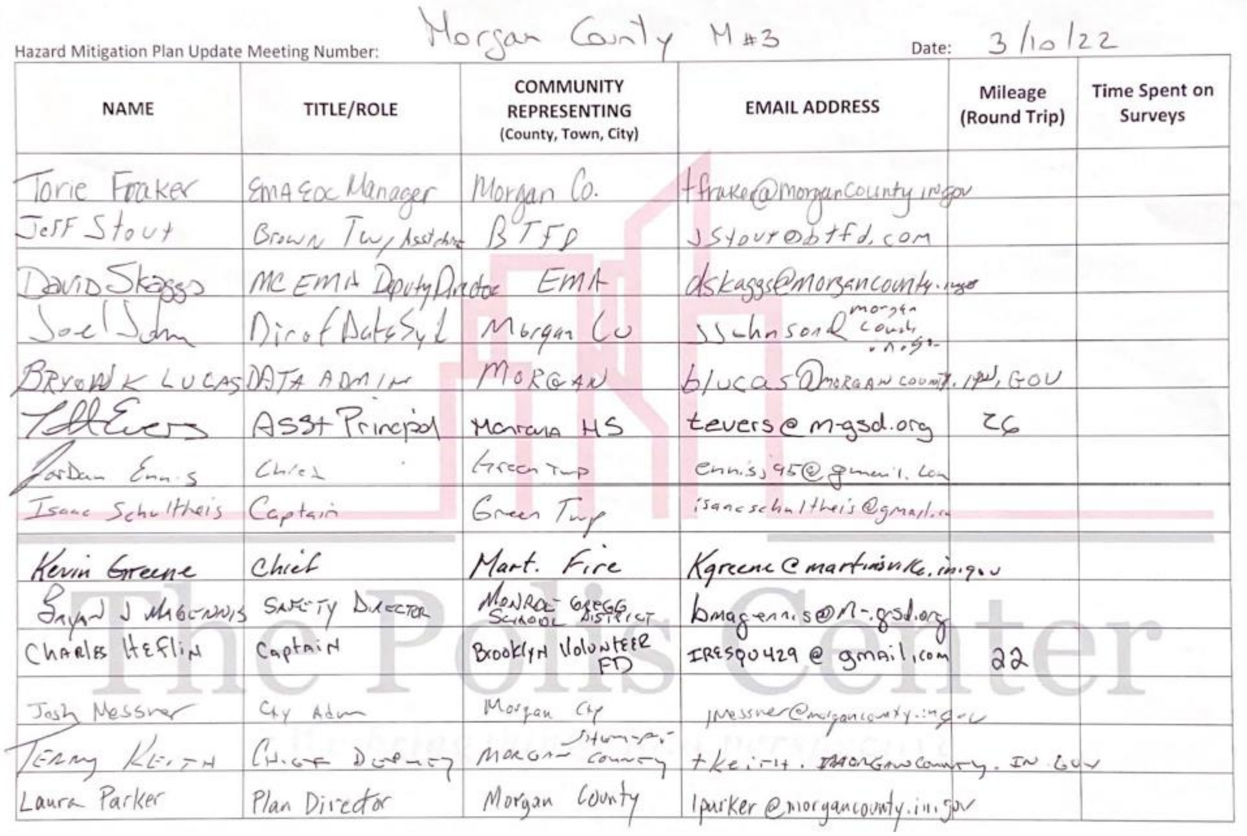
NAME	TITLE/ROLE	COMMUNITY REPRESENTING (County, Town, City)	EMAIL ADDRESS	Mileage (Round Trip)	Time Spent on Surveys
Ren Morley	Brown Twp	Mooresville	[illegible]		
Aaron Fraker	Mart. FD	Martinsville	afraker@martinsville.in.gov		
Mac Dunn	City of Martinsville	Martinsville	mdunn@martinsville.in.gov		
Kenny Costin	City of Martinsville	Martinsville	kcostin@martinsville.in.gov		
Mark Tumey	Director/EMA	Morgan county			
Ryan Swank	Morgantown Pd	Morgantown	rswank@morgantown.in.gov		
[illegible]	911	Morgan Co	mfranzmann@morgancounty.in.gov		
Kenny Hale	Commissioner	Morgan Co	khale@morgancounty.in.gov		
Ben Purdy	EMS	Morgan Co	bpurdy@morgancounty.in.gov		
Laura Parker	Plan Director	Morgan Co	lparker@morgancounty.in.gov		
Josh Messner	Administrator	MC	jmessner@morgancounty.in.gov		
Keenan Blair	Director				
Kevin Greene	Fire Chief				
Jerry Sears	IDHS leason				



Hazard Mitigation Plan Update Meeting Number: Date:

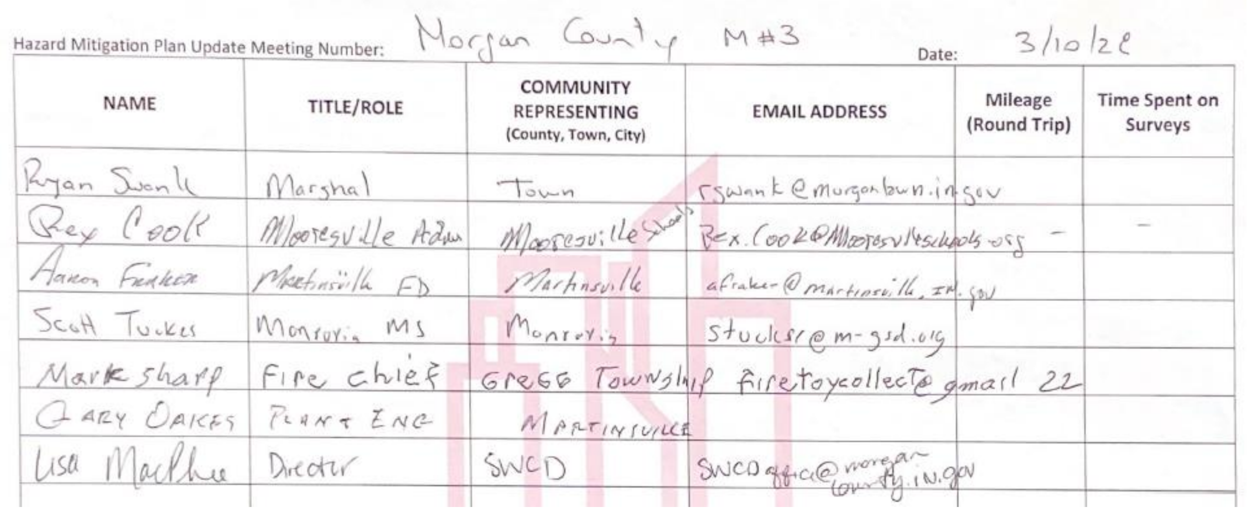
NAME	TITLE/ROLE	COMMUNITY REPRESENTING (County, Town, City)	EMAIL ADDRESS	Mileage (Round Trip)	Time Spent on Surveys
Doree Fry	HR Director	County	dfry@morgancounty.in.gov	0	30min
David Skaggs	Deputy Director MCEMA	Morgan County	dskaggs@morgancounty.in.gov	6	
Torie Fraker	Admin Assistant EMA	Morgan Co.	tfraker@morganco	6	
Charlie Heflin	Captain	Brooklyn Volunteer Fire Department	brooklynvfd@outlook.com	12	45 min.
Mark Sharp	chief	Gregg Twp Fire	firetoycollect@gmail	12	50min
	Chief	Green Twp Fire	ennisj95@gmail.com	6	45 min
William Davis	~~A~~ Chief	Paragon	willsal79@bluemarble.net		
Matt Dalton	Chief	Mooresville	mdalton@mooresville.IN.gov		
Kevin Collier	Councilman	Monrovia	KBCollier4SBCGlobal	—	—
MIKE RICHARDSON	CHIEF	MONROVIA PD	MRICHARDSON@MONROVIA.IN.GOV	15	
Terry Keith	Chief Deputy	MCSD	tkeith@morgancounty.IN.gov	—	—
Steve Wray	[illegible]	MCHD	[illegible].IN.	—	1 HR
Don Adams	Commish	- Morgan	dadams@morgancounty.in.gov	34	30 min
Jeff Story	Asst. Chief	BTFD	jstory@btfd.	20	

Meeting 3



Hazard Mitigation Plan Update Meeting Number: Morgan County M#3 Date: 3/10/22

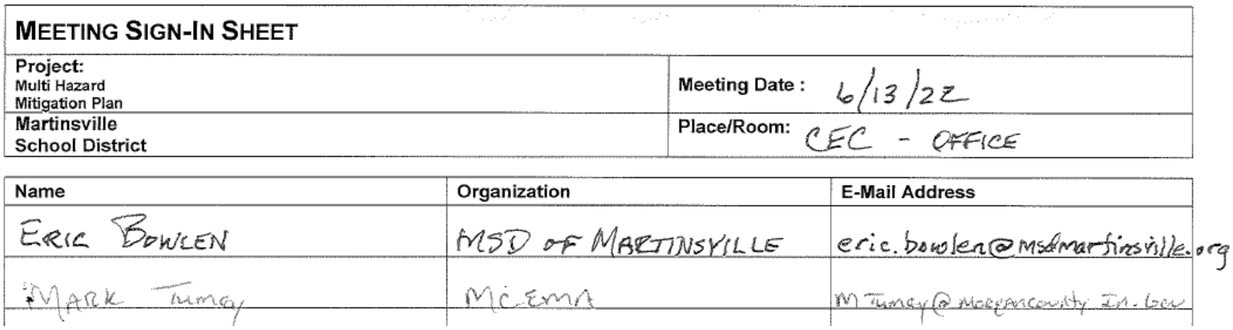
NAME	TITLE/ROLE	COMMUNITY REPRESENTING (County, Town, City)	EMAIL ADDRESS	Mileage (Round Trip)	Time Spent on Surveys
Torie Fraker	EMA EOC Manager	Morgan Co.	tfraker@morgancounty.in.gov		
Jeff Stout	Brown Twp Asst chief	BTFD	jstout@btfd.com		
David Skaggs	MC EMA Deputy Director	EMA	dskaggs@morgancounty.in.gov		
Joel John	Dir of Data Sys	Morgan Co	jjohnson@morgancounty.in.gov		
Bryan K Lucas	DATA ADMIN	MORGAN	blucas@morgancounty.in.gov		
Todd Evers	Asst Principal	Monrovia HS	tevers@m-gsd.org	26	
Jordan Ennis	Chief	Green Twp	ennisj95@gmail.com		
Isaac Schultheis	Captain	Green Twp	isaacschultheis@gmail.com		
Kevin Greene	Chief	Mart. Fire	Kgreene@martinsville.in.gov		
Bryan J Magennis	SAFETY DIRECTOR	MONROE GREGG SCHOOL DISTRICT	bmagennis@m-gsd.org		
Charles Heflin	Captain	Brooklyn Volunteer FD	IRESQ0429@gmail.com	22	
Josh Messner	Cty Adm	Morgan Cty	jmessner@morgancounty.in.gov		
Terry Keith	Chief Deputy	Morgan County Sheriff	tkeith.morgancounty.in.gov		
Laura Parker	Plan Director	Morgan County	lparker@morgancounty.in.gov		



Hazard Mitigation Plan Update Meeting Number: Morgan County M#3 Date: 3/10/22

NAME	TITLE/ROLE	COMMUNITY REPRESENTING (County, Town, City)	EMAIL ADDRESS	Mileage (Round Trip)	Time Spent on Surveys
Ryan Swank	Marshal	Town	rswank@morgantown.in.gov		
Rex Cook	Mooresville Adm	Mooresville Schools	Rex.Cook@Mooresvilleschools.org	-	-
Aaron Fraker	Martinsville FD	Martinsville	afraker@martinsville.in.gov		
Scott Tucker	Monrovia MS	Monrovia	stuckerr@m-gsd.org		
Mark Sharp	Fire chief	GREGG Township	firetoycollect@gmail	22	
Gary Oakes	PLANT ENG	MARTINSVILLE			
Lisa Machlee	Director	SWCD	SWCDoffice@morgancounty.in.gov		

Meeting with Martinsville Schools

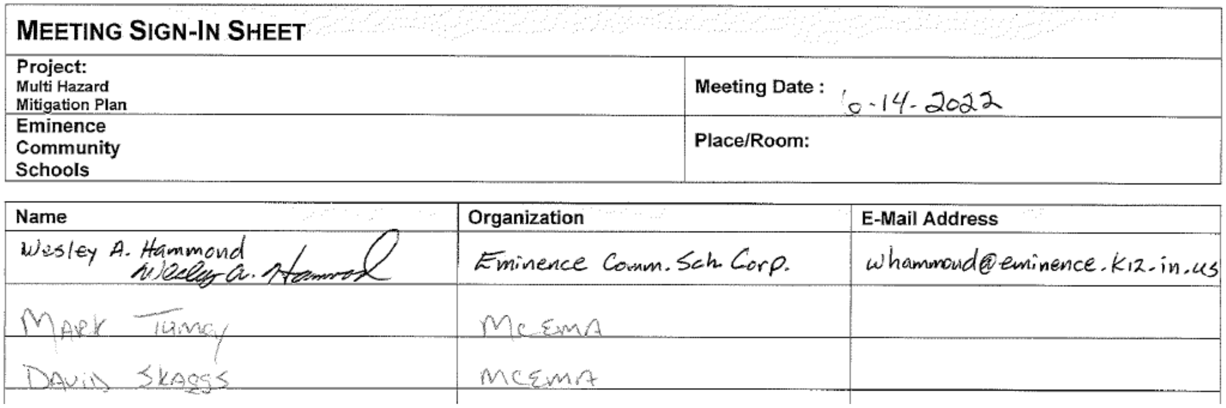


MEETING SIGN-IN SHEET

Project: Multi Hazard Mitigation Plan	**Meeting Date :** 6/13/22
Martinsville School District	**Place/Room:** CEC - OFFICE

Name	Organization	E-Mail Address
ERIC BOWLEN	MSD OF MARTINSVILLE	eric.bowlen@msdmartinsville.org
MARK TUMEY	MCEMA	MTumey@MorganCounty.IN.Gov

Meeting with Eminence Community School Corporation

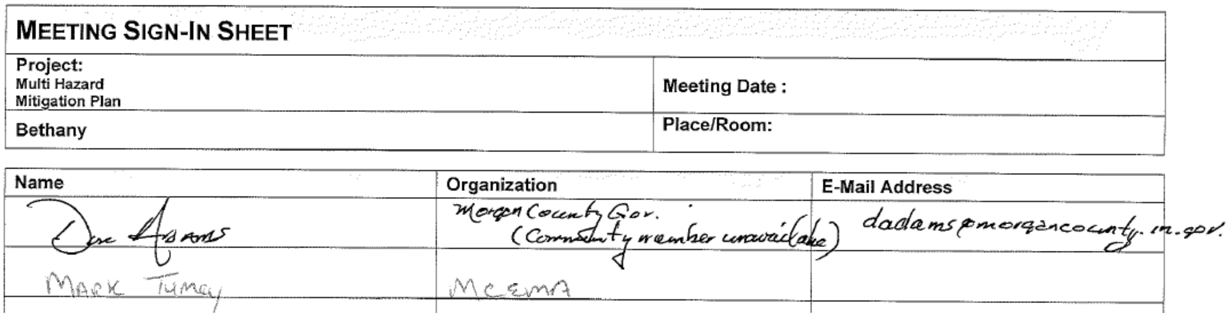


MEETING SIGN-IN SHEET

Project: Multi Hazard Mitigation Plan	**Meeting Date :** 6-14-2022
Eminence Community Schools	**Place/Room:**

Name	Organization	E-Mail Address
Wesley A. Hammond Wesley A. Hammond	Eminence Comm. Sch. Corp.	whammond@eminence.k12.in.us
MARK TUMEY	MCEMA	
DAVID SKAGGS	MCEMA	

Meeting with Bethany



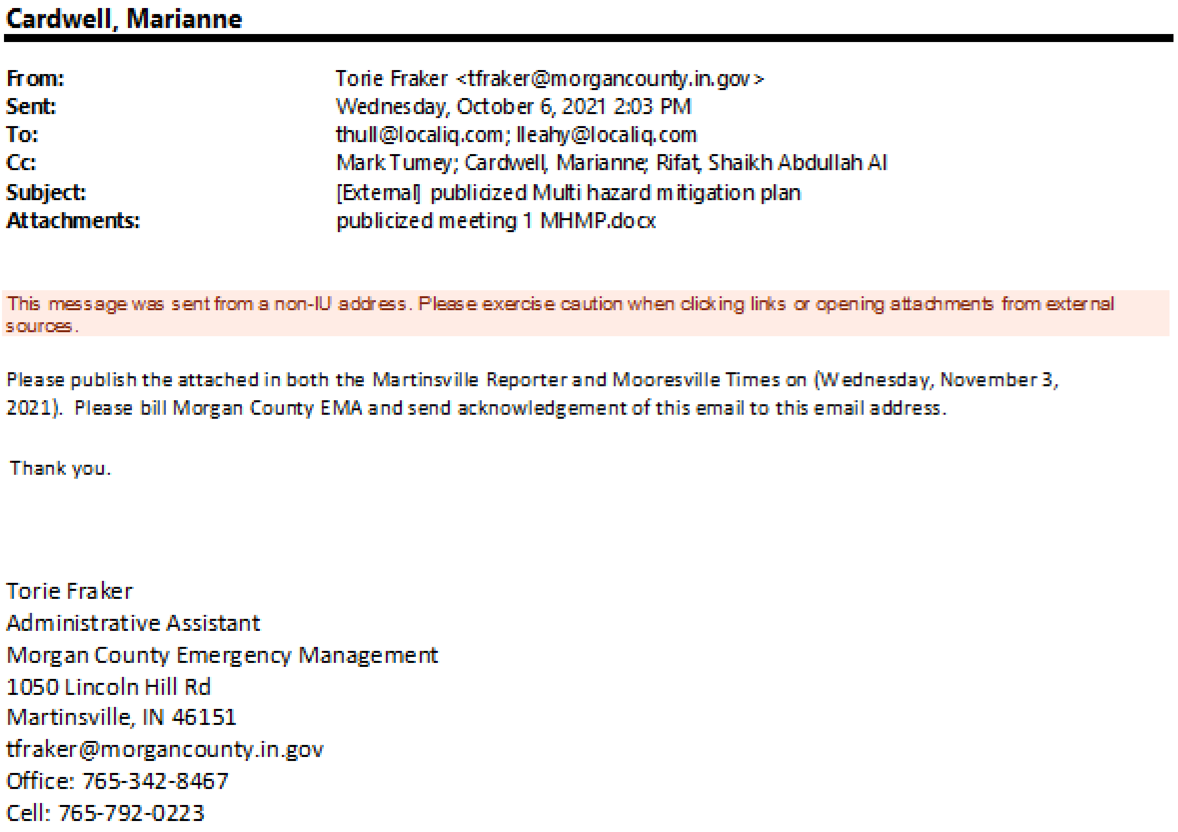
MEETING SIGN-IN SHEET

Project: Multi Hazard Mitigation Plan	**Meeting Date :**
Bethany	**Place/Room:**

Name	Organization	E-Mail Address
Dan Adams	Morgan County Gov. (Community member unavailable)	dadams@morgancounty.in.gov.
MARK TUMEY	MCEMA	

Appendix B: Public Notices in the Local Media

Meeting 1



Cardwell, Marianne

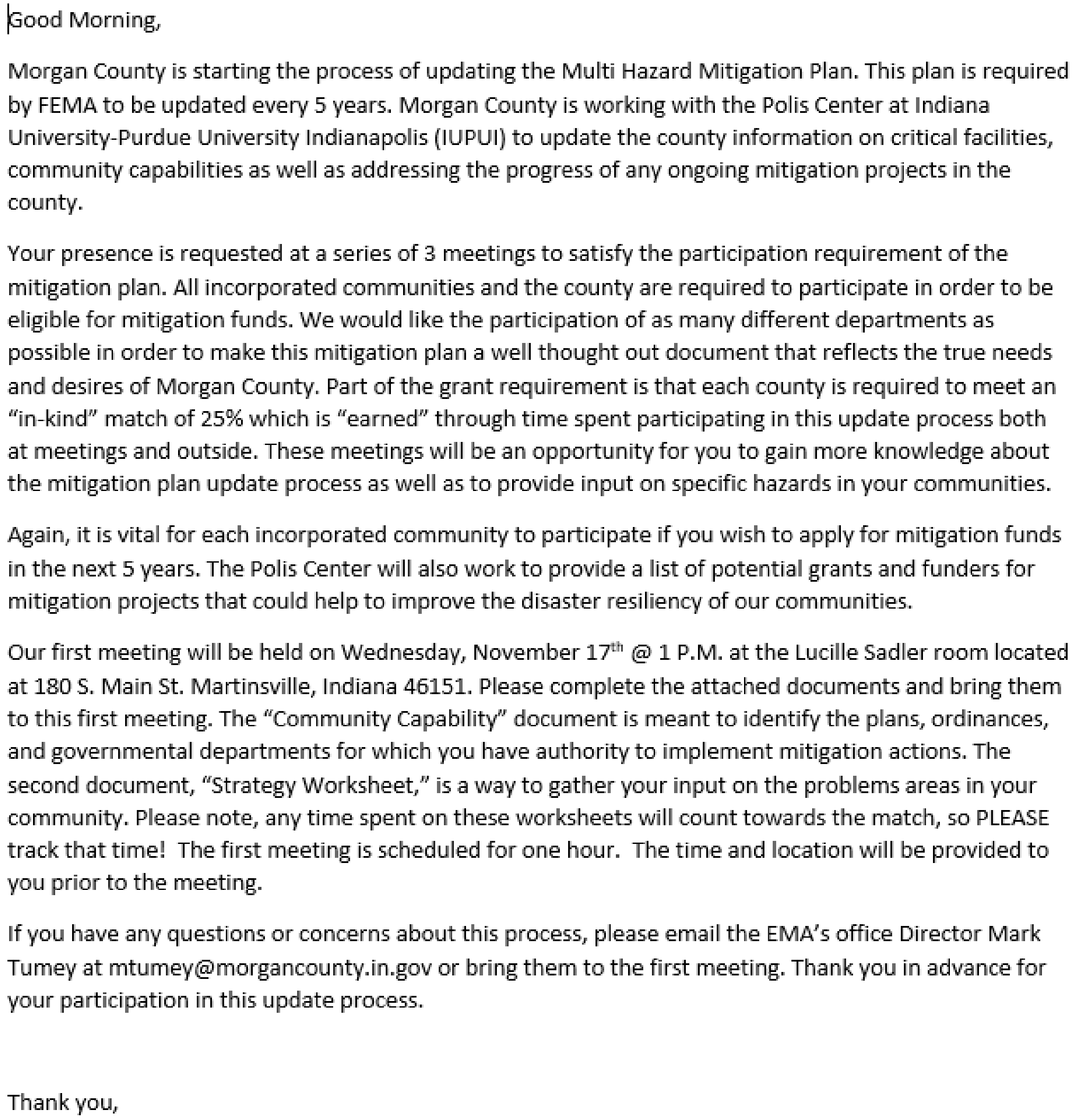
From: Torie Fraker <tfraker@morgancounty.in.gov>
Sent: Wednesday, October 6, 2021 2:03 PM
To: thull@localiq.com; lleahy@localiq.com
Cc: Mark Tumey; Cardwell, Marianne; Rifat, Shaikh Abdullah Al
Subject: [External] publicized Multi hazard mitigation plan
Attachments: publicized meeting 1 MHMP.docx

This message was sent from a non-IU address. Please exercise caution when clicking links or opening attachments from external sources.

Please publish the attached in both the Martinsville Reporter and Mooresville Times on (Wednesday, November 3, 2021). Please bill Morgan County EMA and send acknowledgement of this email to this email address.

Thank you.

Torie Fraker
Administrative Assistant
Morgan County Emergency Management
1050 Lincoln Hill Rd
Martinsville, IN 46151
tfraker@morgancounty.in.gov
Office: 765-342-8467
Cell: 765-792-0223



Good Morning,

Morgan County is starting the process of updating the Multi Hazard Mitigation Plan. This plan is required by FEMA to be updated every 5 years. Morgan County is working with the Polis Center at Indiana University-Purdue University Indianapolis (IUPUI) to update the county information on critical facilities, community capabilities as well as addressing the progress of any ongoing mitigation projects in the county.

Your presence is requested at a series of 3 meetings to satisfy the participation requirement of the mitigation plan. All incorporated communities and the county are required to participate in order to be eligible for mitigation funds. We would like the participation of as many different departments as possible in order to make this mitigation plan a well thought out document that reflects the true needs and desires of Morgan County. Part of the grant requirement is that each county is required to meet an “in-kind” match of 25% which is “earned” through time spent participating in this update process both at meetings and outside. These meetings will be an opportunity for you to gain more knowledge about the mitigation plan update process as well as to provide input on specific hazards in your communities.

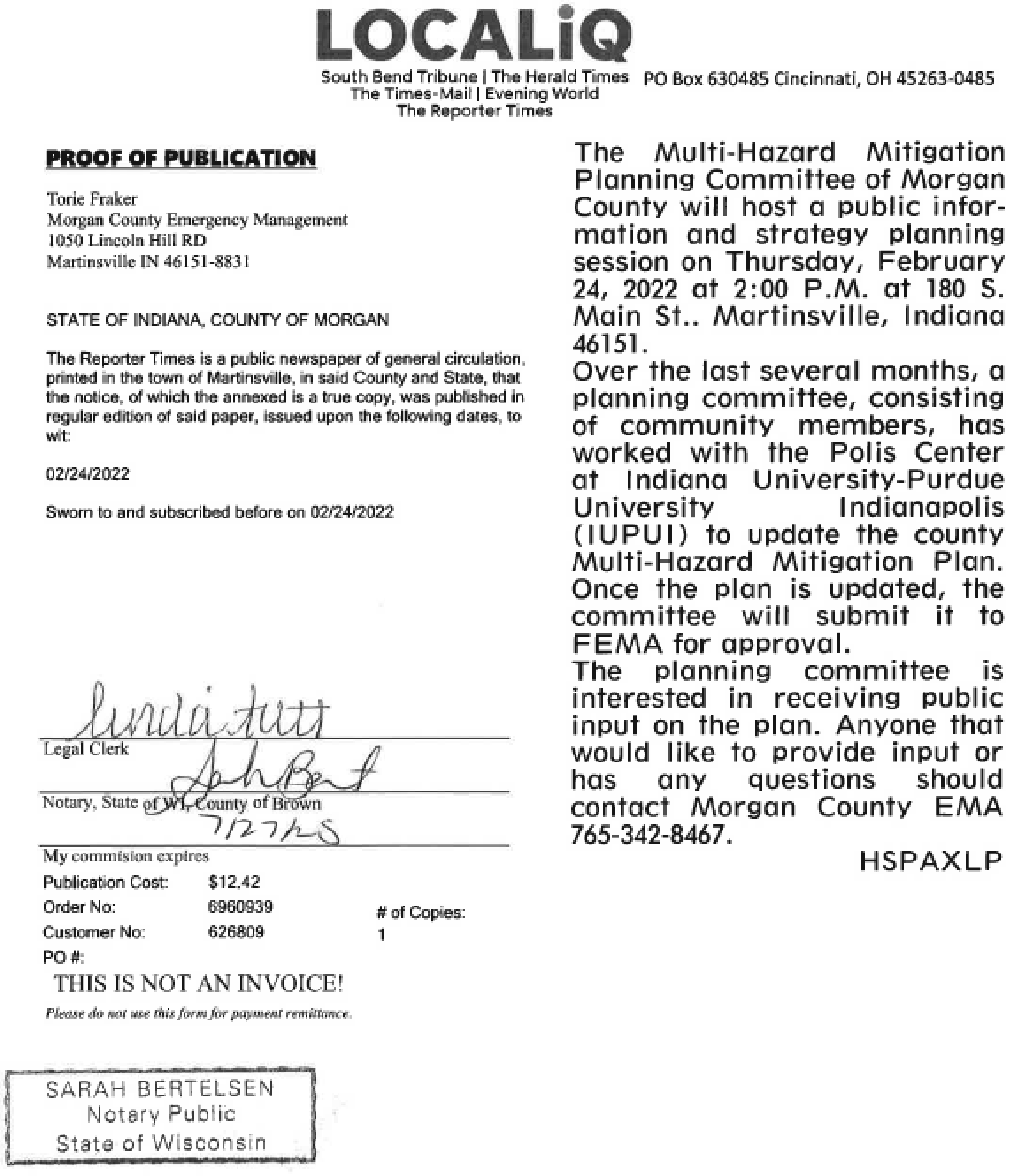
Again, it is vital for each incorporated community to participate if you wish to apply for mitigation funds in the next 5 years. The Polis Center will also work to provide a list of potential grants and funders for mitigation projects that could help to improve the disaster resiliency of our communities.

Our first meeting will be held on Wednesday, November 17th @ 1 P.M. at the Lucille Sadler room located at 180 S. Main St. Martinsville, Indiana 46151. Please complete the attached documents and bring them to this first meeting. The “Community Capability” document is meant to identify the plans, ordinances, and governmental departments for which you have authority to implement mitigation actions. The second document, “Strategy Worksheet,” is a way to gather your input on the problems areas in your community. Please note, any time spent on these worksheets will count towards the match, so PLEASE track that time! The first meeting is scheduled for one hour. The time and location will be provided to you prior to the meeting.

If you have any questions or concerns about this process, please email the EMA’s office Director Mark Tumey at mtumey@morgancounty.in.gov or bring them to the first meeting. Thank you in advance for your participation in this update process.

Thank you,

Meeting 3



LOCALiQ

South Bend Tribune | The Herald Times
The Times-Mail | Evening World
The Reporter Times

PO Box 630485 Cincinnati, OH 45263-0485

PROOF OF PUBLICATION

Torie Fraker
Morgan County Emergency Management
1050 Lincoln Hill RD
Martinsville IN 46151-8831

STATE OF INDIANA, COUNTY OF MORGAN

The Reporter Times is a public newspaper of general circulation, printed in the town of Martinsville, in said County and State, that the notice, of which the annexed is a true copy, was published in regular edition of said paper, issued upon the following dates, to wit:

02/24/2022

Sworn to and subscribed before on 02/24/2022

Legal Clerk

Notary, State of WI, County of Brown

7/27/25

My commision expires

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SARAH BERTELSEN
Notary Public
State of Wisconsin

The Multi-Hazard Mitigation Planning Committee of Morgan County will host a public information and strategy planning session on Thursday, February 24, 2022 at 2:00 P.M. at 180 S. Main St.. Martinsville, Indiana 46151.

Over the last several months, a planning committee, consisting of community members, has worked with the Polis Center at Indiana University-Purdue University Indianapolis (IUPUI) to update the county Multi-Hazard Mitigation Plan. Once the plan is updated, the committee will submit it to FEMA for approval.

The planning committee is interested in receiving public input on the plan. Anyone that would like to provide input or has any questions should contact Morgan County EMA 765-342-8467.

