Butler County, Ohio

2023 Hazard Mitigation Plan

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EMERGENCY MANAGEMENT AGENCY

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SECTION 1. INTRODUCTION

In Butler County, safety is a top priority. An important part of being proactive toward safety is planning for natural and man-made disasters. Disasters can cause significant damage to our communities, businesses, public infrastructure, and environment, in addition to injuries and death. Their impacts include the displacement of people, economic loss and the tremendous costs of response and recovery. Preparing and using the Butler County Hazard Mitigation Plan (HMP) helps us mitigate the effects of these hazards and return to a normal operating status sooner.

Hazard mitigation planning is a process for identifying an area's hazards, determining their likely impacts, setting mitigation goals, and prioritizing and using appropriate mitigation strategies. While we cannot prevent most disasters, we can reduce or eliminate their effects through a well-organized public education and awareness effort, preparedness activities and mitigation actions.

After a disaster, some people repair and reconstruct in ways that simply restore pre-disaster conditions. Such efforts expedite a return to normalcy, but they can result in a cycle of damage, reconstruction, and repeated damage. Hazard mitigation breaks this cycle by ensuring that post-disaster repairs and reconstruction increase the county's resiliency.

BACKGROUND AND PURPOSE

Each year in the United States, disasters take the lives of hundreds of people and injure thousands more. They also destroy or severely damage buildings and infrastructure. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. Throughout Ohio, many disasters create an extreme burden on city governments, small communities and institutions.

To reduce this burden, Butler County partnered with a consultant to develop the 2023 Hazard Mitigation Plan (HMP). The county developed this plan in accordance with the Disaster Mitigation Act of 2000. This Act provides the legislative basis for the Federal Emergency Management Agency's (FEMA) hazard mitigation planning requirements and funding, before and after a hazard event. FEMA requires HMPs to be updated every 5 years.

The federal government has made 14 disaster declarations in Butler County since 1953. They have involved severe storms, flooding, biological pandemics, snowstorms, tornadoes, and hurricanes. These recorded natural hazard events provide a hazard footprint for the region. They help mitigation planners understand the disasters that occur in and around Butler County, and the associated risks to life and property. Understanding hazard risks provides a foundation for developing ways to mitigate or eliminate their potential impacts. These solutions include public education and outreach, preparedness activities, and mitigation actions.

For hazards that can be mitigated, the county must be prepared to apply efficient and effective short- and long-term actions, where needed. The purpose of the 2023 HMP is to provide Butler County with a blueprint for planning hazard mitigation actions. The plan identifies resources, information, and

strategies for risk reduction. It is also a tool to measure the success of mitigation actions on a continual basis. The strategies identified in the updated HMP are intended to:

- Reduce risk, through an all-hazards approach, by creating a set of defined mitigation actions.
- Establish a basis for participating agencies and the public to coordinate and collaborate.
- Help meet the requirements of federal assistance programs.

The HMP does not supersede other current plans and strategies. Rather, it enhances the county's ability to communicate about and mitigate the risk of natural and man-made hazards. The county and its participating jurisdictions will use the information in this plan to help guide and coordinate mitigation activities and decisions by staff and citizens. Proactive mitigation planning will help reduce the risk and cost of the county's disaster response and recovery by protecting critical facilities, reducing liability exposure, and minimizing the impacts and disruptions of all hazards.

AUTHORITY

This plan was prepared using the requirements of DMA 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002, (44 CFR §201.6) and finalized on October 31, 2007. (Hereafter, these requirements and regulations are referred to collectively as the Disaster Mitigation Act (DMA, or DMA 2000.)

DMA emphasizes the need for mitigation plans and more coordinated mitigation planning and implementation. The regulations also establish the requirements local hazard mitigation plans must meet for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288). As Butler County is subject to a variety of hazards, access to federal disaster assistance and hazard mitigation funding is vital to ensure more resilient communities.

PLAN ORGANIZATION

The HMP includes all documentation required to meet the criteria for FEMA approval. It is organized into six sections that reflect the logical procession of the activities taken to develop the plan.

- **Section 1,** Introduction. Describes the background and purpose of the plan, and the authority for developing the plan.
- **Section 2,** Community Profile. Describes Butler County's history, geography, topography, climate, population, economy, housing, and land use and development trends.
- **Section 3,** Planning Process. Describes the 10-step HMP planning process and the meetings and outreach activities use to engage jurisdictions of Butler County, stakeholders, and the public.

- **Section 4,** Hazard Risk Assessment. Identifies and prioritizes all hazards affecting the county and assesses the vulnerability to each identified hazard.
- **Section 5,** Mitigation Strategy. Identifies mitigation goals and objectives and names and prioritizes new mitigation actions.
- **Section 6,** Plan Implementation and Maintenance. Discusses plan adoption and use, as well as the process to monitor, evaluate, update, and maintain the HMP. Discusses continued public involvement. Describes the previous and future plan integration efforts.

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SECTION 2. COMMUNITY PROFILE

The Community Profile summarizes Butler County's history and its existing environmental and socioeconomic conditions, including geography, topography, climate, population, economic, land use and development trends.

1. HISTORY OF BUTLER COUNTY

Butler County was established by the State of Ohio on March 24, 1803. The county was named in honor of Richard Butler, who was killed in St. Clair's defeat in 1791. The county was originally part of Hamilton County at its inception. Butler County has enjoyed a wide array of industry and business since its beginning. The cities of Hamilton and Middletown attracted industries which manufactured hundreds of products including paper, steel, machine tools, safes, and bicycles. By 1910 due to large growth of industry, the City of Hamilton's population was a robust 40,000 strong while the county as a whole was just over 70,000. The county population continued to grow steadily until 1960 when the population jumped from just over 150,000 to nearly 200,000 and has continued to rise to its current population.

Butler County is the birthplace to many historical and important people. One of the many notable people from Butler County is Charles Richter, the creator of the Richter Scale used to measure the magnitude of earthquakes. Charles Richter was born in St. Clair Township, located in Butler County, on April 26, 1900. Developed in 1935, the seismologist was looking to understand how to compare different earthquakes to each other in an objective, uniform manner while he worked at the Seismological Laboratory of the California Institute of Technology. The scale is based on the recording of ground motion and provided a quantitative size of the earthquake measured.

Historic resources can include landmark buildings, historic structures and sites, commercial and residential districts, historic rural resources, archaeological and cultural sites, and the environment in which they exist. Historic resources serve as visual reminders of a community's past. They provide a link to its cultural heritage and a better understanding of the people and events that shaped the patterns of its development. Butler County is currently home to 91 properties listed on the National Register of Historic Places. The historic places in the County include sites, buildings, structures, and districts. Appendix C provides the full list of historic places.

FIGURE 2-1 BUTLER COUNTY, OHIO

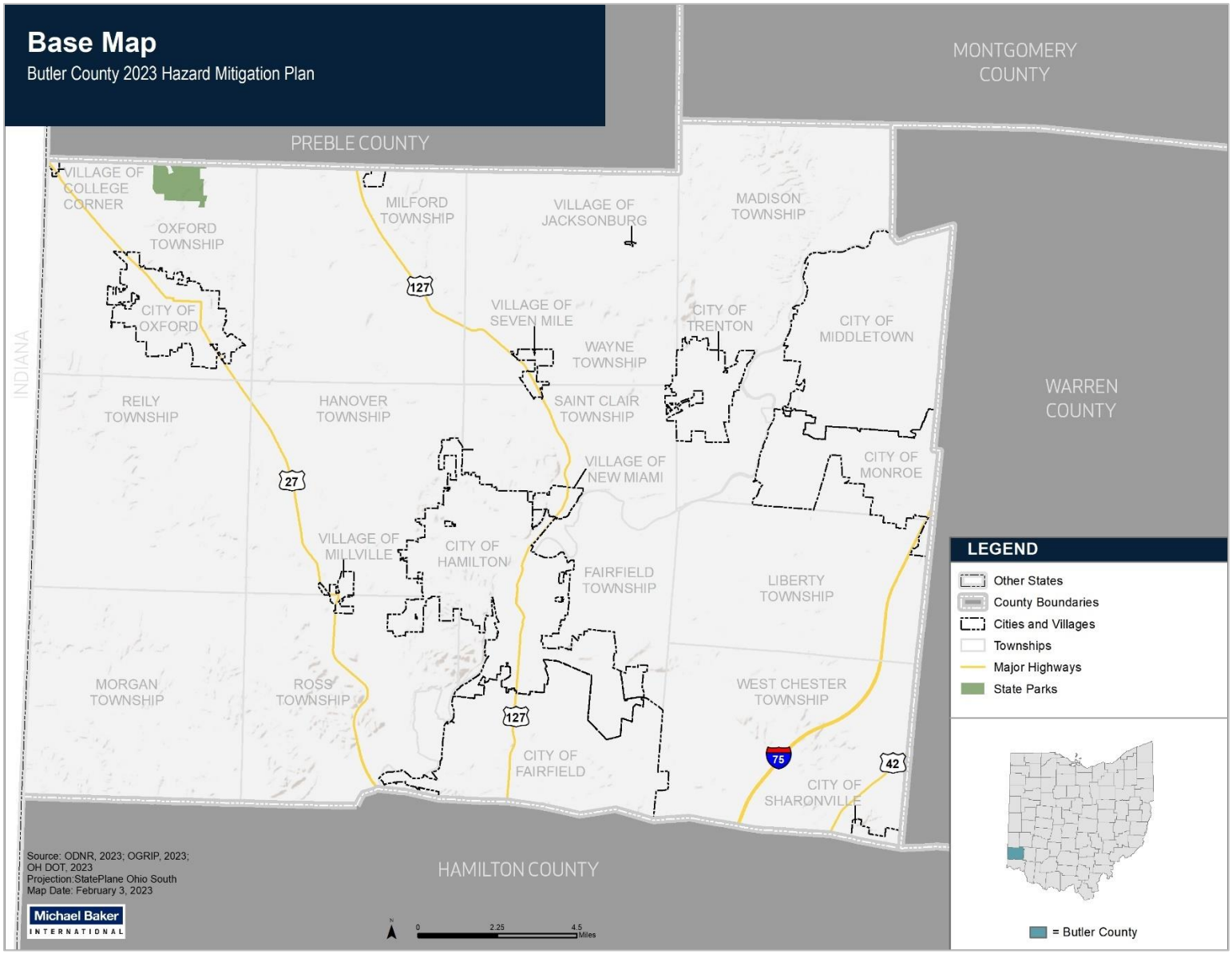
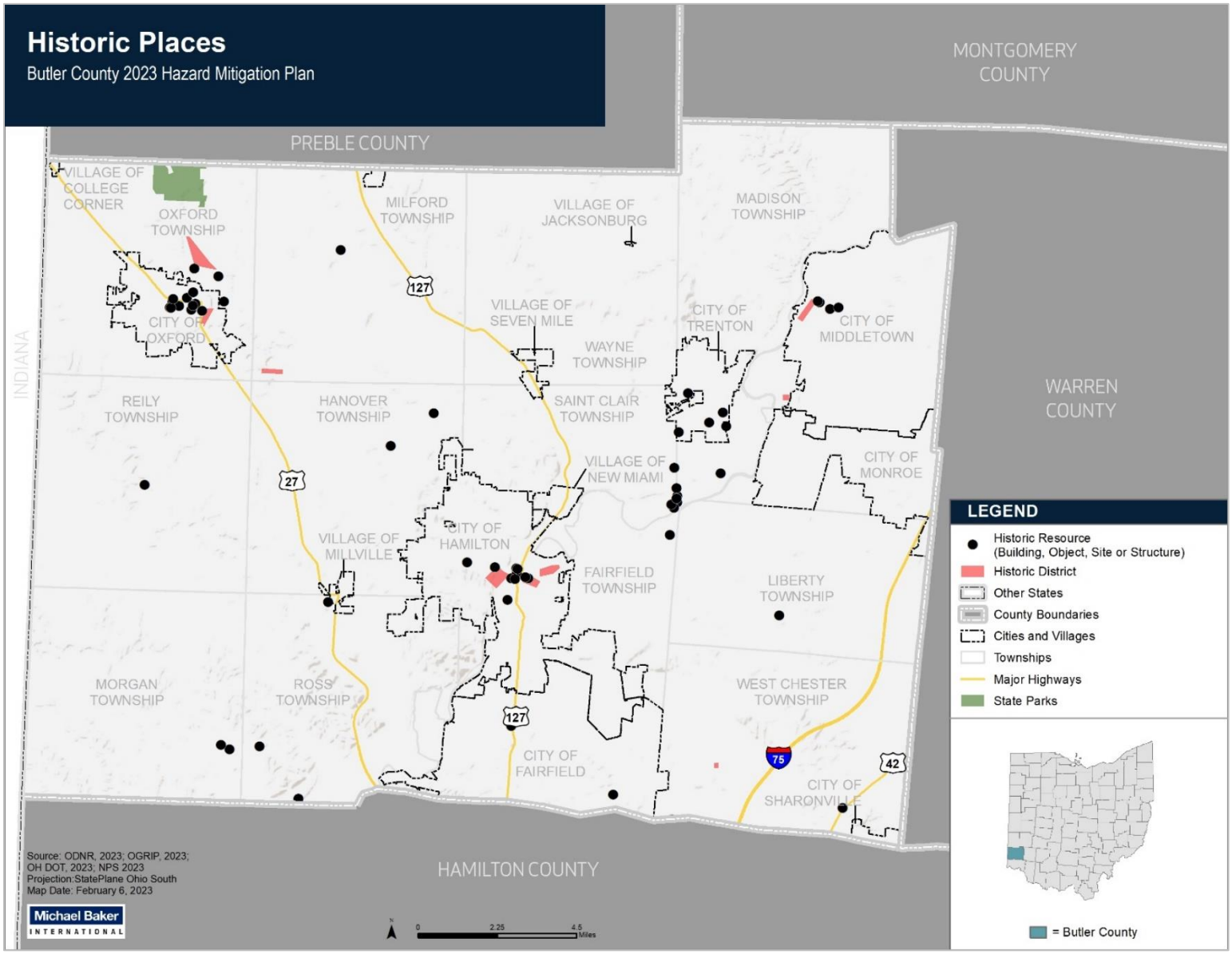


FIGURE 2-2 BUTLER COUNTY, OHIO REGISTERED HISTORIC PLACES



2.1.1 GEOGRAPHY

Butler County is located in the southwest corner of Ohio and is bordered by Preble County to the north, Montgomery County to the northeast, Warren County to the east, Hamilton County to the south, Dearborn County, Indiana to the southwest, Franklin County, Indiana to the west, and Union County, Indiana to the northwest. According to the United States Census Bureau, Butler County has a total of 466.52 square miles. The Great Miami River is the main floodway located within the county. There are numerous other minor streams, creeks, and tributaries throughout Butler County, as well. The county contains 12 municipalities: including the Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, and Trenton, and the Villages of College Corner, Jacksonburg, Millville, New Miami, and Seven Mile.

Butler County contains approximately 11.25 miles of Interstate, 46.45 miles of U.S. highway, and 178.54 miles of state highway. There are several major roadways and railroads that dissect Butler County. Also, vital to the transportation system are three small commercial airports.

2.1.2 TOPOGRAPHY

The County is of mixed land cover. 21.72% of the land cover is forest, 0.32% is shrubbery and grasslands, 24.09% is pasture/hay, 2.27% is cultivated crops, 0.14% is wetlands, 1.17% is open water, and the rest is developed area. According to the Butler County Soil and Water Conservation District, there are 14 different watersheds that influence drainage within the county. Of those 14 watersheds the Great Miami River, Indian Creek, and Four Mile Creek have the largest areas within the county.

Butler County is located in the Loamy, High Lime Till Plans ecoregion in the Eastern Corn Belt Plains, with the bottom right corner of the county located in the Pre-Wisconsinan Drift Plains, according to the Environmental Protection Agency. An ecoregion is an area of similar ecosystems in the type, quality, and quantity of environmental resources in the area. Ecoregions are applicable to hazard mitigation because they can be used to develop water quality standards as well as biology based on the environmental resources that currently exist in the specific ecoregion.

The Loamy, High Lime Till Plains ecoregion consists of flat to rolling hills, with features that were shaped by glaciers. The soil of the ecoregion is rich in lime and sits on loamy, glacial till that is rich in lime and drains well compared to clay-like soils. There are few forests in this ecoregion as the majority of trees have been cleared for agriculture.

The Pre-Wisconsinan Drift Plains ecoregion lays atop older carbonates and has acidic and nutrient-poor soil. The trees in the area are mostly beech with oak-sugar maple and elm-ash trees scattered throughout. The forests in the ecoregion do not drain well and often develop swamp-like conditions.

TABLE 2-1 BUTLER COUNTY LAND COVER, OHIO OFFICE OF RESEARCH

Land Cover	Percent of Total Land
Developed, Lower Intensity	24.80%
Developed, Higher Intensity	7.25%
Barren (strip mines, gravel pits, etc.)	0.24%
Forest	21.72%

Shrub/Scrub and Grasslands	0.32%
Pasture/Hay	24.09%
Cultivated Crops	20.27%
Wetlands	0.14%
Open Water	1.17%

2.1.3 CLIMATE

An area's comfort index is calculated on a number of weather factors, including temperature, probability of precipitation, humidity, wind speed, and cloud cover. The scale ranges from one to ten. The higher the comfort index, the more comfortable the climate is perceived by people across the U.S. One would expect to see a higher index with shirt-sleeve temperatures, minimal chances of rainfall, relatively low humidity, light winds, and fair skies. Lower index values could reflect cool, damp, and windy conditions.

TABLE 2-2 BUTLER COUNTY CLIMATE SUMMARY

Climate Measurements	Butler County	United States
Avg. Annual Rainfall (in.)	42.1	38.1
Avg. Annual Snowfall (in.)	14.2	27.8
Avg. Annual Precipitation (days)	117.6	106.2
Avg. Annual Sunny (days)	179	205
Avg. Annual July High	86.3°F	85.8°F
Avg. Annual Jan. Low	20.6°F	21.7°F
Comfort Index (higher=better)	7.2	7.0
UV Index	3.6	4.3
Avg. Elevation (ft.)	790	2,443

2. POPULATION, OCCUPANCY, AND DEMOGRAPHICS

Population and demographic information provides baseline data about Butler County. Maintaining and reviewing up-to-date data on demographics allows the county to engage the more vulnerable areas of the planning area, better assess hazard magnitudes, and develop more specific mitigation plans.

TABLE 2-3 COUNTY BASELINE DEMOGRAPHICS (CENSUS QUICKFACTS)

Demographic Information	Total Count
Male	192,268
Female	196,152
Total Population	**388,420**
Race and Ethnicity	Residents
White/Caucasian	299,860
Black or African American	39,619
Asian American	18,256
Two or More Races	10,876
American Indian / Alaskan Native	1,165
Other	17,779
Previous Years' Populations	Residents
2015	376,173
2010	368,130
2000	332,807
1990	291,479
1980	258,787
1970	226,207
1960	199,076
1950	147,203

According to the 2022 Population Estimate on QuickFacts, the county's residential population is 388,420. With 466.52 square miles of land, the population density is 832.59 people per square mile. The racial makeup of the county is approximately 77.2% White/Caucasian, 10.2% Black or African American, and 4.7% Two or More Races.

The following chart is a comprehensive list of the county's Census population in 2010, the county's Census population in 2020, the percent change in population between 2010 and 2020, the total number of housing units, and the number of housing units occupied versus vacant.

TABLE 2-4 COUNTY DEMOGRAPHIC PROFILE WITH HOUSING

Municipality	Total Count
2010 Population	368,130
2020 Population	390,357
Percent Population Change 2010 – 2020	6.04%
Total Housing Units	155,633
Occupied Housing Units	146,295
Vacant Housing Units	9,338

TABLE 2-5 POPULATION, BY INCORPORATED AREAS

Community	Population
Fairfield	44,456
Hamilton	62,937
Middletown	51,229
Monroe	15,489
Oxford	19,645
Sharonville	13,899*
Trenton	13,486
College Corner	259
Jacksonburg	35
Millville	644
New Miami	2,300
Seven Mile	632
Total County Population	**388,420**

* = located in multiple counties

2.2.1 EFFECTS OF POPULATION CHANGE ON MITIGATION

Housing occupancy affects the community's overall resilience during and after disasters. Well-maintained homes are less likely to contribute to damage and debris during hazard events. When vacant homes deteriorate, they are more easily damaged or destroyed during hazard events (specifically high winds, thunderstorms, and tornadoes). The building materials from these homes can become projectiles and wind-borne debris that injure people, damage vehicles and structures, and cause a more difficult response and recovery.

Because Butler County's population has been increasing for several decades, there are more people susceptible to hazards within the county. Butler County also has a significant population 65 years or older, which leaves the county *more* susceptible to hazard events, particularly when additional shelter is required. Hazards such as extreme temperatures, tornadoes, severe winter storms, and severe summer storms can cause power outages. The elderly and the very young are most at risk to the consequent losses of heating and cooling.

2.2.2 UNDERSERVED COMMUNITIES AND SOCIAL VULNERABILITY

Council on Environmental Quality Climate and Economic Justice Screening Tool

The Climate and Economic Justice Screening Tool (CEJST), developed by the Council on Environmental Quality in response to Executive Order 14008, identifies underserved communities in each census tract across the United States. The interactive map factors in eight indicators of burden that may cause the census tract to become disadvantaged: climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development. The following criteria discusses how each of the burden factors classifies a community as underserved:

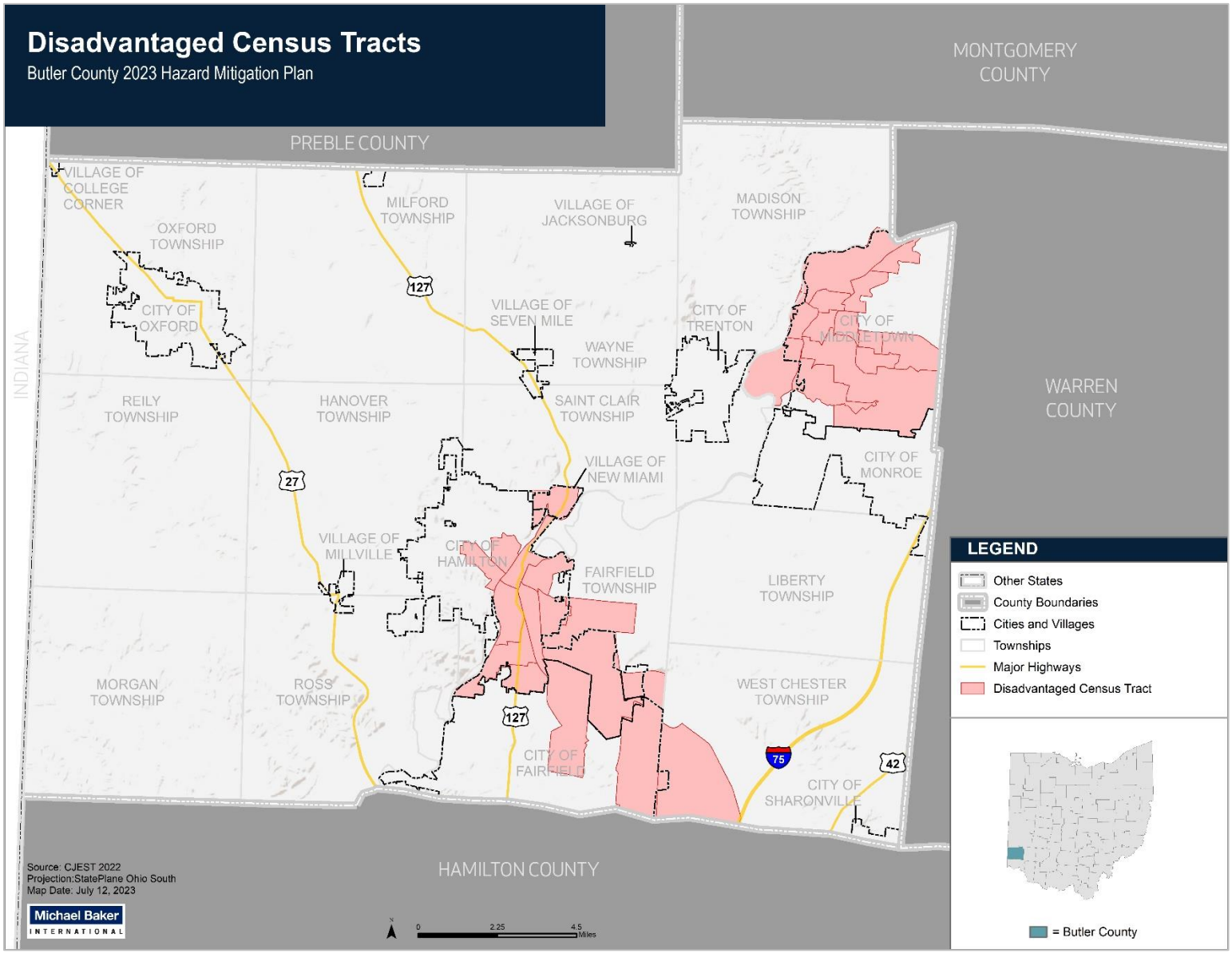
- Climate Change: the census tract is at or above the 90th percentile for expected agriculture loss rate, expected building loss rate, expected population loss rate, projected flood risk, or projected wildfire risk, and is at or above the 65th percentile for low income.

- Energy: the census tract is at or above the 90th percentile for energy cost or fine, inhalable participles that are 2.5 micrometers or smaller in the air and is at or above the 65th percentile for low income.
- Health: the census tract is at or above the 90th percentile for asthma, diabetes, heart disease, or low life expectancy, and is at or above the 65th percentile for low income.
- Housing: the census tract has experienced historic underinvestment, is at or above the 90th percentile for housing cost, lack of green space, lack of indoor plumbing, or has lead paint. The census tract must also be at or above the 65th percentile for low income.
- Legacy Pollution: the census tract has at least one abandoned mine land, formerly used defense site, is at or above the 90th percentile for proximity to hazardous waste facilities, proximity to Superfund sites, or proximity to Risk Management Plan facilities, and is at or above the 65th percentile for low income.
- Transportation: the census tract is at or above the 90th percentile for diesel particulate matter exposure, transportation barriers, or traffic proximity and volume, and is at or above the 65th percentile for low income.
- Water and Wastewater: the census tract is at or above the 90th percentile for underground storage tanks and releases or wastewater discharge and is at or above the 65th percentile for low income.
- Workforce Development: the census tract is at or above the 90th percentile for linguistic isolation, low median income, poverty, or unemployment and more than 10% of the people that live within the tract aged 25 years or older whose high school education is less than a high school diploma.

The data sources used to develop the CEJST tool range from the U.S. Census, FEMA, First Street Foundation, Department of Energy, EPA Office of Air and Radiation, CDC, National Community Reinvestment Coalition, HUD, Multi-Resolution Land Characteristics consortium, DOI, USACE, DOT, and BIA. Percentiles are used to rank the level of each census tract's disadvantage compared to other census tracts.

The following image shows the disadvantaged communities within Butler County. Knowing where disadvantaged communities are located within the county is important in hazard mitigation planning because they have been systematically denied a full opportunity to participate in aspects of economic, social, and civic life. Because of this, these communities may have barriers to participate in various planning processes. They also have an increased vulnerability to hazard impacts and may may need additional assistance following a hazard event. The map and data were also consulted during the planning process to identify where to hold public meetings to directly engage with underserved communities.

FIGURE 2-3 BUTLER COUNTY DISADVANTAGED COMMUNITIES, CEJST



FEMA National Risk Index

FEMA developed a National Risk Index map for Natural Hazards at the county-level and census tract-level for all counties and census tracts in the United States. The risk index is calculated through a combination of three factors: expected annual loss, social vulnerability, and community resilience. Expected annual loss is the amount of loss – building value, population, and agricultural value – that is likely to occur each year due to natural hazard events. Social vulnerability is the vulnerability or susceptibility of social groups to natural hazard impacts. Community resilience is a community's ability to withstand natural hazard events through preparation, recovery, and adaptability.

(Expected Annual Loss x Social Vulnerability) / Community Resilience = Risk Index

The Risk Index as a whole, as well as each factoring attribute, is ranked as a scale. The index, from low risk to high risk includes: Insufficient Data, Not Applicable, No Rating, Very Low, Relatively Low, Relatively Moderate, Relatively High, and Very High.

According to the National Risk Index Map, Butler County has a Risk Index of Relatively Moderate, Expected Annual Loss risk of Relatively Moderate, Social Vulnerability risk of Relatively Low, and Community Resilience of Relatively High. Ranking as an 87.97 on the national percentile and 96.60 on the percentile within Ohio, Butler County's Risk Index is in the Relatively Moderate ranking. 97% of the other Ohio counties have a Risk Index lower than Butler County's Risk Index. Butler County's expected annual loss calculates to a total of $33,695,537.20 – $19,690,446.85 in building value losses, 1.19 fatalities, $13,816,525.66 population equivalence losses, and $188,564.69 in agricultural value losses – 97% of the other Ohio counties have an expected annual loss rating lower than Butler County. The social vulnerability rating for Butler County, measured by University of South Carolina's Hazards and Vulnerability Research Institute (HVRI), is 36.73. Compared to the state's average social vulnerability ranking, 1% of Ohio's counties have a lower social vulnerability than Butler. The community resilience rating for Butler County, measured by University of South Carolina's HVRI, is 76.89. 100% of the counties in Ohio have a higher community resilience score than Butler County.

Additional National Risk Index data and information can be found in the Tornado, Earthquake, Severe Thunderstorms, Flooding, Severe Winter Storms, Extreme Temperatures, and Drought hazard profiles.

CDC/ATSDR Social Vulnerability Index

The Center for Disease Control and Prevention (CDC)/Agency for Toxic Substances and Disease Registry (ATSDR) developed a Social Vulnerability Index through the use of fifteen U.S. Census variables to identify social groups that are vulnerable to disaster events. The CDC/ATSDR social vulnerability definition is, "the potential negative effects on communities caused by external stresses on human health. Such stresses include natural or human-caused disasters or disease outbreaks. Reducing social vulnerability can decrease both human suffering and economic loss" (CDC, 2021). Socially vulnerable populations in a community are at more risk than the general population due to socioeconomic status, household composition, minority status, housing type, and/or means of transportation.

Socioeconomic factors that are considered vulnerable populations are also known as below poverty, unemployed, low income, or no high school diploma. Household compositions that are considered vulnerable include those with a disability, aged 65 years or older, aged 17 years or younger, older than 5 years of age with a disability, and single-parent households. Those with a minority status may not speak the English language or may not be able to communicate fluently through English. Lastly, the housing type and means of transportation indicates additional vulnerable groups of population. Those who live in multi-unit structures, mobile homes, have crowding conditions in their place of residence, have no vehicle, or reside in group quarters are all examples of socially vulnerable populations.

Butler County has an overall Social Vulnerability Index (SVI) score of 0.5862 in 2020, with 0 being the lowest vulnerability and 1 being the highest vulnerability. According to the score, the County ranks in a medium to high level of social vulnerability. Butler County's socioeconomic ranking is 0.4253, indicating a low to medium level of vulnerability; the County's household characteristics ranking is 0.6322, indicating a medium to high level of vulnerability; the County's racial & ethnic minority status ranking is 0.908, indicating a high level of vulnerability; the County's housing type and transportation ranking is 0.5632, indicating a medium to high level of vulnerability.

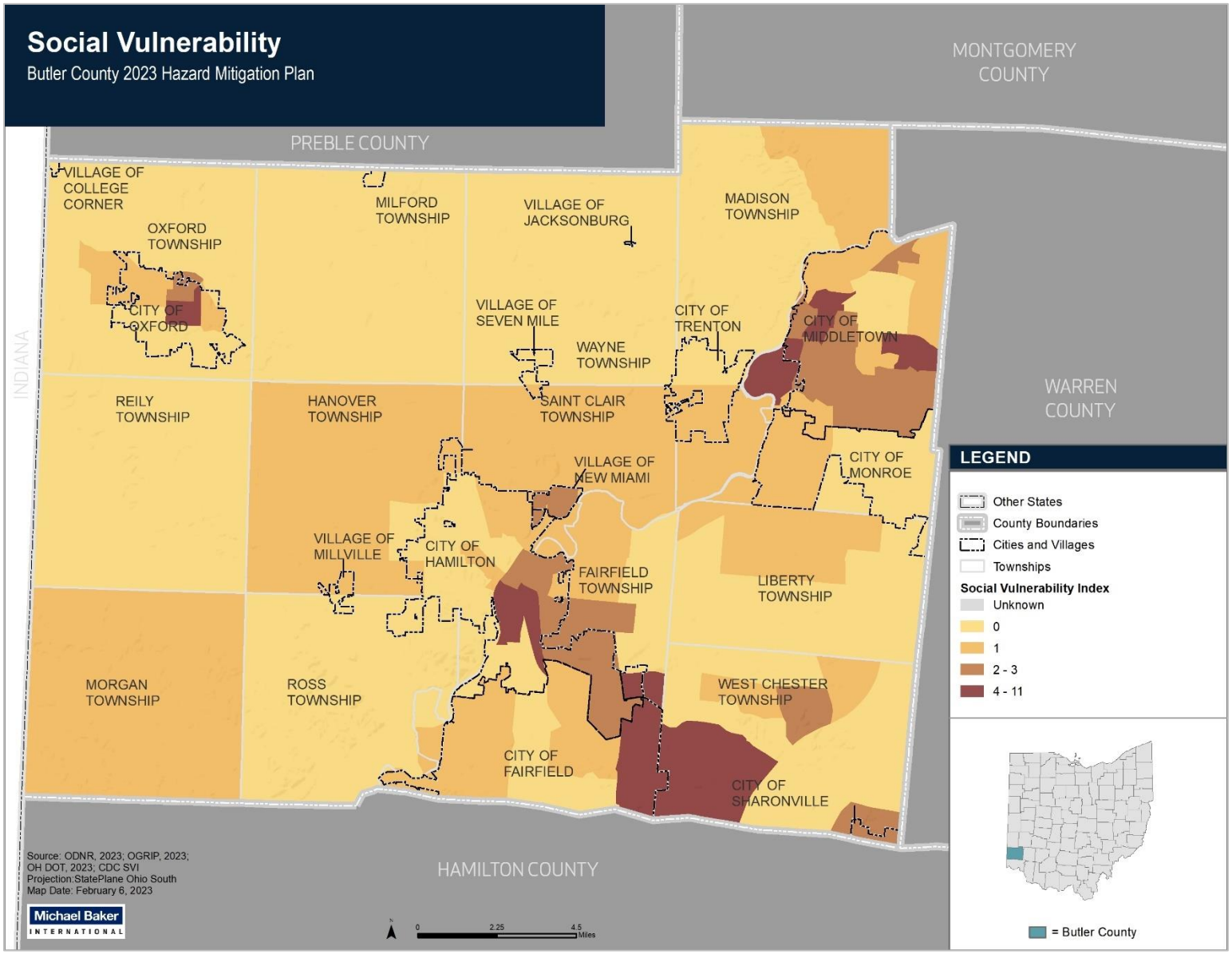
The following table shows how Butler County's SVI and supporting factors compare to its neighboring counties.

TABLE 2-6 BUTLER COUNTY AND SURROUNDING COUNTIES' SVI SCORES

County	Overall SVI	Socioeconomic Ranking	Household Characteristics Ranking	Racial & Ethnic Minority Status Ranking	Housing Type & Transportation Ranking
Butler County	0.5862	0.4253	0.6322	0.908	0.5632
Preble County	0.069	0.1379	0.1264	0.0805	0.046
Montgomery County	0.977	0.8276	0.931	0.954	0.8391
Warren County	0.0805	0.0575	0.1379	0.8046	0.1724
Hamilton County	0.8391	0.5977	0.7241	0.977	0.8621
Dearborn County	0.0769	0.1868	0.1868	0.033	0.1209
Franklin County	0.2418	0.1209	0.6593	0	0.4725
Union County	0.3077	0.3736	0.4505	0.2418	0.2747

The figure below display's the social vulnerability of each census tract within Butler County.

FIGURE 2-4 CDC/ATSDR SOCIAL VULNERABILITY IN BUTLER COUNTY



SVI scores and locations of vulnerable populations are important to know because they can help local officials target areas that may need additional assistance after a disaster, such as additional supplies needed like food, water, medicine or bedding, or additional emergency personnel that need to be dispatched to a certain area(s) within the County. Local officials can also use the SVI scores at the census tract level to identify areas that are in need of emergency shelters, develop evacuation plans, and other mitigation actions that can help alleviate disaster impacts on the identified communities. The map and data were also consulted during the planning process to identify where to hold public meetings to directly engage with underserved communities.

2.2.3 EMPLOYMENT

According to the U.S. Census Bureau's Longitudinal Employer-Household Dynamics (LEHD), 161,175 jobs made up the county's workforce as of 2019. The North American Industry Classification Systems keeps track of jobs based on census blocks. Manufacturing makes up 15.3% of the jobs in the county, followed by Health Care and Social Assistance at 12.8%. The next closest is Retail Trade at 11.7%.

TABLE 2-7 NAICS JOB INVENTORY

Industry	Count	Share
Agriculture, Forestry, Fishing and Hunting	80	0.0%
Mining, Quarrying, and Oil and Gas Extraction	107	0.1%
Utilities	626	0.4%
Construction	8,208	5.1%
Manufacturing	24,686	15.3%
Wholesale Trade	13,851	8.6%
Retail Trade	18,853	11.7%
Transportation and Warehousing	7,058	4.4%
Information	1,270	0.8%
Finance and Insurance	6,797	4.2%
Real Estate and Rental and Leasing	1,517	0.9%
Professional, Scientific, and Technical Services	4,864	3.0%
Management of Companies and Enterprises	1,773	1.1%
Administration and Support, Waste Management and Remediation	10,923	6.8%
Educational Services	13,960	8.7%
Health Care and Social Assistance	20,637	12.8%
Arts, Entertainment, and Recreation	2,544	1.6%
Accommodation and Food Services	15,471	9.6%
Other Services (excluding Public Administration)	4,703	2.9%
Public Administration	3,247	2.0%
Grand Total	**161,175**	**100.0%**

Employment, like housing, can influence mitigation planning and disaster events. It is tied directly to housing and community stability. Many small towns in rural areas rely heavily on a particular

company or industry. When these disappear or take on a reduced role, the resulting economic downturn can increase the number of blighted properties.

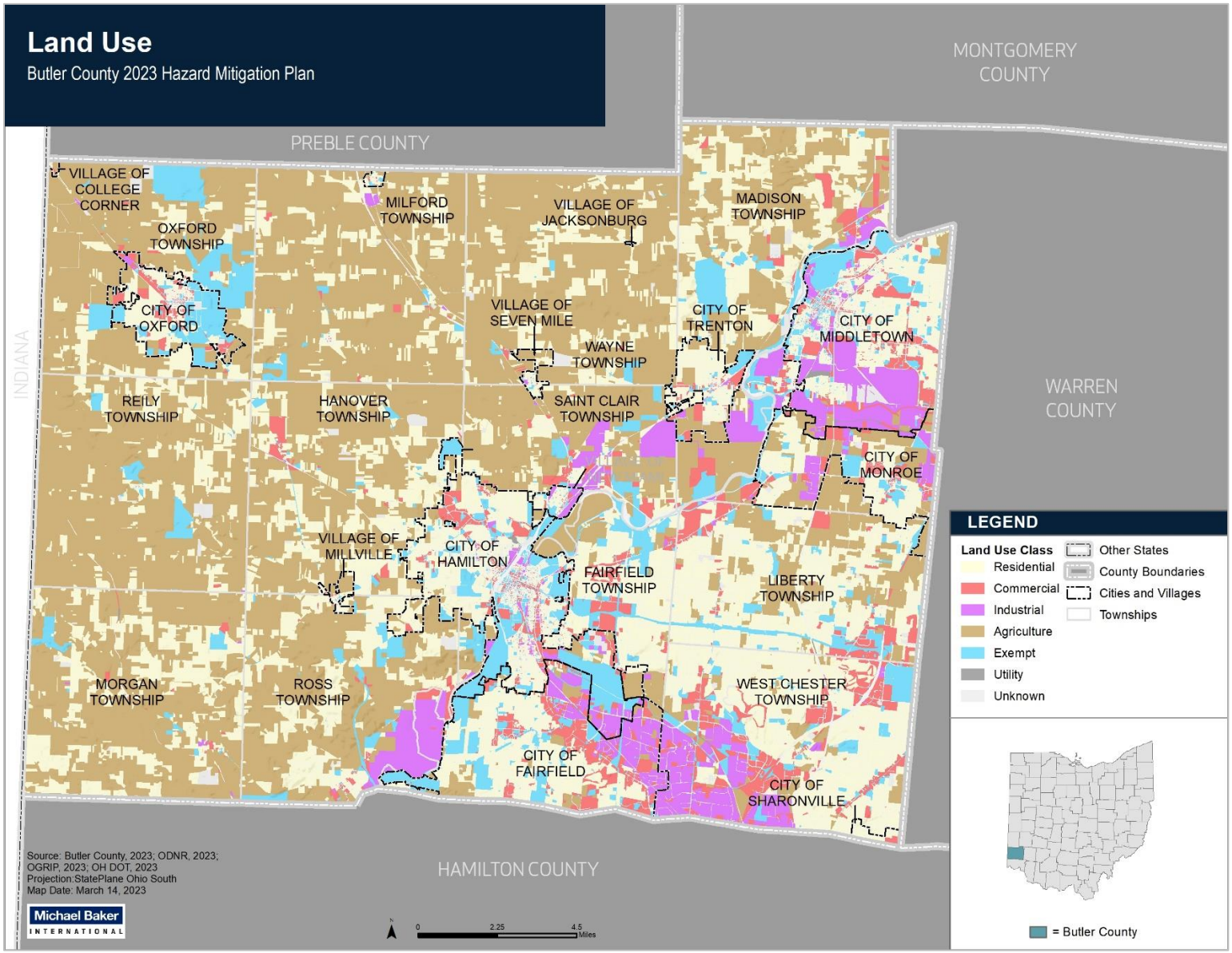
2.2.4 LAND USE AND FUTURE DEVELOPMENT AREAS

Land use patterns described in general terms within Butler County are consistent with typical rural counties in the Midwestern part of the U.S. as development has primarily taken place within and immediately surrounding existing incorporated areas, with the exception of several primarily residential settlements in unincorporated areas (Townships) throughout the County.

TABLE 2-8 LAND USE IN BUTLER COUNTY

Land Use Category	Acreage	Percent of Total County Area
Agriculture	142,544.04	50%
Commercial	16,155.45	6%
Exempt	23,877.55	8%
Industrial	14,819.41	5%
Residential	85,970.51	30%
Unknown	3,091.90	1%
Utility	287.75	0%
Total	**286,746.61**	**100%**

FIGURE 2-5 LAND USE DESIGNATIONS IN BUTLER COUNTY



Butler County and its municipalities have seen small amounts of development and redevelopment since the previous HMP was developed. Members of each participating community completed a Changes in Development form during the first planning meeting or on the Butler County Hazard Mitigation Plan Update project website to determine how they perceived their vulnerability to each hazard had changed in comparison to development trends and larger factors. Each community's response from the Changes in Development form is reflected in the following table. The responses provided by stakeholders during the planning process are located in Appendix I.

TABLE 2-9 BUTLER COUNTY CHANGES IN DEVELOPMENT RESPONSE

Jurisdiction/Organization	Changes in Development Response
Butler County	We have seen some increases in developments, including multi-family housing and mixed-used retail in some areas of the county.
Fairfield	There has been an increase in the number of large commercial structures within the city. This has led to an increase in condensed population which could increase our vulnerability. There has also been an apparent increase in severe thunderstorm and flooding events.
Hamilton	We have completed a stormwater management plan – this plan gets updated based on new occurrences of flooding. There has been new housing stock and subdivisions added throughout the city. In the past five years, Two Mile Creek has begun to flood. Gilmore Ponds could be transformed into wetlands, but this is still in the planning stage.
Middletown	The water department within the city developed a plan to separate combined sewer and stormwater. There has been an increased risk to tornado impacts as there is additional housing and businesses with decreased city staff.
Monroe	There has been an increase in development and impervious surfaces, increasing localized flooding issues. The city is reimagining zoning regulations and there are various efforts underway to develop further plans for improvement.
Oxford	We have had several student housing projects added along the rail line. This has moved a significant portion of our population close to the chemical hazard associated with the train tracks.
Sharonville	Our overall vulnerability for flooding had decreased over the past five years due to improvements made to the dam, storm water system and watershed program. While not technically a physical development, the increase length of trains over the past five years has increased our vulnerability to all hazards due to rail crossings being blocked for longer periods of time, making emergency response difficult.
Trenton	An increase in staffing from 3 to 4 on duty 24/7. We have completed a purchase of a new fire engine, and a new more centered station. There is more lightweight construction as well as more large industrial structures.
College Corner	No changes.
Jacksonburg	No significant changes.
Millville	There have not been any significant changes.
New Miami	There have been no development changes.
Seven Mile	There has not been an increased change, but flooding is still an issue for the village.

From 2016 to 2020, there have been 169 residential units constructed, according to the Butler County Profile 2021 Edition developed by the Ohio Office of Research. The table below shows the residential construction that has occurred within the County each year, broken down by residential building type.

TABLE 2-10 RESIDENTIAL DEVELOPMENT IN BUTLER COUNTY, 2016-2020

Residential Construction	2016	2017	2018	2019	2020
Total Units Constructed	1,140	817	791	805	1,152
Total value of constructed units	$203,759,000	$165,822,000	$166,272,000	$169,929,000	$246,790,000
Single-Unit Buildings Constructed	706	737	694	793	1,134
Average Cost per Single Unit	$223,413	$216,579	$214,465	$212,449	$215,684
Multi-Unit Buildings Constructed	434	80	97	12	18
Average Cost per Unit in Multi-Unit	$106,059	$77,541	$179,722	$121,417	$122,500

In addition to the 4,705 residential units constructed from 2016-2020, the U.S. Census Bureau QuickFacts identifies that there were 941 building permits issued in 2021 for Butler County.

Commercial and residential development is expected to continue to saturate more urban areas, like the cities and larger villages, in the next 25 years. One reason is that the retail and service market is far from being saturated in the incorporated communities in Butler County. Another is that the already high transportation costs are expected to continue to rise. These are keeping more travelers closer to home in their search for goods and services.

SECTION 3. THE PLANNING PROCESS

This section describes each stage of the planning process used to develop the 2023 HMP. This process provides a framework for developing the document and follows FEMA's recommended steps. The prescribed series of planning steps followed for the 2023 HMP includes organizing resources, assessing risk, developing the mitigation plan, drafting the plan, reviewing and revising the plan, and adopting and submitting the plan for approval. Each is described in this section.

1. PLANNING PROCESS

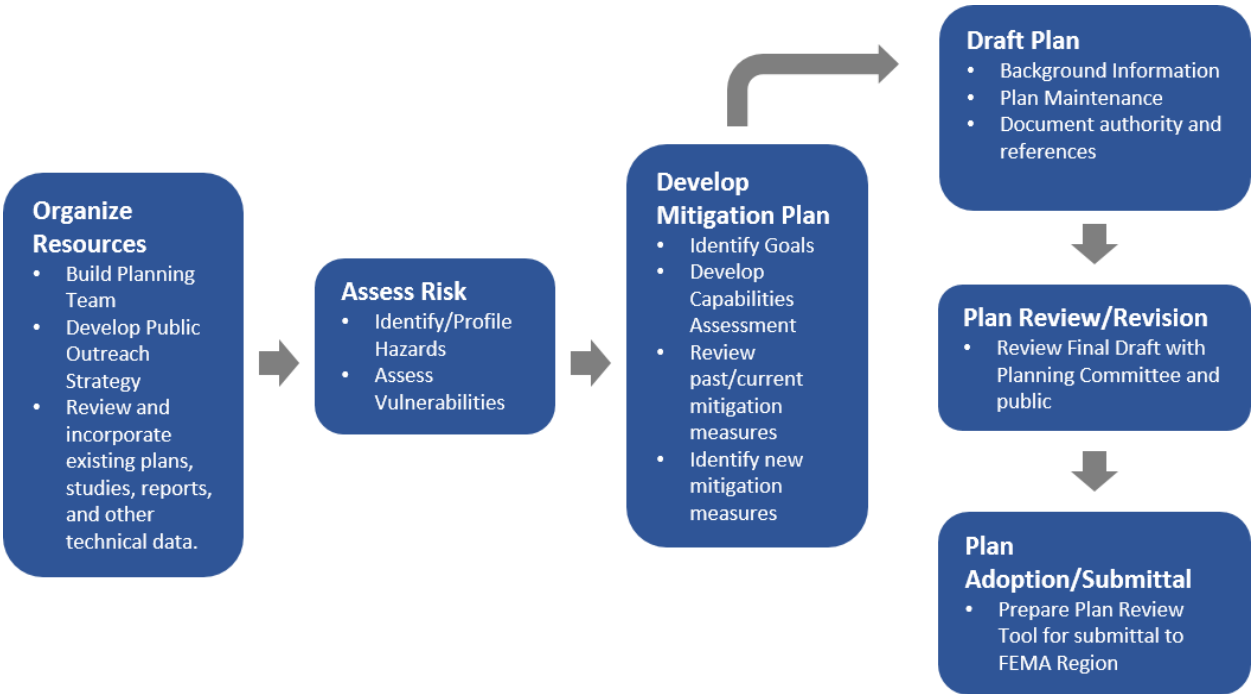
Hazard mitigation planning in the United States is guided by the statutory regulations described in DMA 2000 and implemented through 44 Code of Federal Regulations (CFR) Parts 201 and 206. FEMA's HMP guidelines outline a four-step planning process for the development and approval of HMPs. Table 3-1 lists the specific CFR excerpts that identify the requirements for approval.

TABLE 3-1 DMA 2000 CFR PLANNING PROCESS

DMA 2000 (44 CFR 201.6)	HMP Plan Section
(1) Organize Resources	Section 3
201.6(c)(1)	Organize to prepare the plan
201.6(b)(1)	Involve the public
201.6(b)(2) and (3)	Coordinate with other agencies
(2) Assess Risks	Section 4
201.6(c)(2)(i)	Assess the hazard
201.6(c)(2)(ii) and (iii)	Assess the problem
(3) Develop the Mitigation Plan	Section 5
201.6(c)(3)(i)	Set goals
201.6(c)(3)(ii)	Review possible activities (actions)
201.6(c)(3)(iii)	Draft an action plan
(4) Plan Maintenance	Section 6
201.6(c)(5)	Adopt the plan
201.6(c)(4)	Implement, evaluate, and revise

To develop the 2023 HMP, a planning process was customized to address Butler County's unique population and demographics. This process met all basic federal guidance documents and regulations. As shown in the following figure and documented in the corresponding sections, the HMP planning process included organizing resources, assessing risk, developing the mitigation action strategy, drafting the plan, reviewing and revising the plan, and adopting and submitting the plan.

FIGURE 3-1 MITIGATION PLANNING PROCESS



2. ORGANIZE RESOURCES

Organizing the resources consists of developing a planning team and reviewing documents.

3. BUILDING THE PLANNING TEAM

Having a planning team, the backbone of the planning process, was critical for developing the 2023 HMP. Butler County staff invited all jurisdictions within the county, townships located in the county, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development, neighboring counties, nonprofit organizations, local businesses, academia, and other private organizations to join this group, which was known as the Hazard Mitigation Planning Committee (HMPC). The full list of invited stakeholders can be found in **Appendix A.**

4. HAZARD MITIGATION PLANNING COMMITTEE

The 2023 HMPC consisted of key decision makers in specific county functions. It included stakeholders who participated actively in the planning process. Planning processes included:

- Holding a series of structured coordination meetings;
- Collecting valuable local information and other requested data;
- Deciding on plan process and content;
- Developing mitigation actions for the HMP;
- Reviewing and commenting on plan drafts; and

- Coordinating the public input process.

Preparing the 2023 HMP required a series of meetings and workshops. These were intended to facilitate discussion and initiate data collection efforts with local community officials. More importantly, the meetings and workshops prompted local officials to provide continuous input and feedback throughout the update process.

The Planning Committee is a combination of County and local officials and stakeholders who participated in the planning process. The Butler County EMA was responsible for contacting the local jurisdictions within Butler County to alert and invite them to the planning process. The EMA was also responsible for identifying the stakeholders to be invited to the planning process. Regular updates regarding the progress made on the plan and participation status of the local jurisdictions were provided to the County throughout the plan's development.

The range of stakeholders, including neighboring communities, county agencies, businesses, academia, nonprofits, and other interested parties, were invited and encouraged to participate in developing the Plan. The county encouraged stakeholder involvement by emailing the agencies and individuals to participate in Planning Committee Meetings as well as individual meetings and submitting forms through the Butler County HMP Website. Butler County EMA also sent a letter to entities who own dams within the county – a copy of this letter can be found in **Appendix A**.

The planning committee is the culmination of all participants of the planning process. The following table identifies the participant, the jurisdiction/organization represented, the title or role of the participant within the represented jurisdiction/organization, and which meeting(s) were attended by the participant.

TABLE 3-2 2023 HMP PLANNING COMMITTEE

Name	Jurisdiction / Organization Represented	Title / Role	Meeting(s) Attended
Matt Haverkos	Butler County EMA	Director (former)	1, 2
Jim Bolen		Deputy Director (former), Director	1, 2
Drew Vonderschmidt		EMA Specialist	1, 2
Tom Lakamp	City of Fairfield	Fire Chief	1, 2
Ben Mann		Public Works Director	2
Matt Young		Public Utilities Superintendent	2
James Williams	City of Hamilton	Director of Public Works	1, 2
Liz Hayden		Planning Director	1
AJ Schweier		Planning & Zoning Specialist, Floodplain Manager	2
Tom Eickelberger		Assistant Fire Chief	2
Allen Messer		Assistant Director of Engineering	2
Steve Ludwig	City of Middletown	Assistant Fire Chief	1, 2
Brian Perkins	City of Monroe	Assistant Public Works Director	1, 2
David Leverage		Fire Chief	1

Name	Jurisdiction / Organization Represented	Title / Role	Meeting(s) Attended
Brian Curlis		Police Captain	1
John Detherage	City of Oxford	Fire Chief	2
John Jones		Police Chief	2
Jim Lukas	City of Sharonville	Public Safety Director	Ind. Meeting
Dan Sunderman		Fire Chief	Ind. Meeting
Aaron Nichols	City of Trenton	Fire Department Lieutenant	1, 2
Rob Leighman		Service Director	1
Don Jacksong	Village of College Corner	Fire Chief	Ind. Meeting
Mike Sword	Village of Jacksonburg	Mayor	1, 2
Steve Miller	Village of Millville / Ross Township	Fire Chief	1, 2
Jim Lakes	Village of New Miami	Streets Commissioner	Ind. Meeting
Todd Fryman	Village of Seven Mile	Village Council Member	1, 2
Mark Gadd	Butler County	Project Coordinator	2
Kara Frederick	Butler County Board of Developmental Disabilities	Director of Quality Assurance	1
Jen Rice		Service and Support Administration Director	1
Dwight Finch		Human Resources and Operations Director	1
Martin Schneider	Butler County Coroner's Office	Administrator	2
Uche Adigwe	Butler County Department of Development	Zoning and Floodplain Manager	1, 2
Chris Brown	Butler County Educational Service Center	Superintendent	1
Katharine Clayton		Director of Public School Safety	2
Scott Bressler	Butler County Engineer's Office	Operations Deputy	1, 2
Beth Race	Butler County Family & Children First Council	Director	1, 2
Jenny McCoy	Butler County General Health District	Emergency Preparedness Director	1, 2
Erik Balster		Health Commissioner	2
Kathy Creighton	Butler County Historical Society	Executive Director	1
Paul Stumpf	Butler County LEPC	Chair	2
Mark Franklin	Butler County Regional Transit Authority	Operations Manager	1, 2
Kelly Crout	Butler County Soil and Water Conservation District	Director	1, 2
Kim Whitton	Butler County United Way	Community Impact Manager	1, 2
Derrick Ward	Butler County Water & Sewer Department	Regulatory Compliance Superintendent	2
George Sipka	Cincinnati Financial Corporation	Corporate Safety Director	1
Mike Joseph	Cleveland Cliffs Middletown Works	Senior Environmental Engineer	1, 2
Nan Cahall	Council on Aging of Southwestern Ohio	Government Relations Manager	1
Alicia Adams	Edgewood City School District	Coordinator of Special Services	1, 2
Matt Crapo	Fairfield City Schools	Director of Student Services	1
Lance Perry		Director of Business Operations	2

Name	Jurisdiction / Organization Represented	Title / Role	Meeting(s) Attended
Tim Thomas	Fairfield Township	Fire Chief	1, 2
Dan Bates	Greater Hamilton Chamber of Commerce	President & CEO	1
Tiffany Grubb		Director of Marketing	2
Ethan Klussman	Liberty Township	Fire Chief	1
Dave Greve		Assistant Fire Chief	2
Curtis Kercheval	Mercy Health – Fairfield	EMS Coordinator	2
Barry Puskas	Miami Conservancy District	Chief of Technical and Engineering Services	1
Nicole Roberts	Miami University	Sergeant	2
Chase Redparth		Intern	2
Sharon Burkett		Seargeant	2
Hema Chidambaram	Molson Coors	Environment, Health, and Safety Manager	1
Tom Rogers		Brewery Security	1
Phil Clayton	Ohio Emergency Management Agency	Southwest Ohio Regional Supervisor	1, 2
Bob Wolfe	Public Utilities Commission of Ohio	Public Utilities Administrator	1
Tim Miller	Reily Township	Township Trustee	1, 2
Bryan Rogers	Ross Township	Police Sergeant	1
Terry Purdue	Shared Harvest Foodbank	Executive Director	1
Amberlee Finks		Director of Development	2
Phil Sackenheim	Southwest Regional Water District	General Manager	1, 2
John Johnson	St. Clair Township	Township Trustee	1
Ed Theroux	Talawanda School District	Superintendent	1
Scott Davie		High School Principal	1
Tim Derickson		Middle School Principal	1
Holli Hansel		Director of Communications & Public Relations	2
Mark Johnston	The Christ Hospital – Liberty	EMS Coordinator	2
Holly Gray		Assistant Manager	2
Adrienne Menke		ED RN	2
Jill Ernset	The Health Collaborative	Readiness & Response Program Manager	1
Jessica Skelton		Director of Emergency Preparedness and Response	2
Kay Vonderschmidt	TriHealth	Emergency Manager	2
Gregg Howard	U.S. DHS CISA	Protective Security Advisor	2
Lauren Duff	UC Health – West Chester Hospital / Butler County EMS Council	EMS Manager / Member	2
Jim Franklin	Union County, Indiana EMA	Director	2
David Pickering	West Chester Township	Assistant Fire Chief	1, 2

3.4.1 PLANNING COMMITTEE MEETINGS

The HMPC met throughout the development of the updated HMP. Table 3-3 summarizes the meetings conducted throughout the planning process, including meeting date, type, and topics discussed.

TABLE 3-3 MEETING SUMMARY

Date	Meeting Type	Topics
January 4, 2023	Internal Kickoff	• Scope of Work • Planning Team • Review of Previous County HMP • Review of Mitigation Planning Standards • Schedule and Stakeholder/Public Meetings • Butler County HMP Website • Relevant Data and Documentation • Questions and Next Steps
April 20, 2023	Planning Committee Meeting #1	• Planning Committee Introductions • Introduction to Hazard Mitigation • Components of a Hazard Mitigation Plan • Butler County HMP Website • Completion of Forms • Questions and Next Steps
June 8, 2023	Planning Committee Meeting #2	• Review of Hazard Mitigation ○ Mitigation Strategy • Timeline of Butler County HMP • Butler County HMP Website • Completion of Forms • Butler County Public Survey • Next Steps and Action Items
June 15, 2023-July 6, 2023	Individual Meetings	• Review of the Planning Process, HIRA, Mitigation Strategy ○ Categories of Mitigation Actions • Completion of the 7 Required Forms (Hazard Priority, Risk Evaluation, Vulnerability Assessment, Changes in Development, Capability Assessment, Previous Mitigation Actions, New Mitigation Action) • Next Steps

TABLE 3-4 JURISDICTIONAL PARTICIPATION

Jurisdiction	Meeting Participants				Documentation Provided						
	Meeting 1	Meeting 2	Ind. Meeting	Any Meeting	Hazard Priority	Risk Evaluation	Vulnerability Assessment	Changes in Development	Capability Assessment	Previous Mitigation Actions	New Mitigation Action
Butler County	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Fairfield	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Hamilton	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Middletown	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Monroe	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Oxford		✓		✓	✓	✓	✓	✓	✓	✓	✓
Sharonville			6/15/2023 6/16/2023	✓	✓	✓	✓	✓	✓	✓	✓
Trenton	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
College Corner			7/6/2023	✓	✓	✓	✓	✓	✓	✓	✓
Jacksonburg	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Millville	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
New Miami			6/27/2023	✓	✓	✓	✓	✓	✓	✓	✓
Seven Mile	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓

The “Any Meeting” column represents participation in the planning process through meetings. This criterion can be met through participating in either scheduled group meetings or individual meetings – denoted as Ind. Meeting.

Stakeholders were able to participate in Planning Committee Meeting #1, Planning Committee Meeting #2, individual meetings if desired, and submit responses to 6 of the 7 forms on the during the meetings or on the Butler County HMP Website. A separate tab, titled Partners in Mitigation, allowed for stakeholders to provide additional input on the Hazard Priority, Risk Evaluation, Vulnerability Assessment, Changes in Development, Capability Assessment, and New Mitigation Action forms. The following table outlines the stakeholders that participated and provided feedback during the planning process.

TABLE 3-5 STAKEHOLDER PARTICIPATION

Stakeholder	Meeting Participation		Documentation Provided					
	Meeting 1	Meeting 2	Hazard Priority	Risk Evaluation	Vulnerability Assessment	Changes in Development	Capability Assessment	New Mitigation Action
Butler County		✓						
Butler County Board of Developmental Disabilities	✓		✓	✓	✓	✓		
Butler County Coroner's Office		✓					✓	✓
Butler County Department of Development	✓	✓	✓	✓	✓	✓		
Butler County Educational Service Center	✓	✓					✓	✓

Butler County Engineer's Office	✓	✓	✓	✓	✓	✓	✓	✓
Butler County Family & Children First Council	✓	✓						
Butler County General Health District	✓	✓	✓	✓	✓	✓	✓	✓
Butler County Historical Society	✓		✓	✓	✓	✓	✓	
Butler County LEPC		✓						
Butler County Regional Transit Authority	✓	✓	✓	✓	✓	✓		
Butler County Soil and Water Conservation District	✓	✓	✓	✓	✓	✓	✓	
Butler County United Way	✓	✓	✓	✓	✓	✓	✓	
Butler County Water & Sewer Department		✓						
Cincinnati Financial Corporation	✓		✓	✓	✓	✓	✓	
Cleveland Cliffs Middletown Works	✓	✓	✓	✓	✓	✓	✓	
Council on Aging of Southwestern Ohio	✓		✓	✓	✓	✓		
Edgewood City School District	✓	✓	✓	✓	✓	✓	✓	
Fairfield City Schools	✓	✓	✓	✓	✓	✓	✓	
Fairfield Township	✓	✓	✓	✓	✓	✓	✓	✓
Greater Hamilton Chamber of Commerce	✓		✓	✓	✓	✓		
Hamilton City School District				✓	✓			
Liberty Township	✓	✓	✓	✓	✓	✓	✓	✓
Mercy Health - Fairfield		✓						
Miami Conservancy District	✓		✓	✓	✓	✓		
Miami University		✓						
Molson Coors	✓		✓	✓	✓	✓		
Ohio Emergency Management Agency	✓	✓						
Public Utilities Commission of Ohio	✓		✓	✓	✓	✓		
Reily Township	✓	✓	✓	✓	✓	✓	✓	✓
Ross Township	✓	✓						
Shared Harvest Foodbank	✓	✓	✓	✓	✓	✓	✓	✓
Southwest Regional Water District	✓	✓	✓	✓	✓	✓	✓	
St. Clair Township	✓		✓	✓	✓	✓	✓	✓
Talawanda School District	✓	✓	✓	✓	✓	✓	✓	✓
The Christ Hospital - Liberty		✓					✓	✓
The Health Collaborative	✓	✓	✓	✓	✓	✓	✓	
TriHealth		✓					✓	✓
U.S. DHS CISA		✓						
UC West Chester Hospital/Butler County EMS Council		✓					✓	✓
Union County, Indiana EMA	✓							
West Chester Township	✓	✓	✓	✓	✓	✓	✓	✓

3.4.2 PUBLIC OUTREACH STRATEGY

Public outreach is a major component of the 2023 HMP planning process. Participation from the public is necessary to gain a full picture of the potential issues and hazards that affect the county.

Outreach Strategy

The Outreach Strategy used several methods for communicating information about the planning process to the public. These efforts included direct outreach to the underserved and socially vulnerable populations located in Butler County. During the planning process, a public survey, two dedicated meetings for the public to attend, and a comment period were used to engage the public.

Butler County Hazard Mitigation Plan Public Survey

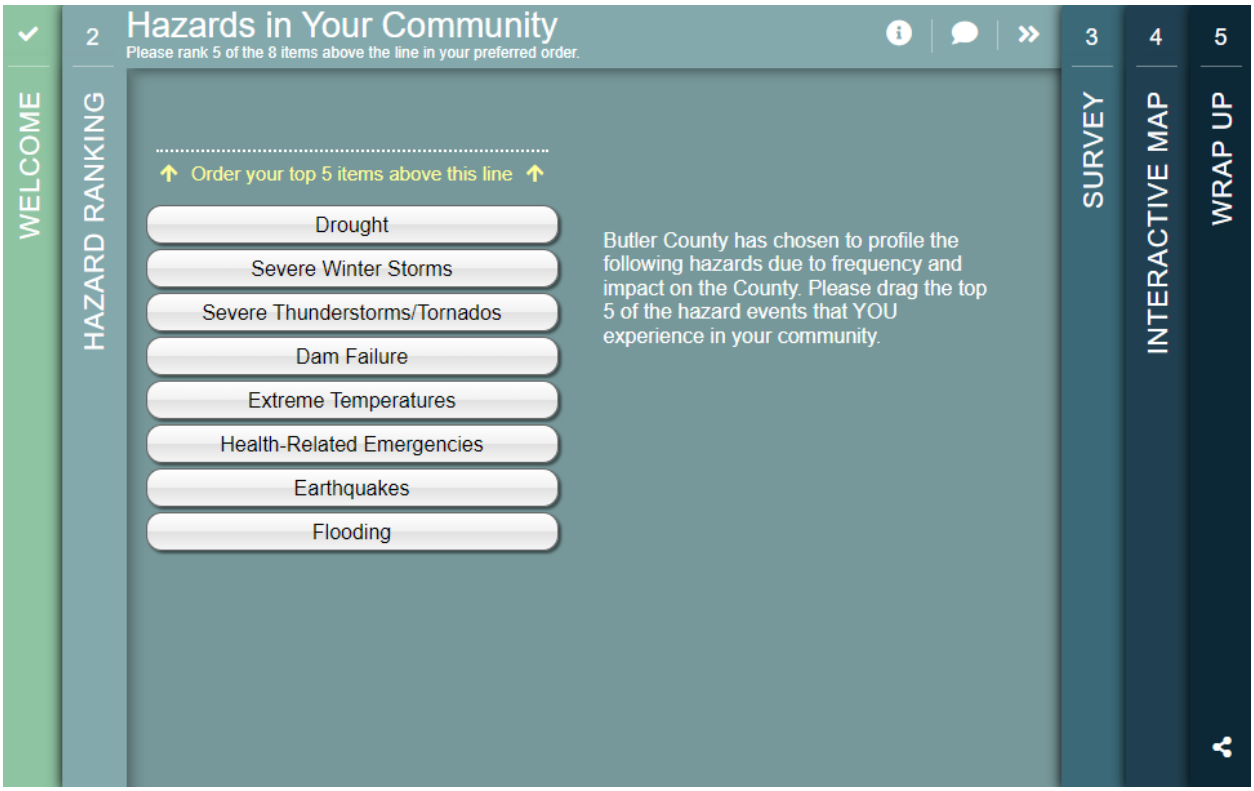
A public survey was developed through MetroQuest, an online engagement platform, for the residents of Butler County to complete. The survey was offered from April 17, 2023, through June 9, 2023, for all residents of the county. Paper copies of the survey were also developed and available at the two public meetings held.

The survey itself included a beginning slide that provided the survey participant with context on hazard mitigation, the importance of the plan, how the survey results would be incorporated into the hazard mitigation plan and alerted the participant to additional participation opportunities. The following image is the introductory slide to the virtual survey.

FIGURE 3-2 INTRODUCTORY SLIDE OF THE PUBLIC SURVEY

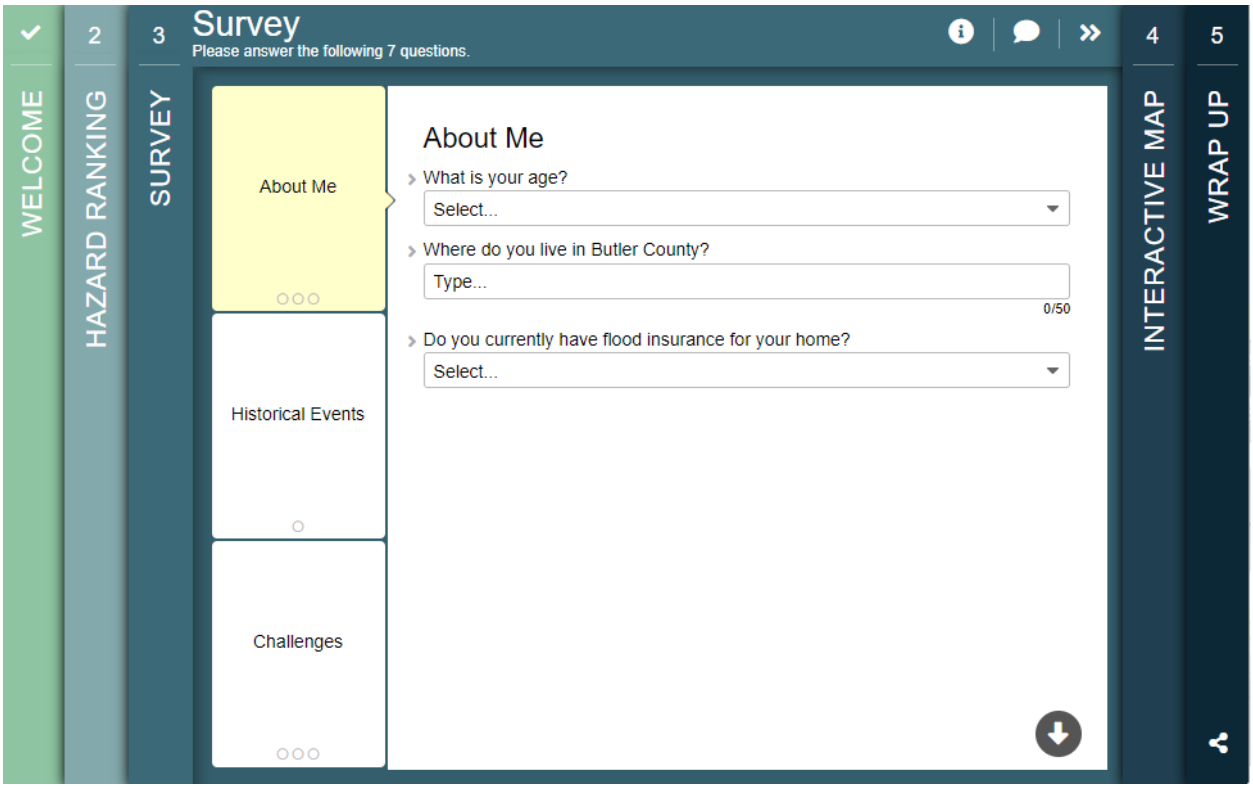
Following the introductory slide, the survey participant was asked to rank the top five hazards for where the participant lives in the county. Two of the profiled hazards were grouped together based on similarity of impacts, severe thunderstorms and tornadoes. The options to rank included: extreme temperatures, severe winter storms, dam failure, earthquakes, severe thunderstorms/tornadoes, drought, health-related emergencies, and flooding. The following image is the second slide of the virtual survey.

FIGURE 3-3 HAZARD RANKING SLIDE OF THE PUBLIC SURVEY



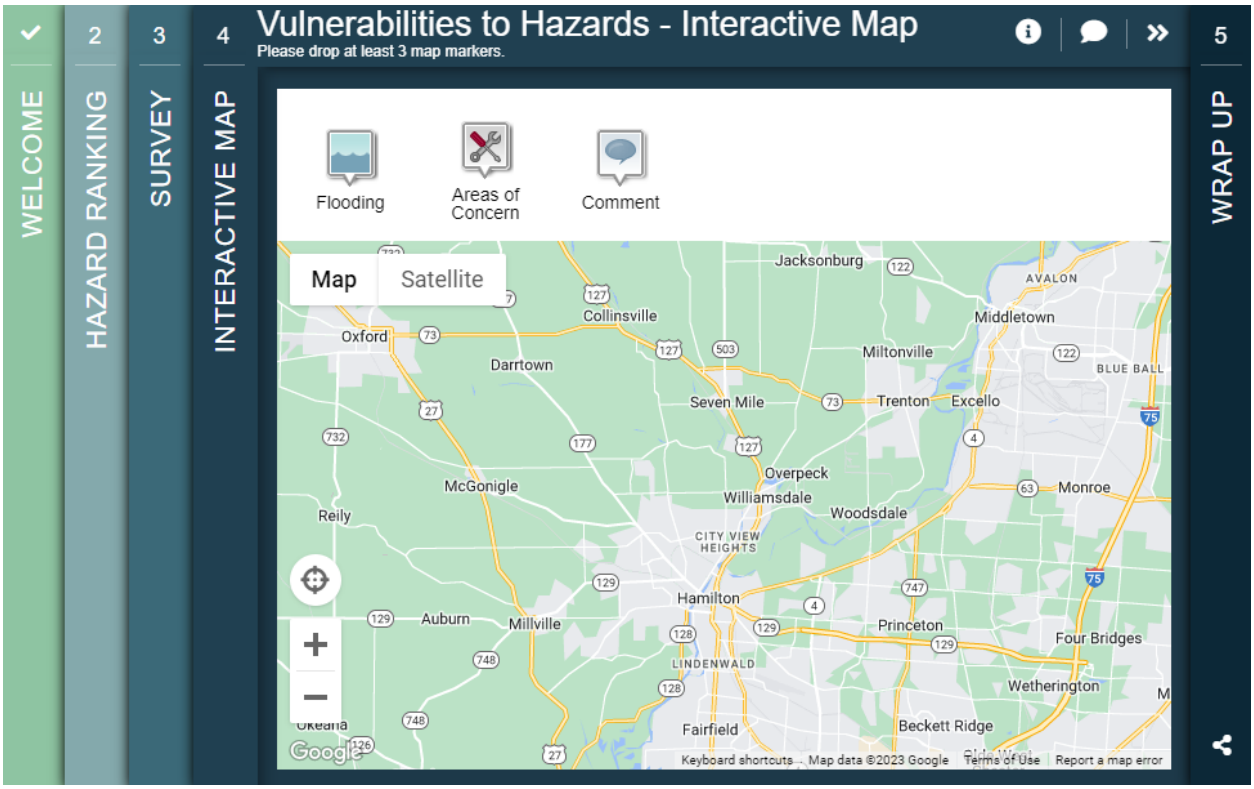
The third slide of the public survey included a brief survey of the participant, including asking the age range of the participant, community of which the participant lives in, if the participant currently has flood insurance. The third slide also asks the survey participant to provide information on the worst hazard event they have experienced in Butler County. Lastly, the third slide asks if there are any disaster events the survey participant's community is vulnerable to as well as any challenges the community faces that may delay disaster response. The following image is the third slide of the public survey.