HSPAXLP

Appendix C: Historical Hazards from NCEI since 2010

Location / County	Date	Event	Dir. Injuries	Indir. Injuries	Dir. Deaths	Indir. Deaths	Property Damage	Crop Damage	Description
Morgan County	40224	Winter Storm	0	0	0	0	0.00K	0.00K	A strong upper low moved across the Ohio Valley on the 15th, bringing snowfall totals to nearly a foot to portions of Central Indiana. This snow fell within a 24 hour period, with some areas seeing the snow start during the late evening of February 14. Snowfall totals across Central Indiana ranged from less than an inch across the far northern sections to around 10 inches across far southern sections. The snowfall total for the 15th at the Indianapolis International Airport reached 6.3 inches, which was a new record snowfall for the date.
Paragon	40273	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed along a warm front across Central Indiana during the afternoon of April 5, 2010. These storms brought large hail and damaging winds to parts of the southern half of Central Indiana into the early evening. Most of the severe weather that occurred was large hail, with a few hailstones reaching over the two inch mark.
Paragon	40273	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed along a warm front across Central Indiana during the afternoon of April 5, 2010. These storms brought large hail and damaging winds to parts of the southern half of Central Indiana into the early evening. Most of the severe weather that occurred was large hail, with a few hailstones reaching over the two inch mark.
Martinsville	40273	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed along a warm front across Central Indiana during the afternoon of April 5, 2010. These storms brought large hail and damaging winds to parts of the southern half of Central Indiana into the early evening. Most of the severe weather that occurred was large hail, with a few hailstones reaching over the two inch mark.
Bethany	40303	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed across portions of central Indiana as a cold front pushed southeast across the forecast area during the evening of the 5th of May. A few reports of small hail were received.
Lewisville	40341	Tornado	0	0	0	0	25.00K	0.00K	Scattered showers and thunderstorms pushed into Central Indiana from the west during the evening of June 12th. The majority of the severe weather reports from this episode were of

Location / County	Date	Event	Dir. Injuries	Indir. Injuries	Dir. Deaths	Indir. Deaths	Property Damage	Crop Damage	Description
									the thunderstorm wind variety. A tornado also touched down north of Paragon in Morgan County. Flooding was noted across portions of the forecast area as well. Approximately 25,000 customers were without power across the state.
Cope	40341	Thunderstorm Wind	0	0	0	0	0.25K	0.00K	Scattered showers and thunderstorms pushed into Central Indiana from the west during the evening of June 12th. The majority of the severe weather reports from this episode were of the thunderstorm wind variety. A tornado also touched down north of Paragon in Morgan County. Flooding was noted across portions of the forecast area as well. Approximately 25,000 customers were without power across the state.
Martinsville	40341	Thunderstorm Wind	0	0	0	0	15.00K	0.00K	Scattered showers and thunderstorms pushed into Central Indiana from the west during the evening of June 12th. The majority of the severe weather reports from this episode were of the thunderstorm wind variety. A tornado also touched down north of Paragon in Morgan County. Flooding was noted across portions of the forecast area as well. Approximately 25,000 customers were without power across the state.
Martinsville	40341	Thunderstorm Wind	0	0	0	0	50.00K	0.00K	Scattered showers and thunderstorms pushed into Central Indiana from the west during the evening of June 12th. The majority of the severe weather reports from this episode were of the thunderstorm wind variety. A tornado also touched down north of Paragon in Morgan County. Flooding was noted across portions of the forecast area as well. Approximately 25,000 customers were without power across the state.
Martinsville	40341	Thunderstorm Wind	0	0	0	0	0.25K	0.00K	Scattered showers and thunderstorms pushed into Central Indiana from the west during the evening of June 12th. The majority of the severe weather reports from this episode were of the thunderstorm wind variety. A tornado also touched down north of Paragon in Morgan County. Flooding was noted across portions of the forecast area as well. Approximately 25,000 customers were without power across the state.
Waverly	40341	Thunderstorm Wind	0	0	0	0	0.00K	0.00K	Scattered showers and thunderstorms pushed into Central Indiana from the west during the evening of June 12th. The majority of the severe weather reports from this episode were of the thunderstorm wind variety. A tornado also touched down north of Paragon in Morgan County. Flooding was noted across

Location / County	Date	Event	Dir. Injuries	Indir. Injuries	Dir. Deaths	Indir. Deaths	Property Damage	Crop Damage	Description
									portions of the forecast area as well. Approximately 25,000 customers were without power across the state.
Wilbur	40343	Flood	0	0	0	0	0.50K	0.50K	With a stationary boundary draped across the region from west to east, a line of thunderstorms pushed eastward into west-central Indiana from Illinois during the evening of June 13th. This bowing line of storms turned southeast as it entered the forecast area. Numerous thunderstorm wind gusts and damage reports were received as this line of storms passed through the area.
Gasburg	40344	Thunderstorm Wind	0	0	0	0	1.00K	0.00K	A band of showers and embedded leading-edge thunderstorms moved into Central Indiana from Illinois during the afternoon and evening of the 15th of June. This line of severe storms moved across the forecast area bringing large hail, damaging winds and flash flooding reports from a number of counties.
Mooresville	40344	Thunderstorm Wind	0	0	0	0	0.00K	0.00K	A band of showers and embedded leading-edge thunderstorms moved into Central Indiana from Illinois during the afternoon and evening of the 15th of June. This line of severe storms moved across the forecast area bringing large hail, damaging winds and flash flooding reports from a number of counties.
Monrovia	40344	Thunderstorm Wind	0	0	0	0	0.00K	0.00K	A band of showers and embedded leading-edge thunderstorms moved into Central Indiana from Illinois during the afternoon and evening of the 15th of June. This line of severe storms moved across the forecast area bringing large hail, damaging winds and flash flooding reports from a number of counties.
Martinsville	40344	Thunderstorm Wind	0	0	0	0	6.00K	0.00K	A band of showers and embedded leading-edge thunderstorms moved into Central Indiana from Illinois during the afternoon and evening of the 15th of June. This line of severe storms moved across the forecast area bringing large hail, damaging winds and flash flooding reports from a number of counties.
Mooresville	40351	Flood	0	0	0	0	10.00K	0.00K	During the afternoon and evening hours on June 21st a combination of old thunderstorm activity that moved in from upstream of Indiana, along with new development behind the previous activity occurred as a result of upper level atmospheric support and ample surface heating. This led to a very to extremely unstable air mass...with MLCAPES exceeding 3500 j/kg.||By early evening discrete cells developed along a west to east oriented boundary that extended roughly from near the Missouri/Iowa border eastward through central Illinois and then

Location / County	Date	Event	Dir. Injuries	Indir. Injuries	Dir. Deaths	Indir. Deaths	Property Damage	Crop Damage	Description
									to just north of Lafayette, Indiana. Radar data showed several of these storm cells having supercellular structure/rotation as they encountered enhanced low level helicity (most simply put, helicity is the amount of spin to a parcel of air) along the boundary. Upstream wind profile data at Davenport, Iowa showed favorable veering of wind with height for storm rotation. Upper air data from the 00z (7 PM EST) sounding from the Central Illinois National Weather Service office showed a low lifted condensation level of 3000 ft and steep low level lapse rates, which lent support to the storms. Storms forming upstream of Indiana moved into the state as the day progressed.
Morgan County	40452	Drought	0	0	0	0	0.00K	0.00K	October 2010 continued the trend of warmer and drier than normal weather|that has prevailed since July. Many locations received less than 2 inches of rainfall. Drought conditions and fire activity worsened during the month. Monthly precipitiation totals ranged from less than 0.50 inches in portions of central Indiana to 3.50 inches near Lake Michigan in northwest Indiana. This was 10% of normal in portions of central Indiana to 125% of normal in portions of northwest and east central Indiana. Nearly one-half of the state received less than an inch of rain during October.||Drought conditions gradually deteriorated during October. The National Drought Monitor for October 5 indicated nearly 50% of the Indiana with moderate (D1) to severe (D2) drought conditions. By the end of October, moderate (D1) to extreme (D3) drought conditions had spread to nearly all of the state. The National Drought Monitor for November 2nd indicated that virtually all of Indiana south of U.S. Highway 36 was in severe (D2) to extreme (D3) drought. Extreme (D3) drought conditions prevailed in much of south central Indiana. Here are some of the impacts of the drought.||Here are some of the agricultural impacts this month. The Indiana Weekly Crop Progress and Condition Report released on November 1st indicated that 98% of the corn and soybean acreage had been harvested (record harvest pace). Soils remained very dry with 93% of the top soil and sub soil moisture rated short to very short. Only 3% of the pastures statewide were rated good. Thirty percent of the winter wheat was rated poor to very poor. Farmers were concerned

Location / County	Date	Event	Dir. Injuries	Indir. Injuries	Dir. Deaths	Indir. Deaths	Property Damage	Crop Damage	Description
									about possible hay shortages during the winter because of poor pasture conditions. Farmers in several areas of southern Indiana continued to haul water to livestock because local springs and streams had gone dry.||Here are some of the water utilities impacts. Southern Indiana's persistent dry spell prompted state officials to ask companies and others in the area that use large volumes of water to voluntarily reduce usage by 10 to 15 percent. Indiana Department of Environmental Management reported a few limited water supply problems in southern Indiana that affected one local business and a small water utility. The agency also reported water levels in wells, lakes and streams lower than normal in southern Indiana.||Here are some of the impacts associated with fires and fire concerns throughout the month. The drought conditions led to numerous field fires Indiana. Large field fires were noted on the 9th, 10th, 20th, 22nd, 23rd and 27th. These fires coincided with warm temperatures, low relative humidity values and moderate to strong winds. Indiana Forestry indicated high fire danger for much of south central Indiana including the counties of Owen, Greene, Martin, Lawrence, Brown, Monroe, Johnson, Morgan, Jackson, Bartholomew, Jennings, Orange, Washington, Scott, Clark, Crawford, Harrison and Perry. Conditions for problematic fires existed in roughly three-quarters of the state. During the first 3 weeks of October, fire activity was well above normal and was comparable to the fire season of 1999 and at times the record fire season of 1988. Fire activity transitioned from field fires in central Indiana to timber fires in southern Indiana during the last week of October. Timber fires were the worst since the record fire season of 1988. At one point in October, burning bans existed for more than 75% of Indianaï¿½ï¿½ï¿½s counties. With the arrival of cooler temperatures and some rainfall near the end of the month, burning bans existed in only 55% of the Indiana counties at the beginning of November.||Here are some of the hydrologic impacts for the month. During October, stream flow continued to slowly diminish. At the end of October, U.S. Geological Survey gauging sites indicated several small watersheds at or near daily record low flow in Indiana. Consequently, the flow in the White,

Location / County	Date	Event	Dir. Injuries	Indir. Injuries	Dir. Deaths	Indir. Deaths	Property Damage	Crop Damage	Description
									East Fork White and Wabash Rivers was below normal. The lowest river flow, when compared to normal, was in southwest Indiana. In central Indiana, all Indianapolis water supply reservoirs and Monroe Lake ranged from 2 to 4.5 feet below normal lake levels.
Morgan County	40483	Drought	0	0	0	0	0.00K	0.00K	The U.S. Drought Monitor released on November 4th indicated 95% of Indiana was experiencing moderate to extreme drought conditions as of November 2nd. This was an increase in moderate to severe coverage across central Indiana and an increase in extreme conditions across the southern Indiana. Severe drought conditions included most areas along and south of U.S. Highway 36. Extreme drought conditions persisted in much of south central Indiana southward to the Ohio River and into Kentucky. Burning bans existed November 12 in 55% of the Indiana counties.||Three new consequences occurred as the result of severe to extreme drought conditions during the first half of November. During routine training operations by the Indiana National Guard at Big Oaks National Wildlife Refuge and military personnel at Camp Atterbury, wild fires were started. The fires at Camp Atterbury burned 3,000 acres. The second event was an arsonist setting fires to railroad trestles in southern Indiana. Debris piled up from past high water events, dried out during the drought, and was easily set ablaze because of low river levels. The third drought consequence was a number of shallow wells went dry or the water changed color and taste in portions of southern Indiana. ||On November 12, U.S. Geological Survey gauging sites indicated virtually all rivers and streams in Indiana were at below normal levels. Several small watersheds were at or near daily record low flow. The lowest river level for the East Fork White, White, and Wabash Rivers was in southwest Indiana. In central Indiana, all Indianapolis water supply reservoirs and Monroe Lake remained at 2 to 4.5 feet below normal lake levels. ||Total precipitation for 2010 at Indianapolis through November 12th was 27.55 inches or more than 8 inches (8.16 inches) below normal. This is the 14th driest year on record at Indianapolis for the January 1st through November 12th periods.||The severe (D2) to extreme (D3) drought indicated by the National Drought

Location / County	Date	Event	Dir. Injuries	Indir. Injuries	Dir. Deaths	Indir. Deaths	Property Damage	Crop Damage	Description
									Monitor for virtually all of Indiana south of U.S Highway 36 began to improve after some of driest areas of southern Indiana received significant rainfall on the 13th and again on the 16th. Total rainfall of 0.50 to nearly 3 inches occurred east of a line from Fort Wayne to Evansville from the 13th to the 16th. Drought conditions were eliminated in southern Indiana following 3 to 8 inches of rainfall along and south of Interstate 70 from the 22nd to the 30th. Portions of west central and northern Indiana remained on the dry side at the close of November. Stream flow increased greatly following the rains during the last week of November. On the last day of the month, stream flow was above normal in most areas. Geist and Morse reservoirs returned to normal levels, but Monroe Lake and Eagle Creek reservoir remained 2 and 4 feet below normal respectively.
Morgan County	40574	Winter Storm	0	0	0	0	0.00K	0.00K	A powerful winter storm moved across the United States, bringing severe winter weather to central Indiana from January 31 through February 2. Freezing rain, sleet, snow, strong winds, and arctic air impacted the state. Indianapolis received 0.6 inches of ice and 1.0 inch of sleet from the storm. The first wave of precipitation fell during the evening of January 31, and this precipitation was mainly freezing rain and sleet, with a little snow across the northern parts of central Indiana. The second wave of precipitation began in earnest during the afternoon of February 1 and continued into the overnight hours. Far northern sections of central Indiana saw snow, with a sleet/freezing rain mix across much of the central part of the area. Across the south, mainly freezing rain was noted. After the strong area of low pressure passed over the area, winds increased with gusts over 50 mph reported. This wind created blowing and drifting snow across the north, and caused trees and power lines to come down across areas that saw freezing rain. Travel became near impossible at many locations, with several counties across central Indiana restricting travel. As the storm moved across the state, warm air briefly moved into central Indiana warming temperatures to above freezing across parts of the area. The warmth was brief though, as Arctic air flowed into the area after the storm passed. Temperatures dropped to near zero in some locations by the

Location / County	Date	Event	Dir. Injuries	Indir. Injuries	Dir. Deaths	Indir. Deaths	Property Damage	Crop Damage	Description
									morning of February 3.
Morgan County	40575	Ice Storm	0	0	0	0	0.00K	0.00K	A powerful winter storm moved across the United States, bringing severe winter weather to central Indiana from January 31 through February 2. Freezing rain, sleet, snow, strong winds, and arctic air impacted the state. Indianapolis received 0.6 inches of ice and 1.0 inch of sleet from the storm. The first wave of precipitation fell during the evening of January 31, and this precipitation was mainly freezing rain and sleet, with a little snow across the northern parts of central Indiana. The second wave of precipitation began in earnest during the afternoon of February 1 and continued into the overnight hours. Far northern sections of central Indiana saw snow, with a sleet/freezing rain mix across much of the central part of the area. Across the south, mainly freezing rain was noted. After the strong area of low pressure passed over the area, winds increased with gusts over 50 mph reported. This wind created blowing and drifting snow across the north, and caused trees and power lines to come down across areas that saw freezing rain. Travel became near impossible at many locations, with several counties across central Indiana restricting travel. As the storm moved across the state, warm air briefly moved into central Indiana warming temperatures to above freezing across parts of the area. The warmth was brief though, as Arctic air flowed into the area after the storm passed. Temperatures dropped to near zero in some locations by the morning of February 3.
Little Pt	40652	Hail	0	0	0	0	0.00K	0.00K	A powerful storm system pushed across the region on the evening of the 19th of April. Severe thunderstorms developed and moved across the area. These evening storms brought widespread wind damage, heavy rain, and a couple of tornadoes. Five tornadoes touched down in central Indiana from this event. Heavy rainfall also caused pockets of flash flooding to occur.
Mooresville	40685	Hail	0	0	0	0	0.00K	0.00K	During the afternoon and early evening of May the 22nd, storms dropped hail up to 3 inches in diameter over mainly the southern half of central Indiana.
Landersdale	40685	Hail	0	0	0	0	0.00K	0.00K	During the afternoon and early evening of May the 22nd, storms dropped hail up to 3 inches in diameter over mainly the southern half of central Indiana.

Location / County	Date	Event	Dir. Injuries	Indir. Injuries	Dir. Deaths	Indir. Deaths	Property Damage	Crop Damage	Description
Martinsville	40688	Hail	0	0	0	0	0.00K	0.00K	The approach of a strong low pressure system from the west set the stage for a significant severe weather outbreak across central Indiana on May 25th. Eight tornadoes touched down in central Indiana, with an additional one moving into the area from southern Indiana. In addition, widespread wind damage and large hail impacted the area. Straight line winds to over 70 mph impacted the area as well, knocking down trees, power lines, as well as damaging structures and blowing over trucks. Straight line wind damage was noted near the tornado paths as well. Hail into the 3 to 4 inch range fell from some of the storms, causing damage. The large hail stones were also blown into structures by the strong straight line winds, causing additional damage.
Martinsville	40688	Thunderstorm Wind	0	0	0	0	1.50K	0.00K	The approach of a strong low pressure system from the west set the stage for a significant severe weather outbreak across central Indiana on May 25th. Eight tornadoes touched down in central Indiana, with an additional one moving into the area from southern Indiana. In addition, widespread wind damage and large hail impacted the area. Straight line winds to over 70 mph impacted the area as well, knocking down trees, power lines, as well as damaging structures and blowing over trucks. Straight line wind damage was noted near the tornado paths as well. Hail into the 3 to 4 inch range fell from some of the storms, causing damage. The large hail stones were also blown into structures by the strong straight line winds, causing additional damage.
Martinsville	40688	Hail	0	0	0	0	0.00K	0.00K	The approach of a strong low pressure system from the west set the stage for a significant severe weather outbreak across central Indiana on May 25th. Eight tornadoes touched down in central Indiana, with an additional one moving into the area from southern Indiana. In addition, widespread wind damage and large hail impacted the area. Straight line winds to over 70 mph impacted the area as well, knocking down trees, power lines, as well as damaging structures and blowing over trucks. Straight line wind damage was noted near the tornado paths as well. Hail into the 3 to 4 inch range fell from some of the storms, causing damage. The large hail stones were also blown into structures by the strong straight line winds, causing additional damage.
Banta	40688	Hail	0	0	0	0	0.00K	0.00K	The approach of a strong low pressure system from the west set

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									the stage for a significant severe weather outbreak across central Indiana on May 25th. Eight tornadoes touched down in central Indiana, with an additional one moving into the area from southern Indiana. In addition, widespread wind damage and large hail impacted the area. Straight line winds to over 70 mph impacted the area as well, knocking down trees, power lines, as well as damaging structures and blowing over trucks. Straight line wind damage was noted near the tornado paths as well. Hail into the 3 to 4 inch range fell from some of the storms, causing damage. The large hail stones were also blown into structures by the strong straight line winds, causing additional damage.
Paragon	40688	Hail	0	0	0	0	0.00K	0.00K	The approach of a strong low pressure system from the west set the stage for a significant severe weather outbreak across central Indiana on May 25th. Eight tornadoes touched down in central Indiana, with an additional one moving into the area from southern Indiana. In addition, widespread wind damage and large hail impacted the area. Straight line winds to over 70 mph impacted the area as well, knocking down trees, power lines, as well as damaging structures and blowing over trucks. Straight line wind damage was noted near the tornado paths as well. Hail into the 3 to 4 inch range fell from some of the storms, causing damage. The large hail stones were also blown into structures by the strong straight line winds, causing additional damage.
Martinsville	40688	Hail	0	0	0	0	0.00K	0.00K	The approach of a strong low pressure system from the west set the stage for a significant severe weather outbreak across central Indiana on May 25th. Eight tornadoes touched down in central Indiana, with an additional one moving into the area from southern Indiana. In addition, widespread wind damage and large hail impacted the area. Straight line winds to over 70 mph impacted the area as well, knocking down trees, power lines, as well as damaging structures and blowing over trucks. Straight line wind damage was noted near the tornado paths as well. Hail into the 3 to 4 inch range fell from some of the storms, causing damage. The large hail stones were also blown into structures by the strong straight line winds, causing additional damage.
Cope	40688	Hail	0	0	0	0	0.00K	0.00K	The approach of a strong low pressure system from the west set the stage for a significant severe weather outbreak across central

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									Indiana on May 25th. Eight tornadoes touched down in central Indiana, with an additional one moving into the area from southern Indiana. In addition, widespread wind damage and large hail impacted the area. Straight line winds to over 70 mph impacted the area as well, knocking down trees, power lines, as well as damaging structures and blowing over trucks. Straight line wind damage was noted near the tornado paths as well. Hail into the 3 to 4 inch range fell from some of the storms, causing damage. The large hail stones were also blown into structures by the strong straight line winds, causing additional damage.
Cope	40688	Hail	0	0	0	0	0.00K	0.00K	The approach of a strong low pressure system from the west set the stage for a significant severe weather outbreak across central Indiana on May 25th. Eight tornadoes touched down in central Indiana, with an additional one moving into the area from southern Indiana. In addition, widespread wind damage and large hail impacted the area. Straight line winds to over 70 mph impacted the area as well, knocking down trees, power lines, as well as damaging structures and blowing over trucks. Straight line wind damage was noted near the tornado paths as well. Hail into the 3 to 4 inch range fell from some of the storms, causing damage. The large hail stones were also blown into structures by the strong straight line winds, causing additional damage.
Banta	40688	Hail	0	0	0	0	0.00K	0.00K	The approach of a strong low pressure system from the west set the stage for a significant severe weather outbreak across central Indiana on May 25th. Eight tornadoes touched down in central Indiana, with an additional one moving into the area from southern Indiana. In addition, widespread wind damage and large hail impacted the area. Straight line winds to over 70 mph impacted the area as well, knocking down trees, power lines, as well as damaging structures and blowing over trucks. Straight line wind damage was noted near the tornado paths as well. Hail into the 3 to 4 inch range fell from some of the storms, causing damage. The large hail stones were also blown into structures by the strong straight line winds, causing additional damage.
Paragon	40688	Hail	0	0	0	0	0.00K	0.00K	The approach of a strong low pressure system from the west set the stage for a significant severe weather outbreak across central Indiana on May 25th. Eight tornadoes touched down in central

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									Indiana, with an additional one moving into the area from southern Indiana. In addition, widespread wind damage and large hail impacted the area. Straight line winds to over 70 mph impacted the area as well, knocking down trees, power lines, as well as damaging structures and blowing over trucks. Straight line wind damage was noted near the tornado paths as well. Hail into the 3 to 4 inch range fell from some of the storms, causing damage. The large hail stones were also blown into structures by the strong straight line winds, causing additional damage.
Paragon	40688	Hail	0	0	0	0	0.00K	0.00K	The approach of a strong low pressure system from the west set the stage for a significant severe weather outbreak across central Indiana on May 25th. Eight tornadoes touched down in central Indiana, with an additional one moving into the area from southern Indiana. In addition, widespread wind damage and large hail impacted the area. Straight line winds to over 70 mph impacted the area as well, knocking down trees, power lines, as well as damaging structures and blowing over trucks. Straight line wind damage was noted near the tornado paths as well. Hail into the 3 to 4 inch range fell from some of the storms, causing damage. The large hail stones were also blown into structures by the strong straight line winds, causing additional damage.
Waverly	40704	Thunderstorm Wind	0	0	0	0	0.00K	0.00K	Coming Soon.
Martinsville	40714	Hail	0	0	0	0	0.00K	0.00K	A line of thunderstorms developed along a warm front moving northeast through central Indiana during the early morning hours of June the 20th. The initial severe impacts came in the form of large hail, but transitioned to a wind damage threat as the morning wore on. A couple flash flood warnings were issued as well.
Martinsville	40714	Hail	0	0	0	0	0.00K	0.00K	A line of thunderstorms developed along a warm front moving northeast through central Indiana during the early morning hours of June the 20th. The initial severe impacts came in the form of large hail, but transitioned to a wind damage threat as the morning wore on. A couple flash flood warnings were issued as well.
Mooresville	40714	Hail	0	0	0	0	0.00K	0.00K	A line of thunderstorms developed along a warm front moving northeast through central Indiana during the early morning hours

Location / County	Date	Event	Dir. Injuries	Indir. Injuries	Dir. Deaths	Indir. Deaths	Property Damage	Crop Damage	Description
									of June the 20th. The initial severe impacts came in the form of large hail, but transitioned to a wind damage threat as the morning wore on. A couple flash flood warnings were issued as well.
Morgan County	40785	Drought	0	0	0	0	0.00K	0.00K	Severe drought conditions began across portions of central Indiana as a result of prolonged hot and dry weather from the middle of July into August. The first third of August started out similar to the vast majority of the previous month, which was characterized by above normal temperatures due to a persistent upper level ridge of high pressure. This allowed much of central Indiana to have highs in the upper 80s to mid 90s and lows near 70.||The dry rainfall pattern from July continued in many areas through August. Monthly rainfall ranged from a quarter of an inch in portions Sullivan, Knox, and Daviess Counties in southwest Indiana to near 7 inches in Warren, Tippecanoe, Cass and Wabash Counties in north central Indiana.
Morgan County	40787	Drought	0	0	0	0	0.00K	0.00K	Severe drought conditions continue in portions of west central Indiana as a result of prolonged hot and dry weather from July 17 through September 13. According to the U.S. Drought Monitor, severe drought conditions are centered on a line from Terre Haute in Vigo County to Spencer in Owen County and include all of Vigo, Clay, Owen and much of Parke, Putnam, Greene, and Sullivan counties. ||The heat wave of August 31-September 3, 2011 was very unusual. There have been only 7 times since weather records began in 1871 that the temperature reached 99 degrees on 3 or more consecutive days. The four-day heat wave of August 31-September 3 was the hottest for so late in the season since September 13-15, 1939. The agricultural community has been affected the most as a result of the drought conditions. Local reports indicated that crop yields in west central and portions of central Indiana will suffer as a result of the hot and dry weather during the summer.||Significant rainfall occurred in portions of central and southern Indiana on September 17-18. Many areas received 1 to more than 3 inches of rainfall...the most since June 20. Recent rainfall of 3 to nearly 9 inches in September has ended the summer drought conditions in much of Indiana. Most of this rainfall has occurred since September 14, with a large

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									share of this rain falling from the 19th through the 25th. After a dry summer at the Indianapolis airport, rainfall for September is the most since the record wet September of 2003. Unfortunately, this recent rainfall came too late for many summer crops.
Martinsville Arpt	40789	Thunderstorm Wind	0	0	0	0	5.00K	0.00K	Scattered thunderstorms began to develop across central Indiana during the afternoon hours of September 3rd. These storms formed out ahead of an upper level disturbance pushing southeast from the Upper Mississippi Valley. Numerous reports of severe wind gusts or damage were received all across central Indiana.
Paragon	40925	Thunderstorm Wind	0	0	0	0	4.00K	0.00K	During the morning of January 17th, a developing low pressure system tracked northeast across the southern Great Lakes and the associated cold front triggered a line of storms in the abnormally warm, moist airmass. The storms caused some small hail and damaging winds resulting mostly in downed trees across southern portions of the area. A few flooding reports were received as well.
Mooresville	40970	Hail	0	0	0	0	0.00K	0.00K	A powerful area of low pressure strengthened as it moved across Indiana into Michigan. Strong winds associated with the system combined with warm and moist air to generate severe thunderstorms across central Indiana. Much of the severe weather was large hail, but damaging winds also occurred. No tornadoes touched down in our County Warning Area. However, just to the south across southern Indiana, numerous tornadoes did strike, causing significant destruction to several towns.||After the storms moved out, strong winds caused by the strengthening of the area of low pressure moved across central Indiana.
Paragon	41030	Hail	0	0	0	0	0.00K	0.00K	An area of low pressure moved along a warm front during the afternoon of May 1. The low and front interacted with warm and unstable air to produce numerous thunderstorms across central Indiana. One storm produced a couple of tornadoes, and another produced a brief tornado. Other storms produced large hail and damaging winds.
Paragon	41030	Hail	0	0	0	0	0.00K	0.00K	An area of low pressure moved along a warm front during the afternoon of May 1. The low and front interacted with warm and unstable air to produce numerous thunderstorms across central Indiana. One storm produced a couple of tornadoes, and another

Location / County	Date	Event	Dir. Injuries	Indir. Injuries	Dir. Deaths	Indir. Deaths	Property Damage	Crop Damage	Description
									produced a brief tornado. Other storms produced large hail and damaging winds.
Morgan County	41072	Drought	0	0	0	0	0.00K	0.00K	Setting the scene for this drought, meteorological spring of 2012 in central Indiana went down as the warmest on record. At Indianapolis, the old record average temperature of 58.1 degrees set during the spring of 1977 was shattered by almost two degrees. Drier than normal conditions were also experienced across central Indiana throughout the spring, with many locations ending up three to six inches below normal on precipitation throughout the period. ||A consistent pattern began to develop by the middle of June, as upper level ridging would expand into the region for a few days producing above normal temperatures, before a weak frontal passage would bring the temperatures back down to near or slightly below normal with the upper ridge shifting back to the south and west. The presence of predominant surface high pressure and steadily worsening drought conditions across the Ohio Valley enabled increasingly hotter temperatures each time the upper ridging returned. ||June was the driest month in over a hundred years in portions of central and southern Indiana. Monthly rainfall totaled from virtually nothing in portions of central Indiana to nearly 6 inches in northwest Indiana. Much of central and southern Indiana received less than an inch of rainfall for the entire month of June. Normal rainfall for June is 4 to 5 inches. ||Stream levels in much of central and southern Indiana had fallen to record or near record low levels for late June. The Indiana Department of Natural Resources issued warnings to local boaters because local reservoirs were so low for the height of boating season.||Crop yields in much of the state will be reduced in later months because of the drought. Numerous wildfires broke out in the later portion of the month, very unusual for June in Indiana. Many communities requested voluntary water conservation. At least one local water company fined violators for ignoring its mandatory restriction on outdoor watering.
Morgan County	41091	Drought	0	0	0	0	0.00K	0.00K	July 2012 was one of the hottest and driest months of record for central and southern Indiana. Drought conditions gradually deteriorated during the month because widespread rainfall was

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									absent. By monthï¿½ï¿½ï¿½s end, drought conditions in portions of west central, central, and southwest were the worst in recorded history.||The historic heat wave of 2012 intensified at the beginning of July and climaxed by the 8th. During this 11-day period from June 28th - July 8th central and southern Indiana experienced 5 to 10 days of triple digit weather, the most since the Dust Bowl days of the 1930s. July was also among the driest months of record in portions of central and southwest. ||As a result of the historic heat wave and prolonged dry conditions, exceptional drought conditions prevailed across nearly one quarter of Indiana as of July 31 according to the U.S. Drought Monitor. The area designated as Exceptional Drought likely experienced the worst drought ever in recorded history.||The effects of the drought had a huge impact on Indiana agriculture. Nearly all the pasture land in the state became barren during July. Late season crops, such as corn and soybeans, may see their worst yields since the Great Drought of 1988 or even lower.||Wildfires, a rarity in Indiana during July, were a daily threat. Hundreds of wildfires broke out in the month. Lightning started at least 50 of these fires, unheard of in Indiana during July. Mandatory outdoor water restrictions remained in place for much of the Indianapolis area. The State of Indiana continued its first ever water shortage warning with a request of a 10-15% voluntary reduction in water use. The Indiana Department of National Resource reported homeowner wells going dry in various areas of the state. Record low water levels for late July along much of the Wabash and White Rivers in western Indiana impacted power generation.
Morgan County	41122	Drought	0	0	0	0	0.00K	0.00K	Drought conditions began to relent during August following beneficial rains and cooler temperatures. Temperatures during August averaged near normal and rainfall was above normal in many of the very dry areas of June and July.||The historic heat wave of 2012 finally broke in central and southern Indiana on the 8th. A strong cold front ushered in much cooler weather. The cool weather persisted through the 22nd. This was the longest stretch of normal to below normal temperatures for central Indiana since February 2010. Seasonal temperatures returned after the

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									22nd.||The rainfall pattern changed dramatically from July to August. Some very dry areas of west central received over 10 inches of rain, while some wet areas of south central and southeast Indiana measured less than 2 inches during the month. The big winner on rainfall during August was much of west central and southwest Indiana where extreme to exceptional drought conditions prevailed.||Drought conditions during the month improved in most sections of central and northern Indiana, but remained nearly the same or deteriorated in southern Indiana. Severe drought conditions prevailed in much of the state along or south of I-70 at the end of August. Although local area reservoirs remained below capacity, stream flow returned to normal in several areas of central Indiana, especially in the Indianapolis area. Near to record low levels continued in the East Fork White River Basin of east central and southern Indiana.
Landersdale	41126	Thunderstorm Wind	0	0	0	0	1.50K	0.00K	Numerous showers and thunderstorms along and ahead of a frontal boundary that moved through central Indiana during the morning hours of August the 5th. These storms were aided by an upper level jet that helped to sustain their intensity. A few scattered severe wind reports were received as these storms moved across the area.
Morgan County	41153	Drought	0	0	0	0	0.00K	0.00K	Drought conditions were greatly diminished over much of central and southwest Indiana by the end of September, while conditions continued to improve in south central portions of the state. The wet weather pattern of August continued in much of Indiana during September. Monthly rainfall was normal to much above normal in central and southern Indiana and generally below normal in northern Indiana. Precipitation totals ranged from 4 to more than 12 inches in central and southern Indiana. There were two widespread rainfall events during September that covered much of central and southern Indiana. The remnants and moisture from Hurricane Isaac produced rainfall of 1 to more than 4 inches from the 1st through the 8th. The last rainfall event of the month was a result of a series of low pressure areas that moved along a stationary front located in central Indiana. These systems dumped 1 to more than 6 inches from the 25th through the 27th. Between these two widespread rainfall events, there