FIGURE 3-4 THIRD SLIDE OF THE PUBLIC SURVEY



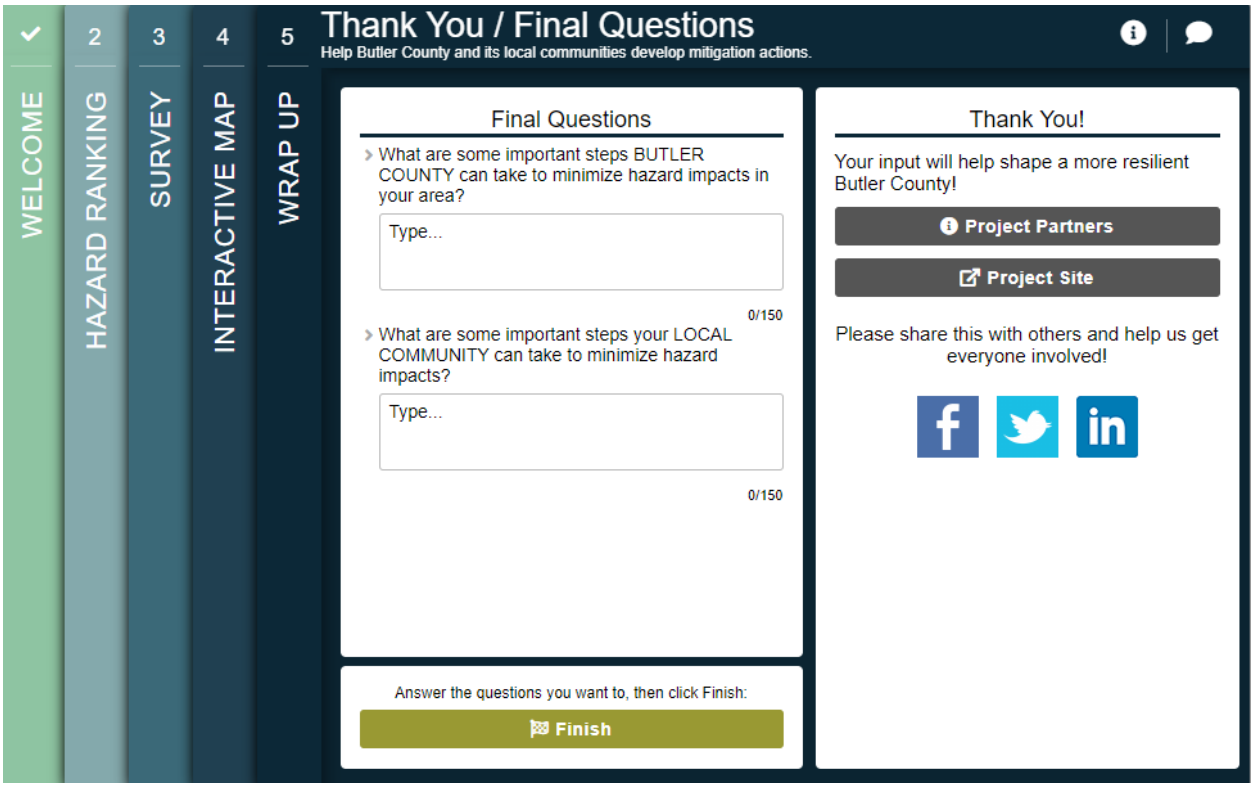
The fourth slide of the public survey asked participants to identify areas in their community that are known to constantly face issues from the hazards the community is vulnerable to through an interactive map that markers that were able to be placed on specific locations. The markers that the participant was able to place on the map included flooding, areas of concern, and general comment markers. The following image is the fourth slide of the public survey.

FIGURE 3-5 FOURTH SLIDE OF THE PUBLIC SURVEY



The last slide of the public survey included a Final Questions section that allowed the participant to identify important steps Butler County, as well as the respondent's local community, can take to minimize hazard impacts in the area. The survey participant was also able to share the public survey through their personal Facebook page, Twitter profile, and LinkedIn page. The following image is the last slide of the public survey.

FIGURE 3-6 FINAL SLIDE OF THE PUBLIC SURVEY



All outreach efforts used to spread awareness of the public survey by Butler County and its jurisdictions can be found in **Appendix A**. In total, 246 people visited the English version of the survey; 89 visitors completed the survey. 2 people visited the Spanish version of the survey; there were no responses. 68 people chose to complete the survey on a computer; 21 people completed the survey through their phones.

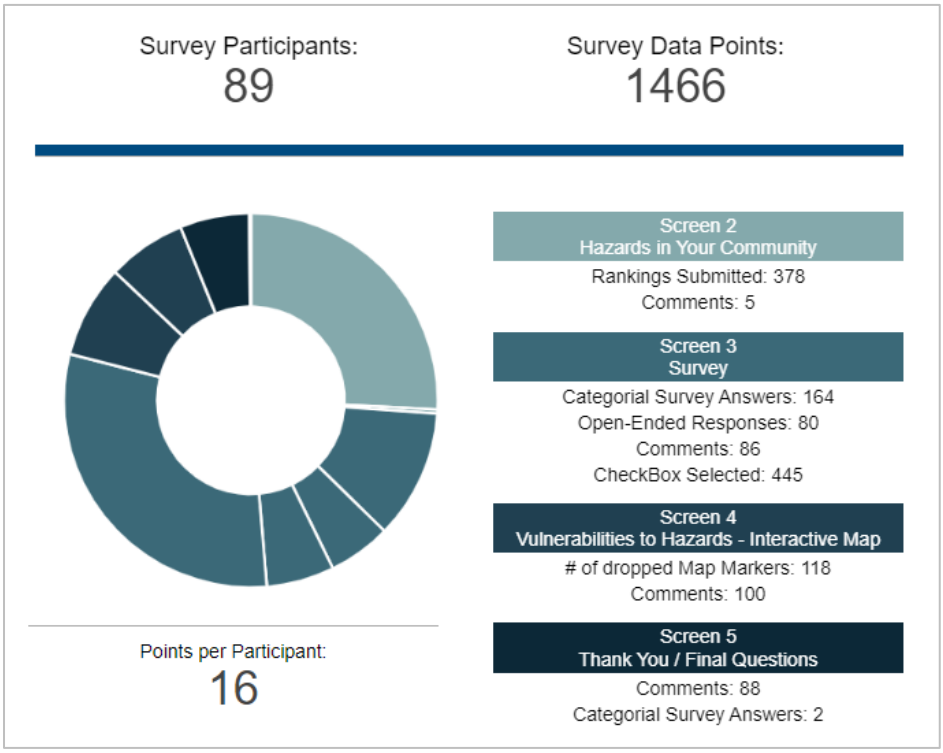
The summarized responses of the Butler County Hazard Mitigation Plan Public Survey are presented in the following narrative. All comments that were received in the public survey are summarized in the applicable narratives; the full list of public comments received as well as their status can be found in **Appendix F**.

TABLE 3-6 SURVEY PARTICIPATION WEEKLY BREAKDOWN

Week of Survey	Cumulative Total Number of Participants
April 16th	0
April 23rd	3
April 30th	16
May 7th	68
May 14th	81
May 21st	82
May 28th	84
June 4th	87
June 9th	89

The image below shows the total number of participants and how they participated in each portion of the survey. Overall, there was 1,466 points of engagement throughout the survey, with an average of 16 engagement points per participant.

FIGURE 3-7 BUTLER COUNTY SURVEY DATA POINTS OF ENGAGMEMENT



The following table displays the results from the hazard ranking slide of the public survey with the Hazard, the Ranking Average with 1 being the highest ranked and five being the lowest ranked, and Number of Inputs identifying how often the hazard was ranked in the top five by each survey respondent. Overall, Severe Thunderstorms/Tornadoes was ranked the most by participants, a total of 78 times out of the 89 responses with an average ranking of 1.97. Extreme Temperatures was ranked the second often, a total of 65 times out of the 89 responses with an average ranking of 3.62. Flooding was ranked the third most often, a total of 64 times out of the 89 responses with an average ranking of 3.03.

TABLE 3-7 HAZARD RANKING PUBLIC SURVEY RESULTS

Hazard	Ranking Average	Number of Inputs
Severe Thunderstorms/Tornadoes	1.97	78
Earthquakes	2.67	3
Flooding	3.03	64
Health-Related Emergencies	3.1	63
Severe Winter Storms	3.1	62
Extreme Temperatures	3.26	65
Drought	3.53	34

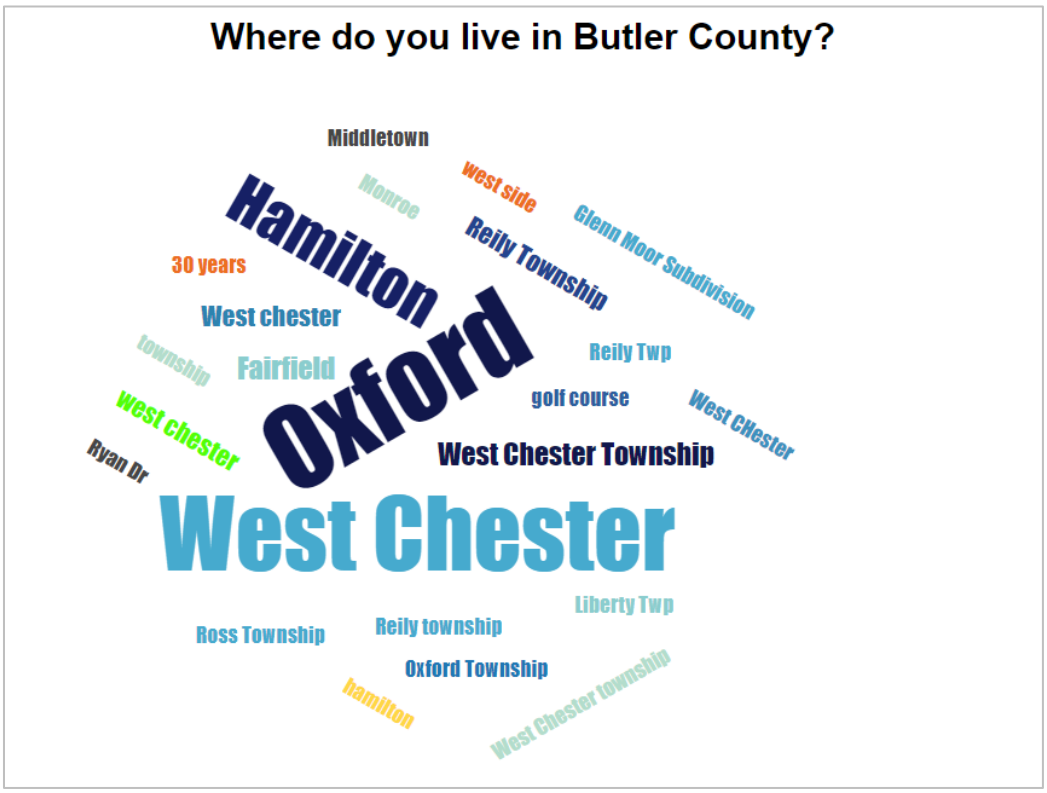
Dam Failure	4	9

The following table displays the age groups that responded to the public survey with the age ranges that were included in the survey as well as the number of respondents that were in each age range.

Age Range	Number of Respondents
18-29 years old	1
30-39 years old	7
40-49 years old	14
50-59 years old	22
60-69 years old	19
70-79 years old	18
80+ years old	2

The following word cloud was generated by MetroQuest for the responses of where the survey participants live in Butler County. The larger the word appears in the graphic indicates that multiple participants live in that specific community.

TABLE 3-8 WORD CLOUD FROM THE PUBLIC SURVEY

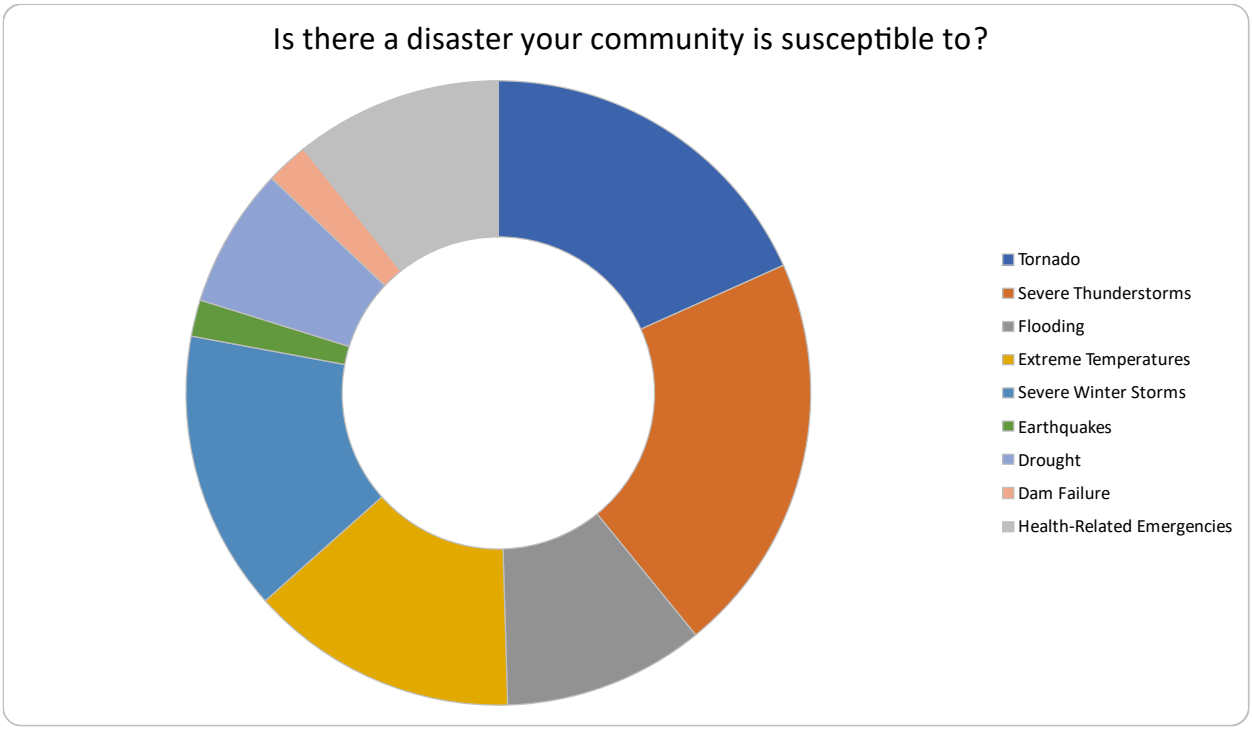


22 of the 89 survey participants currently have flood insurance for their home –59 of the respondents indicated they do not have flood insurance currently. 8 respondents chose to not answer the question.

The top responses for the worst historical hazard event participants have experienced in Butler County were tornado events, power outages, high wind events causing damage to power and structures, a blizzard, and severe weather.

The following pie chart shows the hazards that the participants' communities are vulnerable to. 66 participants selected Severe Thunderstorms, 58 participants selected Tornado, 46 participants selected Severe Winter Storms, 44 participants selected Extreme Temperatures, 34 participants selected Health-Related Emergencies, 33 participants selected Flooding, 23 participants selected Drought, 7 participants selected Dam Failure, and 6 participants selected Earthquakes.

FIGURE 3-8 HAZARD VULNERABILITY RESULTS FROM PUBLIC SURVEY



The following table displays the results from the question that asked what challenges the participant's community may delay disaster response. The table includes the challenges that the participant was able to pick from as well as the number of times the specific challenge was identified as applicable by a survey participant.

Challenge in Community	Number of Participant Selection
Lack of notice prior to a hazard event (i.e., tornado warning or no tornado sirens in area)	26
Not enough emergency personnel to respond to citizens in need	37
Community does not have a plan for post-disaster clean up	30
Post-disaster insurance issues	24
Other	11

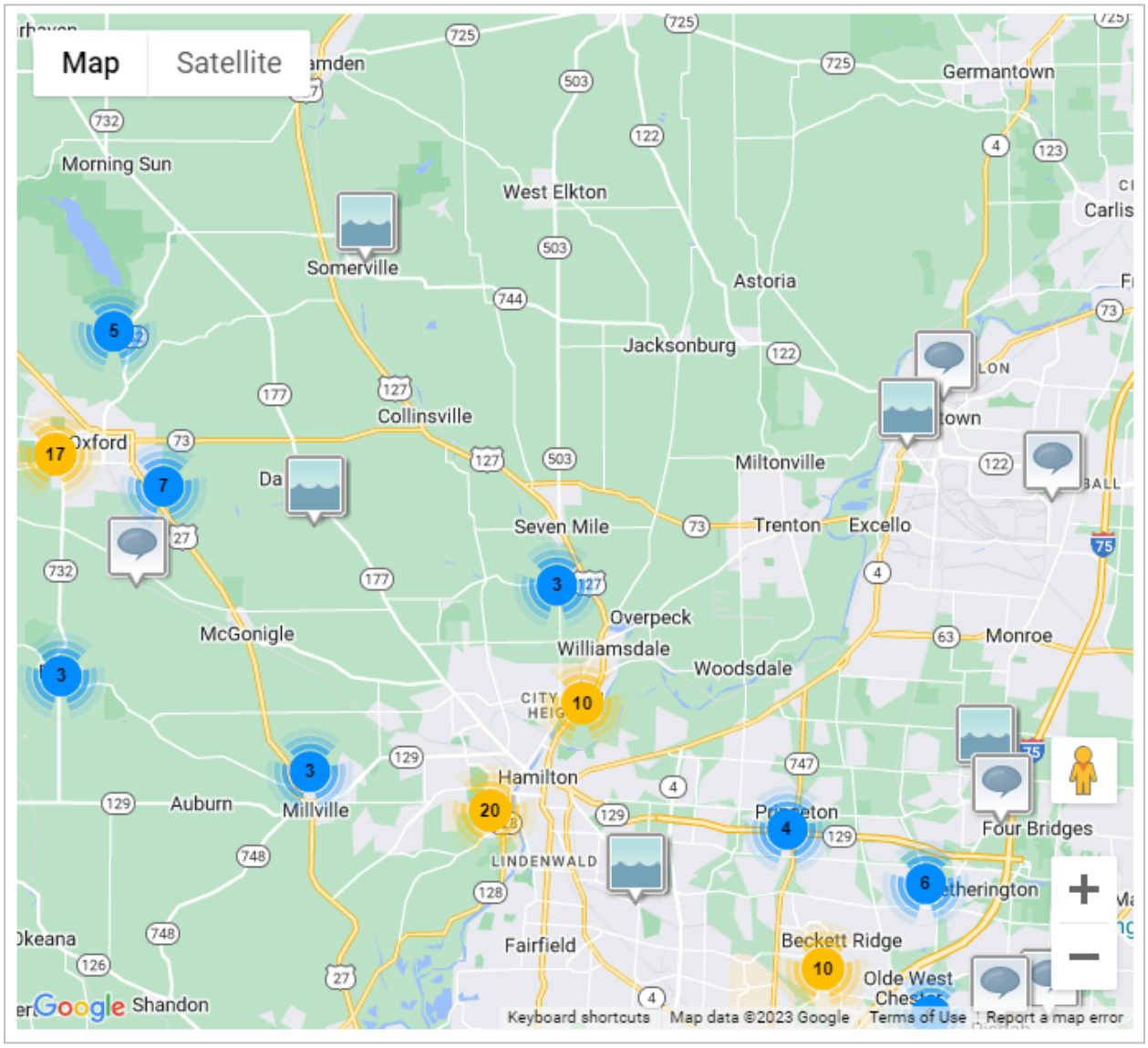
The responses that were given in the "Other" comment box were:

- It is unclear if there has been preparation for a grid-down scenario. Widespread power outage due to natural disaster (including solar flare), cyber-attack, targeted physical attacks which other parts of the country have experienced, or EMP. The grid technology/equipment is from the 1970s. Prepare for this and you will be prepared for any other worst-case scenario. If the mission is to protect the community, this is an area of utmost concern.
- Functioning tornado sirens and ensuring the sirens reach all areas of the county. Most sirens in West Chester do not work, leading to a bad situation.
- Lack of CERT in my community. Also, since I moved here in 2022 from the East Coast, I no longer receive tornado warnings via Wireless Emergency Alert (fortunately I have a NOAA weather radio).
- Elected officials are climate change deniers, but the root of extreme weather is climate change.
- Railway track s divide the community, access to fire and police help on only one side of tracks.
- My community, West Chester, does not provide residents information on its planning & capabilities in responding to a township-wide disaster.
- Lack of back-up electricity when the grid goes down following a severe storm. I have solar panels on my house, each with inverters to transfer DC to AC, but cannot use this or share it with my neighborhood when the grid is down. This is due to some regulation of the electricity grid at the state level. Changing that regulation should be a priority, so that locally generated electricity is available when a storm knocks out the grid.
- I have no idea what is in the plan for a post-disaster cleanup or if there is one.
- Lack of community plan for WHAT to do in case of different emergencies ~ eg, we hear the tornado alarms (usually only for monthly testing) > but what should we do if 1) out driving, 2) at home, 3) walking dog…etc.
- Pandemic response was poor across the board (not just a county issue, but a nationwide issue).
- Loss of cell towers. Loss of electricity could impact gas stations, home heating, refrigeration of food.

The following image shows the geographical results of the interactive map. Participants placed a total of 108 markers on the map – 44 of the markers identified specific flooding locations, 51 of the markers identified specific areas of concern, and 13 of the markers provided general comments of the specific location. The summary of comments included specific areas that are vulnerable to impacts from severe weather events, traffic congestion and roadway issues, bridge locations that are in poor condition and have an increased vulnerability to damage from earthquake or severe weather

events, specific areas where low-income residents live that may need increased response after an event, and a neighborhood that is vulnerable to chemical exposure.

FIGURE 3-9 INTERACTIVE MAP MARKER RESULTS FROM PUBLIC SURVEY



The final slide of the survey provided the participants an opportunity to share thoughts on important steps Butler County and their local community can take to minimize hazard impacts going forward. Overall, the summary of responses included continue to communicate local planning efforts, communicate emergency response and disaster recovery plans, improve drainage in areas prone to flash flooding, utilize natural systems to aid in mitigation efforts, increase the amount of sirens in the county and rural areas, bury utility lines to reduce power loss, incorporate climate change into planning efforts, and retrofit or move structures in hazard prone areas.

Public Meetings

Butler County held two dedicated public meetings during the planning process to further engage the public. The participating jurisdictions of the HMP reviewed the FEMA National Risk Index Social Vulnerability, the CDC/ATSDR Social Vulnerability Index, and the Council on Environmental Quality Climate and Economic Justice Screening Tool to identify the top locations in the county to hold the meetings. Other factors that were considered included proximity to public transit, holding the meeting after normal business hours, and not having a set agenda so that public attendees would not miss any content whenever they arrived or departed.

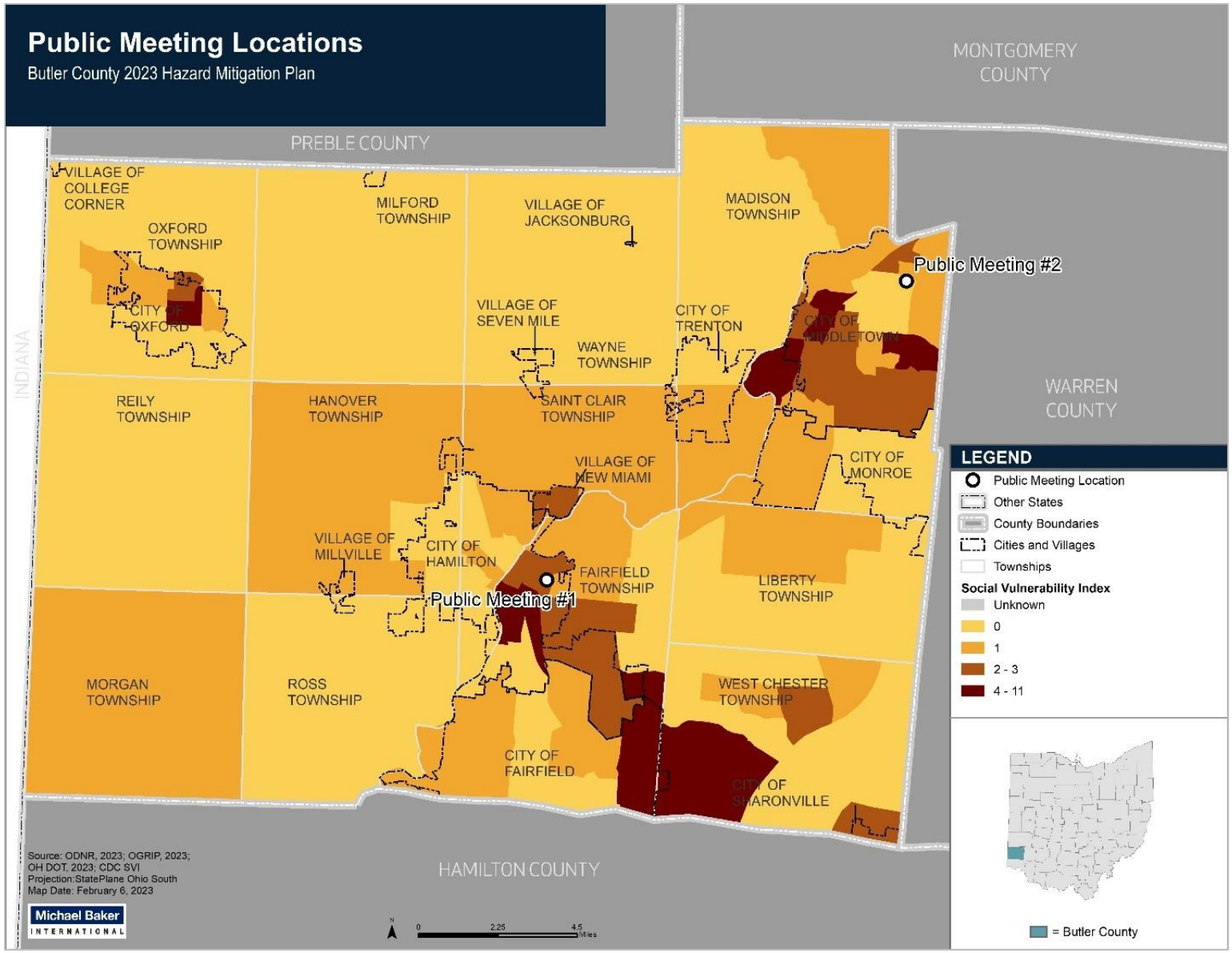
Public Meeting #1

The first public meeting held was on April 20, 2023, from 5:00 to 7:00 PM in the Butler County Educational Services Center. As show in Figure 3-10, the public meeting was located in a higher SVI scored area of the County. The CJEST tool discussed in Section 2.2.2 identifies the meeting location to be in a disadvantaged census tract. Additionally, the meeting was located in an urban, walkable area close to public transit. At the meeting, there was an informal PowerPoint projected for participants to view, a printed version of the public survey in both English and Spanish if the public did not have a mobile device to complete the survey on, informational flyers for the public to take home, and enlarged maps from the plan for the public to interact with. Although there were extensive efforts made by the county, communities, and stakeholders to encourage the public to attend and participate in the planning process, no members of the public attended the meeting. Documentation of the first public meeting can be found in **Appendix B**.

Public Meeting #2

The second public meeting was held on June 8, 2023, from 5:00 to 7:00 PM at the Miami University Middletown campus. As shown in Figure 3-10, the public meeting was located in a lower SVI scored area of the county, but the CJEST tool discussed in Section 2.2.2 shows the meeting location as directly bordering an underserved census tract in Middletown. The meeting location was also chosen due to the campus holding student orientation the same day in hopes of gathering public input from students, staff, and parents alike. Public transit was also in close proximity to the meeting location for ease of travel for the public should they wish to attend the meeting. At the meeting, there was an informal PowerPoint projected for participants to view, a printed version of the public survey in both English and Spanish if the public did not have a mobile device to complete the survey on, and enlarged maps from the plan for the public to interact with. Although the county, communities, and stakeholders made extensive efforts to encourage attendance of the meeting and participate in the planning process, no members of the public attended the meeting. Documentation of the second public meeting can be found in **Appendix B**.

FIGURE 3-10 BUTLER COUNTY SVI SCORES AND PUBLIC MEETING LOCATIONS



3.4.3 DRAFT PLAN COMMENTS RECEIVED

The plan was posted for public review on Butler County's HMP project website beginning on August 10th. The comment period for the participants, stakeholders, and public was open for two weeks, closing on August 24th. The following efforts were made to gather stakeholder and public input during the draft plan comment period. Documentation of these efforts can be found in **Appendix A**.

Butler County EMA dedicated an alert and pop-up on their official website to announce the open comment period to the plan participants, stakeholders, and public on August 10th. The Butler County EMA also posted on their Facebook page to alert the public and stakeholders of the draft plan's open comment period on August 15th, gathering one share of the post. The Facebook post directed users to the Butler County EMA's website, where they were then directed to the Butler County HMP Project Website. Stakeholders and the public alike were invited to submit comments on the draft plan through an online comment submission form, where they would identify the location of the content they were commenting on and the comment itself.

The draft plan was also printed off and posted at the Butler County EMA Office for review. Participants, stakeholders, and the general public was able to visit the EMA's office at 315 High Street, Suite 670, Hamilton, Ohio 45011 during the two-week comment period to provide suggestions, edits, and feedback on the draft plan in person.

There were no comments from the plan participants, stakeholders, or public received to incorporate into the final version of the plan.

3.4.4 REVIEW AND INCORPORATE EXISTING INFORMATION

The HMPC reviewed and assessed the existing plans, studies, and data available from local, state, and federal sources. The documents reviewed and incorporated as part of the HMP planning process are shown in Table 3-9.

TABLE 3-9 EXISTING PLANS, STUDIES, REPORTS, AND TECHNICAL DATA

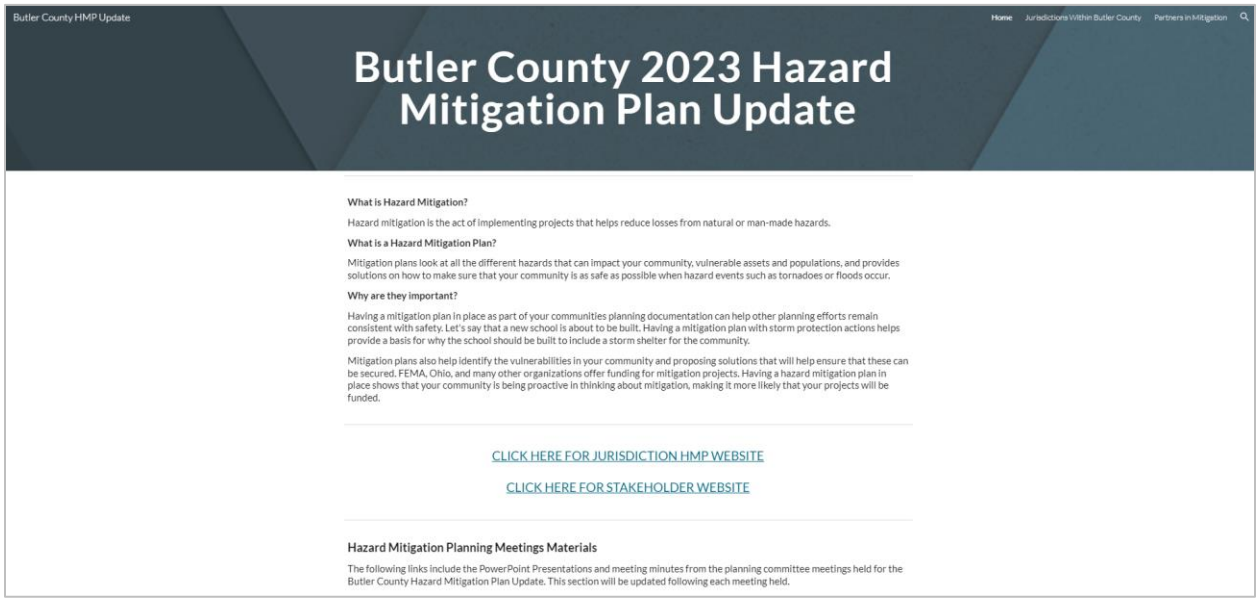
Existing Plans, Studies, Reports, and Other Technical Data/Information	Planning Process / Area of Document Inclusion
2018 Butler County Hazard Mitigation Plan	Used to help identify problems, mitigation goals, strategies and actions; information from the previous plan was used for past data
Ohio Enhanced Mitigation Plan	This plan was consulted for background information and hazard identification
FEMA National Risk Index	Used to identify locations of underserved communities within the county for potential public meeting locations and locations of vulnerable populations; hazard specific data incorporated into applicable hazard profiles
CDC/ATSDR Social Vulnerability Index	Used to identify locations of underserved communities within the county for potential public meeting locations and locations of vulnerable populations
Council on Environmental Quality Climate and Economic Justice Screening Tool	Used to identify locations of underserved communities within the county for potential public meeting locations and locations of vulnerable populations
FEMA Local Mitigation Planning Policy Guide	Used to identify the requirements of a local hazard mitigation plan and guide the development of the

	planning process, risk assessment, and mitigation strategy
FEMA Local Mitigation Planning Handbook	Local Plan Integration Methods
FEMA Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards, January 2013	Mitigation Strategy Development
NOAA Record Storm Events	Death and Injuries Report for past storm and disaster events
State of Ohio Mitigation Assistance Resource Guide	Referenced to identify potential funding sources and programs to assist with mitigation actions
NFIP Regulatory Butler County Flood Insurance Study and Flood Insurance Rate Maps	Technical information and data used throughout the flooding hazard profile to identify principal flood sources, flood zones, extent, and previous occurrences

3.4.5 BUTLER COUNTY HAZARD MITIGATION PLAN WEBSITE

A website was developed for local jurisdictions and stakeholders to provide the information needed to complete the Plan to compliment the forms provided at the meetings held. Upon accessing the website, seven forms were available for the local jurisdictions to complete; five forms were available for partners in mitigation, or stakeholders, to complete. Not only does it ensure participation that is required for jurisdictions to be able to adopt the HMPU, but the website adds to the diversity of methods used to encourage holistic involvement by each community. Hazard Priority Ranking, Risk Evaluation, Vulnerability Assessment, Changes in Development, Capability Assessment, Previous Actions, and New Actions Form were provided on the website – the seven required forms for each local jurisdiction to complete. Partners in mitigation, or stakeholders, were able to submit responses to the Hazard Priority Ranking, Risk Evaluation, Vulnerability Assessment, Changes in Development, and Capability Assessment. The Plan Update Resources tab contained the PowerPoints used for the meetings and meeting minutes as well as the previous plan for visitors to review. The tab was updated after both meetings held. Contact information was provided should the communities or stakeholders in Butler County have questions, and examples and links were embedded in the introductions of each form for guidance.

FIGURE 3-11 BUTLER COUNTY HMPU WEBSITE



3.4.6 ASSESS RISKS

In accordance with FEMA requirements, the 2023 HMPC identified and prioritized the natural and man-made hazards affecting the county and assessed the county's vulnerability to each one. Results from this phase of the HMP planning process later helped the HMPC identify appropriate mitigation actions to reduce risk in specific locations. This phase of the HMP planning process is detailed in Section 4.

Identify/Profile Hazards

Based on a review of past hazards and of the existing plans, reports, and other technical studies/data/information, the 2023 HMPC developed and identified a list of hazards that could affect Butler County. The content for each hazard profile is provided in Section 4.

Assess Vulnerabilities

Hazard profiling exposes the unique characteristics of individual hazards and begins the process of determining which areas of the county are vulnerable to specific types of hazard events. Using these methodologies, the team determined vulnerable populations, infrastructure, and potential loss estimates for each hazard. Detailed information on the vulnerability assessment for each hazard is provided in Section 4.

3.4.7 DEVELOP MITIGATION PLAN

The 2023 HMP was prepared in accordance with DMA 2000 and FEMA's HMP guidance documents. It provides an explicit strategy and blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and the county's ability to expand on and improve these existing tools. Developing the mitigation plan involved identifying goals, assessing existing capabilities, and identifying mitigation actions. This step of the HMP planning process is detailed in Section 5 and summarized below.

Identify Goals
The HMPC developed goals and objectives for the 2023 HMP, based on current information. These are presented in Section 5.

Develop Capability Assessment
A Capability Assessment is a comprehensive review of the various mitigation capabilities and tools currently available to the county to apply the mitigation actions prescribed in the 2023 HMP. The HMPC identified the technical, financial, and administrative capabilities to implement mitigation actions, as detailed in Section 5.

Identify Mitigation Actions
As part of the 2023 HMP planning process, the HMPC worked to identify and develop mitigation actions with implementation elements. Mitigation actions were prioritized, and detailed implementation strategies were developed during and after the meetings held with the communities. A detailed approach for the review of the existing mitigation actions, the identification and prioritization of new mitigation actions, and the creation of the implementation strategy is provided in Section 5.

Draft HMP
Once the risk assessment and mitigation strategy were completed, information, data, and associated narratives were compiled into the 2023 HMP.

Plan Review and Revision
County staff, participating jurisdictions, external stakeholders, and the general public were given the opportunity to review the plan. There were no comments received to incorporate into the final version.

Plan Approval
FEMA Region 5 approved the plan on MONTH DAY, YEAR.

Plan Maintenance
Plan maintenance procedures, found in Section 6, include the measures the county will take to ensure the HMP's continuous, long-term implementation. The procedures also include the way the HMP will be regularly monitored, reported upon, evaluated, and updated to remain a current and meaningful planning document.

SECTION 4. HAZARD IDENTIFICATION AND RISK ASSESSMENT (HIRA)

Hazard Identification and Risk Assessment is the process of measuring the potential effects of natural and man-made hazards on life, property and the economy. The risk assessment is meant to identify, as much as practical given the existing/available data, a community's qualitative and quantitative vulnerabilities. The results of the risk assessment provide a framework for a better understanding potential impacts to the community and a foundation on which to develop and prioritize mitigation actions (see Section 5). Mitigation actions can reduce damage from all disasters. An implementation strategy can direct scarce resources to the areas of greatest vulnerability, as described in this section.

This risk assessment follows the methodology described in FEMA publication *386-2 (2002)*, *Understanding Your Risks—Identifying Hazards and Estimating Losses.* The publication outlines a four-step process:

1) Identify hazards

2) Profile hazard events

3) Inventory assets

4) Estimate losses

Information related to these four steps and gathered during the planning process is incorporated into the discussions in this chapter.

This section identifies and prioritizes the identified natural and man-made hazards that threaten Butler County. The reasoning for omitting some hazards from further consideration is also provided.

Section 4, Sub-sections 1 through 10 The Hazard Profiles describe each hazard that poses a threat to the county. They include information on the location, extent/magnitude/severity, previous occurrences, and likelihood of future occurrences.

Each hazard profile includes a Vulnerability Assessment, which presents the county's exposure to natural and man-made hazards and identifies at-risk populations and assets, including critical facilities. Where information was available, potential dollar loss estimates for facilities show a partial representation of the financial cost of a disaster.

IDENTIFYING THE HAZARDS

Per FEMA guidance, the first step in developing a Risk Assessment is to identify the hazards. The HMPC reviewed several previously prepared hazard mitigation plans and other relevant documents to determine the universe of all-hazards planning with respect to the county.

Hazards were ranked to provide structure and to prioritize the mitigation goals and actions discussed in this plan. Ranking was both quantitative and qualitative. The quantitative analysis considered all the information available, including GIS data and official government records. The qualitative approach, the Risk Factor (RF) approach and the hazard priority ranking approach, was used to rank the specific risks associated with each hazard for each participating jurisdiction. These processes can also be used as a valuable cross-check or validation of the quantitative analysis and identify the increased or lower risk of a hazard in areas of the county.

The RF approach combines historical data, local knowledge, and consensus opinions to produce numerical values; they can be used to rank identified hazards against one another. During the planning process, the Planning Committee checked the results of the hazard profile with their local and historical knowledge to generate a set of ranking criteria. These criteria were used to evaluate hazards and identify the highest risk hazard.

RF values are obtained by assigning varying degrees of risk to five categories for each hazard: probability, impact, spatial extent, warning time, and duration. Each degree of risk was assigned a value from 1 to 4, and the Planning Committee agreed on a weighting factor for each category. To calculate the RF value for a given hazard, the assigned risk value for each category was multiplied by the weighting factor. The sum of all five categories is equal to the final RF value, as demonstrated in the sample equation below:

TABLE 4-1 RISK FACTOR CRITERIA

Risk Assessment Category	Level	Degree of Risk Level	Index	Weight
PROBABILITY *What is the likelihood of a hazard event occurring in a given year?*	**Unlikely**	Less Than 1% Annual Probability	1	30%
	Possible	Between 1 and 10% Annual Probability	2	
	Likely	Between 10 and 100% Annual Probability	3	
	Highly Likely	100% Annual Probability	4	
IMPACT *In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?*	**Minor**	Very few injuries, if any. Only minor property damage and minimal disruption of quality of life. Temporary shutdown of critical facilities.	1	30%
	Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one day.	2	
	Critical	Multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one week.	3	
	Catastrophic	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
GEOGRAPHIC LOCATION *How large of an area could be impacted by a hazard event? Are impacts localized or regional?*	**Negligible**	Less Than 1% Of Area Affected	1	20%
	Small	Between 1 and 10% Of Area Affected	2	
	Moderate	Between 10 and 50% Of Area Affected	3	
	Large	Between 50 and 100% Of Area Affected	4	
WARNING TIME *Is there usually some lead time associated with the hazard event? Have warning measures been implemented?*	**More than 24 HRS**	Self-Defined	1	10%
	12 to 24 HRS	Self-Defined	2	
	6 to 12 HRS	Self-Defined	3	
	Less than 6 HRS	Self-Defined	4	
DURATION *How long does the hazard event usually last?*	**Less than 6 HRS**	Self-Defined	1	10%
	Less than 24 HRS	Self-Defined	2	
	Less than 1 week	Self-Defined	3	
	More than 1 week	Self-Defined	4	
RF Value = [(Probability x .30) + (Impact x .30) + (Geographic Location x .20) + (Warning Time x .10) + (Duration x .10)]				

According to the default weighting scheme applied, the highest possible RF value is 4.0. The methodology illustrated above lists the categories used to calculate the variables for the RF value.

Table 4-2 provides the risk factor value for each hazard profiled in this plan, with the numerical value assigned to that hazard. The risk factor is developed through assessing the probability, impact, spatial extent, warning time, and duration of each hazard type.

TABLE 4-2 BUTLER COUNTY RISK FACTOR HAZARDS

Natural Hazards		Probability		Impact		Spatial Extent		Warning Time		Duration		RF Rating
1	Severe Thunderstorms	4	1.2	2	0.6	2	0.4	2	0.2	1	0.1	2.5
2	Extreme Temperatures	3	0.9	1	0.3	4	0.8	2	0.2	3	0.3	2.5
3	Severe Winter Storms	2	0.6	1	0.3	4	0.8	2	0.2	3	0.3	2.2
4	Drought	2	0.6	1	0.3	4	0.8	1	0.1	4	0.4	2.2
5	Earthquakes	1	0.3	1	0.3	4	0.8	4	0.4	4	0.4	2.2
6	Tornadoes	3	0.9	2	0.6	1	0.2	2	0.2	1	0.1	2.0
7	Dam/Levee Failure	1	0.3	1	0.3	2	0.4	3	0.3	4	0.4	1.7
8	Flooding	3	0.9	1	0.3	1	0.2	1	0.1	2	0.2	1.7
9	Health Related Emergencies	2	0.6	1	0.3	1	0.2	2	0.2	3	0.3	1.6
Man-Made Hazards		**Probability**		**Impact**		**Spatial Extent**		**Warning Time**		**Duration**		**RF Rating**
1	Hazardous Materials Incidents	4	1.2	2	0.6	1	0.2	4	0.4	1	0.1	2.5

Table 4-3 shows the hazards that are included in State of Ohio HMP and those in the previous version of the plan, adopted in 2018. In this plan update, Butler County has identified two additional hazards it is vulnerable to as well as the eight hazards that were profiled in the 2018 hazard mitigation plan.

TABLE 4-3 HAZARDS INCLUDED IN THE 2023 PLAN UPDATE

Hazard Addressed	Ohio HMP	Butler County 2018 HMP	Butler County 2023 HMP	Notes
Flood	O	O	O	Hazard profile titled "Flooding" in 2023 plan
Tornado	O	O	O	
Winter Storm	O	O	O	Hazard profile titled "Severe Winter Storms" in 2023 plan
Landslide	O	X	X	There are no recorded landslide occurrences on the USGS Landslide Inventory
Dam and Levee Failure	O	O	O	Levee Failure was not fully profiled in the Butler County 2018 HMP; there is a full profile for levee failure in the 2023 Butler HMP
Wildfire	O	X	X	The NCDC Storm Events Database does not have any recorded wildfire events in Butler County
Seiche/Coastal Flooding	O	X	X	There are no coasts located in Butler County
Earthquakes	O	O	O	
Coastal Erosion	O	X	X	There are no coasts located in Butler County
Drought	O	O	O	
Severe Summer Storms	O	O	O	Hazard profile titled "Severe Thunderstorms" in 2023 plan
Invasive Species	O	X	X	The county is not at a heightened risk to this hazard.
Land Subsidence	O	X	X	The county is not at a heightened risk to this hazard.
Extreme Temperatures	X	O	O	Heat Emergencies was profiled in the 2018 Butler HMP; both extreme heat and extreme cold are profiled in the Extreme Temperatures hazard profile in the 2023 Butler County HMP
Health Related Emergencies	X	X	O	
Hazardous Materials Incidents	X	X	O	

Previous hazard occurrences were used to validate existing hazards and identify new hazard risks. Previous occurrences provide a historical view of hazard risk and a window into hazards that could affect Butler County and its population in the future. The information in Table 4-4 about federal disaster declarations in the county was compiled from FEMA databases. According to FEMA, Butler County has been a part of 14 federal disaster declarations to date; six of these received public assistance dollars and two received individual assistance.

TABLE 4-4 DECLARED DISASTERS AFFECTING BUTLER COUNTY (FEMA)

Disaster Number	Declaration Date	Title	Public Assistance	Individual Assistance
DR-243	6/5/1968	Heavy Rains, Flooding	-	-
DR-421	4/4/1974	Tornadoes	-	-
EM-3055	1/26/1978	Blizzards and Snowstorms	-	-
DR-831	6/10/1989	Severe Storms, Flooding	-	-
DR-870	6/6/1990	Flooding, Severe Storm, Tornado	-	-
DR-1122	6/24/1996	Flooding	-	-
DR-1390	8/27/2001	Severe Storms & Flooding	$5,935,229.86*	-
DR-1556	9/19/2004	Severe Storms and Flooding	$25,804,256.17*	$23,662,227.18*
EM-3198	1/11/2005	Snow	$8,636,637.81*	-
EM-3250	9/13/2005	Hurricane Katrina Evacuation	$2,541,599.60*	-
DR-1805	10/24/2008	Severe Wind Storm Associated with Tropical Depression Ike	$38,841,921.56*	-
EM-3346	6/30/2012	Severe Storms	-	-
EM-3457	3/13/2020	Covid-19	-	-
DR-4507	3/31/2020	Covid-19 Pandemic	$356,989,329.88*	$137,338,074.82*

**Indicates data from FEMA's Disaster Declarations website. The dollar amounts refer to total funds delegated to all counties within the declared disaster, not just Butler County.*

The Ohio Mitigation Information Portal also includes a list of disasters that have impacted each county within the state. The following table includes the total dollar amounts provided for the declared disasters in Butler County.

TABLE 4-5 DECLARED DISASTERS FOR BUTLER COUNTY (OHIO MITIGATION PORTAL)

Disaster Number	Total Dollars Made Available for Impacted Counties
DR-1122	$10,811,838.00
DR-1390	$7,712,456.00
DR-167	$571,482.00
DR-243	$600,000.00
DR-3055	$3,546,669.00
DR-421	$10,250,454.00
DR-831	$0.00
DR-870	$10,847,075.00
DR-90	$1,434,684.00
EM-3198	$11,116,398.00
EM-3250	$2,499,103.00

In addition to the federal disaster declarations, Butler County has also been affected by 5 gubernational declared disasters since 1996 through 2022. The information in the following table

shows the disaster declaration date, incident causing the declaration, and the financial assistance programs associated with the disaster. The asterisk included in the Financial Assistance Program column denotes that although those programs were available for the disaster, it does not indicate that Butler County received funding. The corresponding federal disaster declaration number is also included, as applicable. Butler County has not had any state declared disasters since March 2018.

TABLE 4-6 DECLARED DISASTERS AFFECTING BUTLER COUNTY (OEMA)

Declaration Date	Incident	Financial Assistance Programs
May 7, 1996; amended May 16, June 4, June 24, and July 8, 1996	May/July 1996 Flooding and Flash Flooding	PA, HMGP (DR-1122)*
July 19, 2001; amended August 14, 2001	July 2001 Severe Storms and Flooding	State IA, SBA, PA, HMGP (DR-1390)*
January 9, 2004; amended January 22, 2004	January 2004 Flooding and Severe Storms	IA, PA, HMGP (DR-1507)*
December 28, 2004; amended January 13, January 31, April 21, 2005	December 22, 2004 – February 15, 2005, Severe Winter Storm, Ice, Flooding, Record Snowfall	IA, PA, HMPG (EM-3250 and DR-1580)*
March 18, 2018	February 2018 Significant Weather Events	FHWA*

The following table displays the results of the Risk Evaluation form completed by each Butler County jurisdiction. The form asks respondents to evaluate how the hazards from the previous plan have changed in regards to risk to the jurisdiction or agency. “I” indicates that the jurisdiction has seen an increase in risk to the hazard; “D” indicates that the jurisdiction has seen a decrease in risk to the hazard; and “NC” indicates the jurisdiction has seen no change in risk to the hazard. The responses provided by stakeholders during the planning process are located in Appendix I.

TABLE 4-7 BUTLER COUNTY RISK EVALUATION JURISDICTION FORM RESPONSES

	Butler County	Fairfield	Hamilton	Middletown	Monroe	Oxford	Sharonville	Trenton	College Corner	Jacksonburg	Millville	New Miami	Seven Mile
Tornado	I	NC	NC	I	NC	NC	NC	I	NC	NC	NC	NC	NC
Severe Thunderstorms	NC	I	NC	NC	I	I	I	I	I	I	I	I	I
Flooding	NC	I	I	NC	I	I	D	I	I	NC	NC	NC	I
Extreme Temperatures	NC	NC	I	NC	NC	I	NC	I	NC	I	NC	NC	NC
Severe Winter Storms	NC	NC	NC	NC	I	NC	NC	I	NC	NC	NC	NC	NC
Earthquakes	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Drought	I	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Dam/Levee Failure	NC	NC	NC	NC	NC	NC	D	NC	NC	NC	NC	NC	NC

HAZARD EVENT DATA

A variety of information sources were consulted to develop the hazard profiles in this plan, including data from the National Oceanic and Atmospheric Administration (NOAA), the National Climatic Data Center (NCDC), and regional National Weather Service (NWS) locations. This data is largely available at a countywide scale, but jurisdiction-level details are often available as well.

NOAA did not record data events for all of the hazards that it currently reports for beginning in 1950. From 1950-1954, the only data recorded was for tornado hazard events. Then from 1955-1992, NOAA began recorded event data for the hazards of tornado, thunderstorm wind and hail. Starting in 1996 to present day, NOAA began to record and report event data for the forty-eight hazards that users can select to view on the database's page. The hazards the NOAA reports event data for are: astronomical low tide, avalanche, blizzard, coastal flood, cold/wind chill, debris flow, dense fog, dense smoke, drought, dust devil, dust storm, excessive heat, extreme cold/wind chill, flash flood, flood, freezing fog, frost/freeze, funnel cloud, hail, heat, heavy rain, heavy snow, high surf, high wind, hurricane (typhoon), ice storm, lake-effect snow, lakeshore flood, lightning, marine hail, marine high wind, marine strong wind, marine thunderstorm wind, rip current, seiche, sleet, sneakerwave, storm

surge/tide, strong wind, thunderstorm wind, tornado, tropical depression, tropical storm, tsunami, volcanic ash, waterspout, wildfire, winter storm, and winter weather.

EVENT NARRATIVES

Within the section for each hazard, a series of narratives provides greater detail on specific events that affected the county. This section (Historical Occurrences, or in some cases Hazard Events/ Historical Occurrences) is not meant to be a comprehensive list of Butler County events. Rather, it provides a context for why the plan includes this hazard.

HAZARD PROFILES

Hazards are profiled individually in this section, in order of priority based on the Risk Factor calculations. These profiles have a baseline definition and describe the hazard in relation to Butler County. Hazard profiles are used to develop a vulnerability assessment, where the community's vulnerability to each hazard deemed significant by the Planning Committee is quantified in terms of population and assets affected.

The hazards that are technological or man-made include additional details in each profile's summary that briefly discuss mitigation best practices, as these hazards are not included in standard mitigation handbooks.

CRITICAL FACILITIES

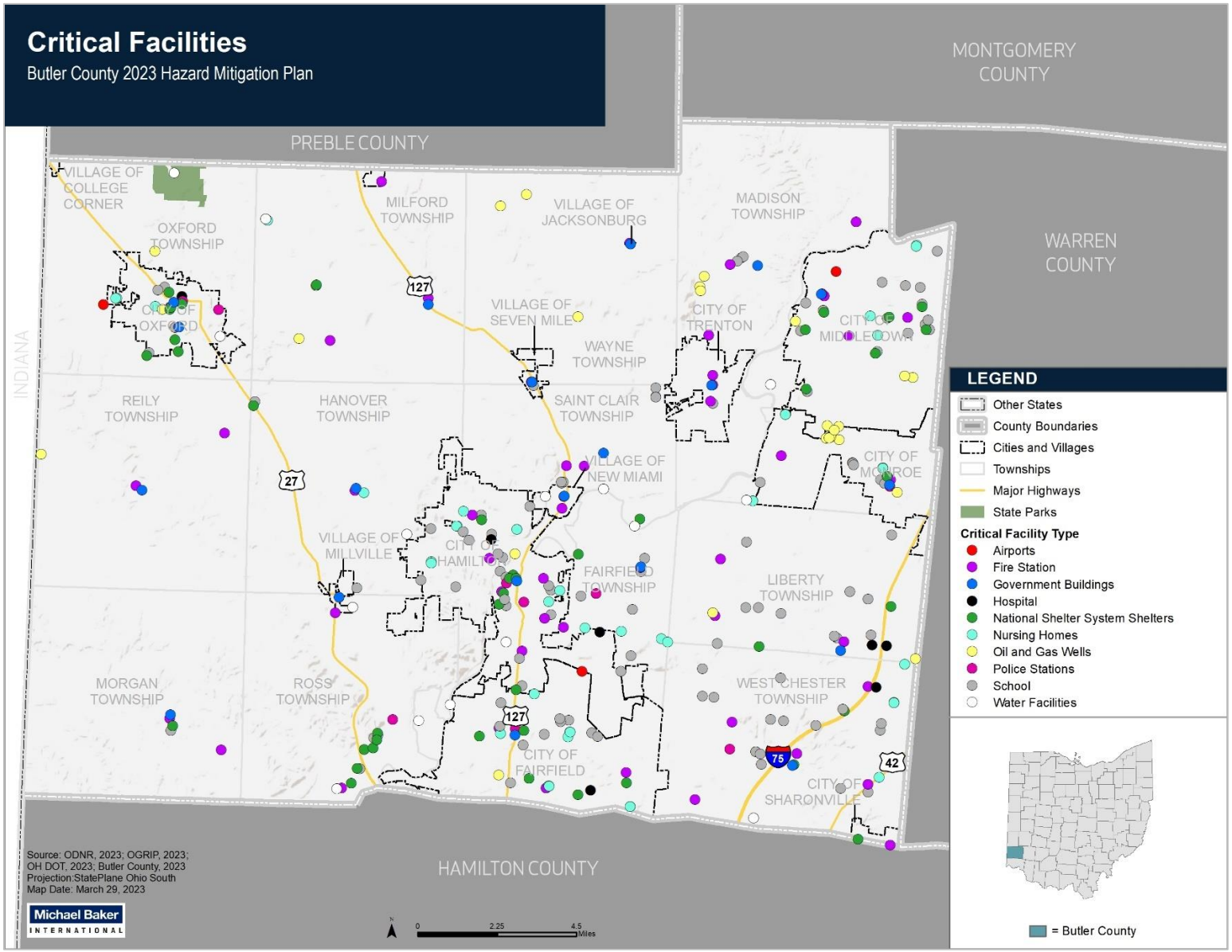
The Planning Committee identified the types of structures they consider to be "critical" to the county's day-to-day operations. This includes government structures (20), nursing homes (41), fire stations (46), police stations (15), hospitals (7), airports (2), National Shelter System Shelters (43), oil and gas wells (28), water facilities (29), and schools (106). Butler County has 337 critical facilities, which are mapped in

Figure 4-1.

TABLE 4-8 BUTLER COUNTY CRITICAL FACILITIES

Category	Number	Data Source
Government	20	USGS
Nursing Homes	41	Butler County
Fire Stations	46	Butler County
Police Stations	15	Butler County
Hospitals	7	Butler County
Airports	2	Butler County
National Shelter System Shelters	43	HIFLD
Oil and Gas Wells	28	ODNR
Water Facilities (Potable and Wastewater)	29	CDMS
Schools	106	Butler County
Grand Total	**337**	

FIGURE 4-1 BUTLER COUNTY CRITICAL FACILITIES



Natural Hazards

1. SEVERE THUNDERSTORMS

Hazard	Probability		Impact		Spatial Extent		Warning Time		Duration		RF Rating
Severe Thunderstorms	4	1.2	2	0.6	2	0.4	2	0.2	1	0.1	2.5
Moderate Risk Hazard (2.0 – 2.99)											

4.1.1 SEVERE THUNDERSTORM DESCRIPTION

Ohio can have extreme weather conditions in any season. Thunderstorms, associated with strong winds, heavy precipitation, and lightning strikes, can be hazardous under the right conditions and locations. Strong winds and tornadoes can take down trees, damage structures, tip high-profile vehicles, and create high velocity flying debris. Large hail can damage crops, dent vehicles, break windows, and injure or kill livestock, pets, and people. Even the remnants of tropical storms and hurricanes have brought severe wind damage and flooding to the state.

- **Thunderstorms** affect smaller areas than hurricanes or winter storms. The typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. Despite their size, thunderstorms are dangerous. Of the estimated 100,000 thunderstorms that occur each year in the United States, about 10% are classified as severe. The National Weather Service considers a thunderstorm severe if it produces hail at least 3/4 inch in diameter, winds of 58 MPH or stronger, or a tornado. Every thunderstorm needs three basic components: (1) moisture to form clouds and rain; (2) unstable air, which is warm air that rises rapidly; and (3) lift, which is a cold or warm front capable of lifting air to help form thunderstorms.

- **Downburst winds** can cause more widespread damage than a tornado. They occur when air is carried into a storm's updraft, cools rapidly, and comes rushing to the ground. Cold air, being denser than warm air, falls quickly to the surface. On warm summer days, when the cold air can no longer be supported by a storm's updraft, or when an exceptional downdraft develops, the air crashes to the ground in the form of strong winds. These winds are forced to spread out horizontally when they reach the ground and can cause significant damage. This type of strong wind is also referred to as a straight-line wind. Downbursts with a diameter of less than 2.5 miles are called microbursts, and those with a larger diameter are called macrobursts. A derecho, or bow echo, is a series of downbursts associated with a line of thunderstorms. This type of phenomenon can extend for hundreds of miles and have wind speeds in excess of 100 mph.

- **Lightning**, although not defined as a severe hazard by the National Weather Service, can accompany heavy rain during thunderstorms. Lightning develops when ice particles in a cloud move around, colliding with other particles. These collisions cause electrical charges to separate. Positively charged ice particles rise to the top of the cloud, and negatively charged ones fall to the middle and lower sections. The negative charges at the base of the cloud attract positive charges at the surface of the Earth. Invisible to the human eye, the negatively

charged area of the cloud sends a charge called a stepped leader toward the ground. Once it gets close enough, a channel develops between the cloud and the ground. Lightning is the electrical transfer through this channel. The channel rapidly heats to 50,000 degrees Fahrenheit and contains approximately 100 million electrical volts. The rapid expansion of the heated air causes thunder.

- Hail develops when a super-cooled droplet collects a layer of ice and continues to grow, sustained by the updraft. Once the updraft can no longer hold up the hail stone, the stone falls to the ground. Nationally, hailstorms cause nearly $1 billion in property and crop damage annually, as peak activity coincides with peak agricultural seasons. Severe hailstorms also cause considerable damage to buildings and automobiles but rarely result in loss of life. Hailstones are usually less than 2 inches in diameter and can fall at speeds of 120 miles per hour (mph), which can be destructive to roofs, buildings, automobiles, vegetation, and crops.
- Heavy Rain is defined as rainfall amounts larger than 0.49 inches in an hour. In the winter months, heavy rain is defined as rainfall amounts greater than 0.24 inches an hour. Typically, heavy rainfalls occur between 6 PM and midnight Rain develops as air rises, cools, and the water vapor within the air condenses into droplets of water, eventually condensing enough to create a cloud of many water droplets around condensation nuclei. As the water droplets within the condensed cloud continue to grow, they begin to fall as rain drops to the earth.

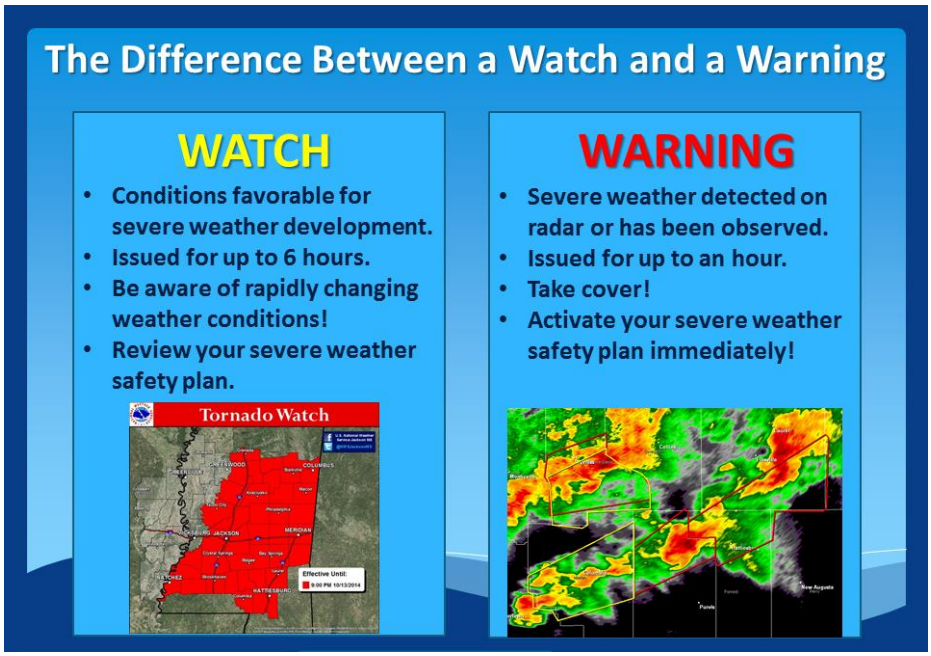
4.1.2 SEVERE THUNDERSTORM LOCATION

Severe thunderstorm events are generally county-wide or region-wide events that could affect all communities in Butler County. On occasion, only part of the county experiences the weather, due to the location in which the storm develops and the path it travels.

4.1.3 EXTENT

The National Weather Service issues thunderstorm watches and warnings. No watches or warnings apply to lightning. The following image explains the difference between NWS watches and warnings.

FIGURE 4-2 NWS WATCH VS. WARNING



The Beaufort scale is used to measure wind speeds. It is based on observation, rather than actual measurement. It is the most widely used system to measure wind speed today. There are 12 levels, plus 0 for “no wind.”

TABLE 4-9 BEAUFORT SCALE

Beaufort Number	MPH	Description	Observation
0	<1	Calm	Calm. Smoke rises vertically.
1	1-3	Light air	Wind motion visible in smoke.
2	3-7	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	Gentle breeze	Leaves and smaller twigs in constant motion.
4	13-17	Moderate breeze	Dust and loose paper raised. Small branches begin to move.
5	18-24	Fresh breeze	Branches of a moderate size move. Small trees begin to sway.
6	25-30	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	31-38	High wind, Moderate Gale, Near Gale	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	39-46	Fresh Gale	Twigs broken from trees. Cars veer on road.
9	47-54	Strong Gale	Larger branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	55-63	Whole Gale/Storm	Trees are broken off or uprooted, saplings bent and deformed, poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	64-72	Violent storm	Widespread vegetation damage. More damage to most roofing surfaces, asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	≥73	Hurricane-force	Considerable and widespread damage to vegetation, a few windows broken, structural damage to mobile homes and poorly constructed sheds and barns. Debris may be hurled about.

TABLE 4-10 HAIL SIZE COMPARISON CHART

Common Object	Size in Diameter
Pea	0.25 Inch
Penny or Dime	0.75 Inch
Quarter	1.00 Inch
Half Dollar	1.25 Inch
Golf Ball	1.75 Inch
Tennis Ball	2.50 Inch
Baseball	2.75 Inch
Grapefruit	4.00 Inch

Hail sizes can differ greatly from one storm to another, depending on the strength of the storm's updraft. Stronger updrafts can create larger hailstones, which cause more damage. This makes reporting the size of hail important for public safety. The preferred hail measurement method is to use a ruler to measure the diameter of the hail stone along its longest axis. However, various coins and balls are often used when reporting hail size.

Heavy rain can be measured by rate of accumulation within an hour or twelve-hour timeframe.

TABLE 4-11 NOAA HEAVY RAINFALL CLASSIFICATIONS

Heavy Rain in a 1-Hour Timeframe		Heavy Rain in a 12-Hour Timeframe	
Classification	Accumulation Rate	Classification	Accumulation Rate
Light	0.01-0.49 inches	Light	< 3.0 inches at two or more weather stations OR < 6.0 inches or more at one station
Heavy	> 0.49 inches	Heavy	3.0 inches or more at two or more weather stations OR 6.0 inches or more at one station

4.1.4 HISTORICAL OCCURRENCES

General Trends

Dangerous and damaging aspects of a severe storm are tornadoes, hail, lightning strikes, flash flooding, and winds associated with downbursts and microbursts. Using the severe weather events reported over the past 20 years provides an acceptable framework for determining and planning for the expected magnitude of such storms.

A complete list of severe thunderstorm events from 1955 to current day can be found in **Appendix B.**

TABLE 4-12 SUMMARY OF SEVERE THUNDERSTORMS IN BUTLER COUNTY (JANUARY 1, 2002-DECEMBER 31, 2022)

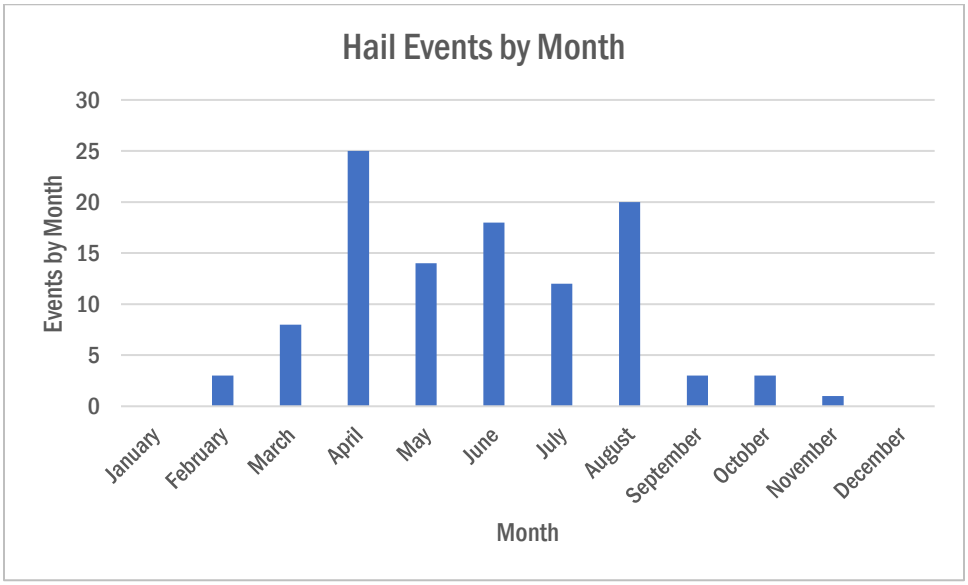
Type	Count	Injuries	Deaths	Property Damage	Crop Damage	Avg Property Damage/Event	Avg Crop Damage/Event
Hail	107	0	0	$31,000	$0	$289.72	-
Heavy Rain	31	0	0	$3,000	$0	$96.77	-
Lightning	3	2	1	$5,000	$0	$1,666.67	-
Strong Wind	4	0	0	$8,500	$0	$2,125	-
Thunderstorm Wind	167	0	0	$841,500	$1,000	$5,038.92	-
Grand Total	**312**	**2**	**1**	**$ 889,000**	**$ 1,000**	**$ 2,849.36**	**$ 3.21**

Hail Events

Large hail can damage structures, break windows, dent vehicles, ruin crops, and kill or injure people and livestock. Based on past occurrences, hail sizes greater than 2.5 inches in diameter are possible and should be considered in future planning activities.

Since 2002, 107 recorded hail events associated with thunderstorms have either directly or indirectly affected the county and its immediately surrounding jurisdictions. The most recent hail event occurred in June 2022. Furthermore, the historic frequency indicates that there is a 100% chance of this type of event occurring each year.

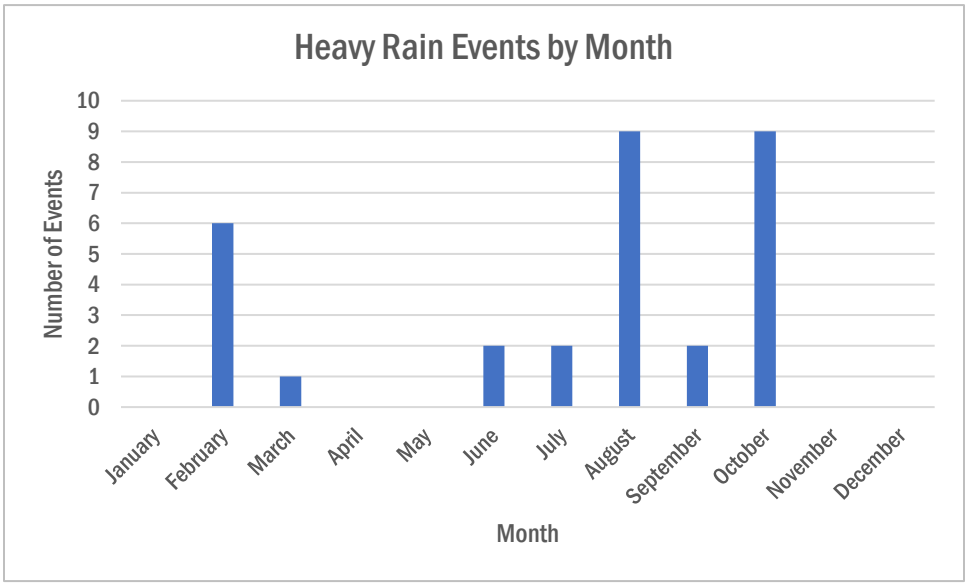
FIGURE 4-3 BUTLER COUNTY HAIL EVENTS BY MONTH, JANUARY 1, 2002-DECEMBER 31, 2022



Heavy Rain Events

There have been 31 recorded heavy rain events associated with thunderstorms since 2002. The historic frequency calculates that there is a 100% chance of this type of event occurring each year. The most recent heavy rain event occurred in June 2015.

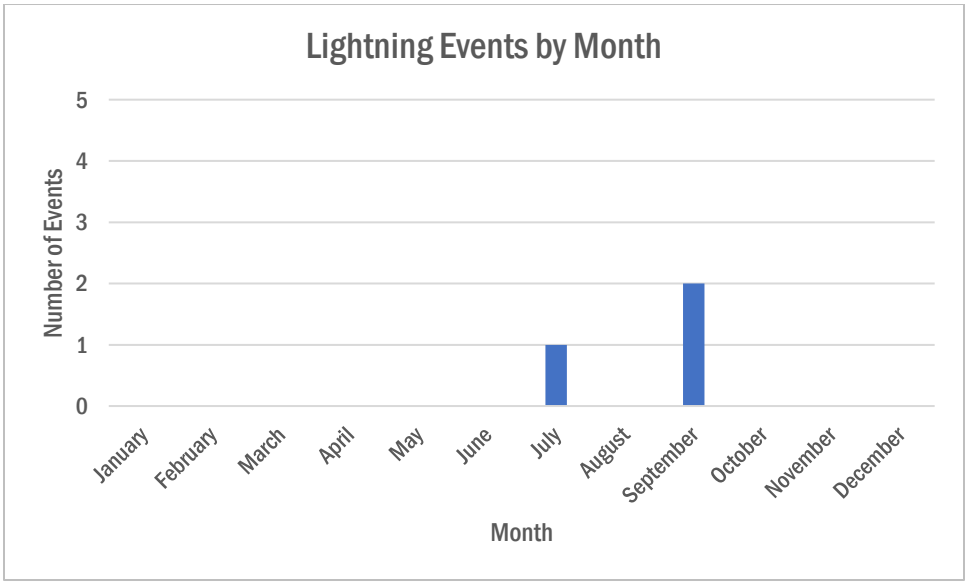
FIGURE 4-4 BUTLER COUNTY HEAVY RAIN EVENTS BY MONTH, JANUARY 1, 2002-DECEMBER 31, 2022



Lightning Events

Except in cases where significant forest or range fires are ignited, lightning generally does not result in disasters. There have been three recorded lightning-related incidents in Butler County since 2002, with the last event occurring on September 5, 2018. The historic frequency calculates that there is a 15% chance of this type of event occurring each year.