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									were three lesser events. At the end of the month, stream flow was above seasonal levels in much of central and southern Indiana.
Morgan County	41263	High Wind	0	0	0	0	0.00K	0.00K	A strong low pressure system moved just north of central Indiana, producing widespread rainfall followed by very strong winds. Non-thunderstorm winds gusted over 55 mph at times. The rain eventually changed to snow. Minor snow accumulations were observed. However, a truck driver was killed in a crash on Interstate 65 in Jackson County after loosing control while crossing an icy bridge.
Morgan County	41269	Blizzard	0	0	0	0	0.00K	0.00K	A strong area of low pressure moved through Tennessee and Kentucky on December 26th. This brought blizzard conditions to central Indiana for much of the daylight hours of the 26th. Much of central Indiana saw over 6 inches of snow, with some areas seeing a foot of snow. Wind gusts over 40 mph at some locations caused some drifting of snow, and the blowing snow reduced visibilities to less than a quarter of a mile at times.
Paragon	41304	Thunderstorm Wind	0	0	0	0	0.00K	0.00K	A strong cold front moved through the Ohio River Valley and produced a number of severe weather reports as it passed across central Indiana. Numerous damaging wind reports were received from the area as the line of storms came through the area.
Bethany	41383	Flood	0	0	0	0	1.00K	0.50K	Local news media reported numerous water rescues of motorists, evacuations of homes, and school closings or delays on the 19th in west central and north central Indiana. On the 20th, two motorists perished while attempting to drive through the near record flood waters of Cicero Creek near Arcadia in northern Hamilton County. All of this was due to ongoing rainfall across central Indiana.
Gasburg	41415	Thunderstorm Wind	0	0	0	0	1.00K	0.00K	A large line of storms swept across central Indiana overnight causing sporadic damage in many areas. One weak tornado occurred west of Brownsburg near North Salem. Toppled trees, snapped limbs, and damage to a barn and house revealed evidence of rotation in the winds and damage consistent with an EF0 tornado. | |Surveying in the Roachdale area north of Greencastle also yielded evidence of an EF0 tornado, where structural and tree damage was observed.| |Additional damage survey work in southern Hendricks County southwest of Plainfield

Location / County	Date	Event	Dir. Injuries	Indir. Injuries	Dir. Deaths	Indir. Deaths	Property Damage	Crop Damage	Description
									revealed two separate paths of straight-line wind damage paralleling both sides of US 40 east of Stilesville. Damage in Hazelwood, the southern-most of the two tracks, also offered evidence of a microburst, intense damage over a short and narrow path.
Paragon	41415	Thunderstorm Wind	0	0	0	0	1.00K	0.00K	A large line of storms swept across central Indiana overnight causing sporadic damage in many areas. One weak tornado occurred west of Brownsburg near North Salem. Toppled trees, snapped limbs, and damage to a barn and house revealed evidence of rotation in the winds and damage consistent with an EF0 tornado. | |Surveying in the Roachdale area north of Greencastle also yielded evidence of an EF0 tornado, where structural and tree damage was observed.| |Additional damage survey work in southern Hendricks County southwest of Plainfield revealed two separate paths of straight-line wind damage paralleling both sides of US 40 east of Stilesville. Damage in Hazelwood, the southern-most of the two tracks, also offered evidence of a microburst, intense damage over a short and narrow path.
Five Pts	41448	Thunderstorm Wind	0	0	0	0	1.00K	0.00K	During the morning and afternoon of the 21st, a large thunderstorm complex moved from the upper Mississippi Valley southeast into the southern Wisconsin and northern Illinois area, producing severe weather and flooding. The complex gradually weakened as it tracked into the northern Wabash Valley during the evening, producing gusty winds to the northwest of Indianapolis before it diminished. This would be the start of an active period for central Indiana, with rain and thunderstorms impacting portions of the area for the rest of the month. The region remained on the fringe of a strong ridge aloft centered over the central Plains with scattered thunderstorms developing as upper level waves tracked along the periphery of the ridge and across the Ohio Valley. The development of an upper low across the region by the end of the month continued the daily threat for rain and thunderstorms. Isolated to scattered severe thunderstorms impacted central Indiana each afternoon and evening from the 22nd through the 27th. Some of the storms moved across the same areas on the 25th and 26th, producing 2

Location / County	Date	Event	Dir. Injuries	Indir. Injuries	Dir. Deaths	Indir. Deaths	Property Damage	Crop Damage	Description
									day rainfall totals over 7 inches.
Martinsville	41448	Thunderstorm Wind	0	0	0	0	1.00K	0.00K	During the morning and afternoon of the 21st, a large thunderstorm complex moved from the upper Mississippi Valley southeast into the southern Wisconsin and northern Illinois area, producing severe weather and flooding. The complex gradually weakened as it tracked into the northern Wabash Valley during the evening, producing gusty winds to the northwest of Indianapolis before it diminished. This would be the start of an active period for central Indiana, with rain and thunderstorms impacting portions of the area for the rest of the month. The region remained on the fringe of a strong ridge aloft centered over the central Plains with scattered thunderstorms developing as upper level waves tracked along the periphery of the ridge and across the Ohio Valley. The development of an upper low across the region by the end of the month continued the daily threat for rain and thunderstorms. Isolated to scattered severe thunderstorms impacted central Indiana each afternoon and evening from the 22nd through the 27th. Some of the storms moved across the same areas on the 25th and 26th, producing 2 day rainfall totals over 7 inches.
Paragon	41475	Flood	0	0	0	0	1.00K	0.00K	Scattered strong to severe thunderstorms producing mainly wind damage impacted parts of central Indiana on the 20th and again on the 23rd as a frontal boundary lingered over the region. The storms on the afternoon of the 20th produced very heavy rainfall and localized flash flooding southwest of Indianapolis, including several water rescues from vehicles across Greene County.
Morgan County	41613	Winter Storm	0	0	0	0	0.00K	0.00K	As a cold front stalled out to the east of central Indiana on December 5th and 6th, waves of low pressure rode along the front. These waves generated snow, sleet, and freezing rain across much of central Indiana. By the time the snow ended December 6, up to around 1 foot of snow fell in parts of the area. The most snow fell across southern sections of central Indiana, along with some ice accumulation.
Cope	41629	Flash Flood	0	0	0	0	1.00K	0.00K	A front stalled out just southeast of central Indiana on December 20-21. Waves of low pressure rode along the front, generating rain across the area. With tropical moisture moving into the system, heavy rain occurred across parts of central Indiana. Some

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									areas received over 5 inches of rain in less than 48 hours. This not only resulted in flash flooding, but also resulted in river flooding not long after. Some rivers across central Indiana saw major flooding, with rivers higher than they had been in 5 years or more. A couple of locations saw the highest flood crests in over 20 years.
Martinsville	41629	Flash Flood	0	0	0	0	50.00K	0.00K	A front stalled out just southeast of central Indiana on December 20-21. Waves of low pressure rode along the front, generating rain across the area. With tropical moisture moving into the system, heavy rain occurred across parts of central Indiana. Some areas received over 5 inches of rain in less than 48 hours. This not only resulted in flash flooding, but also resulted in river flooding not long after. Some rivers across central Indiana saw major flooding, with rivers higher than they had been in 5 years or more. A couple of locations saw the highest flood crests in over 20 years.
Morgan County	41644	Winter Storm	0	0	0	0	0.00K	0.00K	A powerful storm system brought heavy snow and near blizzard conditions to much of central Indiana on January 5th, with a mix of rain and snow across southeast sections of the area. After the snow diminished during the evening, arctic air plunged into the area on strong winds. The snow and cold created dangerous travel conditions across much of Indiana and surrounding areas. Sections of interstates were closed down, and travel was restricted to emergency personnel only. Schools were closed for a week across parts of central Indiana.||The jet stream dove south into the southern United States, allowing cold air straight from the Arctic to flow south into the USA. This cold air interacted with plentiful moisture being drawn northward with an area of low pressure at the surface. The result was heavy snow for several hours across the northwest half of central Indiana. Across the southeast part of the area, warmer air moved north and allowed for a period of rain. This cut down on snow amounts. As strong high pressure moved in behind the low pressure, winds increased across the area. Gusts of 30 to 40 mph were common Sunday night, resulting in blowing and drifting of the snow that fell. ||Snowfall of 8 to 14 inches was common across areas generally along and north of a Terre Haute to New Castle line. Amounts

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									dropped quickly to the south and east of this line due to warmer air allowing rain to fall for several hours. Areas that received heavy snow saw snow falling at a rate of an inch or more per hour during the height of the storm. Snowfall diminished by late afternoon but lighter snows continued into the evening. ||Gusty winds ushering in the colder air brought blowing and drifting snow. Visibility was reduced in blowing snow across many areas through the day of January 6. This resulted in drifts of several feet at some locations. The snow and lowered visibility caused some roads to be shut down across parts of Indiana. Some state highways and U.S. highways were closed. Many counties in Indiana declared travel warnings, meaning that only emergency vehicles were allowed on the roads.
Morgan County	41674	Winter Storm	0	0	0	0	0.00K	0.00K	An area of low pressure moved into the lower Ohio River Valley and brought snow to much of central Indiana on February 4th and into the day on February 5th. Southern sections of central Indiana saw the snow change to sleet and freezing rain for a period the evening of February 4th. Snowfall totals of 4 to 8 inches were common, with some areas seeing up to around 10 inches of snow across northern sections of central Indiana. Strong winds caused low visibilities and drifting of snow. Some area schools were closed again, even up to a few days. Some country roads were impassable.
Morgan County	41674	Winter Storm	0	0	0	0	0.00K	0.00K	An area of low pressure moved into the lower Ohio River Valley and brought snow to much of central Indiana on February 4th and into the day on February 5th. Southern sections of central Indiana saw the snow change to sleet and freezing rain for a period the evening of February 4th. Snowfall totals of 4 to 8 inches were common, with some areas seeing up to around 10 inches of snow across northern sections of central Indiana. Strong winds caused low visibilities and drifting of snow. Some area schools were closed again, even up to a few days. Some country roads were impassable.
Mooresville	41780	Thunderstorm Wind	0	0	0	0	7.00K	0.00K	Thunderstorms developed in warm and unstable air ahead of an approaching cold front during the afternoon and evening hours of May 21. These storms continued into the early morning hours of May 22. Large hail, torrential rain, and some damaging winds

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									accompanied the storms as they moved through the area. Golf ball size hail fell in the Indianapolis area, and the heavy rain caused flash flooding in the same area.||The biggest severe weather event of the month took place on the afternoon and evening of the 21st into the early morning of the 22nd as severe thunderstorms developed along a cold front. Wind damage and large hail were common with the storms, with baseball sized hail confirmed in Waveland in Montgomery County. Numerous reports of half dollar to golf ball size hail along with flash flooding came from the southern Indianapolis suburbs as storms repeatedly tracked across the area and produced up to 3 inches of rain.
Mooresville	41780	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed in warm and unstable air ahead of an approaching cold front during the afternoon and evening hours of May 21. These storms continued into the early morning hours of May 22. Large hail, torrential rain, and some damaging winds accompanied the storms as they moved through the area. Golf ball size hail fell in the Indianapolis area, and the heavy rain caused flash flooding in the same area.||The biggest severe weather event of the month took place on the afternoon and evening of the 21st into the early morning of the 22nd as severe thunderstorms developed along a cold front. Wind damage and large hail were common with the storms, with baseball sized hail confirmed in Waveland in Montgomery County. Numerous reports of half dollar to golf ball size hail along with flash flooding came from the southern Indianapolis suburbs as storms repeatedly tracked across the area and produced up to 3 inches of rain.
Bethany	41780	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed in warm and unstable air ahead of an approaching cold front during the afternoon and evening hours of May 21. These storms continued into the early morning hours of May 22. Large hail, torrential rain, and some damaging winds accompanied the storms as they moved through the area. Golf ball size hail fell in the Indianapolis area, and the heavy rain caused flash flooding in the same area.||The biggest severe weather event of the month took place on the afternoon and evening of the 21st into the early morning of the 22nd as severe

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									thunderstorms developed along a cold front. Wind damage and large hail were common with the storms, with baseball sized hail confirmed in Waveland in Montgomery County. Numerous reports of half dollar to golf ball size hail along with flash flooding came from the southern Indianapolis suburbs as storms repeatedly tracked across the area and produced up to 3 inches of rain.
Mooresville	41780	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed in warm and unstable air ahead of an approaching cold front during the afternoon and evening hours of May 21. These storms continued into the early morning hours of May 22. Large hail, torrential rain, and some damaging winds accompanied the storms as they moved through the area. Golf ball size hail fell in the Indianapolis area, and the heavy rain caused flash flooding in the same area.||The biggest severe weather event of the month took place on the afternoon and evening of the 21st into the early morning of the 22nd as severe thunderstorms developed along a cold front. Wind damage and large hail were common with the storms, with baseball sized hail confirmed in Waveland in Montgomery County. Numerous reports of half dollar to golf ball size hail along with flash flooding came from the southern Indianapolis suburbs as storms repeatedly tracked across the area and produced up to 3 inches of rain.
Bethany	41780	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed in warm and unstable air ahead of an approaching cold front during the afternoon and evening hours of May 21. These storms continued into the early morning hours of May 22. Large hail, torrential rain, and some damaging winds accompanied the storms as they moved through the area. Golf ball size hail fell in the Indianapolis area, and the heavy rain caused flash flooding in the same area.||The biggest severe weather event of the month took place on the afternoon and evening of the 21st into the early morning of the 22nd as severe thunderstorms developed along a cold front. Wind damage and large hail were common with the storms, with baseball sized hail confirmed in Waveland in Montgomery County. Numerous reports of half dollar to golf ball size hail along with flash flooding came from the southern Indianapolis suburbs as storms

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									repeatedly tracked across the area and produced up to 3 inches of rain.
Plano	41814	Tornado	0	0	0	0	10.00K	0.00K	During the afternoon of June 24th, thunderstorms developed ahead of a cold front and area of low pressure. One of the storms began to rotate, and the storm eventually produced 3 tornadoes across central Indiana between 1:15 PM and 2:45 PM EDT. Two of the tornadoes were rated EF-1, with the other EF-0.
Mooresville	41847	Thunderstorm Wind	0	0	0	0	2.00K	0.00K	Several clusters of thunderstorms during the day on the 27th of July produced a singular large hail and several wind damage reports from across the region. One complex of thunderstorms moved almost over the exact same area early on the morning of the 27th as it did on the 26th. Finally, a broken line of storms formed along a cold front during the late afternoon of the 27th. The strongest of the storms along the line produced pockets of wind damage as the line pushed through central Indiana.
Mooresville	41876	Hail	0	0	0	0	0.00K	0.00K	A line of thunderstorms over northwest Indiana pushed south-southeast into central Indiana during the late afternoon and early evening of August the 25th. This line was weakening as it moved into central Indiana, but large hail and damaging winds were observed under one of the stronger storms. Then an isolated cell developed over Marion County bringing small hail and damaging winds to southern portions of the Indianapolis metro area.
Martinsville	41892	Thunderstorm Wind	0	0	0	0	15.00K	0.00K	A band of showers and thunderstorms developed ahead of an upper wave and a strong cold front during the afternoon and evening of September 10. The storms brought heavy rain and damaging winds to parts of the area. Some flash flooding was observed in the Indianapolis metropolitan area.
Morgan County	42056	Heavy Snow	0	0	0	0	0.00K	0.00K	A low pressure system brought accumulating snow to central Indiana on February 21st, starting in the early morning hours and continuing into the early afternoon. Snowfall amounts were generally from 3 to 7 inches. Across far southern portions of central Indiana, a mix of freezing rain, sleet, and snow fell, with overall lower snow amounts. During the mid to late afternoon, skies became partly cloudy and allowed temperatures to climb into the 30s.
Morgan County	42064	Heavy Snow	0	0	0	0	0.00K	0.00K	An area of low pressure brought snow to central Indiana, starting the evening of February 28th and continuing into March 1st. Parts

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									of central Indiana received up to 11 to 12.5 inches of snow during the event. The 11 inches of snow on the ground at Indianapolis on March 1st was the most snow on the ground so late in the year since February 29th, 1984, which also had 11 inches. Some counties north of the warned area accumulated 6 inches of snow after 12 hours.
Martinsville	42102	Hail	0	0	0	0	0.00K	0.00K	A lingering front across central Indiana helped to generate thunderstorms across the area during the morning of April the 8th. The storms brought numerous large hail reports, with singular observations of damaging winds and flash flooding.
Martinsville	42103	Thunderstorm Wind	0	0	0	0	5.00K	0.00K	Thunderstorms developed along a cold front during the evening of April 9th and then pushed across central Indiana into the early morning hours of April 10th. Some of the storms became severe, producing damaging winds. Heavy rain and small hail occurred with some storms.
Martinsville	42167	Thunderstorm Wind	0	0	0	0	0.75K	0.00K	Waves of thunderstorms developed in a warm and unstable atmosphere on June 12th. The storms brought heavy rain and damaging winds to portions of central Indiana.
Paragon	42176	Thunderstorm Wind	0	0	0	0	0.25K	0.50K	Thunderstorms moved into central Indiana during the early morning hours of June 21. These storms produced wind damage across northern sections of the area. Numerous trees and power lines were downed, and some the trees fell on homes causing significant damage. A grain silo was also destroyed by the storms. The storms also brought heavy rain.||A damage survey was done across Tipton County, and the survey determined that straight line winds caused the extensive damage.
Mooresville	42197	Flash Flood	0	0	0	0	80.00K	0.00K	Thunderstorms moved across central Indiana during the early morning of July 12, bringing heavy rain, flooding, and a tornado to the area. Some locations received over 5 inches of rain in just 3 hours. Numerous homes were flooded and roads closed due to high water. The tornado brought down many trees and power lines.
Monrovia	42198	Hail	0	0	0	0	0.00K	0.00K	Waves of showers and thunderstorms moved across central Indiana on July 13 and into the early morning of July 14. Upper level features interacted with a surface front and plenty of moisture and instability to generate severe weather and heavy rains/flooding. Three tornadoes occurred during the evening of

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									the 13th. One tornado was in Warren County, and the other two were in Putnam County. Widespread tree and power line damage occurred across central Indiana, and some locations received over 4 inches of rain. A few locations had hail as well. The heavy rain led to flooding in many areas.
Martinsville	42198	Thunderstorm Wind	0	0	0	0	10.00K	0.00K	Waves of showers and thunderstorms moved across central Indiana on July 13 and into the early morning of July 14. Upper level features interacted with a surface front and plenty of moisture and instability to generate severe weather and heavy rains/flooding. Three tornadoes occurred during the evening of the 13th. One tornado was in Warren County, and the other two were in Putnam County. Widespread tree and power line damage occurred across central Indiana, and some locations received over 4 inches of rain. A few locations had hail as well. The heavy rain led to flooding in many areas.
Martinsville	42198	Thunderstorm Wind	0	0	0	0	0.00K	0.00K	Waves of showers and thunderstorms moved across central Indiana on July 13 and into the early morning of July 14. Upper level features interacted with a surface front and plenty of moisture and instability to generate severe weather and heavy rains/flooding. Three tornadoes occurred during the evening of the 13th. One tornado was in Warren County, and the other two were in Putnam County. Widespread tree and power line damage occurred across central Indiana, and some locations received over 4 inches of rain. A few locations had hail as well. The heavy rain led to flooding in many areas.
Whitaker	42361	Thunderstorm Wind	0	0	0	0	20.00K	0.00K	Thunderstorms developed ahead of a cold front during the afternoon of December 23rd. These storms brought a few tornadoes, straight-line damaging wind reports, and heavy rainfall.
Lewisville	42456	Thunderstorm Wind	0	0	0	0	1.00K	0.00K	Thunderstorms developed in warm and unstable air ahead of a cold front during the afternoon of Easter. Temperatures ahead of a warm front warmed into the middle 70s across parts of central Indiana. Moisture also flowed in from the south. This provided enough instability to work with wind shear to produce the severe storms. Ping pong ball size hail fell in some areas, and hail was common with the storms during the event.
Paragon	42456	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed in warm and unstable air ahead of a

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									cold front during the afternoon of Easter. Temperatures ahead of a warm front warmed into the middle 70s across parts of central Indiana. Moisture also flowed in from the south. This provided enough instability to work with wind shear to produce the severe storms. Ping pong ball size hail fell in some areas, and hail was common with the storms during the event.
Bethany	42456	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed in warm and unstable air ahead of a cold front during the afternoon of Easter. Temperatures ahead of a warm front warmed into the middle 70s across parts of central Indiana. Moisture also flowed in from the south. This provided enough instability to work with wind shear to produce the severe storms. Ping pong ball size hail fell in some areas, and hail was common with the storms during the event.
Centerton	42456	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed in warm and unstable air ahead of a cold front during the afternoon of Easter. Temperatures ahead of a warm front warmed into the middle 70s across parts of central Indiana. Moisture also flowed in from the south. This provided enough instability to work with wind shear to produce the severe storms. Ping pong ball size hail fell in some areas, and hail was common with the storms during the event.
Chetwynd	42456	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed in warm and unstable air ahead of a cold front during the afternoon of Easter. Temperatures ahead of a warm front warmed into the middle 70s across parts of central Indiana. Moisture also flowed in from the south. This provided enough instability to work with wind shear to produce the severe storms. Ping pong ball size hail fell in some areas, and hail was common with the storms during the event.
Morgan County	42462	High Wind	0	0	0	0	0.75K	0.00K	A strong area of low pressure brought strong winds to central Indiana during April 2. Winds of over 60 mph were recorded in some areas, with many trees and power lines down throughout the area. In addition, cold air with the system brought up to an inch of snow to parts of the northern half of central Indiana.
Little Pt	42486	Hail	0	0	0	0	0.00K	0.00K	A cold front moved into central Indiana during the afternoon of April 26th, while upper level energy moved in from the west. The cold front interacted with a warm and unstable air mass as it moved into central Indiana, generating thunderstorms. The storms mainly produced large hail, but also produced a brief EF-0

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									tornado near Worthington.
Paragon	42564	Thunderstorm Wind	0	0	0	0	4.00K	0.00K	A few upper disturbances moved across central Indiana, interacting with a hot and unstable atmosphere to produce numerous thunderstorms. Some of the storms became severe and produced damaging winds and large hail.
Bethany	42692	Thunderstorm Wind	0	0	0	0	0.00K	0.00K	A band of showers and thunderstorms moved into western Indiana from eastern Illinois during the middle to late afternoon hours of November 18th. Strong to damaging wind speeds and wind damage was observed, mainly across portions of the western half of central Indiana.
Martinsville	42794	Hail	0	0	0	0	0.00K	0.00K	A low pressure system brought very warm and unstable air for late February/early March to central Indiana. The result was severe thunderstorms and 7 tornadoes. The severe wind gusts occurred near the Indianapolis metropolitan area and looked to possibly be the result of a descending inflow jet. Aside from the three severe wind reports and one small hail report, most of the severe observations from this episode came in on the 1st of March and will be entered in next month's storm data.
Martinsville	42845	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed across central Indiana during the afternoon, and many storms produced gusty winds and hail up to nickel size. One of the storms produced a tornado in Decatur County.
Paragon	42853	Hail	0	0	0	0	0.00K	0.00K	A frontal boundary and low pressure system remained across the Ohio Valley from April 28th through the 30th. This brought some severe weather but mainly heavy rain across the area, with some areas seeing over 5 of rain total.
Paragon	42865	Thunderstorm Wind	0	0	0	0	5.00K	0.00K	Thunderstorms developed near a cold front during the evening of May 10th. These storms produced wind damage and hail as they moved across the area into the early morning hours of May 11th.
Martinsville	42865	Thunderstorm Wind	0	0	0	0	0.00K	0.00K	Thunderstorms developed near a cold front during the evening of May 10th. These storms produced wind damage and hail as they moved across the area into the early morning hours of May 11th.
Paragon	42923	Hail	0	0	0	0	15.00K	0.00K	Thunderstorms developed as a cold front interacted with warm and humid air. Some of the storms became severe, producing large hail along with damaging winds.
Martinsville Arpt	42923	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed as a cold front interacted with warm and humid air. Some of the storms became severe, producing

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									large hail along with damaging winds.
Martinsville Arpt	42923	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed as a cold front interacted with warm and humid air. Some of the storms became severe, producing large hail along with damaging winds.
Mooresville	42923	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed as a cold front interacted with warm and humid air. Some of the storms became severe, producing large hail along with damaging winds.
Landersdale	42923	Hail	0	0	0	0	0.00K	0.00K	Thunderstorms developed as a cold front interacted with warm and humid air. Some of the storms became severe, producing large hail along with damaging winds.
Martinsville	42927	Flood	0	0	0	0	0.75K	0.00K	Northwest flow in the upper atmosphere allowed multiple waves to move across the area. The atmosphere had a high moisture content and was unstable. The waves interacted with the moisture and instability to produce the severe weather and heavy rain. Multiple rounds of thunderstorms moved over the same locations, creating the flooding problems. Several rounds of thunderstorms, from July 10th through the 13th, brought a tornado, damaging winds, large hail, and flooding to central Indiana. Mainly thunderstorm wind and flooding during this portion of the timeline.
Exchange	42927	Flash Flood	0	0	0	0	0.25K	4.00K	Northwest flow in the upper atmosphere allowed multiple waves to move across the area. The atmosphere had a high moisture content and was unstable. The waves interacted with the moisture and instability to produce the severe weather and heavy rain. Multiple rounds of thunderstorms moved over the same locations, creating the flooding problems. Several rounds of thunderstorms, from July 10th through the 13th, brought a tornado, damaging winds, large hail, and flooding to central Indiana. Mainly thunderstorm wind and flooding during this portion of the timeline.
Morgan County	43183	Heavy Snow	0	0	0	0	0.00K	0.00K	Snow developed ahead of an area of low pressure and an upper level trough. Plentiful moisture combined with strong frontogenetical forcing produced an narrow area of heavy snow. To the southwest of the heavy snow, rain fell along with a few thunderstorms. To the northeast of the snow band, very dry air caused a sharp cut-off to the snow. A narrow band of intense snow produced amounts of 8 to 12 inches, with some locations

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									receiving over 2 inches per hour. The 10.2 inches of snow at Indianapolis set the daily snowfall record and became the second highest one day total for the month of March. Visibility at the Indianapolis International Airport was a quarter of a mile or less from about 2:30 PM to 4:30 PM EDT.
Mahalasville	43193	Flash Flood	0	0	0	0	5.00K	5.00K	A low pressure system generated numerous thunderstorms across central Indiana on April 3rd. The first few rounds of thunderstorms produced heavy rain and flooding across the area, while the final round of thunderstorms brought damaging winds and a couple of tornadoes.
Landersdale	43193	Flood	0	0	0	0	0.25K	0.50K	A low pressure system generated numerous thunderstorms across central Indiana on April 3rd. The first few rounds of thunderstorms produced heavy rain and flooding across the area, while the final round of thunderstorms brought damaging winds and a couple of tornadoes.
Martinsville Arpt	43193	Flash Flood	0	0	0	0	50.00K	0.00K	A low pressure system generated numerous thunderstorms across central Indiana on April 3rd. The first few rounds of thunderstorms produced heavy rain and flooding across the area, while the final round of thunderstorms brought damaging winds and a couple of tornadoes.
Little Pt	43193	Hail	0	0	0	0	0.00K	0.00K	A low pressure system generated numerous thunderstorms across central Indiana on April 3rd. The first few rounds of thunderstorms produced heavy rain and flooding across the area, while the final round of thunderstorms brought damaging winds and a couple of tornadoes.
Paragon	43251	Thunderstorm Wind	0	0	0	0	2.00K	0.00K	An upper level system interacted with hot and humid air to produce severe thunderstorms across central Indiana on May 31. The storms brought down many trees and some power lines across mainly the southern half of central Indiana.
Mooresville	43261	Thunderstorm Wind	0	0	0	0	1.50K	0.00K	A series of lines of showers and thunderstorms developed across central Illinois and moved southeast into central Indiana during much of the day into the evening on June 10th. The first line produced some damaging wind and small hail in the northeast. The next batch provided mainly thunderstorm wind gusts across west-central and central Indiana. After that, large hail was reported in Knox County during the late afternoon, with flash flooding reported during the evening hours.

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Morgan County	43418	Ice Storm	0	0	0	0	0.00K	0.00K	An upper level low brought a wintry mix of snow, sleet, and freezing rain to central Indiana the evening of November 14 into the early morning hours of November 15. The wintry mix created hazardous travel conditions, caused power outages affecting over 60,000 people (according to Indiana Department of Energy), and caused damage to trees. Most of the ice fell across the eastern two thirds of central Indiana, with light snow across the western third. Ice amounts generally ranged from a tenth of an inch to three-tenths of an inch.
Morgan County	43476	Heavy Snow	0	0	0	0	0.00K	0.00K	Snow developed across portions of central Indiana ahead of an approaching area of low pressure. Plentiful moisture combined with strong isentropic lift produced a widespread area of heavy snow. This winter system led to the first January winter storm warning since 2014. Snow fell starting late Friday night and continued through Saturday night. During the afternoon on Saturday, temperatures slowly climbed above freezing across south central Indiana which led to lower amounts of snow. Snowfall totals ranged from 4 inches to as high as 9 inches in Owen County. The 6.9inches of snow at Indianapolis tied the snowfall record for the day.
Paragon	43503	Flood	0	0	0	0	0.50K	0.00K	A low pressure system moved into the forecast area bringing plentiful moisture and produced thunderstorms and waves of moderate to heavy rain to central Indiana around February 7th. The storms produced a tornado in a strong shear and low instability environment. Over 4 inches of rain fell in a couple of days in some areas. The heavy rain produced flash flooding, and extensive flooding developed along rivers and streams.
Landersdale	43631	Thunderstorm Wind	0	0	0	0	2.00K	0.00K	A warm front brought severe storms, tornadoes, and heavy rain on June 15th. A significant tornado outbreak that was the largest since November 17, 2013 occurred during the evening of Saturday, June 15th. Seven tornadoes occurred in central Indiana with 3 additional tornadoes across portions of eastern Indiana.||This is what the environment showed. A weak shortwave trough was moving through central Indiana during the time of the severe weather. This was a high shear, low CAPE environment initially which kept convection to a minimum until around 5 PM when just enough CAPE was there to rapidly

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									increase storm coverage and severity. LCL heights were around 750m at the time. The shear profile was ideal for creating numerous rotating thunderstorms. With 0-1km Shear over 30 knots and Storm Relative Helicity in excess of 300 m^2/s^2, the low level environment was primed for tornadoes. The 0-6km shear of 40-50 knots was sufficient for rotating supercells. The significant tornado parameter was not quite as impressive and was kept fairly low due to the low CAPE environment. Had CAPE values been closer to 2000-3000 J/kg, a much more intense outbreak would have occurred. In addition to the tornado threat, Precipitable Water values were in excess of 1.5 inches which also lead to significant flash flooding as the evening progressed.
Paragon	43639	Thunderstorm Wind	0	0	0	0	0.50L	0.00K	A warm front and an upper level system combined to produce thunderstorms across central Indiana on June 23rd. Some of the storms became severe with damaging winds, including a microburst with 70 mph winds. Mainly trees, power poles, and outbuildings were damaged.
Mooresville	43695	Thunderstorm Wind	0	0	0	0	0.00K	0.00K	A large high-precipitation supercell moved into northwest portions of central Indiana during the afternoon hours of August 18th. This supercell then transitioned to compact bow echo as it moved eastward, impacting the heart of the Indy metro area. Multiple reports of trees and power lines downed, heavy rain, few large hail reports.
Morgan County	43814	Heavy Snow	0	0	0	0	0.00K	0.00K	A low pressure system brought two periods of heavy snow to central Indiana beginning Sunday afternoon and continuing through Monday night with a break during the day Monday. Snowfall amounts were generally highest around Marion county and the surrounding counties with amounts ranging from 6 to 8 inches. Lower amounts were seen across the rest of central Indiana with some minor icing across south central Indiana. Indiana State Police investigated 336 crashes with 79 causing personal injury. Indianapolis Metro Police Department responded to almost 200 incidents with over 75 slideoffs.
Mooresville	43918	Thunderstorm Wind	0	0	0	0	150.00K	0.00K	On March 28th, a strong low pressure system brought 3 rounds of severe thunderstorms to central Indiana. The first round brought widespread 1 to 1.75 inch hail to much of the area with the second event bringing additional large hail and flash flooding.

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									A third round during the late evening and overnight brought additional heavy rain and damaging wind gusts. A microburst caused an intense area of significant damage to portions of Morgan County.
Mooresville	43929	Tornado	0	0	0	0	500.00K	0.00K	A severe weather outbreak occurred during the evening hours of April 8th. A line of severe thunderstorms moved through central Indiana intitially causing large hail and damaging winds. As the storms progressed, the hail threat gradually decreased with wind speeds rapidly increasing. In addition to widespread 60 to 70 mph winds, the line of storms had several mesovortices that led to areas of enhanced winds up to 90 mph and produced an EF-1 tornado in Mooresville, IN.
Morgan County	43992	High Wind	0	0	0	0	10.00K	0.00K	An unusually strong upper level low pressure system and surface cold front moved through central Indiana during the late morning and afternoon hours of June 10th. A very humid air mass was in place behind a tropical system that had passed through. This combined with the strong dynamics allowed for storms with very strong wind gusts and some large hail to form. The strongest storms were north and east of the forecast area. Numerous reports of winds up to 70 mph and hail as large as an inch occurred with this storm system. The most severe damage occurred in portions of Tipton and Howard counties.
Paragon	44031	Thunderstorm Wind	0	0	0	0	2.00K	0.00K	During the afternoon and evening hours, isolated to scattered thunderstorms moved through central Indiana causing widespread tree damage to portions of Carroll county. More isolated damage occurred across other portions of central Indiana. Storms remained nearly stationary in west central Indiana where over 4 inches of rain fell. Flash flooding occurred in Sullivan county which led to US 41 to remain closed for several hours.
Paragon	44031	Thunderstorm Wind	0	0	0	0	1.00K	0.00K	During the afternoon and evening hours, isolated to scattered thunderstorms moved through central Indiana causing widespread tree damage to portions of Carroll county. More isolated damage occurred across other portions of central Indiana. Storms remained nearly stationary in west central Indiana where over 4 inches of rain fell. Flash flooding occurred in Sullivan county which led to US 41 to remain closed for several

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									hours.
Martinsville	44039	Thunderstorm Wind	0	0	0	0	2.00K	0.00K	During the afternoon and evening hours of July 27th, a line of thunderstorms moved across central Indiana causing sporadic wind damage. The thunderstorms initially began producing damaging winds just west of Indianapolis where a wind gust knocked down a partially constructed building causing 3 injuries and 1 fatality. Further east, tree damage occurred from Indianapolis to Rushville.
Whitaker	44053	Thunderstorm Wind	0	0	0	0	5.00K	0.00K	On August 10th, an intense derecho brought severe to extreme winds to much of the Midwest with winds estimated as high as 130 to 140 mph in Iowa. As the derecho neared Indiana, the storms were not quite as intense, but did produce measured winds up to 70 mph and caused significant tree damage and power outages to the local area. Over 100,000 people were without power at one point with power outages lasting several days across portions of the state.

Appendix D: Essential & Critical Facilities List and Maps

Essential Facilities

Table 37. Medical Care Facilities

Facility Name	Address	City
Transitional Services Sub LLC	369 W Washington St	Morgantown
Morgantown Health Care-Inn	140 W Washington St	Morgantown
Ladybug Personal Care LLC	2250 Legendary Dr	Martinsville
Heritage Home Health Services LLC	801 Plaza Dr	Martinsville
Rn2U Inc	9731 N Kitchen Rd	Mooresville
Frabergs Foods	309 W Union Rd	Monrovia
Frabergs Iga 1489	490 N Chestnut St	Monrovia
Kroger J921	530 S Indiana St	Mooresville
Mooresville Wic Clinic	6 E Moore St	Mooresville
Woodchuck Iga 74	80 S Marion St	Morgantown
Waters Of Martinsville The	2055 Heritage Dr	Martinsville
Martinsville Wic Program	1328 Morton Ave	Martinsville
Kroger J907	1600 S Ohio	Martinsville
Save-A-Lot	1209 S Main St	Martinsville
Wal Mart 1356	410 Grand Valley Blvd	Martinsville
Fresenius Medical Care Morgan County	2200 John R Wooden Dr	Martinsville
IU Health Morgan Hospital	2209 John R Wooden Dr	Martinsville
Transitional Services Sub LLC	110 W Pike St	Martinsville
Franciscan St Francis Health - Mooresville	1201 Hadley Rd	Mooresville
Value Market	243 E High St	Mooresville
Mooresville Endoscopy Center LLC	1215 Hadley Rd	Mooresville
St Francis Mooresville Surgery Center LLC	1215 Hadley Rd	Mooresville
Cornerstone Home Healthcare	5 E High St	Mooresville
Miller's Merry Manor	259 W Harrison St	Mooresville
Marsh 25	435 Town Center St N	Mooresville
Meadow Lakes	200 Meadow Lake Dr	Mooresville
Grand Valley Gardens	621 Grand Valley Blvd	Martinsville

Table 38. School Facilities

Facility Name	Address	City
Hall Elementary School	5955 N Hurt Rd	Monrovia
Monrovia Jr-Sr High School	135 S Chestnut St	Monrovia
Monrovia Elementary School	395 S Chestnut St	Monrovia
H Robert Hammons School	1360 E Gray	Martinsville
Martinsville High School	1360 E Gray St	Martinsville

Facility Name	Address	City
John R. Wooden Middle School	109 E Garfield St	Martinsville
Bell Intermediate School	1459 E Columbus St	Martinsville
Centerton Elementary School	6075 High St	Martinsville
South Elementary Sch	500 E Mahalasville Rd	Martinsville
Charles L Smith Elem School	1359 E Columbus St	Martinsville
Poston Road Elementary School	139 E Poston Rd	Martinsville
Martinsville School Administration	389 E Jackson St	Martinsville
Mooresville High School	550 N Indiana St	Mooresville
Paul Hadley Middle Sch	200 W Carlisle St	Mooresville
Neil Armstrong Elem Sch	1000 Rd 144	Mooresville
Newby Memorial Elem Sch	240 N Monroe St	Mooresville
Northwood Elementary School	630 N Indiana St	Mooresville
Waverly Elementary School	8525 Waverly Rd	Martinsville
Green Township Elem Sch	6275 Maple Rd	Martinsville
Brooklyn Elementary School	251 N Church St	Brooklyn
Paragon Elementary School	520 W Union St (Old Sr 67)	Paragon
Mooresville Christian Academy	4271 E S R 144	Mooresville
Eminence Elementary School	6769 N S R 42	Eminence
Eminence Jr-Sr High School	6769 N S R 42	Eminence
Tabernacle Christian Schools	2189 Burton Ln	Martinsville
Footsteps Montessori Preschool	590 E Morgan St	Martinsville
North Madison Elementary School	7456 E Hadley Rd	Mooresville
Prince Of Peace Lutheran School	3496 E Morgan St	Martinsville

Table 39. Police Stations

Facility Name	Address	City
Mooresville Police Dept	104 W Main St	Mooresville
Morgantown Police Dept	120 W Washington St	Morgantown
Town Of Brooklyn Police Dept	16 E Mill	Brooklyn
Morgan County Sheriff	160 N Park Ave	Martinsville
City Of Martinsville Police Dept	59 S Jefferson St	Martinsville
Paragon Police Dept	209 W Union	Paragon

Table 40. Fire Stations

Facility Name	Address	City
Brooklyn Fire Station 41	10 N Main St	Brooklyn
Mooresville Fire Dept Administration	26 S Indiana St	Mooresville
Washington Twp Fire Dept	1890 State Road 44	Martinsville
Morgantown Fire Station 1	269 Highland St	Morgantown
Brown Twp Fire Station 21	53 Indianapolis Rd	Mooresville

Facility Name	Address	City
A&A Township Fire Station 11	6494 N Sr 42	Eminence
Madison Twp Fire Station 31	10023 N Kitchen Rd	Mooresville
Harrison Twp Fire Dept	8475 Waverly Rd	Mooresville
Gregg Twp Fire Station 121	6249 N Baltimore Rd	Monrovia
Paragon Fire Station 17	101 E Union Rd	Martinsville
Brooklyn Fire Station 42	6210 Beech Grove Rd	Brooklyn
Monroe Twp Fire Dept	450 N Chestnut St	Monrovia
Madison Twp Fire Station 32	7047 E Landersdale Rd	Camby
Brown Twp Fire Station 22	471 Old Sr 67 N	Mooresville
Martinsville Fire Dept	160 W Morgan St	Martinsville
Mooresville Fire Station	415 Sr 144	Mooresville
Gregg Twp Fire Dept Station 2	1715 West Shore Dr	Martinsville

Table 41. Emergency Operations Center

Facility Name	Address	City
Morgan County EMA	1789 E Morgan St	Martinsville

Critical Facilities

Table 42. Airport Facilities

Facility Name	Use	Address	City
Patrum Field	Private	Airport	Eminence
Winters	Private	Airport	Hall
Jack Oak	Private	Airport	Lewisville
Shearer	Private	Stolport	Lewisville
Hodges	Private	Airport	Martinsville
Koger Inc	Private	1960 Cessna Blvd	Martinsville
Jungclaw	Private	1316 Dillman	Martinsville
Milhon	Private	2151 Centerton Rd	Martinsville
Mc Daniel'S Field	Private	Robin Rd	Martinsville
Margaret Mershon	Private	2821 W Aurora Ln	Monrovia
Berling	Private	Heliport	Mooresville
Kay Air	Private	Airport	Mooresville
Hopkins	Private	Heliport	Mooresville
Donica Field	Private	Airport	Morgantown
Sara Balzer	Private	2467 S Arthur Rd	Paragon
Pam’S Place Airport Inc	Other	13863 W Sr 42	Cloverdale
Paul Schoolcraft	Other	1700 E Mahalasville Rd	Martinsville
Stephen & Regina Hoffman	Other	8261 W Baseline Rd	Paragon

Table 43. Communication Facilities

Facility Name	Use	Address	City
	Unknown	70 Schnaiter Ln	Martinsville
	Unknown	340 E Mahalasville Rd	Martinsville
	Unknown	1895 Sr 44	Martinsville
	Unknown	N C R 675 West	Monrovia
	Unknown	Sr 37 North	Martinsville
	Unknown	Sr 37 North	Martinsville
	Unknown	N Baltimore Rd	Monrovia
	Unknown	1902 S Graveyard Rd	Paragon
	Unknown	9426 E Sr 44	Morgantown
	Unknown	8590 N Pennington Rd	Mooresville
	Unknown	3244 S Sr 67	Paragon
	Unknown	6310 Baltimore Rd	Monrovia
	Unknown	10402 N Simpson Rd	Stilesville
	Unknown	5320 Perry Rd	Martinsville

Table 44. Hazmat Facilities

Facility Name	Chemical Name	Address	City
Indianapolis Power & Light H.T. Pritchar	Hydrochloric Acid	4040 Blue Bluff Rd.	Martinsville
Indianapolis Power & Light H.T. Pritchar	Sulfuric Acid	4040 Blue Bluff Rd.	Martinsville
Indianapolis Power & Light H.T. Pritchar	Barium Compounds	4040 Blue Bluff Rd.	Martinsville
Indianapolis Power & Light H.T. Pritchar	Chromium Compounds	4040 Blue Bluff Rd.	Martinsville
Indianapolis Power & Light H.T. Pritchar	Manganese Compounds	4040 Blue Bluff Rd.	Martinsville
Indianapolis Power & Light H.T. Pritchar	Zinc Compounds	4040 Blue Bluff Rd.	Martinsville
Indianapolis Power & Light H.T. Pritchar	Chlorine	4040 Blue Bluff Rd.	Martinsville
Federal-Mogul Corp.	Copper	451 County Line Rd.	Mooresville
Federal-Mogul Corp.	Lead	451 County Line Rd.	Mooresville
General Shale Prods. L.L.C. Plant #20 &	Hydrogen Fluoride	Old Hwy. 67 S.	Mooresville
General Shale Prods. L.L.C. Plant #20 &	Chromium Compounds	Old Hwy. 67 S.	Mooresville

Table 45. Potable Water

Facility Name	Address	City
Brown County Water Utility	6690 E Mahalesville Rd	Morgantown
Brooklyn Water Utility	6636 N Tidewater Rd	Brooklyn
Hill Water Corp	2 Squire Dr	Mooresville
Morgan County Rural Water Corp	1395 E Shore Dr	Martinsville
Paragon Water	209 W Union	Paragon
Mapleturn Utilities	2001 E Mapleturn Rd	Martinsville
Painted Hills Utility Co	19 W Washington St	Martinsville

Table 46. Wastewater Treatment Plants

Facility Name	Address	City
Brooklyn Municipal Utilities &	6626 N Tidewater Rd	Brooklyn
Paragon Municipal Wwtp	Sr 67 & Paragon Rd	Paragon
Mapleturn Utilities Wwtp	4203 N Somerset Dr	Martinsville
Wildwood Shores Utility	N Wildwood Ln	Camby
Rolling Vista Estates	N Ridgeview Dr	Mooresville
Town Of Monrovia	N West Union Church Rd	Monrovia
Martinsville Wastewater Tr. Pl	955 Rogers Rd	Martinsville
Mooresville Wastewater Tr. Pl.	499 Park Drive	Mooresville
Morgantown Wwtp	Pond Rd	Morgantown

Appendix E: Hazard Maps

Figure 77. Tornado: Critical Facilities

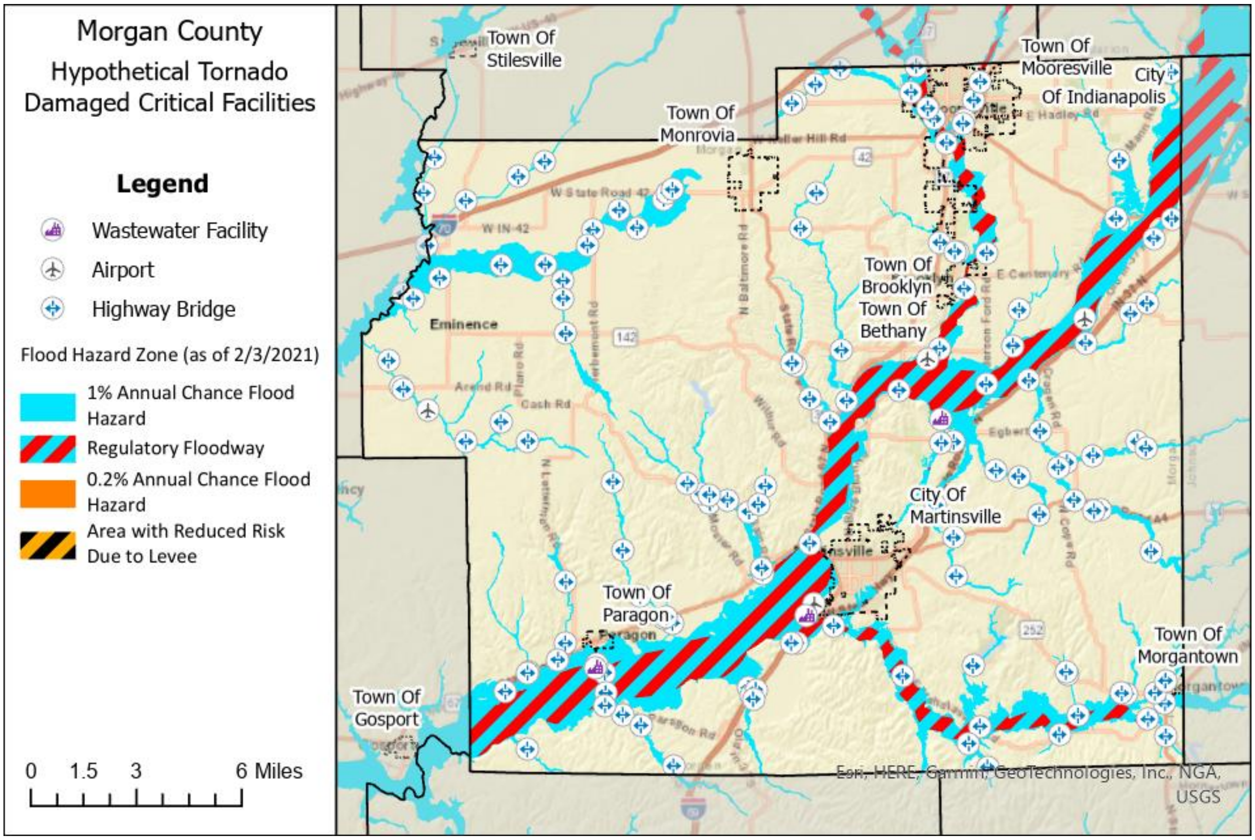


Figure 78. Special Flood Hazard Area: Critical Facilities

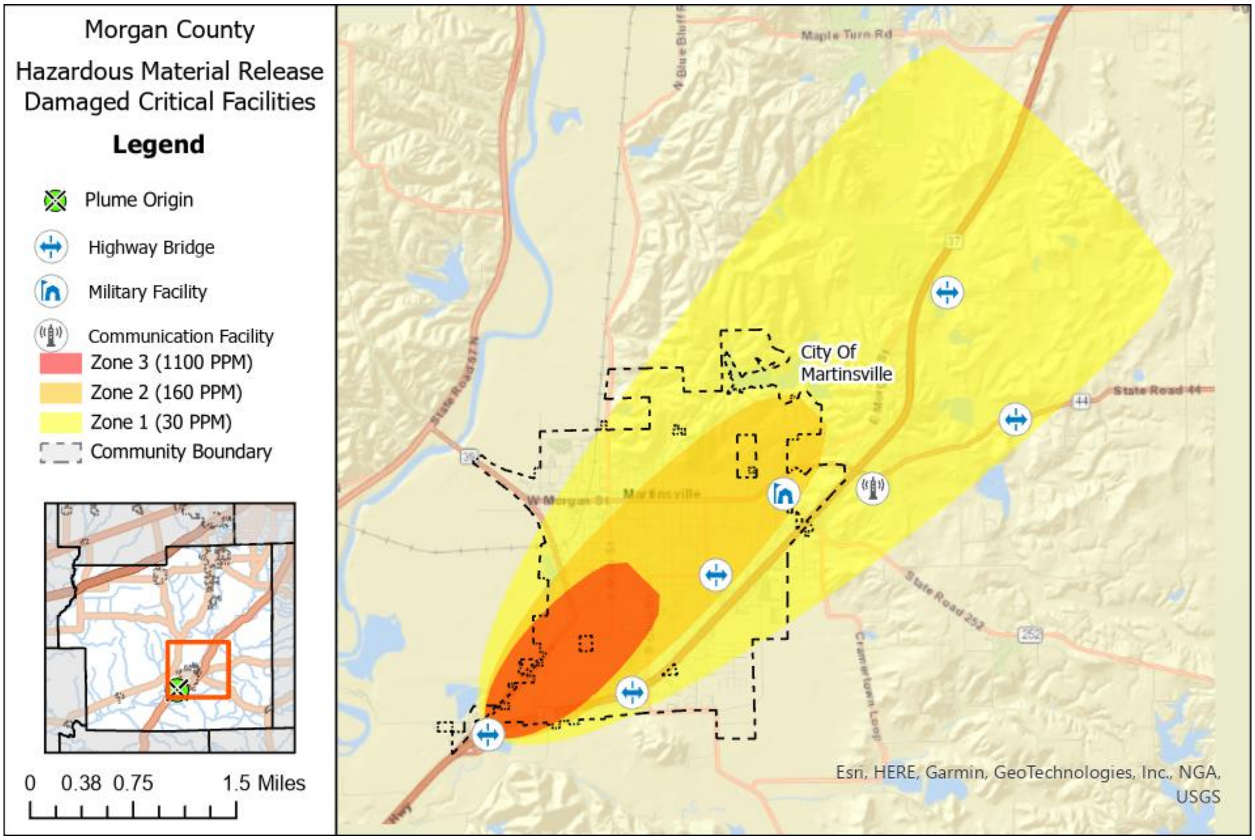


Figure 79. Hazardous Materials Release: Critical Facilities

Appendix F: Community Capability Assessment Results

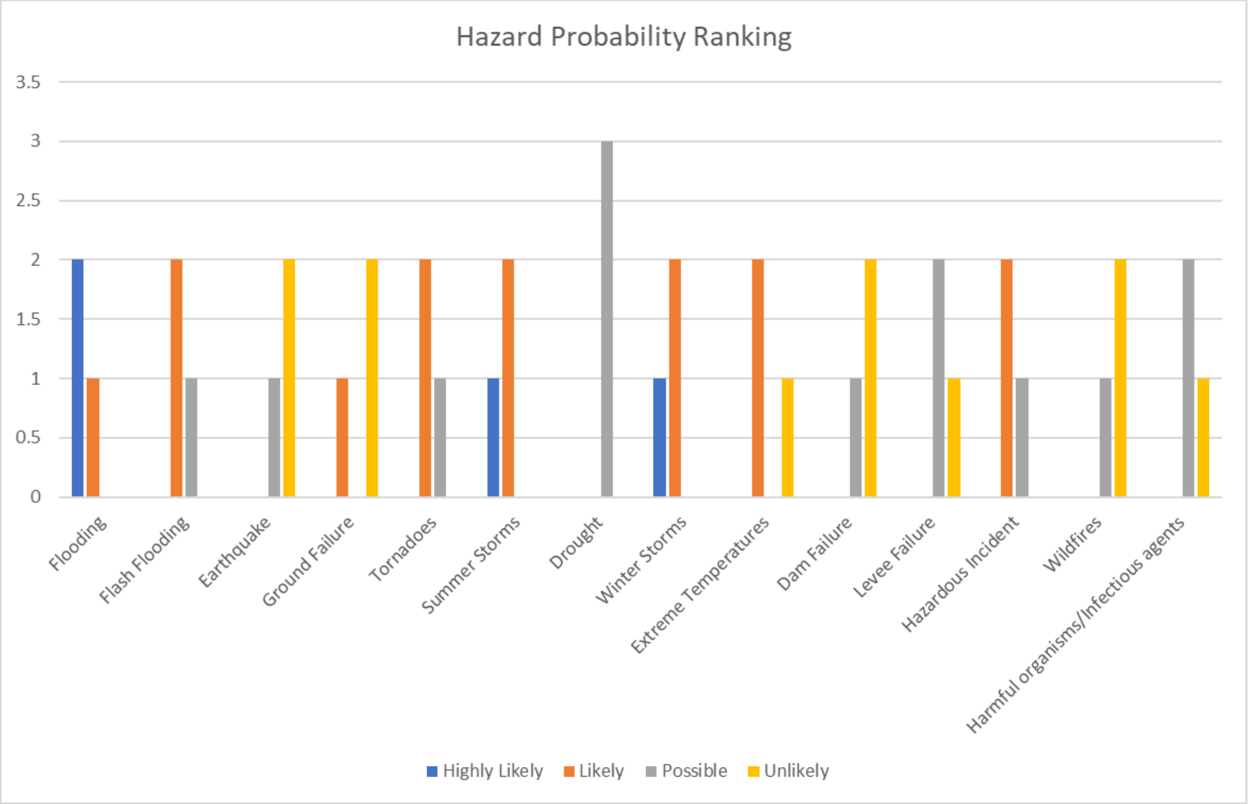


Figure 80. Hazard Probability Ranking Survey Results. Total of 3 Reponses.

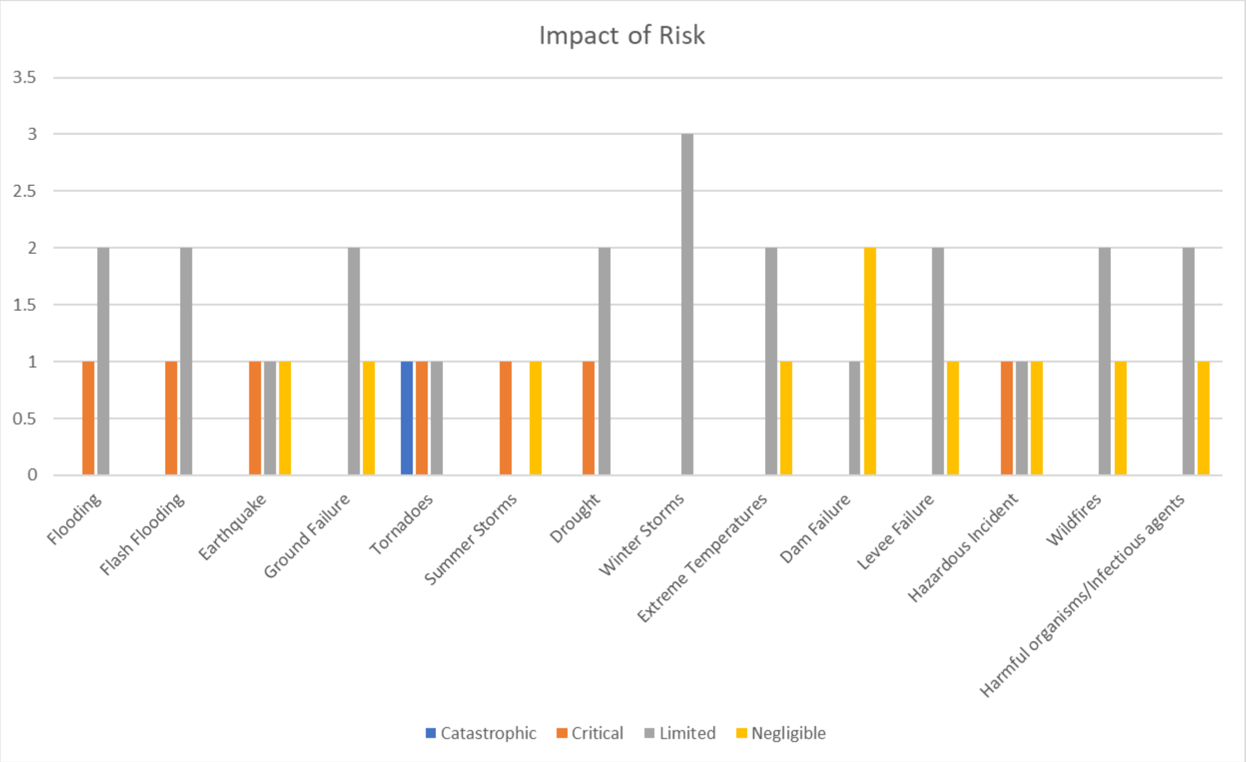
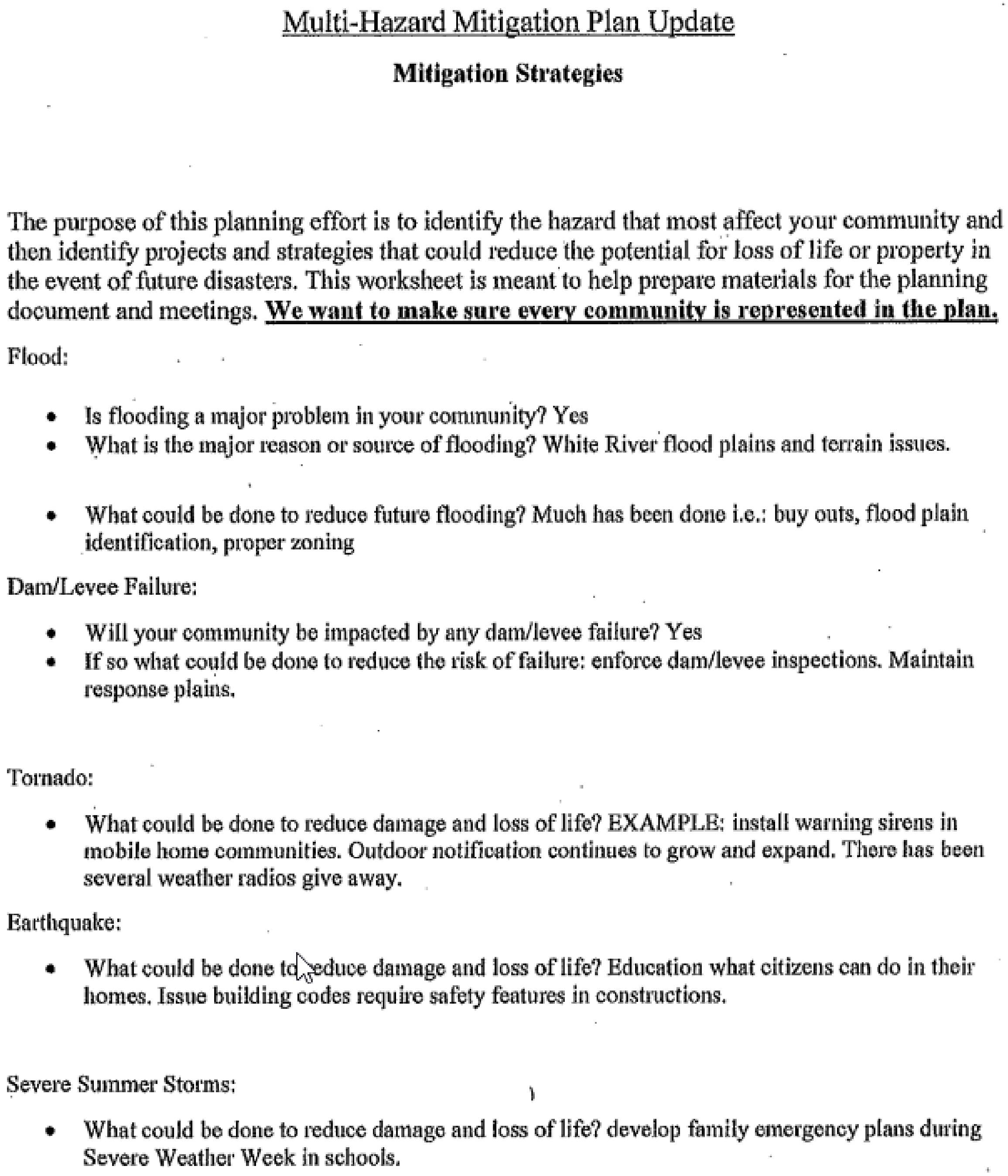


Figure 81. Hazard Risk Impact Survey. Total of 3 Responses.



Multi-Hazard Mitigation Plan Update

Mitigation Strategies

The purpose of this planning effort is to identify the hazard that most affect your community and then identify projects and strategies that could reduce the potential for loss of life or property in the event of future disasters. This worksheet is meant to help prepare materials for the planning document and meetings. **We want to make sure every community is represented in the plan.**

Flood:

- Is flooding a major problem in your community? Yes
- What is the major reason or source of flooding? White River flood plains and terrain issues.
- What could be done to reduce future flooding? Much has been done i.e.: buy outs, flood plain identification, proper zoning

Dam/Levee Failure:

- Will your community be impacted by any dam/levee failure? Yes
- If so what could be done to reduce the risk of failure: enforce dam/levee inspections. Maintain response plains.