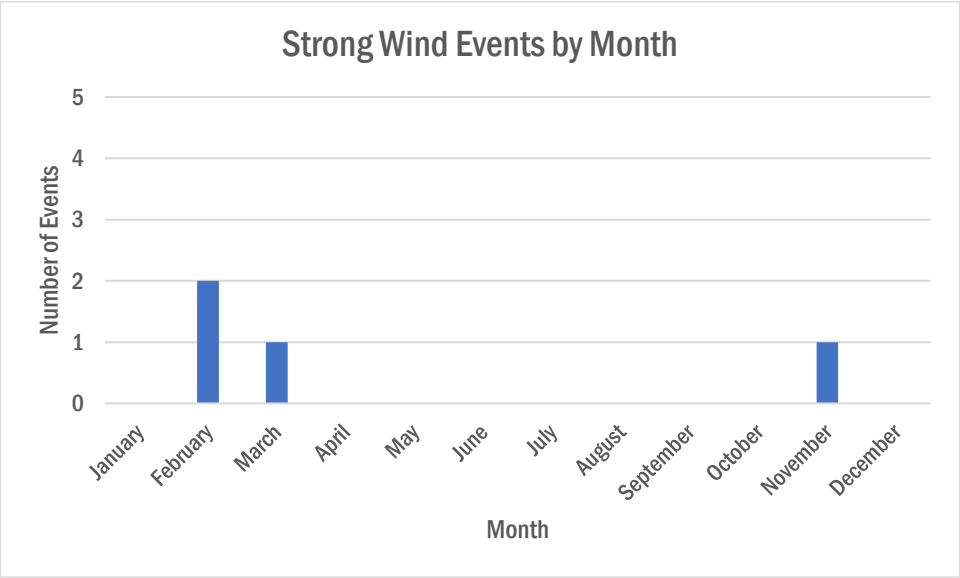
FIGURE 4-5 BUTLER COUNTY LIGHTNING EVENTS BY MONTH, JANUARY 1, 2002-DECEMBER 31, 2022



Strong Wind Events

There have been 4 recorded strong wind events associated with thunderstorms since 2002. The historic frequency calculates that there is a 20% chance of this type of event occurring each year. The most recent strong wind event occurred in November 2020.

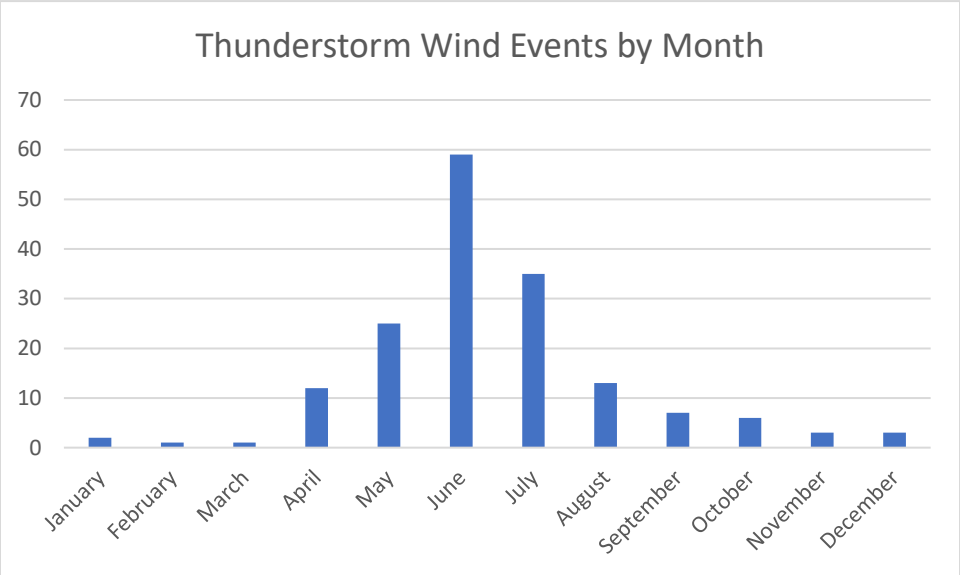
FIGURE 4-6 BUTLER COUNTY STRONG WIND EVENTS BY MONTH, JANUARY 1, 2002-DECEMBER 31, 2022



Thunderstorm Wind Events

Non-tornadic, thunderstorm, and non-thunderstorm winds over 100 mph should also be considered in future planning initiatives. These types of winds can remove roofs, move mobile homes, topple trees, take down utility lines, and destroy poorly built or weak structures. Since 2002, there have been 167 recorded severe wind events associated with thunderstorms, with the most recent event occurring in September 2022. The historic frequency calculates that there is a 100% chance of this type of event occurring each year.

FIGURE 4-7 BUTLER COUNTY THUNDERSTORM WIND EVENTS BY MONTH, JANUARY 1, 2002-DECEMBER 31, 2022



Since 1953, eight federally declared severe thunderstorm weather events have occurred in Butler County, as shown in the following table. According to FEMA declarations (1953 to present), these events include heavy rains, flooding, severe storms, tornadoes, hurricanes, and a severe windstorm from a tropical depression.

TABLE 4-13 SEVERE STORM DISASTER DECLARATIONS

Disaster Number	Declaration Date	Title	Public Assistance	Individual Assistance
DR-243	6/5/1968	Heavy Rains, Flooding	-	-
DR-831	6/10/1989	Severe Storms, Flooding	-	-
DR-870	6/6/1990	Flooding, Severe Storm, Tornado	-	-
DR-1390	8/27/2001	Severe Storms & Flooding	$5,935,229.86*	-
DR-1556	9/19/2004	Severe Storms and Flooding	$25,804,256.17*	$23,662,227.18*
EM-3250	9/13/2005	Hurricane Katrina Evacuation	$2,541,599.60*	-
DR-1805	10/24/2008	Severe Wind Storm Associated with Tropical Depression Ike	$38,841,921.56*	-
EM-3346	6/30/2012	Severe Storms	-	-

**Indicates data from FEMA's Disaster Declarations website. The dollar amounts refer to total funds delegated to all counties within the declared disaster area, not just Butler County.*

Event Narratives

- **April 15, 1994 – Thunderstorm Wind:** Trees were downed at a number of locations. A plane was flipped by high winds at the Butler County Airport. Large hail fell at Hamilton. There was a reported $500,000 in property damage countywide from the event.

- **May 25, 2006 – Hail:** Law enforcement in Middletown reported 1.75-inch hail in the evening of May 25th. The hail caused a reported $12,000 in property damage, and no reported injuries, deaths, or crop damages.
- **September 4, 2011 – Lightning:** Scattered thunderstorms developed during the afternoon on September 3rd and continued to develop into the early morning hours on September 4th. Some of these thunderstorms became severe. The main threats from these storms were damaging thunderstorm winds and large hail. A 40-year old man was struck and killed by lightning while camping during the storm.
- **June 26, 2015 – Heavy Rain:** Severe thunderstorms developed as a low-pressure center tracked east along a stationary front which was draped across the region. Two feet of water was reported in a trailer park in Butler County. However, there were no reported injuries, deaths, property damages, and crop damages.
- **June 6, 2022 – Thunderstorm Wind:** Scattered thunderstorms developed during the afternoon hours along a cold front moving through the Ohio Valley. A large tree fell through the top of a park building, causing significant damage.

4.1.5 PROBABILITY OF FUTURE OCCURRENCES

Reported thunderstorm events over the past 20 years provide an acceptable framework for projecting the frequency of future occurrence. The probability of experiencing thunderstorm events that cause damages or injury can be difficult to predict. However, based on the historical record of 312 thunderstorm events from 2002 through 2022 (15.6 thunderstorms per year), it can reasonably be assumed that this type of event will occur multiple times per year.

(2022 CY) - (2002 HY) = 20 Years on Record

(312 Events) / (20 Years) = 15.6 Events each Year

The Planning Committee, based on their own knowledge, concluded that Severe Thunderstorm events are “Highly Likely” each year. This means that they have a 100% chance of happening annually.

Thunderstorms have occurred regularly every year. Due to climate change, it is expected that thunderstorms will grow increasingly frequent and intensify in severity.

Future Conditions

An important consideration of hazard mitigation planning is to consider how future conditions, including a changing climate, will influence how severe thunderstorms will behave in and impact Butler County. According to the United States Environmental Protection Agency, the Midwest, including Ohio, has had an average air temperature increase by more than 1.5°F, with the rate of increase rising more rapidly in recent decades. Additionally, annual precipitation has increased by a maximum 20% in certain areas of the Midwest. As average temperatures and annual precipitation increase, more intense severe thunderstorms with greater precipitation amounts occur. According to the Climate Explorer, Butler County had a total of 40.03 inches of precipitation in 2005. In 2010, the

observed total precipitation was 36.7 inches. By 2090, it is projected that Butler County will have an increase of 7.26 inches of annual total precipitation with a higher emissions rate. In 2005, Butler County had an average daily maximum temperature of 63.9°F. In 2010, the average daily maximum temperature was observed to be 63.9°F. By 2090, it is projected that Butler County will have an increase of 10.9°F in the average daily maximum temperature with a higher emissions rate.

TABLE 4-14 THE CLIMATE EXPLORER CLIMATE PROJECTIONS FOR BUTLER COUNTY

	2020	2030	2040	2050	2060	2070	2080	2090
Average Daily Maximum Temperature (°F)	66.8°	67.8°	68.9°	70.0°	71.3°	72.5°	73.6°	74.8°
Annual Total Precipitation Totals (in)	41.82	40.88	41.89	42.51	42.9	42.92	43.41	43.96

Because thunderstorm events are often countywide and regionwide events, the location of thunderstorms will not be influenced by climate change in the future.

4.1.6 ASSETS EXPOSED TO SEVERE THUNDERSTORMS

Potential Losses

TABLE 4-15 IMPACTS FROM THUNDERSTORMS

Impact	Description
People	Loss of life or severe injuries can occur, especially to those outside. Lightning will strike outdoors. Hail can cause lacerations, concussions, and even death if large enough.
Infrastructure	Roofs and building siding can be severely damaged by high winds or hail. Power outages may result from lightning strikes or downed power lines.
Economy	Mostly localized disruptions. Large-scale storms, such as hurricanes or derechos, can temporarily affect businesses.
Natural Systems	Lightning can cause wildfires and urban fires. Wind can down trees.
Transportation	Fallen trees can hinder transportation. High winds and heavy rain can temporarily make driving conditions dangerous.

A timely forecast may not be able to mitigate property loss, but it could reduce associated casualties and injuries. It appears possible to forecast these extreme events with some skill. Further research is needed to test the existing hypothesis about the interaction between the convective storm and its environment that produces the extensive swath of high winds. There is no way to predict the specific area that will be impacted by thunderstorm winds, hailstorms or lightning strikes.

Community Vulnerability

The age, type, construction materials, and condition of inventory assets exposed to severe thunderstorms all affect the damage they may receive. Heavy wind loads can cause poorly constructed roofs to fail, and hail can damage the roofs and siding of structures, rendering the building more susceptible to water damage.

All county assets can be considered to be at risk of damage from severe thunderstorms including high winds, lightning strikes, hail, and flooding. Most structures, including critical facilities, should be able to adequately protect people from hail, but windows could get broken and exteriors dented. Facilities with back-up generators are better equipped to handle a severe weather situation if the power goes out.

Severe thunderstorms will remain a highly likely occurrence for the county, with some storms producing lightning and hail. An individual thunderstorm is unlikely to damage large numbers of structures, but its side effects (hail, winds and lightning) can damage structures and property throughout the county.

Hail is the third leading cause of crop failure in the United States and can also damage homes and vehicles. While drought was by far the leading cause of crop failures in 2012, at 79%, thunderstorms and their hazards accounted for over $1 billion in crop losses nationwide that year. A March 2017 report by Willis Re found that the average annual loss for severe storms is $11.23 billion. These losses from thunderstorms can be difficult to overcome. Insurance policies offer some relief for both homeowners and farmers.

The following table reflects each jurisdiction's response from the Vulnerability Assessment form that was completed during the planning process. Responses for the form submitted by stakeholders can be found in **Appendix I.**

Jurisdiction/Organization	Vulnerability Assessment Response
Butler County	Tree limbs affect the powerlines and can cause power outages. The county's infrastructure, such as roads and bridges, need to remain operational for public and rescue services. Other essential county services, such as site visits for the Household Sewage Treatment Program and community outreach programs, can be delayed due to a severe thunderstorm event.
Fairfield	Large commercial structures susceptible to high winds.
Hamilton	Overhead powerlines and spot/flash flooding.
Middletown	Old housing stock, steel mill, paper mill, several chemical facilities.
Monroe	Our utilities are not fully protected to withstand an event.
Oxford	We have a number of old trees in the City along power lines that cause outages.
Sharonville	Down powerlines on main roads can make travel difficult.
Trenton	A lot of old growth trees to fall, lightweight construction houses.
College Corner	Power lines and trees are often affected during heavy winds.
Jacksonburg	No plans for this to address vulnerabilities.
Millville	Old trees can fall down.
New Miami	Have trees go down. We get called out for trees down almost every time it storms.
Seven Mile	Most homes without backup power fire house roof needs replaced & needs a generator.

The following table shows the risk index and expanded expected annual loss information and scores for Butler County for the applicable sub-hazards of Severe Thunderstorms that are included in FEMA's National Risk Index. Overall, Butler County is most vulnerable to lightning based on the risk index rating but has a higher expected annual loss from strong wind.

TABLE 4-16 FEMA NRI SEVERE THUNDERSTORM DATA FOR BUTLER COUNTY

NRI Category	Butler County Rating
Hail	
Risk Index Rating	Very Low (19.7 Rating)
Expected Annual Loss	Very Low (23.7 Rating, $22,578 Expected Annual Loss) • $8,856 in Building Value • $6,022 in Population Equivalence • 0.00 in Population • $7,700 in Agriculture Value
Lightning	
Risk Index Rating	Relatively High (94.9 Rating)
Expected Annual Loss	Relatively High (95.6 Rating, $1,056,887 Expected Annual Loss) • $108,998 in Building Value • $947,889 in Population Equivalence • 0.08 in Population • N/A in Agriculture Value
Strong Wind	
Risk Index Rating	Relatively High (94.2 Rating)
Expected Annual Loss	Relatively High (95.1 Rating, $2,499,618 Expected Annual Loss) • $2,192,159 in Building Value • $307,424 in Population Equivalence • 0.03 in Population • $35 in Agriculture Value

Impacts to Socially Vulnerable Communities

Severe Thunderstorms can knock out power through lightning, wind, and hail. During large-scale events that affect the entire planning area, rural communities are often the ones that are often without power for long periods of time. For communities such as Jacksonville and for the unincorporated areas of the County, it can be days before power is back online. This is particularly dangerous for aging communities, who are dependent on air conditioning during the months when thunderstorms are most likely.

Thunderstorms will also have a disproportional impact on mobile homes and those that do not conform to a specific building code. These are often occupied by families below the poverty line, or those who may be seeking more permanent housing. These structures can sustain greater damage during events.

Hazard Risk by Community

During the planning process, each participating community ranked their risk to each profiled hazard in the plan. The representatives of the jurisdictions within Butler County were asked to consider the risk factors of probability, impact, spatial extent, warning time, and duration and how those factors may increase or decrease their community's risk to the hazard. A ranking of high indicates the community considers at least four of the factors to be an increased concern. A ranking of medium indicates the community considers two to three of the factors to be an increased concern. A ranking of low indicates the community considers one or no factors to be an increased concern. Each community's response to the hazard risk rating for severe thunderstorms is presented in the table below. All stakeholder responses gathered during the planning process through this form can be found in **Appendix I**.

TABLE 4-17 HAZARD RISK BY COMMUNITY FOR SEVERE THUNDERSTORMS

	Fairfield	Hamilton	Middletown	Monroe	Oxford	Sharonville	Trenton	College Corner	Jacksonburg	Millville	New Miami	Seven Mile
Severe Thunderstorms	High	High	Low	High	High	High	High	High	High	High	Low	High

4.1.7 FUTURE CONDITIONS IMPACTS

As the climate, population, and land uses of the county change over time, it is important to identify how these future conditions will affect the impacts of hazards. Severe thunderstorm impacts will be influenced by climate change, changes in population trends, and land use and development trends.

Climate Change Trends

The increase in precipitation due to climate change can impact the county's infrastructure, most notably the storm water drainage as flash flooding may overwhelm the drains and pipes' current capacity. Bridges that are in poor condition due to rapid moving water may also be impacted due to the increase in precipitation and rapid onset of flooding from heavy rainfall, and highways as flash flooding creates deep, impassable puddles. Heavy and increased rainfall during severe thunderstorms can also lead to additional stress on the flood protection systems that are located in Butler County.

The Ohio State University, in association with the State Climatologist Office of Ohio, identifies that as rainfall occurs more heavily in the fall and spring due to climate change, the redistribution of precipitation will impact growing seasons for crops grown in the state. The heavy rainfall in the spring will impact Ohio farmers' ability to plant crops, while the extra precipitation in the fall will impact their ability to harvest.

With an increase of severe thunderstorm events, the likelihood of downed powerlines in Butler County is an increase for public officials. It was noted frequently during the planning process that storms often down trees and cause power outages. These impacts will be exasperated as the frequency and severity of events increase.

Changes in Population Trends

As population trends in Butler County continue to increase, the higher density of population will be impacted greater by severe thunderstorm impacts. An increase in homes, cars, and other assets are exposed to flash flooding, downed trees and power lines, hail, and high winds. If areas in the county start to see population loss, abandoned homes have an increased chance to be impacted by severe thunderstorms as they are not maintained to withstand these effects.

Land Use and Development Trends

All new structures built in Butler County will likely be exposed to severe thunderstorm damage. The county needs to continue to adhere to building codes so that new development is built to current standards.

Regulatory Environment

The formal regulations that pertain to thunderstorm events are negligible. All structures that were built since the latest building codes were adopted in Butler County are meant to be wind resistant, as recommended by the International Building Code.

4.1.8 THUNDERSTORM SUMMARY

Butler County is subject to severe storms, ranging from thunderstorms to tropical storms, which have the potential to cause flash flooding, tornadoes, downbursts, and debris. The Severe Thunderstorms profile primarily describes past and potential damages from high winds, lightning, and hail. Flooding is covered as a separate hazard, even if it is caused by a heavy precipitation event.

Building damage has been most successful mitigated in areas where local governments enforce strict building codes for high wind influence areas and adopt designated special flood hazard areas, and builders comply. Proven grounding techniques are also available to reduce lightning damage to buildings.

Other mitigation efforts include buyout programs, relocations, structural elevations, improved open-space preservation, and land use planning within high-risk areas. Due to the significant risk from severe storms, the county will remain proactive in its mitigation efforts to help build sustainability.

2. EXTREME TEMPERATURES

Hazard	Probability		Impact		Spatial Extent		Warning Time		Duration		RF Rating
Extreme Temperatures	3	0.9	1	0.3	4	0.8	2	0.2	3	0.3	2.5
Moderate Risk Hazard (2.0 – 2.99)											

Climate change may exacerbate the impact of hazardous extreme temperatures. According to the State Hazard Mitigation Plan, extreme heat and heat waves are existing hazards that will be exacerbated by climate change. Heat, one of the leading weather-related killers in the United States, results in hundreds of fatalities each year. Extreme cold can cause hazardous driving conditions, communications and electrical power failures, and community isolation, as well as adversely affecting business continuity. This section defines and profiles the hazard of temperature extremes.

4.2.1 EXTREME TEMPERATURE DESCRIPTION

Extreme Heat

Temperatures that remain 10 degrees or more above the average high temperature for the area are defined as extreme heat. The National Weather Service (NWS) issues an Excessive Heat Warning/Advisory when an event (a "heat wave") is expected within 36 hours. The NWS bases these warnings on a "Heat Index" - a combination of heat and humidity - that is predicted to be at or above 105 degrees for two or more consecutive days. Local weather forecast offices may use different criteria for Excessive Heat Warning/Advisories, based on maximum temperatures, nighttime temperatures, and other methods.

Extreme heat is the top weather-related killer in the United States. It causes more fatalities each year than floods, lightning, tornadoes and hurricanes combined. In the Midwest, summers tend to combine high temperatures and high humidity. Heat disorders generally involve a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating, or a chemical (salt) imbalance caused by too much sweating. When the body heats up too quickly to cool itself safely, or when too much fluid is lost through dehydration or sweating, the body temperature rises, and heat-related illnesses may develop.

Extremely high temperatures cause heat stress, which can be divided into four categories (see Table 4-16). Each category is defined by apparent temperature, which is associated with a heat index value that captures the combined effects of dry air temperature and relative humidity on humans and animals. Major human risks for these temperatures include heat cramps, heat syncope, heat exhaustion, heatstroke, and death. In addition to these human risks, extreme temperatures can elevate consumers' utility costs.

Extreme Cold

Although infrequent in this county, extended periods of extreme cold could occur throughout the winter months. Heating systems compensate for the cold outside, and most people limit their time

outside during extreme cold conditions, but common complaints include pipes freezing and cars not starting. When cold temperatures are combined with wind, dangerous wind chills can develop.

Wind chill is how cold the weather "feels." It is based on the rate at which exposed skin loses heat. As the wind increases, it draws heat from the body. This drives down the skin temperature and, eventually, internal body temperature. Therefore, the wind makes the air feel much colder than its actual temperature. For example, if the temperature is 0°F and the wind is blowing at 15 mph, the wind chill is -19°F. At this wind chill, exposed skin can freeze in 30 minutes. Wind chill does not affect inanimate objects. (National Weather Service)

Extreme cold is also responsible for several fatalities each year. Threats such as hypothermia and frostbite can lead to loss of fingers and toes or cause permanent kidney, pancreas and liver injury or even death. Major winter storms can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall and cold temperatures. Fifty percent of cold-related injuries happen to people over 60 years old. More than 75% of injuries happen to males, and almost 20% occur within the home.

The dangers associated with extreme cold include frostbite and hypothermia. Frostbite is damage to body tissue that is frozen. Frostbite causes a loss of feeling in extremities such as fingers, toes, ear lobes, or the tip of the nose. Hypothermia, or low body temperature, can lead to uncontrollable shivering, memory loss, disorientation, slurred speech, drowsiness, and apparent exhaustion.

4.2.2 EXTREME TEMPERATURE LOCATION

Extreme temperature events are region wide and affect all communities within Butler County.

4.2.3 EXTENT

While cold temperatures and power losses can render a structure uninhabitable for a time, they are unlikely to cause structural damages. People living in older homes are more likely to need services offered in response to extreme cold.

Extremely high temperatures cause four categories of heat stress. Each category is defined by apparent temperature, a general term for the perceived outdoor temperature caused by the combined effects of air temperature, relative humidity, and wind speed. Apparent temperature is associated with a heat index value that captures the combined effects of dry air temperature and relative humidity on humans and animals. Major human risks for these temperatures include heat cramps, fainting, heat exhaustion, heat stroke, and death. Note that while the temperatures in the following tables and figures serve as a guide for various danger categories, the impacts of high temperatures will vary from person to person, based on individual age, health, and other factors.

The National Weather Service issues temperature advisories, watches, and warnings relating to the impacts of the range of temperatures typically experienced in Ohio. Exact thresholds vary across the state, but Heat Advisories are generally issued when the heat index will be at or above 100°F, but less than 105°F. Excessive Heat Warnings are issued when heat indices will attain or exceed 105°F, and Excessive Heat Watches are issued when excessive heat warning criteria may be experienced in 12 to 48 hours.

TABLE 4-18 FOUR CATEGORIES OF HEAT STRESS

Danger Category	Heat Disorders	Apparent Temperature (°F)
I (Caution)	Fatigue possible with prolonged exposure and physical activity.	80 to 90
II (Extreme Caution)	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and physical activity.	90 to 105
III (Danger)	Sunstroke, heat cramps, or heat exhaustion likely; heat stroke possible with prolonged exposure and physical activity.	105 to 130
IV (Extreme Danger)	Heatstroke or sunstroke imminent.	>130

FIGURE 4-8 NWS SEVERE HEAT INDEX

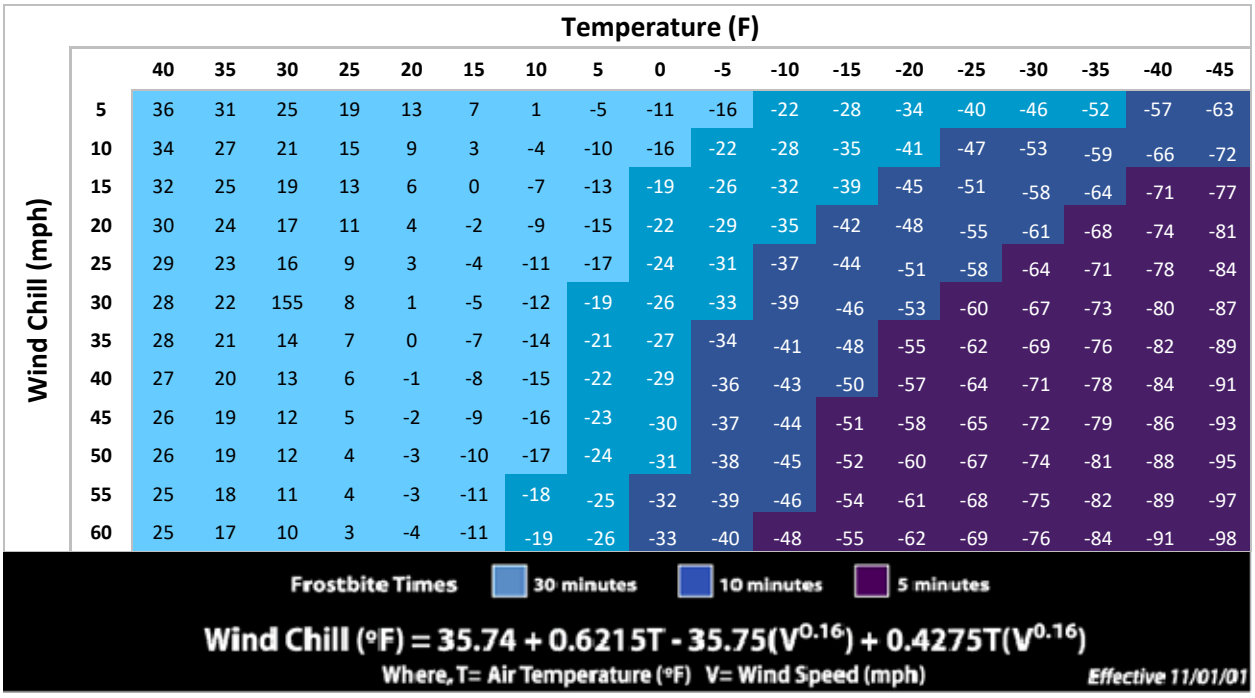
Relative Humidity \ Temperature	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130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

TABLE 4-19 EXTREME COLD TEMPERATURE AND ASSOCIATED THREAT

Excessive Cold Threat Level	Threat Level Descriptions
Non-Threatening	**"No Discernable Threat to Life and Property from Excessive Cold."** Cold season weather conditions are non-threatening.
Very Low	**"A Very Low Threat to Life and Property from Excessive Cold."** It is likely that that wind chill values will drop to -10˚ to -15º F or below for 3 hours or more. Or lowest air temperature 0º to -5ºF.
Low	**"A Low Threat to Life and Property from Excessive Cold."** It is likely that wind chill values will drop to -15º F to -20ºF or below for 3 hours or more. Or lowest air temperature -5º to -10ºF.
Moderate	**"A Moderate Threat to Life and Property from Excessive Cold."** It is likely that wind chill values will drop to -20º to -28 ºF or below for 3 hours or more. Or lowest air temperature -10º to -15ºF.
High	**"A High Threat to Life and Property from Excessive Cold."**

Excessive Cold Threat Level	Threat Level Descriptions
	It is likely that wind chill values will drop to -28º to -35ºF for 3 hours or more. Or lowest air temperature -15º to -20ºF.
Extreme	**"An Extreme Threat to Life and Property from Excessive Cold."** It is likely that wind chill values will drop to -35ºF or below for 3 hours or more. Or lowest air temperature less than or equal to -20ºF.

FIGURE 4-9 NWS WINDCHILL CHART



4.2.4 HISTORICAL OCCURRENCES

General Trends

Extreme temperatures affect areas as large as an entire state or region. As such, events for all of Butler County were looked at as previous hazard events.

According to the NCDC, Butler County has four documented cases of extreme heat since 2002. Since 2002, Butler County has recorded three extreme cold events, all occurring in the past 14 years. A complete list of extreme temperature events from 1996 to current day can be found in **Appendix B.**

TABLE 4-20 SUMMARY OF EXTREME TEMPERATURE EVENTS IN BUTLER COUNTY (JANUARY 1, 2002-DECEMBER 31, 2022)

Type	Count	Injuries	Deaths	Property Damage	Crop Damage	Avg Property Damage/Event	Avg Crop Damage/Event
Extreme Heat	4	0	0	$0	$0	-	-
Extreme Cold	3	0	1	$0	$0	-	-
Grand Total	**7**	**0**	**1**	**$ 0**	**$0**	**-**	**-**

Event Narratives

- Heat – **August 7-10, 2007:** Oppressively hot and humid conditions with heat indices near 105 degrees impacted southern Ohio August 7 through August 10.
- Cold – **February 4-6, 2009:** A cold snap in the beginning of February was the direct cause of a death of an elderly woman in Butler County. A woman wandered from her nursing home in Fairfield and succumbed to hypothermia.
- Cold – **January 30, 2019:** An arctic airmass was pushed into the Ohio Valley behind a cold front. Sub-zero temperatures reached the lower teens in some areas and combined with wind gusts of 30 to 45 mph, creating wind chills from 20 to 40 below zero.
- Heat – **July 19-20, 2019:** With a combination of high temperatures in the 90s and added humidity, heat index values across the region reached into the triple digits for two days in a row.
- Cold – **December 22-24, 2022:** A cold front crossed the Ohio Valley Thursday evening, with plummeting temperatures and strong winds. Sustained 20 to 30 mph winds had higher gusts of 35 to 45 mph. Wind chills fell below -25°.

4.2.5 PROBABILITY OF FUTURE OCCURRENCES

The probability of Butler County experiencing an event with extreme temperatures can be difficult to quantify. Climate models suggest summer global temperatures are likely to increase, with more pronounced changes between temperature extremes. The number of days with temperatures above 100 degrees may also be significantly higher.

Reported extreme temperature events over the past 20 years provide an acceptable framework for projecting the frequency of future occurrence. The probability of experiencing an extreme temperature event can be difficult to quantify, but based on the historical record of six events since 2002, it can reasonably be assumed that this type of event has occurred once every 2.86 years from 2002 through 2022.

(2022 CY) - (2002 HY) = **20 Years on Record**

(**20 Years**) / (**7 Events**) = **2.86 Years Between Events**

The historic frequency indicates that there is a 35% chance of this type of event occurring each year. The Planning Committee, based on their own knowledge, concluded that Extreme Temperature events are “Likely” each year. This means that they have between a 10% and 100% chance of happening annually.

Future Conditions

An important consideration of hazard mitigation planning is to consider how future conditions, including a changing climate, will influence how extreme temperatures will behave in and impact Butler County. By 2090, The Climate Explorer predicts Butler County will have an increase in daily maximum temperature of 10.9°F with a higher emissions rate. Additionally, the resource predicts by

2090, the county will have 111.5 days with a maximum temperature greater than 90°F – an increase of 84.1 days from the observed 27.4 days with a maximum temperature greater than 90°F in 2010. By 2090, The Climate Explorer predicts Butler County will have 4.3 days with the maximum temperature < 32°F, a decrease of 41.8 days from the observed 46.1 days of maximum temperature < 32°F in 2010.

TABLE 4-21 THE CLIMATE EXPLORER CLIMATE PROJECTIONS FOR BUTLER COUNTY

	2020	2030	2040	2050	2060	2070	2080	2090
Average Daily Maximum Temperature (°F)	66.8°	67.8°	68.9°	70.0°	71.3°	72.5°	73.6°	74.8°
Days with Maximum Temperature > 90°F	43.5	52.8	63.2	71.8	84.2	92.7	101.6	111.5
Days with Maximum Temperature > 95°F	12.8	18.7	25.9	33.2	43.7	54	62.6	73.6
Days with Maximum Temperature > 100°F	2.3	4.4	7	10.7	16.4	23.1	28.7	37.3
Days with Maximum Temperature > 105°F	0.1	0.5	1.2	2.5	4.9	8.6	11.5	15.5
Days with Maximum Temperature < 32°F	15.9	14.6	12.4	10.6	8.9	6.7	5.7	4.3

The Climate Mapping for Resilience and Adaptation (CMRA) Assessment Tool for Extreme Heat identifies future projections for days over 90°F around the year 2050 based on a high-emissions scenario. CMRA projects that Butler County will have 68.5 days per year with a maximum temperature over 90°F. The assessment tool also projects there will be 9.2 more days at or above a maximum temperature of 100°F and 0.2 days at or above a maximum temperature of 110°F compared to the 1975-2000 average.

Overall, it can be assumed that Butler County will see an increase in frequency as well as severity of extreme heat events. It can also be assumed that Butler County will see a decrease in frequency and severity of extreme cold events due to the climate increasing in average daily temperature. As extreme temperature events are county and regionwide events, the location will not be influenced by climate change.

4.2.6 ASSETS EXPOSED TO EXTREME TEMPERATURES

Potential Losses

TABLE 4-22 POTENTIAL IMPACTS FROM EXTREME TEMPERATURES

Impact	Description
People	**Heat:** Heat stroke and dehydration **Cold:** Frostbite and hypothermia
Infrastructure	**Heat:** Power outages and brownouts. Water may become scarce. **Cold:** Burst pipes from freezing temperatures.
Economy	By discouraging people from traveling and shopping, extreme temperatures can cause local economic slowdowns. Crop losses may damage the agricultural sector.
Natural Systems	**Heat:** Vegetation can die and dry out, making areas susceptible to wildfires. **Cold:** Crops may be lost if extreme cold occurs during a growing season.
Transportation	**Heat:** Hot vehicles may break down, causing delays. **Cold:** Extreme cold temperatures can cause ice on roads. Cars may not start.

Areas vulnerable to extreme heat were classified as those with a maximum average temperature over 85 degrees, according to the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) study. This range falls within the upper limits of FEMA's heat stress index, Caution Category 1. Extreme heat does not generally affect buildings; it primarily affects people. Nonetheless, facilities must be maintained to ensure that they operate in appropriate conditions to protect people.

Additionally, areas vulnerable to extreme cold were classified as those with a minimum average temperature lower than 14 degrees, according to the USDA NRCS study. Extreme cold does not generally affect buildings; it primarily affects people. Nonetheless, facilities must be maintained to ensure that they operate in appropriate conditions to protect people.

Community Vulnerability

Because extreme temperatures are dangerous and can be potentially life-threatening, it is important to understand how many people are exposed to such conditions, and how many buildings present potential problems if power is lost. Extreme cold can damage structures; for example, burst pipes will damage buildings and necessitate repairs.

All property in Butler County is susceptible to the effects of extreme temperatures. While temperature extremes are not usually thought of as damaging to structures, they can make structures unusable. The age of a structure is also important to consider when discussing temperature extremes. Older homes are more susceptible to extreme temperatures, based on the construction methods prevalent at the time.

According to the U.S. Census QuickFacts, Butler County had approximately 22,140 children under age 5, which is about 5.7% of the total population. An estimated 62,924 people (16.2% of the population) were above the age of 65.

TABLE 4-23 POPULATION AGE ESTIMATES, CENSUS QUICKFACTS

Total	Population	Percent
Under 5 years	22,140	5.7%
65 and up	62,924	16.2%

TABLE 4-24 DATE OF BUILDING CONSTRUCTION, OHIO OFFICE OF RESEARCH 2021

Year Built	Percent	Number
Built 1939 or earlier	12.2%	18,586
Built 1940 to 1949	4.3%	6,479
Built 1950 to 1959	12.0%	18,229
Built 1960 to 1969	9.2%	13,956
Built 1970 to 1979	16.6%	25,138
Built 1980 to 1989	11.9%	18,071
Built 1990 to 1999	16.0%	24,333

Built 2000 to 2009	14.5%	22,067
Built 2010 to 2013	1.4%	2,138
Built 2014 or later	1.9%	2,890
Grand Total	**100.0%**	**151,887**

Butler County is subject to temperature extremes. They are a countywide hazard and effect all areas of the county and its jurisdictions. The effect temperature extremes will have on the County will vary due to population density, age of population, and the age of structures. Older homes are generally less insulated than newer construction. In addition, the use of modern windows and doors can improve a structure's ability to resist extreme temperatures. Older structures and infrastructure are likely to be more susceptible to both heat waves and freezes.

For extreme heat, the urban heat island effect would impact higher populated areas within the county due to higher amounts of asphalt to accommodate transportation and parking. The urban heat island effect results from the change in surfaces. Those areas that were permeable and moist become dry. On a hot, sunny day, the sun can heat surfaces, such as roofs and pavement, to higher temperatures than the surrounding air. The heat island phenomenon is not only a daytime effect. At night, as the infrastructure releases the heat it has accumulated during the day, raising the air temperature. Butler County has several populous municipalities. That means that they are the most likely to suffer from heat island effects. Industrial complexes are also susceptible to these effects.

FIGURE 4-10 EPA URBAN HEAT ISLAND EFFECT DIAGRAM

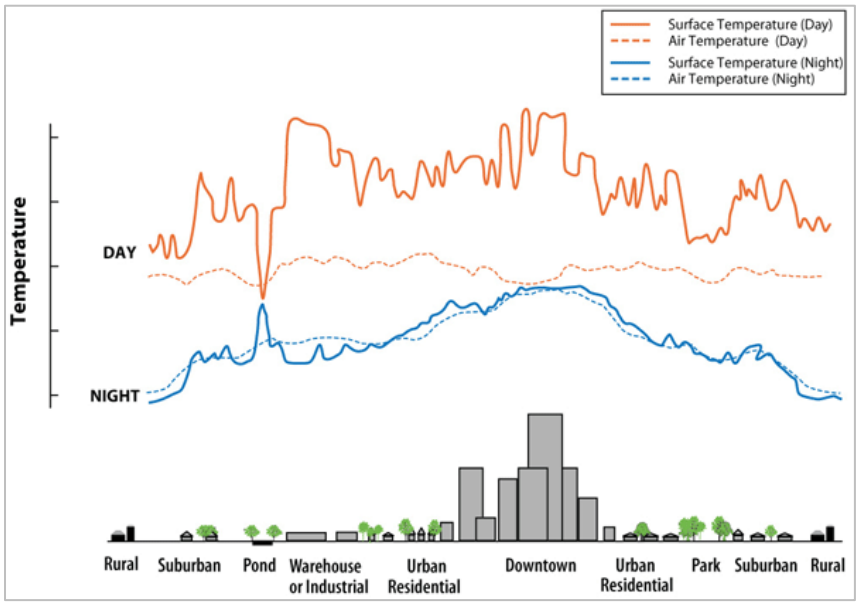
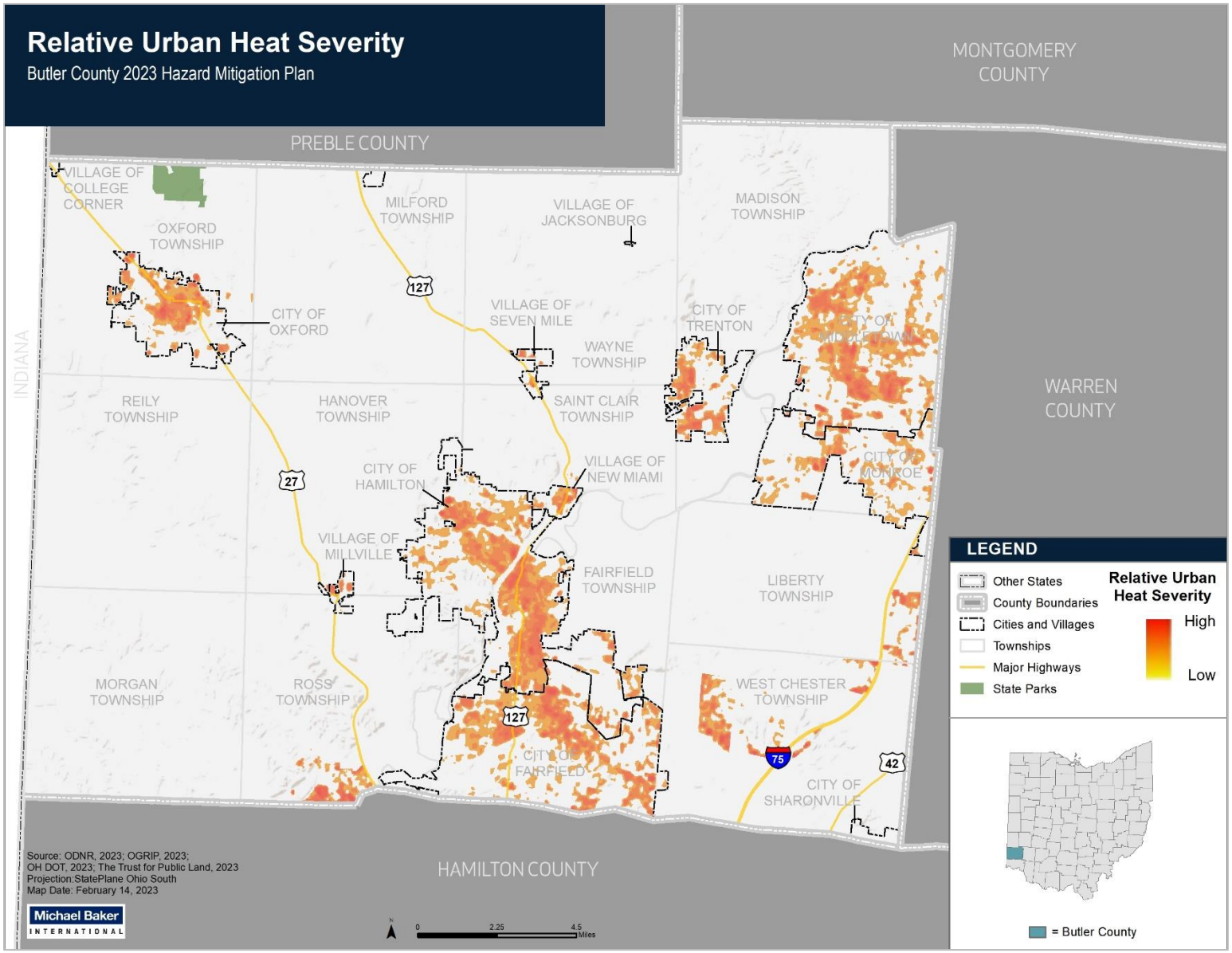


FIGURE 4-11 URBAN HEAT SEVERITY IN BUTLER COUNTY JURISDICTIONS



The following table reflects each jurisdiction's response from the Vulnerability Assessment form that was completed during the planning process. Responses for the form submitted by stakeholders can be found in **Appendix I.**

Jurisdiction/Organization	Vulnerability Assessment Response
Butler County	Aging population is more impacted during an event. County programs, including community outreach programs, are delayed.
Fairfield	Unsure of specific vulnerabilities to this hazard.
Hamilton	Equipment and personnel to support city services.
Middletown	There is an older population in housing with no A/C.
Monroe	High elderly population.
Oxford	Our older and low-income populations do not have immediate access to warming and cooling shelters should we have an electric outage.
Sharonville	Sharonville has several assisted living facilities, while all are conditioned space extreme temperatures with a power outage would affect this population.
Trenton	2 retirement communities to be aware of as well as an aging population.
College Corner	No specific vulnerabilities at this time.
Jacksonburg	No concrete plan for when this hazard occurs.
Millville	Residents may not be aware of where they can go for a heating or cooling center during an event.
New Miami	We do not have a heating or cooling area in the Village. The town hall could be used for this, but it has not been dedicated as one yet. There are a lot of houses in the village that do not have A/C to help with extreme heat events.
Seven Mile	We have a lot of elderly to take care of in the event of such emergency. We need a designated cooling /heating center.

The following table shows the risk index and expanded expected annual loss information and scores for Butler County for the applicable sub-hazards of Extreme Temperatures that are included in FEMA's National Risk Index. Overall, Butler County is most vulnerable to cold waves based on the risk index rating and expected annual losses.

TABLE 4-25 FEMA NRI EXTREME TEMPERATURE DATA FOR BUTLER COUNTY

NRI Category	Butler County Rating
Heat Wave	
Risk Index Rating	Relatively Low (68.5 Rating)
Expected Annual Loss	Relatively Moderate (72.0 Rating, $259,300 Expected Annual Loss) • $14,448 in Building Value • $239,901 in Population Equivalence • 0.02 in Population • $4,951 in Agriculture Value
Cold Wave	
Risk Index Rating	Relatively High (85.7 Rating)
Expected Annual Loss	Relatively High (87.2 Rating, $526,962 Expected Annual Loss) • $3,532 in Building Value • $493,689 in Population Equivalence • 0.04 in Population • $29,741 in Agriculture Value

Impacts to Socially Vulnerable Communities

Extreme temperatures pose the greatest risk to communities who do not have readily available access to cooling and heating facilities. Most commonly, these are aging populations and those living below the poverty line, including transient populations.

Extreme temperatures, both heat and cold, can put a significant strain on the financial situations of those who are already strained. This means that they may have to choose between keeping their home at a livable temperature or other types of necessary expenditures.

Transient populations, including those experiencing homelessness, do not have permanent housing and may have a difficult time finding shelter from extreme temperature events. This can lead to dehydration during heat and frostbite during cold.

Hazard Risk by Community

During the planning process, each participating community ranked their risk to each profiled hazard in the plan. The representatives of the jurisdictions within Butler County were asked to consider the risk factors of probability, impact, spatial extent, warning time, and duration and how those factors may increase or decrease their community's risk to the hazard. A ranking of high indicates the community considers at least four of the factors to be an increased concern. A ranking of medium indicates the community considers two to three of the factors to be an increased concern. A ranking of low indicates the community considers one or no factors to be an increased concern. Each community's response to the hazard risk rating for extreme temperatures is presented in the table below. All stakeholder responses gathered during the planning process through this form can be found in Appendix I.

TABLE 4-26 HAZARD RISK BY COMMUNITY FOR EXTREME TEMPERATURES

	Fairfield	Hamilton	Middletown	Monroe	Oxford	Sharonville	Trenton	College Corner	Jacksonburg	Millville	New Miami	Seven Mile
Extreme Temperatures	Medium	High	Low	Medium	Medium	Medium	Medium	Medium	High	Medium	Low	Medium

4.2.7 FUTURE CONDITIONS IMPACTS

As the climate, population, and land uses of the county change over time, it is important to identify how these future conditions will affect the impacts of hazards. Extreme temperature impacts will be influenced by climate change, changes in population trends, and land use and development trends.

Climate Change Trends

With the increase in the daily temperature as well an increase in days over 90°F or greater, the influence of climate change on extreme temperature impacts will be exasperated. According to the CMRA Extreme Heat hazard analysis, heat has been the leading cause of weather-related deaths in the United States in the last 30 years. Additionally, the number of warm nights will increase due to the environment not being able to cool with heat trapped in earth's atmosphere.

CMRA's Extreme Heat hazard analysis also identifies that with the extreme heat projections, comes an increased amount of energy that will be needed to cool structures. By 2050, it is projected that there will be an increase in energy usage by 75% to cool homes and businesses during extreme heat events.

Climate change has also been shown to increase the severity of extreme cold events during winter. The increasing instability of the atmosphere has led to "polar vortexes" where extremely cold air from the north pole is brought directly into the continental United States. These events can lead to increased severity of extreme cold event.

Changes in Population Trends

The elderly and small children are more susceptible to temperature extremes. As the population continues to age, or as new children are born, these two changes in population will be the most impacted by extreme temperature events.

Underserved communities and socially vulnerable populations, while these groups currently have an increased vulnerability to extreme temperature events, will have a heightened vulnerability as the number of extremely hot days rise. Those who live in homes without air conditioning will be exposed to the high temperatures and risk developing heat-related illnesses or death.

Land Use and Development Trends

Butler County as a whole is subject to temperature extremes. Because they affect entire regions, temperature extremes are a countywide hazard. However, their effects on the county will vary due to population density, age of population, and the age of structures.

Buildings of significant age may be more susceptible. Older homes are generally less insulated than newer construction. In addition, modern windows and doors can improve a structure's ability to resist extreme temperatures. Older structures and infrastructure are likely to be more susceptible to both heat waves and freezes. It is important to identify building stock and special needs populations, so that those who must respond to an emergency will be better prepared.

As more structures with large surface parking lots are built in Butler County, the average temperature will continue to increase due to the urban heat island effect. As explained in the earlier section of the hazard profile, the extreme heat events that occur may be even hotter in highly developed areas with a lack of green infrastructure. The sun heating the asphalt will radiate the high temperatures rather than absorbing and cooling the surface like grass, tree-canopy covered areas.

Regulatory Environment

The formal regulations that pertain to generalized extreme temperature events are negligible. However, Butler County and its municipalities can explore the benefits of green infrastructure implementation in new developments.

4.2.8 TEMPERATURE EXTREME SUMMARY

Temporary periods of extremely hot or cold temperatures typically do not have a significant environmental impact. However, prolonged periods of heat may be associated with drought

conditions and can damage or destroy vegetation, dry up rivers and streams, and reduce water quality. Prolonged exposure to cold can kill wildlife and vegetation and poses a potentially grave danger to residents of Butler County.

3. SEVERE WINTER STORMS

Hazard	Probability		Impact		Spatial Extent		Warning Time		Duration		RF Rating
Severe Winter Storms	2	0.6	1	0.3	4	0.8	2	0.2	3	0.3	2.2
Moderate Risk Hazard (2.0 – 2.99)											

4.3.1 SEVERE WINTER STORM DESCRIPTION

Butler County has been affected by winter storms of varying degrees over the last century, but severe winter storms are relatively infrequent. These can cause hazardous driving conditions, communications and electrical power failure, and community isolation, and they can disrupt business continuity. A severe winter storm may include one or more of the following factors:

Blizzards, as defined by the National Weather Service, combine sustained winds or frequent gusts of 35 mph or greater with visibilities of less than a quarter mile from falling or blowing snow, for 3 hours or more. A blizzard does not, by definition, indicate heavy amounts of snow, but heavy snow may happen at the same time. The strong winds usually create large drifts from the falling or blowing snow. The reduced visibility makes travel, even on foot, particularly treacherous. The strong winds may also support dangerous wind chills. Ground blizzards can develop when strong winds lift snow off the ground and severely reduce visibility.

Heavy snow, in large quantities, may fall during winter storms. Six inches or more in 12 hours or 8 inches or more in 24 hours may significantly hamper travel or create hazardous conditions. The National Weather Service issues warnings for such events. Smaller amounts can also make travel hazardous but mainly causes minor inconveniences. Heavy wet snow before the leaves fall from the trees in the fall or after the trees have leafed out in the spring may break tree branches and damage power lines.

Ice storms develop when a layer of warm (above freezing), moist air aloft coincides with a shallow cold (below freezing) pool of air at the surface. As snow falls into the warm layer of air, it melts to rain, and then freezes when it hits the frozen ground or other cold objects at the surface, creating a smooth layer of ice. This phenomenon is called freezing rain. Sleet occurs when the rain in the warm layer freezes into pellets while falling through a cold layer of air at or near the Earth's surface. Extended periods of freezing rain can lead to accumulations of ice on roadways, walkways, power lines, trees, and buildings. Almost any accumulation can make driving and walking hazardous. Thick accumulations can bring down trees and power lines.

Heavy snowstorms can immobilize a region and paralyze the county. These events can strand commuters, close airports, stop supplies from reaching their destinations and disrupt emergency and medical services. Accumulating snow can cause roofs to collapse and knock down trees and power lines. Homes and farms may be isolated and unprotected, and livestock may be lost. The cost of snow removal, repairing damages, and the loss of business can affect cities and towns economically.

Extreme cold, over extended periods can occur throughout the winter months in Butler County, though it is infrequent. While heating systems can usually compensate for the cold, people limit their time outside during extremely cold conditions. Common complaints usually include pipes freezing and cars not starting. Cold temperatures combined with wind can create dangerous wind chills.

Wind chill is how cold the weather "feels." It is based on the rate at which exposed skin loses heat. As the wind increases, it draws heat from the body. This drives down the skin temperature and, eventually, internal body temperature. Therefore, the wind makes the air feel much colder than its actual temperature. For example, if the temperature is 0°F and the wind is blowing at 15 mph, the wind chill is -19°F. At this wind chill, exposed skin can freeze in 30 minutes. Wind chill does not affect inanimate objects. (National Weather Service)

The science of meteorology and records of severe winter storms are not quite sophisticated enough to identify what areas of the county have a greater risk of damage. Therefore, all areas of the county are assumed to have the same winter storm risk.

Severe winter storms can result in the closing of roads (particularly in rural locations), loss of utility services, and depletion of heating supplies. Environmental impacts often include shrubbery and tree damage due to snow loading, ice build-up, and/or high winds, which can break limbs or even bring down large trees. Gradual melting of snow and ice provides excellent groundwater recharge; however, high temperatures after heavy snow can cause rapid surface water runoff and severe flash flooding.

Ohio has an extensive history of severe winter storms. In the winter of 2005, the state was hit by a series of winter storms. These included ice storms followed by unseasonably high temperatures and high rainfall totals, all of which resulted in extensive flooding and mudslides. This series of storms resulted in Presidential Declaration FEMA-DR-1580-OH, which provided over $140 million in recovery funds via Individual Assistance, Public Assistance, Hazard Mitigation Grant funds, and a state match to the federal hazard mitigation funds.

4.3.2 LOCATION

Severe winter storm events are region-wide events that affect the entirety of Butler County. All communities can be affected during these occurrences.

4.3.3 WINTER STORM EXTENT

The National Weather Service uses different terminology for winter storm events, depending on the situation.

- Outlook - Winter weather that may cause significant impact in the 3- to 7-day forecast period and eventually lead to a Watch or Warning is contained in a Hazardous Weather Outlook. More scientific discussion on the event can be found in the Area Forecast Discussion. Forecasts in the 3- to 7-day period typically have a lot of uncertainty (in the 30% to 50% range) about whether the event will occur and reach warning criteria. It is intended to provide information to those who need lead time to prepare for the event.

- **Watch** - A Watch is generally issued in the 24- to 72-hour forecast timeframe, when the risk of a hazardous winter storm event has increased (50 to 80% certainty that warning thresholds will be met). It is intended to provide enough lead time for those who need it to set their plans in motion. A Watch is issued using the WSW Winter Weather Message product and will appear as a headline in some text products, such as the Zone Forecast. It will change the color, as shown in the table below, of the counties on the NWS front page map according to the type of watch that has been issued.

TABLE 4-27 WINTER STORM WATCH DEFINITIONS

Watch Type	Description
Blizzard Watch	Conditions are favorable for a blizzard event in the next 24 to 72 hours. Sustained wind or frequent gusts greater than or equal to 35 mph will accompany falling and/or blowing snow to frequently reduce visibility to less than 1/4 mile for 3 or more hours.
Lake Effect Snow Watch	Conditions are favorable for a lake effect snow event to meet or exceed local lake effect snow warning criteria in the next 24 to 72 hours. Widespread or localized lake-induced snow squalls or heavy snow showers may produce snowfall accumulation to 7 or more inches in 12 hours or less. Lake effect snow usually develops in narrow bands and impacts a limited area within a county or forecast zone. Use "mid-point" of snowfall range to trigger a watch (i.e., 5 to 8 inches of snow = watch).
Wind Chill Watch	Conditions are favorable for wind chill temperatures to meet or exceed local wind chill warning criteria in the next 24 to 72 hours. Wind chill temperatures may reach or exceed -25°F.
Winter Storm Watch	Conditions are favorable for a winter storm event (heavy sleet, heavy snow, ice storm, heavy snow and blowing snow or a combination of events) to meet or exceed local winter storm warning criteria in the next 24 to 72 hours. Criteria for snow is 7 inches or more in 12 hours or less; or 9 inches or more in 24 hours, covering at least 50% of the zone or encompassing most of the population. Use "mid-point" of snowfall range to trigger a watch (i.e. 5 to 8 inches of snow = watch). Criteria for ice is 1/2 inch or more over at least 50% of the zone or encompassing most of the population.

- **Advisory** - Advisories are issued when a hazardous winter storm event is occurring, is imminent, or has a very high probability of occurrence (generally greater than 80%). An advisory is for less serious conditions that cause significant inconvenience and, if caution is not exercised, could lead to situations that may threaten life and/or property. Advisories are issued using the WSW Winter Weather Message product and will appear as a headline in some text products such as the Zone Forecast. The table below shows the different type of winter weather advisories and the conditions that it takes for them to be met.

TABLE 4-28 WINTER WEATHER ADVISORY DEFINITIONS

Advisory Type	Description
Winter Weather Advisory	A winter storm event (sleet, snow, freezing rain, snow and blowing snow, or a combination of events) is expected to meet or exceed local winter weather advisory criteria in the next 12 to 36 hours but stay below warning criteria. Criteria for snow is 4 inches or more in 12 hours or less, covering at least 50% of the zone or encompassing most of the population. Use "mid-point" of snowfall range to trigger advisory (i.e., 2 to 5 inches of snow = advisory). Criteria for ice is any ice accumulation less than 1/2 inch over at least 50% of the zone or encompassing most of the population. Winter Weather Advisory can also be issued for black ice. This is optional.
Freezing Rain Advisory	Any accumulation of freezing rain is expected in the next 12 to 36 hours (but will remain below 1/2 inch) for at least 50% of the zone or encompassing most of the population.
Lake Effect Snow Advisory	A lake effect snow event is expected to meet or exceed local lake effect snow advisory criteria in the next 12 to 36 hours. Widespread or localized lake induced snow squalls or heavy snow showers which produce snowfall accumulating to 4 or more inches in 12 hours or less but remain less than 7 inches. Lake effect snow usually develops in narrow bands and impacts a limited area within a county or forecast zone. Use "mid-point" of snowfall range to trigger advisory (i.e., 2 to 5 inches of snow = advisory).
Wind Chill Advisory	Wind chill temperatures are expected to meet or exceed local wind chill advisory criteria in the next 12 to 36 hours. Wind chill temperatures may reach or exceed -15°F.

- **Warning** - Warnings are issued when a hazardous winter storm event is occurring, is imminent, or has a very high probability of occurrence (generally greater than 80%). A warning is used for conditions posing a threat to life or property. Warnings are issued using the WSW Winter Weather Message product and will appear as a headline in some text products such as the Zone Forecast. The table below discusses the various winter storm warnings that can occur and the conditions of each that are required for them to be posted.

TABLE 4-29 WINTER WEATHER WARNING DEFINITIONS

Warning Type	Description
Blizzard Warning	Blizzard event is imminent or expected in the next 12 to 36 hours. Sustained wind or frequent gusts greater than or equal to 35 mph will accompany falling and/or blowing snow to frequently reduce visibility to less than 1/4 mile for three or more hours.
Ice Storm Warning	An ice storm event is expected to meet or exceed local ice storm warning criteria in the next 12 to 36 hours. Criteria for ice is 1/2 inch or more over at least 50% of the zone or encompassing most of the population.
Lake Effect Snow Warning	A lake effect snow event is expected to meet or exceed local lake effect snow warning criteria in the next 12 to 36 hours. Widespread or localized lake induced snow squalls or heavy snow showers which produce snowfall accumulation to 7 or more inches in 12 hours or less. Lake effect snow usually develops in narrow bands and impacts a limited area within a county or forecast zone. Use "mid-point" of snowfall range to trigger warning (i.e., 5 to 8 inches of snow = warning).
Wind Chill Warning	Wind chill temperatures are expected to meet or exceed local wind chill warning criteria in the next 12 to 36 hours. Wind chill temperatures may reach or exceed -25°F.
Winter Storm Warning	A winter storm event (heavy sleet, heavy snow, ice storm, heavy snow and blowing snow or a combination of events) is expected to meet or exceed local winter storm warning criteria in the next 12 to 36 hours. Criteria for snow is 7 inches or more in 12 hours or less; or 9 inches or more in 24 hours covering at least 50% of the zone or encompassing most of the population. Use "mid-point" of snowfall range to trigger warning (i.e. 5 to 8 inches of snow = warning). Criteria for ice is 1/2 inch or more over at least 50% of the zone or encompassing most of the population.

4.3.4 HISTORICAL OCCURRENCES

General Trends

According to NOAA, Butler County has had **52 winter storm events** since 2002, resulting in 1 death, no reported injuries, property damage or crop damage. A complete list of severe winter storm events from 1996 to current day can be found in **Appendix B.**

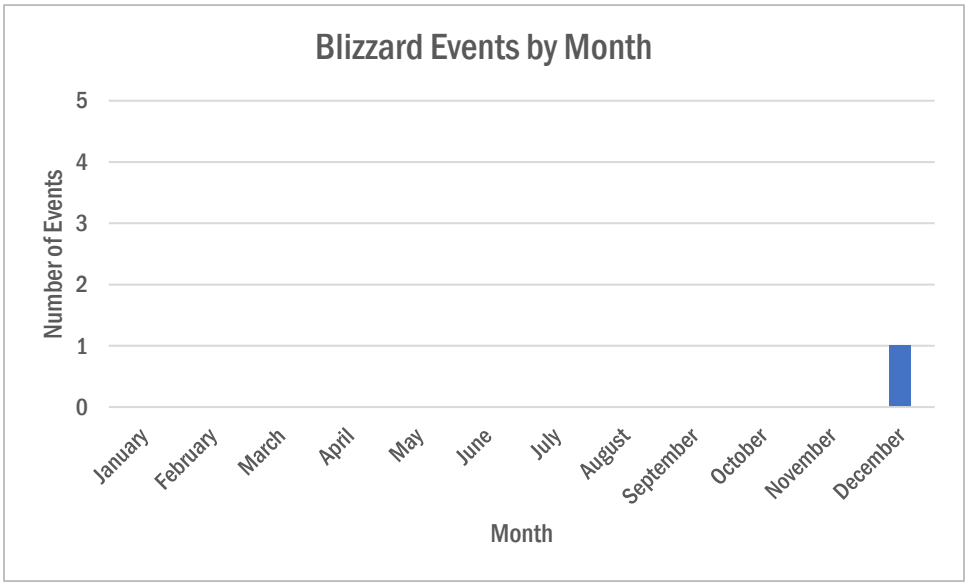
TABLE 4-30 SUMMARY OF WINTER STORM EVENTS IN BUTLER COUNTY (JANUARY 1, 2002-DECEMBER 31, 2022)

Event	Count	Injuries	Deaths	Property Damage	Crop Damage	Avg Property Damage/Event	Avg Crop Damage/Event
Blizzard	1	0	0	$0	$0	-	-
Heavy Snow	11	0	0	$0	$0	-	-
Ice Storm	3	0	0	$0	$0	-	-
Winter Storm	34	0	0	$0	$0	-	-
Extreme Cold/Wind Chill	3	0	1	$0	$0	-	-
Grand Total	**52**	**0**	**1**	**$ 0**	**$ 0**	**-**	**-**

Blizzard Events

Since 2002, one blizzard has affected the county and its jurisdictions. The most recent blizzard event occurred in December 2012. Furthermore, the historic frequency indicates that there is a 5% chance of this type of event occurring each year.

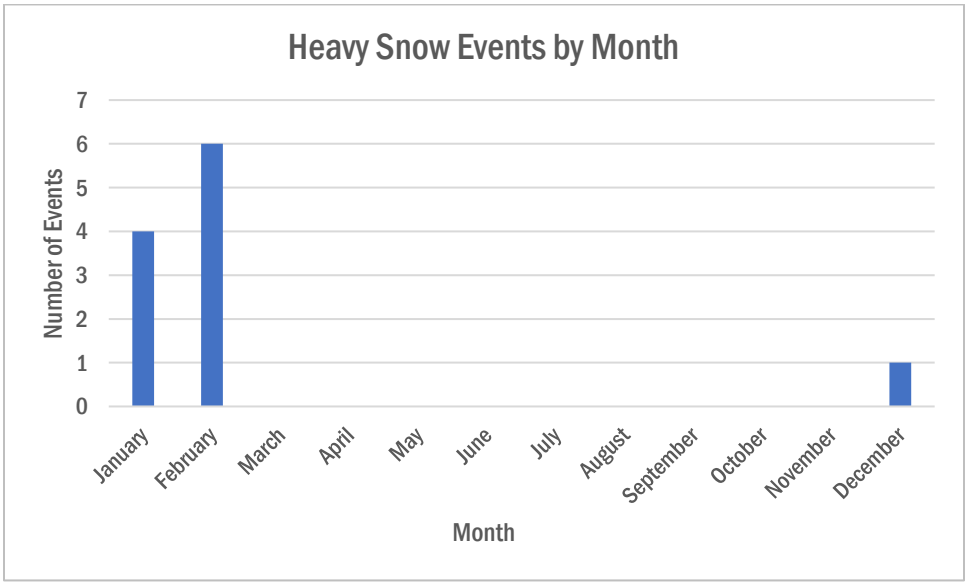
FIGURE 4-12 BUTLER COUNTY BLIZZARD EVENTS BY MONTH, JANUARY 1, 2002-DECEMBER 31, 2022



Heavy Snow

Since 2002, 11 recorded heavy snow events affected the county and its jurisdictions. The most recent heavy snow event occurred in January 2011. Furthermore, the historic frequency indicates that there is a 55% chance of this type of event occurring each year.

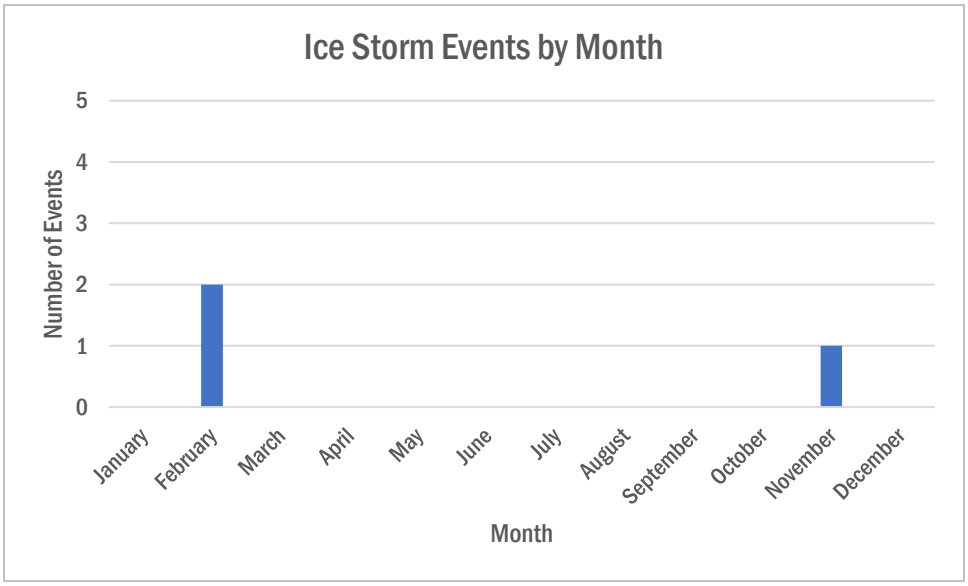
FIGURE 4-13 BUTLER COUNTY HEAVY SNOW EVENTS BY MONTH, JANUARY 1, 2002-DECEMBER 31, 2022



Ice Storms

Since 2002, 3 recorded ice storm events affected the county and its jurisdictions. The most recent ice storm event occurred in November 2018. Furthermore, the historic frequency indicates that there is a 15% chance of this type of event occurring each year.

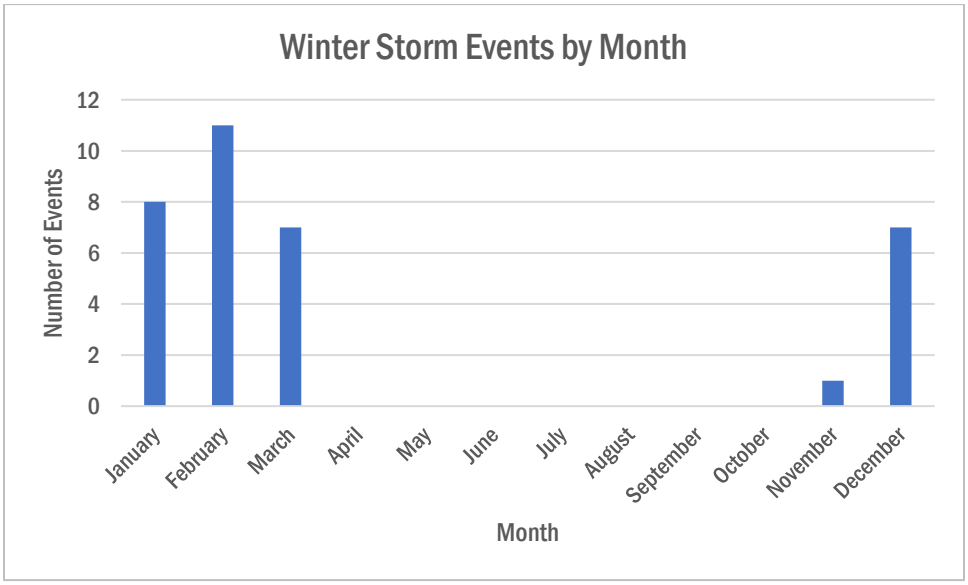
FIGURE 4-14 BUTLER COUNTY ICE STORM EVENTS BY MONTH, JANUARY 1, 2002-DECEMBER 31, 2022



Winter Storms

Since 2002, 34 recorded winter storm events affected the county and its jurisdictions. The most recent winter storm event occurred in December 2022. Furthermore, the historic frequency indicates that there is a 100% chance of this type of event occurring each year.

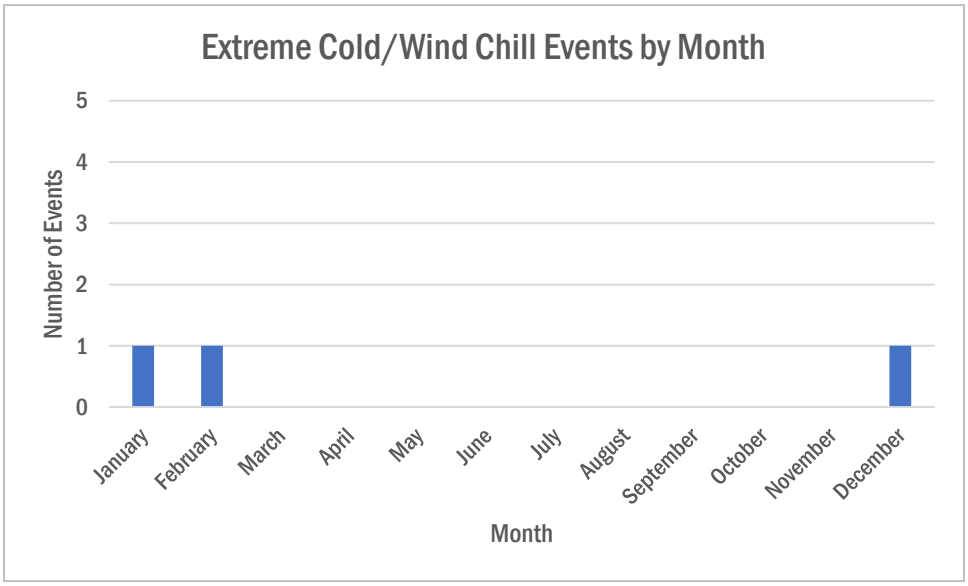
FIGURE 4-15 BUTLER COUNTY WINTER STORM EVENTS BY MONTH, JANUARY 1, 2002-DECEMBER 31, 2022



Extreme Cold/Wind Chill

Since 2002, 3 recorded extreme cold/wind chill events affected the county and its jurisdictions. The most recent extreme cold/wind chill event occurred in December 2022. Furthermore, the historic frequency indicates that there is a 15% chance of this type of event occurring each year.

FIGURE 4-16 BUTLER COUNTY EXTREME COLD/WIND CHILL EVENTS BY MONTH, JANUARY 1, 2002-DECEMBER 31, 2022



Since 1953, two federally declared severe winter storm events have affected Butler County, as shown in the following table. According to FEMA Disaster Declarations for States and Counties database (1953 to present), the events have included snowstorms, blizzards, and snow.

TABLE 4-31 FEDERALLY DECLARED WINTER DISASTERS

Disaster Number	Declaration Date	Title	Public Assistance	Individual Assistance
EM-3055	1/26/1978	Blizzards and Snowstorms	-	-
EM-3198	1/11/2005	Snow	$8,636,637.81*	-

**Indicates data from FEMA's Disaster Declarations website. The dollar amounts refer to total funds delegated to all counties within the declared disaster area, not just Butler County.*

Event Narratives

- **January 26, 1978 – Blizzard:** The forecast initially called for nothing more than "rain tonight, possibly mixed with snow at time. Windy and cold Thursday with snow flurries." What actually followed was one of the worst winter storms that the state has ever seen. Much of Ohio received several feet of snow, with some drifts reaching as high as 15 feet, resulting in wide-ranging transportation shutdowns and utility outages.

- **January 6-8, 1996 – Winter Storm:** The worst blizzard conditions occurred over West Central areas as dry and powdery snow was blown around by high winds causing whiteouts. Some areas had more than 30 continuous hours of snowfall, and many people in Southern Ohio felt this was the worst winter storm since the Blizzard of '78. By the end of the storm, many homes and businesses had their roof collapse or partially collapse from the weight of the new snow, and snow from a storm earlier in the week. By late in the day on the 7th, arctic air was pouring into the region. A 47-year-old man died of exposure under an overpass in Miami

County, and a 76-year-old man died of exposure on his front porch in Montgomery County. In Butler County, there were not any reported injuries or deaths, but there was $500,000 in reported property damage.