Tornado:

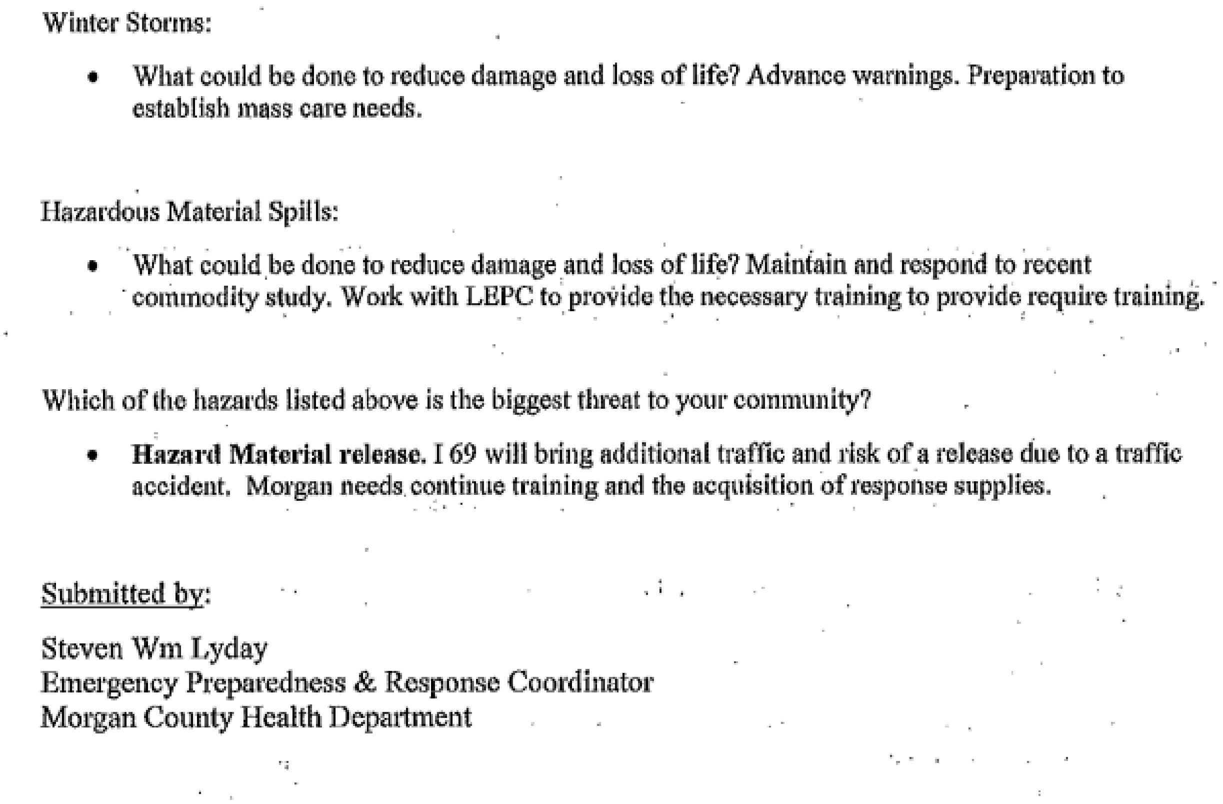
- What could be done to reduce damage and loss of life? EXAMPLE: install warning sirens in mobile home communities. Outdoor notification continues to grow and expand. There has been several weather radios give away.

Earthquake:

- What could be done to reduce damage and loss of life? Education what citizens can do in their homes. Issue building codes require safety features in constructions.

Severe Summer Storms:

- What could be done to reduce damage and loss of life? develop family emergency plans during Severe Weather Week in schools.



Winter Storms:

- What could be done to reduce damage and loss of life? Advance warnings. Preparation to establish mass care needs.

Hazardous Material Spills:

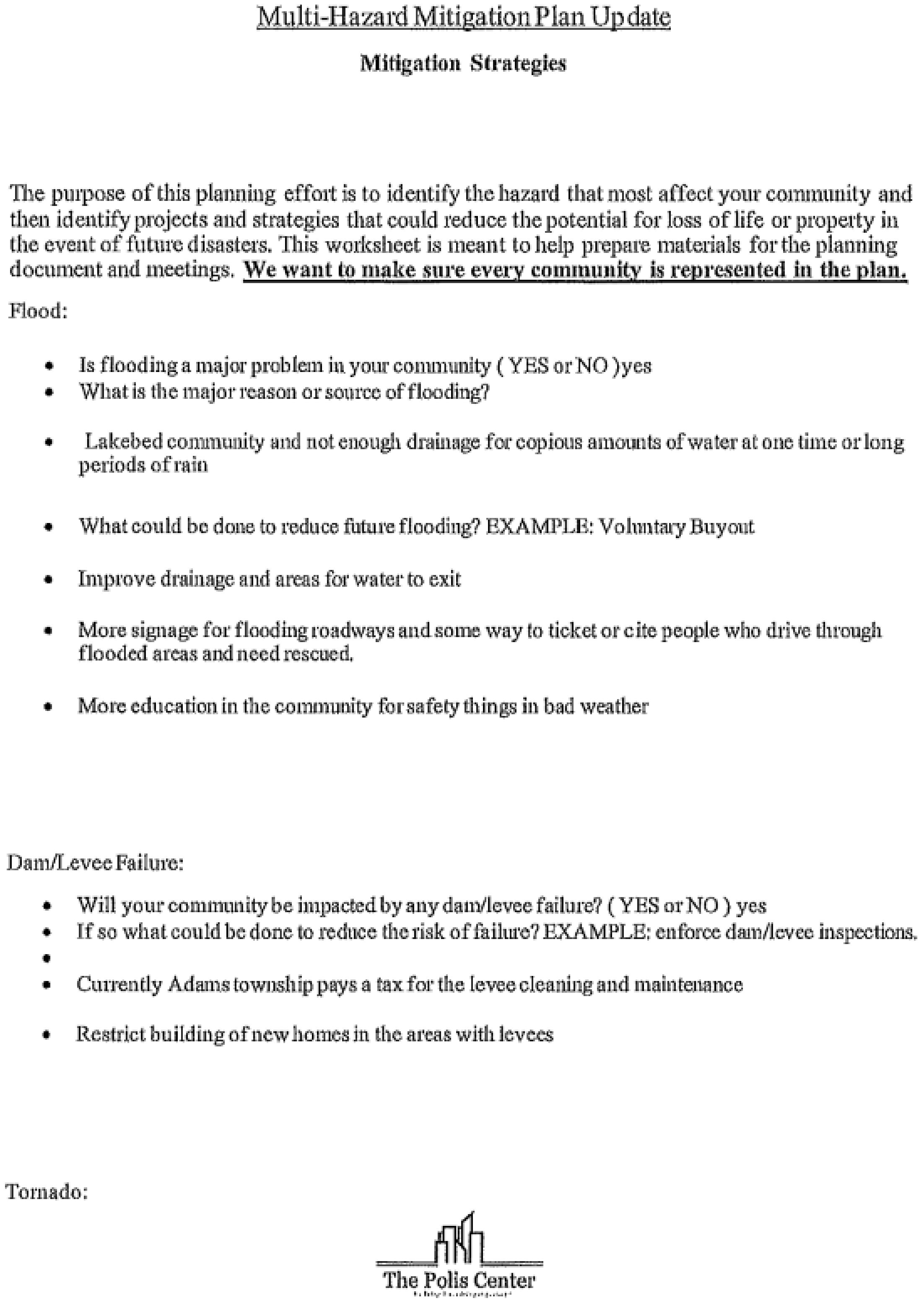
- What could be done to reduce damage and loss of life? Maintain and respond to recent commodity study. Work with LEPC to provide the necessary training to provide require training.

Which of the hazards listed above is the biggest threat to your community?

- **Hazard Material release.** I 69 will bring additional traffic and risk of a release due to a traffic accident. Morgan needs continue training and the acquisition of response supplies.

Submitted by:

Steven Wm Lyday
Emergency Preparedness & Response Coordinator
Morgan County Health Department



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Flood:

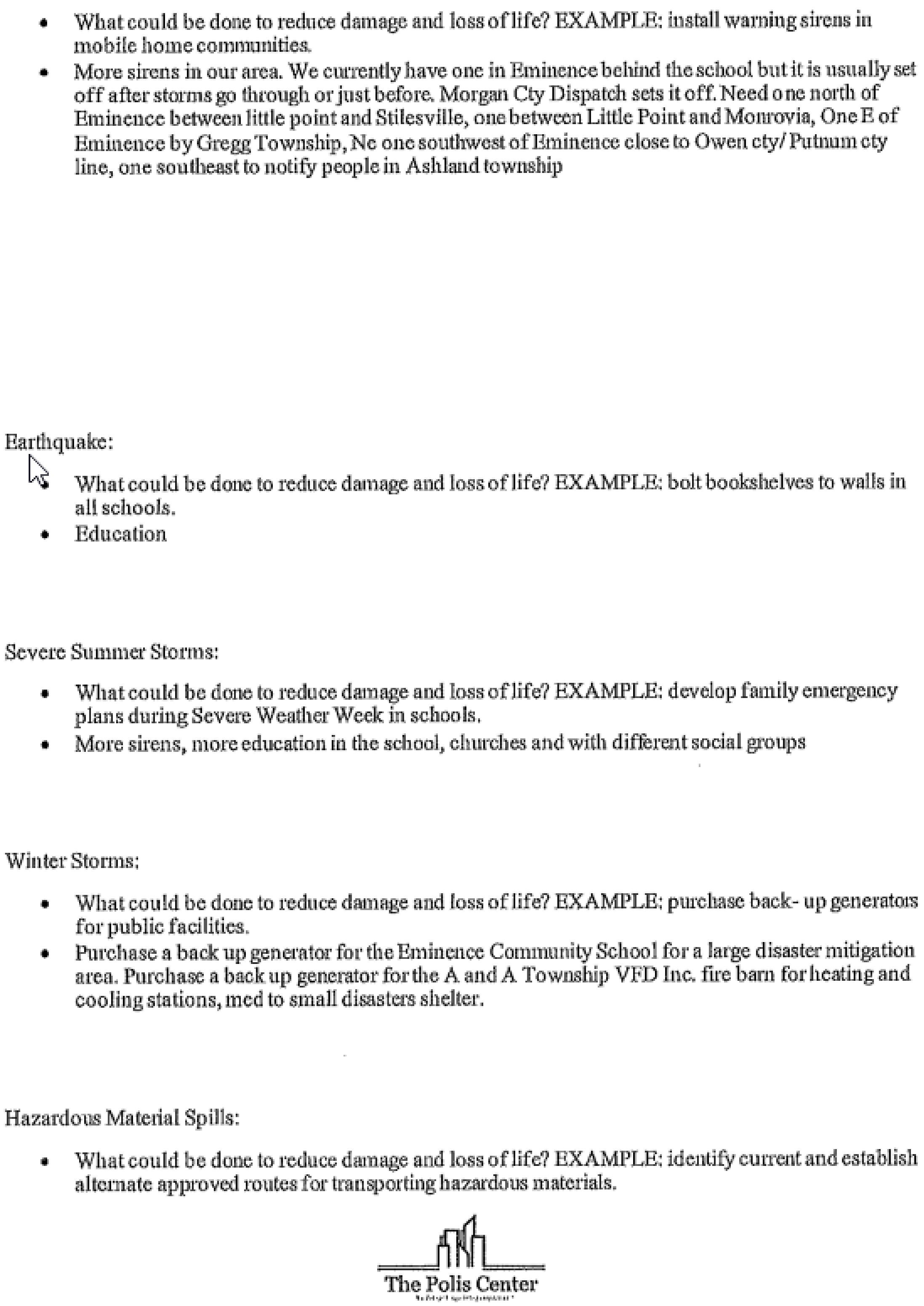
- Is flooding a major problem in your community (YES or NO) yes
- What is the major reason or source of flooding?
- Lakebed community and not enough drainage for copious amounts of water at one time or long periods of rain
- What could be done to reduce future flooding? EXAMPLE: Voluntary Buyout
- Improve drainage and areas for water to exit
- More signage for flooding roadways and some way to ticket or cite people who drive through flooded areas and need rescued.
- More education in the community for safety things in bad weather

Dam/Levee Failure:

- Will your community be impacted by any dam/levee failure? (YES or NO) yes
- If so what could be done to reduce the risk of failure? EXAMPLE: enforce dam/levee inspections.
-
- Currently Adams township pays a tax for the levee cleaning and maintenance
- Restrict building of new homes in the areas with levees

Tornado:

The Polis Center



- What could be done to reduce damage and loss of life? EXAMPLE: install warning sirens in mobile home communities.
- More sirens in our area. We currently have one in Eminence behind the school but it is usually set off after storms go through or just before. Morgan Cty Dispatch sets it off. Need one north of Eminence between little point and Stilesville, one between Little Point and Monrovia, One E of Eminence by Gregg Township, Ne one southwest of Eminence close to Owen cty/ Putnum cty line, one southeast to notify people in Ashland township

Earthquake:

- What could be done to reduce damage and loss of life? EXAMPLE: bolt bookshelves to walls in all schools.
- Education

Severe Summer Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: develop family emergency plans during Severe Weather Week in schools.
- More sirens, more education in the school, churches and with different social groups

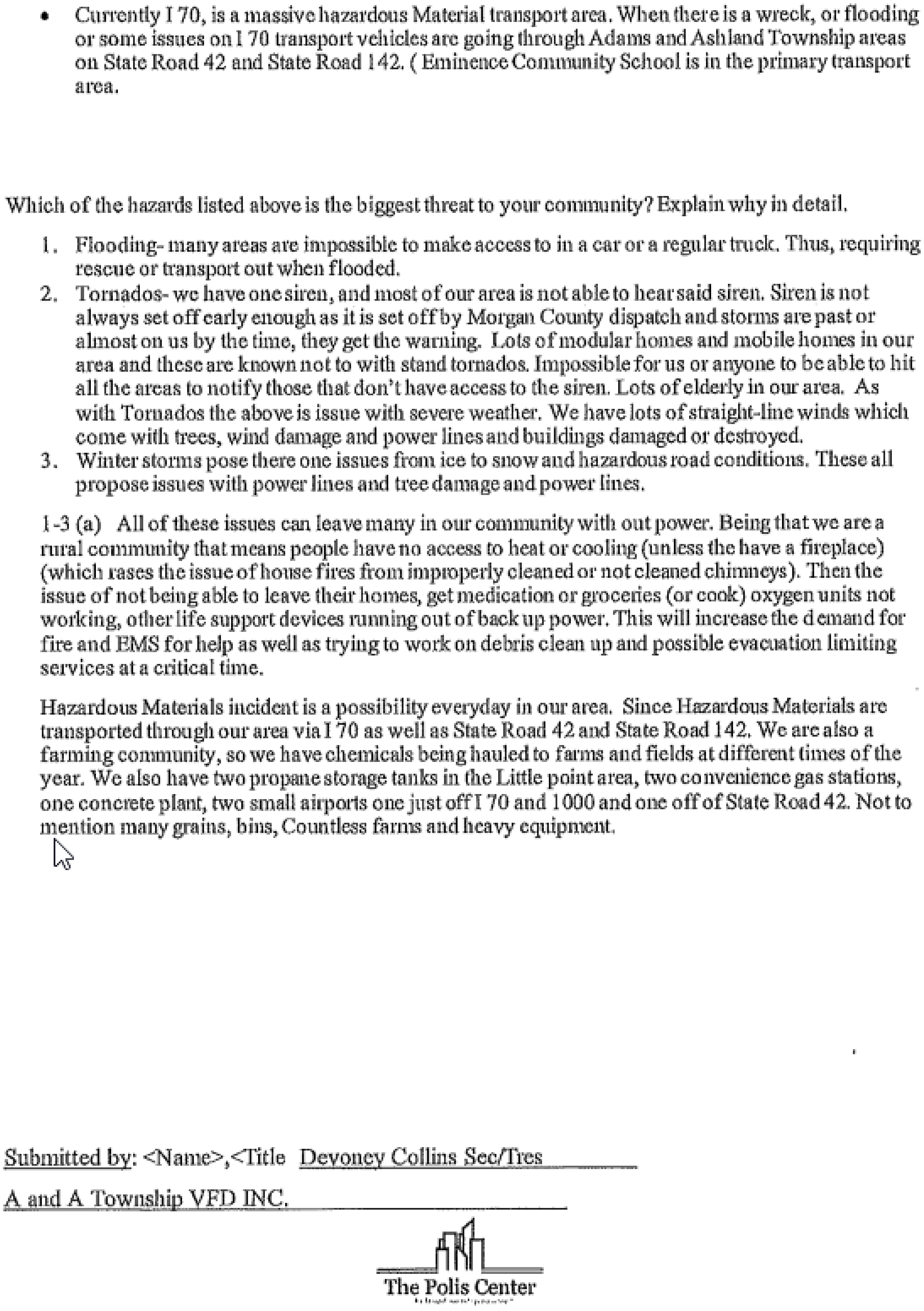
Winter Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: purchase back- up generators for public facilities.
- Purchase a back up generator for the Eminence Community School for a large disaster mitigation area. Purchase a back up generator for the A and A Township VFD Inc. fire barn for heating and cooling stations, med to small disasters shelter.

Hazardous Material Spills:

- What could be done to reduce damage and loss of life? EXAMPLE: identify current and establish alternate approved routes for transporting hazardous materials.

The Polis Center



- Currently I 70, is a massive hazardous Material transport area. When there is a wreck, or flooding or some issues on I 70 transport vehicles are going through Adams and Ashland Township areas on State Road 42 and State Road 142. (Eminence Community School is in the primary transport area.

Which of the hazards listed above is the biggest threat to your community? Explain why in detail.

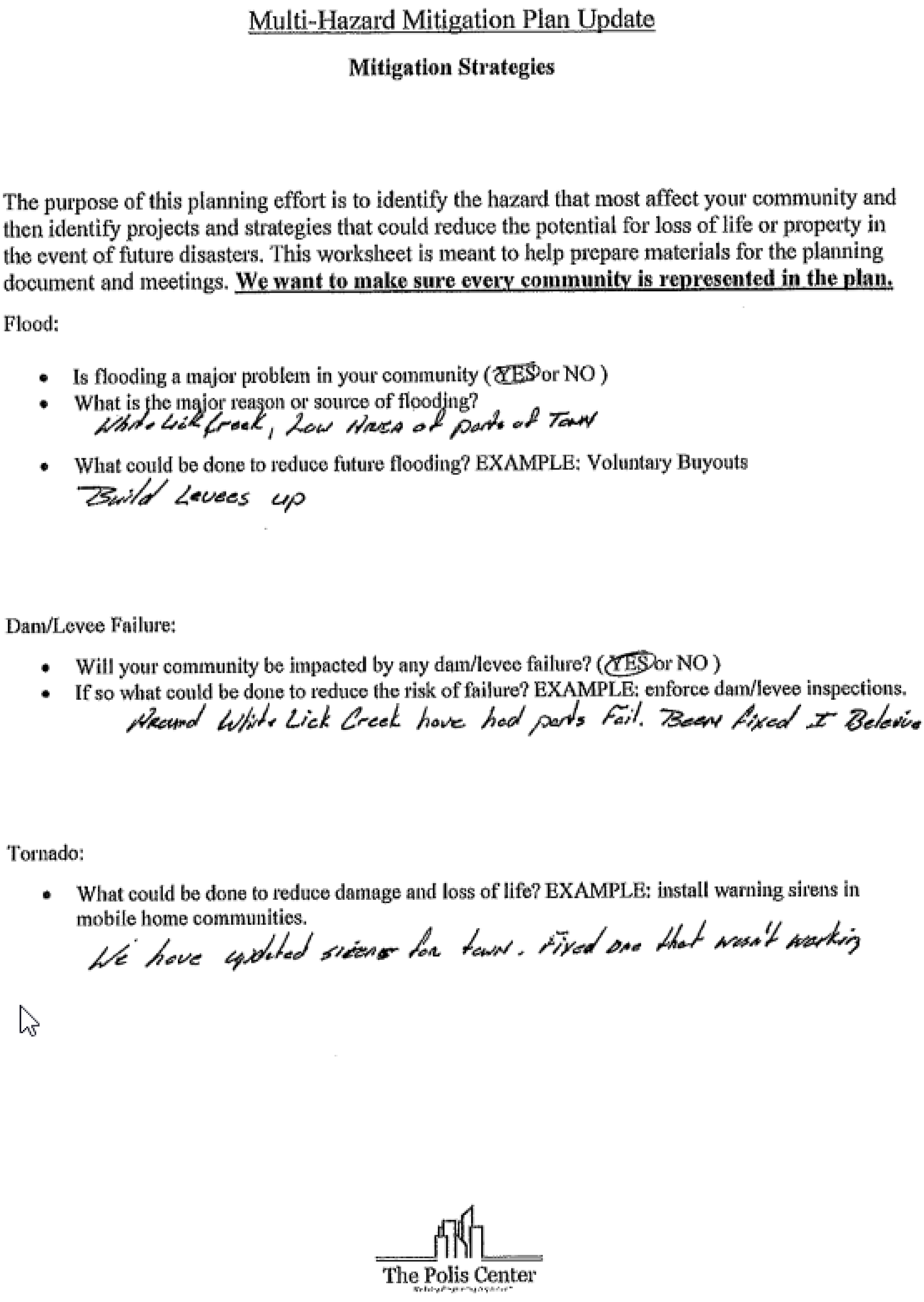
1. Flooding- many areas are impossible to make access to in a car or a regular truck. Thus, requiring rescue or transport out when flooded.
2. Tornados- we have one siren, and most of our area is not able to hear said siren. Siren is not always set off early enough as it is set off by Morgan County dispatch and storms are past or almost on us by the time, they get the warning. Lots of modular homes and mobile homes in our area and these are known not to with stand tornados. Impossible for us or anyone to be able to hit all the areas to notify those that don't have access to the siren. Lots of elderly in our area. As with Tornados the above is issue with severe weather. We have lots of straight-line winds which come with trees, wind damage and power lines and buildings damaged or destroyed.
3. Winter storms pose there one issues from ice to snow and hazardous road conditions. These all propose issues with power lines and tree damage and power lines.

1-3 (a) All of these issues can leave many in our community with out power. Being that we are a rural community that means people have no access to heat or cooling (unless the have a fireplace) (which rases the issue of house fires from improperly cleaned or not cleaned chimneys). Then the issue of not being able to leave their homes, get medication or groceries (or cook) oxygen units not working, other life support devices running out of back up power. This will increase the demand for fire and EMS for help as well as trying to work on debris clean up and possible evacuation limiting services at a critical time.

Hazardous Materials incident is a possibility everyday in our area. Since Hazardous Materials are transported through our area via I 70 as well as State Road 42 and State Road 142. We are also a farming community, so we have chemicals being hauled to farms and fields at different times of the year. We also have two propane storage tanks in the Little point area, two convenience gas stations, one concrete plant, two small airports one just off I 70 and 1000 and one off of State Road 42. Not to mention many grains, bins, Countless farms and heavy equipment.

Submitted by: <Name>,<Title Devoney Collins Sec/Tres

A and A Township VFD INC.



Multi-Hazard Mitigation Plan Update

Mitigation Strategies

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Flood:

- Is flooding a major problem in your community ([✓ YES] or NO)
- What is the major reason or source of flooding?
  White Lick Creek, Low Area of parts of Town
- What could be done to reduce future flooding? EXAMPLE: Voluntary Buyouts
  Build Levees up

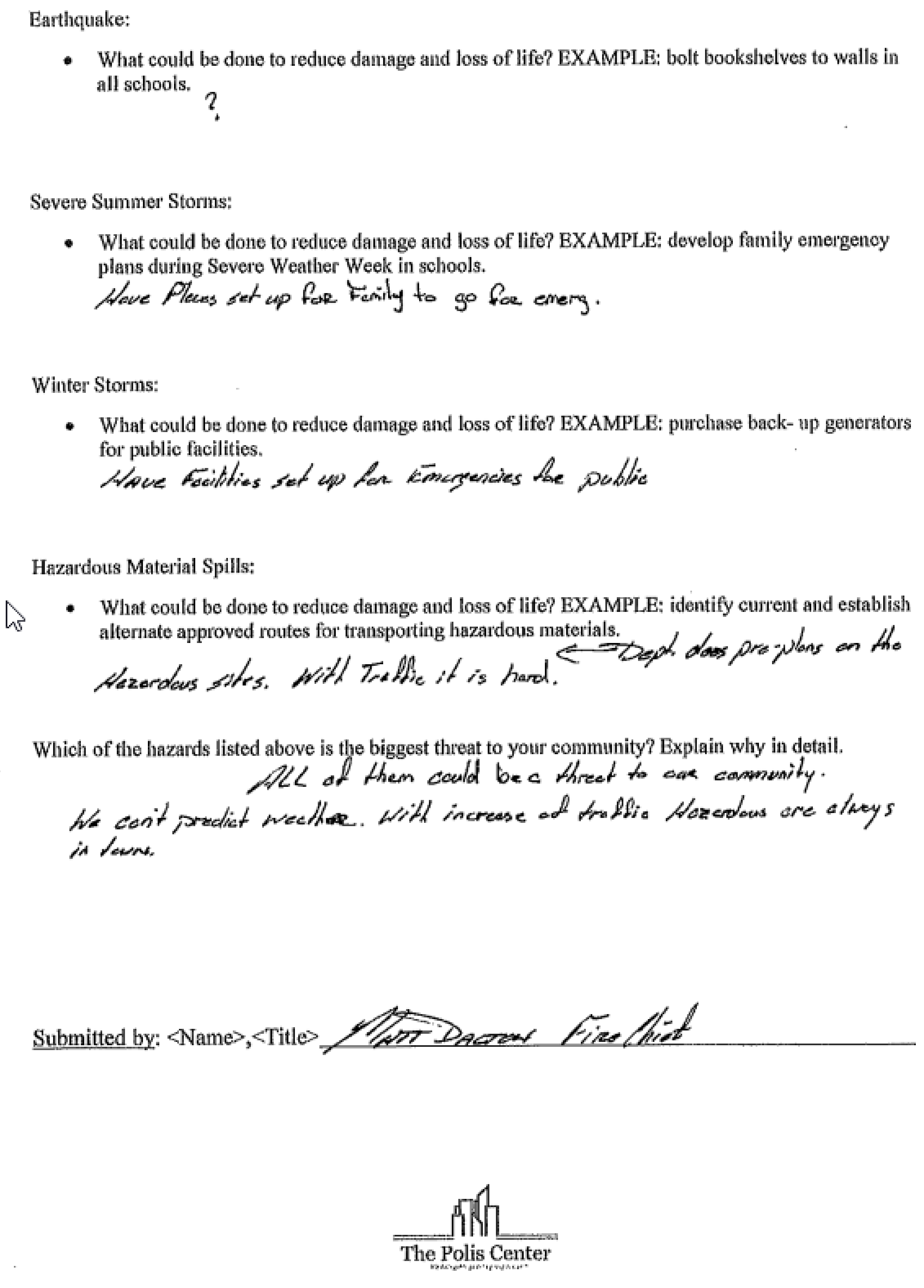
Dam/Levee Failure:

- Will your community be impacted by any dam/levee failure? ([✓ YES] or NO)
- If so what could be done to reduce the risk of failure? EXAMPLE: enforce dam/levee inspections.
  Around White Lick Creek have had parts Fail. Been fixed I Believe

Tornado:

- What could be done to reduce damage and loss of life? EXAMPLE: install warning sirens in mobile home communities.
  We have updated sirens for town. Fixed one that wasn't working

The Polis Center



Earthquake:

- What could be done to reduce damage and loss of life? EXAMPLE: bolt bookshelves to walls in all schools.

?

Severe Summer Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: develop family emergency plans during Severe Weather Week in schools.

Have Places set up for Family to go for emerg.

Winter Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: purchase back- up generators for public facilities.

Have Facilities set up for Emergencies the public

Hazardous Material Spills:

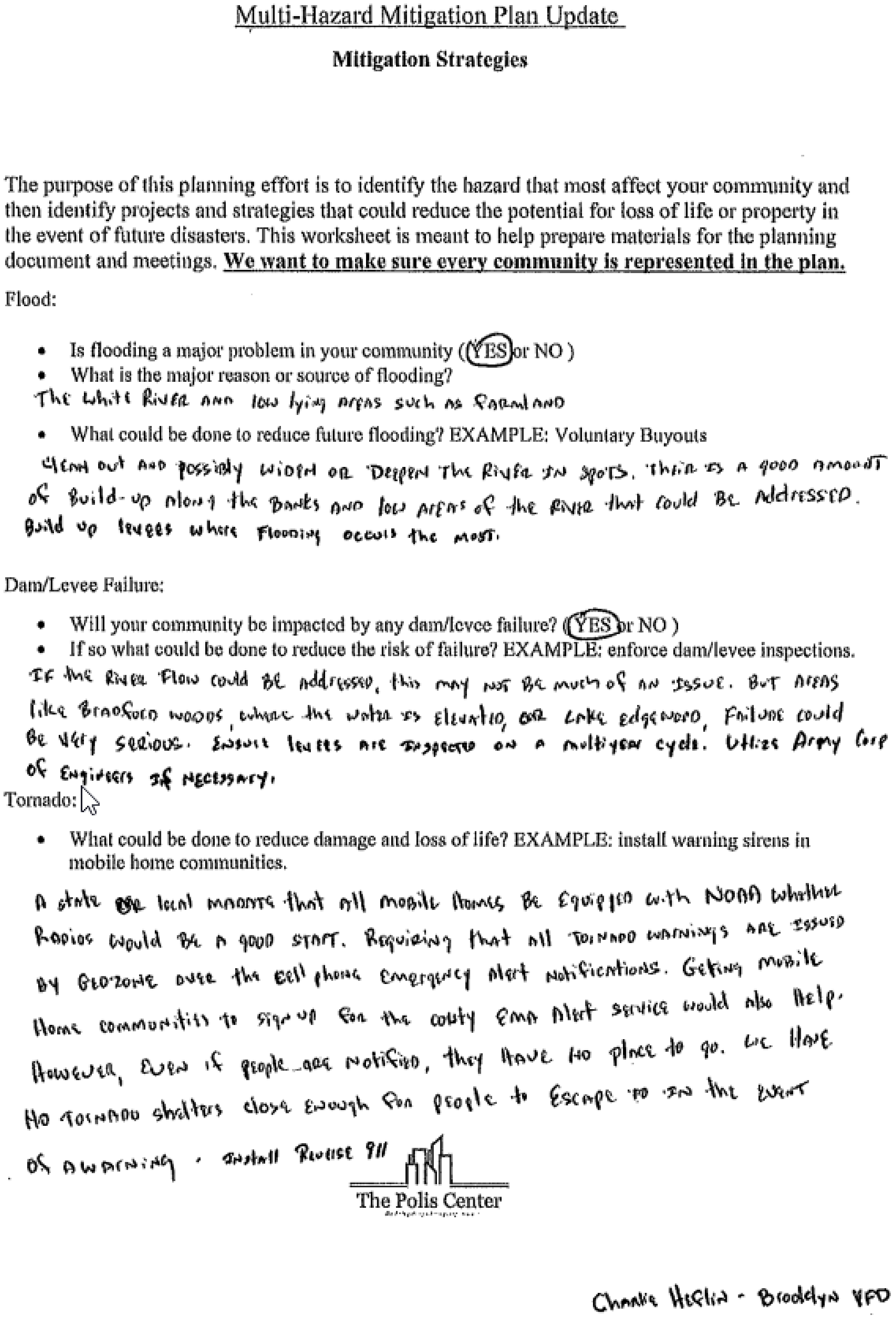
- What could be done to reduce damage and loss of life? EXAMPLE: identify current and establish alternate approved routes for transporting hazardous materials. ← Dept. does pre-plans on the Hazardous sites. With Traffic it is hard.

Which of the hazards listed above is the biggest threat to your community? Explain why in detail.

ALL of them could be a threat to our community. We can't predict weather. With increase of traffic Hazardous are always in town.

Submitted by: <Name>,<Title> Matt Dalton Fire Chief

The Polis Center



Multi-Hazard Mitigation Plan Update

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Flood:

- Is flooding a major problem in your community ([✓ YES] or NO)
- What is the major reason or source of flooding?

The White River and low lying areas such as farmland

- What could be done to reduce future flooding? EXAMPLE: Voluntary Buyouts

Clean out and possibly widen or deepen the River in spots. There is a good amount of Build-up along the Banks and low areas of the River that could Be addressed. Build up levees where flooding occurs the most.

Dam/Levee Failure:

- Will your community be impacted by any dam/levee failure? ([✓ YES] or NO)
- If so what could be done to reduce the risk of failure? EXAMPLE: enforce dam/levee inspections.

If the River flow could Be addressed, this may not Be much of an issue. But areas like Bradford Woods, where the water is elevated, or Lake Edgewood, failure could Be very serious. Ensure levees are inspected on a multiyear cycle. Utlize Army Corp of Engineers if necessary.

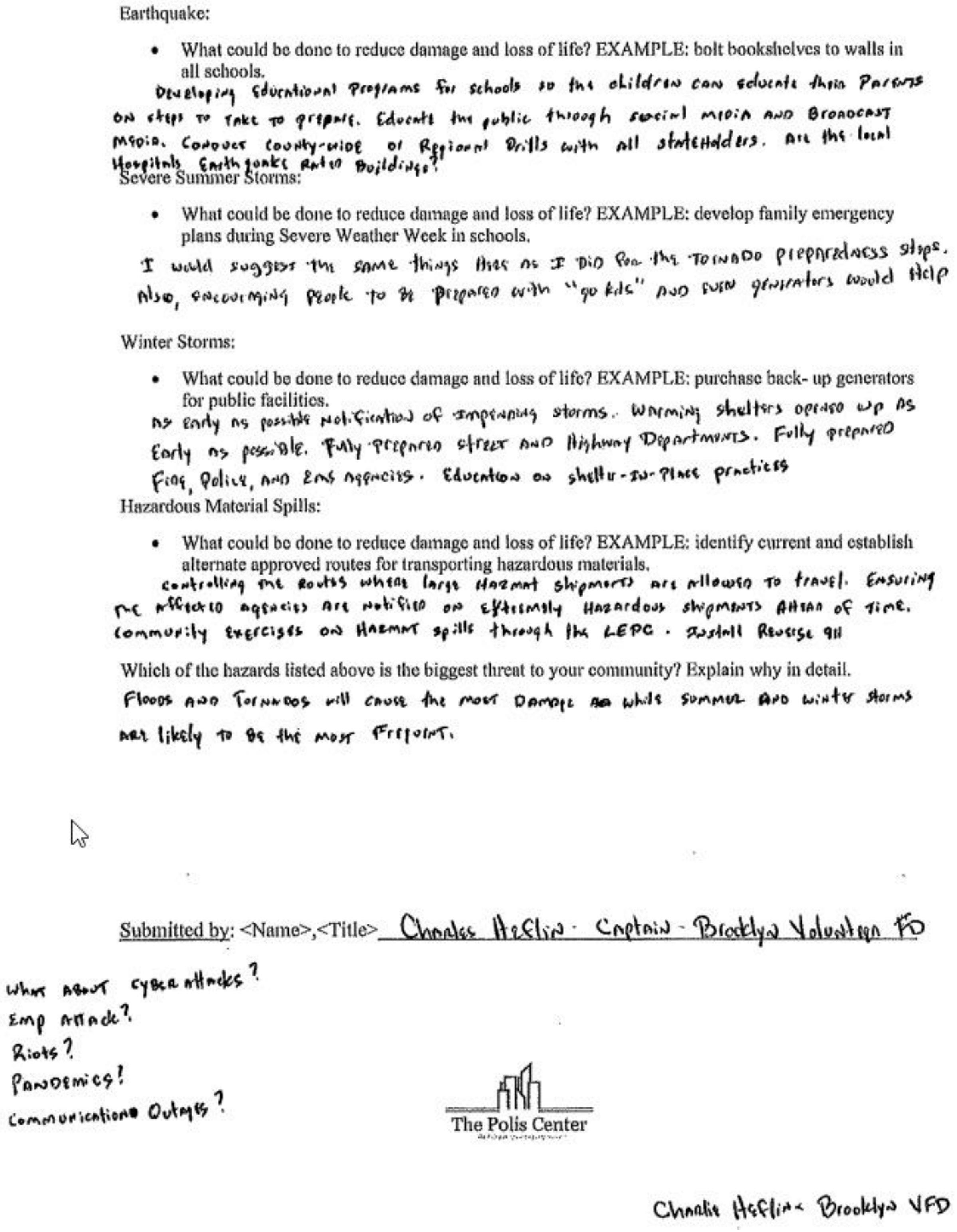
Tornado:

- What could be done to reduce damage and loss of life? EXAMPLE: install warning sirens in mobile home communities.

A state or local mandate that all mobile homes Be equipped with NOAA weather Radios would Be a good start. Requiring that all Tornado warnings are issued by Geozone over the cell phone emergency alert notifications. Getting mobile home communities to sign up for the couty EMA alert service would also help. However, even if people are notified, they have no place to go. We have no tornado shelters close enough for people to Escape to in the event of a warning. Install Reverse 911

The Polis Center

Charlie Heflin - Brooklyn VFD



Earthquake:

- What could be done to reduce damage and loss of life? EXAMPLE: bolt bookshelves to walls in all schools.

Developing educational programs for schools so the children can educate their parents on steps to take to prepare. Educate the public through social media and broadcast media. Conduct county-wide or regional drills with all stakeholders. Are the local hospitals earthquake rated buildings?

Severe Summer Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: develop family emergency plans during Severe Weather Week in schools.

I would suggest the same things that as I did for the tornado preparedness steps. Also, encouraging people to be prepared with "go kits" and even generators would help

Winter Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: purchase back- up generators for public facilities.

As early as possible notification of impending storms. Warming shelters opened up as early as possible. Fully prepared street and highway departments. Fully prepared fire, police, and EMS agencies. Education on shelter-in-place practices

Hazardous Material Spills:

- What could be done to reduce damage and loss of life? EXAMPLE: identify current and establish alternate approved routes for transporting hazardous materials.

Controlling the routes where large hazmat shipments are allowed to travel. Ensuring the affected agencies are notified on extremely hazardous shipments ahead of time. Community exercises on hazmat spills through the LEPC. Install Reverse 911

Which of the hazards listed above is the biggest threat to your community? Explain why in detail.

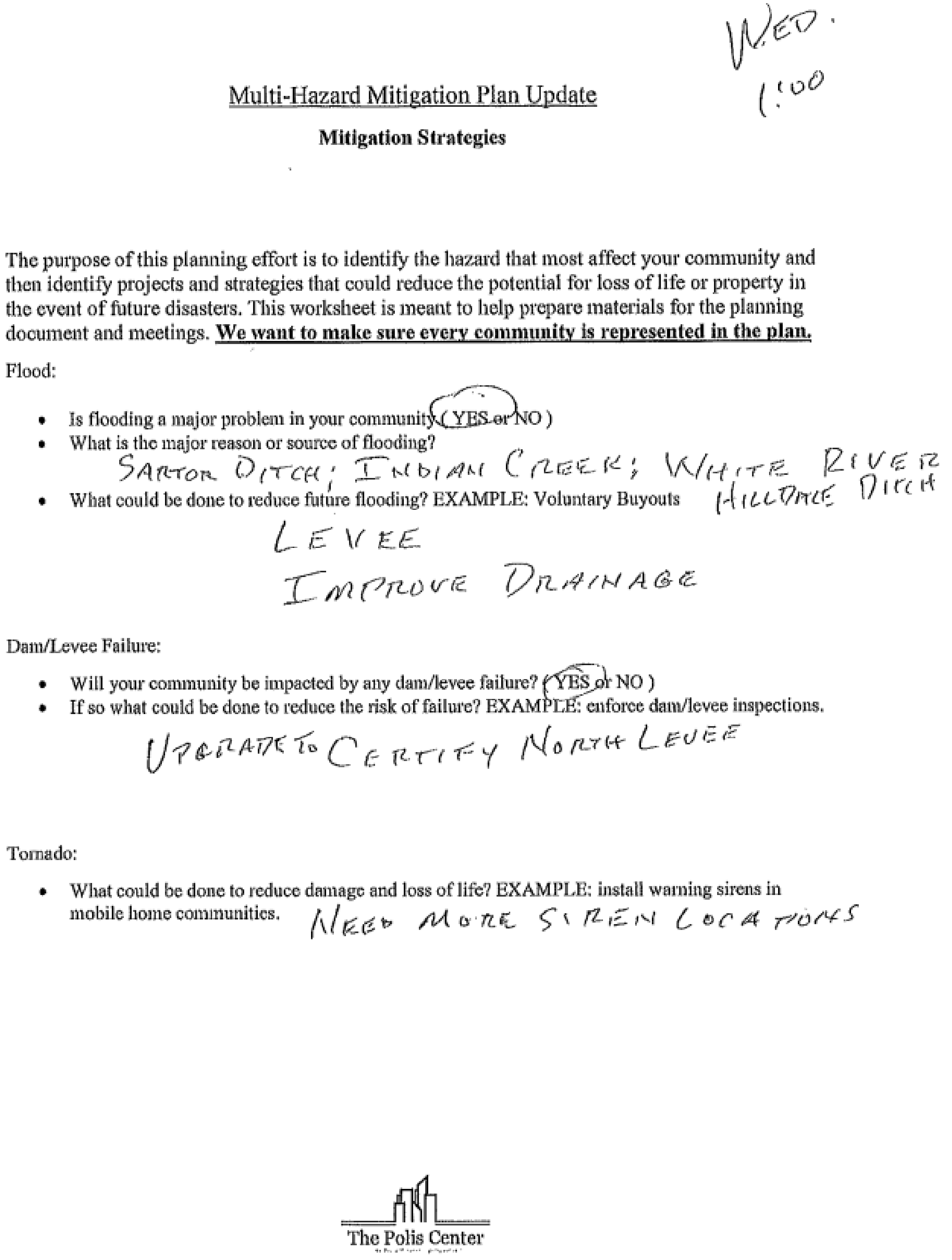
Floods and tornados will cause the most damage while summer and winter storms are likely to be the most frequent.

Submitted by: <Name>,<Title> Charles Heflin - Captain - Brooklyn Volunteer FD

What about cyber attacks?
EMP attack?
Riots?
Pandemics?
Communication outages?

The Polis Center

Charlie Heflin - Brooklyn VFD



WED.
1:00

Multi-Hazard Mitigation Plan Update

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Flood:

- Is flooding a major problem in your community ([✓ YES] or NO)
- What is the major reason or source of flooding?
  SARTOR DITCH; INDIAN CREEK; WHITE RIVER
  HILLDALE DITCH
- What could be done to reduce future flooding? EXAMPLE: Voluntary Buyouts
  LEVEE
  IMPROVE DRAINAGE

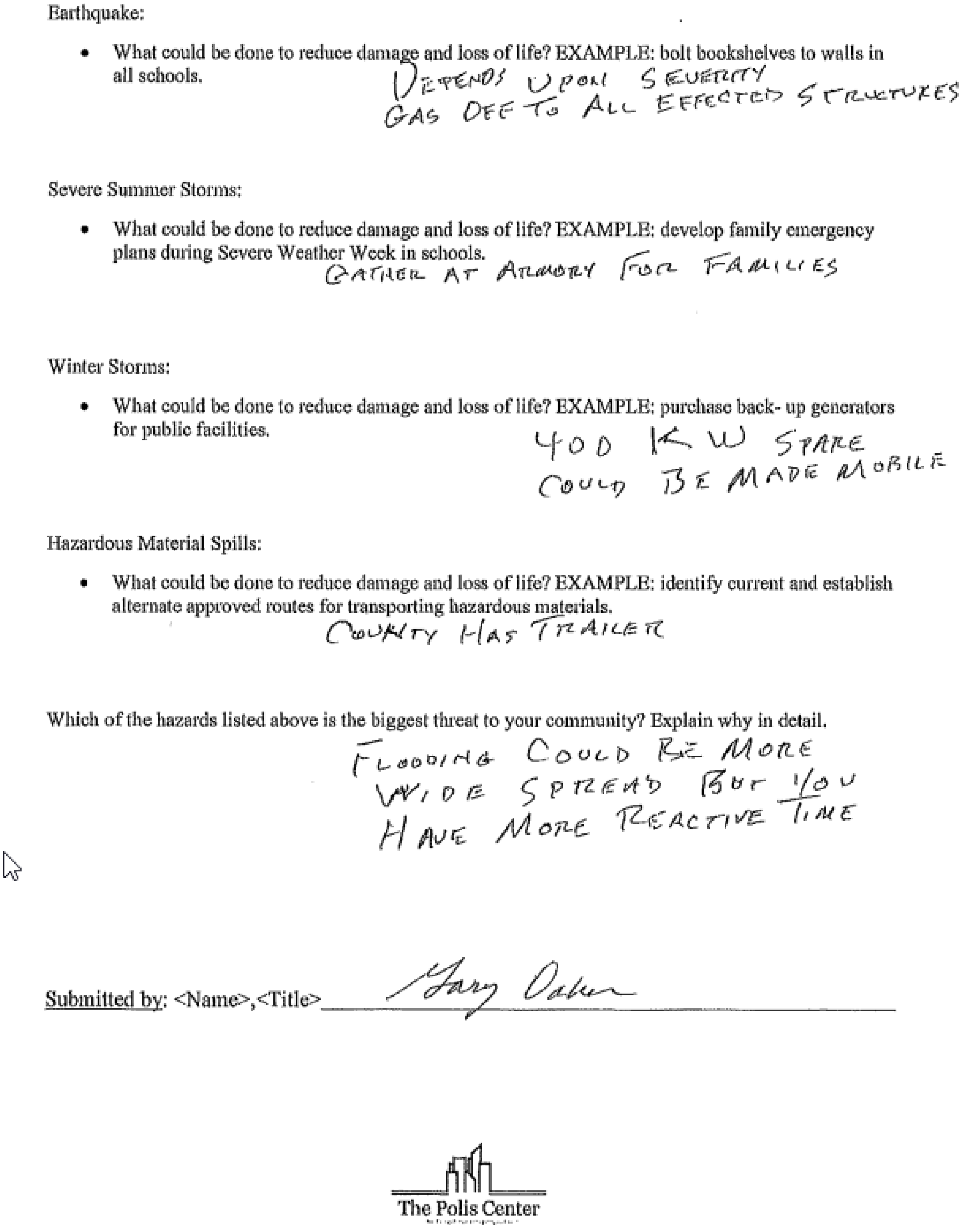
Dam/Levee Failure:

- Will your community be impacted by any dam/levee failure? ([✓ YES] or NO)
- If so what could be done to reduce the risk of failure? EXAMPLE: enforce dam/levee inspections.
  UPGRADE TO CERTIFY NORTH LEVEE

Tornado:

- What could be done to reduce damage and loss of life? EXAMPLE: install warning sirens in mobile home communities. NEED MORE SIREN LOCATIONS

The Polis Center



Earthquake:

- What could be done to reduce damage and loss of life? EXAMPLE: bolt bookshelves to walls in all schools.

DEPENDS UPON SEVERITY
GAS OFF TO ALL EFFECTED STRUCTURES

Severe Summer Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: develop family emergency plans during Severe Weather Week in schools.

GATHER AT ARMORY FOR FAMILIES

Winter Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: purchase back- up generators for public facilities.

400 KW SPARE
COULD BE MADE MOBILE

Hazardous Material Spills:

- What could be done to reduce damage and loss of life? EXAMPLE: identify current and establish alternate approved routes for transporting hazardous materials.

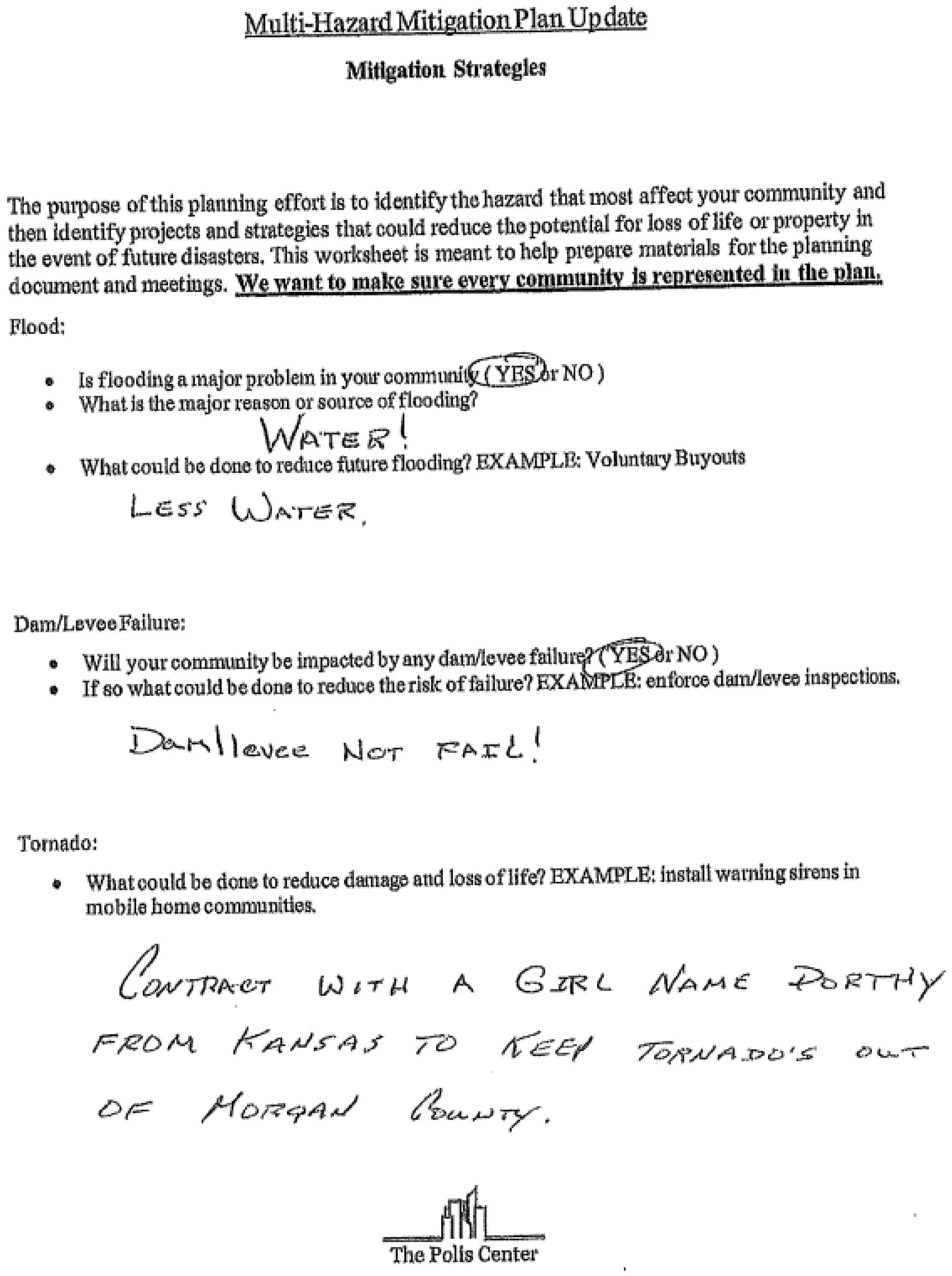
COUNTY HAS TRAILER

Which of the hazards listed above is the biggest threat to your community? Explain why in detail.

FLOODING COULD BE MORE
WIDE SPREAD BUT YOU
HAVE MORE REACTIVE TIME

Submitted by: <Name>,<Title> Gary Oaker

The Polis Center



Multi-Hazard Mitigation Plan Update

Mitigation Strategies

The purpose of this planning effort is to identify the hazard that most affect your community and then identify projects and strategies that could reduce the potential for loss of life or property in the event of future disasters. This worksheet is meant to help prepare materials for the planning document and meetings. **We want to make sure every community is represented in the plan.**

Flood:

- Is flooding a major problem in your community ([✓ YES] or NO)
- What is the major reason or source of flooding?

WATER!

- What could be done to reduce future flooding? EXAMPLE: Voluntary Buyouts

LESS WATER.

Dam/Levee Failure:

- Will your community be impacted by any dam/levee failure? ([✓ YES] or NO)
- If so what could be done to reduce the risk of failure? EXAMPLE: enforce dam/levee inspections.

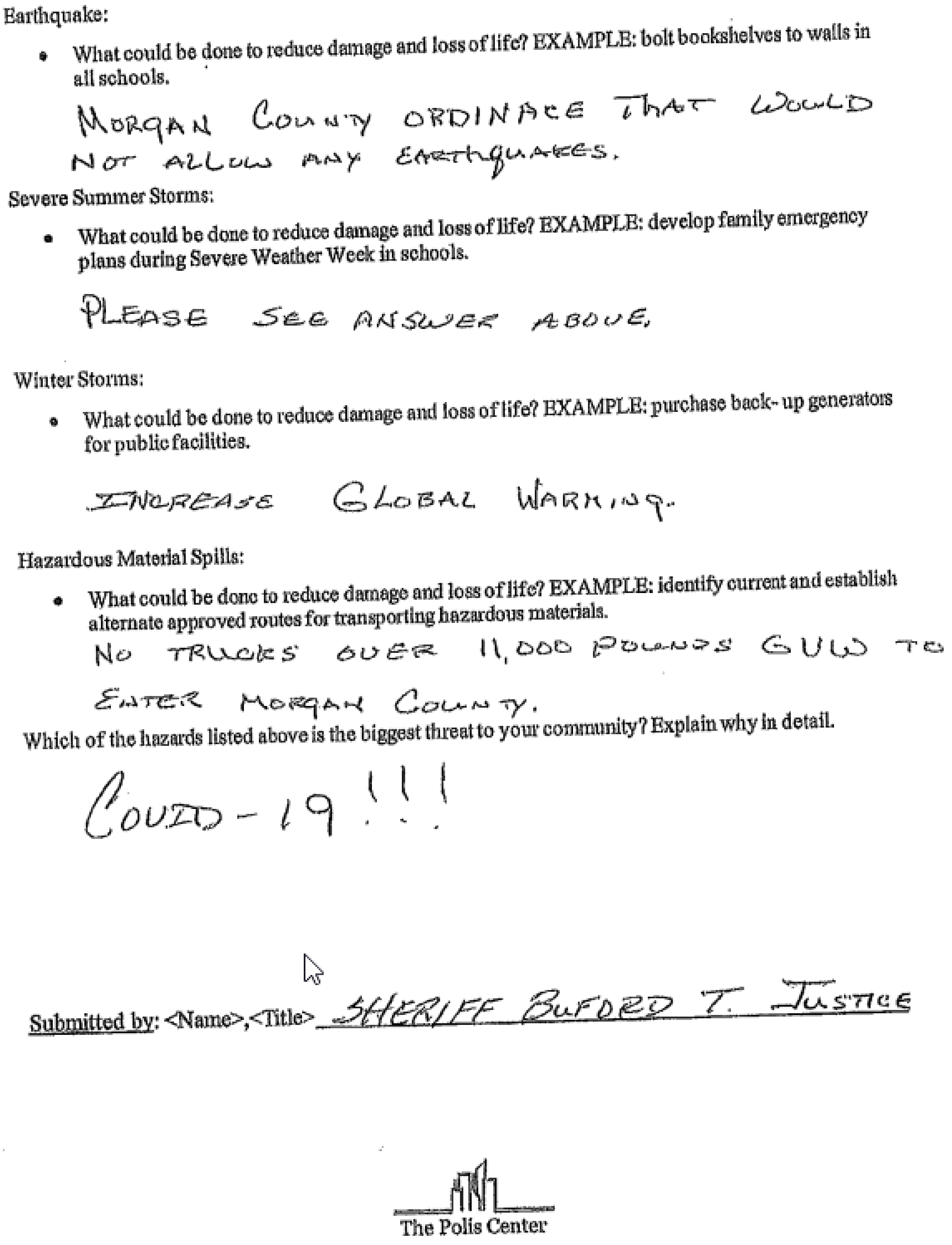
Dam/levee NOT FAIL!

Tornado:

- What could be done to reduce damage and loss of life? EXAMPLE: install warning sirens in mobile home communities.

CONTRACT WITH A GIRL NAME DORTHY FROM KANSAS TO KEEP TORNADO'S OUT OF MORGAN COUNTY.

The Polis Center



Earthquake:

- What could be done to reduce damage and loss of life? EXAMPLE: bolt bookshelves to walls in all schools.

MORGAN COUNTY ORDINACE THAT WOULD NOT ALLOW ANY EARTHQUAKES.

Severe Summer Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: develop family emergency plans during Severe Weather Week in schools.

PLEASE SEE ANSWER ABOVE.

Winter Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: purchase back- up generators for public facilities.

INCREASE GLOBAL WARMING.

Hazardous Material Spills:

- What could be done to reduce damage and loss of life? EXAMPLE: identify current and establish alternate approved routes for transporting hazardous materials.

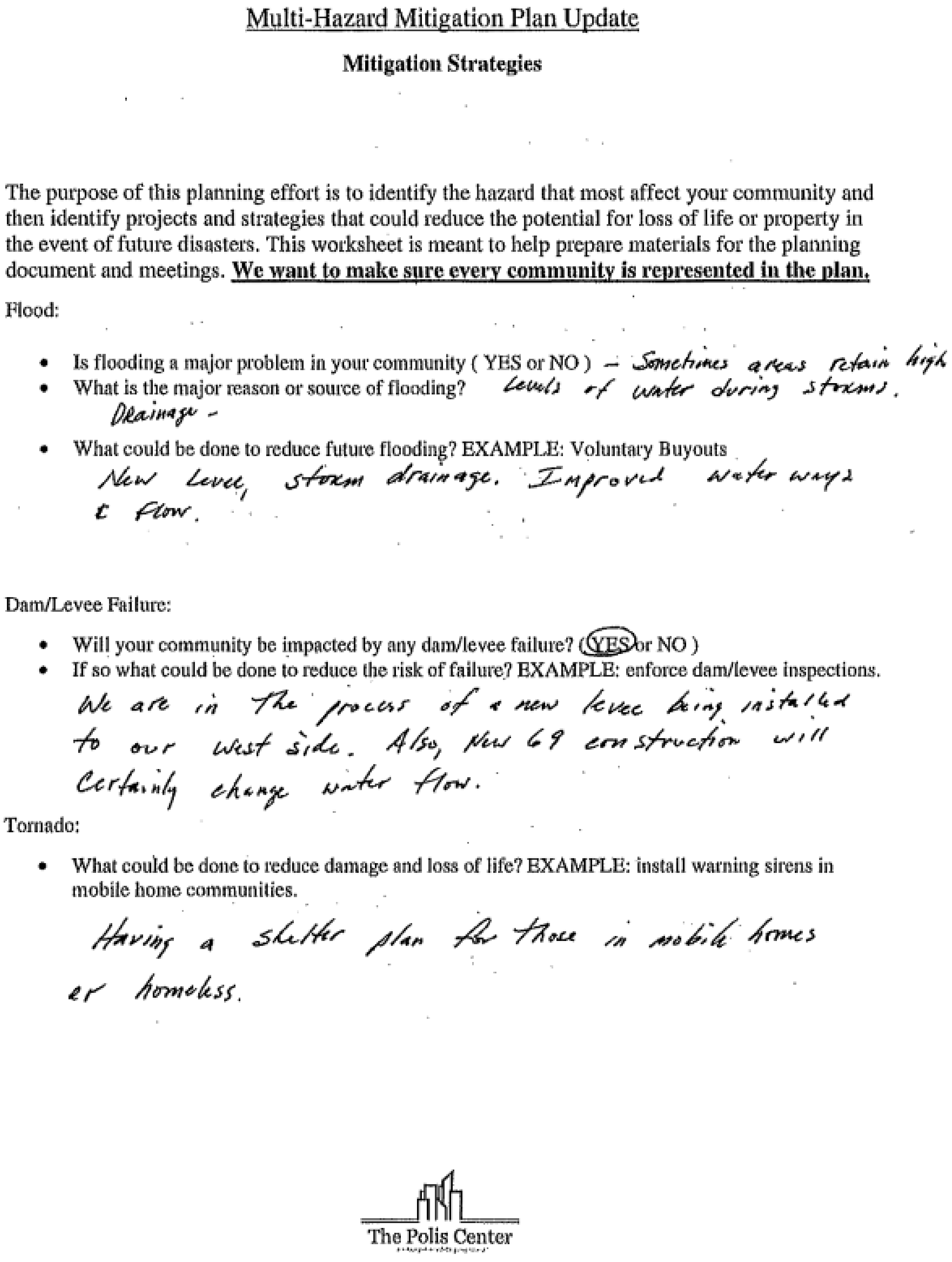
NO TRUCKS OVER 11,000 POUNDS GVW TO ENTER MORGAN COUNTY.

Which of the hazards listed above is the biggest threat to your community? Explain why in detail.

COVID-19!!!

Submitted by: <Name>,<Title> SHERIFF BUFORD T. JUSTICE

The Polis Center



Multi-Hazard Mitigation Plan Update

Mitigation Strategies

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Flood:

- Is flooding a major problem in your community (YES or NO) – Sometimes areas retain high
- What is the major reason or source of flooding? levels of water during storms.

  Drainage –
- What could be done to reduce future flooding? EXAMPLE: Voluntary Buyouts

  New Levee, storm drainage. Improved water ways & flow.

Dam/Levee Failure:

- Will your community be impacted by any dam/levee failure? ([✓ YES] or NO)
- If so what could be done to reduce the risk of failure? EXAMPLE: enforce dam/levee inspections.

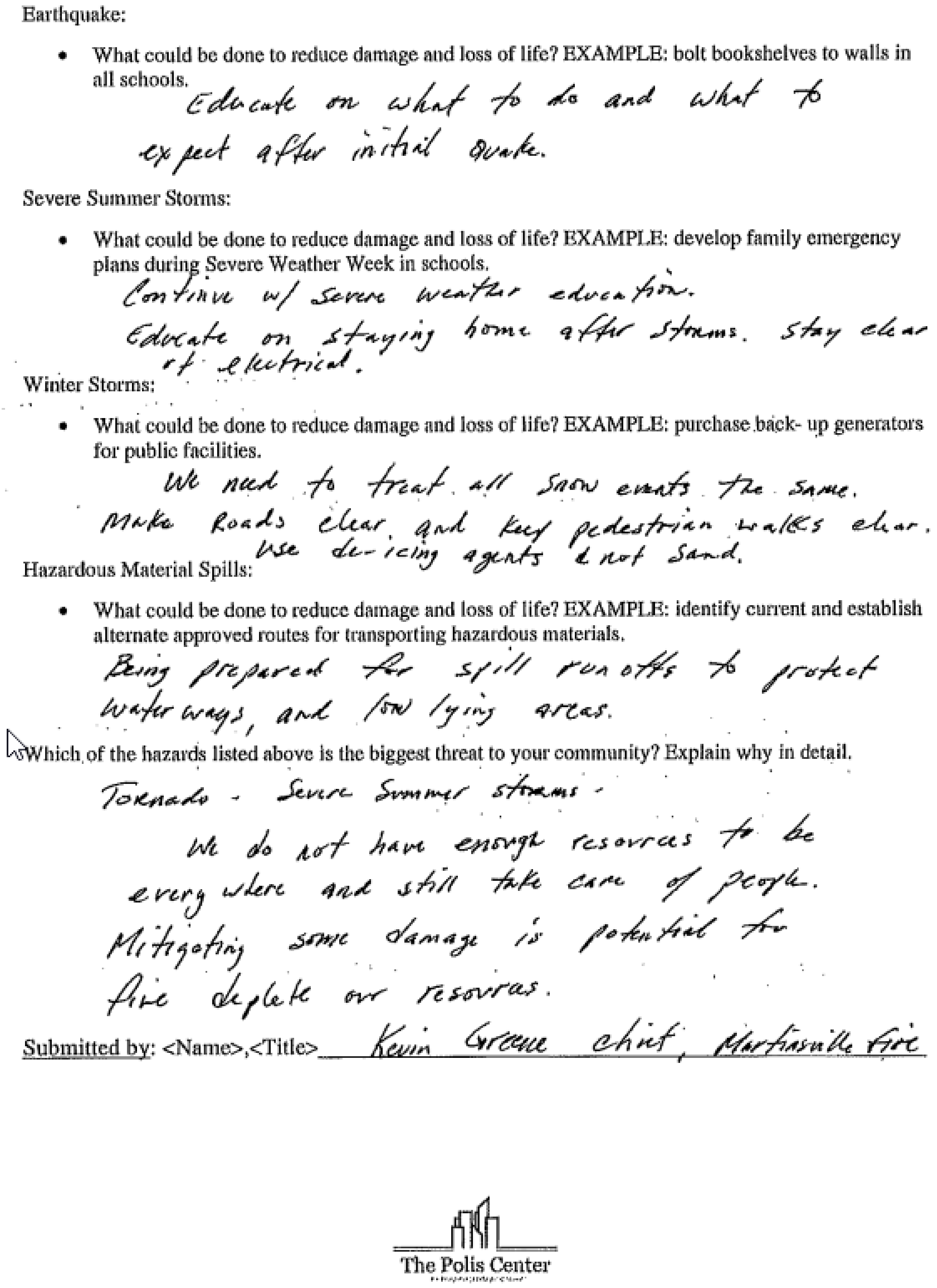
  We are in the process of a new levee being installed to our west side. Also, New 69 construction will certainly change water flow.

Tornado:

- What could be done to reduce damage and loss of life? EXAMPLE: install warning sirens in mobile home communities.

  Having a shelter plan for those in mobile homes or homeless.

The Polis Center



Earthquake:

- What could be done to reduce damage and loss of life? EXAMPLE: bolt bookshelves to walls in all schools.

Educate on what to do and what to expect after initial quake.

Severe Summer Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: develop family emergency plans during Severe Weather Week in schools.

Continue w/ severe weather education.