- **February 6, 2007 – Heavy Snow:** A clipper system tracked northwest to southeast through the Ohio Valley and brought a quarter to a third of an inch of precipitation. Cold air in place over the region allowed for significant snow accumulation due to a high snow to water ratio. Seven inches of snow was reported in Trenton. Six and a half inches was reported near Oxford and 5 inches was reported in both Fairfield and Monroe.

- **February 21-22, 2013 – Ice Storm:** A significant winter storm system over the Plains moved into the mid-Mississippi Valley, spreading a wintry mix of precipitation across the Ohio Valley during the evening hours of February 21st into the morning hours of February 22nd. With sub-freezing temperatures near the surface, the precipitation started off as a mix of sleet/snow early on and then transitioned to mainly freezing rain as warmer air aloft nosed into the region. Snow and sleet accumulations were generally less than an inch, and ice accumulations from freezing rain generally ranged from one to two tenths of an inch. A spotter in Oxford measured a quarter inch of ice accumulation.

- **February 8-9, 2021 – Winter Storm:** An upper-level low pressure system moving through the Ohio Valley produced heavy snow along the I-71 corridor. The snow started to fall during the evening of February 8th and continued into the morning hours of February 9th. Six to 10 inches of snow fell across much of the I-71 corridor. A spotter northwest of Oxford reported 8 inches of snow. Seven inches was reported in Middletown, and 6.5 inches was noted northwest of Hamilton.

4.3.5 PROBABILITY OF FUTURE OCCURRENCES

Winter events reported over the past 20 years provide an acceptable framework for projecting the frequency of future occurrence. 52 winter storm events have been recorded since 2002, a frequency of 2.6 events per year.

(2022 CY) - (2002 HY) = 20 Years on Record

(52 Events) / (20 Years) = 2.6 Events per Year

The historic frequency indicates a 100% chance of this type of event occurring each year. The Planning Committee, based on their own knowledge, concluded that Severe Winter Storm events are "Possible" each year. This means that they have between a 1% and 10% chance of happening annually.

Future Conditions

An important consideration of hazard mitigation planning is to consider how future conditions, including a changing climate, will influence how severe winter storms will behave in and impact Butler County. According to the U.S. Global Change Research Program's Global Climate Change Impacts in the United States, the Midwest and northern Great Plains' average winter temperatures

have increased by more than 7°F in the past 30 years. However, an increase of average temperature does not indicate that severe winter storms will not occur in Butler County. There is a projected increase in winter precipitation frequency as well as intensity with rapid melting that will lead to flooding for the Midwest. The Climate Explorer projects that the projected 2060-2090 average of total precipitation will be greater than the 1950-2013 observed total precipitation for all winter months.

TABLE 4-32 THE CLIMATE EXPLORER CLIMATE PROJECTIONS FOR BUTLER COUNTY

	December	January	February	March
1950-2013 Observed Total Precipitation	3.01	2.84	2.43	3.31
2010-2040 Projected Total Precipitation	3.05	3.0	2.63	3.56
2035-2065 Projected Total Precipitation	3.24	3.21	2.79	3.75
2060-2090 Projected Total Precipitation	3.46	3.34	2.88	3.87

The Global Climate Change Impacts in the United States report states the cause of an increase in winter precipitation will be a result of the warm, moist air from the south interacting with the cold air from the north, developing intense winter storms with an increased amount of precipitation. Butler County may see an increase in wetter, heavier snow events, but the location of severe winter storms will not be influenced as winter storms are countywide and regionwide events.

4.3.6 ASSETS EXPOSED TO SEVERE WINTER STORMS

Potential Losses

TABLE 4-33 POTENTIAL IMPACTS FROM WINTER STORMS

Impact	Description
People	Winter storms can bring severely cold temperatures, which can cause frostbite. Slips and falls resulting from ice can cause injuries, particularly to older populations. Communities may become isolated with little power, water, or food.
Infrastructure	Power outages can result from heavy snow on power lines. Roof collapses may also occur. Burst pipes may damage homes and businesses.
Economy	As transportation becomes dangerous, local shops lose customers. Some must close during storms.
Natural Systems	Rivers may freeze and cause flooding. Trees and other vegetation may be killed by ice or brought down by high winds.
Transportation	Roads can become either dangerous or completely impassable.

Community Vulnerability

All Butler County assets can be considered at risk from severe winter storms. This includes 100% of the county population and all buildings and infrastructure. Damages are primarily the result of cold temperatures, heavy snow or ice, and sometimes strong winds. Due to their regular occurrence,

these storms are considered hazards only when they result in damage to specific structures or disrupt traffic, communications, electric power, or other utilities.

A winter storm can adversely affect roadways, utilities, and business activities. They can cause loss of life, frostbite and freezing conditions and can result in the closing of secondary roads, particularly in rural locations, loss of utility services and depletion of heating supplies. Most structures, including the county's critical facilities, could suffer damage from snow load on rooftops and large deposits of ice. Facilities with back-up generators are better equipped to handle a severe storm if the power goes out, even if that generator only powers certain systems.

Winter storms do not generally have a negative impact on structures. While low temperatures and power losses can render a structure uninhabitable for a time, they are unlikely to cause structural damage. However, snow and ice accumulation can affect structures and infrastructure. Older structures are more susceptible to the impacts of winter storms due to their methods of construction and insulation.

In addition to protecting its infrastructure, the county must consider population needs. Butler County is home to an estimated 388,420 people. At particular risk are elderly individuals. The U.S. Census Bureau estimates that approximately 16.2% of the county's population, or more than 62,000 individuals, are above the age of 65 and at risk from severe winter storms.

A timely forecast may not allow the county to mitigate property loss, but it could reduce casualties and injuries. In severe winter storm events, buildings are vulnerable to widespread utility disruptions (including the loss of heat and electricity), as well as building collapse or damage from downed trees. Butler County is also subject to outages resulting from damage to the electrical grid in other parts of Ohio.

Winter storms affect all of Butler County, all communities and jurisdictions, and all above-ground structures and infrastructure. Although structural losses are typically minimal and covered by insurance, they can cause lost time, maintenance costs, and contents losses.

The following table reflects each jurisdiction's response from the Vulnerability Assessment form that was completed during the planning process. Responses for the form submitted by stakeholders can be found in **Appendix I.**

Jurisdiction/Organization	Vulnerability Assessment Response
Butler County	Countywide programs, including community outreach programs, are often delayed. The roads must be cleared and treated for travel. Aging infrastructure that has been routinely treated by roadway salt and de-icing treatments can be weakened. Properties located in the A-1 zoning districts of the county are often more impacted.
Fairfield	Winter storms affect power distribution and will negatively impact the elderly population.
Hamilton	The city is equipped for an event, but the number of personnel is often the challenge to implementing plans for treatment.
Middletown	Limited unique vulnerabilities.

Jurisdiction/Organization	Vulnerability Assessment Response
Monroe	Utilities are not protected, issues with hilly topography and access to those in need during an event.
Oxford	Many of our older folks are snowed in during winter storms. Ice storms and heavy snowstorms usually result in power failures.
Sharonville	Severe ice events have caused large scale power outraged in the past.
Trenton	Old growth trees, aging power grid, aging population. Having more snow removal equipment would help.
College Corner	No specific vulnerabilities at this time.
Jacksonburg	We have two main roads in the village – one is a state route and one is a county road.
Millville	No specific vulnerabilities at this time.
New Miami	Have lines go down. Plow trucks are getting old. We have a hard time with trees falling on power lines as well as the snow/ice weighing on structures.
Seven Mile	We have a lot of elderly some with disabilities who cannot get around in snow, ice. Snow and ice also down power lines and trees.

The following table shows the risk index and expanded expected annual loss information and scores for Butler County for the applicable sub-hazards of Severe Winter Storms that are included in FEMA's National Risk Index. Cold wave data can be found in the Extreme Temperatures hazard profile. Overall, Butler County is most vulnerable to winter weather based on the risk index rating and expected annual losses.

TABLE 4-34 FEMA NRI SEVERE WINTER STORM DATA FOR BUTLER COUNTY

NRI Category	Butler County Rating
Ice Storm	
Risk Index Rating	Relatively High (88.8 Rating)
Expected Annual Loss	Relatively High (90.1 Rating, $554,112 Expected Annual Loss) • $56,922 in Building Value • $497,190 in Population Equivalence • 0.04 in Population • N/A in Agriculture Value
Winter Weather	
Risk Index Rating	Relatively High (94.5 Rating)
Expected Annual Loss	Relatively High (95.2 Rating, $660,342 Expected Annual Loss) • $61,003 in Building Value • $599,086 in Population Equivalence • 0.05 in Population • $253 in Agriculture Value

Impacts to Socially Vulnerable Communities

Severe winter storms can have impacts similar to both thunderstorms as well as extreme cold events. Heavy snow loads can impact power lines, which can adversely affect aging populations and rural communities. These groups often do not have the same resources as more urbanized areas, and will have longer wait times until power is restored. Coupled with extremely low temperatures, and groups such as those below the poverty line, aging populations, and transient populations, can have trouble making it through a major storm event. High winds from these storms can damage older structures, or those where there has not been funds to maintain them. This can lead to families

and individuals having to leave their homes, which can add on expenses that they may not be able to handle.

Large amounts of snow can also impact transportation systems. There are many who rely on transit to get to their jobs or school, which can be shut down during winter storms. Many individuals are not able to afford cars, or cannot drive because of medical conditions. In all these cases, they rely on public and non-profit options to help them get to the grocery store or doctors appointments.

Hazard Risk by Community

During the planning process, each participating community ranked their risk to each profiled hazard in the plan. The representatives of the jurisdictions within Butler County were asked to consider the risk factors of probability, impact, spatial extent, warning time, and duration and how those factors may increase or decrease their community's risk to the hazard. A ranking of high indicates the community considers at least four of the factors to be an increased concern. A ranking of medium indicates the community considers two to three of the factors to be an increased concern. A ranking of low indicates the community considers one or no factors to be an increased concern. Each community's response to the hazard risk rating for severe winter storms is presented in the table below. All stakeholder responses gathered during the planning process through this form can be found in Appendix I.

TABLE 4-35 HAZARD RISK BY COMMUNITY FOR SEVERE WINTER STORMS

	Fairfield	Hamilton	Middletown	Monroe	Oxford	Sharonville	Trenton	College Corner	Jacksonburg	Millville	New Miami	Seven Mile
Severe Winter Storms	High	High	Low	High	High	Medium	High	High	High	Medium	High	Medium

4.3.7 FUTURE CONDITIONS IMPACTS

As the climate, population, and land uses of the county change over time, it is important to identify how these future conditions will affect the impacts of hazards. Severe winter storm impacts will be influenced by climate change, changes in population trends, and land use and development trends.

Climate Change Trends

As climate changes leads to an increase in more wet, heavy snowfalls, the weight of the snow load on old roofs or roofs that do not have a slope, or a steep enough slope, will collapse into buildings. With temperatures fluctuating more rapidly, climate change may cause snow and ice to melt rapidly and cause flooding and flash flooding. Rapid melting of the ice on waterways in Butler County may also lead to ice jams, flooding land behind and around the jam.

However, as the average temperature of Butler County continues to increase, the frequency at which severe winter storms occur is expected to decrease. Therefore, the impacts of severe winter weather in relation to climate change will generally decrease over time.

Changes in Population Trends

Winter storms have an indirect effect on the environment through the treatment of roadway surfaces with salt, chemicals, and other de-icing materials, which can impair adjacent surface and ground waters. This is particularly a concern in urban areas. As areas of the county are developed more and have a denser population, county and municipal road crews will treat the roads more frequently to ensure the safety of those traveling.

As the county's population ages, there will be an increased number of people that will be vulnerable to severe winter storm impacts. As discussed in the Community Vulnerability section of this profile, the elderly population is a group of people that has a hard time remaining mobile during severe winter storm events and may need checked in on by first responders during a long-term power outage.

Land Use and Development Trends

In severe winter storm events, buildings are vulnerable to widespread utility disruptions (including loss of heat and electricity) and may collapse or be damaged by downed trees. Environmental impacts often include damage to shrubbery and trees from heavy snow loading, ice build-up and/or high winds, which can break limbs or even bring down large trees. Another important secondary impact of winter storms is collapsing structures; the weight of snow may cause building damage or even a collapse during a heavy snowfall or a significant accumulation over time.

New construction in Butler County is built to adhere to the various Ohio building codes so the effects of severe winter storms may not be drastic.

Winter storms have a positive environmental impact as well; gradual melting of snow and ice provides excellent groundwater recharge. However, abruptly high temperatures following a heavy snowfall can cause rapid surface water runoff and severe flooding.

4.3.8 WINTER STORM SUMMARY

Butler County is subject to severe winter storms, which have the potential to become a hazard via cold temperatures, heavy snow or ice, and strong winds. The range of damage to structures depends on the magnitude and duration of the storm event. Losses may be as small as lost productivity and wages, when workers are unable to travel, or as large as roof damage or building collapse. The profile for severe winter storms primarily covers past and future damages from cold temperatures, heavy snow or ice, and sometimes strong winds.

4. DROUGHT

Hazard	Probability		Impact		Spatial Extent		Warning Time		Duration		RF Rating
Drought	2	0.6	1	0.3	4	0.8	1	0.1	4	0.4	2.2
Moderate Risk Hazard (2.0 – 2.99)											

4.4.1 DROUGHT DESCRIPTION

Drought is a normal, recurrent, feature of climate and originates from a deficiency of precipitation over an extended period, usually one or more seasons. Drought can result in a water shortage for some activity, group, or environmental sector. Drought is a complex natural hazard, as is reflected in the following four definitions commonly used to describe it:

- **Agricultural:** Defined principally in terms of naturally occurring soil moisture deficiencies relative to the water demands of plant life, usually arid crops.
- **Hydrological:** Related to the effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
- **Meteorological:** Defined solely on the degree of dryness, expressed as a departure of actual precipitation from an expected average or normal amount, based on monthly, seasonal, or annual time scales.
- **Socio-economic:** Associates the supply and demand of economic goods or services with elements of meteorological, hydrologic, and agricultural drought. Socioeconomic drought occurs when the demand for water exceeds the supply as a result of a weather-related supply shortfall. It may also be called a water management drought.

Although climate is a primary contributor to hydrological drought, factors such as changes in land use (e.g., deforestation), land degradation, and the construction of dams also affect the hydrological characteristics of a particular region. Since regions are interconnected by natural systems, the impact of meteorological drought may extend well beyond the borders of the precipitation-deficient area. Changes in land use upstream may alter hydrologic characteristics such as infiltration and runoff rates, resulting in more variable stream flow and a higher incidence of hydrologic drought downstream. Land use change is one way human actions alter the frequency of water shortage, even when no change in precipitation has been observed.

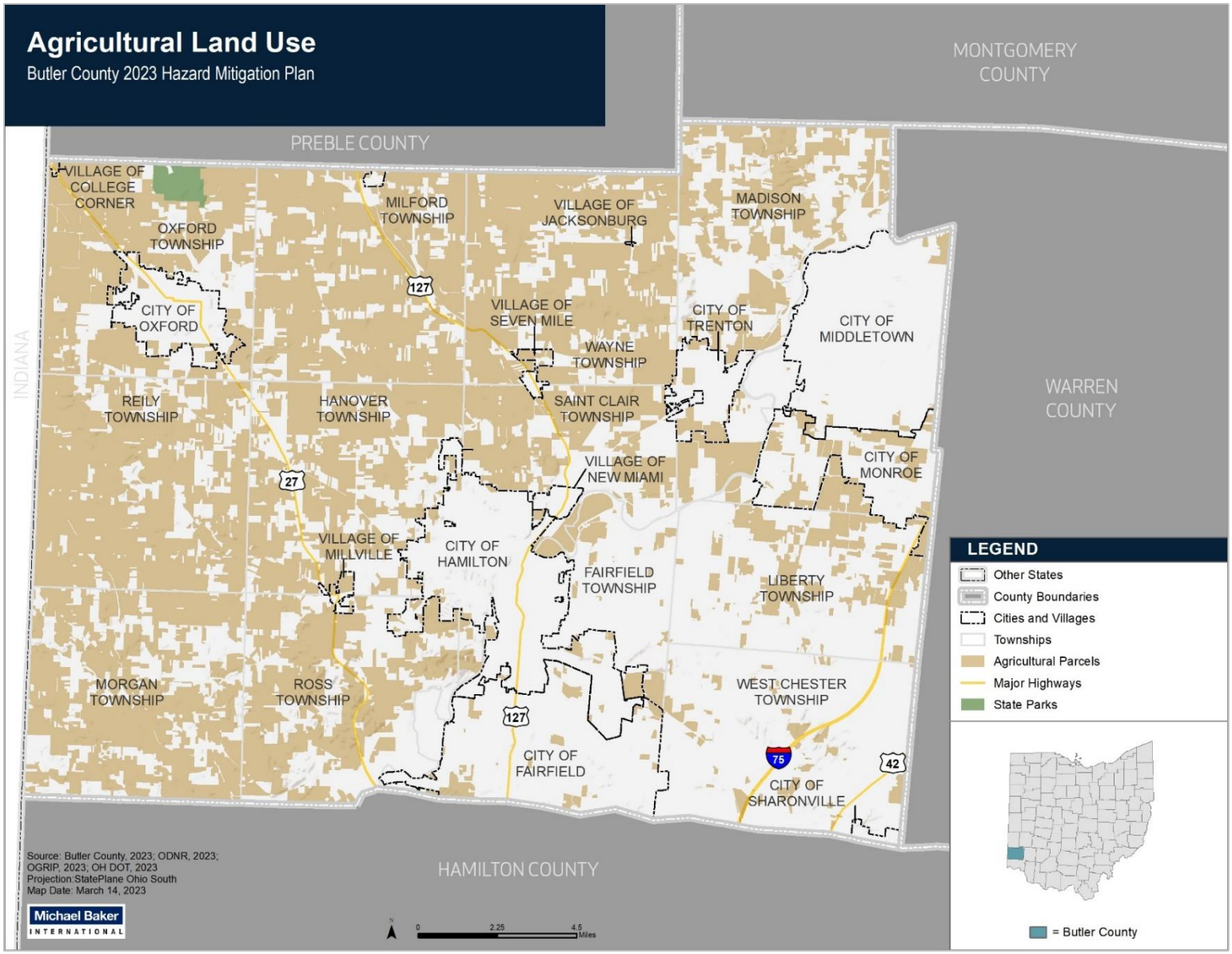
Drought risk is assessed based on a combination of the frequency, severity, and spatial extent (the physical nature of drought) and the degree to which a population or activity is vulnerable to the effects of drought. The degree of Butler County's vulnerability to drought depends on the region's environmental and social characteristics and is measured by its ability to anticipate, cope with, resist, and recover from drought.

Because drought is usually considered a regional hazard, it is not enhanced or analyzed by county-level mapping other than showing the areas more vulnerable to drought impacts. Mapping of the current drought status is published by the National Integrated Drought Information System (NIDIS).

4.4.2 LOCATION

Droughts are region-wide events that affect all of Butler County. All communities are affected during these occurrences. Drought impacts can be exasperated in agriculture land use and for structures that have a well as the source of water. The following image shows the land use that is designated as agricultural within Butler County.

FIGURE 4-17 AGRICULTURAL LAND USE IN BUTLER COUNTY



4.4.3 DROUGHT EXTENT

The Palmer Drought Severity Index (PDSI), developed by Wayne Palmer in the 1960s, uses temperature and rainfall information in a formula to determine dryness. It has become the semi-official drought index. The Palmer Index is most effective in determining long term drought—a matter of several months—and is not as good with short-term forecasts (a matter of weeks). It uses 0 as normal, and drought is shown in terms of negative numbers; for example, minus 2 is moderate drought, minus 3 is severe drought, and minus 4 is extreme drought.

TABLE 4-36 PALMER DROUGHT SEVERITY INDEX

Drought Severity	Return Period (Years)	Description of Possible Impacts	Drought Monitoring Indices		
			Standardized Precipitation Index (SPI)	NDMC* Drought Category	Palmer Drought Index
Minor Drought	3 to 4	Going into drought; short-term dryness slowing growth of crops or pastures; fire risk above average. Coming out of drought; some lingering water deficits; pastures or crops not fully recovered.	-0.5 to -0.7	D0	-1.0 to -1.9
Moderate Drought	5 to 9	Some damage to crops or pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested.	-0.8 to -1.2	D1	-2.0 to -2.9
Severe Drought	10 to 17	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed	-1.3 to -1.5	D2	-3.0 to -3.9
Extreme Drought	18 to 43	Major crop and pasture losses; extreme fire danger; widespread water shortages or restrictions	-1.6 to -1.9	D3	-4.0 to -4.9
Exceptional Drought	44 +	Exceptional and widespread crop and pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells creating water emergencies	Less than -2	D4	-5.0 or less

Drought severity depends on numerous factors, including duration, intensity, and geographic extent, as well as regional water supply demands by humans and vegetation. The severity of drought can be aggravated by other climatic factors, such as prolonged high winds and low relative humidity. The magnitude of drought is usually measured in time and the severity of the hydrologic deficit.

Several resources are available to evaluate drought status and estimate future expected conditions. The NIDIS Act of 2006 (Public Law 109-430) prescribes an interagency approach for drought monitoring, forecasting, and early warning. The NIDIS maintains the U.S. Drought Portal (www.drought.gov), a web-based access point to several drought-related resources, including the U.S. Drought Monitor (USDM) and the U.S. Seasonal Drought Outlook (USSDO).

4.4.4 HISTORICAL OCCURRENCES

General Trends

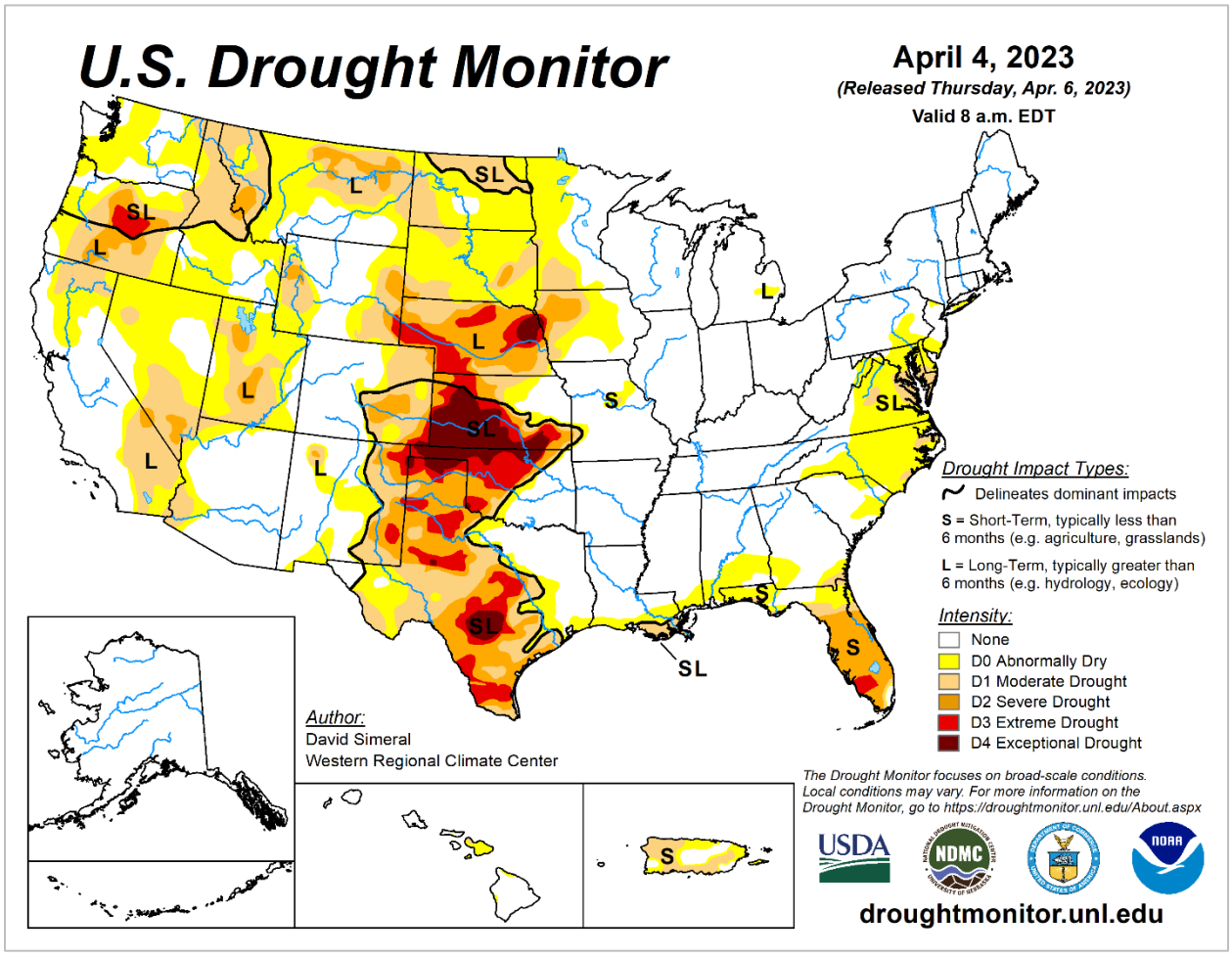
Butler County has not experienced any drought events since 2002, according to the NOAA NCEI Storm Events Database. However, there are two droughts on the database, dated to the months of July and August 1999.

Event Narratives

- **July 1999:** Dry conditions that began in the spring and early summer continued into July. Excessive heat contributed to substantial crop loss across much of the Buckeye state. Rainfall was widely scattered and did little to help farmers. Crop damage amounts were not available at the time of this writing.

- **August 1999:** Drought conditions continued across the Ohio Valley through August with most areas receiving well below normal rainfall for the month. In some areas around 50% of crops were considered total losses. Most counties in southwest Ohio were declared Federal Disaster Areas by the US Department of Agriculture.

FIGURE 4-18 EXAMPLE US DROUGHT MONITOR MAP



4.4.5 PROBABILITY OF FUTURE OCCURRENCES

Drought conditions are likely to become more frequent and persistent over the 21st century due to climate change. Drought related to climate change will increase pressure on Ohio water resources. Decreasing snowmelt and spring stream flows, coupled with increasing populations, anticipated hotter climate, and demand for water may lead to water shortages for residents.

(2022 CY) - (2002 HY) = 20 Years on Record

(20 Years) / (0 Events) = Greater than 20 years between events

Drought is difficult to predict but warning indicators can be tracked and monitored. Understanding the historical frequency, duration, and spatial extent of drought can help determine the likelihood and potential severity of future droughts. The characteristics of past droughts provide benchmarks for future projections. However, the probability that the county will experience a drought in any given year is difficult to predict. Based on historic frequency, there is a 0% chance for a drought event each year. The Planning Committee, based on their own knowledge, concluded that Drought events are "Possible" each year. This means that they have between at 1% and 10% chance of happening annually.

NOAA's Paleoclimatology Program studies drought by analyzing records from tree rings, lake and dune sediments, archaeological remains, historical documents, and other environmental indicators to obtain a broader picture of the frequency of droughts in the United States. According to their research, "…paleoclimatic data suggest that droughts as severe as the 1950s drought have occurred in central North America several times a century over the past 300-400 years, and thus we should expect (and plan for) similar droughts in the future. The paleoclimatic record also indicates that droughts of a much greater duration than any in the 20th century have occurred in parts of North America as recently as 500 years ago." Based on this research, the 1950s drought situation could be expected approximately once every 50 years (or has a 20% chance of occurring every 10 years). An extreme drought, worse than the 1930s "Dust Bowl," has an approximate probability of occurring once every 500 years or a 2% chance of occurring each decade. (NOAA, 2003) A 500-year drought with a magnitude similar to that of the 1930s, which destroys the agricultural economy and leads to wildfires, is an example of a high-magnitude event.

Impacts to vegetation and wildlife can include death from dehydration, the spread of invasive species, or disease because of stressed conditions. However, drought is a natural part of the environment in Ohio, and native species are likely to be adapted to surviving periodic drought conditions. It is unlikely that drought would jeopardize the existence of rare species or vegetative communities.

Environmental impacts are more likely at the interface of the human and natural world. The loss of crops or livestock due to drought can have far-reaching economic effects. Wind and water erosion can alter the visual landscape, and dust can damage property. Water-based recreational resources are affected by drought conditions. Indirect impacts from drought include wildfire, which may have additional effects on the landscape and sensitive resources, such as historic or archeological sites.

The following figure depicts the percentage of time that each county within Ohio spends in drought. Butler County spends approximately 5-9.99% of the time in a drought, the lowest percentage compared to the other regions within the state.

Future Conditions

An important consideration of hazard mitigation planning is to consider how future conditions, including a changing climate, will influence how drought will behave in and impact Butler County. The Ohio State University, in association with the State Climatologist Office of Ohio, identifies that the seasonal redistribution of precipitation will lead to an increase of precipitation in the spring and fall, but leave the summers in Ohio dry, causing drought-like conditions. According to The Climate Explorer, Butler County is projected to have 184.4 dry days a year by the 2090 decade, an increase of 6.5 days from the observed 1961-1990 average, and an increase of 20.2 days from the observed 164.2 dry days in 2010. The EPA also identifies that the Midwest will have hotter summers with longer dry periods.

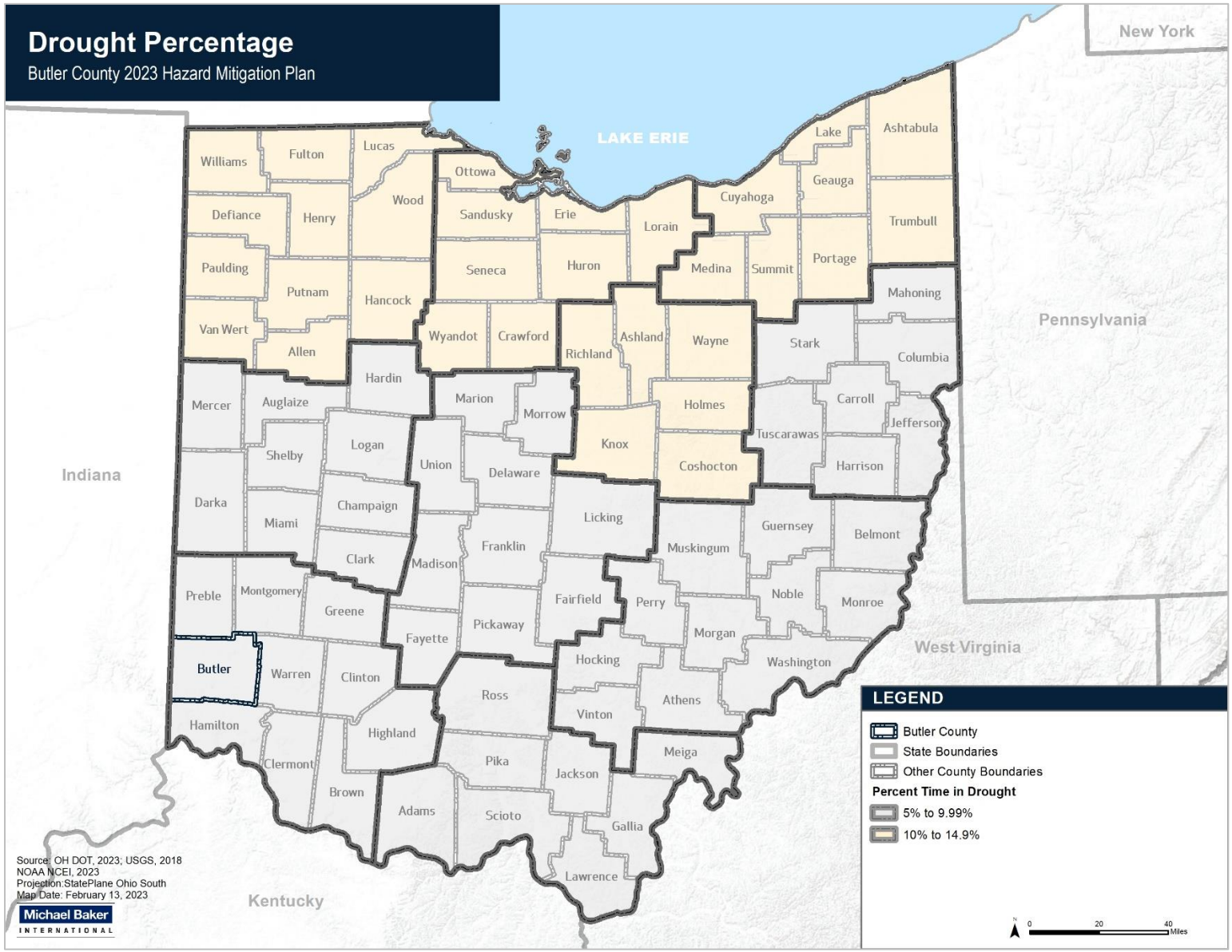
TABLE 4-37 THE CLIMATE EXPLORER CLIMATE PROJECTIONS FOR BUTLER COUNTY

	2005 Observed	2010 Observed	2020s Projection	2030s Projection	2040s Projection	2050s Projection	2060s Projection	2070s Projection	2080s Projection	2090s Projection
Dry Days per Period	174.1	164.2	178.3	182.3	181.3.	183.2	183.1	185.6	185.5	184.4

The Climate Mapping for Resilience and Adaptation (CMRA) Assessment Tool for Drought identifies future drought tendencies around the year 2050 based on a high-emissions scenario. CMRA projects that Butler County will have up to 13.6 days in a row with no precipitation, or consecutive dry days. The assessment tool projection is an increase of 1.1 days compared to the 1975-2000 average of consecutive dry days. The assessment tool also projects that by or around 2050, the daily maximum temperature will be 5.2°F higher and the daily minimum temperature will be 4.9°F higher

Based on this data, it can reasonably assumed that Butler County will have an increase in frequency and severity of drought events as the number of dry days will lead to greater, more significant drought events. Because droughts are often region and statewide events, the location of drought will not be impacted. However, the severity of droughts will be more noticeable in the agricultural crops that are grown in Butler County.

FIGURE 4-19 BUTLER COUNTY DROUGHT PERCENTAGE



4.4.6 ASSETS EXPOSED TO DROUGHT

Potential Losses

Agriculture: Impacts associated with agriculture, farming, and ranching. Drought-induced agricultural effects include: poor crop quality; income loss for farmers due to reduced crop yields; reduced productivity of cropland (due to wind erosion, long-term loss of organic matter, etc.); insect infestation; plant disease; increased irrigation costs; costs of developing new or supplemental water resources (wells, dams, pipelines); reduced productivity of rangeland; forced reduction of foundation stock; closure/limitation of public lands to grazing; high cost for/unavailability of water for livestock; and range fires.

The ArcGIS Living Atlas identifies Butler County to have $54,903,000 total sales related to agriculture annually. Broken down further, there is $18,684,000 in soy sales, $16,483,000 in corn sales, $3,172,951 in hay sales, $14,108,000 in livestock sales, and $1,043,180 in winter wheat sales. The interactive dataset also identifies 564 jobs in Butler County are agricultural-related positions.

Water/Energy: Impacts associated with surface or subsurface water supplies (i.e., reservoirs or aquifers), stream levels or stream flow, hydropower generation, or navigation. Drought-induced water/energy impacts include: lower water levels in reservoirs, lakes, and ponds; reduced flow from springs; reduced stream flow; loss of wetlands; estuarine impacts (e.g., changes in salinity levels); increased groundwater depletion, land subsidence, reduced recharge; water quality effects (e.g., salt concentration, increased water temperature, pH, dissolved oxygen, turbidity); revenue shortfalls and/or windfall profits; cost of water transport or transfer; cost of new or supplemental water resource development; loss from impaired navigability of streams, rivers, and canals.

Environment: Impacts associated with wildlife, fisheries, forests, and other fauna. Drought-induced environment impacts include: loss of plants or wildlife biodiversity; loss of trees from urban landscapes, shelterbelts, and wooded conservation areas; reduced or degraded fish and wildlife habitat; lack of feed and drinking water; greater wildlife mortality as animals seek food from farms and producers are less tolerant of the intrusion; disease; increased vulnerability to predation (from species concentrated near water); migration and concentration (loss of wildlife in some areas and too much in others); and increased stress on endangered species.

Fire: Impacts associated with forest and range fires that occur during droughts. The relationship between fires and droughts is very complex. Not all fires are caused by droughts, and serious fires occur when droughts are not taking place.

Social: Impacts associated with the public or the recreation/tourism sector. Drought-induced social impacts include: health-related low-flow problems (cross-connection contamination, diminished sewage flows, increased pollutant concentrations, reduced firefighting capability, etc.); loss of human life (e.g., from heat stress, suicides); public safety from forest and range fires; increased respiratory ailments; increased disease caused by wildlife concentrations; population migrations (rural to urban areas, migrants into the United States); loss of aesthetic values; reduction or

modification of recreational activities; losses to manufacturers and sellers of recreational equipment; losses related to curtailed activities (hunting and fishing, bird watching, boating, etc.).

TABLE 4-38 POTENTIAL IMPACTS FROM DROUGHT

Impact	Description
People	Dehydration can occur if water reserves run out.
Infrastructure	Lack of moisture in the ground can cause roadways to crack after long periods. Water reservoirs can dry up.
Economy	Rural areas that rely on crops suffer the most damage economically. Farmers lose large amounts of money during extended drought.
Natural Systems	Vegetation can be severely damaged. Rivers and streams can dry up.
Transportation	Cracks in roads can cause delays or detours.

Drought does not typically have a direct impact on critical facilities or structures. However, possible losses/impacts to critical facilities include the loss of function due to low water supplies. Severe droughts can negatively affect drinking water supplies. If this affects a public water system, shipping in outside water could cost millions of dollars. Private springs/wells could also dry up. Possible losses to infrastructure include the loss of potable water.

Droughts are not likely to affect structures or infrastructure. The prolonged absence of precipitation is more likely to have an impact on agricultural operations than on urban settings. The agricultural program's various project areas in Butler County may be affected. The county has an estimated $211 million in agriculture products. A 1% loss in crops would equate to $2,111,605, and a 5% loss would be $10,558,027 million.

Community Vulnerability

Droughts evolve slowly, and the population typically has ample time to prepare for their effects. However, if a drought affects the water available for public water systems or individual wells, the compromised availability of clean drinking water would require emergency actions and could overwhelm the local government and financial resources.

Due to the nature of drought, all property in the county is expected to be affected by drought conditions. However, agricultural land throughout the county would be affected the most. No injuries, death, property damage, or crop damage have been recorded as a result of drought in Butler County.

The following table reflects each jurisdiction's response from the Vulnerability Assessment form that was completed during the planning process. Responses for the form submitted by stakeholders can be found in **Appendix I.**

Jurisdiction/Organization	Vulnerability Assessment Response
Butler County	Crops dependent on rain would suffer, could cause a cascading economic impact for the county.
Fairfield	None identified.
Hamilton	No specific vulnerabilities.
Middletown	None.
Monroe	No specific vulnerabilities.
Oxford	Our city relies on local well water that has gone dry in the past. The solution was to run a pipe into a different community to access another aquafer for emergency use. This system is getting older and is not redundant.
Sharonville	City water is reliant on the Ohio River.
Trenton	No plan in place.
College Corner	No specific vulnerabilities at this time.
Jacksonburg	No plan in place.
Millville	No real threat.
New Miami	Not an area of concern.
Seven Mile	No known / foreseeable issues.

The following table shows the risk index and expanded expected annual loss information and scores for Butler County for Drought in FEMA's National Risk Index. The calculated rating for drought differs from the other hazard-specific ratings as it is based on agricultural impacts.

TABLE 4-39 FEMA NRI DROUGHT DATA FOR BUTLER COUNTY

NRI Category	Butler County Rating
Drought	
Risk Index Rating	Very Low (46.1 Rating)
Expected Annual Loss	Very Low (49.4 Rating, $19,594 Expected Annual Loss) • N/A in Building Value • N/A in Population Equivalence • N/A in Population • $19,594 in Agriculture Value

Impacts to Socially Vulnerable Communities

Drought does not often have a direct impact on people or infrastructure, but can heavily affect systems. There are groups within the county who rely on steady agricultural production for their livelihood. When drought reduces crop yields, they can find that they are stretched even more thinly than before. This can lead to increased homelessness and medical issues as families and individuals have to choose between competing costs.

Hazard Risk by Community

During the planning process, each participating community ranked their risk to each profiled hazard in the plan. The representatives of the jurisdictions within Butler County were asked to consider the risk factors of probability, impact, spatial extent, warning time, and duration and how those factors may increase or decrease their community's risk to the hazard. A ranking of high indicates the community considers at least four of the factors to be an increased concern. A ranking of medium indicates the community considers two to three of the factors to be an increased concern. A ranking of low indicates the community considers one or no factors to be an increased concern. Each community's response to the hazard risk rating for drought is presented in the table below. All

stakeholder responses gathered during the planning process through this form can be found in **Appendix I**.

TABLE 4-40 HAZARD RISK BY COMMUNITY FOR DROUGHT

	Fairfield	Hamilton	Middletown	Monroe	Oxford	Sharonville	Trenton	College Corner	Jacksonburg	Millville	New Miami	Seven Mile
Drought	Medium	Low	Low	Low	Low	Low	Low	Medium	Low	Medium	Medium	Low

4.4.7 FUTURE CONDITIONS IMPACTS

As the climate, population, and land uses of the county change over time, it is important to identify how these future conditions will affect the impacts of hazards. Drought impacts will be influenced by climate change, changes in population trends, and land use and development trends.

Climate Change Trends

The overall increase in dry days per year as well as longer consecutive dry day periods will drastically impact the county's grown crops, dry out forests, lead to an increased chance of wildfires, and reduce water. CMRA's Drought hazard analysis also identifies that recreational and tourist activities may also be impacted. Boating, fishing, and camping may suffer with the lack of water available, decreasing the economic benefits these activities bring.

The Ohio State University, in association with the State Climatologist Office of Ohio, discusses the relationship between dry days and the typical growing period of crops within the state. The seasonal redistribution of rainfall will cause dry summers, decreasing the precipitation needed for vast farmland crops needed to grow as well as hydrate livestock during the hot summer months.

Changes in Population Trends

Society's vulnerability to drought is affected by (among other things) population growth and shifts, urbanization, demographic characteristics, technology, water use trends, government policy, social behavior, and environmental awareness. These factors are continually changing, and society's vulnerability to drought may rise or fall in response to these changes. For example, increasing and shifting populations put more pressure on water and other natural resources.

Land Use and Development Trends

Future development's greatest impact on drought hazards could be related to ground water resources. New water and sewer systems or significant well and septic sites could use more of the water available, particularly during periods of drought. Public water systems are monitored, but individual wells and septic systems are not as strictly regulated. Therefore, future development could have an impact on drought vulnerabilities.

Regulatory Environment

The formal regulations that pertain to drought events are negligible.

4.4.8 DROUGHT SUMMARY

Drought is extremely difficult to predict, but drought indicators can be identified and monitored. The county will review and consider several mitigation measures for incorporation into future Plan updates.

- Assessment programs.
- Water supply augmentation and development of new supplies.
- Public awareness and education programs.
- Technical assistance on water conservation.
- Reduction and water conservation programs.
- Emergency response programs.
- Drought contingency plans.

Some of these actions can have long-term impacts, such as developing contingency plans and water conservation and public awareness programs. As Butler County gains more experience in assessing and responding to drought, future actions will undoubtedly become more timely, effective, and proactive.

5. EARTHQUAKE

Hazard	Probability		Impact		Spatial Extent		Warning Time		Duration		RF Rating
Earthquake	1	0.3	1	0.3	4	0.8	4	0.4	4	0.4	2.2
Moderate Risk Hazard (2.0 – 2.99)											

4.5.1 EARTHQUAKE DESCRIPTION

Earthquake Characteristics

The term "earthquake" refers to a vibration of the Earth's surface. These can be caused by movement along a fault, a volcanic eruption, or even manmade explosions. The vibration can be violent and cause widespread damage and injury or may be barely felt. Most destructive earthquakes are caused by movements along faults. An earthquake is both the sudden slip on an active earth fault and the resulting shaking and radiated seismic energy caused by the slip (USGS 2009). Stresses in the earth's outer layer push the sides of the fault together. Stress builds up, and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt. The amount of energy released during an earthquake is usually expressed as a magnitude and is measured directly from the earthquake as recorded on seismographs. Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface. Seismic shaking is typically the greatest cause of damage to structures during earthquakes.

Earthquakes may also cause landslides, particularly during the wet season, in areas of high water or saturated soils. The most likely areas for earthquake-induced landslides correlate to the areas of high landslide potential discussed later in this section.

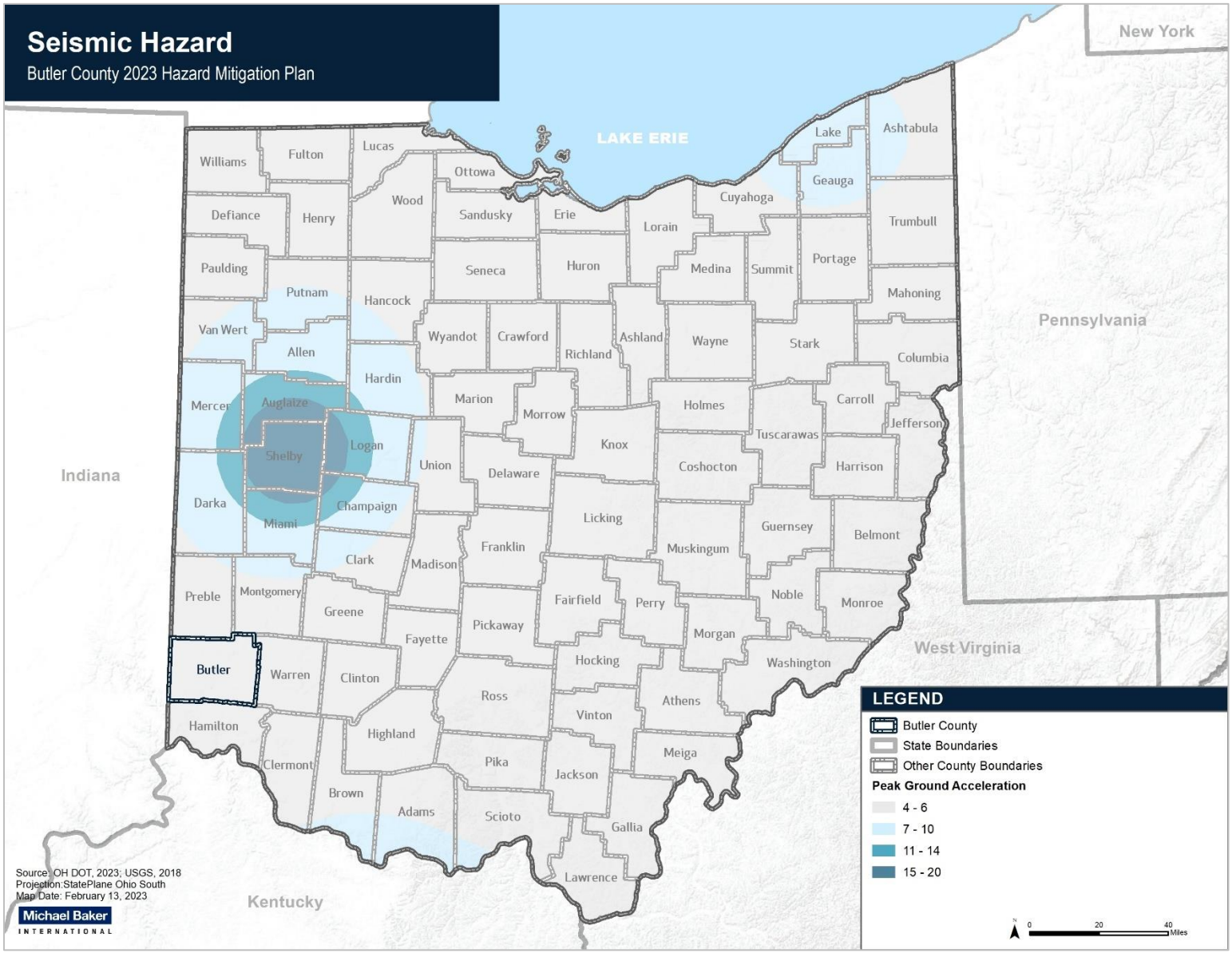
Ohio lies on the outermost boundaries of the New Madrid fault, centered at New Madrid, Missouri. This particular fault has created significant activity over the last 200 years. The most intense activity occurred in 1811 and-1812, when two earthquakes estimated to be 7's on the Richter scale hit the New Madrid Fault.

Ohio has recorded more than 300 earthquakes with a magnitude of 2.0 or greater since 1776. Of these, 15 were reported to have caused noticeable to moderate damage statewide. Two major centers of seismic activity in Ohio are 1) the Anna Seismogenic Area in Shelby and Auglaize counties, and 2) the northeast area of the state on the eastern side of Lake Erie, which is referred to as the Akron Magnetic Boundary. The Anna area has had more than 40 earthquakes, while northeastern Ohio has recorded over 100. None of these were reported to cause major damage or loss of life. Most seismologists predict that the largest magnitude of earthquake that might occur in the western Ohio zone could register between 6.5 and 7.0, while the northeastern zone could generate an earthquake with a magnitude between 6.0 and 6.5. The amount of damage would be difficult to predict, due to the area's lack of historic activity.

The county's lack of noticeable activity can be partly attributed to the Peak Ground Acceleration (PGA). PGA is partly determined by an area's soils and bedrocks. Butler County's PGA is very low.

According to the Ohio Seismic Network, poorly constructed buildings may be damaged when the peak acceleration nears 0.1g, while acceleration nearing 0.2g would create a loss of balance and greater damage to lesser quality structures. Butler County has a peak acceleration much below that number and is thus buffered from most seismic activity. The following figure depicts Butler County's PGA.

FIGURE 4-20 BUTLER COUNTY PEAK GROUND ACCELERATION



Earthquake Mechanics

Regardless of the source of the earthquake, the associated energy travels in waves radiating outward from the point of release. When these waves travel along the surface, the ground shakes and rolls, fractures form, and water waves may be generated. Earthquakes generally last a matter of seconds, but the waves may travel for long distances and cause damage well after the initial shaking at the point of origin has subsided.

Breaks in the crust associated with seismic activity are known as "faults." They are classified as either active or inactive. Faults may be expressed on the surface by sharp cliffs or scarps or may be buried below surface deposits.

"Foreshocks," minor releases of pressure or slippage, may occur months or minutes before the actual onset of an earthquake. "Aftershocks," which range from minor to major, may occur for months after the main earthquake. In some cases, strong aftershocks may cause significant additional damage, especially if the initial earthquake affected emergency management and response functions or weakened structures.

Factors Contributing to Damage

The damage associated with each earthquake is subject to four primary variables:

- Seismic Activity: The properties of earthquakes vary greatly from event to event. Some seismic activity is localized (a small point of energy release), while other activity is widespread (e.g., a major fault slipping all at once). Earthquakes can be very brief (a few seconds) or last for a minute or more. The depth of release and type of seismic waves also play roles in the nature and location of damage; shallow quakes will hit the area close to the epicenter harder but tend to be felt across a smaller region than deep earthquakes.

- Geology and Soils: The surface geology and soils of an area influence the propagation (conduction) of seismic waves and how strongly the energy is felt. Generally, stable areas (e.g., solid bedrock) experience less destructive shaking than unstable areas (e.g., fill soils). The siting of a community or even individual buildings plays a strong role in the nature and extent of damage from an event.

- Development: A small earthquake in the center of a major city can have far greater consequences than a major event in a thinly populated place.

- Time of Day: The timing of an event controls the distribution of the population of an affected area. On weekdays, the majority of the community will commute between work or school and home. The relative seismic vulnerability of each location can strongly influence the resulting injuries and loss of life.

Types of Damage

- Shaking: In minor events, objects fall from shelves and dishes are rattled. In major events, large structures may be torn apart by the forces of the seismic waves. In all but the largest quakes, structural damage is generally limited to older structures that are poorly maintained, constructed, or designed. Unreinforced masonry buildings and wood frame homes not

anchored to their foundations are typical victims. Loose or poorly secured objects also pose a significant hazard. These "non-structural falling hazard" objects include bookcases, heavy wall hangings, and building facades. Home water heaters pose a special risk due to their tendency to start fires when they topple over and rupture gas lines. Crumbling chimneys may also be responsible for injuries and property damage. Dam and bridge failures are significant risks during stronger earthquake events, and such failures may result in considerable property damage and loss of life. In areas of severe seismic shaking hazard, Intensity VII or higher can be experienced even on solid bedrock. In these areas, older buildings especially are at significant risk.

- **Ground Displacement:** Often, the most dramatic evidence of an earthquake is ground displacement along a fault line. Utility lines and roads may be disrupted, but direct damage is generally limited. In rare instances displacement may destroy a structure directly on the fault line.
- **Landslides and Avalanches:** Even small earthquake events can cause landslides. Rock falls are common as unstable material on steep slopes is shaken loose, but certain conditions can also generate significant landslides or debris flows. Roads blocked by landslides may hamper response and recovery operations.
- **Liquefaction and Subsidence:** Soils may liquefy and/or subside when impacted by the seismic waves. Fill and previously saturated soils are especially at risk. The failure of the soils can lead to widespread structural damage. It may also result in increased water flow and/or failure of wells as the subsurface flows are disrupted and sometimes permanently altered. Increased flows may be dramatic, with geyser-like waterspouts and/or flash floods. Similarly, damaged septic systems can create both inconvenience and health concerns.

4.5.2 LOCATION

While there are multiple sources of seismic activity in Ohio, the location of seismic activity varies as well. Many earthquakes do occur along faults. Information about faults can be obtained from the Ohio Seismic Network. No fault lines are within the county's border, so it is not possible to designate a specific area or areas as potential earthquake hazard locations. All of Butler County is at risk.

FIGURE 4-21 FAULT LINES IN THE STATE OF OHIO

4.5.3 EARTHQUAKE EXTENT

The most common method for measuring earthquakes is magnitude, which refers to the strength of the earthquake. Although the Richter Scale is known as a measurement for magnitude, most scientists currently use either the Mw Scale or Modified Mercalli Intensity (MMI) Scale. The effects of an earthquake in a particular location are measured by intensity. The earthquake's intensity decreases with increasing distance from its epicenter.

The magnitude of an earthquake is related to the total area of the fault that ruptured, as well as the amount of offset (displacement) across the fault. As shown in the following table, the seven earthquake magnitude classes range from great to micro. An earthquake with a "great" magnitude could cause tremendous damage to county infrastructure, while a micro class results in only minor damage.

TABLE 4-41 MOMENT MAGNITUDE SCALE

Magnitude Class	Magnitude Range (M = Magnitude)	Probable Damage Description
Micro	M < 3	Minor damage
Minor	3 <= M < 3.9	Rarely causes damage.
Light	4 <= M < 4.9	Moderate damage
Moderate	5 <= M < 5.9	Considerable damage
Strong	6 <= M < 6.9	Severe damage
Major	7 <= M < 7.9	Widespread heavy damage
Great	M > 8	Tremendous damage

The MMI Scale measures earthquake intensity. As the following table shows, the MMI Scale has 12 intensity levels. Each is defined by a group of observable earthquake effects, such as ground shaking or damage to infrastructure. Levels I through VI describe what people see and feel during a small to moderate earthquake. Levels VII through XII describe damage to infrastructure during a moderate to catastrophic earthquake.

TABLE 4-42 MODIFIED MERCALLI SCALE WITH ASSOCIATED IMPACTS

Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Usually detected only on seismographs.	<4.2
II	Feeble	Felt only by a few persons at rest, especially on upper floors of buildings.	
III	Slight	Felt quite noticeably indoors, especially on upper floors. Most people don't recognize it as an earthquake (i.e. a truck rumbling).	
IV	Moderate	Can be felt by people walking; dishes, windows, and doors are disturbed.	
V	Slightly Strong	Sleepers are awoken; unstable objects are overturned.	<4.8
VI	Strong	Trees sway; suspended objects swing; objects fall off shelves; damage is slight.	<5.4
VII	Very Strong	Damage is negligible in buildings of good design and construction, slight to moderate in well-built ordinary structures, and considerable in poorly built or badly designed structures; some chimneys are broken.	<6.1
VIII	Destructive	Damage is slight in specially designed structures; considerable in ordinary, substantial buildings. Moving cars become uncontrollable; masonry fractures, poorly constructed buildings damaged.	<6.9
IX	Ruinous	Some houses collapse, ground cracks, pipes break open; damage is considerable in specially designed structures; buildings are shifted off foundations.	
X	Disastrous	Some well-built wooden structures are destroyed; most masonry and frame structures are destroyed along with foundations. Ground cracks profusely; liquefaction and landslides widespread.	<7.3
XI	Very Disastrous	Most buildings and bridges collapse, roads, railways, pipes and cables destroyed.	<8.1
XII	Catastrophic	Total destruction; trees fall; lines of sight and level are distorted; ground rises and falls in waves; objects are thrown upward into the air.	>8.1

As indicated earlier, Ohio has multiple sources and locations of seismic activity. Many earthquakes occur along faults, and information about faults can be obtained from the Ohio Seismic Network.

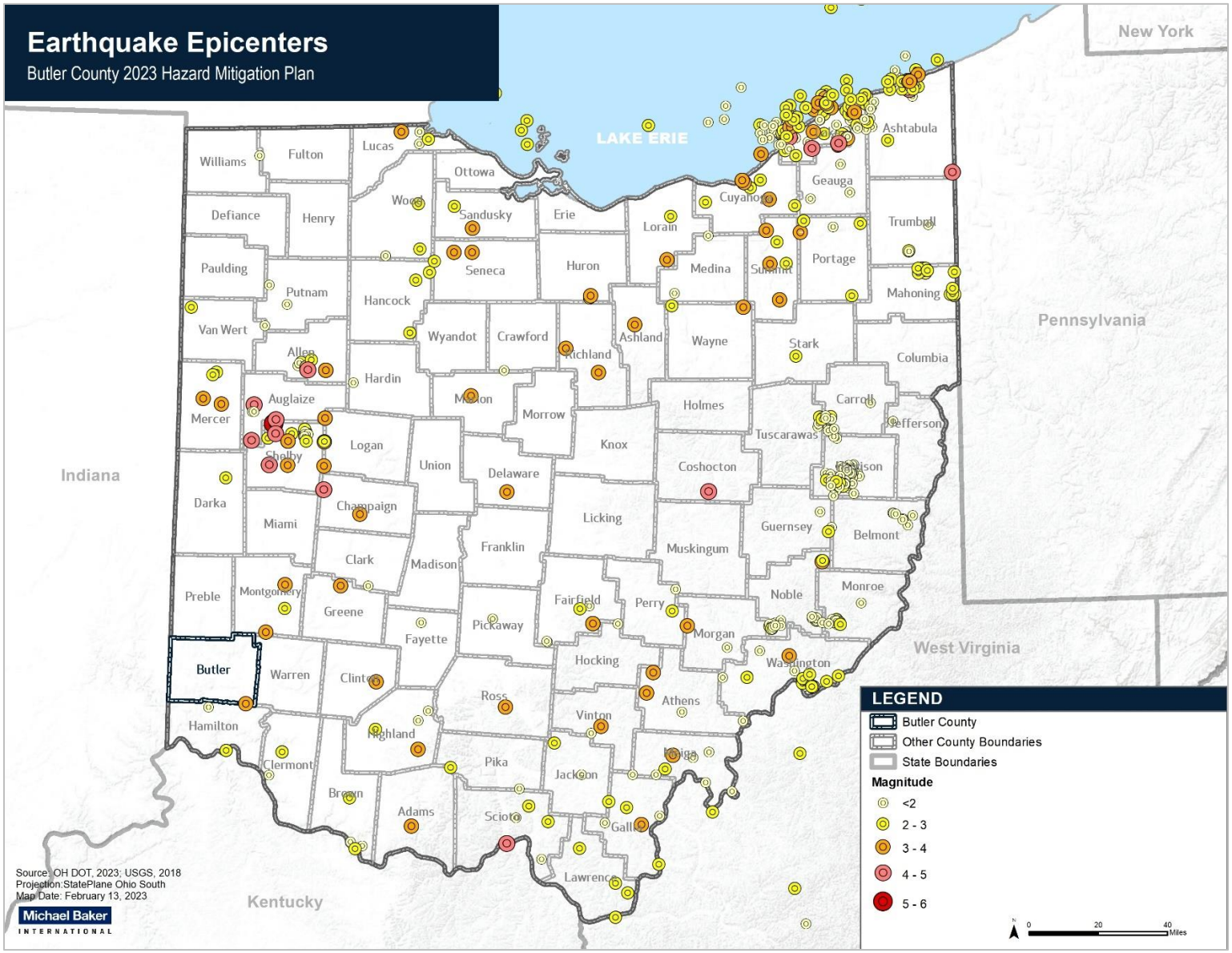
4.5.4 HISTORICAL OCCURRENCES

Earthquake Events

There have not been any recorded earthquakes in Butler County. There also has not been any recorded earthquakes in Preble, Montgomery, Warren, or Hamilton counties in the past 20 years according to the Ohio Department of Natural Resources Ohio Earthquake Epicenters interactive database. Indiana's 2019 State Hazard Mitigation Plan includes an image of earthquake epicenters, and there have not been any recent epicenters in the counties that border Butler County since 1975 to present day.

The following figure shows epicenters in the State of Ohio from 1970 – 2023 from Ohio Department of Natural Resources Earthquake Epicenters Database.

FIGURE 4-22 OHIO HISTORIC EARTHQUAKE EPICENTERS



4.5.5 PROBABILITY OF FUTURE OCCURRENCES

Recorded earthquakes over the past 20 years provide an acceptable framework for determining the future occurrence in terms of frequency for such events. The probability of experiencing earthquakes associated with damages or injury can be difficult to predict. Based on the historical record of no earthquake event from 2002 through 2022, it can reasonably be assumed that this type of event will occur in intervals greater than 20 years, or there is a 0% chance it will occur annually.

(2022 CY) - (2002 HY) = 20 Years on Record

(20 Years) / (0 Events) = Greater Than 20 Years Between Events

The Planning Committee, based on their own knowledge, concluded that Earthquake events are "Unlikely" each year. This means that they have less than a 1% chance of happening annually.

Future Conditions

An important consideration of hazard mitigation planning is to consider how future conditions, including a changing climate, will influence how earthquakes will behave in and impact Butler County. Currently, there are no studies or data to suggest that earthquake frequency, type, location, or intensity will be influenced by climate change. If new data or information is developed during this plan's five-year lifespan, the HMPC will update the plan to ensure this section is accurate.

4.5.6 ASSETS EXPOSED TO EARTHQUAKES

Potential Losses

TABLE 4-43 POTENTIAL IMPACTS FROM EARTHQUAKES

Impact	Description
People	Injuries may occur from falling objects during an earthquake. Landslides can result in death or injury if unexpected.
Infrastructure	Homes and businesses can suffer cracks to their structure. If they are close to a landslide, they could be potentially destroyed. Underground infrastructure may be split open during an earthquake.
Economy	Localized damaged only.
Natural Systems	Landslides can move large sections of land, killing trees and rerouting rivers.
Transportation	Entire roads can be cracked, uplifted, or otherwise made impassable until repaired. Detours would be needed in the meantime.

Community Vulnerability

Butler County is at a very low vulnerability to disastrous seismic activity. The nearest major fault, the New Madrid Fault, is hundreds of miles away. The lack of major historical events in the County, along with the relatively low PGA associated with the lands around the area put seismic events very low in the category of probability of occurrence. However, if a severe event were to occur with the County near the epicenter, damages would significant.

Hazus-MH 5.0 Earthquake

Hazus-MH was used to determine the types and numbers of potential assets exposed to earthquake damage. Hazus-MH is a regional multi-hazard loss estimation model developed by FEMA and the National Institute of Building Sciences. This program was conducted at the census block level, and a 5.0 magnitude earthquake was modeled. The results are presented below.

Although a 5.0-magnitude has never occurred within Butler County, this is the accepted baseline for simulating potential losses due to seismic events. The software takes into account the depth and location of the epicenter. In addition, the program helps determine the potential losses based on the region's prevailing soil types.

The geographical size of the region is 470.01 square miles and contains 80 census tracts. There are over 135 thousand households in the region which has a total population of 368,130 people (2010 Census Bureau data). There are an estimated 132 thousand buildings in the region with a total building replacement value (excluding contents) of 43,592 (millions of dollars). Approximately 92.00 % of the buildings (and 77.00% of the building value) are associated with residential housing. The replacement value of the transportation and utility lifeline systems is estimated to be 3,693 and 7,591 (millions of dollars), respectively.

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 9 hospitals in the region with a total bed capacity of 879 beds. There are 116 schools, 46 fire stations, 18 police stations and 1 emergency operation facility. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes 179 hazardous material sites, no military installations and no nuclear power plants.

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The total value of the lifeline inventory is over 11,284 (millions of dollars). This inventory includes over 183.93 miles of highways, 375 bridges, and 6,717.64 miles of pipes. The lifeline inventory data are provided in the following tables.

TABLE 4-44 TRANSPORTATION SYSTEM LIFELINE INVENTORY

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	375	888.5127
	Segments	105	1770.8860
	Tunnels	0	0.0000
	Subtotal		2659.3987
Railways	Bridges	76	349.0386
	Facilities	3	7.9690
	Segments	372	432.9025
	Tunnels	0	0.0000
	Subtotal		789.9301
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
	Subtotal		0.0000
Bus	Facilities	1	1.4696
	Subtotal		1.4696
Ferry	Facilities	0	0.0000
	Subtotal		0.0000
Port	Facilities	0	0.0000
	Subtotal		0.0000
Airport	Facilities	3	27.7393
	Runways	5	215.0463
	Subtotal		242.7856
	Total		3,693.60

TABLE 4-45 UTILITY SYSTEM LIFELINE INVENTORY

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	133.6597
	Facilities	1	34.9650
	Pipelines	0	0.0000
		Subtotal	168.6247
Waste Water	Distribution Lines	NA	80.1958
	Facilities	28	3677.7650
	Pipelines	0	0.0000
		Subtotal	3757.9608
Natural Gas	Distribution Lines	NA	53.4639
	Facilities	1	1.6074
	Pipelines	5	74.3942
		Subtotal	129.4655
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	0.0000
Electrical Power	Facilities	6	3534.4754
		Subtotal	3534.4754
Communication	Facilities	10	1.0500
		Subtotal	1.0500
		Total	7,591.60

The following images show the Peak Ground Acceleration and Peak Ground Velocity of the modeled earthquake scenario in Butler County.

FIGURE 4-23 HAZUS PGA IN BUTLER COUNTY

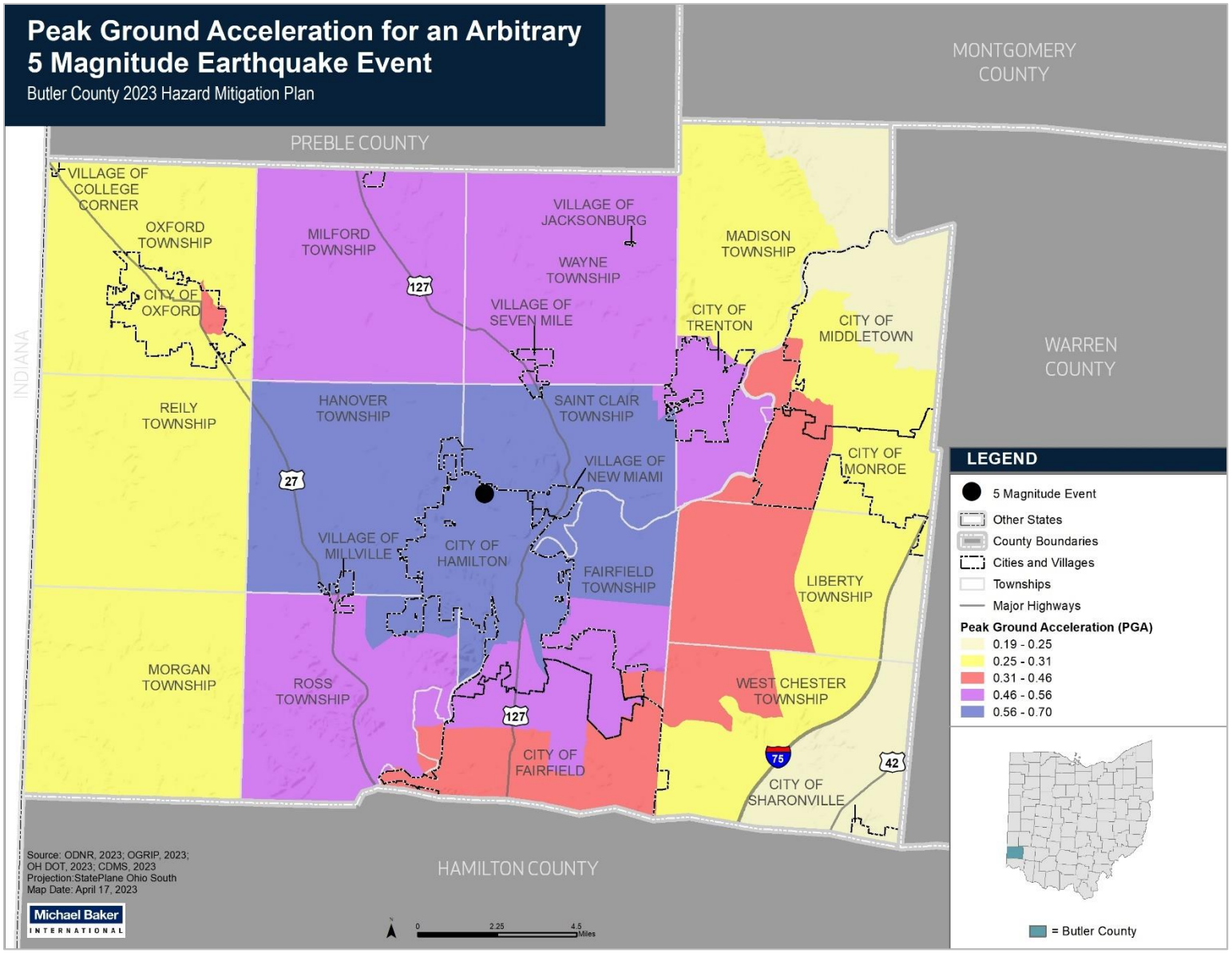
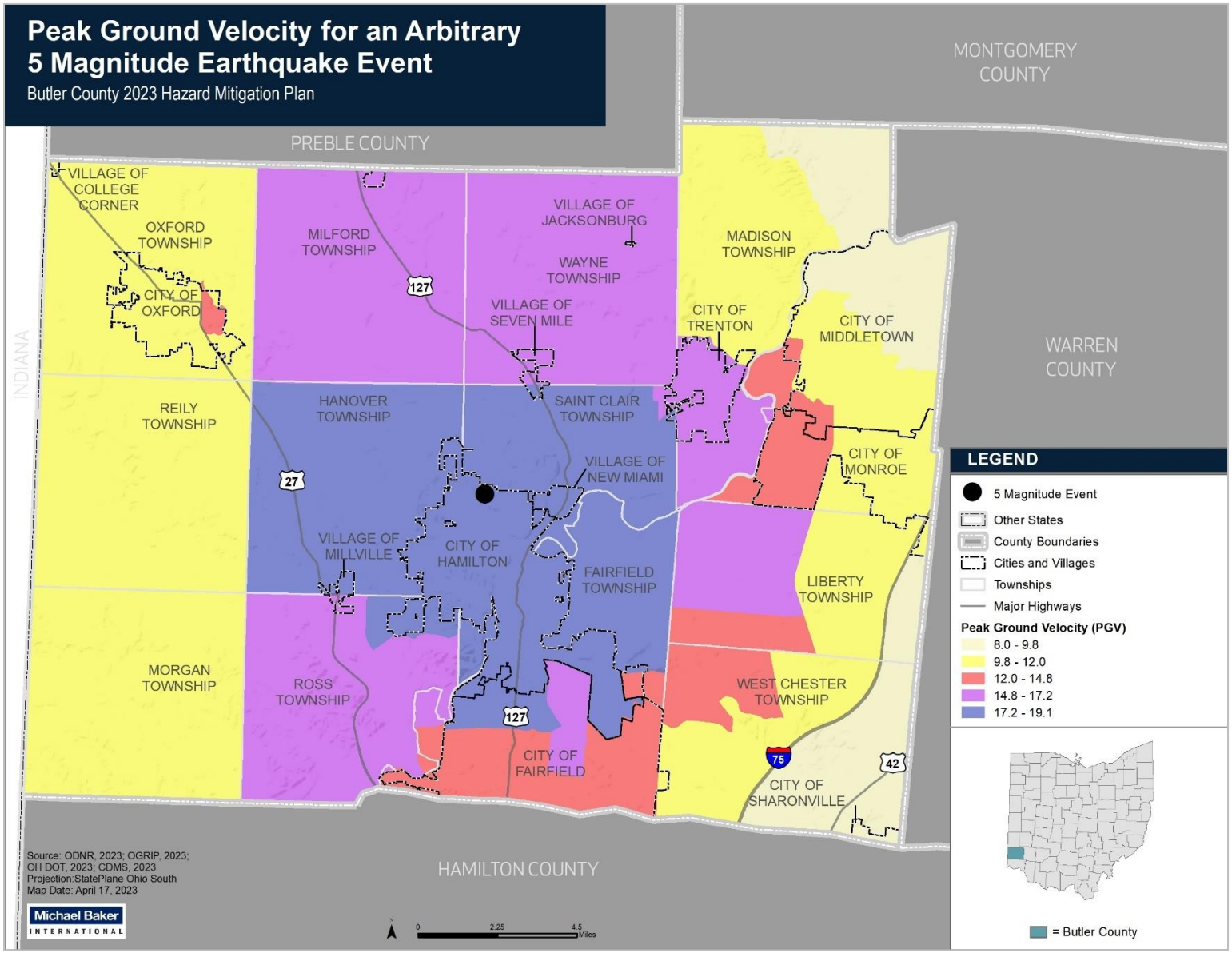


FIGURE 4-24 HAZUS PGV IN BUTLER COUNTY



Building Damage

Hazus estimates that about 34,264 buildings will be at least moderately damaged. This is over 26.00% of the buildings in the region. An estimated 3,658 buildings will be damaged beyond repair. Volume 1: Chapter 5 of the Hazus technical manual defines the various states of damage. The following table summarizes the expected damage to buildings in the region by general occupancy. The next table summarizes the expected damage by general building type.