Educate on staying home after storms. Stay clear of electrical.

Winter Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: purchase back- up generators for public facilities.

We need to treat all snow events the same.

Make Roads clear and keep pedestrian walks clear.

Use de-icing agents & not sand.

Hazardous Material Spills:

- What could be done to reduce damage and loss of life? EXAMPLE: identify current and establish alternate approved routes for transporting hazardous materials.

Being prepared for spill run offs to protect water ways, and low lying areas.

Which of the hazards listed above is the biggest threat to your community? Explain why in detail.

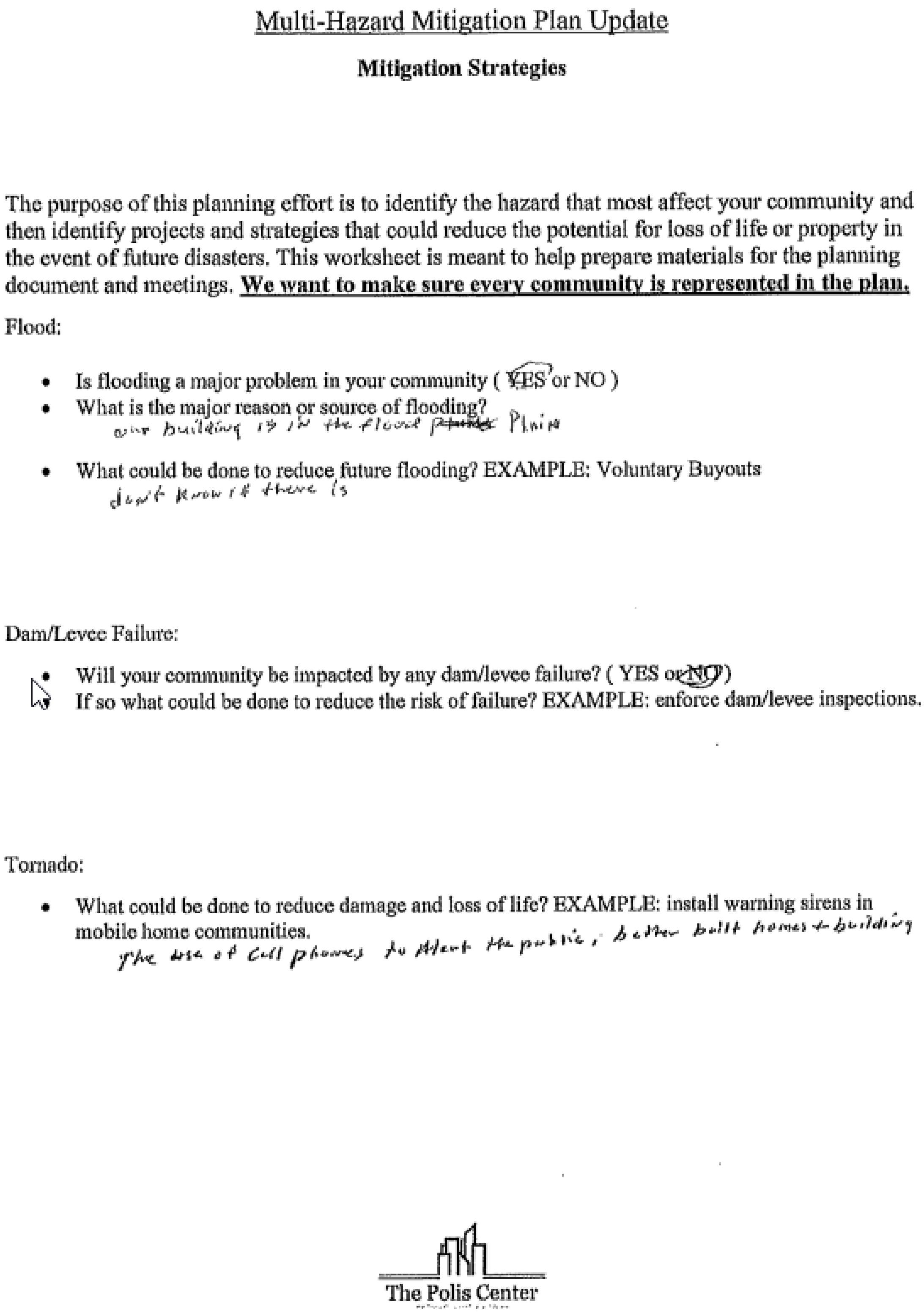
Tornado - Severe Summer storms -

We do not have enough resources to be everywhere and still take care of people.

Mitigating some damage is potential for fire deplete our resources.

Submitted by: <Name>,<Title> Kevin Greene chief, Martinsville Fire

The Polis Center



Multi-Hazard Mitigation Plan Update

Mitigation Strategies

The purpose of this planning effort is to identify the hazard that most affect your community and then identify projects and strategies that could reduce the potential for loss of life or property in the event of future disasters. This worksheet is meant to help prepare materials for the planning document and meetings. **We want to make sure every community is represented in the plan.**

Flood:

- Is flooding a major problem in your community ([✓ YES] or NO)
- What is the major reason or source of flooding?
  our building is in the flood [illegible] Plain
- What could be done to reduce future flooding? EXAMPLE: Voluntary Buyouts
  don't know if there is

Dam/Levee Failure:

- Will your community be impacted by any dam/levee failure? (YES or [✓ NO])
- If so what could be done to reduce the risk of failure? EXAMPLE: enforce dam/levee inspections.

Tornado:

- What could be done to reduce damage and loss of life? EXAMPLE: install warning sirens in mobile home communities.
  The use of Cell phones to Alert the public, better built homes + building

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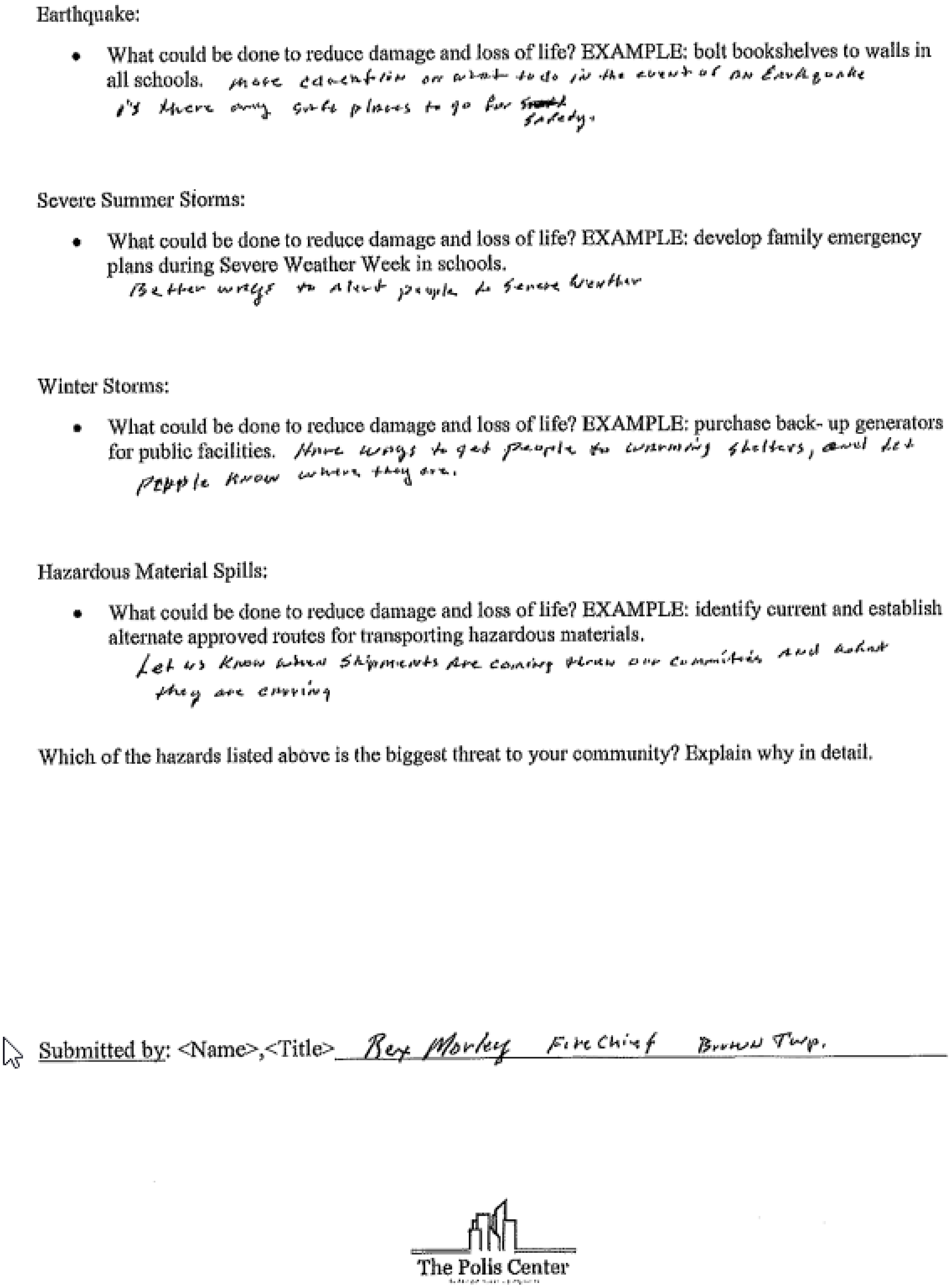


Earthquake:

- What could be done to reduce damage and loss of life? EXAMPLE: bolt bookshelves to walls in all schools. more attention on what to do in the event of an Earthquake i's there any safe places to go for ~~[illegible]~~ safety.

Severe Summer Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: develop family emergency plans during Severe Weather Week in schools.
  Better ways to alert people to Severe Weather

Winter Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: purchase back- up generators for public facilities. Have ways to get people to warming shelters, and let people know where they are.

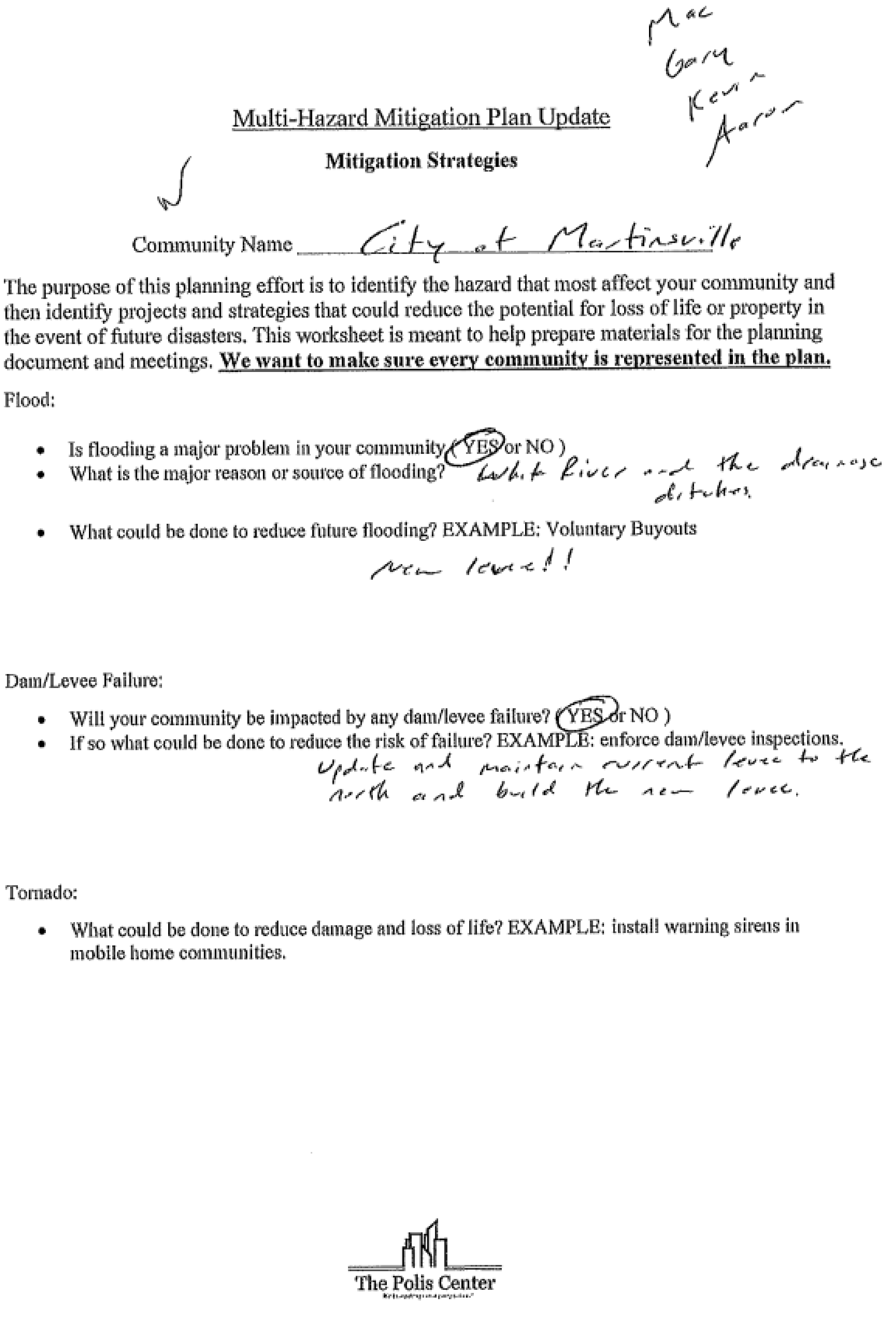
Hazardous Material Spills:

- What could be done to reduce damage and loss of life? EXAMPLE: identify current and establish alternate approved routes for transporting hazardous materials.
  Let us know when Shipments are coming threw our communities and what they are carrying

Which of the hazards listed above is the biggest threat to your community? Explain why in detail.

Submitted by: <Name>,<Title> Rex Morley Fire Chief Brown Twp.

The Polis Center



Mac
Gary
Kevin
Aaron

Multi-Hazard Mitigation Plan Update

Mitigation Strategies

✓

Community Name City of Martinsville

The purpose of this planning effort is to identify the hazard that most affect your community and then identify projects and strategies that could reduce the potential for loss of life or property in the event of future disasters. This worksheet is meant to help prepare materials for the planning document and meetings. **We want to make sure every community is represented in the plan.**

Flood:

- Is flooding a major problem in your community ([✓ YES] or NO)
- What is the major reason or source of flooding? White River and the drainage ditches.
- What could be done to reduce future flooding? EXAMPLE: Voluntary Buyouts

  New levee!!

Dam/Levee Failure:

- Will your community be impacted by any dam/levee failure? ([✓ YES] or NO)
- If so what could be done to reduce the risk of failure? EXAMPLE: enforce dam/levee inspections.

  Update and maintain current levee to the north and build the new levee.

Tornado:

- What could be done to reduce damage and loss of life? EXAMPLE: install warning sirens in mobile home communities.

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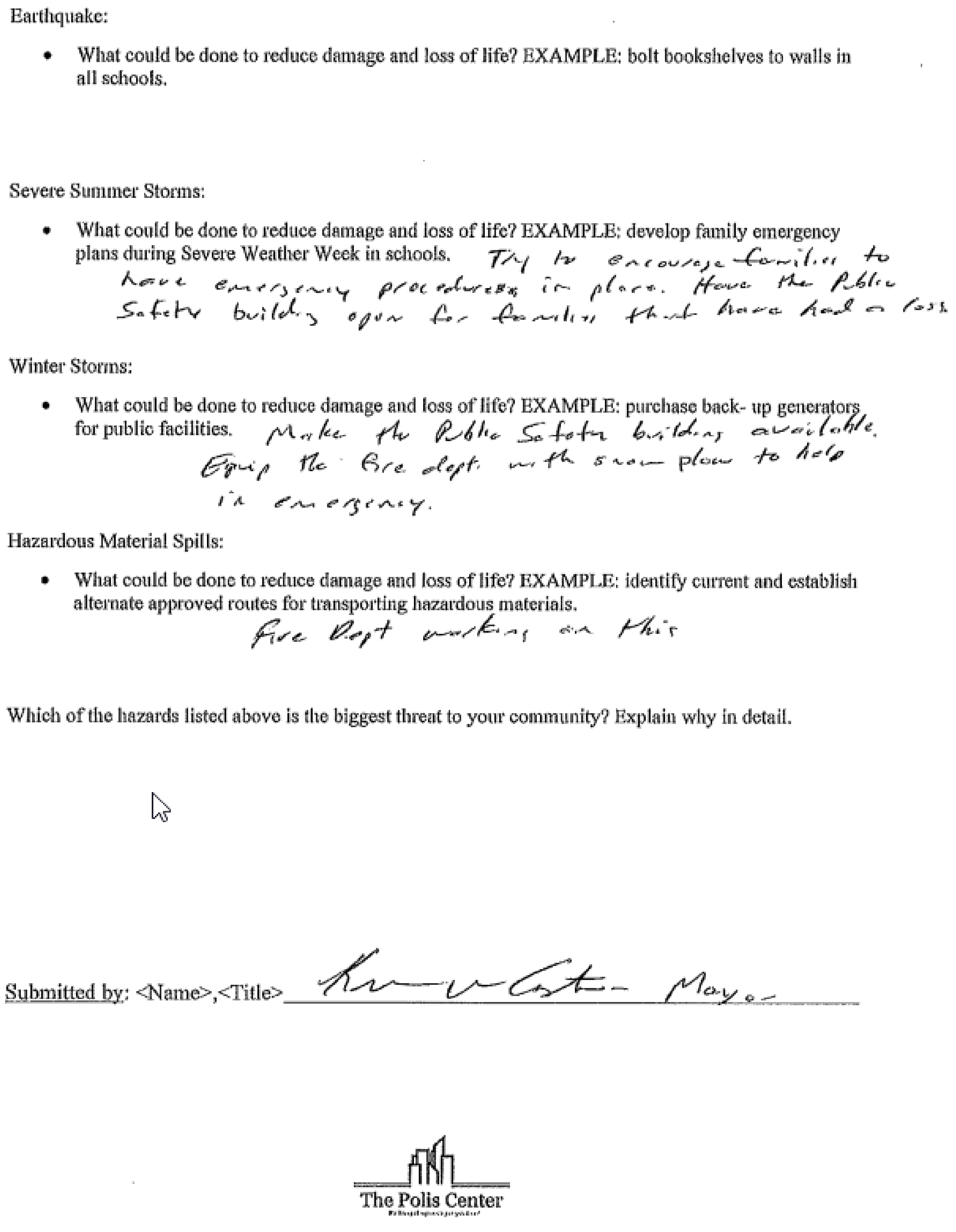


Earthquake:

- What could be done to reduce damage and loss of life? EXAMPLE: bolt bookshelves to walls in all schools.

Severe Summer Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: develop family emergency plans during Severe Weather Week in schools. Try to encourage families to have emergency procedures in place. Have the Public Safety building open for families that have had a loss.

Winter Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: purchase back- up generators for public facilities. Make the Public Safety building available. Equip the fire dept. with snow plow to help in emergency.

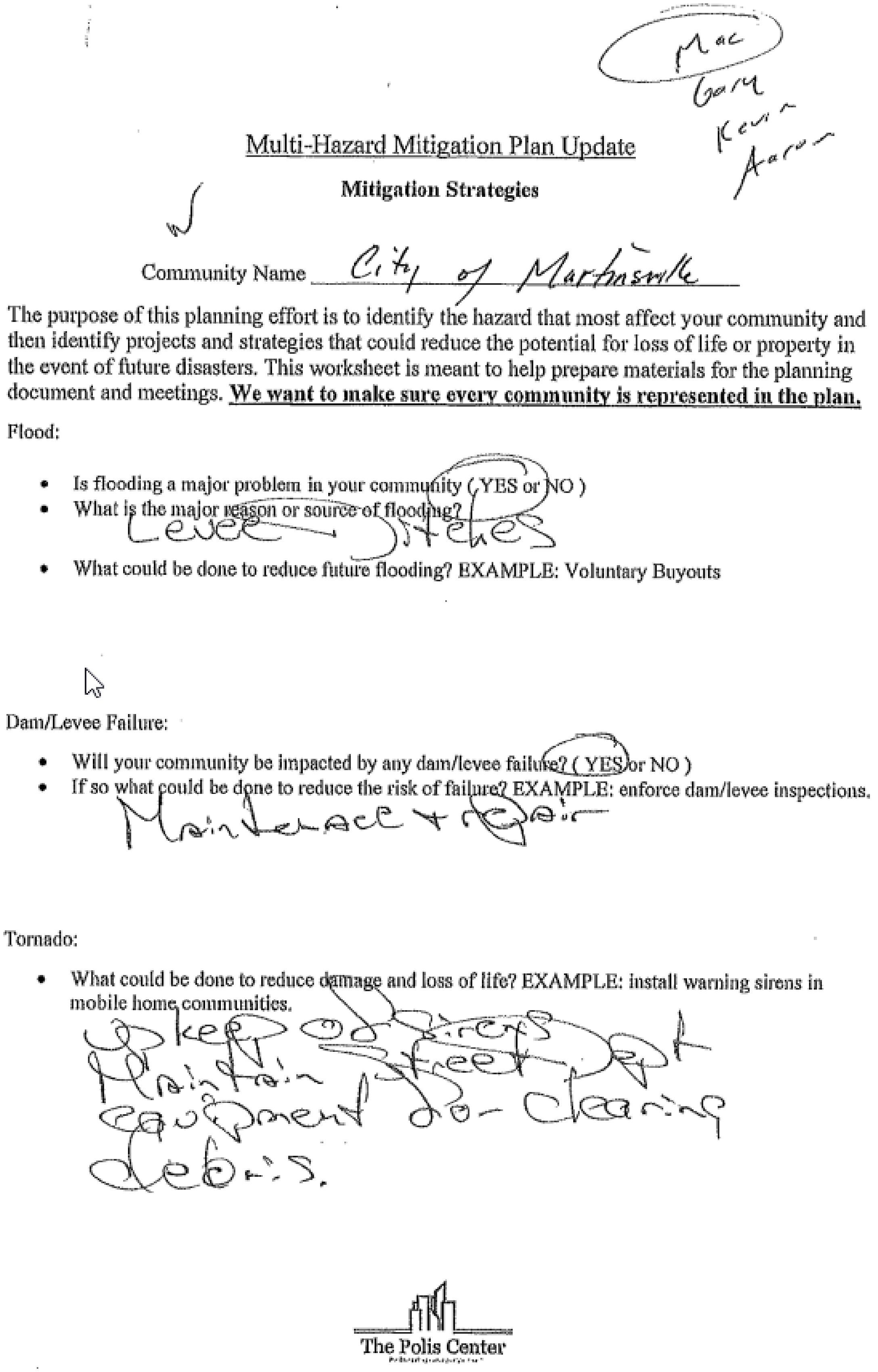
Hazardous Material Spills:

- What could be done to reduce damage and loss of life? EXAMPLE: identify current and establish alternate approved routes for transporting hazardous materials. Fire Dept working on this

Which of the hazards listed above is the biggest threat to your community? Explain why in detail.

Submitted by: <Name>,<Title> Mayor

The Polis Center



Mac
Gary
Kevin
Aaron

Multi-Hazard Mitigation Plan Update

Mitigation Strategies

Community Name City of Martinsville

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Flood:

- Is flooding a major problem in your community ([✓ YES] or NO)
- What is the major reason or source of flooding?
  Levee — ditches
- What could be done to reduce future flooding? EXAMPLE: Voluntary Buyouts

Dam/Levee Failure:

- Will your community be impacted by any dam/levee failure? ([✓ YES] or NO)
- If so what could be done to reduce the risk of failure? EXAMPLE: enforce dam/levee inspections.
  Maintenance + repair

Tornado:

- What could be done to reduce damage and loss of life? EXAMPLE: install warning sirens in mobile home communities.
  keep our sirens
  Maintain Street Dept
  equipment for clearing
  debris.

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Earthquake:

- What could be done to reduce damage and loss of life? EXAMPLE: bolt bookshelves to walls in all schools.

Severe Summer Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: develop family emergency plans during Severe Weather Week in schools.

School buses to evacuate.
Armory or S.B. EMA coordinate.

Winter Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: purchase back-up generators for public facilities.

Cooling At generator At
Block Mart.

Hazardous Material Spills:

- What could be done to reduce damage and loss of life? EXAMPLE: identify current and establish alternate approved routes for transporting hazardous materials.

Which of the hazards listed above is the biggest threat to your community? Explain why in detail.

Submitted by: <Name>,<Title> Mac Dunn

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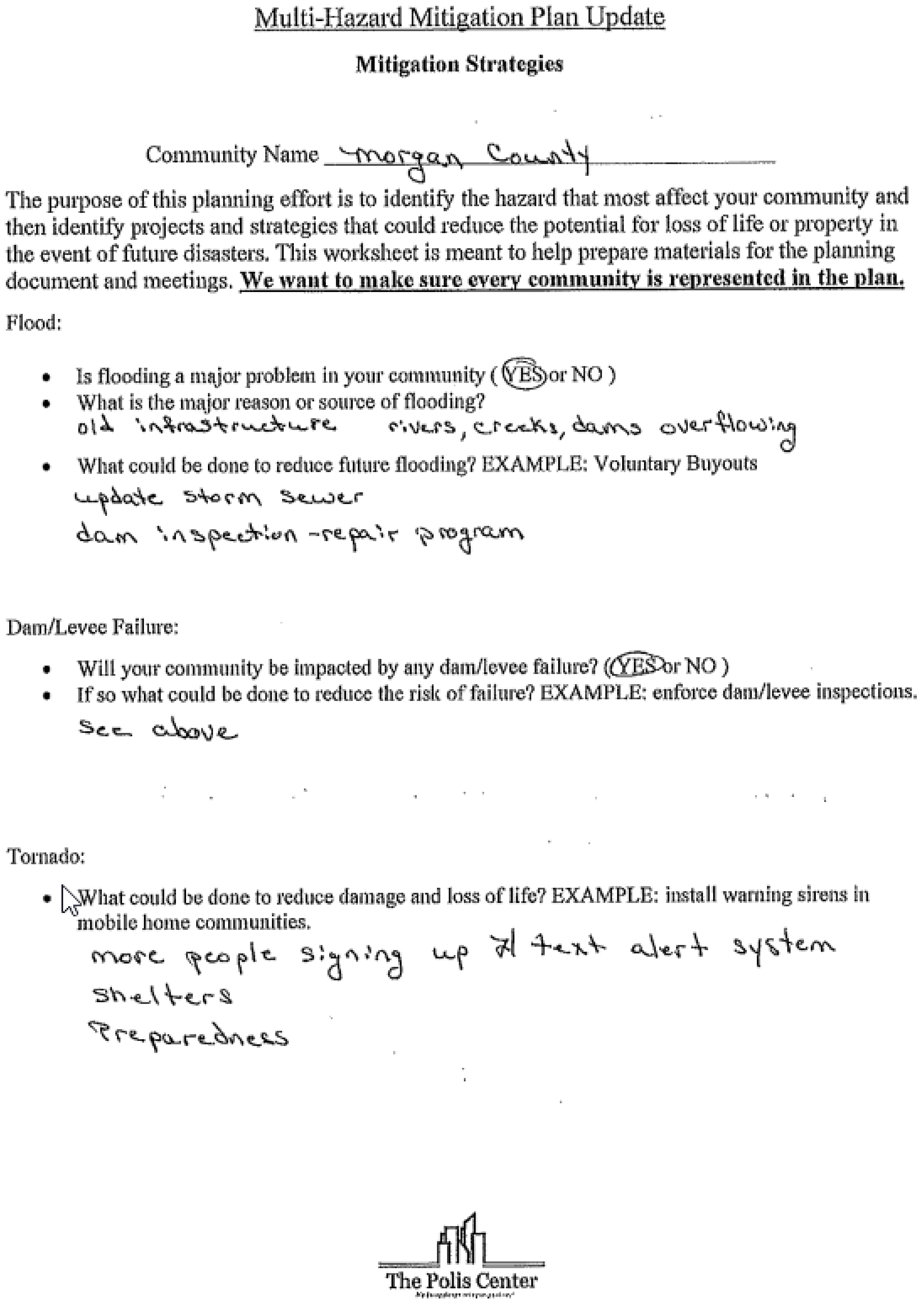

Multi-Hazard Mitigation Plan Update

Mitigation Strategies

Community Name Morgan County

The purpose of this planning effort is to identify the hazard that most affect your community and then identify projects and strategies that could reduce the potential for loss of life or property in the event of future disasters. This worksheet is meant to help prepare materials for the planning document and meetings. **We want to make sure every community is represented in the plan.**

Flood:

- Is flooding a major problem in your community ([✓ YES] or NO)
- What is the major reason or source of flooding?
  old infrastructure rivers, creeks, dams overflowing
- What could be done to reduce future flooding? EXAMPLE: Voluntary Buyouts
  update storm sewer
  dam inspection-repair program

Dam/Levee Failure:

- Will your community be impacted by any dam/levee failure? ([✓ YES] or NO)
- If so what could be done to reduce the risk of failure? EXAMPLE: enforce dam/levee inspections.
  See above

Tornado:

- What could be done to reduce damage and loss of life? EXAMPLE: install warning sirens in mobile home communities.
  more people signing up w/ text alert system
  shelters
  Preparedness

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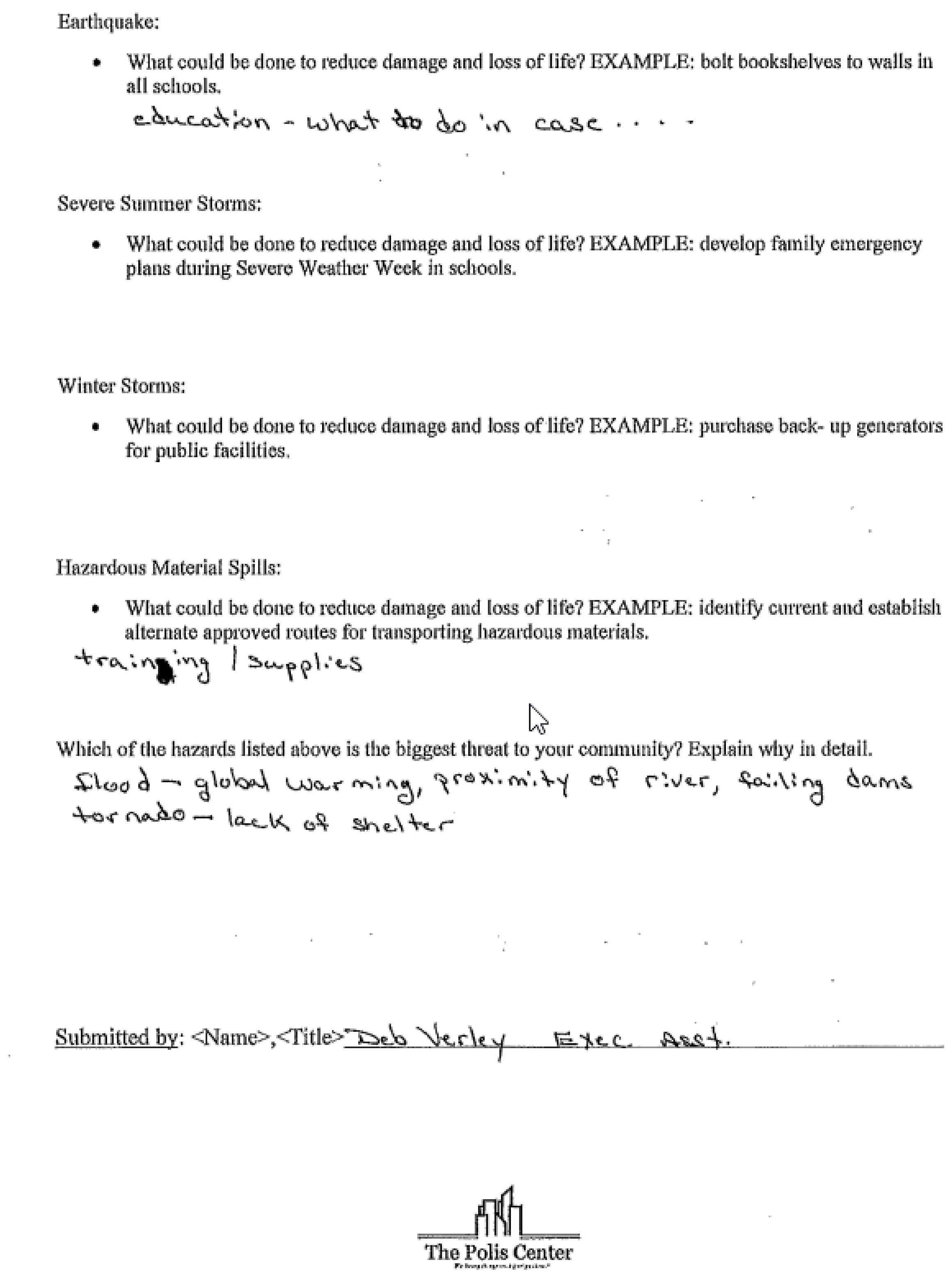

Earthquake:

- What could be done to reduce damage and loss of life? EXAMPLE: bolt bookshelves to walls in all schools.

education - what to do in case . . . .

Severe Summer Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: develop family emergency plans during Severe Weather Week in schools.

Winter Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: purchase back- up generators for public facilities.

Hazardous Material Spills:

- What could be done to reduce damage and loss of life? EXAMPLE: identify current and establish alternate approved routes for transporting hazardous materials.

training / supplies

Which of the hazards listed above is the biggest threat to your community? Explain why in detail.

flood - global warming, proximity of river, failing dams
tornado - lack of shelter

Submitted by: <Name>,<Title> Deb Verley Exec. Asst.

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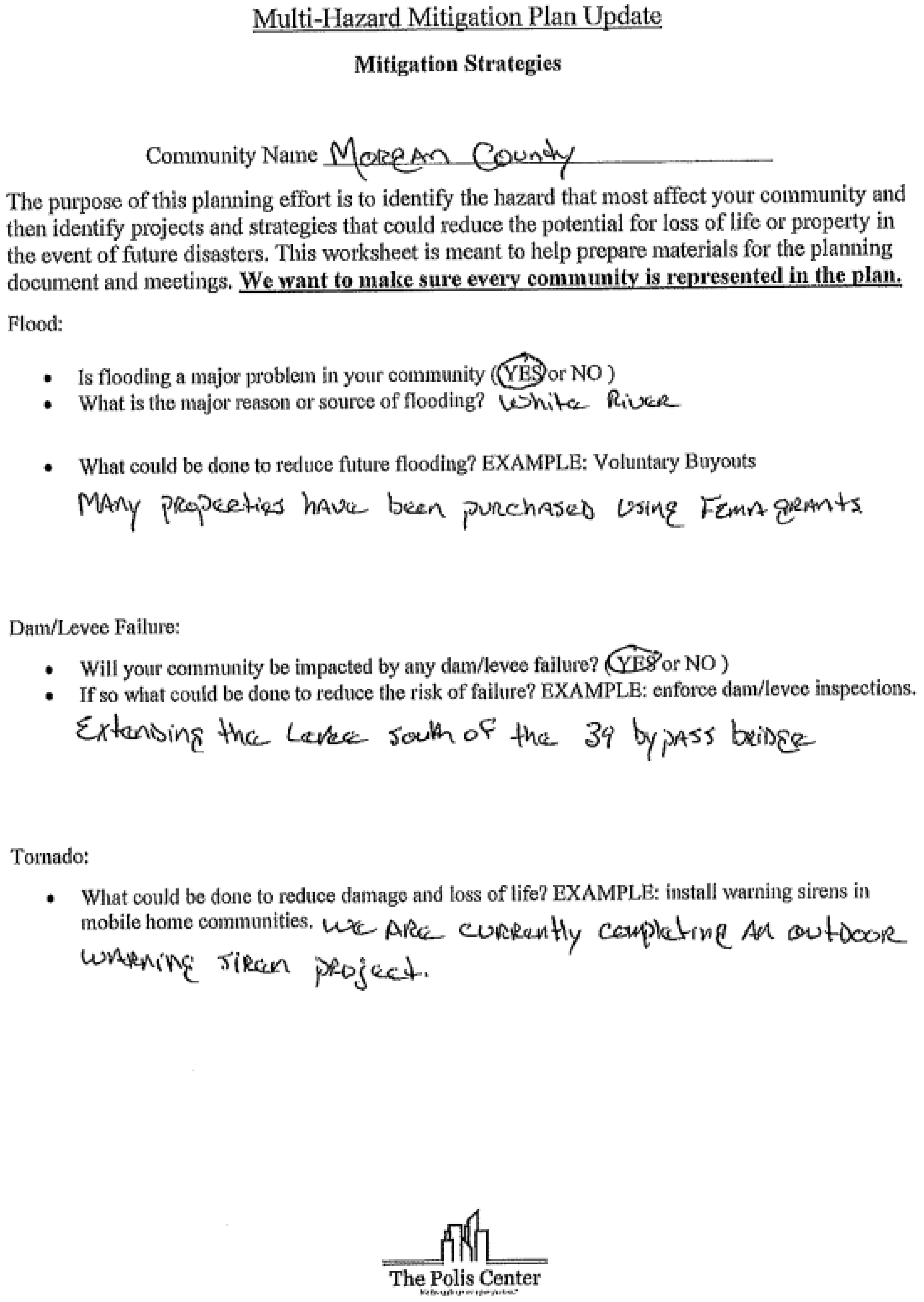

Multi-Hazard Mitigation Plan Update

Mitigation Strategies

Community Name Morgan County

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Flood:

- Is flooding a major problem in your community ([✓ YES] or NO)
- What is the major reason or source of flooding? White River
- What could be done to reduce future flooding? EXAMPLE: Voluntary Buyouts

  Many properties have been purchased using Fema grants.

Dam/Levee Failure:

- Will your community be impacted by any dam/levee failure? ([✓ YES] or NO)
- If so what could be done to reduce the risk of failure? EXAMPLE: enforce dam/levee inspections.

  Extending the Levee south of the 39 bypass bridge

Tornado:

- What could be done to reduce damage and loss of life? EXAMPLE: install warning sirens in mobile home communities. We are currently completing an outdoor warning siren project.

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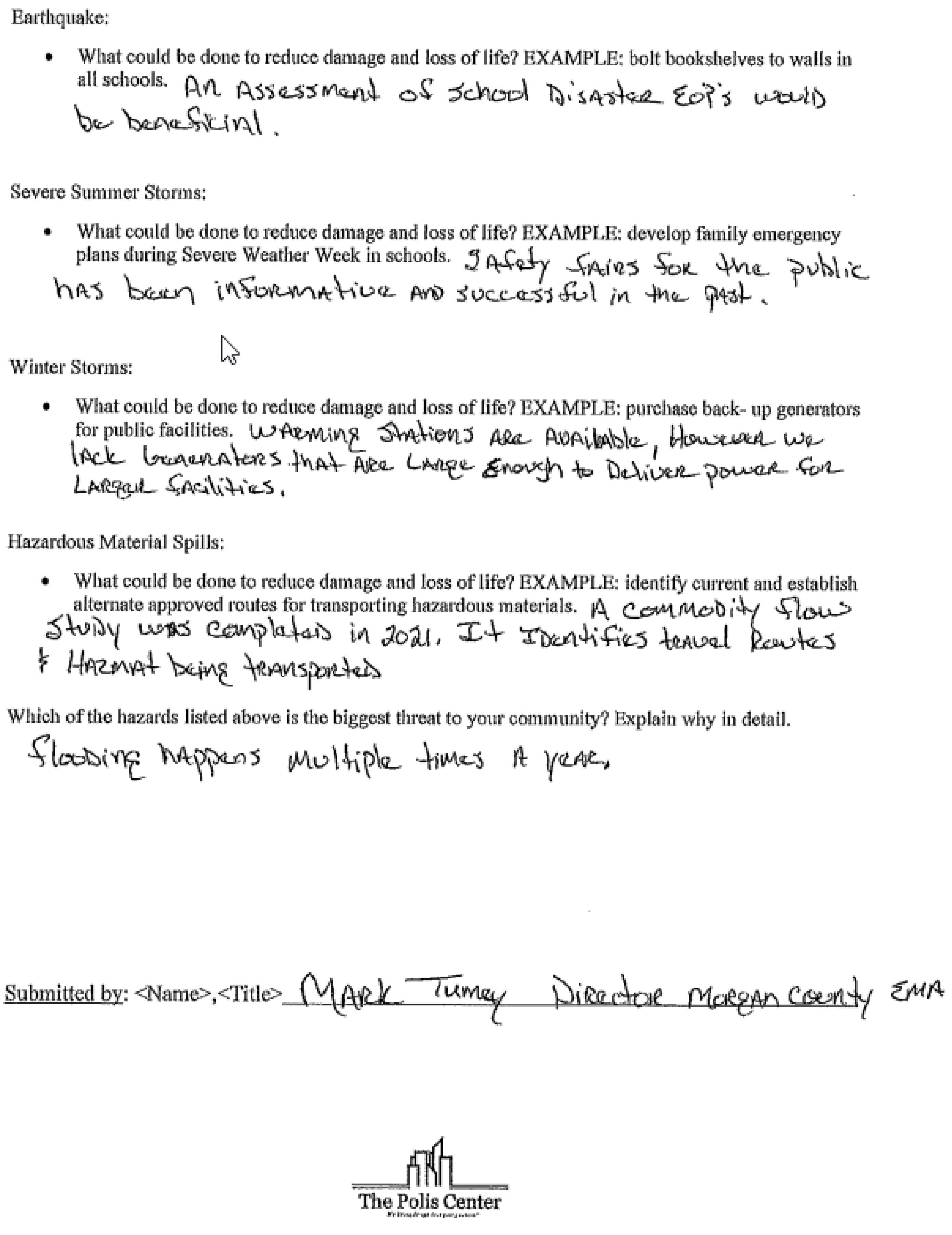

Earthquake:

- What could be done to reduce damage and loss of life? EXAMPLE: bolt bookshelves to walls in all schools. An Assessment of School Disaster EOP's would be beneficial.

Severe Summer Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: develop family emergency plans during Severe Weather Week in schools. Safety fairs for the public has been informative and successful in the past.

Winter Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: purchase back- up generators for public facilities. Warming Stations are Available, However we lack Generators that are Large Enough to Deliver power for Larger facilities.

Hazardous Material Spills:

- What could be done to reduce damage and loss of life? EXAMPLE: identify current and establish alternate approved routes for transporting hazardous materials. A commodity flow study was completed in 2021. It Identifies travel Routes & Hazmat being transported

Which of the hazards listed above is the biggest threat to your community? Explain why in detail.

flooding happens multiple times a year.

Submitted by: <Name>,<Title> Mark Tumey Director Morgan County EMA

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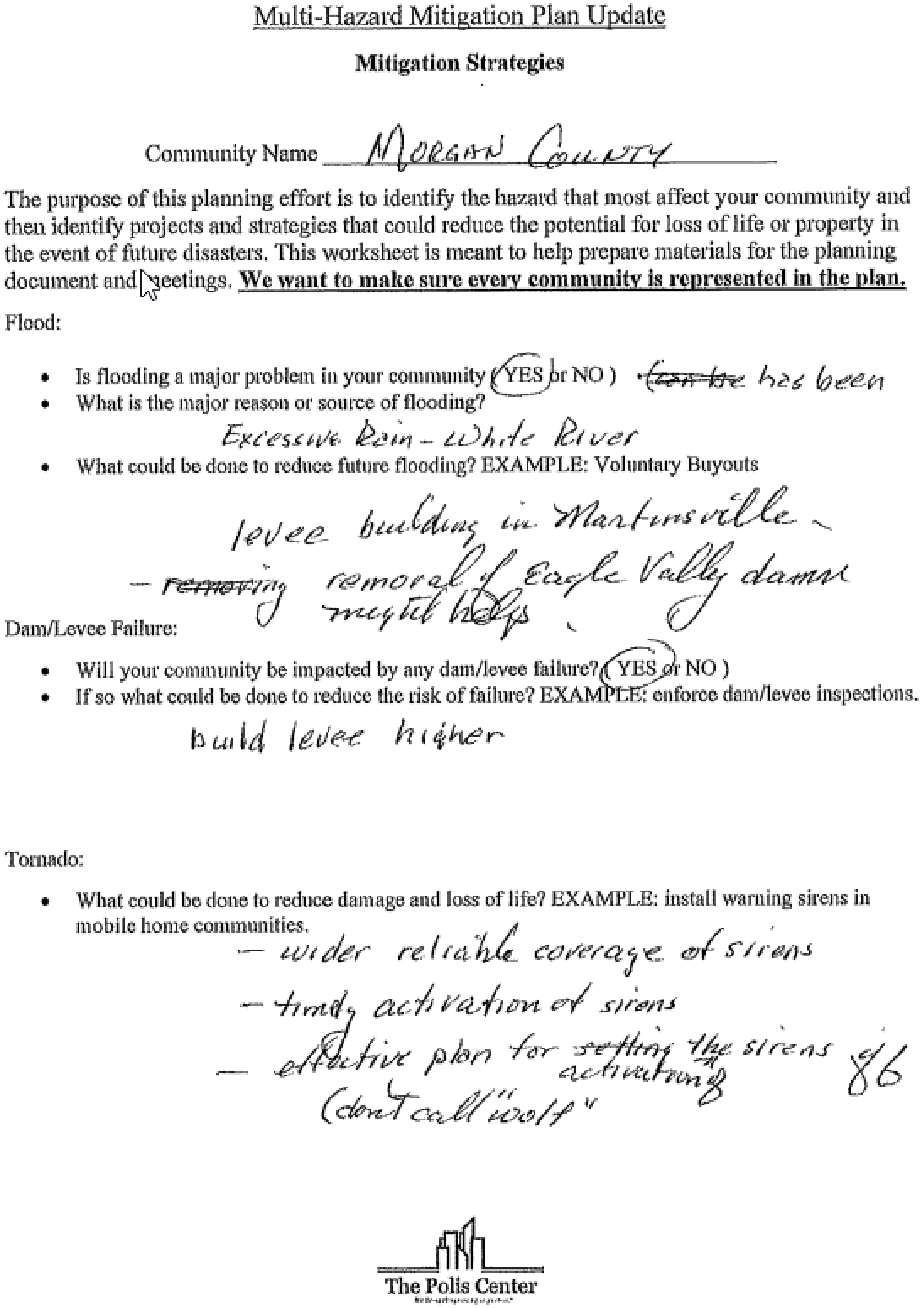

Multi-Hazard Mitigation Plan Update

Mitigation Strategies

Community Name MORGAN COUNTY

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Flood:

- Is flooding a major problem in your community ([✓ YES] or NO) ~~can be~~ has been
- What is the major reason or source of flooding?

  Excessive Rain - White River
- What could be done to reduce future flooding? EXAMPLE: Voluntary Buyouts

  levee building in Martinsville -

  - ~~removing~~ removal of Eagle Valley dam
  might helps

Dam/Levee Failure:

- Will your community be impacted by any dam/levee failure? ([✓ YES] or NO)
- If so what could be done to reduce the risk of failure? EXAMPLE: enforce dam/levee inspections.

  build levee higher

Tornado:

- What could be done to reduce damage and loss of life? EXAMPLE: install warning sirens in mobile home communities.

  - wider reliable coverage of sirens
  - timely activation of sirens
  - effective plan for ~~setting~~ activating the sirens
  (don't call "wolf")

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Earthquake:

- What could be done to reduce damage and loss of life? EXAMPLE: bolt bookshelves to walls in all schools. schools – regular drills – (we do fire drills – we do not cond. effective earthquake drills to my knowledge

Severe Summer Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: develop family emergency plans during Severe Weather Week in schools.

National weather – education – sirens –
Radio Public service –
use of social media (for something useful for once)

Winter Storms:

- What could be done to reduce damage and loss of life? EXAMPLE: purchase back- up generators for public facilities.

~~Public training – publication~~
information via radio & in advance –

Hazardous Material Spills:

- What could be done to reduce damage and loss of life? EXAMPLE: identify current and establish alternate approved routes for transporting hazardous materials.

traffic planning – ✓

Which of the hazards listed above is the biggest threat to your community? Explain why in detail.

the greatest risk is probably earthquakes →

Submitted by: <Name>,<Title> Don Adams, County Commissioner

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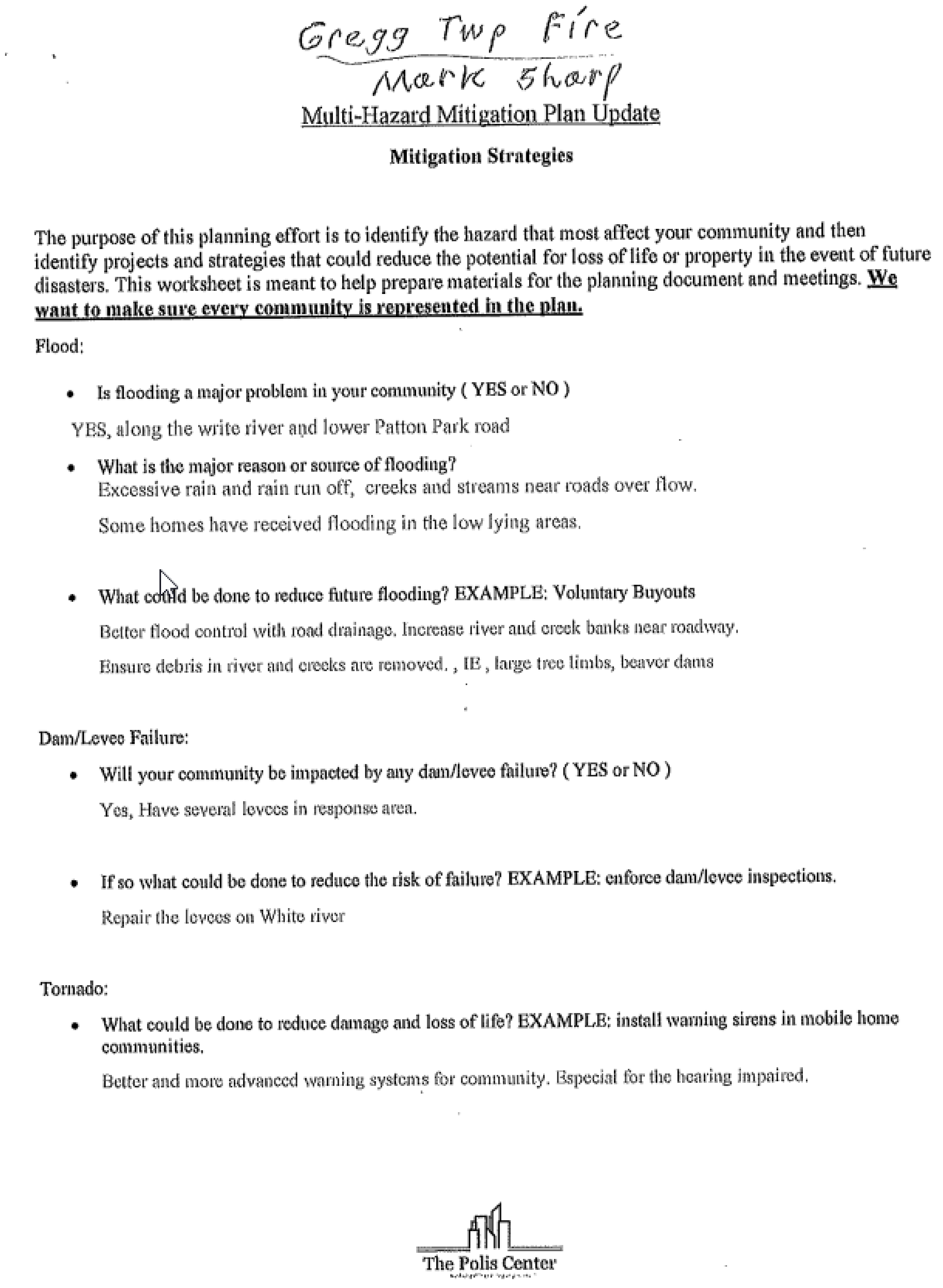

Gregg Twp Fire

Mark Sharp

Multi-Hazard Mitigation Plan Update

Mitigation Strategies

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Flood:

- **Is flooding a major problem in your community (YES or NO)**

YES, along the write river and lower Patton Park road

- **What is the major reason or source of flooding?**

  Excessive rain and rain run off, creeks and streams near roads over flow.

  Some homes have received flooding in the low lying areas.

- **What could be done to reduce future flooding? EXAMPLE: Voluntary Buyouts**

  Better flood control with road drainage. Increase river and creek banks near roadway.

  Ensure debris in river and creeks are removed. , IE , large tree limbs, beaver dams

Dam/Levee Failure:

- **Will your community be impacted by any dam/levee failure? (YES or NO)**

  Yes, Have several levees in response area.

- **If so what could be done to reduce the risk of failure? EXAMPLE: enforce dam/levee inspections.**

  Repair the levees on White river

Tornado:

- **What could be done to reduce damage and loss of life? EXAMPLE: install warning sirens in mobile home communities.**

  Better and more advanced warning systems for community. Especial for the hearing impaired.

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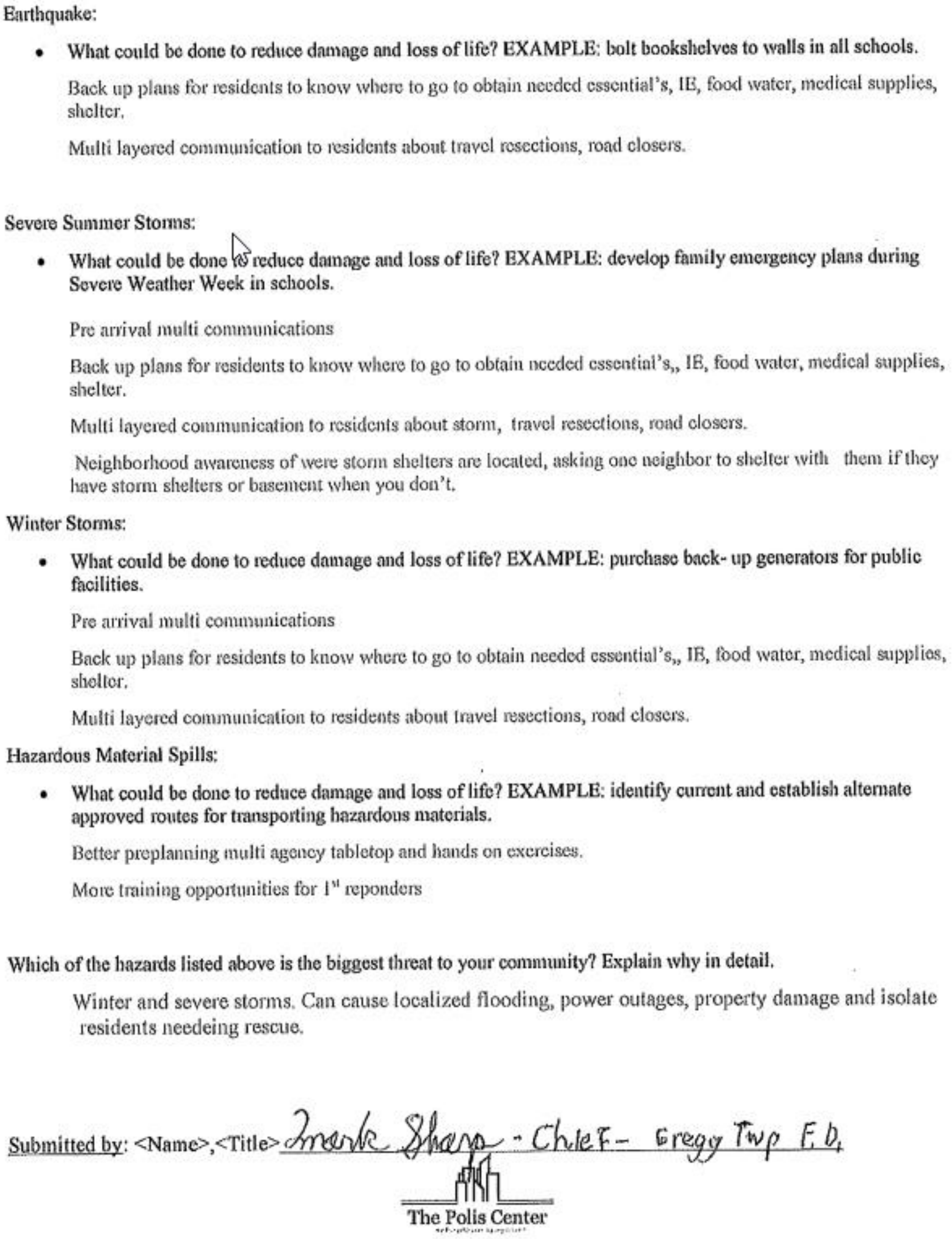

Earthquake:

- **What could be done to reduce damage and loss of life? EXAMPLE: bolt bookshelves to walls in all schools.**

  Back up plans for residents to know where to go to obtain needed essential's, IE, food water, medical supplies, shelter.

  Multi layered communication to residents about travel resections, road closers.

Severe Summer Storms:

- **What could be done to reduce damage and loss of life? EXAMPLE: develop family emergency plans during Severe Weather Week in schools.**

  Pre arrival multi communications

  Back up plans for residents to know where to go to obtain needed essential's,, IE, food water, medical supplies, shelter.

  Multi layered communication to residents about storm, travel resections, road closers.

  Neighborhood awareness of were storm shelters are located, asking one neighbor to shelter with them if they have storm shelters or basement when you don't.

Winter Storms:

- **What could be done to reduce damage and loss of life? EXAMPLE: purchase back- up generators for public facilities.**

  Pre arrival multi communications

  Back up plans for residents to know where to go to obtain needed essential's,, IE, food water, medical supplies, shelter.

  Multi layered communication to residents about travel resections, road closers.

Hazardous Material Spills:

- **What could be done to reduce damage and loss of life? EXAMPLE: identify current and establish alternate approved routes for transporting hazardous materials.**

  Better preplanning multi agency tabletop and hands on exercises.

  More training opportunities for 1st reponders

Which of the hazards listed above is the biggest threat to your community? Explain why in detail.

Winter and severe storms. Can cause localized flooding, power outages, property damage and isolate residents needeing rescue.

Submitted by: <Name>,<Title> Mark Sharp - Chief - Gregg Twp F.D.

The Polis Center

Capabilities	County	Martinsville	Bethany	Brooklyn	Monrovia	Mooresville	Morgantown	Paragon
Funding Sources								
Capital Improvements Project Funding	Yes	Yes	No	Yes	Yes	Yes	Yes	No
Authority to Levey Taxes for Specific Purposes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Fees for water, sewer, gas or electric services	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes
Impact fees for new development	No	Yes	No	No	-	No	No	No
Storm Water Utility Fee	-	Yes	No	No	Yes	Yes	Yes	Yes
Incur Debt through general obligation bonds and/or special tax bonds	Yes	Yes	No	Yes	Yes	Yes	Yes	No
Community Development Block Grant	Yes	Yes	No	Yes	Yes	No	Yes	No
Staff								
Chief Building Officer	No	Yes	Yes	No	-	Yes	No	No
Floodplain Administrator	Yes	Yes	N/A	No	-	Yes	No	No
Emergency Manager	Yes	Yes	No	Yes	Yes	Yes	No	No
Community Planner	No	Yes	Yes	No	-	Yes	No	No
Civil Engineer	No	Yes	No	Yes	-	No	No	No
GIS Coordinator	No	Yes	No	Yes	Yes	No	No	No
Administrative & Planning								
Planning Commission	Yes	Yes	Yes	Yes	County	Yes	Yes	County
Mitigation Planning Committee	No	No	Yes	Yes	County	No	No	No
Maintenance Programs to Reduce Risk	Yes	Yes	Yes	Yes	County	Yes	No	Yes
Mutual Aid Agreements	Yes (EMS)	Yes	No	Yes	County	Yes	No	Yes
Warning Systems/Services (Ie. Reverse 911, Outdoor Warning Signals)	Yes	Yes	No	Yes	County	Yes	Yes	Yes
Hazard Data & Information	Yes	Yes	N/A	Yes	State	No	No	No
Grant Writing	Yes	Yes	Yes	No	-	No	Yes	No
Education & Outreach								
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations,	Yes	Yes	No	Yes	Yes	No	No	No

Capabilities	County	Martinsville	Bethany	Brooklyn	Monrovia	Mooresville	Morgantown	Paragon
etc.								
Ongoing public education o-r information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	No	Yes	No	Yes	County	No	No	No
Natural disaster or safety related school programs	No	Yes	No	Yes	County	Yes	No	No
StormReady certification	Yes	No	No	No	-	No	No	No
Firewise Communities Certification	No	Yes	No	No	-	No	No	No
Public-private partnership initiatives addressing disaster-related issues	No	Yes	Yes	No	-	Yes	No	No

Capabilities	Eminence Community SC	Martinsville Schools	Monroe-Gregg SC	Mooresville Consolidated SC	Soil & Water Conservation District
Funding Sources					
Capital Improvements Project Funding	Yes	No	Yes	No	Yes
Authority to Levey Taxes for Specific Purposes	Yes	No	N/A	Yes	No
Fees for water, sewer, gas or electric services	No	No	N/A	No	No
Impact fees for new development	No	No	N/A	No	No
Storm Water Utility Fee	No	No	N/A	No	No
Incur Debt through general obligation bonds and/or special tax bonds	Yes	No	Yes	Yes	No
Community Development Block Grant	No	No	N/A	No	No
Staff					
Chief Building Officer	No	Yes	Yes	-	No
Floodplain Administrator	No	No	N/A	No	No
Emergency Manager	No	Yes	N/A	Yes	No
Community Planner	No	No	N/A	No	No
Civil Engineer	No	No	N/A	No	No
GIS Coordinator	No	No	N/A	No	No

Capabilities	Eminence Community SC	Martinsville Schools	Monroe-Gregg SC	Mooresville Consolidated SC	Soil & Water Conservation District
Administrative & Planning					
Planning Commission	No	Yes	N/A	Yes	No
Mitigation Planning Committee	No	No	N/A	No	No
Maintenance Programs to Reduce Risk	No	Yes	Yes	Yes	No
Mutual Aid Agreements	Yes	No	N/A	Yes	No
Warning Systems/Services (Ie. Reverse 911, Outdoor Warning Signals)	Yes	No	Yes	Yes	No
Hazard Data & Information	Yes	No	No	Yes	No
Grant Writing	Yes	Yes	Yes	Yes	Yes
Education & Outreach					
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	No	No	N/A	No	Yes
Ongoing public education o-r information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	No	No	No	No	Yes
Natural disaster or safety related school programs	Yes	No	No	Yes	No
StormReady certification	No	No	No	No	No
Firewise Communities Certification	No	No	N/A	No	No
Public-private partnership initiatives addressing disaster-related issues	No	No	N/A	Yes	No

Appendix G: Adopting Resolutions

RESOLUTION OF THE CITY OF _______________

ADOPTION OF THE MORGAN COUNTY
MULTI-HAZARD MITIGATION PLAN

WHEREAS the City of _______________ has participated in the hazard mitigation planning process as established under the Disaster Mitigation Act of 2000; and

WHEREAS, the Act establishes a framework for the development of a multi-jurisdictional County Hazard Mitigation Plan; and

WHEREAS, the Act as part of the planning process requires public involvement and local coordination among neighboring local units of government and businesses; and

WHEREAS, the Morgan County Plan includes a risk assessment including past hazards, hazards that threaten the county, an estimate of structures at risk, a general description of land uses and development trends; and

WHEREAS, the Morgan County Plan includes a mitigation strategy including goals and objectives and an action plan identifying specific mitigation projects and costs; and

WHEREAS, the Morgan County Plan includes a maintenance or implementation process including plan updates, integration of the plan into other planning documents and how Morgan County will maintain public participation and coordination; and

WHEREAS, the Plan has been shared with the Indiana Department of Homeland Security and the Federal Emergency Management Agency for review and comment; and

WHEREAS, the Morgan County Multi-Hazard Mitigation Plan will make the county and participating jurisdictions eligible to receive FEMA hazard mitigation assistance grants; and

WHEREAS, Morgan County Multi-Hazard Mitigation Plan updates the existing Multi-Hazard Mitigation Plan adopted in _______________ (month/year); and

WHEREAS, this is a multi-jurisdictional plan and cities and towns that participated in the planning process may choose to also adopt the county plan.

NOW THEREFORE, BE IT RESOLVED BY MORGAN COUNTY, INDIANA, that the City of ______________ supports the hazard mitigation planning efforts and wishes to adopt the Morgan County Multi-Hazard Mitigation Plan.

This resolution was declared duly passed and adopted and was signed by the __________ and attested by the _________ this _____ day of _______, 202_.

____

Attest:

____