FIGURE 4-25 EXPECTED BUILDING DAMAGE BY OCCUPANCY

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	116.40	0.18	73.79	0.21	113.49	0.51	86.29	1.01	48.03	1.31
Commercial	1842.60	2.90	1261.89	3.66	1743.87	7.90	1136.58	13.34	622.06	17.00
Education	71.30	0.11	44.20	0.13	60.01	0.27	36.48	0.43	18.01	0.49
Government	34.01	0.05	26.20	0.08	44.66	0.20	33.32	0.39	19.81	0.54
Industrial	574.50	0.90	384.91	1.12	587.92	2.66	419.68	4.93	228.00	6.23
Other Residential	3977.18	6.26	2416.64	7.01	2246.31	10.17	1334.05	15.66	619.82	16.94
Religion	267.13	0.42	157.38	0.46	161.19	0.73	102.97	1.21	56.33	1.54
Single Family	56605.63	89.16	30113.35	87.34	17130.10	77.56	5369.53	63.03	2046.39	55.94
Total	**63,489**		**34,478**		**22,088**		**8,519**		**3,658**	

FIGURE 4-26 EXPECTED BUILDING DAMAGE BY BUILDING TYPE

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	51737.81	81.49	26270.76	76.19	11625.54	52.63	1822.50	21.39	194.64	5.32
Steel	609.13	0.96	373.91	1.08	840.36	3.80	812.31	9.54	527.24	14.41
Concrete	250.46	0.39	139.78	0.41	212.10	0.96	151.19	1.77	70.40	1.92
Precast	243.01	0.38	110.36	0.32	214.53	0.97	194.91	2.29	89.29	2.44
RM	117.91	0.19	41.26	0.12	84.45	0.38	80.75	0.95	36.11	0.99
URM	9660.96	15.22	6835.70	19.83	7894.04	35.74	4482.18	52.61	2262.42	61.84
MH	869.48	1.37	706.58	2.05	1216.52	5.51	975.05	11.45	478.37	13.08
Total	**63,489**		**34,478**		**22,088**		**8,519**		**3,658**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Before the earthquake, the region had 879 hospital beds available for use. On the day of the earthquake, the model estimates that only 391 hospital beds (45.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 66.00% of the beds will be back in service. By 30 days, 87.00% will be operational.

TABLE 4-46 EXPECTED DAMAGE TO ESSENTIAL FACILITIES

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	9	2	0	5
Schools	116	43	0	30
EOCs	1	1	0	0
PoliceStations	18	8	0	3
FireStations	46	18	0	10

TABLE 4-47 EXPECTED DAMAGE TO THE TRANSPORTATION SYSTEMS

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	105	0	0	105	105
	Bridges	375	9	0	366	370
	Tunnels	0	0	0	0	0
Railways	Segments	372	0	0	372	372
	Bridges	76	0	0	76	76
	Tunnels	0	0	0	0	0
	Facilities	3	0	0	3	3
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	0	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	3	1	0	2	3
	Runways	5	0	0	5	5

TABLE 4-48 EXPECTED UTILITY SYSTEM FACILITY DAMAGE

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	1	1	0	0	1
Waste Water	28	24	0	0	18
Natural Gas	1	0	0	0	1
Oil Systems	0	0	0	0	0
Electrical Power	6	5	0	2	5
Communication	10	5	0	6	10

TABLE 4-49 EXPECTED UTILITY SYSTEM PIPELINE DAMAGE (SITE SPECIFIC)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	4,153	1524	381
Waste Water	2,492	765	191
Natural Gas	74	5	1
Oil	0	0	0

TABLE 4-50 EXPECTED POTABLE WATER AND ELECTRIC POWER SYSTEM PERFORMANCE

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	135,960	31,179	24,340	11,298	0	0
Electric Power		70,935	46,983	20,281	3,946	86

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that the earthquake will generated. The model breaks the debris into two general categories: a) brick/wood and b) reinforced concrete/steel. It makes this distinction because different types of material-handling equipment are required to handle the debris.

The model estimates that the earthquake will generate 1,836,000 tons of debris. Of that total amount, brick/wood comprises 46.00%, and the remainder is reinforced concrete/steel. The tonnage of this debris will require 73,440truckloads (@25 tons/truck) to remove.

FIGURE 4-27 HAZUS EARTHQUAKE DEBRIS

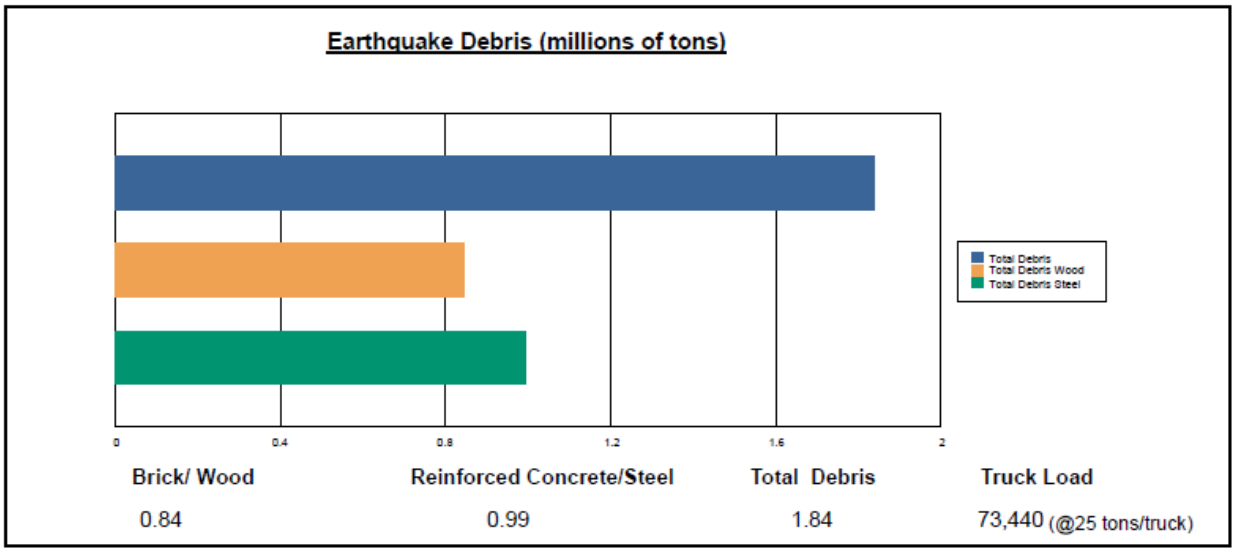
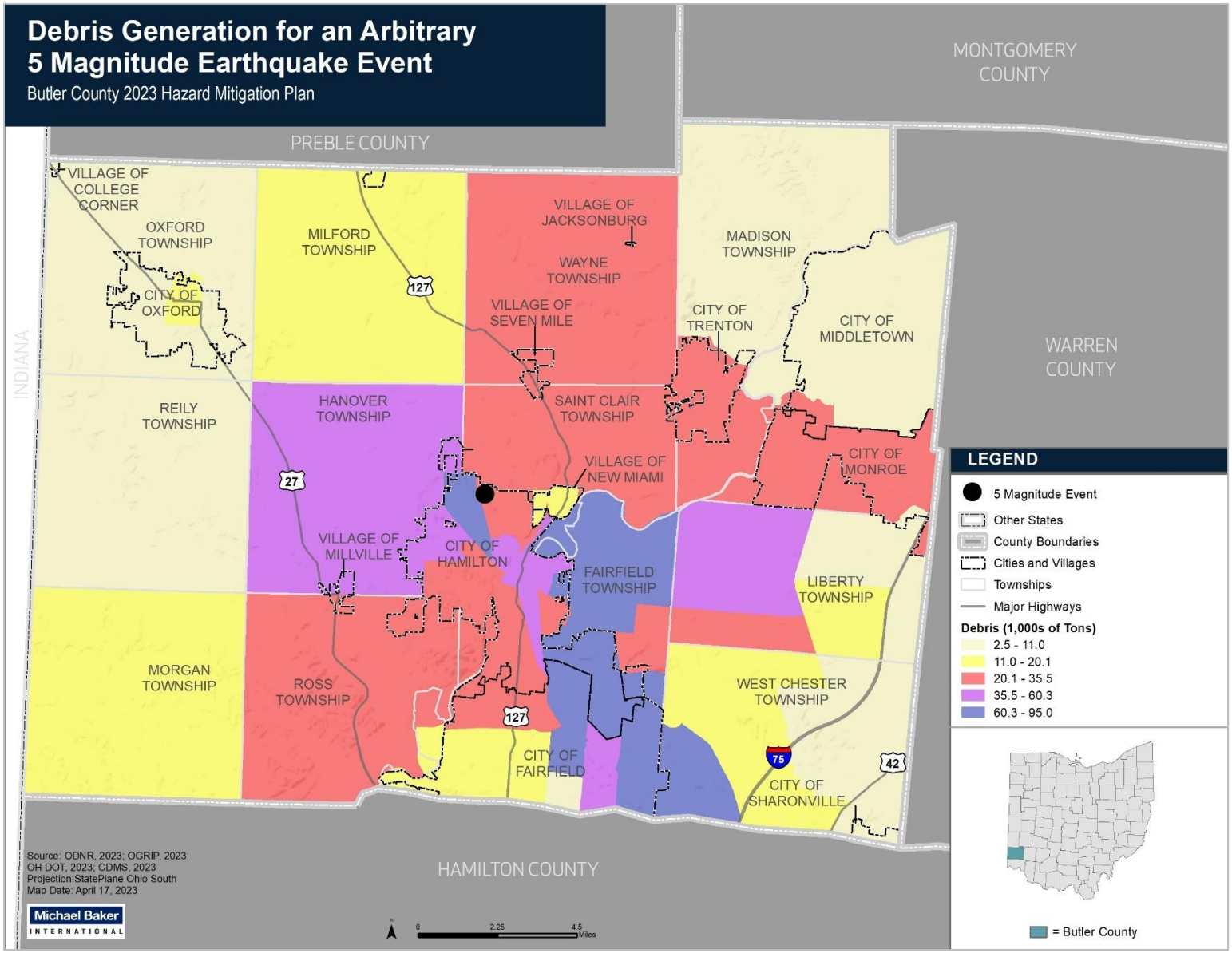


FIGURE 4-28 BUTLER COUNTY DEBRIS GENERATION



Shelter Requirements

HAZUS estimates the number of households that would be displaced from their homes by the earthquake and the number of displaced people who will require accommodations in temporary public shelters. The model estimates 4,395 households will be displaced by the earthquake. Of these, 2,773 people (from a total population of 368,130) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

TABLE 4-51 CASUALTY ESTIMATES

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	33.74	8.91	1.25	2.43
	Commuting	0.06	0.09	0.13	0.03
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	54.88	14.68	2.05	3.99
	Other-Residential	383.47	93.59	12.34	23.95
	Single Family	1089.60	264.37	37.10	72.89
	Total	**1,562**	**382**	**53**	**103**
2 PM	Commercial	1945.10	514.49	72.33	140.41
	Commuting	0.51	0.82	1.21	0.24
	Educational	734.77	199.29	30.79	59.88
	Hotels	0.00	0.00	0.00	0.00
	Industrial	404.99	108.50	15.22	29.37
	Other-Residential	75.61	18.93	2.60	4.87
	Single Family	222.77	55.98	8.21	15.41
	Total	**3,384**	**898**	**130**	**250**
5 PM	Commercial	1400.28	371.16	52.64	100.80
	Commuting	9.80	15.85	23.40	4.70
	Educational	72.61	18.73	2.80	5.46
	Hotels	0.00	0.00	0.00	0.00
	Industrial	253.12	67.81	9.51	18.36
	Other-Residential	149.54	37.23	5.11	9.57
	Single Family	438.29	109.73	16.07	30.15
	Total	**2,324**	**621**	**110**	**169**

Economic Loss

The total economic loss estimated for the earthquake is $8,783.88 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake.

The total building-related losses were $6,461.07 (millions of dollars); 18% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 54% of the total loss. The following table provides a summary of the losses associated with the building damage.

TABLE 4-52 BUILDING-RELATED ECONOMIC LOSS ESTIMATES

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	11.6962	204.4084	12.9954	15.2644	244.3644
	Capital-Related	0.0000	4.9649	179.4567	8.0732	3.1939	195.6887
	Rental	63.7757	41.6854	107.9877	4.3211	6.5329	224.3028
	Relocation	223.0658	30.6607	170.8088	20.7624	52.1541	497.4518
	Subtotal	**286.8415**	**89.0072**	**662.6616**	**46.1521**	**77.1453**	**1161.8077**
Capital Stock Losses							
	Structural	399.8793	78.6877	270.3697	75.4665	61.0198	885.4230
	Non_Structural	1520.9696	421.0667	712.0119	241.0622	171.5816	3,066.6920
	Content	572.5313	123.5585	358.5956	159.1087	89.6725	1,303.4666
	Inventory	0.0000	0.0000	10.8935	31.6943	1.0923	43.6801
	Subtotal	**2493.3802**	**623.3129**	**1351.8707**	**507.3317**	**323.3662**	**5299.2617**
	Total	**2780.22**	**712.32**	**2014.53**	**553.48**	**400.51**	**6461.07**

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages.

TABLE 4-53 TRANSPORTATION SYSTEM ECONOMIC LOSSES

(Millions of dollars)

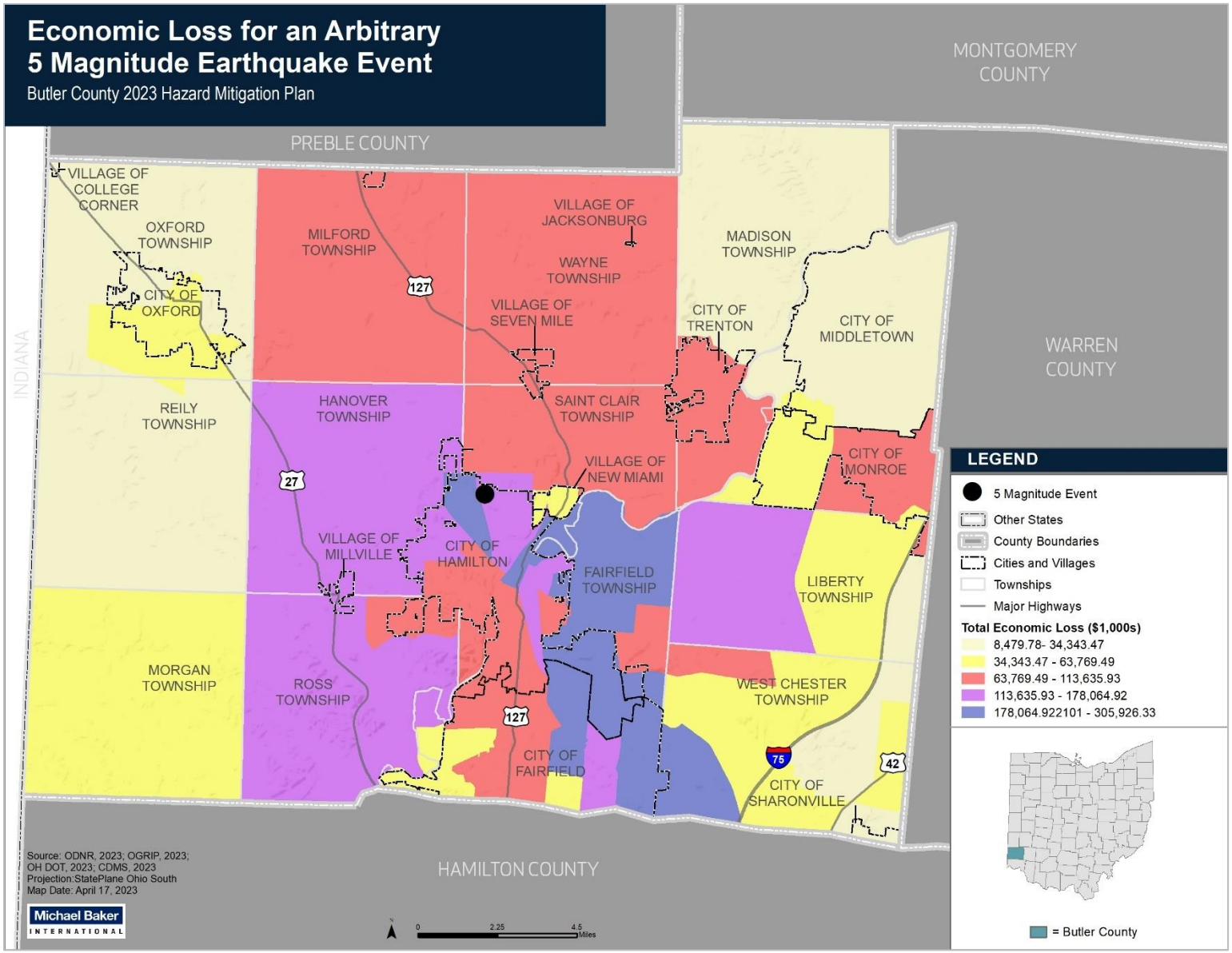
System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	1770.8860	0.0000	0.00
	Bridges	888.5127	29.3536	3.30
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**2659.3987**	**29.3536**	
Railways	Segments	432.9025	0.0000	0.00
	Bridges	349.0386	8.5631	2.45
	Tunnels	0.0000	0.0000	0.00
	Facilities	7.9890	1.6246	20.34
	Subtotal	**789.9301**	**10.1877**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	1.4696	0.3832	26.08
	Subtotal	**1.4696**	**0.3832**	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Port	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Airport	Facilities	27.7393	8.6128	31.05
	Runways	215.0463	0.0000	0.00
	Subtotal	**242.7856**	**8.6128**	
	Total	**3,693.58**	**48.54**	

TABLE 4-54 UTILITY SYSTEM ECONOMIC LOSSES

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	34.9650	11.7904	33.72
	Distribution Lines	133.6597	6.8564	5.13
	Subtotal	**168.6247**	**18.6468**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	3677.7650	1107.8243	30.12
	Distribution Lines	80.1958	3.4441	4.29
	Subtotal	**3757.9608**	**1111.2684**	
Natural Gas	Pipelines	74.3942	0.0000	0.00
	Facilities	1.6074	0.2136	13.29
	Distribution Lines	53.4639	1.1799	2.21
	Subtotal	**129.4655**	**1.3935**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	3534.4754	1142.7325	32.33
	Subtotal	**3534.4754**	**1142.7325**	
Communication	Facilities	1.0500	0.2307	21.97
	Subtotal	**1.0500**	**0.2307**	
	Total	**7,591.58**	**2,274.27**	

FIGURE 4-29 BUTLER COUNTY TOTAL ECONOMIC LOSS



The following table reflects each jurisdiction's response from the Vulnerability Assessment form that was completed during the planning process. Responses for the form submitted by stakeholders can be found in **Appendix I.**

Jurisdiction/Organization	Vulnerability Assessment Response
Butler County	Buildings not built to withstand an earthquake would suffer damage. There is concern over the bridges remaining operational and not failing during an event.
Fairfield	Older homes cannot withstand an event.
Hamilton	Homes and structures built decades ago would be impacted.
Middletown	Housing stock, hospital, steel mill, paper mill, chemical facilities are all vulnerable.
Monroe	Structures not built to withstand.
Oxford	Our City maintenance garage is old and likely wouldn't survive much of an earthquake.
Sharonville	There are multiple overpasses on I-75 and I-275 in Sharonville.
Trenton	No plan in place.
College Corner	No specific vulnerabilities at this time.
Jacksonburg	No plans.
Millville	Unsure what would be impacted.
New Miami	Not many structures in the village could withstand an earthquake.
Seven Mile	Fire house, town hall, police department, and village garage are very old and in need of repair and or replacement.

The following table shows the risk index and expanded expected annual loss information and scores for Butler County for Earthquake in FEMA's National Risk Index.

TABLE 4-55 FEMA NRI EARTHQUAKE DATA FOR BUTLER COUNTY

NRI Category	Butler County Rating
Earthquake	
Risk Index Rating	Relatively Low (89.0 Rating)
Expected Annual Loss	Relatively Low (87.3 Rating, $2,377,209 Expected Annual Loss) • $1,889,953 in Building Value • $487,256 in Population Equivalence • 0.04 in Population • N/A in Agriculture Value

Impacts to Socially Vulnerable Communities

Damages from earthquakes will often impact those who have the fewest resources. If a major event were to occur, those who live in unreinforced buildings, mobile homes, or in shelters will be the most impacted. This will typically mean aging populations and those living beneath the poverty line. These groups will not have the ability to quickly recover.

Hazard Risk by Community

During the planning process, each participating community ranked their risk to each profiled hazard in the plan. The representatives of the jurisdictions within Butler County were asked to consider the risk factors of probability, impact, spatial extent, warning time, and duration and how those factors may increase or decrease their community's risk to the hazard. A ranking of high indicates the community considers at least four of the factors to be an increased concern. A ranking of medium indicates the community considers two to three of the factors to be an increased concern. A ranking

of low indicates the community considers one or no factors to be an increased concern. Each community's response to the hazard risk rating for earthquakes is presented in the table below. All stakeholder responses gathered during the planning process through this form can be found in Appendix I.

TABLE 4-56 HAZARD RISK BY COMMUNITY FOR EARTHQUAKES

	Fairfield	Hamilton	Middletown	Monroe	Oxford	Sharonville	Trenton	College Corner	Jacksonburg	Millville	New Miami	Seven Mile
Earthquake	Medium	Low	Low	Medium	Low	Medium	Low	Low	Medium	Low	High	Low

4.5.7 FUTURE CONDITIONS IMPACTS

As the climate, population, and land uses of the county change over time, it is important to identify how these future conditions will affect the impacts of hazards. Earthquake impacts will be influenced by changes in population trends, and land use and development trends.

Changes in Population Trends

As populations become denser in already developed areas, the vulnerability of these populations and structures within these areas increase. Large amounts of people located in a small area could be severely injured or killed by falling debris or collapsing buildings. People that live or work in older homes and structures will continue to be vulnerable earthquake impacts. Because each municipality and Butler County officials enforce the building codes for new construction, an overall increase in population and new construction that comes with additional population, may not be exposed to earthquake impacts.

Land Use and Development Trends

Infrastructure in Butler County, including office buildings, government buildings, and homes, are not built to withstand the effect of a major earthquake. Continued enforcement of the unified construction code should mitigate this vulnerability for newly constructed buildings. However, Ohio building codes generally do not focus on construction relative to earthquake loads. Where earthquakes or seismic events are mentioned, it is usually in relation to truss design and anchoring appliances in structures. Because Ohio does not have strong earthquakes, the laws and guidelines pertaining to seismic stress on roads, bridges, or buildings are negligible.

4.5.8 EARTHQUAKE SUMMARY

Most sources in the geology science predict that the largest magnitude earthquake that might occur in Ohio would register no higher than 5. However, some sources state that an earthquake with a magnitude of 6 or higher could be registered in the Anna region. An event of this intensity would likely be felt throughout the county, but since the area has not been the epicenter to an earthquake or seismic event, it is difficult to estimate potential damage.

6. TORNADO

Hazard	Probability		Impact		Spatial Extent		Warning Time		Duration		RF Rating
Tornado	3	0.9	2	0.6	1	0.2	2	0.2	1	0.1	2.0
Moderate Risk Hazard (2.0 – 2.99)											

4.6.1 TORNADO DISCRIPTION

A **tornado** is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. Tornadoes are most often generated by thunderstorm activity (but sometimes result from hurricanes or tropical storms), when cool, dry air intersects and overrides a layer of warm, moist air and forces the warm air to rise rapidly. The damage caused by a tornado is a result of high wind velocities and wind-blown debris. According to the National Weather Service, tornado wind speeds can range from 30 to more than 300 miles per hour.

FIGURE 4-30 EXAMPLE OF A TORNADO

Tornadoes are more likely to occur during the spring and early summer months of March through June and are most likely to form in the late afternoon and early evening. Most tornadoes are a few dozen yards wide and touch down briefly, but even small, short-lived tornadoes can inflict tremendous damage. Destruction ranges from minor to catastrophic, depending on the intensity, size, and duration of the storm. Structures made of light materials, such as mobile homes, are most susceptible to damage. Each year, an average of over 800 tornadoes is reported nationwide, resulting in an average of 80 deaths and 1,500 injuries.

Strong winds not associated with tornadoes, severe thunderstorms, and winter storms can also occur. These winds typically develop with strong pressure gradients and gusty frontal passages. The closer and stronger two systems are (one high pressure, one low pressure), the stronger the pressure gradient and, therefore, the stronger the winds.

4.6.2 LOCATION

All communities in Butler County are affected by these occurrences. Tornadoes can touch down in any location, without any way to predict where they will occur. Generally, an entire county or region is under a tornado warning or watch.

4.6.3 TORNADO EXTENT

The Enhanced Fujita Scale, also known as the “EF-Scale,” measures tornado strength and associated damages. The EF-Scale updates the Fujita scale, the following table, which was published in 1971. Both scales classify U.S. tornadoes into six intensity categories, based on the estimated maximum winds within the wind vortex. Since it was applied by the National Weather Service in

2007, the EF-Scale has become the definitive metric for estimating tornado wind speeds based on the damage done to buildings and structures.

TABLE 4-57 FUJITA SCALE AND ASSOCIATED DAMAGE

F-Scale Number	Wind Speed (MPH)	Type of Damage Possible
0	< 73	**Light damage.** Chimney damage; branches broken off trees; smaller trees/shallow-rooted trees pushed over; damage to sign boards.
1	73-112	**Moderate Damage.** Surface-layer of roofs pulled off; mobile homes pushed off foundations or pushed over; cars pushed off roads.
2	113-157	**Considerable Damage.** Entire roofs torn off homes; mobile homes destroyed; train cars pushed over; large trees uprooted; cars lifted off the ground; lighter objects become flying debris.
3	158-206	**Severe damage.** Roofs and walls torn off homes; complete trains overturned; entire forests destroyed with uprooted trees; heavy automobiles lifted off the ground and thrown.
4	207-260	**Devastating damage.** Homes completely leveled; buildings with weaker structure destroyed and turned into flying debris; cars turned into flying debris.
5	261-318	**Incredible damage.** All structures leveled; cars that are turned into flying debris traveling through the air for over 100 meters; trees debarked.

TABLE 4-58 ENHANCED FUJITA SCALE AND ASSOCIATED DAMAGE

EF-Scale Number	Wind Speed (MPH)	Type of Damage Possible
EF0	65-85	**Minor damage**: Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e., those that remain in open fields) are always rated EF0.
EF1	86-110	**Moderate damage**: Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	**Considerable damage**: Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136-165	**Severe damage**: Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	**Devastating damage**: Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	>200	**Extreme damage**: Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (300 ft.); steel reinforced concrete structure badly damaged; high-rise buildings have significant structural deformation.

The Storm Prediction Center (SPC) has developed damage indicators to be used with the Enhanced Fujita Scale for different types of buildings. They can also be used to classify any high wind event. Some of the indicators for different building types are shown in the following tables.

TABLE 4-59 SPC INSTITUTIONAL BUILDING DAMAGE INDICATORS

Damage Description	Wind Speed Range (Expected, in Parentheses)
Threshold of visible damage	59-88 MPH (72 MPH)
Loss of roof covering (<20%)	72-109 MPH (86 MPH)
Damage to penthouse roof and walls, loss of rooftop HVAC equipment	75-111 MPH (92 MPH)
Broken glass in windows or doors	78-115 MPH (95 MPH)
Uplift of lightweight roof deck and insulation, significant loss of roofing material (>20%)	95-136 MPH (114 MPH)
Façade components torn from structure	97-140 MPH (118 MPH)
Damage to curtain walls or other wall cladding	110-152 MPH (131 MPH)
Uplift of pre-cast concrete roof slabs	119-163 MPH (142 MPH)
Uplift of metal deck with concrete fill slab	118-170 MPH (146 MPH)
Collapse of some top building envelope	127-172 MPH (148 MPH)
Significant damage to building envelope	178-268 MPH (210 MPH)

Source: Storm Prediction Center, 2009

TABLE 4-60 SPC EDUCATIONAL INSTITUTIONS (ELEMENTARY) DAMAGE INDICATORS

Damage Description	Wind Speed Range (Expected, in Parentheses)
Threshold of visible damage	55-83 MPH (68 MPH)
Loss of roof covering (<20%)	66-99 MPH (79 MPH)
Broken windows	71-106 MPH (87 MPH)
Exterior door failures	83-121 MPH (101 MPH)
Uplift of metal roof decking; significant loss of roofing material (>20%); loss of rooftop HVAC	85-119 MPH (101 MPH)
Damage to or loss of wall cladding	92-127 MPH (108 MPH)
Collapse of tall masonry walls at gym, cafeteria, or auditorium	94-136 MPH (114 MPH)
Uplift or collapse of light steel roof structure	108-148 MPH (125 MPH)
Collapse of exterior walls in top floor	121-153 MPH (139 MPH)
Most interior walls of top floor collapsed	133-186 MPH (158 MPH)
Total destruction of a large section of building envelope	163-224 MPH (192 MPH)

Source: Storm Prediction Center, 2009

TABLE 4-61 SPC METAL BUILDING SYSTEMS DAMAGE INDICATORS

Damage Description	Wind Speed Range (Expected, in Parentheses)
Threshold of visible damage	54-83 MPH (67 MPH)
Inward or outward collapsed of overhead doors	75-108 MPH (89 MPH)
Metal roof or wall panels pulled from the building	78-120 MPH (95 MPH)
Column anchorage failed	96-135 MPH (117 MPH)
Buckling of roof purlins	95-138 MPH (118 MPH)
Failure of X-braces in the lateral load resisting system	118-158 MPH (138 MPH)
Progressive collapse of rigid frames	120-168 MPH (143 MPH)
Total destruction of building	132-178 MPH (155 MPH)

Source: Storm Prediction Center, 2009

TABLE 4-62 SPC ELECTRIC TRANSMISSION LINES DAMAGE INDICATORS

Damage Description	Wind Speed Range (Expected, in Parentheses)
Threshold of visible damage	70-98 MPH (83 MPH)
Broken wood cross member	80-114 MPH (99 MPH)
Wood poles leaning	85-130 MPH (108 MPH)
Broken wood poles	98-142 MPH (118 MPH)

Source: Storm Prediction Center, 2009

Improved and consistent building codes have been considered a key measure for mitigating the life and property losses associated with tornadoes and wind events. All of Butler County is equally at risk of tornado damage.

4.6.4 HISTORICAL OCCURRENCES

General Trends

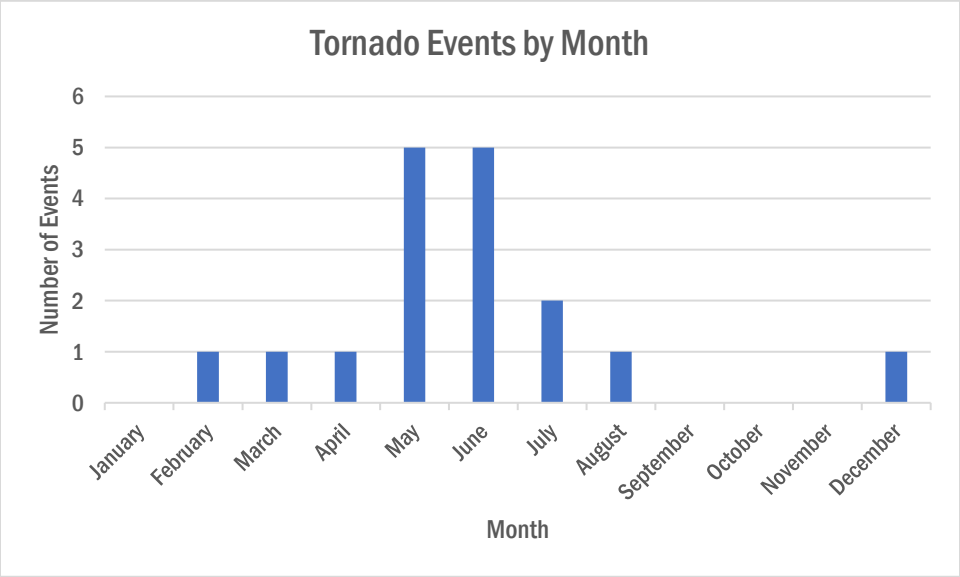
Butler County may experience intense winds from thunderstorms, tornadoes, or even the remnants of hurricanes and tropical storms. Tornadoes can occur any time of the year, though county records indicate that tornado occurrences peak from May through July (see the following figure). There has

been a total of 3 tornadoes in the last twenty years in Butler County, resulting in no deaths, no injuries, $215,000 in property damages, and no reported crop damages, according to the NCDC. An additional tornado touched down February 27, 2023, with a magnitude of EF1. The NCDC Storm Events Database only has tornado events up until December 31, 2022, so the February 27, 2023, touchdown has not been recorded in the database at the time of this plan's development. A complete list of tornado events from 1950 to current day can be found in **Appendix B.** There has been an average of $71,667 in property damages per tornado event in the past 20 years, and there has not been an average of crop damage per tornado event.

TABLE 4-63 TORNADO EVENTS IN BUTLER COUNTY, JANUARY 1, 2002-DECEMBER 31, 2022

Location	Date	Time	Mag	Deaths	Injuries	Property Damage	Crop Damage
Oxford Miami University Ar	6/3/2008	8:05 PM	EF0	0	0	$30,000	$0
Hughes	5/25/2011	11:30 PM	EF1	0	0	$175,000	$0
Astoria	6/18/2021	7:41 PM	EF0	0	0	$10,000	$0
Grand Total				**0**	**0**	**$215,000**	**$ 0**

FIGURE 4-31 BUTLER COUNTY TORNADO EVENTS BY MONTH, JANUARY 1, 1950-DECEMBER 31, 2022



Butler County has been directly affected by 18 tornadoes events since 1950, including the February 2023 EF1 tornado. The County has been a part of one federal disaster declaration where tornadoes were a factor in the overall emergency.

TABLE 4-64 FEDERALLY DECLARED DISASTERS AFFECTING BUTLER COUNTY

Disaster Number	Declaration Date	Title	Public Assistance	Individual Assistance
DR-421	4/4/1974	Tornadoes	-	-

Event Narratives

- **May 10, 1969:** An F3 tornado touched down in Butler County at 2:10 in the afternoon of May 10th. The tornado traveled from the southwest corner of the county through the eastern border for a length of 23.8 miles. The tornado was 400 yards wide and caused 9 injuries. There was a reported $2,500,000 in property damage.

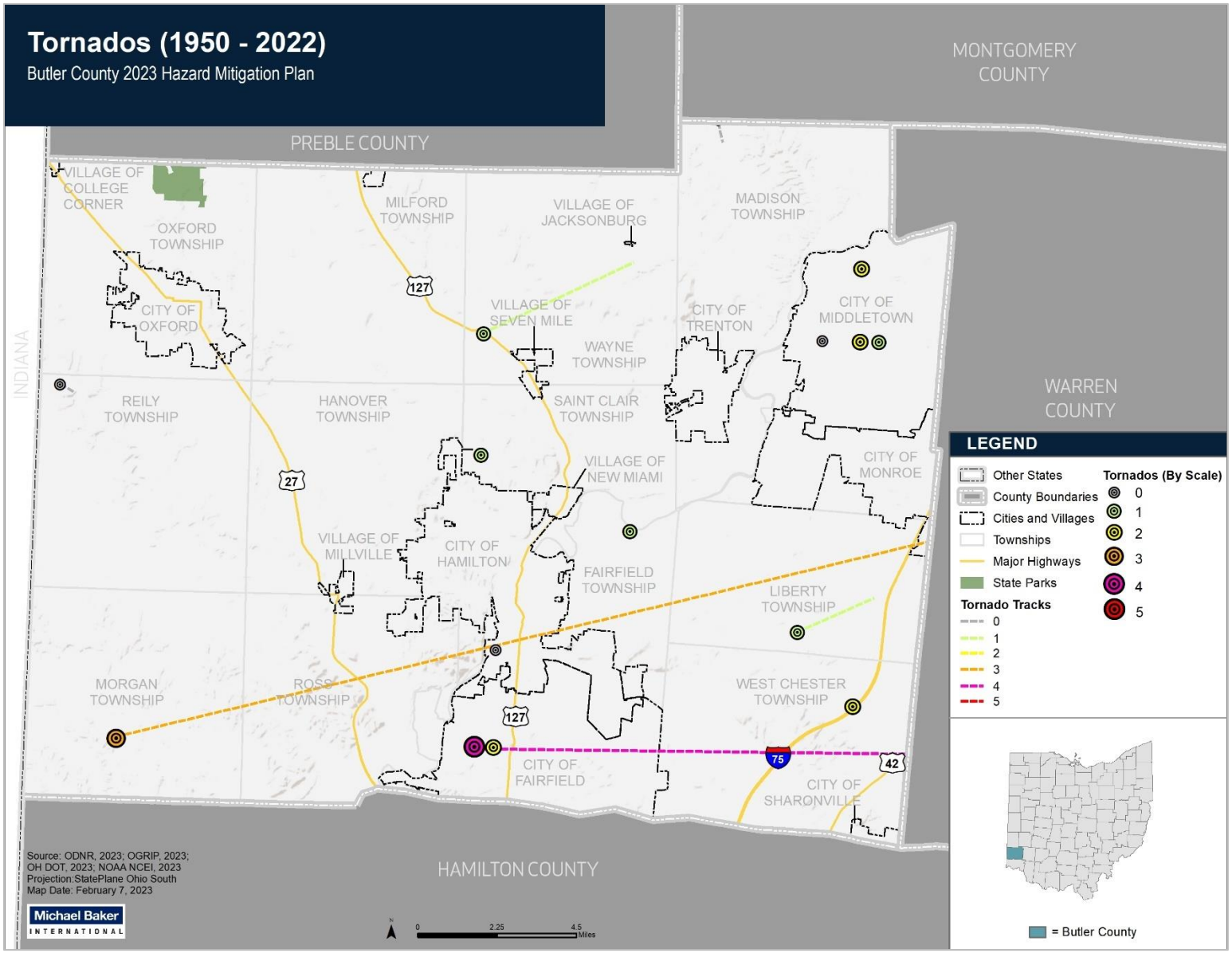
- **May 19, 1973:** A small tornado touched down briefly in Ross, Ohio. Most of the damage appeared to be from straight line winds, but debris on a farm indicated tornado circulation. Two farm buildings were demolished and about fifteen houses had shingles and TV antennas blown off. Numerous trees were uprooted or broken off. Power lines were downed by falling trees or tree branches, up to ten miles east of Ross in Butler and Hamilton counties, from the same storm. The tornado traveled for 1 mile, with a width of 77 yards, and measured as an F1.

- **June 2, 1990:** An F4 tornado traveled three miles with a width of 1,350 yards. The tornado caused a reported $25,000,000 in property damages and 2 injuries. After traveling through neighboring counties, the tornado touched down in Butler County at 11:45 PM. 19 homes and 4 mobiles homes were destroyed in Butler County. 58 homes, 22 mobile homes, and 5 apartment buildings were moderately damaged.

- **May 25, 2011:** A National Weather Service storm survey confirmed an EF1 tornado near Liberty Township. The tornado lifted an entire roof off of a two-story home and the exterior walls collapsed. Significant roof damage occurred to three other residences nearby as well. Multiple vehicles sustained damage in the path of the tornado. Numerous trees were snapped, power poles were snapped, and several homes had minor roof and siding damage due to the tornado. The maximum estimated wind speed based on damage was around one-hundred and five miles per hour.

- **February 27, 2023:** Confirmed by the National Weather Service, a tornado touched down at approximately 2:37 in the afternoon in Butler County. The tornado was on the ground for 6 minutes, lifting at 2:43 PM. The EF1 tornado impacted land northwest of Middletown – Madison Township and Wayne Township – with a measured windspeed reaching 110 MPH and was 150 yards wide at its peak. No injuries were reported, but a house in the tornado's path, on Elk Creek Road, lost its roof and the barn on the property was completely destroyed. The tornado then traveled northeast towards Dicker Road, spreading debris from homes approximately 2,000 feet away from the houses. The total cost of property damage has not yet been determined.

FIGURE 4-32 HISTORICAL TORNADO TRACKS IN BUTLER COUNTY



4.6.5 PROBABILITY OF FUTURE OCCURRENCES

Reported tornado events over the past 21 years provide an acceptable framework for projecting the frequency of future occurrence. The probability of experiencing a tornado event can be difficult to quantify, but based on a historical record of 4 tornado events since 2002, it can reasonably be assumed that this type of event occurred once every 5.25 years from 2002 through 2023.

(2023 CY) - (2002 HY) = 21 Years on Record

(21 Years) / (4 Events) = 5.25 Years Between Events

The historic frequency indicates that there is a 19% chance of this type of event occurring each year. The Planning Committee, based on their own knowledge, concluded that Tornado events are "Likely" each year. This means that they have between at 10% and 100% chance of happening annually.

Future Conditions

An important consideration of hazard mitigation planning is to consider how future conditions, including a changing climate, will influence how tornadoes will behave in and impact Butler County. Climate change has a direct impact on the potential frequency of tornadoes develop during a severe thunderstorm. As severe thunderstorms become more frequent and intense, tornadoes also have a higher chance to develop during severe thunderstorm events. The location of where a tornado can occur is not predictable, and it will continue to be unpredictable as climate change influences the chance of a tornado occurring and a potential for a stronger intensity. The U.S. Global Change Research Program's Global Climate Change Impacts in the United States report does state that there is limited knowledge in how tornado characteristics will change in the future, however. The report discusses that there has been an increase in reported severe weather with tornadoes in the past fifty years. Although, this could be attributed to improvements in radars and increased public awareness. Therefore, there is no true data to support tornado events have increased in frequency or strength since the 1950s in the United States. Looking forward, though, Butler County can reasonably assume that with the increase in severe thunderstorm frequency and severity, the likelihood of a tornado developing can also increase.

4.6.6 ASSETS EXPOSED TO TORNADOES

Potential Losses

TABLE 4-65 POTENTIAL IMPACTS FROM TORNADOES

Impact	Description
People	Severe injuries or death may occur, particularly to those outside or in their vehicles. Large enough tornadoes can kill people, even in moderately sturdy structures.
Infrastructure	Damaged or completely destroyed. Weak tornadoes may only rip shingles off a roof, while the strongest can level buildings completely. Power lines can be ripped off their poles and create power outages for large areas.
Economy	Small towns will often be affected the most by significant events. Large tornadoes can hinder transportation, delaying or cutting off supplies to towns.
Natural Systems	Small trees may be completely uprooted, and large trees could lose significant branches. Crops may be destroyed or heavily damaged.

Transportation	Transportation can be severely disrupted by debris on roadways.

While all county assets are considered to be at risk from this hazard, a particular tornado would only cause damages along its specific track. A high-magnitude tornado sweeping through densely populated portions of the county could create extensive injuries, deaths, and economic losses. There is no way to be sure how many people would be injured or killed due to the differences in time of day and path, but property values can be used to estimate economic losses.

Community Vulnerability

All assets in Butler County can be considered at risk from tornadoes and wind events. This includes 100% of the county's population and all critical facilities, structures, and infrastructure. Mobile homes can have a heightened vulnerability to strong wind and tornado events if they are not anchored in place. There are an estimated 1,120 mobile homes within Butler County. Lemon Township has the highest number of mobile homes, with 219 structures on mobile home parcels. St. Clair Township has the second highest number of structures on mobile home parcels with 191, and Fairfield has the third highest number of structures on mobile home parcels with 181 mobile homes. Lemon Township also has the largest percentage of mobile homes in relation to total structures, with 20% of its total structures are mobile home parcels. Sharonville has the second highest percentage, 16% of its total structures are mobile home parcels. St. Clair Township has the third highest percentage, with 9% of its total structures are mobile home parcels.

TABLE 4-66 ESTIMATED MOBILE HOMES PER MUNICIPALITY IN BUTLER COUNTY

Municipality	Total Structures	Structures on mobile home parcels	Percent Mobile Homes
City of Fairfield	15,552	181	1%
City of Hamilton	26,081	115	0%
City of Middletown	21,236	0	0%
City of Monroe	5,523	0	0%
City of Oxford	5,393	6	0%
City of Sharonville	995	158	16%
City of Trenton	4,610	0	0%
Fairfield Township	8,640	42	0%
Hanover Township	3,264	0	0%
Lemon Township	1,108	219	20%
Liberty Township	15,221	36	0%
Madison Township	3,476	1	0%
Milford Township	1,300	0	0%
Morgan Township	2,283	85	4%
City of Oxford Township	976	0	0%
Reily Township	1,141	0	0%

Ross Township	3,370	76	2%
Somerville Township	122	0	0%
St. Clair Township	2,018	191	9%
Village of College Corner	97	0	0%
Village of Jacksonburg	29	0	0%
Village of Millville	335	10	3%
Village of New Miami	931	0	0%
Village of Seven Mile	325	0	0%
Wayne Township	1,595	11	1%
West Chester Township	24,287	3	0%
Grand Total	**124,026**	**1,120**	**1%**

The following table reflects each jurisdiction's response from the Vulnerability Assessment form that was completed during the planning process. Responses for the form submitted by stakeholders can be found in **Appendix I.**

Jurisdiction/Organization	Vulnerability Assessment Response
Butler County	Building infrastructure, impacts to food facilities, impacts to clients served through outreach programs. Our county's infrastructure overseen by the Engineer's Office, roads bridges, is county-wide, and needs to be operational for public and rescue services.
Fairfield	Large percentage of the population is in multi-story, multi-family dwellings without a basement shelter. Large commercial structures are susceptible to high wind impacts.
Hamilton	City services and infrastructure.
Middletown	Old housing stock, steel mill, paper mill, several chemical facilities.
Monroe	Home construction is not built to withstand a tornado.
Oxford	We have a trailer park and numerous slab build homes that are susceptible to tornadoes. We have no storm shelters for this population.
Sharonville	A tornado during normal business hours could quickly overwhelm emergency services due to the increase in daytime/business population vs residential population.
Trenton	Our schools are spread out all over the city, increasing the risk of more than one being damaged. One central fire station is vulnerable for total loss of emergency services if it is hit directly by a tornado.
College Corner	No specific vulnerabilities at this time.
Jacksonburg	We need a tornado siren for the village and Wayne Township.
Millville	There are no additional vulnerabilities.
New Miami	Many homes are older in the Village. A lot of homes could not withstand a tornado. Town hall has a basement but has not been dedicated as a storm/tornado shelter. Residents may be unaware of the basement shelter.
Seven Mile	A lot of older homes that cannot stand against powerful tornado/high winds. No power outage preparedness. Lack of shelter for residents.

The following table shows the risk index and expanded expected annual loss information and scores for Butler County for Tornado in FEMA's National Risk Index.

TABLE 4-67 FEMA NRI TORNADO DATA FOR BUTLER COUNTY

NRI Category	Butler County Rating
Tornado	
Risk Index Rating	Relatively High (98.2 Rating)
Expected Annual Loss	Relatively High (98.2 Rating, $24,723,047 Expected Annual Loss) • $14,813,610 in Building Value • $9,908,729 in Population Equivalence • 0.85 in Population • $708 in Agriculture Value

Impacts to Socially Vulnerable Communities

Tornado has very similar effects to high wind events and thunderstorms on socially vulnerable communities and underserved populations. As these groups may reside in structures that are more susceptible to damage, these buildings may not hold up during a tornado, putting them more at risk. Structures like mobile homes can be severely damaged and destroyed by even smaller tornadoes.

Transient populations are particularly susceptible since they may not have the ability to seek shelter in time.

Hazard Risk by Community

During the planning process, each participating community ranked their risk to each profiled hazard in the plan. The representatives of the jurisdictions within Butler County were asked to consider the risk factors of probability, impact, spatial extent, warning time, and duration and how those factors may increase or decrease their community's risk to the hazard. A ranking of high indicates the community considers at least four of the factors to be an increased concern. A ranking of medium indicates the community considers two to three of the factors to be an increased concern. A ranking of low indicates the community considers one or no factors to be an increased concern. Each community's response to the hazard risk rating for tornadoes is presented in the table below. All stakeholder responses gathered during the planning process through this form can be found in Appendix I.

TABLE 4-68 HAZARD RISK BY COMMUNITY FOR TORNADOES

	Fairfield	Hamilton	Middletown	Monroe	Oxford	Sharonville	Trenton	College Corner	Jacksonburg	Millville	New Miami	Seven Mile
Tornadoes	High	High	High	High	High	Medium	High	High	High	Low	High	High

4.6.7 FUTURE CONDITIONS IMPACTS

As the climate, population, and land uses of the county change over time, it is important to identify how these future conditions will affect the impacts of hazards. Tornado impacts will be influenced by

changes in population trends and land use and development trends. As it is currently unclear how climate change will influence future tornado events, Tornadoes are often produced by and during severe thunderstorm events – it can reasonably assumed that climate change trends related to severe thunderstorms are aligned with how climate change will influence tornado impacts.

Changes in Population Trends

As population increase within the county, more people are exposed to tornado impacts. Additionally, an increase in mobile or manufactured homes and residents of these homes would also impact the county's vulnerability.

Land Use and Development Trends

Improved and consistent building codes are considered to be a key measure to mitigate the risk of life and property losses associated with tornadoes and wind events. All Butler County property is equally at risk to tornado damage, and there are no locations of high-risk exposure. An increase in development does add additional structures that can be damaged if they are located in a tornado's path, but newer structures are built to withstand higher wind events.

Regulatory Environment

The formal regulations that pertain to tornadoes are negligible. While protective measures are suggested, especially for mobile/modular homes, these are not generally required in local codes.

4.6.8 TORNADOES SUMMARY

It is difficult to separate the tornado wind components that cause damage from other wind-related natural events that often generate those tornadoes. For example, hurricanes with intense winds often spawn numerous tornadoes or generate severe thunderstorms that produce strong, localized down-drafts. Tornadoes are difficult to predict, and the entire county is subject to all categories of windstorms.

In addition to improved construction standards, retrofitting infrastructure to enhance the design standards can limit exposure. Examples include structural cladding, shuttering systems, and materials that are resistant to the penetration of wind-blown debris and projectiles.

7. DAM/LEVEE FAILURE

Hazard	Probability		Impact		Spatial Extent		Warning Time		Duration		RF Rating
Dam/Levee Failure	1	0.3	1	0.3	2	0.4	3	0.3	4	0.4	1.7
Low Risk Hazard (1.0 – 1.99)											

4.7.1 DAM/LEVEE FAILURE DESCRIPTION

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

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

A levee, unlike a dam, is an elongated ridge constructed of fill or wall which regulates water levels. These are usually earthen hills built along a river's floodplain to prevent flooding in nearby population areas. Typically, these run parallel to a river. **According to the National Levee Inventory, there are seven levee systems in Butler County.**

Dam and levee failures typically occur when spillway capacity is inadequate and excess flow overtops the dam, or when internal erosion (piping) through the dam or foundation occurs. Complete failure occurs if internal erosion or overtopping results in a complete structural breach, releasing a high-velocity wall of debris-laden water that rushes downstream.

Dam and levee failures can result from any one or a combination of the following causes:

- **Prolonged periods of rainfall and flooding**, which cause most failures;
- **Inadequate spillway capacity**, resulting in excess overtopping flows;
- **Internal erosion** caused by embankment or foundation leakage or piping;
- **Improper maintenance**, including failure to remove trees, repair internal seepage problems, replace lost material from the cross section of the dam and abutments, or maintain gates, valves, and other operational component;
- **Improper design**, including the use of improper construction materials and construction practices;
- **Negligent operation**, including the failure to remove or open gates or valves during high flow periods;
- **Failure of upstream dams** on the same waterway;
- **Landslides into reservoirs**, which cause surges that result in overtopping;

- **High winds**, which can cause significant wave action and result in substantial erosion; and
- **Earthquakes**, which typically cause longitudinal cracks at the tops of the embankments, which can weaken entire structures.

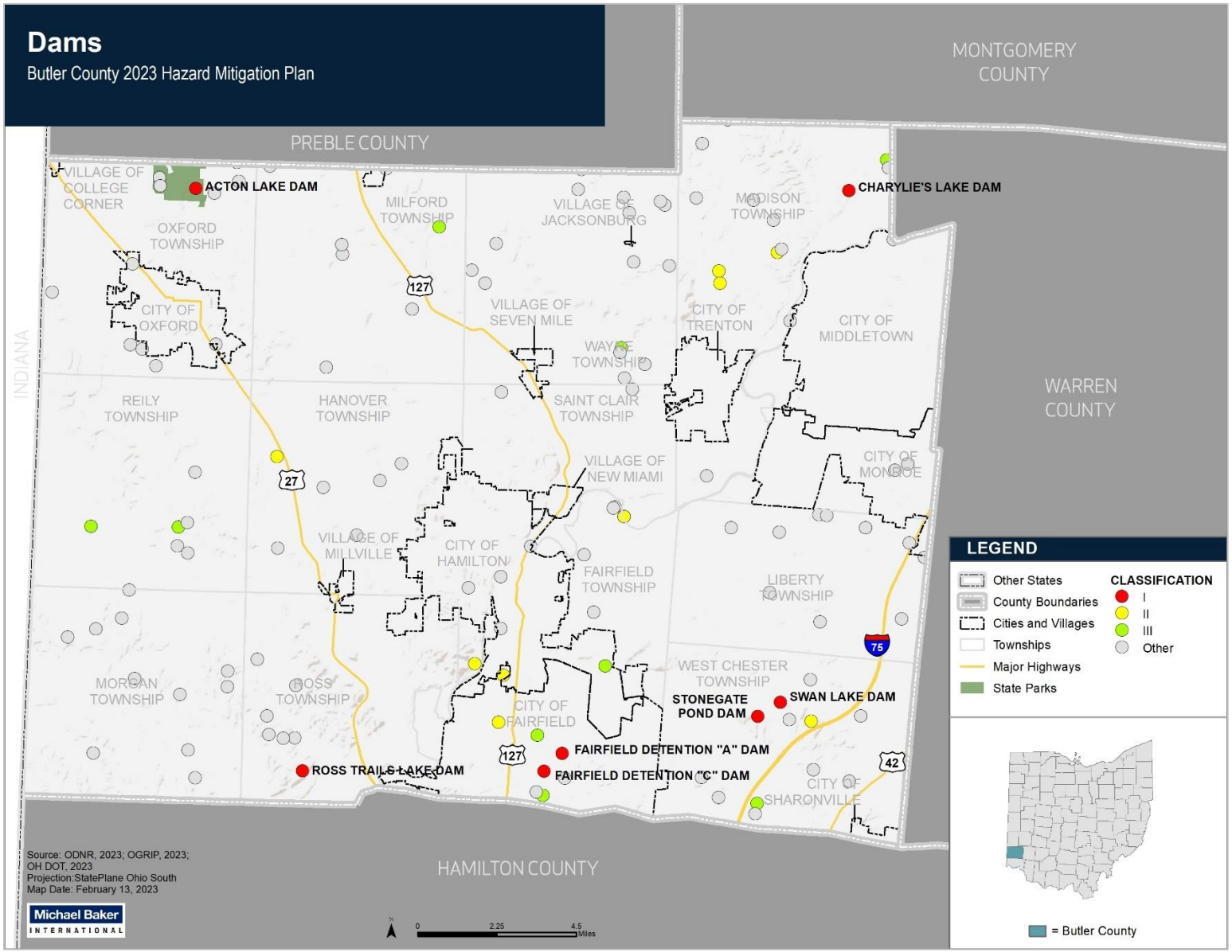
Dams are considered to be localized in the state and are most likely to affect inundation areas downstream and immediate areas around the dam or levee. Discharge from a dam breach is usually several times the 1% chance flood, and, therefore, typical flood studies are of limited use in estimating the extent of flooding.

Determining the impact of flooding is difficult to accomplish, especially for estimating loss of life. Loss of life is a function of the time of day, warning time, awareness of those affected and particular failure scenarios. Many dam safety agencies have used "population at risk", a more quantifiable measurement of the impact to human life, rather than "loss of life". Population at risk is the number of people in structures within the inundation area that would be subject to significant personal danger, if they took no action to evacuate. The impacts of a dam failure are contingent on many factors and, therefore, cannot be concisely described.

4.7.2 DAM/LEVEE FAILURE LOCATION

There are 25 dams located in Butler County according to the National Inventory of Dams and ODNR Ohio Dam Locator databases, as shown in the following figure.

FIGURE 4-33 BUTLER COUNTY DAMS



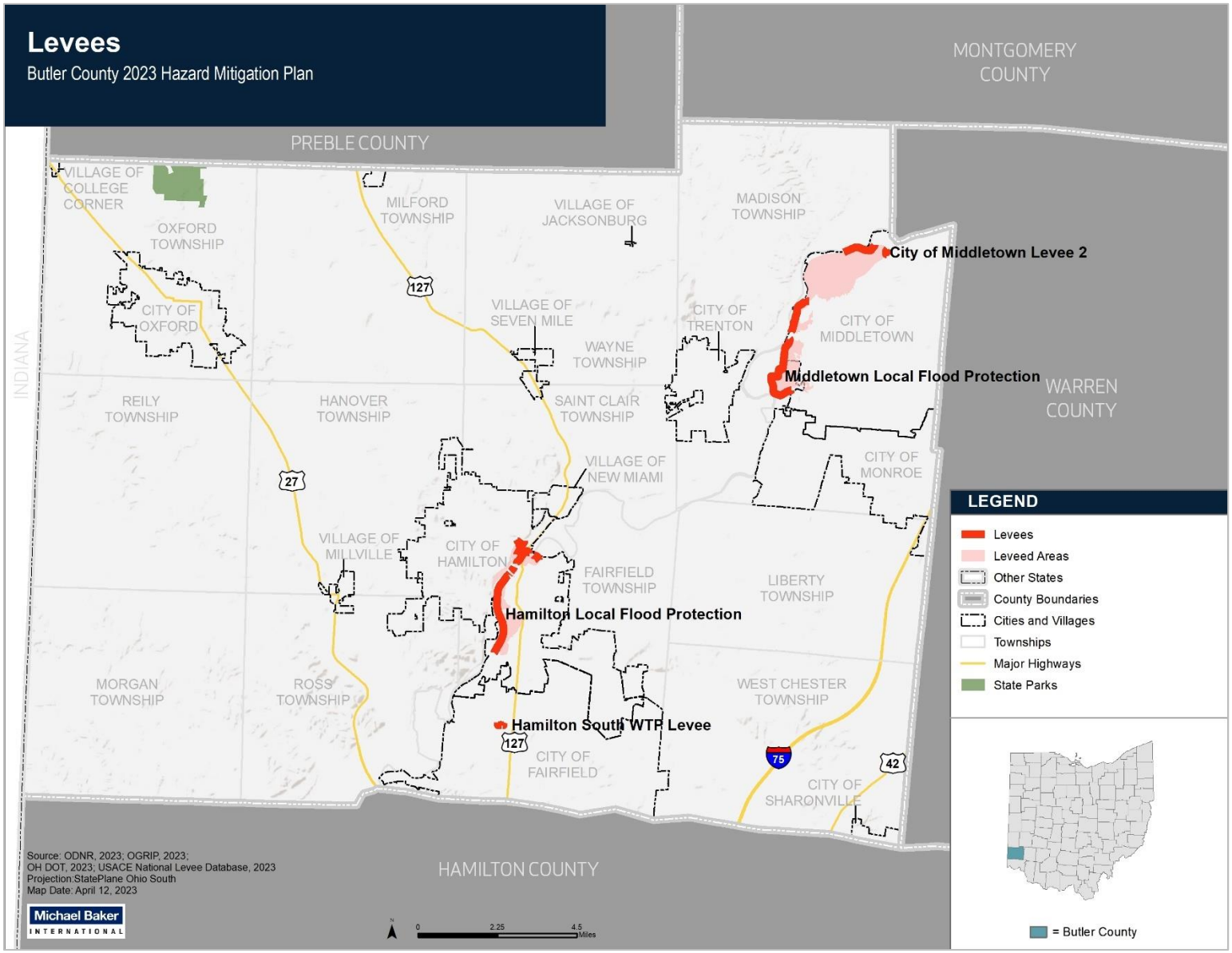
There are seven levee systems located in Butler County. All seven levees are utilized to protect cities of the county from the Great Miami River and tributary waters as the potential floodwaters rise.

TABLE 4-69 BUTLER COUNTY LEVEE CHARACTERISTICS

	City of Hamilton Levee 2	City of Middletown Levee 2	Hamilton Local Flood Protection	Hamilton Local Flood Protection (HAML5)	Hamilton South WTP Levee	Middletown Local Flood Protection	Middletown Local Flood Protection (Middletown Extension)
Location	Hamilton	Middletown	Hamilton	Hamilton	Fairfield	Middletown	Middletown
Area Protected (Square Miles)	0.014	0.21	0.16	0.88	0.014	2.2	0.85
Levee Length (mi)	0.33	1.11	1.62	3.63	0.49	3.42	2.47
Accredited Under FEMA NFIP? (Y/N)	N	Y	N	Y	Y	Y	Y
Ownership	Miami Conservancy District	Miami Conservancy District	Miami Conservancy District	Miami Conservancy District	City of Hamilton	Miami Conservancy District	Miami Conservancy District
Risk Classification	Not Screened	Not Screened	Not Screened	Not Screened	Not Screened	Not Screened	Not Screened
Average Height (ft)	Information not available	Information not available	Information not available	Information not available	Information not available	Information not available	Information not available
Minimum Height (ft)	Information not available	Information not available	Information not available	Information not available	Information not available	Information not available	Information not available
Maximum Height (ft)	Information not available	Information not available	Information not available	Information not available	Information not available	Information not available	Information not available

In addition to the seven levee systems listed on the National Levee Database, the ODNR Ohio Dam Safety Ohio Dam Locator webpage also identifies two additional levee systems located in Butler County. Banker Drive Levee has a length of 1,400 feet, a height of 3 feet, and is owned by the City of Fairfield. Windisch Road Levee has a null length, a height of 2.9 feet, and is owner by a commercial company.

FIGURE 4-34 BUTLER COUNTY LEVEES



4.7.3 EXTENT

The severity of a dam failure depends mostly on what class the dam is, where it is located, and what caused it to fail. The inundation zone as defined by each Emergency Action Plan (EAP) shows what areas will be the most heavily impacted during a dam failure event. During these events, hazardous materials such as agricultural chemicals and wastes, solid wastes, raw sewage, common household chemicals, and loose mud and concrete can worsen rescue and cleanup operation. Much of the damage done during a dam failure will be downstream and within the immediate area.

Many dams throughout Ohio were created 50 years ago or more. These dams present the possibility that at some point in time they may fail. If this is the case, there will be damage to the surrounding area. According to the Ohio Department of Natural Resources, the damage predicted by a dam failure coincides with the class of the dam. The potential downstream hazard is broken into four classes.

- **Class I** – Probable loss of life, serious hazard to health, structural damage to high value property (i.e., homes, industries, and major public utilities.).
- **Class II** – Floodwater damage to homes, businesses, and industrial structures (no loss of life envisioned); damage to state and interstate highways, railroads; only access to residential areas.
- **Class III** – Damage to low value non-residential structures, local roads, agricultural crops and livestock.
- **Class IV** – Losses restricted mainly to the dam

ODNR also classifies dams by the height of dam:

- **Class I** – greater than 60 feet
- **Class II** – greater than 40 feet
- **Class III** – greater than 25 feet
- **Class IV** – less than or equal to 25 feet

Also by storage volume:

- **Class I** – greater than 5000 acre-feet
- **Class II** – greater than 500 acre-feet
- **Class III** – greater than 50 acre-feet
- **Class IV** – less than or equal to 50 acre-feet

Another way to classify dam failure in terms of extent is through FEMA's High Hazard Potential Classification. The classification has three categories of potential impacts a dam failure would create:

1. **Low Hazard Potential:** Dams assigned the low hazard potential classification are those where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

2. **Significant Hazard Potential:** Dams assigned the significant hazard potential classification are those dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
3. **High Hazard Potential:** Dams assigned the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life.

The following table presents the ODNR dam classification of each dam in Butler County as well as the FEMA hazard potential, if the dam has an emergency action plan (EAP), and the owner of the dam. Fairfield Golf Course Lake Dam and Our Farm Lake Dam are not listed in the National Inventory of Dams, so the hazard potential and EAP status is unknown.

TABLE 4-70 HIGH-HAZARD DAM INFORMATION FOR BUTLER COUNTY

Dam Name	Class	Hazard Potential	EAP	Owner
Acton Lake Dam	I	High	Yes	ODNR, Division of Parks & Watercraft
Ross Trails Lake Dam	I	High	Yes	Private
Fairfield Detention “A” Dam	I	High	Yes	City of Fairfield
Fairfield Detention “C” Dam	I	High	Yes	City of Fairfield
Charylie’s Lake Dam	I	High	No	Private
Stonegate Pond Dam	I	High	No	Private
Swan Lake Dam	I	High	Yes	Private
Lakota Lake Dam	II	Significant	Yes	Private
Middletown Sportsman Club Lake Dam	II	Significant	Yes	Private
Elk Creek Meadow Ridge Pond #1 Dam	II	Significant	Yes	MetroParks of Butler County
Elk Creek Meadow Ridge Pond #2 Dam	II	Significant	Yes	MetroParks of Butler County
Hamilton Lime Sludge Lagoon	II	Significant	Yes	City of Hamilton
Greenbriar Lake Dam	III	Low	Yes	Private
Trenton Sportsmen Club Lake Dam	III	Low	Not Required	Private
Pythias Lake Dam	III	Low	Yes	Private
Hamilton Fairfield Airport Dam	III	Low	Yes	Butler County Regional Airport Authority
Fairfield Golf Course Lake Dam	III	Unknown	Unknown	City of Fairfield
Our Farm Lake Dam	III	Unknown	Unknown	Private
Bunker Hill Haven Lake Dam	Other	Low	No	Private
O’Bob Farm Lake Dam	Other	Low	No	Private
Bear Pond Dam	Other	Low	No	Private
Two Mile Dam	Other	Low	Yes	Miami Conservancy District
Hamilton Low Dam	Other	Low	Yes	Miami Conservancy District
Hamilton Small Diversion	Other	Low	Not Required	City of Hamilton
Horseshoe Diversion Dam	Other	Low	Not Required	City of Hamilton

Ohio Department of Natural Resources classify levees into three different classes:

- **Class I:** probable loss of human life, structural collapse of at least one residence or one commercial or industrial business
- **Class II:** disruption of a public water supply or wastewater treatment facility, or other health hazards; flooding of residential, commercial, industrial, or publicly owned structures; flooding of high-value property; damage or disruption to major roads including but not limited to interstate and state highways, and the only access to residential or other critical areas such as hospitals, nursing homes, or correctional facilities as determined by the chief; damage or disruption to railroads or public utilities
- **Class III:** a levee having a height of not more than three feet and a levee having a height of more than three feet when sudden failure of the levee would result in at least one of the following conditions: property losses including but not limited to rural buildings not otherwise described in this rule; damage or disruption to local roads including but not limited to roads not otherwise listed as major roads in this rule; property losses restricted mainly to the levee and to the owner's property or to rural lands.

Hamilton South Water Treatment Plant (Hamilton South WTP) is classified as a Class II levee, Banker Drive Levee is classified as a Class III levee, and Windisch Road Levee is classified as a Class III levee. The other levees located in Butler County are classified as "Other" currently or are not mapped on the Ohio Dam Safety Program's interactive Ohio Dam Locator map.

4.7.4 HISTORICAL OCCURRENCES

Dam Failure

There have not been any recorded dam failure events in Butler County to date.

Levee Failure

There have been no recorded levee failures in Butler County.

4.7.5 PROBABILITY OF FUTURE OCCURRENCES

For reasons previously mentioned in this section and uncontrollable by humans, it is possible a dam or levee can fail at any time, given the right circumstances. However, the probability of future occurrence for regulated dams and levees can be reduced due to proactive preventative action in compliance with the Ohio Department of Natural Resources – Dam Safety Program. Ohio's Dam Safety Program provides for the regulation and safety of high hazard dams and reservoirs throughout the state in order to protect the health, safety, and welfare of its citizens and their property.

The Planning Committee, based on their own knowledge, concluded that dam/levee failure events are "Unlikely" each year. This means that there is less than a 1% chance of occurring annually.

The National Levee Database includes an Incipient Overtopping Annual Exceedance Probability (AEP) which is the annual probability of a flood event that would load the levee system to the top. The following table includes each levee's AEP as identified in the National Levee Database.

TABLE 4-71 BUTLER COUNTY LEVEE AEP

Levee	Incipient Overtopping Annual Exceedance Probability (AEP)
City on Hamilton Levee 2	0.0002

City of Middletown Levee 2	Not identified
Hamilton Local Flood Protection	0.0002
Hamilton Local Flood Protection (HAML5)	0.0002
Hamilton South WTP Levee	0.0002
Middletown Local Flood Protection	0.0002
Middletown Local Flood Protection (Middletown Extension)	0.0005

Future Conditions

An important consideration of hazard mitigation planning is to consider how future conditions, including a changing climate, will influence how dam/levee failure will behave in and impact Butler County. According to a report from Yale Climate Connections, heavier precipitation caused by climate change places increased stress on the flood control systems in the United States. According to the Climate Explorer, Butler County had a total of 40.03 inches of precipitation in 2005. In 2010, the observed total precipitation was 36.7 inches. By 2090, it is projected that Butler County will have an increase of 7.26 inches of annual total precipitation with a higher emissions rate. Butler County is also projected to have 5.5 days of precipitation greater than 1 inch a year by the 2090s decade, an increase of 4 days compared to the observed 1.5 days in 2010.

TABLE 4-72 THE CLIMATE EXPLORER CLIMATE PREDICTIONS FOR BUTLER COUNTY

	2020	2030	2040	2050	2060	2070	2080	2090
Projected Annual Total Precipitation Totals (in)	41.82	40.88	41.89	42.51	42.9	42.92	43.41	43.96
Days with > 1" of Precipitation	3.9	4.1	4.3	4.8	4.9	5.2	5.4	5.5
Days with > 2" of Precipitation	0.3	0.3	0.4	0.4	0.4	0.5	0.6	0.5
Days with > 3" of Precipitation	0	0	0	0.1	0	0.1	0.1	0.1

The Climate Mapping for Resilience and Adaptation (CMRA) Assessment Tool for Flooding identifies future projections for days with extreme precipitation around the year 2050 based on a high-emissions scenario. CMRA projects that Butler County will have 6.8 days per year with events in the top 1% of all historic daily totals. The assessment tool also projects there will be 4.5 days a year with precipitation over 1 inch, 0.40 days a year with precipitation over 2 inches, 0.05 days a year with precipitation over 3 inches and 0.01 days a year with precipitation over 4 inches around the year 2050. In addition, CMRA projects the number of days with precipitation over 1 inch will increase by 1.26 days compared to the observed average from 1975-2000.

With the increased annual precipitation and increased days with heavy rainfall projected for Butler County, it can be assumed that the added stress to the flood protection systems in the county have an increased chance for failure.

4.7.6 ASSETS EXPOSED TO DAM/LEVEE FAILURE

Potential Losses from Dam/Levee Failure

TABLE 4-73 POTENTIAL IMPACTS FROM DAM/LEVEE FAILURE

Impact	Description
People	Loss of life and injury is most likely in Class I breaches. Fatalities could be expected in the dozens or hundreds depending on population density. Communities can become isolated due to impassable roads.
Infrastructure	Entire buildings can be washed away, or otherwise flooded irreparably. Power outages from disrupted underground utilities.
Economy	Significant or catastrophic dam failures can wipe out large portions of a single small town. Residents may move away permanently, and jobs may be lost.
Natural Systems	Flooding can destroy large tracts of land. Alteration of riverbeds can occur. Debris can become stuck in place.
Transportation	Bridges, highways, and roads can be destroyed completely. Significant detours will be necessary.

Dam or levee failures can have a greater environmental impact than that associated with a flood event. Large amounts of sediment from erosion can alter the landscape changing the ecosystem. Hazardous materials can be carried away from flooded out properties and distributed throughout the floodplain. Industrial and agricultural chemicals and wastes, solid wastes, raw sewage, and common household chemicals comprise the majority of hazardous materials spread by flood waters along the flood zone, polluting the environment and contaminating private property and the community's water supply. The soil loss from erosion and scouring would be significantly greater because of a large amount of fast-moving water affecting a small, localized area, which would likely change the ecosystem.

In FEMA's Federal Guidelines for Dam Safety, the following impacts are identified:

TABLE 4-74 FEMA DAM HAZARD CLASSIFICATION IMPACTS

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

Community Vulnerability

The following table includes ODNR Class I, II, and III dams as well the dams listed in the National Inventory of Dams. There are seven dams listed in the USACE NID as "Low" hazard potential but are classified as "Other" on the ODNR Ohio Dam Locator. All other dams identified as an ODNR Class Other were omitted from this table due to lack of risk it presents to the assets of the county.

TABLE 4-75 DAMS IN BUTLER COUNTY

Name	Owner	Primary Purpose of Dam	Type of Impoundment	Type of Structure	Length (feet)	Height (feet)	Top of Dam Storage (Acre Ft.)
ODNR Class 1 Dams							
Acton Lake Dam	ODNR, Division of Parks & Watercraft	Recreation	Dam and Spillway	Earthfill	1,092	62	20,297
Ross Trails Lake Dam	Private	Recreation	Dam and Spillway	Earthfill	620	47.6	141
Fairfield Detention "A" Dam	City of Fairfield	Flood Risk Reduction	Dam and Spillway	Earthfill	580	23.5	170
Fairfield Detention "C" Dam	City of Fairfield	Flood Risk Reduction	Dam and Spillway	Earthfill	620	31	490.2
Charylie's Lake Dam	Private	Recreation	Dam and Spillway	Earthfill	290	28.6	46.5
Stonegate Pond Dam	Private	Recreation	Dam and Spillway	Earthfill	1,400	21.3	35.5
Swan Lake Dam	Private	Recreation	Dam and Spillway	Earthfill	670	18.4	38
ODNR Class 2 Dams							
Lakota Lake Dam	Private	Recreation	Dam and Spillway	Earthfill	600	58.1	129
Middletown Sportsman Club Lake Dam	Private	Recreation	Dam and Spillway	Earthfill	465	40.5	67
Elk Creek Meadow Ridge Pond #1 Dam	MetroParks of Butler County	Recreation	Dam and Spillway	Earthfill	195	26	75
Elk Creek Meadow Ridge Pond #2 Dam	MetroParks of Butler County	Recreation	Dam and Spillway	Earthfill	340	23.2	76
Hamilton Lime Sludge Lagoon	City of Hamilton	Tailings	Upground	Earthfill, Homogeneous	3,860	11	131.4
ODNR Class 3 Dams							
Greenbriar Lake Dam	Private	Recreation	Dam and Spillway	Earthfill	1,520	37.6	394.1
Trenton Sportsmen Club Lake Dam	Private	Recreation	Dam and Spillway	Earthfill	730	20	32
Pythias Lake Dam	Private	Recreation	Dam and Spillway	Earthfill	340	29.7	26.1
Hamilton Fairfield Airport Dam	Butler County Regional Airport Authority	Flood Risk Reduction	Dam and Spillway	Earthfill	600	15.5	91.4
Fairfield Golf Course Lake Dam	City of Fairfield	Recreation	Dam and Spillway	Earthfill	350	16.3	18
ODNR Class Other Dams							
Bunker Hill Haven Lake Dam	Private	Recreation	Dam and Spillway	Earthfill	322	34	31.9
O'Bob Farm Lake Dam	Private	Recreation	Dam and Spillway	Earthfill	400	28.9	22

Name	Owner	Primary Purpose of Dam	Type of Impoundment	Type of Structure	Length (feet)	Height (feet)	Top of Dam Storage (Acre Ft.)
Bear Pond Dam	Private	Recreation	Dam and Spillway	Earthfill	300	25.8	42.9
Two Mile Dam	Miami Conservancy District	Flood Risk Reduction	Channel Dam	Concrete, Gravity	820	10	415
Hamilton Low Dam	Miami Conservancy District	Recreation	Channel Dam	Concrete, Gravity	450	9	291
Hamilton Small Diversion	City of Hamilton	Hydroelectric	Channel Dam	Concrete, Gravity	196	10	Null
Horseshoe Diversion Dam	City of Hamilton	Hydroelectric	Channel Dam	Concrete, Gravity	104	29	Null

The probability of future occurrence for regulated dams is reduced through compliance with the Ohio's Department of Natural Resources, Dam Safety Program. 71% of the High Hazard Dams in Butler County have Emergency Action Plans (EAP) in place.

There were not any non-breach or breach scenarios available on the National Inventory of Dams database for the dams located in Butler County.

According to the National Levee Database, there are 14,225 residents and 3,615 structures that could be impacted by levee failure in Butler County. The property value for the structures behind the levees is valued at $2,930,200,000.

TABLE 4-76 BUTLER COUNTY ASSETS AT RISK TO LEVEE FAILURE

Levee System	Population Behind Levee	Number of Buildings Behind Levee	Property Value Behind Levee
City of Hamilton Levee 2	135	51	$15,000,000
City of Middletown Levee 2	1,366	234	$185,000,000
Hamilton Local Flood Protection	1,152	253	$265,000,000
Hamilton Local Flood Protection (HAML5)	2,808	432	$629,000,000
Hamilton South WTP Levee	12	1	$5,200,000
Middletown Local Flood Protection	4,893	1,746	$1,300,000,000
Middletown Local Flood Protection (Middletown Extension)	3,859	898	$531,000,000

The following table reflects each jurisdiction's response from the Vulnerability Assessment form that was completed during the planning process. Responses for the form submitted by stakeholders can be found in **Appendix I.**

Jurisdiction/Organization	Vulnerability Assessment Response
Butler County	There are aging dams in the county that are vulnerable, and some dams are owned by private organizations.
Fairfield	Unsure of what would be vulnerable from a failing dam.

Jurisdiction/Organization	Vulnerability Assessment Response
Hamilton	There are several dams located in the city as well as upstream.
Middletown	Levee failure in extreme event could impact the downtown area.
Monroe	None.
Oxford	We only have one dam that is upstream of the City. It has recently been repaired and should be good for the foreseeable future.
Sharonville	The downtown area is below the dam, while the dam has been improved in recent years and risk of failure has decreased failure would flood a large area of the downtown area.
Trenton	No dams to be worried about.
College Corner	No specific vulnerabilities at this time.
Jacksonburg	None identified.
Millville	Unsure of what would be vulnerable from a failing dam.
New Miami	If the dam upstream were to break, we would be in trouble. There are 2 dams in Hamilton, but we are north of those.
Seven Mile	No known or foreseeable issues.

4.7.7 FUTURE CONDITIONS IMPACTS

As the climate, population, and land uses of the county change over time, it is important to identify how these future conditions will affect the impacts of hazards. Dam/levee failure impacts will be influenced by changes in climate change trends, population trends, and land use and development trends.

Climate Change Trends

With the increase of total precipitation as well as the increase of days with heavy rainfall, there will be added stress on the flood protection systems in Butler County. With higher waters being held back by the dams and levees, the current conditions impacts identified in Section 4.7.6 may be more extreme.

Changes in Population Trends

An increase of population in or around dam inundation zones would put more people and structures at risk. However, if people were to relocate out of mapped inundation zones, the rapid flooding impacts may not be as catastrophic.

Land Use and Development Trends

Public awareness measures such as notices on final plats and public education on dam safety are proactive mitigation measures that should be implemented by local communities. Also, Emergency Action Plans that identify potential dam failure inundation areas, notification procedures, and thresholds are also prepared for response to potential dam related disaster events.

Regulatory Environment

The Ohio Department of Natural Resources classifies dams by 2 conditions: height and storage. There are 4 classes of dams, which vary, based on the height of the actual dam, and the amount of water held behind the dam.

Dam safety laws are embodied in the Dam Safety and Encroachments Act ("DSE Act") -enacted July 1, 1979 and last amended in 1985. Rules pertaining to dam safety are found in Title 25-Rules and Regulations; Part I-Department of Environmental Resources; Subpart C-Protection of Natural Resources; Article II-Water Resources; Chapter 105-Dam Safety and Waterway Management ("the Rules") -adopted.

ODNR also provides a template for EAP development. Emergency Action Plans include a description of the dam, the area at risk should the dam fail, and contact information for stakeholders. EAPs essentially identify actions that must be taken should an emergency occur. All dams regulated by Water Resources at ODNR are required by Ohio Administrative Code Rule 1501:21-15-07 to have an EAP in place.

Dams and levees have inundation maps that are very strictly controlled by the structure owners and the county, who do not release this information publicly. The EAPs for the high hazard potential dams located in the county are also protected by the owners and cannot be publicized due to public safety concerns. The following table includes all dams in Butler County, the date of the EAP, and the last inspection date of the dam. There are two high hazard potential dam, ODNR Class I dams that do not have an EAP – Charylie's Lake Dam and Stonegate Pond Dam.

TABLE 4-77 BUTLER COUNTY DAM EAP AND INSPECTION DATES

Dam Name	EAP Date	Last Inspection Date
Acton Lake Dam	3/5/2020	5/5/2021
Ross Trails Lake Dam	1/8/2019	6/22/2021
Fairfield Detention "A" Dam	7/9/1999	5/4/2021
Fairfield Detention "C" Dam	7/9/1999	5/4/2021
Charylie's Lake Dam	-	6/3/2021
Stonegate Pond Dam	-	6/10/2021
Swan Lake Dam	5/12/2010	6/10/2021
Lakota Lake Dam	12/20/2017	6/10/2021
Middletown Sportsman Club Lake Dam	4/24/2013	4/22/2021
Elk Creek Meadow Ridge Pond #1 Dam	4/25/2017	4/22/2021
Elk Creek Meadow Ridge Pond #2 Dam	4/25/2017	4/22/2021
Hamilton Lime Sludge Lagoon	4/12/2012	5/4/2021
Greenbriar Lake Dam	12/18/2012	5/5/2021
Trenton Sportsmen Club Lake Dam	-	-
Pythias Lake Dam	9/3/2020	5/6/2021
Hamilton Fairfield Airport Dam	12/18/2012	6/10/2021
Bunker Hill Haven Lake Dam	-	6/22/2021
O'Bob Farm Lake Dam	-	3/24/2016
Bear Pond Dam	-	4/20/2016
Two Mile Dam	12/6/2013	3/29/2016
Hamilton Low Dam	12/6/2013	3/29/2016
Hamilton Small Diversion	11/21/2022	8/21/2018
Horseshoe Diversion Dam	-	8/21/2018

Impacts to Socially Vulnerable Communities

A major dam failure can affect socially vulnerable communities who live near rivers, and those who rely on agricultural areas for income that can be damaged by these events. In the flood profile in section 4.8.6, there are an estimated 90 mobile homes in the SFHA. These homes are the most likely to be damaged or destroyed during a flood event. The occupants may also not have the ability to relocate quickly in the event of a catastrophic dam failure. Those living within the inundation zone who are not able to drive or leave their home may also face losses to life and property.

Hazard Risk by Community

During the planning process, each participating community ranked their risk to each profiled hazard in the plan. The representatives of the jurisdictions within Butler County were asked to consider the risk factors of probability, impact, spatial extent, warning time, and duration and how those factors may increase or decrease their community's risk to the hazard. A ranking of high indicates the community considers at least four of the factors to be an increased concern. A ranking of medium indicates the community considers two to three of the factors to be an increased concern. A ranking of low indicates the community considers one or no factors to be an increased concern. Each community's response to the hazard risk rating for dam/levee failure is presented in the table below. All stakeholder responses gathered during the planning process through this form can be found in Appendix I.

TABLE 4-78 HAZARD RISK BY COMMUNITY FOR DAM/LEVEE FAILURE

	Fairfield	Hamilton	Middletown	Monroe	Oxford	Sharonville	Trenton	College Corner	Jacksonburg	Millville	New Miami	Seven Mile
Dam/Levee Failure	Low	Medium	Low	Low	Low	High	Low	Low	Low	Low	High	Low

4.7.8 DAM/LEVEE FAILURE SUMMARY

As dams continue to age, the likelihood for failure increases as undesirable woody vegetation on the embankment, deteriorated concrete, inoperable gates, and corroded outlet pipes become problems. Since dam failures are often exacerbated by flooding, the probability of dam failures can be associated with projected flood frequencies. Overall, the probability of a dam failure throughout the state should remain low with continued maintenance of dams. Additionally, warning plans in place for designated high hazard dams will continue to decrease the danger for those residents in potential risk areas.

Mitigation Best Practices

Butler County jurisdictions can best prevent dam failure in the future by taking it upon themselves to learn more about dam safety from both the Ohio Department of Natural Resources (ODNR) and FEMA. Best practices for dam safety include regularly inspecting and maintaining dams as they age, providing educational materials to those who either live or do business beneath a dam, and to make sure that each dam in the community has an EAP.

ODNR's website has additional information and guides that relate to Dam Safety and can be found here: http://water.ohiodnr.gov/safety/dam-safety.

8. FLOODING

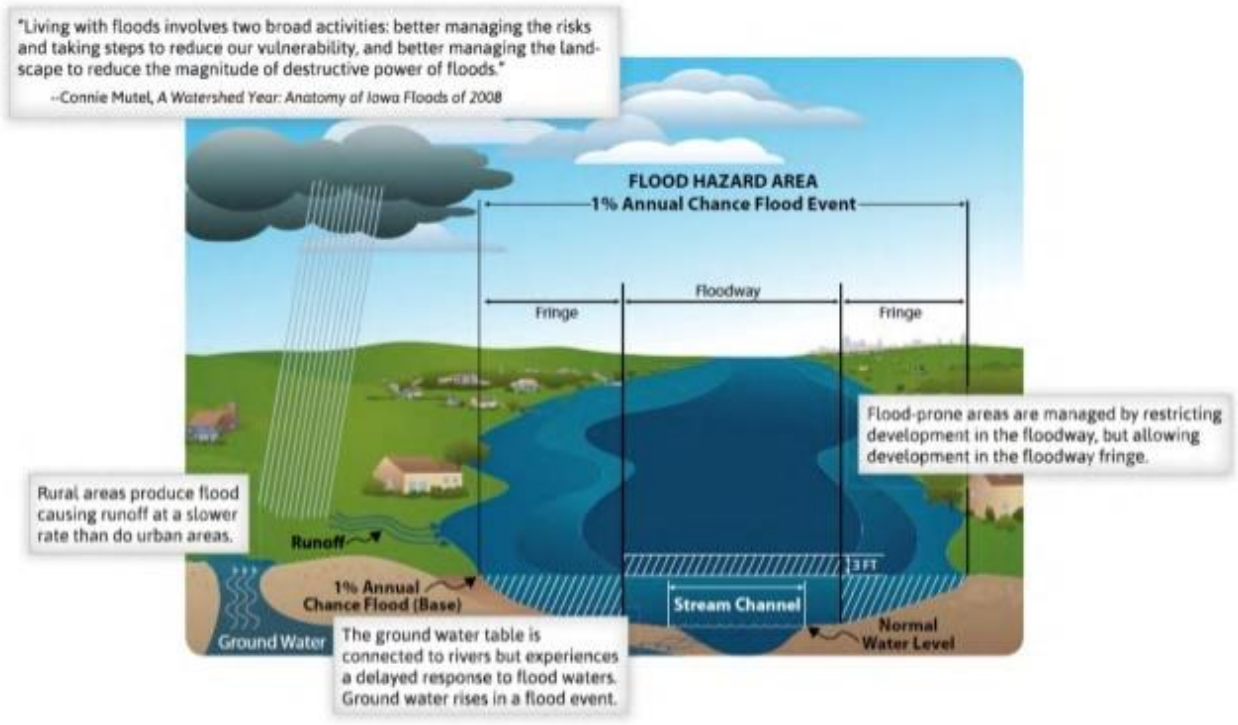
Hazard	Probability		Impact		Spatial Extent		Warning Time		Duration		RF Rating
Flooding	3	0.9	1	0.3	1	0.2	1	0.1	2	0.2	1.7
Low Risk Hazard (1.0 – 1.99)											

4.8.1 FLOODING DESCRIPTION

A flood is a natural event for rivers and streams. It occurs when a normally dry area is inundated with water. Excess water from snowmelt or rainfall accumulates and flows over the stream banks and into adjacent floodplains. Floodplains are lowlands adjacent to rivers, streams, and creeks that are subject to recurring floods. Flash floods usually resulting from heavy rains or rapid snowmelt. They can flood areas not typically subject to flooding, including urban areas. Extremely cold temperatures can cause streams and rivers to freeze, causing ice jams and creating flood conditions.

FEMA develops Flood Insurance Rate Maps (FIRMs) to identify the 1%-annual-chance flood zone for land use planning and the National Flood Insurance Program (NFIP). This 1%-annual-chance flood zone is used to delineate Special Flood Hazard Areas (SFHAs) and identify Base Flood Elevations. The figure below illustrates these terms. Butler County's current FIRMs became effective in March 2010, December 2010, February 2012, and October 2018.

FIGURE 4-35 DIAGRAM IDENTIFYING THE SPECIAL HAZARD FLOOD AREA



Floods are considered hazards when people and property are affected. Nationwide, hundreds of floods occur each year, making it one of the most common hazards in all states and U.S. territories. In Ohio, flooding from a variety of sources is common and can occur in any season. Most injuries and deaths from flooding happen when people are swept away by flood currents. Most property damage results from inundation by sediment-filled water. Fast-moving water can wash buildings off their foundations and sweep vehicles downstream. Pipelines, bridges, and other infrastructure can be damaged when high water combines with flood debris. Flooding can cause extensive damage, even if it only affects a basement. It also damages crop lands and kills livestock. Several factors determine the severity of floods, including rainfall intensity and duration, topography and ground cover.

- Riverine flooding typically originates when rising water levels from a river, creek, or stream spread onto normally dry land. Extra water from snowmelt, rainfall, freezing streams, and/or ice flows causes the river or stream to overflow into adjacent floodplains. Winter flooding usually occurs when ice creates dams or streams freeze from the bottom up during extreme cold spells. Spring flooding is usually the direct result of melting winter snowpack, heavy spring rains, or both.
- Flash floods can occur anywhere that a large volume of water flows or melts over a short time period. They are usually caused by slow-moving thunderstorms or rapid snowmelt. Because flash floods are so localized, their hazard areas cannot be clearly defined. They often occur with little warning and have significant impacts. Rapidly moving water only a few inches deep can lift people off their feet, and a depth of only a foot or two is needed to sweep cars away. Most flood deaths result from flash floods.
- Urban flooding is the result of development without adequate drainage systems, which decreases the ground's ability to absorb excess water. Typically, urban flooding occurs when fields or woodlands are changed to roads and parking lots. Urbanization can increase runoff, which is two to six times higher in urban areas than on natural terrain (National Oceanic and Atmospheric Administration, 1992). Flooding may occur in developed areas when the amount of water generated from rainfall and runoff exceeds a stormwater system's capability to remove it.
- Stream bank erosion is measured by the rate of the change in the position or horizontal displacement of a stream bank over a period of time. It is generally associated with riverine flooding and may be exacerbated by human activities such as bank hardening and dredging.
- Ice jams are stationary accumulations of ice that restrict river flow. They can be freeze-up jams, breakup jams, or a combination. Ice jams increase upstream water levels considerably, while reducing downstream levels. When an ice jam releases, the effects downstream can be similar to those of a flash flood or dam failure. Ice jam flooding generally occurs in the late winter or spring.

Flood reduction, prevention, and mitigation are major challenges to Butler County residents and its floodplain manager. Many areas of the county are at risk of flooding, especially properties near

waterways. Heavy seasonal rainfall, which typically occurs from late October through April, can make streams overflow.

4.8.2 FLOODING LOCATION

The Flood Insurance Study (FIS) for Butler County was revised on October 19, 2018. The riverine flooding sources identified in the study are as follows:

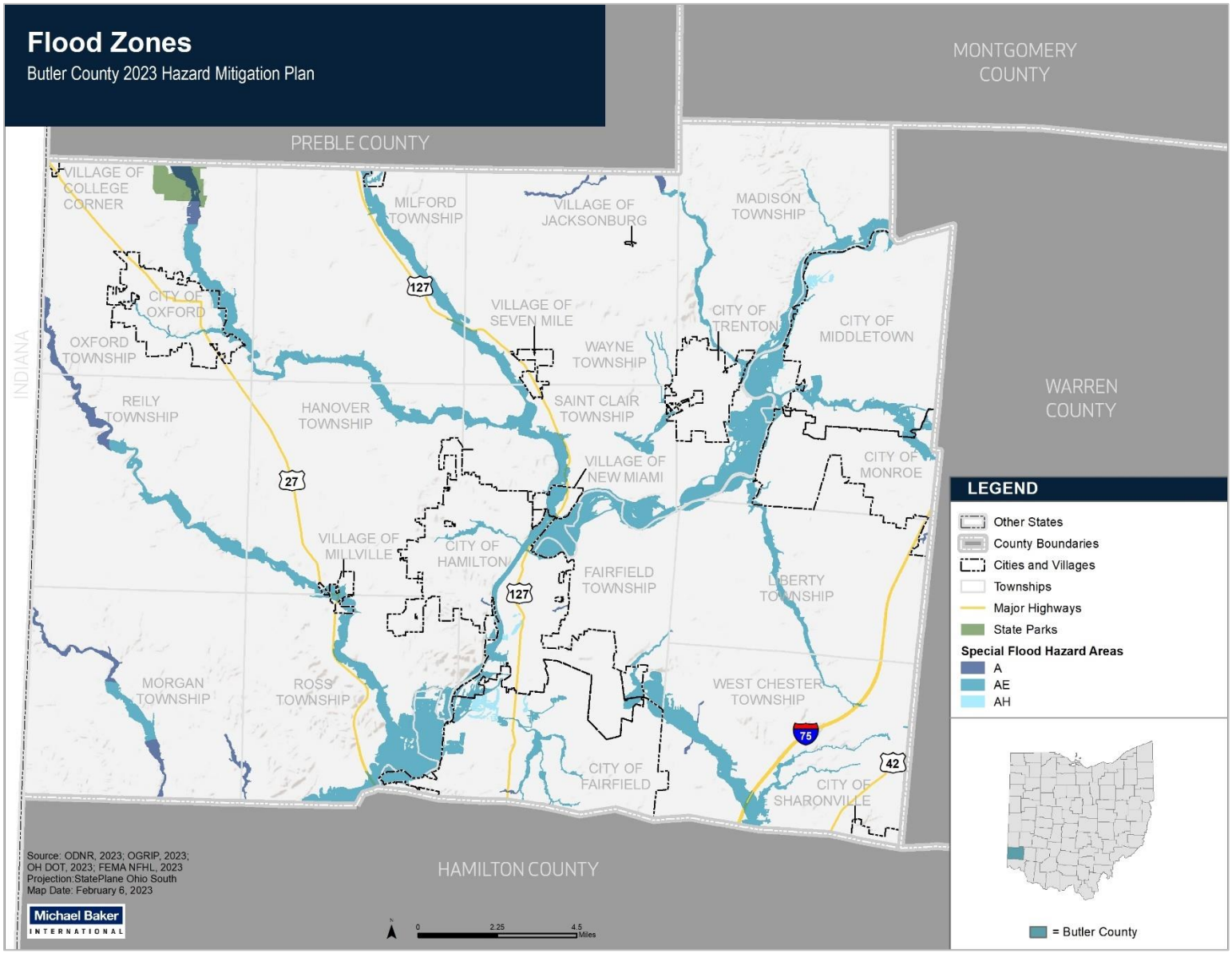
- Beals Run
- Beals Run Tributary
- Coldwater Creek
- Dry Fork Whitewater River
- Eberharts Run
- Four Mile Creek
- GM Ditch
- Indian Creek
- Jackson Ditch
- Jackson Ditch – East Branch of East Fork
- Jackson Ditch – East Fork
- Jackson Ditch – West Fork
- Dicks Creek
- Paddys Run
- Tributary to Bull Run/Collins Creek
- Little Muddy Creek
- North Branch Dicks Creek
- Overflow of Millers Creek
- Pleasant Run
- Pleasant Run Branch No. 1
- East Branch of Pleasant Run
- Sevenmile Creek
- Shaker Creek
- Tributary No. 1
- Browns Run
- Bull Run/Collins Creek
- East Branch Pleasant Run
- Tributary to Mill Creek 1
- Tributary to Pleasant Run
- East Fork Mill Creek
- Elk Creek
- Great Miami River
- Gregory Creek
- High School Tributary
- Mill Creek
- Millers Creek
- Tributary to East Fork Mill Creek
- Two Mile Creek
- Acton Lake
- Crawford Run
- Denny Creek
- Four Mile Creek US Reach
- Hendricksons Run
- Tributary to Pleasant Run Branch No. 4/East Branch of Pleasant Run
- Tributary to Mill Creek 2

Butler County's FIS identifies that there are no Special Flood Hazard Areas (SFHA) located in the Village of Jacksonburg.

There are two jurisdictions located partially in Butler County and an adjacent county – College Corner is also located in Preble County and Sharonville is also located in Hamilton County. Preble County's FIS was last updated on March 2, 2010, and College Corner does not have any SFHAs identified at the time of Preble County's FIS revision. Hamilton County's FIS was last updated June 7, 2023, and the updated document identifies East Fork Mill Creek, Mill Creek, Sharon Creek, and Springdale Tributary as the flooding sources located in Sharonville. Hamilton County's FIS also identifies Sharonville as having A, AE, and X FEMA flood zones within the jurisdiction.

Flooding in Butler County is most likely to occur in the floodplains identified in the following figure. Smaller-scaled flooding can also occur outside of these areas.

FIGURE 4-36 FLOOD ZONES IN BUTLER COUNTY



4.8.3 FLOODING EXTENT

In Butler County, more severe flooding is generally the result of prolonged periods of heavy rainfall and high-intensity, short-duration events. Floods usually occur during the season of highest precipitation or during heavy rainfalls after long dry spells. Widespread storms over the region are common from September through April. Flooding is more severe when the ground cannot soak up the water because it is frozen or saturated. Rain on snow in the higher elevations adds snowmelt to rainfall runoff and intensifies flood conditions.

Cloudburst storms, sometimes lasting as long as 3 hours, can occur over this region from late spring to early fall. They also may occur as an extremely severe sequence within a general winter rainstorm or during unseasonable rains. The intensity of cloudburst storms is very high, and the storms can produce enough precipitation to result in significant runoff.

Surface flooding, including some street flooding, can occur during severe storms. Minor flooding to garages and outbuildings, landscape erosion, and flooded streets have been reported in and around the county. Trash and other debris can also obstruct culvert and pipe openings in smaller channels. This can lead to clogging, obstruction, and flooding of nearby properties during even moderate flows.

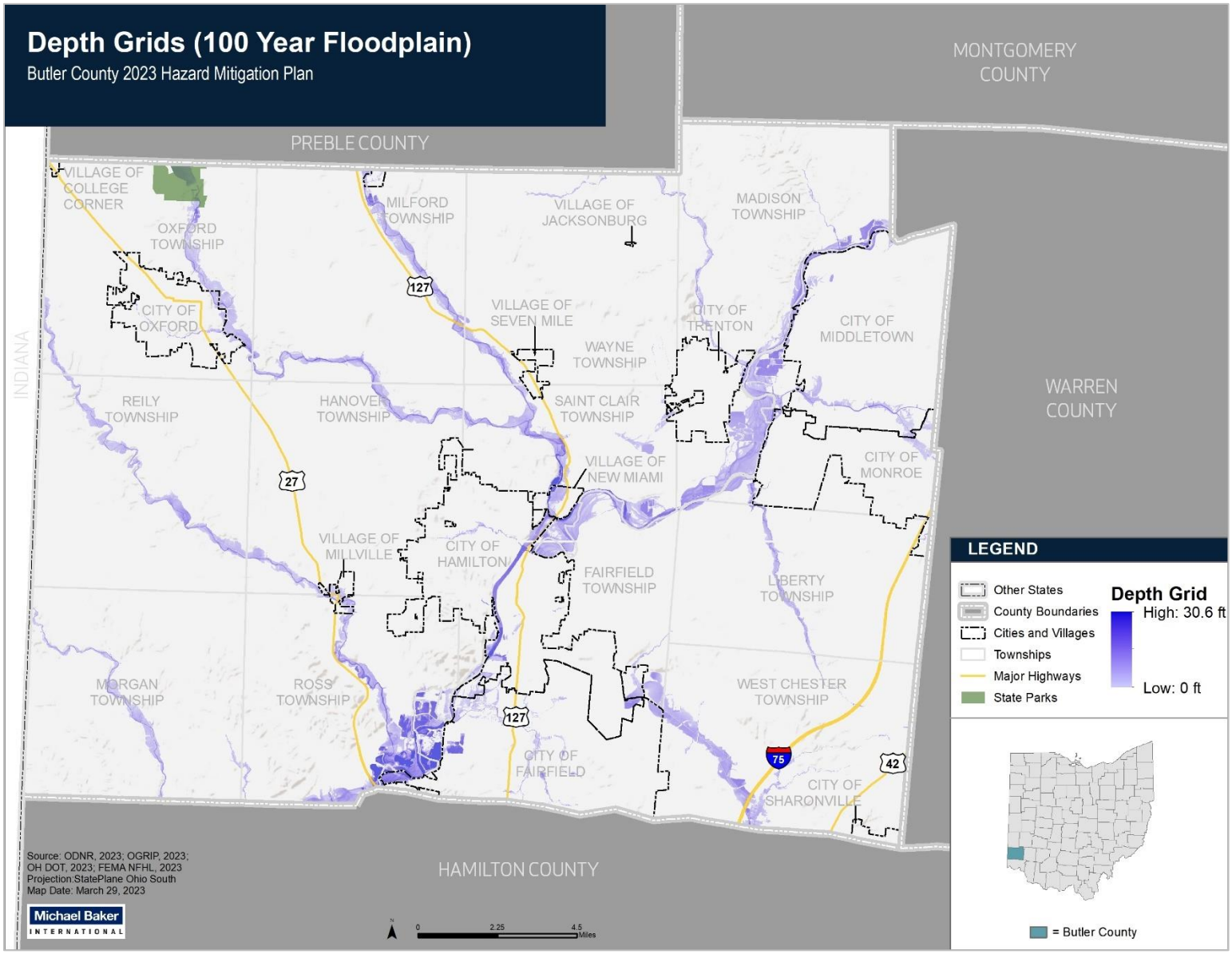
FEMA defines flood-prone areas and their associated risk through zone designation. The following table includes the different flood zone designations as well as the description of the flood zone. Butler County has flood zones A, AE, and AH.

TABLE 4-79 FEMA FLOOD ZONE DESIGNATIONS

Zone	Description
Moderate to Low Risk Areas	
B and X	Area of moderate flood hazard, usually the area between the limits of the 100- year and 500-year floods. B Zones are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile
C and X	Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level. Zone C may have ponding and local drainage problems that don't warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood and protected by levee from 100- year flood
High Risk Areas	
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.
A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.
High Risk – Coastal Areas	
V	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. No base flood elevations are shown within these zones.
VE, V1-30	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
Undetermined Risk Areas	
D	Areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk.

The following figure shows the flood depth grids for the identified flood sources throughout Butler County.

FIGURE 4-37 BUTLER COUNTY FLOOD DEPTH GRIDS



Flood Warning and Notification

The magnitude and severity of flood damage can be reduced with proper notification and longer warning periods before flood waters arrive. Warning times of 12 hours or more have proven adequate to prepare communities for flooding and reduce flood damages. Warning of a flood more than 12 hours in advance can reduce a community's flood damage by approximately 40% (Read Sturgess and Associates 2000). In addition, seasonal notifications about flooding can enhance the awareness of at-risk residents. When communicated effectively, advance notifications can reach target audiences on a large scale. The Butler County EMA coordinates with the National Weather Service.

Butler County River and Creek Characteristics

Large floods from the rivers and creeks that run throughout the county have occurred in all seasons of the year. Information on historical floods along the Great Miami River was obtained from stream gauging stations maintained by the NOAA. The following tables show the flood stage categories for the Great Miami River at Hamilton stream gauge as determined by the National Oceanic and Atmosphere Administration and the National Weather Service (NWS). The other flooding sources identified in Butler County do not have gauges located in the county's borders or they do not exist at this time.

TABLE 4-80 FLOOD CATEGORIES FOR GREAT MIAMI RIVER AT HAMILTON

Flood Category	Crest (ft)
Low Stage	61'
Action Stage	73'
Flood Stage	75'
Moderate Flood Stage	82'
Major Flood Stage	89.5'

TABLE 4-81 HIGHEST HISTORICAL CRESTS ON THE GREAT MIAMI RIVER AT HAMILTON

Crest (ft)	Date of Crest
79.20'	1/21/1959
76.60'	3/19/1943
76.50'	2/26/1929
76.33'	1/22/1937
75.95'	1/27/1952

The following table is from Butler County's Flood Insurance Study. The table identifies the flood sources in the county and a description of the flood problems associated with the flooding source.

TABLE 4-82 BUTLER COUNTY FLOOD PROBLEMS, 2018 FIS

Flooding Source	Description of Flood Problems
Great Miami River	The two largest floods on the Great Miami River were those of March 1913 and January 1959 as recorded at the Hamilton, Ohio gage. The largest flood of record, March 1913, produced a maximum

Flooding Source	Description of Flood Problems
	discharge of 352,000 cubic feet per second (cfs). This flood occurred prior to the construction of five dams upstream of the study area. Since regulation, the highest flood at the gage was in January 1959 and produced a discharge of 108,000 cfs, approximately equivalent to a 2-percent-annual-chance flood. The 1913 flood reduced (i.e., the same flood flowing through the dams and reservoir system) would have produced a discharge of 175,300 cfs. A flood of this magnitude has a less than 0.2-percent-annual-chance probability of occurrence. The series of flood control dams mentioned minimize flood damage from heavy rains in headwater areas. However, only the major rivers have control structures, and it was from the rampaging waters of the secondary uncontrolled streams that much of the damage from the 1959 flood occurred.
Mill Creek	Most floods in the Mill Creek watershed occur during late winter and early summer. The USGS operated a stream gage for Mill Creek, located approximately 7 miles downstream from East Crescentville Road at Reading. The gage had a period of record from 1939 to 1991. According to the records of this gage, major floods have occurred in April 1940, March 1941, January 1959, March 1963, and September 1979. For each flood, the peak flow recorded at the gage exceeded the estimated peak flow of the 10-percent-annual-chance flood (5,000 cfs), as published in a USGS report.
Great Miami River & Pleasant Run	Low lying areas of the City of Fairfield are subject to periodic flooding caused by overflow of the Great Miami River, Pleasant Run, and its branches. The most severe flooding occurs on the Great Miami River during the period from mid-winter to mid-spring with the two largest floods, those of March 1913 and January 1959, occurring during that period. The waters from the Great Miami River cause backwater flooding on Pleasant Run for a distance of approximately one-half mile. The most severe flooding occurs on this reach and in the area along the left riverbank. The headwater flows from Pleasant Run also flood this area but not to the extent and severity of the Great Miami River. Flooding from the 1959 flood caused personal property damages in the City of Fairfield estimated at $8,000 to $10,000 and roadway, bridge and culvert damages of approximately $25,000.
Pleasant Run & Pleasant Run Branch No. 1	Shallow flooding occurs in Fairfield where water overtops the banks of Pleasant Run and Pleasant Run Branch No. 1 and flows away from the streams. These areas include: the area on the south side of Nilles Road from approximately Bibury Road to Talawanda Drive; the area bounded generally by East River Road on the south and east and by Pleasant Run on the north and Suwanee Drive on the west; and the area between Pleasant Run and Magie Avenue from Redwood Drive to East River Road. In two locations of the shallow flooding areas, at Fenwick Drive and in the southeast quadrant of the intersection of Nilles Road and Pleasant Avenue, low areas exist that pond water to shallow depths of approximately two and three feet, respectively.
Shaker Creek & Dicks Creek	The flood problems in the City of Middletown typically stem from Shaker and Dicks Creeks. Significant floodplain areas are located along these streams within the community. The residential flooding occurs between station 70+00 and 170+40 along Dicks Creek. Amanda Elementary School is located beside Dicks Creek and is subjected to flooding during the 1-percent-annual-chance event. From station 207+40 to 272+80 along Dicks Creek and station 0+00 to 33+00 along Shaker Creek there is commercial property that would be subjected to flooding.
Indian Creek	The major flood season along Indian Creek is the period from mid-winter to midspring. The severe flood of January 1959 which produced a discharge of 23,500 cfs on Indian Creek. Based on the methods of determining flood discharges for ungaged streams, this was of a magnitude of a 1-percent-annualchance flood.
Great Miami River & Four Mile Creek	The major flood season for the reach of the Great Miami River near the Village of New Miami is the period from mid-winter to mid-spring. The flood of March 1913 produced a discharge of 44,500 cfs at the Four Mile Creek gage which is two miles upstream of the northern corporate limits of New Miami. This also had an approximate magnitude of 50 years. The March 1913 flood is the highest known flood on Four Mile Creek. During the 1959 flood, severe basement flooding resulted in many fires and explosions, and the evacuation of over 500 homes, with an estimated damage of $740,000 at New

Flooding Source	Description of Flood Problems
	Miami. Although the 1959 flood was two to three feet below the 1913 flood, the damage was greater due to increased development within the floodplain.
Four Mile Creek	The principal flood problem in the City of Oxford occurs due to flooding from Four Mile Creek. The major flood season in the City of Oxford is the period from midwinter to mid-spring. Additional summer flooding is not uncommon for this area, though these floods are typically of shorter duration than the winter to spring floods. A major flood occurred in January 1959 on Four Mile Creek that caused extensive damage in Oxford.
Sevenmile Creek	The major flood season along Sevenmile Creek is the period from mid-winter to late spring. The most recently observed severe flood on Sevenmile Creek was in May 1968, which produced a maximum discharge of 16,800 cfs at the stream gage at Collinsville, which is 4 miles downstream of Somerville. This flood was of equal magnitude as the January 1959 flood. The maximum discharge recorded on Sevenmile Creek for the 1959 flood was 16,600 cfs. In comparison to the summary of flood-frequency data for Ohio streams based on gaging station records through 1975, these floods had the magnitude of a 2.5-percent-annualchance flood.

4.8.4 HISTORICAL OCCURRENCES

General Trends

According to the NOAA Storm Events Database, Butler County has had 81 flood or flash flood events since 2002, resulting in no injuries or deaths, $1,507,500 in property damage no reported crop damage. A complete list of flooding events from 1996 to current day can be found in **Appendix B.**

TABLE 4-83 SUMMARY OF FLOOD EVENTS IN BUTLER COUNTY (JANUARY 1, 2002-DECEMBER 31, 2022)

Event	Count	Injuries	Deaths	Property Damage	Crop Damage	Avg Property Damage/Event	Avg Crop Damage/Event
Flood	41	0	0	$89,000	$0	$2,170.73	-
Flash Flood	40	0	0	$1,418,500	$0	$35,462.50	-
Grand Total	**81**	**0**	**0**	**$ 1,507,500**	**$ 0**	**$ 18,611.11**	**-**

FIGURE 4-38 BUTLER COUNTY FLASH FLOOD EVENTS BY MONTH, JANUARY 1, 2002-DECEMBER 31, 2022

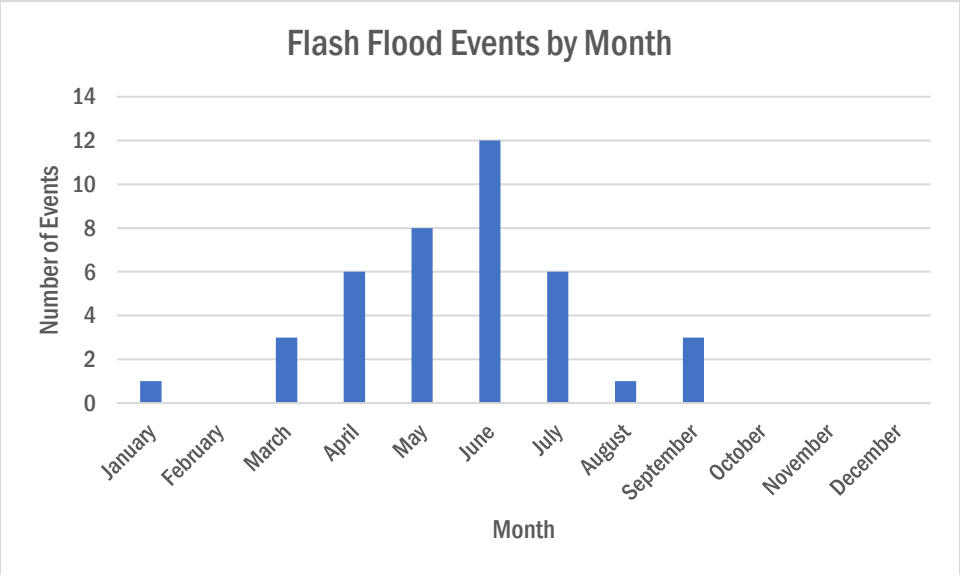
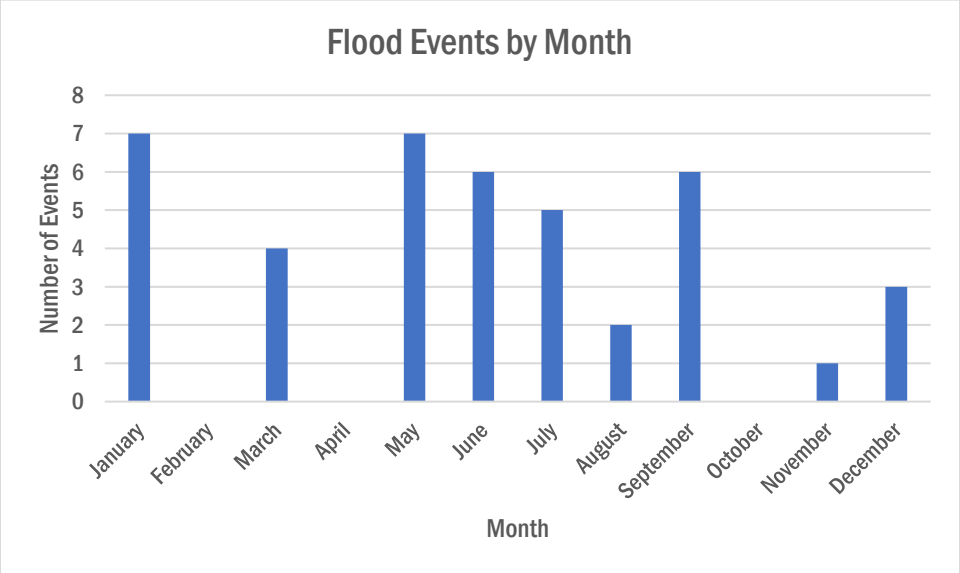


FIGURE 4-39 BUTLER COUNTY FLOOD EVENTS BY MONTH, JANUARY 1, 2002-DECEMBER 31, 2022



Butler County has been a part of six Federal Disaster Declarations that included flooding. Two disasters resulted in public assistance, and one disasters resulted in individual assistance.

TABLE 4-84 DECLARED DISASTERS AFFECTING BUTLER COUNTY

Disaster Number	Declaration Date	Title	Public Assistance	Individual Assistance
DR-243	6/5/1968	Heavy Rains, Flooding	-	-
DR-831	6/10/1989	Severe Storms, Flooding	-	-
DR-870	6/6/1990	Flooding, Severe Storm, Tornado	-	-

Disaster Number	Declaration Date	Title	Public Assistance	Individual Assistance
DR-1122	6/24/1996	Flooding	-	-
DR-1390	8/27/2001	Severe Storms & Flooding	$5,935,229.86*	-
DR-1556	9/19/2004	Severe Storms and Flooding	$25,804,256.17*	$23,662,227.18*

**Indicates data from FEMA's Disaster Declarations website. The dollar amounts refer to total funds delegated to all counties within the declared disaster area, not just Butler County.*

Event Narratives

- **June 1, 1997 – Flash Flood:** A cut-off low pressure in the upper levels of the atmosphere remained across the Ohio valley from late on May 31st through June 2nd. Heavy showers fell across Southern and Central Ohio from the 31st through the morning hours of the 1st. In the afternoon of both the 1st and 2nd, additional heavy rainfall occurred with afternoon thunderstorm development mainly over Central and South-Central parts of the state. Many county roads were flooded by persistent heavy rainfall. The New London Road bridge was washed out. There was a reported $450,000 in property damages from the event.

- **July 17-18, 2001 – Flash Flood:** Several state, county and township roads incurred culvert and/or beam damage. 159 dwellings and one nursing home with damage across county. A stream was out of its banks at the intersection of State Routes 73 and 177. Total estimate of public assistance is $1,465,350.

- **September 2, 2003 – Flooding:** Persistent heavy rain produced an additional one to two inches across southwest Ohio during the afternoon. The heavy rain caused flooding of roads and several creeks rose out of their banks. A school bus was stranded in high water near Mason. Kings Mills Road in Mason collapsed in a construction area when the heavy rains washed out a culvert. Twenty-five people were evacuated from the Royal Oaks Apartments in Fairfield due to high water.

- **June 2, 2016 – Flash Flooding:** Slow moving thunderstorms with heavy rain developed ahead of a low-pressure system. Street flooding occurred along Western Avenue and several other roadways in the Highland Park neighborhood of Hamilton. Water was as deep as 3 feet in some locations.

- **May 19, 2020 – Flash Flooding:** A slow moving upper-level low pressure system produced showers and thunderstorms across the Ohio Valley. All of the businesses along Windisch Road were evacuated due to rising water along Mill Creek, affecting about 1,000 individuals.

4.8.5 PROBABILITY OF FUTURE OCCURRENCES

Reported flood events over the past 20 years provide an acceptable framework for projecting the frequency of future occurrence. The probability of the county experiencing a flood event can be difficult to quantify, but the historical record of fifty-two flood events since 2002 indicates that this type of event has occurred once every 0.25 years from 2002 through 2022.

(2022 CY) - (2002 HY) = 20 Years on Record

(81 Events) / (20 Years) = 4.05 Events per Year

The historic frequency calculates that the chance of this type of event occurring each year is 100%. The Planning Committee, based on their own knowledge, concluded that Flooding events are "Likely" each year. This means that they have between a 10% and 100% chance of happening annually.

Future Conditions

An important consideration of hazard mitigation planning is to consider how future conditions, including a changing climate, will influence how flooding will behave in and impact Butler County. According to The Ohio State University's Department of Geography in association with the State Climatologist Office of Ohio, has identified that there will be more rain in the spring and fall. The Climate Explorer shows Butler County had a total of 40.03 inches of precipitation in 2005. In 2010, the observed total precipitation was 36.7 inches. By 2090, it is projected that Butler County will have an increase of 7.26 inches of annual total precipitation with a higher emissions rate. Butler County is also projected to have 5.5 days of precipitation greater than 1 inch a year by the 2090s decade, an increase of 4 days compared to the observed 1.5 days in 2010.

TABLE 4-85 THE CLIMATE EXPLORER CLIMATE PREDICTIONS FOR BUTLER COUNTY

	2020	2030	2040	2050	2060	2070	2080	2090
Projected Annual Total Precipitation Totals (in)	41.82	40.88	41.89	42.51	42.9	42.92	43.41	43.96
Days with > 1" of Precipitation	3.9	4.1	4.3	4.8	4.9	5.2	5.4	5.5
Days with > 2" of Precipitation	0.3	0.3	0.4	0.4	0.4	0.5	0.6	0.5
Days with > 3" of Precipitation	0	0	0	0.1	0	0.1	0.1	0.1

The Climate Mapping for Resilience and Adaptation (CMRA) Assessment Tool for Flooding identifies future projections for days with extreme precipitation around the year 2050 based on a high-emissions scenario. CMRA projects that Butler County will have 6.8 days per year with events in the top 1% of all historic daily totals. The assessment tool also projects there will be 4.5 days a year with precipitation over 1 inch, 0.40 days a year with precipitation over 2 inches, 0.05 days a year with precipitation over 3 inches and 0.01 days a year with precipitation over 4 inches around the year 2050. In addition, CMRA projects the number of days with precipitation over 1 inch will increase by 1.26 days compared to the observed average from 1975-2000.

With the increased annual precipitation and increased days with heavy rainfall projected for Butler County, it can be assumed that both flooding and flash flooding will increase in frequency and severity, especially in the spring and fall months. The locations of both types of flooding are likely to expand the current locations. Flooding events may approach more significant benchmarks, such as more frequently approaching the 1% floodplain boundary or expand into areas that were not previously mapped as flood zone. Flash flooding events may expand further out of the various localized locations, making roadways impassable and impending further into properties.

4.8.6 ASSETS EXPOSED TO FLOODING

Potential Losses

TABLE 4-86 IMPACTS FROM FLOODING

Impact	Description
People	Severe floods can kill those caught in their way. Injuries may also result. Illnesses from water-borne viruses, bacteria, or parasites if contact is made with floodwaters.
Infrastructure	Buildings can be severely damaged or destroyed. Mold can occur after flooding.
Economy	Local economies can sustain the most damage. If damage or transportation shortages cause enough disruption, effects may be felt at a larger scale.
Natural Systems	Land may be waterlogged, destroying crops. Vegetation may be uprooted and displaced. Animals can lose habitats.
Transportation	Roadways may become impassable. Affected railways can halt movement of goods.

Community Vulnerability

In Butler County, there are 2,345 total structures located in the Special Flood Hazard Area (SFHA); 23 of the county's critical facilities are located in the SFHA. Fairfield has the highest number of structures in the SFHA with 572 structures, New Miami has the second highest with 372 structures, and Middletown has the third highest with 280 structures. Millville has the highest percent of structures in the SFHA with 45% of total structures located in the SFHA, New Miami has 40% of its total structures located in the SFHA, and Somerville Township has 16% of its total structures located in the SFHA. There are a total of 23 critical facilities located in the SFHAs of Butler County, accounting for a total of 8% of the county's critical facilities.

TABLE 4-87 COMMUNITY FLOOD VULNERABILITY IN BUTLER COUNTY

Municipality	Total Structures	Structures in SFHA	Percent Structures in SFHA	Total Critical Facilities	Critical Facilities in SFHA	Percent Critical Facilities in SFHA
City of Fairfield	15,552	572	4%	33	1	3%
City of Hamilton	26,081	138	1%	49	1	2%
City of Middletown	21,236	280	1%	38	0	0%
City of Monroe	5,523	4	0%	26	2	8%
City of Oxford	5,393	3	0%	22	0	0%
City of Sharonville	995	0	0%	2	0	0%
City of Trenton	4,610	1	0%	5	0	0%
Fairfield Township	8,640	15	0%	17	3	18%
Hanover Township	3,264	39	1%	8	0	0%
Lemon Township	1,108	104	9%	4	2	50%
Liberty Township	15,221	53	0%	21	0	0%
Madison Township	3,476	20	1%	10	0	0%

Municipality	Total Structures	Structures in SFHA	Percent Structures in SFHA	Total Critical Facilities	Critical Facilities in SFHA	Percent Critical Facilities in SFHA
Milford Township	1,300	78	6%	9	0	0%
Morgan Township	2,283	28	1%	5	0	0%
Oxford Township	976	12	1%	6	2	33%
Reily Township	1,141	39	3%	4	0	0%
Ross Township	3,370	272	8%	14	3	21%
Somerville Township	122	20	16%	1	0	0%
St. Clair Township	2,018	144	7%	14	6	43%
Village of College Corner	97	0	0%	0	0	0%
Village of Jacksonburg	29	0	0%	2	0	0%
Village of Millville	335	151	45%	3	3	100%
Village of New Miami	931	372	40%	5	0	0%
Village of Seven Mile	325	0	0%	4	0	0%
Wayne Township	1,595	3	0%	3	1	33%
West Chester Township	24,287	176	1%	32	2	6%
Grand Total	**124,026**	**2,345**	**2%**	**302**	**23**	**8%**

Impacts to Socially Vulnerable Communities

While flooding can be devastating to any community, those who do not have the means or ability to leave their homes during an event are most likely to be caused harm. Individuals and families who live below the poverty line, as well as seniors, do not always have the ability to leave during a storm event that can cause flooding. The most well-known areas of flooding are in the SFHA, but urban flooding can happen as well that goes unreported. This can also lead to issues with flooded out roads that can disrupt critical lines of transit. Those who do not have the ability to drive may have to remain at home, forgoing critical appointments or the ability to get groceries.

In Butler County, there are 1,120 mobile homes. Out of the 1,120 mobile homes, 90, or 8%, are located in the SFHA. 80 of the 90 mobile homes located in the SFHA are in Unincorporated Butler County. The remaining 10 mobile homes located in the SFHA are in Millville.

TABLE 4-88 MOBILE HOMES VULNERABLE TO FLOODING IN BUTLER COUNTY

Municipality	Total Mobile Homes	Total Mobile Homes in SFHA	Percent Mobile Homes in SFHA
City of Fairfield	181	0	0%
City of Hamilton	115	0	0%
City of Middletown	0	0	0%
City of Monroe	0	0	0%
City of Oxford	6	0	0%
City of Sharonville	158	0	0%

City of Trenton	0	0	0%
Fairfield Township	42	0	0%
Hanover Township	0	0	0%
Lemon Township	219	27	12%
Liberty Township	36	36	100%
Madison Township	1	0	0%
Milford Township	0	0	0%
Morgan Township	85	0	0%
Oxford Township	0	0	0%
Reily Township	0	0	0%
Ross Township	76	0	0%
Somerville Township	0	0	0%
St. Clair Township	191	16	8%
Village of College Corner	0	0	0%
Village of Jacksonburg	0	0	0%
Village of Millville	10	10	100%
Village of New Miami	0	0	0%
Village of Seven Mile	0	0	0%
Wayne Township	11	0	0%
West Chester Township	3	1	33%
Grand Total	**1,120**	**90**	**8%**

There are a total of 2,345 structures in the SFHA in Butler County. 49 of the structures are agriculture parcels, 341 are commercial structures, 96 are exempt, 22 are industrial parcels, 1,823 are residential structures, 14 are unknown classification, and no utility parcels are located in the floodplain.

TABLE 4-89 FLOOD VULNERABILITY BY LAND USE IN BUTLER COUNTY

Municipality	Total Structures	Agriculture	Commercial	Exempt	Industrial	Residential	Unknown	Utility
City of Fairfield	15,552	2	21	33	0	515	1	0
City of Hamilton	26,081	0	44	3	0	91	0	0
City of Middletown	21,236	0	9	15	5	247	4	0
City of Monroe	5,523	0	3	0	1	0	0	0
City of Oxford	5,393	0	0	2	0	1	0	0
City of Sharonville	995	0	0	0	0	0	0	0
City of Trenton	4,610	0	0	0	0	1	0	0
Fairfield Township	8,640	1	1	0	3	10	0	0
Hanover Township	3,264	8	18	1	0	12	0	0
Lemon Township	1,108	0	43	2	3	56	0	0
Liberty Township	15,221	2	47	0	0	4	0	0

Municipality	Total Structures	Agriculture	Commercial	Exempt	Industrial	Residential	Unknown	Utility
Madison Township	3,476	0	0	2	0	18	0	0
Milford Township	1,300	5	1	4	1	66	1	0
Morgan Township	2,283	4	1	3	0	20	0	0
Oxford Township	976	4	0	2	0	6	0	0
Reily Township	1,141	12	0	2	0	24	1	0
Ross Township	3,370	4	53	3	8	204	0	0
Somerville Township	122	0	1	0	0	18	1	0
St. Clair Township	2,018	5	50	4	0	84	1	0
Village of College Corner	97	0	0	0	0	0	0	0
Village of Jacksonburg	29	0	0	0	0	0	0	0
Village of Millville	335	2	42	10	0	94	3	0
Village of New Miami	931	0	7	10	1	352	2	0
Village of Seven Mile	325	0	0	0	0	0	0	0
Wayne Township	1,595	1	0	0	0	2	0	0
West Chester Township	24,287	1	63	2	90	17	3	0
Grand Total	**124,026**	**49**	**341**	**96**	**22**	**1,823**	**14**	**0**

The following table reflects each jurisdiction's response from the Vulnerability Assessment form that was completed during the planning process. Responses for the form submitted by stakeholders can be found in **Appendix I.**

Jurisdiction/Organization	Vulnerability Assessment Response
Butler County	Essential county functions like inspections for food service facilities, SSP, Mom's and Baby's First Home Visit, and other community programs are often delayed by flood events. The county's bridges and roads must remain operational for public and rescue services. There are critical infrastructure and homes in and near the floodplain in the county.
Fairfield	Water treatment plant is close to the Great Miami River.
Hamilton	The storm mains in the city are not sized to accommodate higher flows.
Middletown	Water treatment facility location.
Monroe	There is always an impact on our parks when the Great Miami River floods.
Oxford	Our fire station is susceptible to flooding in the basement during times of heavy rain. The roof in the bay area is old and beginning to leak when there is heavy rain.
Sharonville	As was noted in risk assessment, the risk of flooding has decreased in Sharonville due to multiple flood mitigation projects. Flooding does still remain a risk to several business near the Mill Creek and blocked roads due to flooding. Mainly Mosteller Rd at Sharon and Canal Rd.
Trenton	Only minor flooding of some streets and intersections, shallow enough to driven through if needed.
College Corner	Community has flooded during heavy rainstorms in the past.
Jacksonburg	We are one of the highest elevation communities in the county.
Millville	Flooding has been an issue in the Village of Millville from Beal Run Creek over the last year due to land clearing upstream.

Jurisdiction/Organization	Vulnerability Assessment Response
New Miami	We have streets that flood during heavy rains. A lot of property here in the lower village floods. We haven't had a flood in about a year though. We used to get them all the time. In the event of a 100-year flood, the impacts would be catastrophic. Great Miami River is on one side of the village, Four Mile Creek is on the other side. There is bad streamway erosion on Four Mile Creek – almost lost a road from the erosion. There's approximately six feet between the edge of the stream bank and the road.
Seven Mile	Every year multiple homes are flooded. The village needs water ways opened up and new storm sewers as well as additional storm water sewers.

The following table shows the risk index and expanded expected annual loss information and scores for Butler County for Flooding in FEMA's National Risk Index.

TABLE 4-90 FEMA NRI RIVERINE FLOODING DATA FOR BUTLER COUNTY

NRI Category	Butler County Rating
Riverine Flooding	
Risk Index Rating	Relatively Low (58.3 Rating)
Expected Annual Loss	Relatively Low (62.1 Rating, $671,742 Expected Annual Loss) • $244,716 in Building Value • $302,149 in Population Equivalence • 0.03 in Population • $124,877 in Agriculture Value

Hazard Risk by Community

During the planning process, each participating community ranked their risk to each profiled hazard in the plan. The representatives of the jurisdictions within Butler County were asked to consider the risk factors of probability, impact, spatial extent, warning time, and duration and how those factors may increase or decrease their community's risk to the hazard. A ranking of high indicates the community considers at least four of the factors to be an increased concern. A ranking of medium indicates the community considers two to three of the factors to be an increased concern. A ranking of low indicates the community considers one or no factors to be an increased concern. Each community's response to the hazard risk rating for flooding is presented in the table below. All stakeholder responses gathered during the planning process through this form can be found in **Appendix I**.

TABLE 4-91 HAZARD RISK BY COMMUNITY FOR FLOODING

	Fairfield	Hamilton	Middletown	Monroe	Oxford	Sharonville	Trenton	College Corner	Jacksonburg	Millville	New Miami	Seven Mile
Flooding	Medium	High	Medium	Medium	Medium	Medium	High	HIgh	Low	High	High	High

Hazus-MH 100-Year Flood Scenario

The method used in determining the types and numbers of potential assets exposed to flooding was conducted using a loss estimation model called HAZUS-MH. HAZUS-MH is a regional multi-hazard loss estimation model that was developed by the FEMA and the National Institute of Building Sciences (NIBS). For this Plan, a 100- year flood scenario was modeled, and the results are presented below.

The geographical size of the region is approximately 470 square miles and contains 6,185 census blocks. The region contains over 136 thousand households and has a total population of 368,130 people (2010 Census Bureau data).

There are an estimated 132,232 buildings in the region with a total building replacement value (excluding contents) of 43,593 million dollars. Approximately 92.16% of the buildings (and 77.07% of the building value) are associated with residential housing.

For essential facilities, there are 9 hospitals in the region with total bed capacity of 879 beds. There are 116 schools, 46 fire stations, 18 police stations, and 1 emergency operation center.

TABLE 4-92 BUILDING EXPOSURE BY OCCUPANCY TYPE FOR THE SCENARIO

Occupancy	Exposure ($1000)	Percent of Total
Residential	5,231,262	70.6%
Commercial	1,477,749	19.9%
Industrial	454,412	6.1%
Agricultural	34,022	0.5%
Religion	108,416	1.5%
Government	32,924	0.4%
Education	74,453	1.0%
Total	**7,413,238**	**100%**

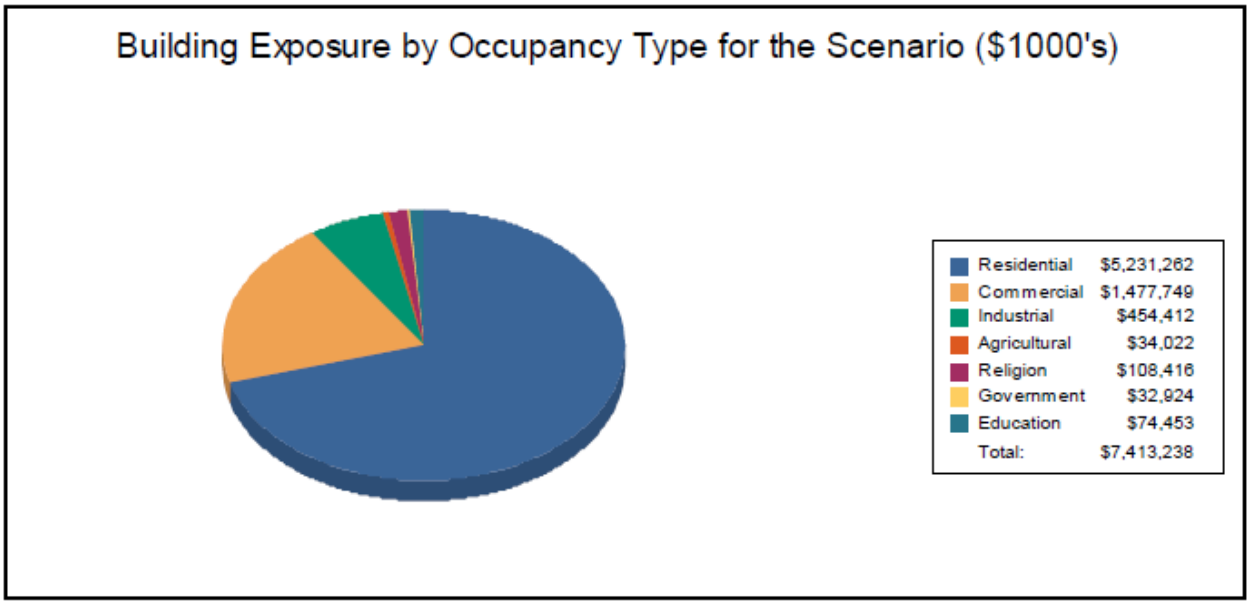
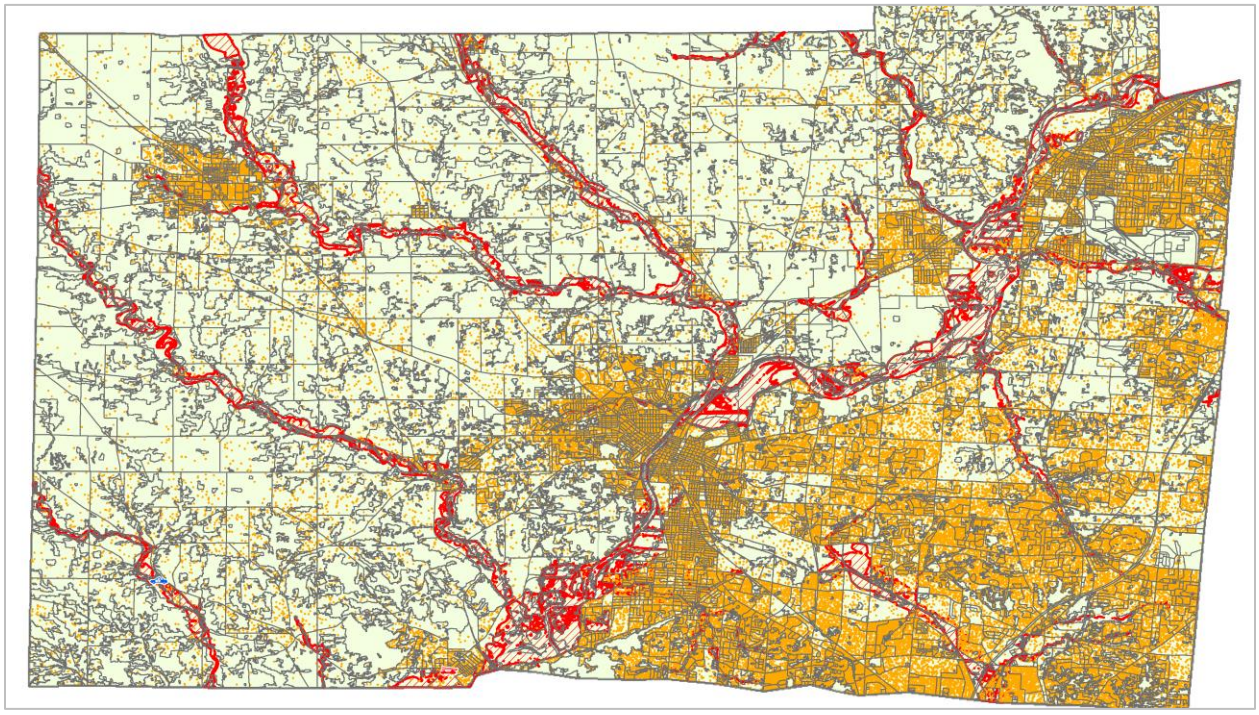


TABLE 4-93 MODELED FLOOD EXTENT IN STUDY REGION



General Building Stock Damage

Hazus estimates that about 796 buildings will be at least moderately damaged. This is over 74% of the buildings in the scenario. An estimated 51 buildings will be completely destroyed. The Hazus Flood Technical Manual defines the various states of damage. The first table below summarizes the expected damage by general occupancy for the buildings in the region. The second table summarizes the expected damage by general building type. The last table summarizes the expected damage to essential facilities.

TABLE 4-94 EXPECTED BUILDING DAMAGE BY OCCUPANCY

	1-10		11-20		21-30		31-40		41-50		>50	
Occupancy	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	6	67	2	22	0	0	1	11	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	391	33	481	41	169	14	63	5	29	2	51	4
Total	397		483		169		64		29		51	

TABLE 4-95 EXPECTED BUILDING DAMAGE BY BUILDING TYPE

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	1	50	1	50	0	0	0	0	0	0	0	0
ManufHousing	0	0	2	5	3	8	0	0	6	16	27	71
Masonry	69	35	88	45	24	12	8	4	3	2	4	2
Steel	2	67	1	33	0	0	0	0	0	0	0	0
Wood	325	34	392	41	142	15	55	6	20	2	20	2

TABLE 4-96 EXPECTED DAMAGE TO ESSENTIAL FACILITIES

Classification	Total	# Facilities		
		At Least Moderate	At Least Substantial	Loss of Use
Emergency Operation Centers	1	0	0	0
Fire Stations	46	1	0	1
Hospitals	9	0	0	0
Police Stations	18	1	0	0
Schools	116	0	0	0

Shelter Requirements

Hazus estimates the number of households that would be displaced from their homes by the flood and the associated potential evacuation. It also estimates how many displaced people will require accommodations in temporary public shelters. In this case, the model estimates 2,576 households (or 7,727 people) will be displaced (households evacuated from within or very near to the inundated area). Of these, 286 people (from a Hazus-estimated total population of 368,130) will seek temporary shelter in public shelters.

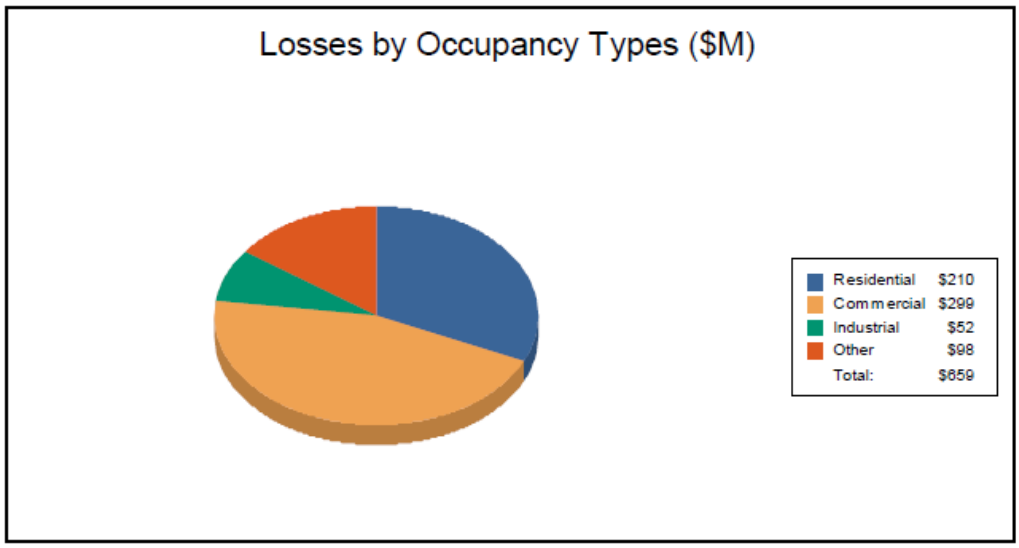
Building-Related Losses

As noted, building losses are broken into two categories: direct and business interruption. Direct building losses are the estimated costs to repair the damage or replace the building and its contents. Business interruption losses are those associated with the inability to operate a business because of the flood. Business interruption losses also include temporary living expenses for people displaced from their homes by the flood. The total building-related losses were $350.74 million, with 47% of the estimated losses related to the region's business interruption. Residential properties made up 31.92% of the total loss. The following table summarizes the losses associated with building damage. The total economic loss estimated for the flood is $658.81 million, which represents 8.89% of the total replacement value of the scenario buildings.

TABLE 4-97 BUILDING-RELATED ECONOMIC LOSS ESTIMATES

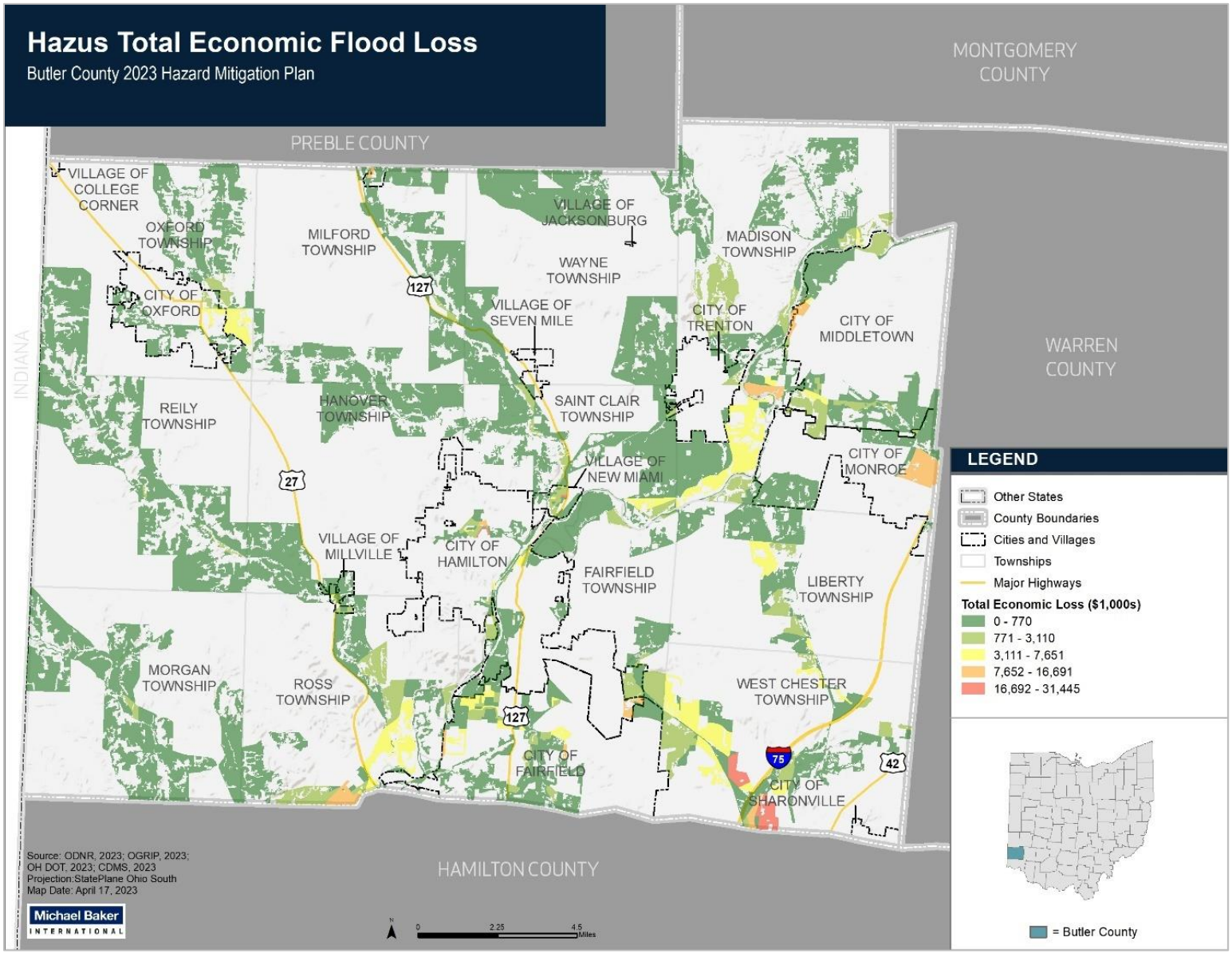
(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	104.29	33.07	13.23	4.46	155.04
	Content	49.05	85.45	29.09	23.72	187.32
	Inventory	0.00	3.14	4.76	0.50	8.39
	Subtotal	**153.34**	**121.66**	**47.08**	**28.67**	**350.74**
Business Interruption						
	Income	1.97	71.01	1.44	9.67	84.08
	Relocation	36.51	19.47	1.14	4.26	61.38
	Rental Income	13.81	13.83	0.25	0.47	28.35
	Wage	4.67	73.03	1.64	54.93	134.26
	Subtotal	**56.95**	**177.35**	**4.46**	**69.32**	**308.07**
ALL	**Total**	**210.29**	**299.01**	**51.53**	**97.99**	**658.81**



The entire county is susceptible to flooding, either directly or through cleanup efforts and lasting economic impacts. Those closest to the floodplains throughout the county are vulnerable to floodwaters. Those areas and the rest of the county may also be affected by localized flash flooding.

FIGURE 4-40 BUTLER COUNTY TOTAL ECONOMIC LOSS



4.8.7 FUTURE CONDITIONS IMPACTS

As the climate, population, and land uses of the county change over time, it is important to identify how these future conditions will affect the impacts of hazards. Flooding impacts will be influenced by climate change trends, changes in population trends, and land use and development trends.

Climate Change Trends

As total precipitation amounts are expected to increase along with bursts of heavy rainfall due to climate change, Butler County can expect to see flooding and flash flooding occur in expanded and new areas throughout the county. The CMRA Flooding hazard analysis identifies that flash flooding will become especially problematic in urban areas, where nonpermeable surfaces create runoff with the increased rainfalls and could overwhelm existing culverts, bridges, and stormwater systems. Road closures may occur due to impassable conditions and may create a stranded island effect for those who need assistance from first responders.

Changes in Population Trends

An increase in population is directly related to the development and infrastructure that would be needed to support. The public health of people could be at a heightened risk due to an increased amount of flooding. Flooding can lead to mold growth in buildings. Drinking water could also become polluted from floodwaters. An increased population would also lead to an increased risk of people drowning during flood events.

Land Use and Development Trends

Butler County is largely rural with pockets of urbanized land, with only 24.80% of the total county land lower-intensity developed and 7.25% of the total county land higher-intensity developed. Much of the existing development and trends are in the cities, larger villages, and existing industrial areas. Localized flooding remains a possibility throughout the county, especially in the many low-lying areas. It is essential that land use plans consider not only the dollar amount of damage that buildings near waterways could incur, but also the danger of increasing flood risk by building close to the rivers, which adds flood debris and narrows the floodplains.

Changing the natural floodplain to support additional population or structures would also lead to changes in flooding drainage. Without the permeable soil present to absorb floodwaters, the base flood elevation will increase, causing a higher magnitude flood. Rapid moving floodwaters, without the absorption into permeable ground surfaces, will continue to move downstream and impact land, structures, and populations.

Regulatory Environment

Numerous laws at the federal, state, and local levels relate to floodplain management. Butler County and its municipalities continue to work to enforce the local floodplain management ordinance requirements for all flooding programs, including the National Flood Insurance Program.

Risk Mapping, Assessment and Planning

Butler County had a Flood Insurance Study (FIS) revised on October 19, 2018. The county's FIRMs were updated on March 2010, October 2018, and June 2023.

National Flood Insurance Program

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. As a participating member of the NFIP, Butler County is dedicated to protecting homes, with 694 NFIP policies currently in force. Jacksonburg and College Corner do not have any identified special flood hazard areas, so they do not participate in the NFIP currently.

TABLE 4-98 BUTLER COUNTY NFIP STATUS SUMMARY

CID	Community	Initial FHBM	Initial FIRM	Current Effective Map Date	Reg-Emerg Date
390037	Butler County	12/23/1977	11/4/1981	10/19/2018	10/5/1989
390038	Fairfield	3/1/1974	3/15/1979	10/19/2018	3/15/1979
390039	Hamilton	2/15/1974	7/15/1977	10/19/2018	7/15/1977
390040	Middletown	6/21/1974	3/2/1979	10/19/2018	3/2/1979
390041	Millville	6/7/1974	2/4/1981	10/19/2018	2/4/1981
390042	Monroe	5/17/1974	8/5/1991	10/19/2018	8/5/1991
390043	New Miami	2/8/1974	2/18/1981	10/19/2018	2/18/1981
390731	Oxford	5/10/1974	2/16/1979	10/19/2018	2/16/1979
390045	Seven Mile	6/14/1974	12/17/2010	10/19/2018	8/24/1981
390236	Sharonville	4/12/1974	1/2/1987	6/7/2023	1/2/1987
390047	Trenton	5/10/1974	12/25/1981	10/19/2018	9/3/1979

Butler County entered the NFIP on December 23, 1977, three years after the other NFIP participants within Butler County. As participants in the NFIP, the county and communities are dedicated to regulating development in the FEMA floodplain areas in accordance with NFIP criteria. Structures permitted or built in the county before the NFIP regulatory requirements were incorporated into the ordinances (before the effective date of the county's FIRM) and are called "pre-FIRM" structures.

TABLE 4-99 BUTLER COUNTY NFIP POLICIES AND CLAIM INFORMATION

CID	Community	Number of Policies	Total Coverage	Total Premiums	Total Claims Since 1978	Total Paid Since 1978	V-Zone Policies	A-Zone Policies
390037	Butler County	271	$59,711,000	$225,967	134	$1,999,975	0	109
390038	Fairfield	186	$41,356,000	$125,354	229	$1,252,090	0	85
390039	Hamilton	36	$9,710,000	$34,899	26	$142,923	0	3
390040	Middletown	41	$7,126,000	$40,046	12	$92,827	0	15
390041	Millville	27	$4,613,000	$28,570	20	$84,598	0	14
390042	Monroe	8	$2,229,000	$9,197	8	$303,482	0	5
390043	New Miami	61	$5,605,000	$60,777	20	$49,796	0	57
390045	Seven Mile	2	$490,000	$876	5	$242,267	0	0
390047	Trenton	1	$249,000	$554	2	$10,338	0	33
390236	Sharonville	49	$17,307,000	$56,110	78	$2,869,732	0	5
390731	Oxford	12	$2,680,000	$5,698	5	$241,983	0	0

FEMA designates any insured property that has made two or more claims of more than $1,000 in any rolling 10-year period since 1978 as a Repetitive Loss (RL) property. The term "rolling 10-year period" means that a claim of $1,000 can be made in 1991 and another claim for $2,500 in 2000; or one claim in 2001 and another in 2007, as long as both qualifying claims are within 10 years of each other. Claims must be at least 10 days apart but within 10 years of each other. RL properties may be classified as Severe Repetitive Loss (SRL) under certain conditions. SRL properties are those with four or more claims of at least $5,000, or at least two claims that cumulatively exceed the building's reported value. A property that sustains repetitive flooding may or may not be on the county's RL property list for a number of reasons:

- Not everyone is required to carry flood insurance. Structures that carry federally backed mortgages and are in an SFHA are required to carry flood insurance in the county;
- Owners who have completed the terms of the mortgage or who purchased their property outright may choose not to carry flood insurance and instead bear the costs of recovery on their own;
- The owner of a flooded property that does carry flood insurance may choose not to file a claim;
- Some insured properties that are flooded regularly and filed claims may not meet the $1,000 minimum threshold to be recognized as an RL property; or
- The owner adopted mitigation measures that reduce the impact of flooding on the structure, removing it from the RL threat and the RL list (in accordance with FEMA's mitigation reporting requirements).

The following table breaks down the repetitive losses in Butler County. The data provided by the State of Ohio is the most recent data available for inclusion in the plan. The repetitive loss data is from April 2022. There are 51 repetitive loss properties in Butler County, with one being classified as a severe repetitive loss property, for a total of $1,641,670.16 paid.

TABLE 4-100 REPETITIVE LOSS PROPERTIES

Community	# of RL Properties	Type	Total Losses	Total Paid
Butler County	9	Single Family	23	$399,015.98
City of Fairfield	32	Single Family	94	$838,105.05
City of Hamilton	3	Single Family	7	$111,052.16
City of Middletown	1	Single Family	2	$9,843.60
	1	Other - Nonresidential	$25,998.87	3
Village of Millville	1	Single Family	3	$24,283.41
Village of Seven Mile	1	Single Family	2	$151,650.26
Village of Somerville (Unincorporated)	2	Single Family	4	$23,825.87

Extensive FEMA NFIP databases are used to track claims for every participating community. Because they maintain all, NFIP claims, FEMA databases allow users to examine single-loss (SL) and RL

properties. The data provided by the State of Ohio shows that Butler County has one SRL properties with a total of $57,894.96 paid.

TABLE 4-101 SEVERE REPETITIVE LOSS

Community	# of RL Properties	Type	Total Losses	Total Paid
City of Fairfield	1	Single Family	5	$57,894.96

NFIP Community Rating System (CRS)

The NFIP Community Rating System is an additional step in the NFIP that local communities can participate in to lower their residents' flood insurance premiums through a percentage amount based off of the credit points the community accumulates. CRS is a voluntary incentive program that recognizes and rewards communities to go above and beyond the minimum requirements of the NFIP. Communities that participate in CRS abide by the three goals of the program:

- Reduce and avoid flood damage to insurable property,
- Strengthen and support the insurance aspects of the National Flood Insurance Program, and
- Foster comprehensive floodplain management.

A participating community in CRS can have different degrees of participation, which is calculated through the credit points the community receives. Communities can earn credit points through the nineteen different of activities completed in the categories of Public Information, Mapping & Regulations, Flood Damage Reduction, and Flood Preparedness. Additional credit points can also be earned by regulating development outside the SFHA, future flood condition assessments, state-based credit, and other activities listed in the CRS Coordinator's Manual. The table below displays the different rate classes, the corresponding discounts, and the credit points required to achieve the rate class.

TABLE 4-102 CRS CREDIT POINT SYSTEM

Rate Class	Discount for SFHA	Discount for Non-SFHA	Credit Points Required
1	45%	10%	4,500+
2	40%	10%	4,000-4,499
3	35%	10%	3,500-3,999
4	30%	10%	3,000-3,499
5	25%	10%	2,500-2,999
6	20%	10%	2,000-2,499
7	15%	5%	1,500-1,999
8	10%	5%	1,000-1,499
9	5%	5%	500-999
10	0	0	0-499

In Butler County, there is one community that participates in the NFIP CRS program as of April 1, 2023, according to FEMA. The City of Fairfield joined the program on October 1, 1993.

TABLE 4-103 BUTLER COUNTY CRS COMMUNITIES

Community Number	Community Name	CRS Entry Date	Current Effective Date	Current Class	% Discount for SFHA	% Discount for Non-SFHA
390038	Fairfield	10/1/1993	4/1/2022	10	0%	0%

4.8.8 FLOODING SUMMARY

Severe flooding has the potential to cause significant damage along the rivers and small creeks throughout the county. Assessing flood damage requires county residents to remain alert and notify local officials of potentially flood prone areas near infrastructure such as roads, bridges, and buildings. Flooding remains a highly likely occurrence in the county. Smaller floods caused by heavy rains and inadequate drainage capacity will be more frequent, but not as costly as the large-scale floods that could occur at less frequent intervals.

9. HEALTH RELATED EMERGENCIES

Hazard	Probability		Impact		Spatial Extent		Warning Time		Duration		RF Rating
Health Related Emergency	2	0.6	1	0.3	1	0.2	2	0.2	3	0.3	1.6
Low Risk Hazard (1.0 – 1.99)											

4.9.1 HEALTH RELATED EMERGENCY DESCRIPTION

Pandemic

Pandemic is defined as a disease affecting or attacking the population of an extensive region which may include several countries and/or continents. It is further described as extensively epidemic. Generally, pandemic events cause sudden, pervasive illness in all age groups on a global scale, though some age groups may be more at risk. As such, pandemic events cover a wide geographic area and can affect large populations, depending on the disease. The exact size and extent of the infected population is dependent upon how easily the illness is spread, the mode of transmission, and the amount of contact between infected and non-infected persons. Three recent pandemics that have affected Butler County are West Nile Virus, Influenza, and COVID-19.

- **West Nile Virus** is a vector-borne disease that can cause headache, high fever, neck stiffness, disorientation, tremors, convulsions, muscle weakness, paralysis, and, in its most serious form, death. The virus spreads via mosquito bite and is aided by warm temperatures and wet climates conducive to mosquito breeding.
- **Influenza,** also known as “the flu,” is a contagious disease that is caused by the influenza virus and typically presents with fever, headache, sore throat, cough, and muscle aches. Influenza is considered to have pandemic potential if it is novel, meaning that people have no immunity to it, virulent, it causes deaths in normally healthy individuals, and it is easily transmittable from person-to-person. Influenza spreads via the air in crowded populations in enclosed spaces, and it may persist on surfaces and in the air. Individuals are communicable for 3-5 days after clinical onset. Pandemic influenza planning began in response to the H5N1 (avian) flu outbreak in Asia, Africa, Europe, the Pacific, and the Near East in the late 1990s and early 2000s. In 2009, the US experienced a pandemic of H1N1. Continuing to prepare and plan for future pandemics needs to continue. As stated in the Ohio Department of Health Pandemic Influenza Preparedness and Response Plan, “The impact of an influenza pandemic on the health care system could be devastating. The CDC estimates in the United States a moderate pandemic could result in 90 million people becoming ill; 45 million outpatient visits; 865,000 hospitalizations; and 209,000 deaths.” This underscores the importance of planning for this hazard (Ohio Department of Health, 2006).
- **COVID-19**, also known as Coronavirus, is a respiratory disease that spreads from person-to-person contact. This specific coronavirus, COVID-19, comes from a large group of viruses that infect people and different species of animals. Only a few strains of animal coronaviruses

can infect people, but SARS-CoV-2, the virus behind the pandemic, is one of the three that can infect and spread between people. The virus has its origin from bats. The first cases of the pandemic originated in Wuhan, China. Symptoms of the virus can appear as early as two days or as late as fourteen days after exposure. Fever, cough, and shortness of breath are associated with the virus, and they can range from mild to severe to death. The severity of the illness can also increase in patients who older in age, have chronic medical conditions such as heart disease, diabetes, or lung disease, and those who have compromised immune systems. Since the initial spread of COVID-19, the virus has mutated to create new variants. Variants of SARS-CoV-2 are similar to the original strain of the virus, but they may spread easier or prove to be more resilient against the vaccines that were developed to combat SARS-CoV-2. Currently, there are six variants of SARS-CoV-2 in the United States, all of which have been a concern according to the CDC. The vaccines that were developed in response to the COVID-19 pandemic protect the vaccinated people against the variants. Vaccinated people can still contract the virus variants, but the vaccine can fight against severe illness, hospitalization, and death.

- **B.1.1.7 (Alpha)** – detected in the United States in December 2020, originated in the United Kingdom. This variant spreads much faster than other variants, but treatments are effective against the variant. The Alpha variant may cause a more severe sickness in those who contract the virus variant.
- **B.1.351 (Beta) –** detected in the United States in January 2021, originated in South Africa. The Beta variant may spread faster than other variants, and some monoclonal antibody treatments are less effective against the variant.
- **P.1 (Gamma) –** detected in the United States in January 2021, originated in Brazil but was detected in Japan. The Gamma variant spreads faster than other variants, and certain monoclonal antibody treatments are not as effective against the variant.
- **B.1.427 and B1.429 (Epsilon) –** originated and detected in California in February 2021. This variant is not identified as a variant of concern at this time.
- **B.1.617.2 (Delta) –** detected in the United States in March 2021, originated in India. Spreads much faster than other variants, and certain monoclonal antibody treatments are not as effective. The Delta variant may cause more severe sickness in the patient who contracts the variant than the original strain of SARS-CoV-2.
- **B.1.1.529 (Omicron)** – first identified in South Africa. Omicron spreads more easily than the original virus that caused COVID-19. However, Omicron is generally less severe than the other variants.

Epidemic

Epidemic is defined as something affecting many persons at the same time and spreading from person to person in a locality where the disease is not permanently prevalent. The amount of a particular disease that is usually present in a community is referred to as the baseline or endemic level of the disease. This level is not necessarily the desired level, which may in fact be zero, but rather is the observed level. In the absence of intervention and assuming that the level is not high enough to deplete the pool of susceptible persons, the disease may continue to occur at this level indefinitely. Thus, the baseline level is often regarded as the expected level of the disease.

While some diseases are so rare in a given population that a single case warrants an epidemiologic investigation (e.g., rabies, plague, polio), other diseases occur more commonly so that only deviations from the norm warrant investigation. Sporadic refers to a disease that occurs infrequently and irregularly. Endemic refers to the constant presence and/or usual prevalence of a disease or infectious agent in a population within a geographic area. Hyperendemic refers to persistent, high levels of disease occurrence.

Occasionally, the amount of disease in a community rises above the expected level. Epidemic refers to an increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area. Outbreak carries the same definition of epidemic but is often used for a more limited geographic area. Cluster refers to an aggregation of cases grouped in place and time that are suspected to be greater than the number expected, even though the expected number may not be known. Pandemic refers to an epidemic that has spread over several countries or continents, usually affecting a large number of people.

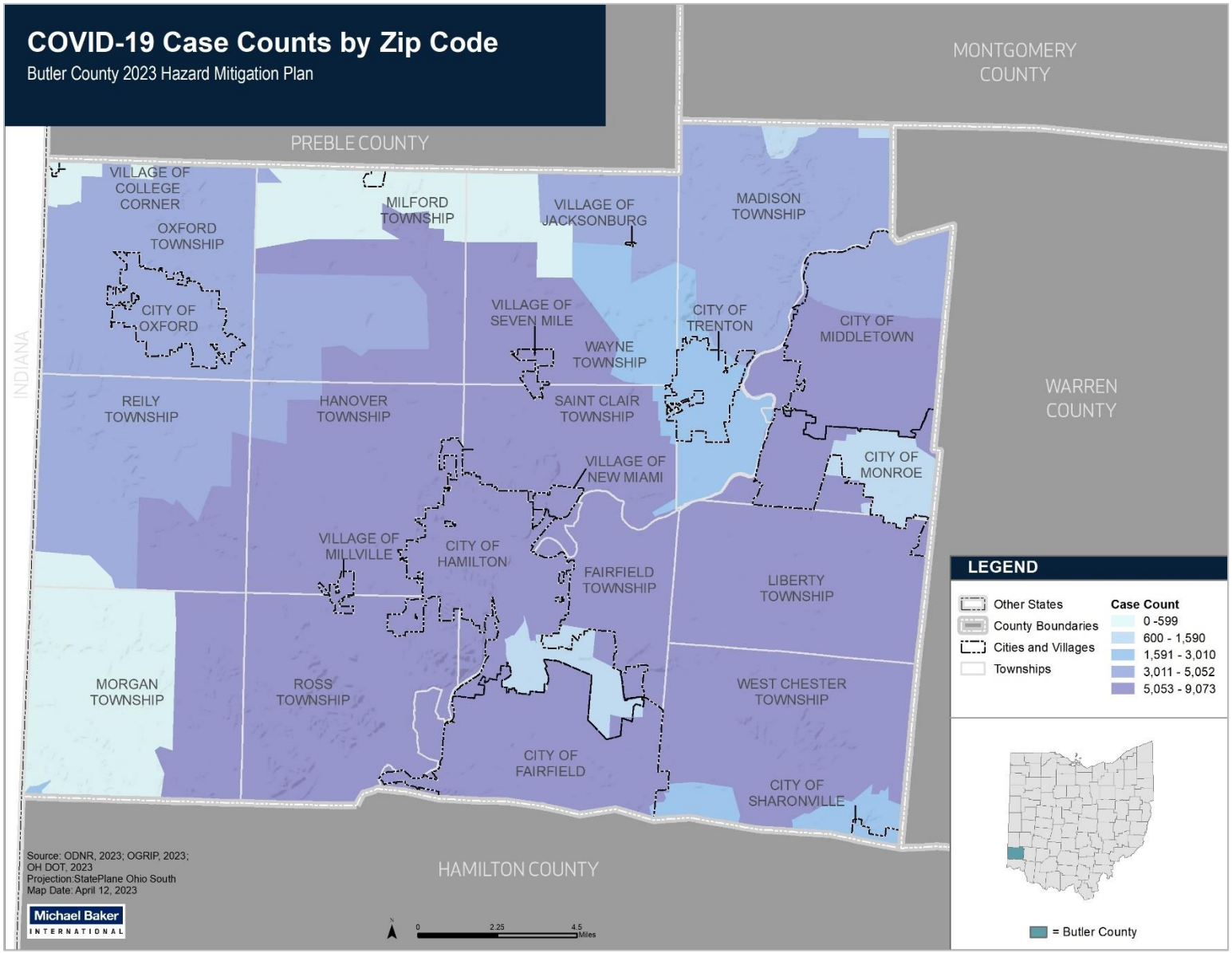
Epidemics occur when an agent and susceptible hosts are present in adequate numbers, and the agent can be effectively conveyed from a source to the susceptible hosts. More specifically, an epidemic may result from:

- A recent increase in amount or virulence of the agent,
- The recent introduction of the agent into a setting where it has not been before,
- An enhanced mode of transmission so that more susceptible persons are exposed,
- A change in the susceptibility of the host response to the agent, and/or
- Factors that increase host exposure or involve introduction through new portals of entry

4.9.2 HEALTH RELATED EMERGENCY LOCATION

As this hazard initially affects humans, the location of the hazard is the entire County. Due to community spread, each jurisdiction within Butler County is susceptible to a public health emergency. The following figure depicts the total cumulative cases of COVID-19 in the county by zip code as of April 2023.

FIGURE 4-41 COVID-19 CASE COUNTS BY ZIP CODE IN BUTLER COUNTY



4.9.3 EXTENT

The magnitude of a health-related emergency will range significantly depending on the aggressiveness of the virus in question and the ease of transmission. Pandemic influenza is more easily transmitted from person-to-person and is more easily transmitted than West Nile, but advances in medical technologies have greatly reduced the number of deaths caused by influenza over time. In terms of lives lost, the impact various pandemic influenza outbreaks have had globally over the last century has declined. The 1918 Spanish flu pandemic remains the worst-case pandemic event on record.

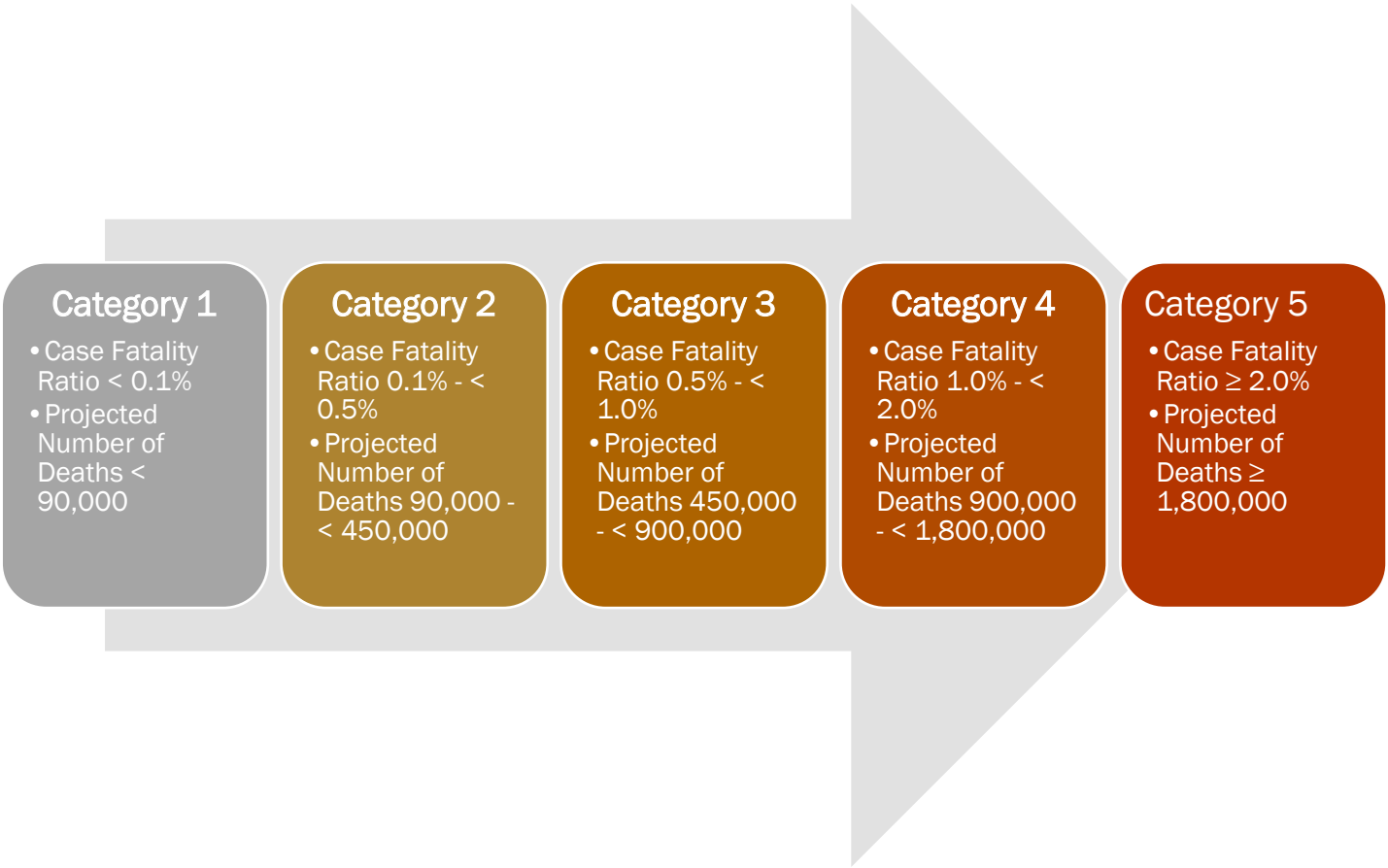
In contrast, the severity of illness from the 2009 H1N1 influenza flu virus has varied, with the gravest cases occurring mainly among those considered at high risk. High risk populations considered more vulnerable include children, the elderly, pregnant women, and chronic disease patients with reduced immune system capacity. Most people infected with H1N1 in 2009 have recovered without needing medical treatment. According to the CDC, about 70% of those who have been hospitalized with the 2009 H1N1 flu virus in the United States have belonged to a high-risk group (CDC, 2009).

COVID-19 has brought an unprecedented time upon Butler County, Ohio, the United States of America, and the entire globe. The extent of the virus has changed the way of life for Ohioans. According to Ohio's COVID-19 Dashboard as of May 2023, the overall hospitalization rate for confirmed cases of the virus in Ohio is 4.08% with 10.83% of the cases requiring ICU admission, and 42,213 total reported deaths. When Ohio was experiencing extremely high cases per day – approximately November 2020 through January 2021, the hospitalization rate was 17.9%, with 26.9% of cases requiring ICU admission. The community spread aspect of COVID-19 not only sparked a shutdown of the entire State's economy except for essential businesses for approximately a month and a half, but it has also set forth guidelines for Ohioans to follow as businesses begin to open back up. Wearing masks while having a six-foot distance between consumers when possible was required for approximately fifteen months, with all state-mandated orders ending on June 2, 2021. Increased surveillance employee and consumer health is also a best-practice guideline.

The magnitude of a health-related emergency may be exacerbated by the fact that outbreaks across the United States could limit the ability to transfer assistance from one jurisdiction to another. Additionally, effective preventative and therapeutic measures, including vaccines and other medications, will likely be in short supply or will not be available. There are no true environmental impacts in pandemic disease outbreaks, but there may be significant economic and social costs beyond the possibility of deaths. Widespread illness may increase the likelihood of shortages of personnel to perform essential community services. In addition, high rates of illness and worker absenteeism occur within the business community, and these contribute to social and economic disruption. Social and economic disruptions could be temporary but may be amplified in today's closely interrelated and interdependent systems of trade and commerce. Social disruption may be greatest when rates of absenteeism impair essential services, such as power, transportation, and communications.

The following image is the Centers for Disease Control and Prevention Pandemic Severity Index that can be used to further define and explain extent of a pandemic. The projected number of deaths is based off of the United States population in 2006 and assumes a 30% illness rate.

FIGURE 4-42 CDC PANDEMIC SEVERITY INDEX



4.9.4 HISTORICAL OCCURRENCES

General Trends

Butler County's General Health District reported that in 2022, 249 residents were hospitalized due to confirmed influenza-associated symptoms. In 2023, through 4/22/2023, there have been 28 hospitalizations due to confirmed influenza.

Butler County has been a part of 2 Federal Disaster Declarations that included public health emergencies. One has resulted in Public Assistance and Individual Assistance.

TABLE 4-104 DECLARED DISASTERS AFFECTING BUTLER COUNTY

Disaster Number	Declaration Date	Title	Public Assistance	Individual Assistance
EM-3457	3/13/2020	Covid-19	-	-
DR-4507	3/31/2020	Covid-19 Pandemic	$356,989,329.88*	$137,338,074.82*

**Indicates data from FEMA's Disaster Declarations website. Totals provided on the webpage are for total funds delegated to all counties within the declared disaster rather than just for Butler County.*

Event Narratives

2009: The 2009 H1N1 influenza (flu) pandemic occurred against a backdrop of pandemic response planning at all levels of government including years of developing, refining and regularly exercising response plans at the international, federal, state, local, and community levels. At the time, experts believed that avian influenza A (H5N1) viruses posed the greatest pandemic threat. H5N1 viruses were endemic in poultry in parts of the world and were infecting people sporadically, often with deadly results. Given that reality, pandemic preparedness efforts were largely based on a scenario of severe human illness caused by an H5N1 virus. Despite differences in planning scenarios and the actual 2009 H1N1 pandemic, many of the systems established through pandemic planning were used and useful for the 2009 H1N1 pandemic response.

H1N1 was first detected in the United States in April 2009. This virus was a unique combination of influenza virus genes never previously identified in either animals or people. The virus genes were a combination of genes most closely related to North American swine-lineage H1N1 and Eurasian lineage swine-origin H1N1 influenza viruses. Because of this, initial reports referred to the virus as a swine origin influenza virus. However, investigations of initial human cases did not identify exposures to pigs and quickly it became apparent that this new virus was circulating among humans and not among U.S. pig herds.

Infection with this new influenza A virus (then referred to as 'swine origin influenza A virus') was first detected in a 10-year-old patient in California on April 15, 2009, who was tested for influenza as part of a clinical study. Laboratory testing at Centers for Disease Control (CDC) confirmed that this virus was new to humans. Two days later, CDC laboratory testing confirmed a second infection with this virus in another patient, an 8-year-old living in California about 130 miles away from the first patient who was tested as part of an influenza surveillance project. There was no known connection between the two patients. Laboratory analysis at CDC determined that the viruses obtained from these two patients were very similar to each other, and different from any other influenza viruses previously seen either in humans or animals.

A Butler County resident was the first Ohioan to pass away due to the virus. Although details were not released regarding the death, the Ohio Department of Health stated that the man in his 40s had underlying health conditions that may be attributed.

2014/2015: The 2014 Ebola epidemic is the largest in history, affecting multiple countries in West Africa. There were a small number of cases reported in Nigeria and Mali and a single case reported in Senegal; however, these cases were contained, with no further spread in these countries. Two imported cases, including one death, and two locally acquired cases in healthcare workers were reported in the United States. CDC and its partners are taking precautions to prevent additional Ebola cases in the United States. CDC is working with other U.S. government agencies, the World Health Organization (WHO), and other domestic and international partners and has activated its Emergency Operations Center to help coordinate technical assistance and control activities with

partners. CDC has also deployed teams of public health experts to West Africa and will continue to send experts to the affected countries. At the time, the general public and media feared that the epidemic would spread to Ohio after a nurse from Texas traveled to the Akron, Ohio area in advance of a wedding.

2020-2023: On March 11, 2020, the outbreak of COVID-19 was characterized as a pandemic by the World Health Organization. Originating from the Hubei Province in China, the virus reached the United States on January 22, 2020. As of May 2023, there have been over 104 million confirmed cases in all fifty states, according to the CDC COVID Data Tracker. Community spread remains to be the biggest culprit of infection. In order to slow the spread in Ohio, Governor Mike DeWine placed a Stay at Home order on March 23 at 11:59 P.M. for two weeks. A new order was put into place on April 6 as a continuation of the Stay at Home order which was later extended until May 29th. Many other health orders, guidelines, and curfews have been implemented to slow the spread of COVID over 2020 and into the beginning of 2022. As of May 8, 2023, Ohio has recorded 3,441,458 cases, 140,473 hospitalizations with 15,212 requiring ICU admission, and 42,213 deaths resulting from the illness. Butler County has had 117,672 confirmed cases, 4,019 people have been hospitalized, and 1,268 people have passed away due to the virus. Based on the CDC's Pandemic Severity Scale, COVID-19 has been a Category 4 pandemic for the United States. The extent scale is not applicable at the county or state level due to the definition of a pandemic – a disease crossing international boundaries. The shortage of testing available for the state, and nation, at the beginning of the pandemic made it difficult to test all those who are reporting symptoms. Tests were reserved for those who are showing the most severe symptoms, so the numbers reported may not reflect the totality of the infected.

Vaccines were rapidly developed and received emergency approval from the Food and Drug Administration (FDA) for distribution. Pfizer-BioNTech is a two-shot vaccination that is approved for people 12 years and older, with the vaccines given 21 days apart. Moderna is a two-shot vaccine that is approved for people 18 years and older, with the vaccines given 28 days apart. Johnson & Johnson's Janssen is a one-shot vaccination that is approved for people 18 years and older. All three vaccines require a two-week waiting period to become considered "fully vaccinated." Novavax vaccine is a booster that is available for people 18 years or older and have received a primary COVID-19 vaccine at least six months prior to receiving the Novavax shot but have not had any additional COVID-19 booster doses. Vaccines were made available to the general public, without priority other than being over the age of 12 years old, on March 29, 2021. Children aged 6 months through 17 years of age are able to receive the Pfizer-BioNTech or Moderna vaccination.

Ohio Department of Health lists the following phases for the vaccine distribution in the state:

- Phase 1A: began December 14, 2020
    - Healthcare workers and personnel who are routinely involved n the care of COVID-19 patients
    - Residents and staff in nursing homes.
    - Residents and staff in assisted living facilities.

    - Patients and staff at state psychiatric hospitals.
    - People with developmental disabilities and those with mental health disorders, including substance-use disorders, who live in group homes, residential facilities, or centers, and staff at those locations.
    - Residents and staff at our two state-run homes for Ohio veterans.
    - EMS responders
- Phase 1B: began January 19, 2021
    - Ohioans, age 65 and up.
    - Ohioans born with or who have early childhood conditions that are carried into adulthood, which put them at a higher risk for adverse outcomes due to COVID-19.
        - Sickle cell anemia.
        - Down syndrome.
        - Cystic fibrosis.
        - Muscular dystrophy.
        - Cerebral palsy.
        - Spina bifida.
        - People born with severe heart defects, requiring regular specialized medical care.
        - People with severe type 1 diabetes, who have been hospitalized for this in the past year.
        - Phenylketonuria (PKU), Tay-Sachs, and other rare, inherited metabolic disorders.
        - Epilepsy with continuing seizures; hydrocephaly; microcephaly, and other severe neurological disorders.
        - Turner syndrome, fragile X syndrome, Prader-Willi syndrome, and other severe genetic disorders.
        - People with severe asthma, who have been hospitalized for this in the past year.
        - Alpha and beta thalassemia.
        - Solid organ transplant candidates and recipients
    - Adults/employees in K-12 schools that want to go back to, or to remain with, in-person or hybrid learning models.
- Phase 1C: began March 4, 2021
    - Individuals who have additional medical conditions that may increase their risk of severe illness and death from COVID-19. The new qualifying conditions are not already covered through Ohio's age-based approach to vaccine eligibility.
        - People with amyotrophic lateral sclerosis (ALS), bone marrow transplant recipients, people with type 1 diabetes, pregnant women
    - Ohioans who work in certain occupations, including childcare services, funeral services, and law enforcement and correction services.

    - Eligible individuals can receive a vaccine from the provider of their choice. Individuals may be asked to confirm during the registration or screening process that they are eligible to receive the vaccine based on a qualifying medical condition or based on their occupation.
- Phase 1D: began March 11, 2021
    - Individuals who have the specified medical conditions listed below that may increase their risk of severe illness and death from COVID-19.
        - People with type 2 diabetes, people with end-stage renal disease
    - These individuals are not already eligible through Ohio's age-based approach to vaccine eligibility.
    - Eligible individuals can receive a vaccine from the provider of their choice. Individuals may be asked to confirm during the registration or screening process that they are eligible to receive the vaccine based on a qualifying medical condition.
- Phase 1E: began March 19, 2021
    - Individuals who have the specified medical conditions listed below that may increase their risk of severe illness and death from COVID-19.
        - Cancer, chronic kidney disease (CKD), chronic obstructive pulmonary disease (COPD), heart disease, obesity
    - These individuals are not already eligible through Ohio's age-based approach to vaccine eligibility.
    - Eligible individuals can receive a vaccine from the provider of their choice. Individuals may be asked to confirm during the registration or screening process that they are eligible to receive the vaccine based on a qualifying medical condition.
- Phase 2A: began March 4, 2021
    - Individuals age 60 and older
- Phase 2B: began March 11, 2021
    - Individuals age 50 and older
- Phase 2C: began March 19, 2021
    - Individuals age 40 and older
- Phase 2D: began March 29, 2021
    - Individuals age 16 and older

4.9.5 PROBABILITY OF FUTURE OCCURRENCE

The precise timing of a health-related emergency is uncertain. Pandemic occurrences are most likely when the Influenza Type A virus makes a dramatic change, or antigenic shift, that results in a new or "novel" virus to which the population has no immunity. Epidemic occurrences are more likely when there are ecological changes, the pathogen mutates, or the pathogen is introduced into an unprepared host population.

Reported health related emergency events over the past 20 years provide an acceptable framework for determining the future occurrence in terms of frequency for such events. It can be assumed that there is a yearly occurrence of hospitalizations due to influenza, bringing the total of health related

emergency total to 23 events since 2002. The probability of the County experiencing a health related emergency event can be difficult to quantify but based on historical record of 23 events since 2002, this type of event has occurred once every 0.87 years from 2002 through 2022.

(2022 CY) - (2002 HY) = 20 Years on Record

(20 Years) / (23 Events) = 0.87 Years Between Events

Furthermore, the historic frequency calculates that there is an 100% chance of this type of event occurring each year. The Planning Committee, based on their knowledge, determined that health related emergency events are "Possible," meaning that there is between 1% and 10% annual chance of occurring.

Future Conditions

An important consideration of hazard mitigation planning is to consider how future conditions, including a changing climate, will influence how health related emergencies will behave in and impact Butler County. The Ohio State University Department of Geography, in association with the State Climatologist Office of Ohio, link the increase in average temperatures to an increase in insect-spread diseases. For example, tick and other insects prefer warmer climates. As Ohio's average temperature increases, the likelihood for malaria and Lyme disease also increases.

Harvard T.H. Chan's School of Public Health notes the relationship between increased temperature and the migration of animals to seek a cooler atmosphere. This leads to interactions between animals that historically have not interacted as more animals move to the poles. Viruses and bacterial diseases that are commonly found in the North and South poles now have new hosts and can spread to humans through the various ways animal-to-human diseases are spread. Additionally, Harvard T.H. Chan's School of Public Health also identifies deforestation, a leading cause of climate change, creates the loss of habitat for animals. Then, animals migrate to new homes, increasing the contact between other animals and humans, thus increasing the sharing and spreading of germs.

In conclusion, climate change is expected to increase the type and frequency of health related emergencies, specifically diseases that are spread between animal and insect interactions with humans. The location of these emergencies will not be impacted, as they have the ability to spread throughout an entire region, nation, and worldwide. The range of expected intensities will not be impacted by climate change as the cause of extent is related to human-to-human interaction.

4.9.6 ASSETS EXPOSED TO HEALTH RELATED EMERGENCIES

Potential Losses

Health-related emergencies are unlikely to directly impact buildings and infrastructure. However, losses can be measured in lost productivity from employees unable to perform their job duties and students not able to attend classes. In Ohio alone, three months after the declaration of the pandemic, 1.5 million people had filed for unemployment in the state. As of March 2023, the unemployment rate for the state was 3.8% according to the United States Department of Labor, Bureau of Labor Statistics. In the United States, over 57.4 million people had filed for unemployment benefits from the start of state shutdowns in mid-March 2020 to mid-August 2020, according to

Forbes. According to an article The Century Foundation from March 2021, one in four workers relied on unemployment aid during the pandemic.

TABLE 4-105 POTENTIAL LOSSES FROM HEALTH-RELATED EMERGENCIES

Impact	Description
People	People are likely to bear the brunt of a health-related emergency, as they are the ones who will be impacted by diseases. They can become extremely sick and possibly die depending on the illness.
Infrastructure	There are no expected impacts on Infrastructure from this hazard.
Economy	The economy can be damaged due to drops in productivity due to illness.
Natural Systems	There are no expected impacts on Natural Systems from this hazard.
Transportation	There are no expected impacts on Transportation from this hazard.

Community Vulnerability

The following table reflects each jurisdiction's response from the Vulnerability Assessment form that was completed during the planning process. Responses for the form submitted by stakeholders can be found in **Appendix I.**

Jurisdiction/Organization	Vulnerability Assessment Response
Butler County	There is a large number of healthcare facilities in the county. However, there is an extensive vulnerability throughout the general population. Access to care, reliable transportation, functional needs, well-paying jobs, affordable childcare are some of the challenges that can heightened the impacts of a pandemic. Funding only becomes available in the midst of an emergency, so it's a response effort rather than a mitigation or preparedness. Lack of staff and monetary support for programs further hinders mitigating or better preparedness.
Fairfield	The older population.
Hamilton	Community spread is a concern. We do have a hospital located in the city that cared for COVID-19 patients during the pandemic.
Middletown	Elderly and low-income populations.
Monroe	Large elderly population and access to healthcare.
Oxford	We have a small local hospital in town with a small emergency room. When the University is in session it is frequently full beyond capacity. It could be easily overrun in a large-scale emergency.
Sharonville	There are several senior living facilities in Sharonville. Health related emergencies that affect the elderly population would quickly overwhelm health services.
Trenton	Several ER's in the vicinity for multiple patients. We have a large stock of PPE on hand.
College Corner	No specific vulnerabilities at this time.
Jacksonburg	No specific vulnerabilities at this time.
Millville	Older residents.
New Miami	We do not have a hospital in the Village. However, there are 6 hospitals in the area. There was community spread during COVID-19, especially in the low-income areas of the village. There's an increased vulnerability in the village as residents

Jurisdiction/Organization	Vulnerability Assessment Response
	will wait until they are extremely sick before they seek help. Some residents also don't have cars, so they need transportation which is an added expense.
Seven Mile	Elderly may need transportation.

Impacts to Socially Vulnerable Communities

Certain population groups are at higher risk of pandemic infection. This population group includes people 65 years and older, children younger than 5 years old, pregnant women, and people of any age with certain chronic medical conditions. Such conditions include but are not limited to diabetes, heart disease, asthma and kidney disease (CDC, 2015). Schools, colleges, convalescent centers, and other institutions serving those younger than 5 years old and older than 65 years old, are locations conducive to faster transmission of viruses, bacterial infections, and other diseases since populations identified as being at high risk are concentrated at these facilities or because of a large number of people living in close quarters. The hospital system would be the most likely point of introduction for an epidemic or pandemic to enter the County's area.

TABLE 4-106 POPULAGE AGE ESTIMATES, CENSUS QUICKFACTS

Age Group	Population	Percent
Under 5 years	22,140	5.7%
65 and up	62,924	16.2%

Hazard Risk by Community

During the planning process, each participating community ranked their risk to each profiled hazard in the plan. The representatives of the jurisdictions within Butler County were asked to consider the risk factors of probability, impact, spatial extent, warning time, and duration and how those factors may increase or decrease their community's risk to the hazard. A ranking of high indicates the community considers at least four of the factors to be an increased concern. A ranking of medium indicates the community considers two to three of the factors to be an increased concern. A ranking of low indicates the community considers one or no factors to be an increased concern. Each community's response to the hazard risk rating for health-related emergencies is presented in the table below. All stakeholder responses gathered during the planning process through this form can be found in **Appendix I**.

TABLE 4-107 HAZARD RISK BY COMMUNITY FOR HEALTH-RELATED EMERGENCIES

	Fairfield	Hamilton	Middletown	Monroe	Oxford	Sharonville	Trenton	College Corner	Jacksonburg	Millville	New Miami	Seven Mile

Health-Related Emergencies	High	Medium	Medium	High	High	Medium	Medium	Medium	Low	Medium	Medium	Medium

4.9.7 FUTURE CONDITIONS IMPACTS

As the climate, population, and land uses of the county change over time, it is important to identify how these future conditions will affect the impacts of hazards. Health related emergency impacts will be influenced by climate change, changes in population trends, and land use and development trends.

Climate Change Trends

According to The Ohio State University, in association with the State Climatologist Office of Ohio, an increase of temperature will be favorable for insect populations to spread disease, such as ticks spreading Lyme disease and mosquitos spreading malaria.

Georgetown University Medical Center published a news release regarding a study linking climate change to a pandemic occurrence. As animals are relocating due to deforestation, a climate change factor, or in search of cooler climates, they may live closer than ever to dense human populations. Viruses that live amongst animal populations will then have a shorter distance to travel to infect a new host, humans. Ebola and coronaviruses are two of the top viral diseases that could be transmitted to humans.

Changes in Population Trends

Harvard T. H. Chan's School of Public Health identifies that people with chronic health conditions, lower-income, and communities of color are all at heightened risk to be impacted by COVID-19. As these populations increase in Butler County, they are likely to have more extreme symptoms. Also, a general increase and/or more dense population will allow for greater community spread in diseases that infect through human-to-human contact.

Land Use and Development Trends

Denser areas are more susceptible to the spread of diseases as people tend to live closer to one another. Because of this, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, and Trenton, who have a population over 3,000 people, is the most vulnerable to a rapidly spready disease. Changes in land use are not assumed to have influence on health related emergency impacts.

Regulatory Environment

There are a variety of regulations which drive the health industry, and as a result, the treatment of pandemics and epidemics. The Ohio Revised Code, Chapter 3701-59 specifically deals with hospitals. Christ Hospital, UC Health, TriHealth, Cincinnati Children's, Mercy Health, and Kettering Health Hospital have been accredited by The Joint Commission with its Gold Seal of Approval for demonstrating compliance with their national standard for health care quality. The Joint Commission is an independent, not-for-profit organization. The Joint Commission accredits and certifies nearly 21,000 health care organizations and programs in the United States. Joint Commission accreditation

and certification is recognized nationwide as a symbol of quality that reflects an organization's commitment to meeting certain performance standards.

Butler County, according to the Ohio Office of Research County Profiles 2021 Edition, has 537 physicians, 8 registered hospitals with 900 beds, 24 licensed nursing homes with 2,216 beds, and 24 licensed residential care facilities with 2,017 beds. As for persons covered with health insurance within Butler County, 92.3% of people ages 0-64 have health insurance. 90.9%% of adults aged 18-64 are insured, and 95.7% of persons under 19 years old are insured.

4.9.8 HEALTH RELATED EMERGENCIES SUMMARY

Pandemic and infectious disease events cover a wide geographical area and can affect large populations. The exact size and extent of an infected population is dependent upon how easily the illness is spread, the mode of transmission and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in denser areas where there are large concentrations of people. The transmission rate of infectious disease will depend on the mode of transmission of a given illness.

Man-Made Hazards

10. HAZARDOUS MATERIALS INCIDENTS

Hazard	Probability		Impact		Spatial Extent		Warning Time		Duration		RF Rating
Hazardous Materials Release/Spill	4	1.2	2	0.6	1	0.2	4	0.4	1	0.1	2.5
Moderate Risk Hazard (2.0 – 2.9)											

4.10.1 HAZARDOUS MATERIALS INCIDENT DESCRIPTION

Traditional Hazardous Materials

A hazardous material release is the contamination of the environment (i.e. air, water, soil) by any material that because of its quantity, concentration, physical characteristics, or chemical characteristics threatens human, animal, or plant health, the environment, or property. Hazardous material spills are usually accidental events that arise from human activities such as the manufacture, transportation, storage, and use of hazardous materials. The consequences of such spills are usually unintended. An accidental or intentional release of hazardous materials could produce a health hazard to those in the area, downwind, and/or downstream with immediate, prolonged, and/or delayed effects. The spread of the material may additionally be defined by weather conditions and topography of the area. A hazardous material release can come from a fixed facility, transportation, or an intentional release such as terrorism.

A hazardous material release may also occur due to a transportation accident. The most likely locations for a transportation-related hazardous material release are along the heavy-traffic roadways or railroads that run through the County. Gas, propane, and other hazardous materials are delivered throughout the area year-round. The need for gas, propane, fertilizers, and other toxic materials in daily life creates a larger risk for a hazardous materials release.

A hazardous materials release in the County may not only contaminate dirt or surface material but potentially contaminate flowing water in ditches, rivers, and small streams. Ground water may also be contaminated, depending on the size of the incident. Other potential concerns for spills/leaks are icy road conditions during winter months, sabotage, and terrorism.

When a release occurs, Butler County has multiple responding agencies prepared to minimize the impact. The Butler County Regional Hazmat, Butler County Incident Management Team, Butler County EMA Emergency Support Unit, and local fire departments makeup the county's immediate response team. The three county units respond to incidents within Butler, Southwest Ohio Homeland Security Region 6, State of Ohio, and national level events.

Fixed facilities housing hazardous substances at the County include swimming pools, gas stations, and supply stores containing substances such as fuel, farm chemicals, propane, fuel oil, paint, and small amounts of chlorine.

Hospital Radioactive Isotopes

Hospitals are increasingly using radioactive isotopes for diagnostic and therapeutic applications. The bulk of the hospital radioactive waste is commonly generated in the department of Nuclear Medicine. Generally, most of the radioactive waste is liquid. Some lesser amounts of the waste are solid and gaseous. The solid waste containing traces of radioactivity can be in the form of syringes, needles, cotton swabs, vials, contaminated gloves and absorbent materials.

4.10.2 HAZARDOUS MATERIALS RELEASE/SPILL LOCATION

While the initial incident may occur on a roadway, railroad, or in a facility that houses hazardous materials, the hazard could expand to the entire County. Contamination of hazardous materials can spread through the air, soil, and water of surrounding resources thus carrying the toxin throughout the area. There are several major US Routes and State Routes that intersect Butler County. Hazardous Materials incidents can occur on any roadway, railroad, or in a facility, but roadways that see heavier traffic have a higher probability of being a location for an event.

Butler County has 43 Toxics Release Inventory (TRI) facilities according to the United States Environmental Protection Agency (EPA) website. TRI facilities are industrial and federal facilities that are releasing certain toxic chemicals through the air, water, or land disposal. These facilities' releases are tracked and regulated by the EPA as the chemicals they are releasing may pose a threat to human health and the environment. The toxic chemicals that facilities are required to report when released include chemicals that cause cancer or other chronic human health effects, significant adverse acute human health effects, and significant adverse environmental effects. As these facilities are regulated, thus required to safely release toxic chemicals, they are not considered to be a hazardous materials incident. However, it is still important to identify the locations of where toxic chemicals are being released.

The following figure shows the locations of gas transmission pipelines and hazardous liquid pipelines within Butler County. The pipelines are possible locations for a hazardous materials incident should the structures fail.

FIGURE 4-43 TRI FACILITIES IN BUTLER COUNTY

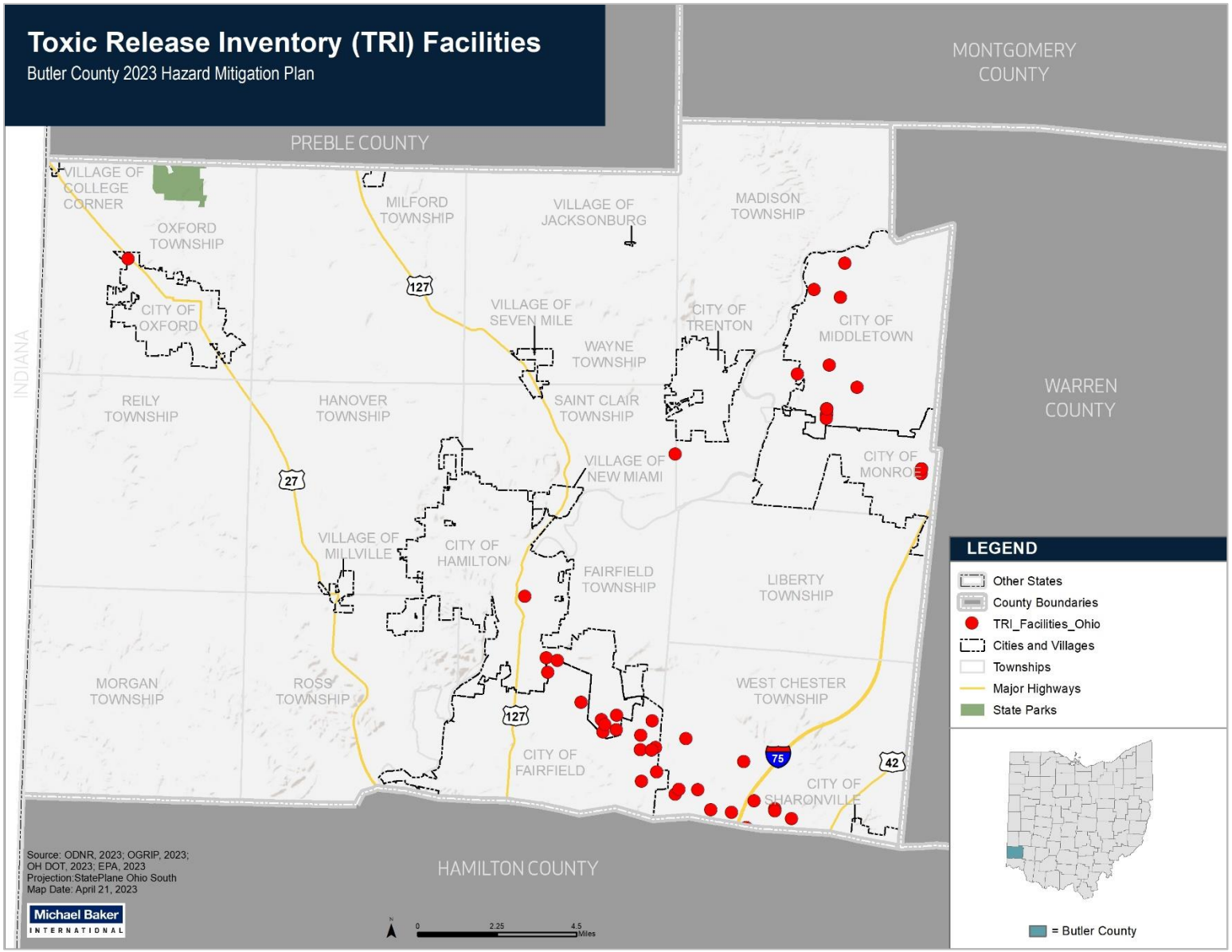
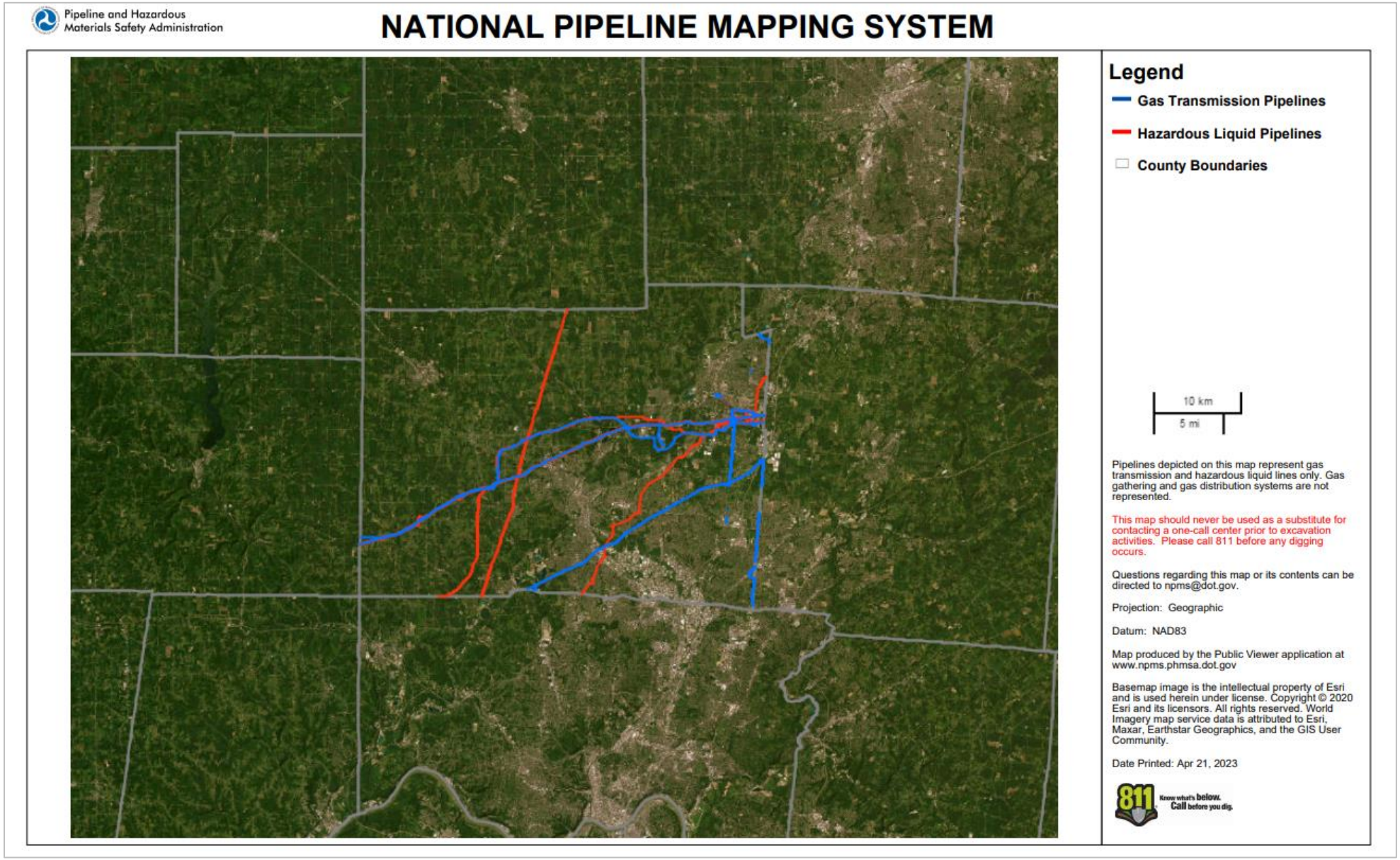


FIGURE 4-44 OIL AND GAS PIPELINES WITHIN BUTLER COUNTY



4.10.3 EXTENT

With a hazardous material release, whether accidental or intentional, there are several potentially exacerbating or mitigating circumstances that will affect its severity or impact. Mitigating conditions are precautionary measures taken in advance to reduce the impact of a release on the surrounding environment. Primary and secondary containment or shielding by sheltering-in-place protects people and property from the harmful effects of a hazardous material release. Exacerbating conditions, or characteristics that can enhance or magnify the effects of a hazardous material release, include:

- **Weather conditions**: affects how the hazard occurs and develops
- **Micro-meteorological effects** of buildings and terrain, alters dispersion of hazardous materials
- **Non-compliance with applicable codes** (e.g. building or fire codes) and maintenance failures (e.g. fire protection and containment features): can substantially increase the damage to the facility itself and to surrounding buildings

Whether or not a hazardous materials site is contained in the SFHA is also a concern, as there could be larger-scale water contamination during a flood event should the flood compromise the production or storage of hazardous chemicals. Such a situation could swiftly move toxic chemicals throughout a water supply and across great distances.

The severity of a given incident is dependent not only on the circumstances described above, but also with the type of material released and the distance and related response time for emergency response teams. The areas within closest proximity to the releases are generally at greatest risk, yet depending on the agent, a release can travel great distances or remain present in the environment for a long period of time (e.g., centuries to millennia for radioactive materials), resulting in extensive impacts on people and the environment.

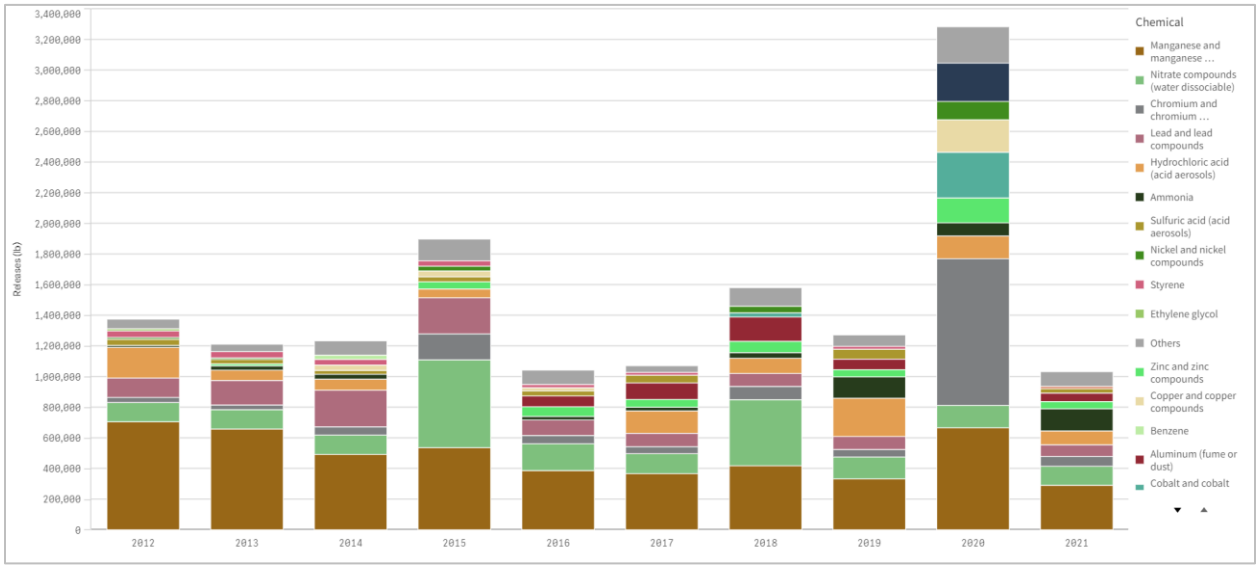
4.10.4 HISTORICAL OCCURRENCES

There are small-scale spills and hazardous materials incidents that occur on a regular basis. These usually consist of mostly innocuous incidents such as traffic accidents that leave gasoline on the roadway. However, large-scale incidents are far rarer and more catastrophic when they occur.

General Trends

From 2012 to 2021, Butler County has seen a fairly consistent release of chemicals into the air, off-site, land, and water aside from a spike in releases in 2020. The addition of approximately 15 million pounds of chemicals have occurred over the ten-year snapshot. While manganese and manganese compounds, the top chemical release in the County, have generally declined over the timeframe, other chemicals have increased amount of releases in the past 10 years. However, these releases of chemicals are reported to the EPA from the facilities in Butler County and do not account for hazardous materials spills or accidents.

FIGURE 4-45 BUTLER COUNTY TRI FACILITY CHEMICAL RELEASE



Since 2017, there have been 390 hazardous materials spill events according to the Butler County Emergency Management Agency's Ohio EPA records. The table below shows the number of events per year from 2017-2023. The complete list of recorded hazardous materials incidents recorded by the Ohio EPA can be reviewed in **Appendix C**.

TABLE 4-108 HAZARDOUS MATERIALS SPILLS IN BUTLER COUNTY

Year	Number of Hazardous Materials Spills Recorded
2017	39
2018	56
2019	69
2020	67
2021	64
2022	59
2023	36
Grand Total	**390**

During the second meeting with stakeholders, the Seven Mile representative spoke about previous train derailments and the concern for a larger scale event. There was a train derailment in Seven Mile in 2022 that closed Route 127 for about a week. There were no hazardous materials spilled. However, there is concern that as the railroad tracks continue to age, there is an increased probability that one of the many trains carrying hazardous materials will derail in or nearby the village.

4.10.5 PROBABILITY OF FUTURE OCCURRENCES

Hazardous materials incidents happen every day throughout the county. Small-scale incidents will continue to occur as normal operation around the County. Larger incidents will remain seldom but can still occur at any time. The HMPC determined that it is "Highly Likely" that Hazardous Materials Incident will continue to occur in Butler County, meaning that they will remain as an annual event.

Reported hazardous material release or spill events over the past 7 years provide an acceptable framework for determining the future occurrence in terms of frequency for such events. The probability of experiencing a hazardous material release/spill event, although infrequent, can be difficult to quantify, but based on historical record of 390 events according to the County's data since 2017, it can reasonably be assumed that this type of event has occurred once every 0.018 years from 2017 through 2023.

(2023 CY) - (2017 HY) = 7 Years on Record

(7 Years) / (390 Events) = 0.018 Years Between Events

The historic frequency indicates that there is a 100% chance of this type of event occurring each year.

4.10.6 ASSETS EXPOSED TO HAZARDOUS MATERIALS RELEASE/SPILL

Potential Losses

A hazardous materials release has the possibility of having a significant impact on the County. Most hazardous material releases do not usually have an effect on infrastructure, particularly underground infrastructure. Some critical facilities use hazardous materials to operate such as chlorine for water treatment and PCB's for electric transformers. Similarly, the contamination of the water supply may

be treated like a hazardous material release. Propane, oil, and natural gas, necessary fuels for heating, can also be hazardous if released during their delivery due to their explosive potential. Transportation may be limited if a key roadway or railway is blocked by an incident.

- **Possible losses to critical facilities include:**
  - Critical functional losses
  - Contamination
  - Structural and contents losses, if an explosion is present

  Possible losses to structures include:
  - Inaccessibility
  - Contamination
  - Structural and contents losses, if an explosion is present
- **Possible ecologic losses include:**
  - Loss of wildlife
  - Habitat damage
  - Reduced air and water quality
- **Possible social losses include:**
  - Canceled activities
  - Emotional impacts of significant population losses and illnesses

TABLE 4-109 POTENTIAL IMPACTS FROM HAZMAT INDICENTS

Impact	Description
People	In some hazmat incidents, toxic chemicals can force residents to evacuate. High levels of exposure can result in health complications.
Infrastructure	Significant events can damage structures
Economy	Hazmat incidents are unlikely to cause long-lasting economic damage. Business may be closed as well as losses associated with business disruption.
Natural Systems	Nearby vegetation may die as the result of hazmat spills. Materials that spills into waterways can adversely impact wildlife and other areas downstream.
Transportation	Major highways are the most likely to incur major incidents. If one does occur, major delays and reroutes are possible.

Community Vulnerability

All County assets can be considered at risk from hazardous materials releases. This includes 100 percent of the County population and all buildings and infrastructure. The presence of the roadways that run throughout the County, as well as railways and pipelines, present a high risk of hazardous materials incidents occurring.

The following table reflects each jurisdiction's response from the Vulnerability Assessment form that was completed during the planning process. Responses for the form submitted by stakeholders can be found in **Appendix I.**

Jurisdiction/Organization	Vulnerability Assessment Response
Butler County	Several busy roadways with hazardous materials being transported as well as railroads moving hazardous materials throughout the county. Two trainyards vulnerable to man-made hazard events.
Oxford	A busy rail line is within 75' of our only fire station. This line carries large amounts of hazardous materials at all times of the day and night. It also delays our emergency response to the west side of the City when trains travel through or stopped to mechanical failures. One car rolling off the track and leaking could put our fire department out of business. Our high school is also located close to the same line. We have US 27 that come through the heart of our City that also carries Haz-mat trucks.
Sharonville	There is significant rail and semi-truck traffic throughout the city. Hazardous Materials Incident ranked high on the Hazard Priority form due to the amount of rail and semi-truck traffic in Sharonville.
College Corner	Several trains that travel through the area, often at high speeds.
New Miami	We have several railroad tracks in the village and a school less than 100 yards from one. There is also two train yards in the village – one is Norfolk Southern's and the other is CSX's. Train companies are not required to tell the village or county what is being transported through. Additional training for the fire department is needed.
Seven Mile	Railroads / Route 127 pass through the heart of the village. Trains and trucks hauling hazardous materials daily. Our school is between them; both less than 1/4 mile from the school. There are also two houses located directly next to the railroad tracks.

The following table shows the structures that are within 1.5 miles of the hazardous materials facilities that are located within Butler County, including critical facilities. Structures that are located in close proximity to hazardous material facilities are vulnerable to a release or spill incident. Middletown has the highest number of structures located near a hazardous material facility with 14,436 structures. Hamilton has the second highest number of structures located within 1.5 miles of a hazardous material facility with 14,420 structures, and West Chester Township has the third highest with 11,374 structures. Sharonville has the highest percent of its total structures within 1.5 miles of a facility with 72%, Middletown has the second highest percentage with 68%, and Monroe has the third highest with 62%. Hamilton has the highest number of its critical facilities located within 1.5 miles of a hazardous material facility with 31 critical facilities. Middletown has the second highest number of critical facilities located within 1.5 miles of hazardous material facilities with 23 structures, and Monroe has the third highest number with 21 structures.

TABLE 4-110 VULNERABILITY OF STRUCTURES NEAR HAZARDOUS MATERIALS SITES

Municipality	Total Structures	Structures in within 1.5 Miles of a TRI Facility	Percent Structures within 1.5 Miles of a TRI Facility	Total Critical Facilities	Critical Facilities within 1.5 Miles of a TRI Facility	Percent Critical Facilities within 1.5 Miles of a TRI Facility
City of Fairfield	15,552	7,394	48%	33	17	52%

City of Hamilton	26,081	14,420	55%	49	31	63%
City of Middletown	21,236	14,436	68%	38	23	61%
City of Monroe	5,523	3,442	62%	26	21	81%
City of Oxford	5,393	1,579	29%	22	5	23%
City of Sharonville	995	721	72%	2	2	100%
City of Trenton	4,610	303	7%	5	0	0%
Fairfield Township	8,640	1,407	16%	17	2	12%
Hanover Township	3,264	0	0%	8	0	0%
Lemon Township	1,108	681	61%	4	2	50%
Liberty Township	15,221	25	0%	21	0	0%
Madison Township	3,476	786	23%	10	1	10%
Milford Township	1,300	0	0%	9	0	0%
Morgan Township	2,283	0	0%	5	0	0%
Oxford Township	976	159	16%	6	2	33%
Reily Township	1,141	0	0%	4	0	0%
Ross Township	3,370	0	0%	14	0	0%
Somerville Township	122	0	0%	1	0	0%
St. Clair Township	2,018	426	21%	14	0	0%
Village of College Corner	97	0	0%	0	0	0%
Village of Jacksonburg	29	0	0%	2	0	0%
Village of Millville	335	0	0%	3	0	0%
Village of New Miami	931	0	0%	5	0	0%
Village of Seven Mile	325	0	0%	4	0	0%
Wayne Township	1,595	0	0%	3	0	0%
West Chester Township	24,287	11,374	47%	32	17	53%
Grand Total	**124,026**	**45,779**	**37%**	**302**	**106**	**35%**

The following table displays the structures that are vulnerable to hazardous materials release by land use type per municipality. There are a total of 124,026 structures within 1.5 miles of a hazardous material facility in Butler County. 126 of the structures are classified as agriculture, 8,793 of the structures are classified as commercial, 1,845 structures are classified as exempt, 635 structures are classified as industrial, 32,514 structures are residential buildings, 1,862 are unknown classifications, and 4 are utility structures.

TABLE 4-111 STRUCTURES VULNERABLE TO HAZARDOUS MATERIALS RELEASE BY LAND USE TYPE PER MUNICIPALITY

Municipality	Total Structures	Agriculture	Commercial	Exempt	Industrial	Residential	Unknown	Utility
City of Fairfield	15,552	12	2,388	79	305	4,596	14	0
City of Hamilton	26,081	3	1,819	802	140	10,403	1,250	3
City of Middletown	21,236	4	2,377	835	115	10,613	492	0
City of Monroe	5,523	15	396	42	48	2,868	73	0

City of Oxford	5,393	2	584	15	4	962	12	0
City of Sharonville	995	0	564	1	0	156	0	0
City of Trenton	4,610	2	9	0	2	289	1	0
Fairfield Township	8,640	6	133	31	4	1,224	9	0
Hanover Township	3,264	0	0	0	0	0	0	0
Lemon Township	1,108	3	173	22	4	475	3	1
Liberty Township	15,221	2	0	0	0	23	0	0
Madison Township	3,476	25	344	9	9	396	3	0
Milford Township	1,300	0	0	0	0	0	0	0
Morgan Township	2,283	0	0	0	0	0	0	0
Oxford Township	976	33	4	3	0	116	3	0
Reily Township	1,141	0	0	0	0	0	0	0
Ross Township	3,370	0	0	0	0	0	0	0
Somerville Township	122	0	0	0	0	0	0	0
St. Clair Township	2,018	19	2	6	4	393	2	0
Village of College Corner	97	0	0	0	0	0	0	0
Village of Jacksonburg	29	0	0	0	0	0	0	0
Village of Millville	335	0	0	0	0	0	0	0
Village of New Miami	931	0	0	0	0	0	0	0
Village of Seven Mile	325	0	0	0	0	0	0	0
Wayne Township	1,595	0	0	0	0	0	0	0
West Chester Township	24,287	29	3,281	68	959	6,913	122	2
Grand Total	**124,026**	**126**	**8,793**	**1,845**	**635**	**32,514**	**1,862**	**4**

Impacts to Socially Vulnerable Communities

Hazardous materials incidents will affect those who are unable to leave their homes, who do not have access to transportation, and those who have existing health conditions. This can include seniors, children, transient populations, and those living below the poverty line. Because events can happen very suddenly, there may be no warning and no means to evacuate for these groups. This can lead them to suffering the most from a catastrophic incident.

4.10.7 LAND USE & DEVELOPMENT TRENDS

The population impacts are often greater than the structural impacts during a hazardous material release. Depending on the material, the health impacts to humans can be long and short term. Generally, an incident will affect only a subset of the total population at risk. In a hazardous materials release, those in the immediate isolation area would have little to no warning, whereas, the population further away in the dispersion path may have some time to evacuate, depending on the weather conditions, material released, and public notification.

Regulatory Environment

Extensive regulations are in place, set forth by both the State of Ohio and the United States government on the handling and transport of hazardous materials. Newer hazards, such as those introduced through fracking, also have many regulations pertaining to their safety and use.

The US EPA's Toxic Release Inventory (TRI) program tracks hazardous materials release and disposal data for communities throughout the nation. Disposals in Butler County largely include Manganese and manganese compounds, nitrate compounds (water dissociable), Chromium and chromium compounds, Lead and lead compounds and other unnamed chemicals. The TRI data also provides data regarding the effect on the public of releases or disposals of hazardous materials.

4.10.8 HAZARDOUS MATERIALS RELEASE/SPILL SUMMARY

Hazardous materials incidents can pose a series of threats to human safety and welfare, as well as the environment. Incidents occur regularly but are not often of a size to cause a significant countywide threat. However, it seems likely that incidents will continue and the potential for a significant release is present. Incidents often occur in conjunction with, or as a result of, natural hazards impacting facilities that house hazardous materials. Depending upon the materials released, as well as atmospheric conditions, an incident has the potential to cause significant disruption to the County.

Mitigation Best Practices

FEMA has published a series of prevention and mitigation measures that is geared toward residents and households on what they can do to help reduce the number of hazardous materials incidents, or the severity of these events. These can be used in educational materials distributed by the County or its jurisdictions and are a good way of preventing smaller scale incidents.

Prevention

- Use all materials in accordance with their instructions.
- Store pesticides and other hazardous chemicals in safe places where children and animals cannot be exposed. Storage areas must guard against freezing and overheating of hazardous materials. They should also have separate locks.
- Store chemicals on the floor or on lower shelves to prevent spills. Lips are recommended for all shelving upon which hazardous materials are stored.
- Properly dispose of any unsafe or excess materials and containers.

Protection Actions

- Ask your local fire department or emergency management agency for information on hazardous materials in your community.
- Find out what clinical signs these toxins may cause if a person or an animal has been exposed.
- Take a training course in hazardous materials.
- FEMA may provide resource information and technical and financial assistance to States for developing emergency plans for hazardous materials accidents and other types of emergencies, and assist State and local governments in hazardous materials training.
- The Environmental Protection Agency (EPA) also conducts technical and environmental training programs related to hazardous materials. At the request of community officials, the EPA can provide technical expertise on the full range of environmental contamination issues.

Mitigation Measures

- Install and label sinks and eye wash stations.
- Store appropriate absorbent materials near hazardous materials in the event of a spill.
- Post warning signs on storage areas.
- Post and review Material Safety Data Sheets (MSDS) for commonly used chemicals.

The full guide can be found at https://emilms.fema.gov/is10a/AID0107030text.htm

SECTION 5. MITIGATION STRATEGY

The following Mitigation Strategy is designed to be comprehensive and strategic. Its intent is to provide Butler County and its municipalities with:

- Goals to serve as guiding principles for administering future mitigation policy and projects.
- A list of proposed actions to meet those goals and reduce the impact of natural hazards.

The process to develop the strategy included a thorough review of Butler County's natural, technological, and man-made hazards. We also identified policies and projects that would not only reduce the future impacts of hazards, but also help the county achieve compatible economic, environmental and social goals. This section is also intended to be strategic, in that all policies and projects are linked to established priorities assigned to specific departments or individuals, who are responsible for their implementation and completion deadlines. Potential funding sources the projects are also identified.

- **Mitigation goals** are general guidelines that explain what the county wants to achieve. Goals are usually expressed as broad policy statements that represent desired long-term results.
- **Mitigation objectives** describe strategies or steps to attain the identified goals. Objectives are more specific than goals; the steps they describe are usually measurable and can have a defined completion date.
- **Mitigation Actions** provide more detailed descriptions of specific tasks to help the county and its municipalities achieve those goals and objectives.

1. GOALS

The following goals and objectives were developed for and apply to this mitigation plan:

- **GOAL 1: Protect the people, property, and infrastructure of Butler County by minimizing the potential impacts of natural and man-made hazards.**
    - OBJECTIVE 1.1: Undertake structure improvements to reduce risk.
    - OBJECTIVE 1.2: Undertake planning initiatives to protect the residents of Butler County from the risks of natural and man-made hazards.
    - OBJECTIVE 1.3: Restore natural systems to vulnerable areas to reduce hazard impacts.
- **GOAL 2: Protect Butler County's assets through best practice hazard mitigation actions and projects.**
    - OBJECTIVE 2.1: Build on the county's previous hazard mitigation successes to further resiliency by implementing the plan update's mitigation actions.

- **GOAL 3: Increase public awareness of hazards, hazard impacts, and hazard mitigation techniques through a robust public outreach campaign.**
    - OBJECTIVE 3.1: Undertake public education and outreach programs throughout the county.
- **GOAL 4: Address High Hazard Potential Dams in Butler County.**

Based on participation from the Butler County Mitigation Planning Committee, the mitigation strategy was developed. Objectives were clarified to document roles and responsibilities more clearly. Actions were added to address particular hazards the county faces, and a consensus was achieved on how to address those actions.

The last step in updating the Mitigation Strategy is to create Mitigation Action Plans (MAPs). The MAPs represent the key outcome of the mitigation planning process. They include a prioritized list of the county's proposed hazard mitigation actions (policies and projects), with accompanying information such as the agencies or individuals that are responsible for each one, potential funding sources, estimated target date for completion, and current status. The MAPs provide the individuals or agencies responsible for each mitigation action with a clear roadmap that also serves as a tool for monitoring progress over time. The combined actions listed in each jurisdiction's MAP also serve as an easily understood synopsis of activities for local decision makers.

To ensure that a broad range of mitigation actions were considered, the Mitigation Planning Committee analyzed a comprehensive range of specific mitigation actions for each hazard (after it completed the risk assessment). This helped provide sufficient span and creativity for considering the mitigation actions.

The County considered **four categories** of mitigation actions in developing its plan:

1. **Local Plans and Regulations:** These actions include work on government authorities, policies, or codes that influence the way land and buildings are developed and built.
2. **Structure and Infrastructure Projects:** These actions involve modifying existing structures and infrastructure to protect them from a hazard or to remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves constructing structures to reduce the impact of hazards. Many of these types of actions are eligible for funding through FEMA's Hazard Mitigation Assistance program.
3. **Natural Systems Protection:** These actions minimize damage and losses and preserve or restore the functions of natural systems.
4. **Education and Awareness Program:** These actions inform and educate students, faculty and staff about hazards and potential ways to mitigate them. They may include participation in national programs, such as StormReady or Firewise Communities. Although this type of mitigation reduces risk less directly than structural projects or regulation, it is an important

foundation. A greater understanding and awareness of hazards and risk among county officials, stakeholders, and the public is likely to lead to more direct actions.

2. 2023 PLAN UPDATE MITIGATION ACTION PRIORITIZATION METHODOLOGY

Prioritizing mitigation actions for the 2018 plan was completed by using timeframes to communicate the priority of each action in the plan. A high priority indicated it would be implemented within 1 year of the plan's finalization. A medium priority indicated the action would be implemented within two to three years of the plan's finalization. A low priority indicated the action would be implemented within 4 to five years of the plan's finalization.

Since then, the prioritization process has changed to incorporate a more adaptable method that allows for a more comprehensive examination of the mitigation actions. In the plan update, each mitigation action was classified as on a scale of 1-10, with 1 being the lowest priority ranking and 10 being the highest priority ranking.

FEMA mitigation planning requirements indicate that any prioritization system must include a special emphasis on the extent to which benefits are maximized according to a cost-benefit review of the proposed projects. To do this in an efficient manner consistent with FEMA's guidance on using cost-benefit review in mitigation planning, the high/medium/low ranking method was adapted to include a higher weighting for the economic feasibility factor – Benefits of Action and Costs of Action. This method incorporates concepts similar to those described in Method C of FEMA 386-5: Using Benefit Cost Review in Mitigation Planning (FEMA, 2007).

Projects with a high priority ranking (priority ranking 8-10) are associated with at least seven of the following qualities; projects with a medium priority ranking (priority ranking 5-7) are associated with five to seven or more of the following qualities; and projects with a low priority ranking (priority ranking 1-4) are associated with four or less of the following qualities:

- Low cost
- High impact
- Urgency in completion
- Widespread mitigation
- Feasibility
- General acceptance
- Additional impacts resulting from the project
- Resources required to complete the project
- Project complexity

3. PLANNING PROCESS FOR SETTING HAZARD MITIGATION GOALS AND OBJECTIVES

The mitigation strategy represents the key outcomes of the 2023 Butler County HMP planning process. The hazard mitigation planning process conducted by the Planning Committee is a typical problem-solving methodology:

- Estimate the impacts the problem could cause;
- Describe the problem;
- Assess the existing safeguards and resources that could potentially lessen those impacts;
- Develop Goals and Objectives with current capabilities to address the problem; and
- Using this information, determine what, if anything, can be done, and select the actions that are appropriate for the community

4. BUTLER COUNTY CAPABILITY ASSESSMENT

The mitigation strategy includes an assessment of Butler County's planning and regulatory, administrative/technical, and fiscal capabilities to augment known issues and weaknesses related to the identified natural hazards. The following section captures each jurisdiction's current resources in place that were identified during the plan's development. The responses provided by stakeholders during the planning process are located in Appendix I.

5.4.1 ABILITY TO EXPAND ON EXISTING CAPABILITIES

The planning process used surveys to determine the county's existing capabilities and those of its political subdivisions. These capabilities can be expanded upon with the proper influx of funds or personnel. If additional state or federal funding becomes available to specifically augment the existing capabilities, the jurisdictions represented in this plan would be able to improve their capabilities. Additionally, as personnel leave, they may be replaced by individuals with skillsets not captured in these surveys. The county will continue to develop its staff capabilities over time and expand upon them where they are able.

Planning and Regulatory Capability: The table below summarizes each community's planning and regulatory capabilities. These are the plans and policies that jurisdictions have in place that can help to further mitigation. UD denotes that the planning or regulatory is currently under development for the community.

TABLE 5-1 PLANNING AND REGULATORY CAPABILITIES

Tool/Program	Butler County	Fairfield	Hamilton	Middletown	Monroe	Oxford	Sharonville	Trenton	College Corner	Jacksonburg	Millville	New Miami	Seven Mile
Building Codes	X	X	X	X	X	X	X	X	X	X	X	X	X
Capital Improvement Plan	X	X	X	UD	X	X	X	X					
Comprehensive Plan	X	X	X	X	X	X	X	UD					
Continuity of Operations Plan	X		X	X	UD	X		UD				X	
Disaster Recovery Plan	X	UD	X	X	X			X			X	X	
Economic Development Plan	X	X		X	X			X	X				
Emergency Operations Plan	X	X	X	X	X	X		X	X		X	X	
Evacuation Plan	X		X	X				X	X				
Farmland Preservation Plan								UD	X				
Fire Code	X	X	X	X	X	X	X	X	X	X	X	X	X
Firewise													
Floodplain Management Plan	X	UD		X				X			X	X	
Floodplain Regulations	X	X	X	X	X	X	X	X			X	X	X
Historic Preservation Plan	X		X	UD		X		X					
Natural Resource Protection Plan	X		X	UD									
Open Space Management Plan	X		X	X	X	X		X					
Stormwater Management Plan/Ordinance	X	X	X	X	X	X	X	X	X	X		X	
Subdivision Regulations	X	X	X	X	X	X	X	X			X		
Zoning Regulations	X	X	X	X	X	X	X	X	X	X	X	X	X
Other		X*											

X* = Connectivity Master Plan

Building Codes

Butler County and all its municipalities have adopted and enforce the 2019 State of Ohio Building Code. The following sets of codes make up the 2019 State of Ohio Building Code.

- 2019 Residential Code of Ohio: The set of regulations identifies administration, definitions, building planning and construction, energy efficiency, mechanical, fuel gas, plumbing, and electrical standards for the new construction of single-family, two-family, and three-family houses.
- 2017 Ohio Building Code with August 2018 Updates & Errata 2/8/2019: The set of regulations identifies the following standards for the construction of all buildings that do not

fall under the residential classification covered under the 2019 Residential Code of Ohio requirements. The following standards are included in this set of codes:

Administration	Definitions	Use and Occupancy Classification	Special Detailed Requirements Based on Use and Occupancy
General Building Heights and Areas	Types of Construction	Fire and Smoke Protection Features	Interior Finishes
Fire Protection Systems	Means of Egress	Accessibility	Interior Environment
Energy Efficiency	Exterior Walls	Roof Assemblies and Rooftop Structures	Structural Design
Special Inspections and Tests	Soils and Foundations	Concrete	Aluminum
Masonry	Steel	Wood	Glass and Glazing
Gypsum Board, Gypsum Panel Products, and Plaster	Plastic	Electrical	Mechanical Systems
Plumbing Systems	Elevators and Conveying Systems	Special Construction	Encroachments into the Public Right-of-Way
Safeguards During Construction	Existing Buildings and Structures	Referenced Standards	

- 2017 Ohio Fire Code with January 2019 Errata: The set of regulations identifies an array of standards to address conditions hazardous to life and property from fire, explosion, handling or use of hazardous materials to safeguard the public health and safety in all communities.
- 2017 Ohio Plumbing Code with August 2018 Updates: The set of regulations identifies the design and installation of plumbing systems to emphasize performance and protect the public health and safety in all communities. The following plumbing topics are regulated through this code: scope and administration, definitions, general regulations, fixtures, faucets, and fixture fittings, water heaters, water supply and distribution, sanitary drainage, indirect/special waste, vents, traps, interceptors, and separators, storm drainage, special piping and storage systems, nonpotable water systems, subsurface landscape irrigation systems, and referenced standards.
- 2017 Ohio Mechanical Code with August 2018 Updates: The set of regulations identifies the design and installation of mechanical systems to emphasize performance and protect the public health and safety in all communities. The following mechanical topics are regulated through this code: scope and administration, definitions, general regulations, ventilation, exhaust systems, duct systems, combustion air, chimneys and vents, specific appliances, fireplaces, and solid fuel-burning equipment, boilers, water heaters, and pressure vessels, refrigeration, hydronic piping, fuel oil piping and storage, solar systems, and referenced standards.

- 2017 Ohio Energy Code: The set of regulations identifies the design of energy-efficient building envelopes and installation of energy efficient materials and systems.

Zoning Regulations

Butler County: The Butler County Department of Development enforces the Butler County, Ohio Rural Zoning Resolution in the following villages: College Corner, Millville, New Miami, and Seven Mile.

The Butler County Rural Zoning Resolution is enacted for the purpose of promoting public health, safety, morals, comfort and general welfare; conserving and protecting property and property values; securing the most appropriate use of land, and facilitating adequate and economical provisions for public improvement, all in accordance with a comprehensive plan for the desirable future development of the County, and providing a method of administration and prescribing penalties for the violations of provisions described - all as authorized by the provisions of Chapter 303 and the Sections thereunder of the Ohio Revised Code. The resolution was revised November 21, 2022, and went into effective December 21, 2022.

The ordinance establishes general provisions for new development to adhere to as well as development and maintenance standards for a variety of districts designated throughout the county's boundaries. The following districts are included in the resolution: agricultural districts, residential districts, residential planned unit development (R-PUD) district, business planned unit development (B-PUD) district, mixed use overlay (MUO) district, planned conservation development district, special purpose development district, R-MHP manufactured home park district, B-1 neighborhood business district, B-2 community business district, B-3 general business district, B-4 office district, M-1 light industrial district, M-2 general industrial district, F-1 flood plain district, and source water protection overlay district.

Fairfield: The City of Fairfield's Zoning Ordinance is enacted for the purpose of promoting public health, safety, convenience, comfort, prosperity and general welfare by regulating and restricting the location, bulk and height of buildings and structures and of premises to be used for trade, industry, residence or other specified uses, all in accordance with a comprehensive plan for the desirable future development of the community; and to provide a method of administration and to prescribe penalties for the violations of provisions described.

The ordinance establishes districts and their boundaries throughout the city as well as special case locations in Fairfield. Regulations are codified for the central business district, general industrial district, residential districts, and agricultural districts. This ensures the city can oversee and regulate new development as well as any changes in zoning.

Hamilton: The City of Hamilton's Zoning Ordinance, developed and enforced by the city's planning department, goal is to regulate, restrict and limit, in the interest of the public health, safety, convenience, comfort, prosperity and general welfare, the uses and location of buildings and other structures and of premises to be used for trade, industry, residence or other specified uses, the height, bulk and location of buildings and other structures erected or altered, including the percentage of lot occupancy, setback building lines, and the area of yards, courts and other open

spaces: and for said purposes to divide the city into zones or districts of such number, shape and area as are deemed best suited to carry out said purposes; and to provide a method of administration and to prescribe penalties for the violation of the provisions.

The ordinance establishes land uses throughout the city as well as development standards. The ordinance also identifies the following districts for additional standards and regulations: agricultural district, R-1, R-2, R-2A, R-3, R-4, R-0, traditional neighborhood, B-1, B-2, B-3, I-1, I-2, form-based zoning districts, planned developments, and special districts and overlays.

Middletown: The Middletown Development Code, effective November 4, 2022, is enforced by the city's planning & zoning division. It is the purpose of the development code to promote and protect the public health, safety, comfort, convenience, and general welfare of the people of the City of Middletown through the establishment of minimum regulations governing the development, subdivision, and use of land. Furthermore, the intent of the regulations is:

- To implement the City of Middletown Master Plan, City of Middletown Street Master Plan, and other plans and policies adopted by City Council;
- To encourage and facilitate orderly, efficient, and appropriate growth and development within the City;
- To preserve and enhance the character and quality of neighborhoods;
- To establish appropriate development density and intensity to prevent or reduce congestion and to secure the economy in the cost of providing water supply systems, electricity, sewage systems, streets, and highways, fire and police protection, schools, parks and recreation facilities, and other governmental services;
- To conserve the value of buildings and land;
- To protect residential, commercial, office, and industrial areas alike from harmful encroachment by incompatible uses and to ensure that land allocated to a class of uses shall not be usurped by other inappropriate uses;
- To avoid the inappropriate development of lands and provide for adequate drainage, curbing of erosion, and reduction of flood damage; and
- To foster a more rational pattern of relationship between agricultural, conservation, residential, commercial, office, industrial and institutional uses for the mutual benefit of all.

The code establishes zoning districts throughout the city and regulates the uses within each district. Accessory and temporary use regulations are also identified as well as general development and architectural standards. Historic preservation and parkland dedication/open space regulations and standards are outlined. Finally, subdivision design and enforcement procedures are provided.

Monroe: The City of Monroe's Planning and Zoning Code is currently being updated. However, the effective code, last amended in April 2018, is enforced by the city's Department of Development.

The code is adopted to secure and provide the following objectives for the City of Monroe: maintain and enhance the community's distinct character; promote the public health, safety, comfort, and welfare of the residents of the City; create residential areas with strong neighborhood qualities including pedestrian-friendly streets, community gathering spaces, and basic commercial needs in close proximity; preserve the character and quality of residential neighborhoods; provide for the expansion and diversification of the economic base to assure a strong economy; establish and maintain zoning districts in order to protect the property rights of all individuals by assuring the compatibility and efficient relationships of uses and practices within districts; promote orderly, efficient, and appropriate development of land; ensure compatibility between different types of development and land uses; provide standards and guidelines for compatibility of designs, materials, layout, landscaping, and effective use of land for quality development; facilitate the provision of public utilities and public services; provide for the proper arrangement of streets or highways including the improvement and promotion of connectivity to better serve residents and businesses; provide uniform procedures and standards for observance by both the approving authority and the subdivider for the division, subdivision, and development of land; manage traffic access and circulation; allow freedom of speech and expression in accordance with the laws of the state and nation; ensure adequate provision of open space for light, air, and fire safety; preserve and protect existing trees and vegetation, flood plains, stream corridors, and other areas of scenic and environmental significance from adverse impacts of land development; and require the adequate and safe provision of transportation, water, sewage, and drainage in the City.

The ordinance establishes development review procedures, zoning districts, use regulations, and planned unit development. Subdivision design standards are also included in addition to general development and architectural standards. Open space and performance standards are established was well.

Oxford: The City of Oxford Planning & Zoning Code, enforced by the city's Community Development Department, is adopted for the purposes of promoting and protecting the public health, safety, and general welfare of the people and to support the comfort and convenience of the Citizens of Oxford. The fulfillment of this purpose is to be accomplished by seeking:

- To encourage and facilitate orderly, efficient, and appropriate growth and development.
- To establish population densities to prevent or reduce congestion and to secure economy in the cost of providing water supply and sewerage systems, streets, and highways, fire and police protection, schools, parks and recreation facilities, and other governmental services.
- To zone all properties with a view to conserving the property value and encouraging the most appropriate use of land throughout the City.
- To protect agricultural, residential, business commercial and industrial areas alike from harmful encroachment by incompatible uses, and to ensure that land allocated to a category of uses shall not be usurped by other inappropriate uses.

- To avoid inappropriate development of land and provide for adequate drainage, control of erosion, and reduction of flood damage.
- The standards and requirement contained in the ordinance, and the district mapping reflected on the Oxford Zoning Map, are intended to further the implementation of the future planning objectives for the city as well as protect all desirable existing structures and uses.

The ordinance establishes the following districts for the city: R-1A Single-Family Low-Density Residential District, R-1B Single-Family Medium Density Residential District, R-1MS Single-Family Residential Mile-Square District, R-2A Single- and Two-Family Residential District, R-2MS Single- and Two-Family Mile-Square Residential District, R-3 Multi-Family Residential District, R-4 Multi-Family Residential District, R-3MS Single, Two, and Three-Family Mile-Square Residential District, R-MH Planned Mobile and Manufactured Home Residential District, RO Office Residential District, UP Uptown District, MU University District, GB General Business District, OI Office & Light Industrial District, LI Light Industrial District, Agricultural Open Space District, and NM Neighborhood Business District.

Sharonville: The Planning and Zoning Code, enforced by city's Community Development Department, to promote and protect the public health, safety, comfort, prosperity, convenience, and general welfare of the people of the City of Sharonville through the establishment of minimum regulations governing the subdivision, development, structures, and use of land. Furthermore, the more specific purpose of this Planning and Zoning Code is to:

- Implement the City of Sharonville Comprehensive Plan and other policies or plans adopted or approved by the City as they relate to the development of land;
- Encourage and facilitate orderly, efficient, and appropriate growth and development;
- Protect the character and the values of the residential, business, industrial and recreational areas and to assure the orderly and beneficial development of these areas;
- Provide adequate open spaces for light and air for all residents;
- Establish appropriate development density and intensity in order to prevent or reduce congestion and to secure the economy in the cost of providing water supply systems, electricity, sewerage systems, streets, and highways, fire and police protection, schools, parks and recreation facilities, and other governmental services;
- Manage congestion on the streets to improve the public safety by locating buildings and uses adjacent to streets in such a manner that they will cause the least interference with traffic movements;
- Provide for adequate access to all areas of the City by people of all abilities and by varied modes of transportation;
- Encourage interconnectivity of developments in order to provide multiple access points in and out of developments for safety purposes and traffic dispersion;

- Improve the quality of life through protection of the City's total environment including, but not limited to, the prevention of air, water and noise pollution;
- Avoid the inappropriate subdivision or development of lands and provide for adequate drainage, curbing of erosion, and reduction of flood damage; and
- Foster a more rational pattern of relationship between recreation, conservation, residential, business, commercial, industrial, and institutional uses for the mutual benefit of all.

The ordinance establishes zoning districts classified into three main categories: residential zoning districts, nonresidential zoning districts, and special zoning districts. The ordinance lays out the regulations and standards associated with each zoning district. Subdivision design, architectural standards, and historic preservation guidelines are also included in the ordinance.

Trenton: The Planning and Zoning Code for the City of Trenton, enforced by the city's Planning and Zoning Department, intends to promote the health, safety, morals and general welfare of its residents, businesses and visitors through the following objectives:

- To prevent community needs and priorities from becoming subservient to regional market pressures.
- To prevent hazards to the health and safety of the public and of all occupants of improved real property.
- To assure adequate light, air and convenience of access for all properties.
- To promote the delivery of public services such as utilities, streets, refuse collection, emergency medical services, fire and police protection.
- To separate incompatible land uses and cluster compatible and mutually supportive land uses.
- To create physical buffers between zones where generally beneficial, and within zones where tensions or conflicts may occur between dissimilar land uses.
- To provide for creatively designed single-use and mixed-use Planned Unit Developments, and to preserve their character and vitality through ongoing regulatory supervision.
- To assure, through an appropriate site plan review, that the general, district and supplementary regulations of the zoning code are being followed in the design of each new site improvement or redevelopment.
- To minimize adverse effects on traffic safety caused by development and certain land uses.
- To minimize adverse effects on the environment resulting from development and certain land uses.
- To facilitate the efficient and economical development and use of land and public facilities.

- To allocate to each site development, rather than to the public, the maximum feasible portion of the infrastructure and operating costs which arise as a result of that development.
- To fairly balance the interest of property owners and occupants in continuing their nonconforming land uses against the community interest in achieving full compliance with the zoning code.
- To protect floodways and flood plains from development which increases the general risk of flooding or puts occupants of the development at risk.
- To preserve and enhance property values.
- To protect public and private water supplies, both in quality and quantity.
- To promote the economic vitality of business and industry.
- To direct particular land uses to the parcels of land best suited for them physically and in terms of access to highways and public services.
- To enhance the predictability and profitability of private investments made in the city.
- To continuously improve the aesthetic character of all parts of the city.
- To provide for variances from certain aspects of the zoning code where justified by special circumstances and where the public interest will not be adversely affected.
- To provide for thorough, efficient and lawful code administration.

The ordinance identifies how it is the direct result and enforceable measure of the city's Land Use Master Plan. Zoning districts throughout the city are established as well as the regulations and standards associated with each district.

TABLE 5-2 NFIP PARTICIPANT FLOODPLAIN MANAGEMENT REGULATIONS

NFIP Information	Community Response
Butler County, Monroe, Millville, New Miami, Seven Mile	
Adoption of Floodplain Management Regulations	November 15, 2010
Floodplain Management Regulations	The Special Purpose Flood Damage Prevention Regulations for Butler County contains various methods to reduce flood loss within the county by: • Restricting or prohibiting uses which are dangerous to health, safety, and property due to water hazards, or which result in damaging increases in flood heights or velocities; • Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction; • Controlling the alteration of natural flood plains, stream channels, and natural protective barriers, which help accommodate or channel flood waters; • Controlling filling, grading, dredging, and other development which may increase flood damage; and, • Preventing or regulating the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas.
Substantial Improvement/Substantial Damage Provision Implementation	**Substantial Improvement** All new construction and substantial improvements shall be anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy. All new construction and substantial improvements shall be constructed with materials resistant to flood damage. All new construction and substantial improvements shall be constructed using methods and practices that minimize flood damage. All new construction and substantial improvements shall be constructed with electrical, heating, ventilation, plumbing and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding. In all areas of special flood hazard identified as Zone A on the Flood Insurance Rate Map where base flood elevation data are not available from any source, the following provision applies: New construction and substantial improvement of any residential, commercial, industrial, or other nonresidential structure shall have the lowest floor, including basement, elevated to at least three feet (3') above the highest adjacent natural grade. In all areas of special flood hazard identified as an area outside the studied area lying along blue line streams and/or areas with flood prone soils which are contiguous to blue line streams as shown on the Butler County Flood Prone Soils Map, the following provision applies: New construction and substantial improvement of any residential, commercial, industrial, or other nonresidential structure shall have the lowest floor, including basement, elevated to at least one foot, six inches (1' 6") above the 100-year base flood elevation as determined by a registered professional engineer employed by the applicant. Additions to buildings or structures built prior to the date of this resolution shall have the lowest floor including basement, elevated to at least one foot, zero inches (1' 0") above the 100-year base flood elevation, or elevate the lowest floor, including basement, to at least three feet (3') above the highest adjacent natural grade. New construction and substantial improvement of any residential structure shall have the lowest floor, including basement, elevated to at least one foot, six inches (1' 6") above the base flood elevation. Additions to buildings or structures built prior to January 29, 2009 shall have the lowest floor including basement, elevated to at least one foot, zero inches (1' 0") above the 100-year base flood elevation. In AO zones new construction and substantial improvements shall have the lowest floor, including basement, elevated above the highest adjacent grade at least three feet (3') above the depth number on the community's Flood Insurance Rate Map. Adequate drainage paths shall be provided around structures on slopes, to guide floodwaters around and away from proposed structures. New construction and substantial improvement of any commercial, industrial or other nonresidential structure shall either have the lowest floor, including basement, elevated to the level of at least one foot, six inches (1' 6") above the base flood elevation; additions to buildings or structures built prior to January 29, 2009 shall have the lowest floor including basement, elevated to at least one foot, zero inches (1' 0") above the 100-year base flood elevation or together with attendant utility, sanitary facilities shall:

	• be dry floodproofed so that the structure is watertight with walls substantially impermeable to the passage of water to the level of at least one foot, six inches (1' 6") above the base flood elevation. Additions to the buildings or structures built prior to January 29, 2009 shall have the lowest floor including basement, elevated to at least one foot, zero inches (1' 0") above the 100-year base flood elevation. • have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy, and, • be certified by a registered professional engineer or architect that the design and methods of construction are in accordance with accepted standards of practice for meeting the standards of this subsection. Such certification shall be provided to the Butler County Building and Zoning Administrator. In AO zones new construction and substantial improvements shall either have the lowest floor, including basement, elevated above the highest adjacent grade at least three feet (3') above the depth number on the community's Flood Insurance Rate Map; or be floodproofed to that level consistent with the floodproofing standards, and adequate drainage paths shall be provided around structures on slopes, to guide floodwaters around and away from proposed structures. **Substantial Damage** Damages to structures may result from a variety of causes including flood, tornado, wind, heavy snow, fire, etc. After such a damage event, the Floodplain Administrator shall: • Determine whether damaged structures are located in special flood hazard areas; • Conduct substantial damage determinations for damaged structures located in special flood hazard areas; • Make reasonable attempt to notify owners of substantially damaged structures of the need to obtain a floodplain development permit prior to repair, rehabilitation, or reconstruction. Additionally, the Floodplain Administrator may implement other measures to assist with the substantial damage determination and subsequent repair process. These measures include issuing press releases, public service announcements, and other public information materials related to the floodplain development permits and repair of damaged structures; coordinating with other federal, state, and local agencies to assist with substantial damage determinations; providing owners of damaged structures materials and other information related to the proper repair of damaged structures in special flood hazard areas; and assist owners of substantially damaged structures with Increased Cost of Compliance insurance claims.
Fairfield	
Adoption of Floodplain Management Regulations	November 8, 2010
Floodplain Management Regulations	Located in the Planning and Zoning Code, Special Provisions section of the ordinance, the Flood Damage Reduction chapter contains various methods to reduce flood loss within all areas mapped as special flood hazard within the jurisdiction and any additional annexed land that has special flood hazard area. The Flood Damage Reductions: • Restrict or prohibit uses which are dangerous to health, safety and property due to water hazards, or which result in damaging increases in flood heights or velocities. • Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction. • Control the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters. • Control filling, grading, dredging, excavating, and other development which may increase flood damage. • Prevent or regulate the construction of flood barriers, which will unnaturally divert flood waters or which may increase flood hazards in other areas.
Substantial Improvement/Substantial Damage Provision Implementation	**Substantial Improvement:** New construction and substantial improvements shall be anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy. Where a structure, including its foundation members, is elevated on fill to or above the base flood elevation, the requirements for anchoring and construction materials resistant to flood damage are satisfied. New construction and substantial improvements shall be constructed with methods and materials resistant to flood damage.

	New construction and substantial improvements shall be constructed with electrical, heating, ventilation, plumbing and air conditioning equipment and other service facilities that are designed and/or elevated so as to prevent water from entering or accumulating within the components during conditions of flooding. New construction and substantial improvement of any residential structure, including manufactured homes, shall have the lowest floor, including basement, elevated to or above the flood protection elevation. In zone AO areas with no elevations specified, the structure shall have the lowest floor, including basement, elevated at least one foot above the highest adjacent natural grade. New construction and substantial improvements, including manufactured homes, that do not have basements and that are elevated to the flood protection elevation using pilings, columns, posts, or solid foundation perimeter walls with openings sufficient to allow unimpeded movement of flood waters may have an enclosure below the lowest floor provided the enclosure meets the following standards: • Be used only for the parking of vehicles, building access, or storage; and • Be designed and certified by a registered professional engineer or architect to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters; or • Have a minimum of two openings on different walls having a total net area not less than one square inch for every square foot of enclosed area, and the bottom of all such openings being no higher than one foot above grade. The openings may be equipped with screens, louvers, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters. **Substantial Damage:** Damages to structures may result from a variety of causes including flood, tornado, wind, heavy snow, fire, etc. After such a damage event, the Floodplain Administrator shall: • Determine whether damaged structures are located in special flood hazard areas; • Conduct substantial damage determinations for damaged structures located in special flood hazard areas; and • Make reasonable attempt to notify owners of substantially damaged structures of the need to obtain a floodplain development permit prior to repair, rehabilitation, or reconstruction. Additionally, the Floodplain Administrator may implement other measures to assist with the substantial damage determination and subsequent repair process. These measures include issuing press releases, public service announcements, and other public information materials related to the floodplain development permits and repair of damaged structures; coordinating with other federal, state, and local agencies to assist with substantial damage determinations; providing owners of damaged structures materials and other information related to the proper repair of damaged structures in special flood hazard areas; and assisting owners of substantially damaged structures with increased cost of compliance insurance claims.
Hamilton	
Adoption of Floodplain Management Regulations	July 14, 2023
Floodplain Management Regulations	Located in the Planned Development Regulations, Special Districts, Overlays, and Provisions section of the ordinance, the Flood Damage Reduction chapter contains various methods to reduce flood loss within all areas mapped as special flood hazard area within the jurisdiction and any additional annexed land that has special flood hazard area. The Flood Damage Regulations: • Restrict or prohibit uses which are dangerous to health, safety, and property due to water hazards, or which result in damaging increases in flood heights or velocities. • Require that uses vulnerable to floods, including facilities, which serve such uses, be protected against flood damage at the time of initial construction. • Control the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters. • Control filling, grading, dredging, excavating, and other development which may increase flood damage. • Prevent or regulate the construction of flood barriers, which will unnaturally divert flood, waters or which may increase flood hazards in other areas.

Substantial Improvement/Substantial Damage Provision Implementation	**Substantial Improvement:** Substantial improvements to existing residential structures shall be anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy. Where a structure, including its foundation members, is elevated on fill to or above the base flood elevation, the requirements for anchoring and construction materials resistant to flood damage are satisfied. Substantial improvements to existing residential structures shall be constructed with electrical, heating, ventilation, plumbing and air conditioning equipment and other service facilities that are designed and/or elevated so as to prevent water from entering or accumulating within the components during conditions of flooding. Substantial improvements to existing residential structures, including manufactured homes, shall have the lowest floor, including basement, elevated to or above the flood protection elevation. Substantial improvements to existing residential structures, including manufactured homes, that do not have basements and that are elevated to the flood protection elevation using pilings, columns, posts, or solid foundation perimeter walls with openings sufficient to allow unimpeded movement of flood waters may have an enclosure below the lowest floor provided the enclosure meets the following standards: • Be used only for the parking of vehicles, building access, or storage; • Are designed and certified by a registered professional engineer or architect to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters; or • Have a minimum of two openings on different walls having a total net area not less than one square inch for every square foot of enclosed area, and the bottom of all such openings being no higher than one foot above grade. The openings may be equipped with screens, louvers, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters. **Substantial Damage:** Damages to structures may result from a variety of causes including flood, tornado, wind, heavy snow, fire, etc. After such a damage event, the Floodplain Administrator shall: • Determine whether damaged structures are located in special flood hazard areas; • Conduct substantial damage determinations for damaged structures located in special flood hazard areas; • Make reasonable attempt to notify owners of substantially damaged structures of the need to obtain a floodplain development permit prior to repair, rehabilitation, or reconstruction. Additionally, the Floodplain Administrator may implement other measures to assist with the substantial damage determination and subsequent repair process. These measures include issuing press releases, public service announcements, and other public information materials related to the floodplain development permits and repair of damaged structures; coordinating with other federal, state, and local agencies to assist with substantial damage determinations; providing owners of damaged structures materials and other information related to the proper repair of damaged structures in special flood hazard areas; and assist owners of substantially damaged structures with Increased Cost of Compliance insurance claims.
Middletown	
Adoption of Floodplain Management Regulations	October 2010
Floodplain Management Regulations	The Flood Damage Prevention Regulations for Middletown include various methods to reduce flood loss within the mapped special flood hazard areas within the jurisdiction and any additional annexed land that has special flood hazard area. The Flood Damage Prevention Regulations: • Restrict or prohibit uses which are dangerous to health, safety, and property due to water hazards, or which result in damaging increases in flood heights or velocities. • Require that uses vulnerable to floods, including facilities, which serve such uses, be protected against flood damage at the time of initial construction. • Control the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters. • Control filling, grading, dredging, excavating, and other development which may increase flood damage.

	• Prevent or regulate the construction of flood barriers, which will unnaturally divert flood, waters or which may increase flood hazards in other areas.
Substantial Improvement/Substantial Damage Provision Implementation	**Substantial Improvement:** Substantial improvements to existing residential structures shall be anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy. Where a structure, including its foundation members, is elevated on fill to or above the base flood elevation, the requirements for anchoring and construction materials resistant to flood damage are satisfied. Substantial improvements to existing residential structures shall be constructed with electrical, heating, ventilation, plumbing and air conditioning equipment and other service facilities that are designed and/or elevated so as to prevent water from entering or accumulating within the components during conditions of flooding. Substantial improvements to existing residential structures, including manufactured homes, shall have the lowest floor, including basement, elevated to or above the flood protection elevation. Substantial improvements to existing residential structures, including manufactured homes, that do not have basements and that are elevated to the flood protection elevation using pilings, columns, posts, or solid foundation perimeter walls with openings sufficient to allow unimpeded movement of flood waters may have an enclosure below the lowest floor provided the enclosure meets the following standards: • Be used only for the parking of vehicles, building access, or storage; • Are designed and certified by a registered professional engineer or architect to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters; or • Have a minimum of two openings on different walls having a total net area not less than one square inch for every square foot of enclosed area, and the bottom of all such openings being no higher than one foot above grade. The openings may be equipped with screens, louvers, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters. **Substantial Damage:** Damages to structures may result from a variety of causes including flood, tornado, wind, heavy snow, fire, etc. After such a damage event, the Floodplain Administrator shall: • Determine whether damaged structures are located in special flood hazard areas; • Conduct substantial damage determinations for damaged structures located in special flood hazard areas; • Make reasonable attempt to notify owners of substantially damaged structures of the need to obtain a floodplain development permit prior to repair, rehabilitation, or reconstruction. Additionally, the Floodplain Administrator may implement other measures to assist with the substantial damage determination and subsequent repair process. These measures include issuing press releases, public service announcements, and other public information materials related to the floodplain development permits and repair of damaged structures; coordinating with other federal, state, and local agencies to assist with substantial damage determinations; providing owners of damaged structures materials and other information related to the proper repair of damaged structures in special flood hazard areas; and assist owners of substantially damaged structures with Increased Cost of Compliance insurance claims.
Oxford	
Adoption of Floodplain Management Regulations	October 29, 2010
Floodplain Management Regulations	Located in Planning and Zoning Code, Zoning section of the ordinance, the Flood Plain Regulations and Flood Damage Prevention chapter contains various methods to reduce flood loss within the jurisdiction. The Flood Plain Regulations and Flood Damage Prevention: • Restrict or prohibit uses which are dangerous to health, safety, and property due to water hazards, or which result in damaging increases in flood heights or velocities. • Require that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction.

	• Control the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters. • Control filling, grading, dredging, and other development which may increase flood damage. • Prevent or regulate the construction of flood barriers which will unnaturally divert flood, waters or which may increase flood hazards in other areas. • Minimize the impact of development on adjacent properties within and near flood prone areas. • Ensure that the flood storage and conveyance functions of the floodplain are maintained. • Minimize the impact of development on the natural, beneficial values of the floodplain. • Prevent floodplain uses that are either hazardous or environmentally incompatible. • Meet community participation requirements of the National Flood Insurance Program.
Substantial Improvement/Substantial Damage Provision Implementation	**Substantial Improvement** All new construction and substantial improvements shall be anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy. Where a structure, including its foundation members, is elevated on fill to or above the base flood elevation, the requirements for anchoring, herein, and construction materials resistant to flood damage. All new construction and substantial improvements shall be constructed with materials resistant to flood damage. All new construction and substantial improvements shall be constructed using methods and practices that minimize flood damage; and All new construction and substantial improvements shall be constructed with electrical, heating, ventilation, plumbing and air conditioning and/or located so as to prevent water from entering or accumulation within the components during conditions of flooding. The following standards apply to all new construction and substantially improved residential, including manufactured homes, and nonresidential structures that are elevated two feet above the base flood elevation using pilings, columns, or posts or solid foundation perimeter walls, with openings sufficient to allow unimpeded movement of flood waters, may have an enclosure below the lowest floor provided the enclosure meets the following standards: • Be used only for parking of vehicles, building access, or storage; and • Be designed and certified by a registered professional engineer or architect to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters; or • Have a minimum of two openings on different walls having a total net area of not less than one square inch for every square foot of enclosed area, and • The bottom of all openings shall be no higher than one foot above grade. The openings may be equipped with screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters. **Substantial Damage** Damages to structures may result from a variety of causes including flood, tornado, wind, heavy snow, fire, etc. After such a damage event, the Floodplain Administrator shall: • Determine whether damaged structures are located in special flood hazard areas; • Conduct substantial damage determinations for damaged structures located in special flood hazard areas; and • Make reasonable attempt to notify owners of substantially damaged structures of the need to obtain a floodplain development permit prior to repair, rehabilitation, or reconstruction. Additionally, the Floodplain Administrator may implement other measures to assist with the substantial damage determination and subsequent repair process. These measures include issuing press releases, public service announcements, and other public information materials related to the floodplain development permits and repair of damaged structures; coordinating with other federal, state, and local agencies to assist with substantial damage determinations; providing owners of damaged structures materials and other information related to the proper repair of damaged structures in special flood hazard areas; and assist owners of substantially damaged structures with Increased Cost of Compliance insurance claims.
Sharonville	

Adoption of Floodplain Management Regulations	March 30, 2004
Floodplain Management Regulations	Located in the Building Code section of the ordinance, the Flood Damage Reduction chapter contains various methods to reduce flood loss within all areas mapped as special flood hazard area within the jurisdiction and any additional annexed land that has special flood hazard area. The Flood Damage Regulations: • Restrict or prohibit uses which are dangerous to health, safety, and property due to water hazards, or which result in damaging increases in flood heights or velocities. • Require that uses vulnerable to floods, including facilities, which serve such uses, be protected against flood damage at the time of initial construction. • Control the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters. • Control filling, grading, dredging, excavating, and other development which may increase flood damage. • Prevent or regulate the construction of flood barriers, which will unnaturally divert flood, waters or which may increase flood hazards in other areas.
Substantial Improvement/Substantial Damage Provision Implementation	**Substantial Improvement** New construction and substantial improvements shall be anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy. Where a structure, including its foundation members, is elevated on fill to or above the base flood elevation, the requirements for anchoring and construction materials resistant to flood damage are satisfied. New construction and substantial improvements shall be constructed with methods and materials resistant to flood damage. New construction and substantial improvements shall be constructed with electrical, heating, ventilation, plumbing and air conditioning equipment and other service facilities that are designed and/or elevated so as to prevent water from entering or accumulating within the components during conditions of flooding. New construction and substantial improvement of any residential structure, including manufactured homes, shall have the lowest floor, including basement, elevated to or above the flood protection elevation, which is the base flood elevation plus 1 foot of freeboard. New construction and substantial improvements, including manufactured homes, that do not have basements and that are elevated to the flood protection elevation using pilings, columns, posts, or solid foundation perimeter walls with openings sufficient to allow unimpeded movement of flood waters may have an enclosure below the lowest floor provided the enclosure meets the following standards: • Be used only for the parking of vehicles, building access, or storage; and • Be designed and certified by a registered professional engineer or architect to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters; or • Have a minimum of two openings on different walls having a total net area not less than one square inch for every square foot of enclosed area, and the bottom of all such openings being no higher than one foot above grade. The openings may be equipped with screens, louvers, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters. New construction and substantial improvement of any commercial, industrial or other nonresidential structure shall meet the requirements of residential substantial improvement structures. New construction and substantial improvement of any commercial, industrial or other nonresidential structure shall either have the lowest floor, including basement, elevated to or above the level of the flood protection elevation, which is the base flood elevation plus I foot of freeboard; or, together with attendant utility and sanitary facilities, shall meet all of the following standards: • Be dry floodproofed so that the structure is watertight with walls substantially impermeable to the passage of water to the level of the flood protection elevation; • Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy; and, • Be certified by a registered professional engineer or architect, through the use of a Federal Emergency Management Floodproofing Certificate, that the design and methods of construction are in accordance with the regulations set forth. **Substantial Damage**

	Damages to structures may result from a variety of causes including flood, tornado, wind, heavy snow, fire, etc. After such a damage event, the Floodplain Administrator shall: • Determine whether damaged structures are located in special flood hazard areas; • Conduct substantial damage determinations for damaged structures located in special flood hazard areas; • Make reasonable attempt to notify owners of substantially damaged structures of the need to obtain a floodplain development permit prior to repair, rehabilitation, or reconstruction. Additionally, the Floodplain Administrator may implement other measures to assist with the substantial damage determination and subsequent repair process. These measures include issuing press releases, public service announcements, and other public information materials related to the floodplain development permits and repair of damaged structures; coordinating with other federal, state, and local agencies to assist with substantial damage determinations; providing owners of damaged structures materials and other information related to the proper repair of damaged structures in special flood hazard areas; and assist owners of substantially damaged structures with Increased Cost of Compliance insurance claims.
Trenton	
Adoption of Floodplain Management Regulations	October 7, 2010
Floodplain Management Regulations	Located in the Building and Housing Code section, the Flood Damage Prevention chapter contains various methods to reduce flood loss within all areas mapped as special flood hazard area within the jurisdiction and any additional annexed land that has special flood hazard area. The Flood Damage Regulations: • Restrict or prohibit uses which are dangerous to health, safety, and property due to water hazards, or which result in damaging increases in flood heights or velocities. • Require that uses vulnerable to floods, including facilities, which serve such uses, be protected against flood damage at the time of initial construction. • Control the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters. • Control filling, grading, dredging, excavating, and other development which may increase flood damage. • Prevent or regulate the construction of flood barriers, which will unnaturally divert flood, waters or which may increase flood hazards in other areas.
Substantial Improvement/Substantial Damage Provision Implementation	**Substantial Improvement** New construction and substantial improvements shall be anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy. Where a structure, including its foundation members, is elevated on fill to or above the base flood elevation, the requirements for anchoring and construction materials resistant to flood damage are satisfied. New construction and substantial improvements shall be constructed with methods and materials resistant to flood damage. New construction and substantial improvements shall be constructed with electrical, heating, ventilation, plumbing and air conditioning equipment and other service facilities that are designed and/or elevated so as to prevent water from entering or accumulating within the components during conditions of flooding. New construction and substantial improvement of any residential structure, including manufactured homes, shall have the lowest floor, including basement, elevated to or above the flood protection elevation. Where flood protection elevation data are not available, the structure shall have the lowest floor, including basement, elevated at least two feet above the highest adjacent natural grade. New construction and substantial improvements, including manufactured homes, that do not have basements and that are elevated to the flood protection elevation using pilings, columns, posts, or solid foundation perimeter walls with openings sufficient to allow unimpeded movement of flood waters may have an enclosure below the lowest floor provided the enclosure meets the following standards: • Be used only for the parking of vehicles, building access, or storage; • Be designed and certified by a registered professional engineer or architect to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters; or

	• Have a minimum of two openings on different walls having a total net area not less than one square inch for every square foot of enclosed area, and the bottom of all such openings being no higher than one foot above grade. The openings may be equipped with screens, louvers, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters. • In AO Zones, new construction and substantial improvement shall have adequate drainage paths around structures on slopes to guide floodwaters around and away from the structure. New construction and substantial improvement of any commercial, industrial or other nonresidential structure shall meet the requirements of the residential substantial improvement requirements. New construction and substantial improvement of any commercial, industrial or other nonresidential structure shall either have the lowest floor, including basement, elevated to or above the level of the flood protection elevation; or, together with attendant utility and sanitary facilities, shall meet all of the following standards: • Be dry floodproofed so that the structure is watertight with walls substantially impermeable to the passage of water to the level of the flood protection elevation; • Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy; and, • Be certified by a registered professional engineer or architect, through the use of a Federal Emergency Management Agency Floodproofing Certificate, that the design and methods of construction are in accordance the requirements. Where flood protection elevation data are not available, the structure shall have the lowest floor, including basement, elevated at least two feet above the highest adjacent natural grade. **Substantial Damage** Damages to structures may result from a variety of causes including flood, tornado, wind, heavy snow, fire, etc. After such a damage event, the Floodplain Administrator shall: • Determine whether damaged structures are located in special flood hazard areas; • Conduct substantial damage determinations for damaged structures located in special flood hazard areas; • Make reasonable attempt to notify owners of substantially damaged structures of the need to obtain a floodplain development permit prior to repair, rehabilitation, or reconstruction. Additionally, the Floodplain Administrator may implement other measures to assist with the substantial damage determination and subsequent repair process. These measures include issuing press releases, public service announcements, and other public information materials related to the floodplain development permits and repair of damaged structures; coordinating with other federal, state, and local agencies to assist with substantial damage determinations; providing owners of damaged structures materials and other information related to the proper repair of damaged structures in special flood hazard areas; and assist owners of substantially damaged structures with Increased Cost of Compliance insurance claims.

Administrative and Technical Capability: The table below summarizes the administrative and technical capabilities, organized by staff type and department. It is important to understand current administrative and technical capabilities before developing a myriad of mitigation activities.

TABLE 5-3 ADMINISTRATIVE AND TECHNICAL CAPABILITIES

Tool/Program	Butler County	Fairfield	Hamilton	Middletown	Monroe	Oxford	Sharonville	Trenton	College Corner	Jacksonburg	Millville	New Miami	Seven Mile
Emergency Manager	X	X	X	X	X	X	X	X	X	X	X	X	X
Engineers	X	X	X	X	X	X	X	X					X
Floodplain Manager	X	X	X	X	X	X	X	X			X	X	X
GIS Personnel	X	X	X	X	X	X			X				
Grant Writers or Fiscal Staff to handle large/complex grants	X	X	X	X		X	X	X	X				
Land Surveyors	X		X						X				
Planners	X	X	X	X	X	X	X	X					
Others													

Butler County's Department of Development enforces the 2019 State of Ohio Building Code for the unincorporated areas of the county as well as for the villages of College Corner, Jacksonburg, Millville, New Miami, and Seven Mile. The cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, and Trenton all have planning departments that review and enforce the building codes for proposed construction in their municipalities.

Each community that participates in the NFIP has a floodplain manager that implements the addressed commitments and requirements of the program. The following table identifies each Floodplain Administrator's role within the NFIP community, as several communities' floodplain manager holds more than one title. Jacksonburg and College Corner do not have any Special Flood Hazard Areas identified, so they currently do not participate in the NFIP or have a floodplain manager.

TABLE 5-4 BUTLER COUNTY NFIP FLOODPLAIN MANAGERS

CID	Community	Floodplain Manager
390037	Butler County	Zoning & Floodplain Manager
390038	Fairfield	Development Services Director
390039	Hamilton	Floodplain Manager
390040	Middletown	Public Works Director

390041	Millville	Mayor
390042	Monroe	City Manager
390043	New Miami	Mayor
390731	Oxford	Community Development Director
390045	Seven Mile	Mayor
390236	Sharonville	Public Safety Director
390047	Trenton	Service Director

Fiscal Capability: This section identifies the financial tools or resources that Butler County could potentially use to help fund mitigation activities. Fiscal capabilities include community specific resources as well as state and federal resources.

TABLE 5-5 FISCAL CAPABILITY

Tool/Program	Butler County	Fairfield	Hamilton	Middletown	Monroe	Oxford	Sharonville	Trenton	College Corner	Jacksonburg	Millville	New Miami	Seven Mile
Capital Improvement Planning	X	X	X	X	X	X							
Community Development Block Grant (CDBG)	X	X	X	X		X			X	X	X		
Development Impact Fees				X	X	X							
Gas/Electric Utility Fees			X		X				X				
General Obligation, Revenue, and/or Special Tax Bonds	X		X	X	X	X	X						X
Partnering Arrangements or Intergovernmental Agreements	X	X	X	X		X	X		X				X
Special Purpose Taxes	X			X	X	X						X	
Stormwater Utility Fees	X		X	X	X				X			X	
Water/Sewer Fees	X	X	X	X	X	X			X			X	
Other													

Self-Assessment of Capability: The table below shows each community's estimated degree of capability.

TABLE 5-6 OVERALL DEGREE OF CAPABILITY

Area	Butler County	Fairfield	Hamilton	Middletown	Monroe	Oxford	Sharonville	Trenton	College Corner	Jacksonburg	Millville	New Miami	Seven Mile
Planning and Regulatory Capability	H	H	H	M	M	M	M	M	L	L	L	L	L
Administrative and Technical Capability	H	M	H	M	M	H	M	M	L	L	L	L	M
Fiscal Capability	L	M	H	M	M	M	M	M	L	H	L	I	L

L = Limited, M = Moderate, H = High

5. MITIGATION ACTIONS

The goals and objectives form the basis for developing a Mitigation Action Strategy and specific mitigation projects to consider.

The process consists of 1) setting goals and objectives, 2) considering mitigation alternatives, 3) identifying strategies or "actions," and 4) developing a prioritized action plan that results in a mitigation strategy.

5.5.1 2018 MITIGATION ACTION REVIEW

During the second Planning Committee meeting and the individual meetings with the participating jurisdictions, the mitigation actions from the 2018 HMP were reviewed and determined to be: deferred into the new plan; in progress; changed to reflect an update in priorities; completed; or deleted. These actions are found in Table 5-7. Actions marked as "Completed" were finished between the drafting of the 2018 HMP and the completion of the 2023 HMP. Deletion of an action generally refers to that action no longer being relevant to the community.

All actions were either multi-jurisdictional or included all jurisdictions in the county. After each community provided a status update to each action that was in the previous plan, they then developed unique actions for their specific vulnerabilities to the hazards that are profiled in Section 4.

TABLE 5-7 PREVIOUS MITIGATION ACTION STATUS

Action	Jurisdiction	Status (Completed / Carrying to New Plan / Removed from Plan / In Progress)
Emergency Notification: Investigate new notification options including media/social media and by connecting partners Education i.e., emergency utility shutoffs (gas, water, electricity	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Oxford, Sharonville, College Corner Carrying to New Plan – Fairfield, Trenton, Jacksonburg, Millville, New Miami In Progress – Butler County, Hamilton, Middletown, Monroe, Seven Mile
IPAWS Web app Implementation: Apply for funding and implement this program	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County, Oxford, College Corner Carrying to New Plan – Fairfield, Sharonville, Trenton, Jacksonburg, Millville, New Miami In Progress – Hamilton, Middletown, Monroe, Seven Mile
Update list of Emergency shelters	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County, Oxford, College Corner Carrying to New Plan – Fairfield, Hamilton, Jacksonburg, Millville, New Miami In Progress – Middletown, Monroe, Sharonville, Trenton, Seven Mile
Mitigation activity funding: Apply for funding to implement top priority mitigation projects	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County Carrying to New Plan – Fairfield, Hamilton, Trenton, Jacksonburg, Millville, New Miami In Progress – Middletown, Monroe, Oxford, Sharonville, College Corner, Seven Mile
Stricter Building Codes: Investigate and support the update of building codes to achieve sustainable buildings and structures to severe weather, flooding and other natural hazards. Priority focus on manufactured and mobile housing code enhancements	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Carrying to New Plan – Butler County, Fairfield, Hamilton, Millville Removed from Plan – Jacksonburg In Progress – Middletown, Monroe, Oxford, Trenton, College Corner, New Miami, Seven Mile
Manufactured Housing Standards: Integrate and support zoning and health department priority focus on upgraded standards for manufactured and mobile housing codes	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Carrying to New Plan – Butler County, Fairfield, Hamilton, Sharonville, Millville Removed from Plan – Jacksonburg In Progress – Middletown, Monroe, Oxford, Trenton, College Corner, New Miami, Seven Mile
Build Disaster Recovery Support Network	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – College Corner Carrying to New Plan – Hamilton, Sharonville, Jacksonburg, Millville, New Miami Removed from Plan – Fairfield In Progress – Butler County, Middletown, Monroe, Oxford, Trenton, Seven Mile
Coordinate fuel for hazard mobilization efforts	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County, Oxford, Trenton, College Corner Carrying to New Plan – Hamilton, Middletown, Sharonville, Jacksonburg, Millville, New Miami

Action	Jurisdiction	Status (Completed / Carrying to New Plan / Removed from Plan / In Progress)
		In Progress – Fairfield, Monroe, Seven Mile
Public awareness: Update all printed material into electronic format for use on media and social media. Priority focus on severe weather, tornadoes, and flooding	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Sharonville, College Corner Carrying to New Plan – Butler County, Hamilton, Middletown, Jacksonburg, Millville, New Miami In Progress – Fairfield, Monroe, Oxford, Trenton, Seven Mile
Maintain NWS "Severe Weather Ready" County status	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County, Oxford, Sharonville, College Corner Carrying to New Plan – Hamilton, Trenton, Jacksonburg, Millville In Progress – Fairfield, Middletown, Monroe, New Miami, Seven Mile
Tree Maintenance: Continue to coordinate with utility companies	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County, College Corner Carrying to New Plan – Hamilton, Sharonville, Jacksonburg, Millville, New Miami In Progress – Fairfield, Middletown, Monroe, Oxford, Sharonville, Trenton, Seven Mile
Back-up Generators: Critical Facilities Plan. Develop coordinated back-up generator plan for all critical facilities	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Fairfield, Middletown, Oxford, College Corner Carrying to New Plan – Hamilton, Millville, New Miami Removed from Plan – Jacksonburg In Progress – Butler County, Monroe, Trenton, Seven Mile
Back-up Generators: Funding. Seek funding for backup generators for all critical facilities in the county	Butler County, Trenton, College Corner	Completed – Butler County Carrying to New Plan – Trenton In Progress – College Corner
Enhance public awareness and preparation for severe weather: Update written info into media and social media platforms and include straight-line winds and lightning	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County, College Corner Carrying to New Plan – Hamilton, Millville, Oxford, New Miami In Progress – Fairfield, Middletown, Monroe, Sharonville, Trenton, Jacksonburg, Seven Mile
Significant Building and Critical Infrastructure Sustainability: Identify historic /architecturally significant buildings and critical infrastructure that may need structural upgrades to withstand severe weather events	Butler County, Fairfield, Hamilton, Middletown	In Progress – Butler County, Fairfield, Hamilton, Middletown
Complete FEMA Rate Map update	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile

Action	Jurisdiction	Status (Completed / Carrying to New Plan / Removed from Plan / In Progress)
Identify and GIS/inventory structures subject to flood damage, including critical facilities and repetitive loss properties	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – College Corner Carrying to New Plan – Trenton, Millville, New Miami Removed from Plan – Jacksonburg In Progress – Butler County, Fairfield, Middletown, Monroe, Oxford, Sharonville, Seven Mile
Develop Mitigation Projects to mitigate FEMA identified repetitive loss susceptible structures	Butler County, Fairfield, New Miami, Millville	Completed – Butler County Carrying to New Plan – Fairfield, Millville, New Miami
Develop Mitigation Projects to mitigate structures and critical facilities in designated floodplain areas	Butler County, Monroe, Seven Mile	Completed – Butler County Carrying to New Plan – Monroe In Progress – Seven Mile
Develop a public education program for residents and business owners located in flood prone areas regarding river setbacks, erosion, safe egress, and other soil/flood related issues	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – College Corner Carrying to New Plan – Butler County, Monroe, Oxford, Sharonville, Trenton, Millville, New Miami Removed from Plan – Jacksonburg In Progress – Fairfield, Hamilton, Middletown, Seven Mile
Link flood/hydraulic modeling monitoring to real-time maps and promote their availability	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Carrying to New Plan – Hamilton, Monroe, Oxford, Sharonville, Trenton, Millville, New Miami Removed from Plan – Fairfield, Jacksonburg In Progress – Butler County, Middletown, College Corner, Seven Mile
Monitor and maintain list of Butler Co communities to assure full participation in NFIP	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – College Corner Carrying to New Plan – Hamilton, Monroe, Oxford, Sharonville, Trenton, Jacksonburg, Millville In Progress – Butler County, Fairfield, Middletown, New Miami, Seven Mile
Investigate new technologies for flood prevention and diversion	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Carrying to New Plan – Oxford, Sharonville, Trenton, Millville, New Miami Removed from Plan – Fairfield, Jacksonburg In Progress – Butler County, Hamilton, Middletown, Monroe, College Corner, Seven Mile
Place public awareness signage at repetitive loss locations	Butler County	Carrying to New Plan
Use alternative storm water retention strategies, like Rain Gardens where appropriate	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Carrying to New Plan – Monroe, Trenton, Millville, New Miami Removed from Plan – Jacksonburg In Progress – Butler County, Fairfield, Hamilton, Middletown, Oxford, Sharonville, College Corner, Seven Mile

Action	Jurisdiction	Status (Completed / Carrying to New Plan / Removed from Plan / In Progress)
Encourage residents to secure available FEMA Flood Insurance	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Carrying to New Plan – Monroe, Oxford, Sharonville, Trenton, Millville, New Miami Removed from Plan – Fairfield, Jacksonburg In Progress – Butler County, Hamilton, Middletown, College Corner, Seven Mile
GIS Class I and II dams and their potential inundation zones	Butler County, Fairfield, Middletown, Oxford	Carrying to New Plan – Oxford In Progress – Butler County, Fairfield, Middletown
Develop and exercise emergency action plans, including evacuation plans, in the event of a dam/levee failure	Butler County, Fairfield, Middletown, Oxford	Completed – Butler County Carrying to New Plan – Oxford In Progress – Fairfield, Middletown
Develop public education program for property owner in inundation areas	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – College Corner Carrying to New Plan – Butler County, Monroe, Oxford, Sharonville, Trenton, Millville, New Miami Removed from Plan – Jacksonburg In Progress – Fairfield, Middletown, Hamilton, Seven Mile
Encourage local entities to include snow Emergency Management removal vehicles and equipment, salt storage facilities etc., in their local Capital Improve Emergency Management Plans (CIPs) and to consider shared use facilities and consumable materials (salt etc.) where appropriate	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Fairfield, College Corner Carrying to New Plan – Trenton, Jacksonburg, Millville In Progress – Butler County, Hamilton, Middletown, Monroe, Oxford, Sharonville, New Miami, Seven Mile
Ongoing briefings for public official officials regarding winter storm preparedness	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County, College Corner Carrying to New Plan – Trenton, Millville, New Miami Removed from Plan – Jacksonburg In Progress – Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Seven Mile
Work with local jurisdiction warming centers to assure all can be operational during winter storm events and extreme cold conditions (power outages, heating issues etc.)	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County, College Corner Carrying to New Plan – Hamilton, Oxford, Jacksonburg, Millville, New Miami In Progress – Fairfield, Middletown, Monroe, Sharonville, Trenton, Seven Mile
Continue to review and update existing warning sirens coverage county-wide and investigate needs for additional sirens	Butler County, Jacksonburg	Carrying to New Plan – Butler County, Jacksonburg
Continue to update tornado warning siren public Education program	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – College Corner Carrying to New Plan – Butler County, Trenton, Jacksonburg, Millville, New Miami In Progress – Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Seven Mile

Action	Jurisdiction	Status (Completed / Carrying to New Plan / Removed from Plan / In Progress)
Increase availability of Weather Radios, targeting the elderly and other vulnerable populations	Butler County	Carrying to New Plan
Provide training to the elderly regarding tornadoes safety and available supportive resources	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – College Corner Carrying to New Plan – Butler County, Hamilton, Trenton, Millville, New Miami Removed from Plan – Jacksonburg In Progress – Fairfield, Middletown, Monroe, Oxford, Sharonville, Seven Mile
Continue to evaluate the need for tornado safe rooms and shelter rooms at schools and critical facilities	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Carrying to New Plan – Hamilton, Trenton, Millville, New Miami Removed from Plan – Oxford, Jacksonburg In Progress – Butler County, Fairfield, Middletown, Monroe, Sharonville, College Corner, Seven Mile
Deliver National Weather Service weather spotter course	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County, Oxford, College Corner Carrying to New Plan – Sharonville, Trenton, Millville, New Miami Removed from Plan – Hamilton, Jacksonburg In Progress – Fairfield, Middletown, Monroe, Seven Mile
Continue to evaluate and implement tornado safe rooms and shelter rooms at Mobile Home communities	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Carrying to New Plan – Hamilton, Monroe, Trenton, Millville, New Miami Removed from Plan – Jacksonburg In Progress – Butler County, Fairfield, Middletown, Oxford, Sharonville, College Corner, Seven Mile
Investigate and develop shelters at parks, ball fields and other open public spaces	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – New Miami Carrying to New Plan – Monroe, Trenton, Millville Removed from Plan – Jacksonburg In Progress – Butler County, Fairfield, Hamilton, Middletown, Oxford, Sharonville, College Corner, Seven Mile
Establish MOUs with private contracts for the supply and distribution of water and ice in case of prolonged drought conditions and coordinate with Co EOP	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Carrying to New Plan – Hamilton, Oxford, Jacksonburg, Millville, New Miami In Progress – Butler County, Fairfield, Middletown, Monroe, Sharonville, Trenton, College Corner, Seven Mile
Develop a template for use by local fire and public service officials to help identify alternative water sources (i.e., lakes, ponds etc.) that can supplement firefighting efforts during dry and drought conditions	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – College Corner Carrying to New Plan – Hamilton, Oxford, Jacksonburg, Millville, New Miami In Progress – Butler County, Fairfield, Middletown, Monroe, Sharonville, Trenton, Seven Mile
Develop an educational campaign for public and business awareness/ preparation for drought conditions, including the increased risk of wildfires	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Fairfield, College Corner Carrying to New Plan – Hamilton, Monroe, Oxford, Millville, New Miami

Action	Jurisdiction	Status (Completed / Carrying to New Plan / Removed from Plan / In Progress)
		Removed from Plan – Butler County, Jacksonburg In Progress – Middletown, Sharonville, Trenton, Seven Mile
Investigate and secure funding for Dry force Fire hydrants in high-risk areas in the county	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – New Miami Carrying to New Plan – Hamilton, Monroe, Oxford, Trenton, Sharonville, Jacksonburg, Millville Removed from Plan – Fairfield, College Corner In Progress – Butler County, Middletown, Seven Mile
Coordination of tanker transportation of public potable water during droughts	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – College Corner Carrying to New Plan – Hamilton, Monroe, Oxford, Sharonville, Trenton, Jacksonburg, Millville, New Miami Removed from Plan – Butler County, Fairfield In Progress – Middletown, Seven Mile
Coordinate removal of dead trees and underbrush to reduce the risk of drought-related fires	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – New Miami, College Corner Carrying to New Plan – Butler County, Monroe, Oxford, Trenton, Millville Removed from Plan – Fairfield, Jacksonburg In Progress – Hamilton, Middletown, Sharonville, Seven Mile
Update potential earthquake impact information (HAZUS) and disseminate it to the public and implement a public awareness campaign to educate the public on earthquake preparedness	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County, College Corner Carrying to New Plan – Hamilton, Monroe, Oxford, Sharonville, Trenton, Jacksonburg, Millville, New Miami In Progress – Fairfield, Middletown, Seven Mile
Sustain capabilities of Butler County Tech Rescue Team (BCTRT) for incidences dealing with building collapse	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County, College Corner Carrying to New Plan – Oxford, Sharonville, Jacksonburg, Millville, New Miami In Progress – Fairfield, Hamilton, Middletown, Monroe, Trenton, Seven Mile
Continue to provide all necessary support and equipment for BCTRT and invest in enhanced technologies	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County, College Corner Carrying to New Plan – Oxford, Sharonville, Jacksonburg, Millville, New Miami In Progress – Fairfield, Hamilton, Middletown, Monroe, Trenton, Seven Mile
Based on identification of earthquake at-risk critical infrastructure, identify funding to implement earthquake risk reduction practices	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Carrying to New Plan – Fairfield, Hamilton, Monroe, Oxford, Sharonville, Trenton, Jacksonburg, Millville, New Miami Removed from Plan – College Corner In Progress – Butler County, Middletown, Seven Mile
Provide First Response and firefighter training for HazMat, rail, storage area and pipeline events	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County, New Miami, College Corner Carrying to New Plan – Oxford, Millville Removed from Plan – Jacksonburg

Action	Jurisdiction	Status (Completed / Carrying to New Plan / Removed from Plan / In Progress)
		In Progress – Fairfield, Hamilton, Middletown, Monroe, Sharonville, Trenton, Seven Mile
Regularly assess risks using Commodity Flow Studies	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Carrying to New Plan – Butler County, Hamilton, Monroe, Oxford, Trenton, Millville, New Miami Removed from Plan – Jacksonburg In Progress – Fairfield, Middletown, Sharonville, College Corner, Seven Mile
Develop a public education program for residents and business owners regarding Heat Emergencies	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – College Corner Carrying to New Plan – Butler County, Monroe, Oxford, Sharonville, Jacksonburg, Millville, New Miami In Progress – Fairfield, Hamilton, Middletown, Trenton, Seven Mile
Plan for and support cooling stations to serve high at-risk populations	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Completed – Butler County, College Corner Carrying to New Plan – Oxford, Sharonville Millville, New Miami Removed from Plan – Jacksonburg In Progress – Fairfield, Hamilton, Middletown, Monroe, Trenton, Seven Mile
Link Heat Emergencies with Emergency Operations Plan (EOP)	Butler County, Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Carrying to New Plan – Hamilton, Oxford, Sharonville, Trenton, Jacksonburg, Millville, New Miami In Progress – Butler County, Fairfield, Middletown, Monroe, College Corner, Seven Mile
Conduct system wide evaluation of stormwater infrastructure to identify projects that will reduce flooding in residential neighborhoods and City-owned right-of-way	Middletown	Carrying to New Plan

5.5.2 MITIGATION ACTION DEVELOPMENT

To identify mitigation actions, the HMP Planning Committee first reviewed the identified hazards and the mitigation goals and objectives. Based on the priorities and risk assessment results, mitigation actions were developed. Most importantly, the newly developed mitigation actions acknowledge the updated risk assessment information outlined in Section 4.

Mitigation Costs

The cost-effectiveness of each measure was a primary consideration for developing mitigation actions. Because mitigation is an investment to reduce future damages, it is important to select measures for which the reduced damages over the life of the measure are likely to be greater than the project cost. For structural projects, the level of cost-effectiveness is based primarily on the likelihood of damages occurring in the future, the severity of the damages when they occur, and the selected measure's level of effectiveness.

Throughout the development of the mitigation actions, the planning committee members were encouraged to consult the State of Ohio Mitigation Assistance Resource Guide. This document compiles all funding and administrative support that is available for use. Federal and state programs are identified, as well as each program's contact information, funding restrictions and criteria, and success stories when available.

As the jurisdictions begin to create a plan to complete their designated actions, they are strongly encouraged to continue to reference the resource guide to acquire funds.

While a detailed analysis was not conducted during the mitigation action development process, these factors were of primary concern when selecting measures. For measures that do not result in a quantifiable reduction of damages, such as public education and outreach, the relationship of the probable future benefits and the cost of each measure was considered when developing the mitigation actions.

New mitigation actions for the 2023 plan are found below:

TABLE 5-8 BUTLER COUNTY 2023 MITIGATION ACTIONS

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
1	Butler County	Health Related Emergencies	Build or purchase the space required to create a Butler County cache of emergency medical supplies and equipment for public health emergencies and medical surges.	Butler County General Health District	$2,000,000	Medium Term (2-3 years)	ASPR grant, CDC, ODH	9
2	Butler County	Severe Thunderstorms, Tornado, Severe Winter Storm, Earthquake	The loss of power for the County Coroner's Office would be a large impact to continue required operations. Deploy generators to the coroner's office to maintain continuity of operations.	Coroner's Administrator, Butler County EMA	$5,000	Near Term (0-1 year)	General fund, Capital Improvement Fund	10
3	Butler County	Flooding	Place public awareness signage at repetitive loss locations	EMA Director	Staff time and resources	Near Term (0-1 year)	Annual operating budget	9
4	Butler County	Tornado	Increase availability of Weather Radios, targeting the elderly and other vulnerable populations	EMA Director	$10,000	Medium Term (2-3 years)	FEMA HMGP, existing budget	7
5	Butler County Educational Service Center	Tornado	Tornado saferoom in school buildings to support staff and students	Butler County Educational Service Center Director	$100,000	Medium Term (2-3 years)	FEMA HMGP, OFCC grant	9
6	Butler County Educational Service Center	Hazardous Materials Incident	Implement a communication system to use during hazardous materials incidents in the community	Butler County Educational Service Center Director, Butler County EMA Director	$100,000	Medium Term (2-3 years)	FEMA HMGP, OFCC grant	9
7	Butler County, Cities of Fairfield, Hamilton, Middletown	Severe Thunderstorm	Significant Building and Critical Infrastructure Sustainability: Identify historic /architecturally significant buildings and critical infrastructure that may need structural upgrades to withstand severe weather events	County EMA, Engineer, City Zoning Departments	Staff time and resources	Near Term (0-1 year)	Existing budgets, support from Butler County Historical Society	10
8	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	All hazards	Emergency Notification: Investigate new notification options including media/social media and by connecting partners Education i.e., emergency utility shutoffs (gas, water, electricity	County EMA, IT City Public Information Officers, Village Public Information Offices	$3,000	Near Term (0-1 year)	Existing budgets	8
9	Butler County, Cities of Fairfield, Hamilton,	All hazards	Stricter Building Codes: Investigate and support the update of building codes to achieve sustainable buildings and structures to severe	County EMA, Building Department, City	$10,000	Medium Term (2-3 years)	FEMA BRIC, existing budgets	7

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
	Middletown, Monroe, Oxford, Trenton, Villages of College Corner, Millville, New Miami, Seven Mile		weather, flooding and other natural hazards. Priority focus on manufactured and mobile housing code enhancements	Zoning Departments, Village Councils				
10	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of College Corner, Millville, New Miami, Seven Mile	All hazards	Manufactured Housing Standards: Integrate and support zoning and health department priority focus on upgraded standards for manufactured and mobile housing codes	County Building Department, General Health District, City Zoning Departments, Village Councils	Staff time and resources	Near Term (0-1 year)	Existing budgets	4
11	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Millville, New Miami, Seven Mile	Flooding	Develop a public education program for residents and business owners located in flood prone areas regarding river setbacks, erosion, safe egress, and other soil/flood related issues	County Floodplain Manager, City Floodplain Managers, Village Floodplain Managers	$5,000	Near Term (0-1 year)	Existing budgets	6
12	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	Flooding	Monitor and maintain list of Butler Co communities to assure full participation in NFIP	County EMA, Floodplain Manager, City Floodplain Managers, Village Floodplain Managers	Staff time and resources	Near Term (0-1 year)	Existing budgets	9

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
13	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of College Corner, Millville, New Miami, Seven Mile	Flooding	Use alternative storm water retention strategies, like Rain Gardens where appropriate	County Engineer, City Councils, Village Councils	$75,000	Medium Term (2-3 years)	Incorporated into project costs – existing budgets	7
14	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Millville, New Miami, Seven Mile	Dam/Levee Failure	Develop public education program for property owner in inundation areas	County EMA, City Planning Departments, Village Councils	$3,000	Near Term (0-1 year)	Existing budgets	10
15	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	Tornado	Continue to update tornado warning siren public Education program	County EMA, City Public Information Officers, Village Public Information Officers	Staff time and resources	Near Term (0-1 year)	Existing budgets	8
16	Butler County, Cities of Fairfield, Hamilton, Middletown,	Tornado	Provide training to the elderly regarding tornadoes safety and available supportive resources	County EMA, City Administrators, Village Administrators	Staff time and resources	Near Term (0-1 year)	Existing budgets	10

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
	Monroe, Oxford, Sharonville, Trenton, Villages of Millville, New Miami, Seven Mile							
17	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Sharonville, Trenton, Villages of College Corner, Millville, New Miami, Seven Mile	Tornado	Continue to evaluate the need for tornado safe rooms and shelter rooms at schools and critical facilities	County EMA, City Fire Chiefs, Village Fire Chiefs	$5,000	Medium Term (2-3 years)	Existing budgets	7
18	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of College Corner, Millville, New Miami, Seven Mile	Tornado	Continue to evaluate and implement tornado safe rooms and shelter rooms at Mobile Home communities	County EMA, Engineer, City Public Works Departments, Village Councils	$1,000	Medium Term (2-3 years)	Existing budgets	8
19	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of College Corner,	Tornado	Investigate and develop shelters at parks, ball fields and other open public spaces	County EMA, City Councils, Village Councils	$50,000	Medium Term (2-3 years)	FEMA HMGP, existing budgets	9

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
	Millville, Seven Mile							
20	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Drought	Establish MOUs with private contracts for the supply and distribution of water and ice in case of prolonged drought conditions and coordinate with Co EOP	County EMA, City Councils, Village Councils	Staff time and resources	Near Term (0-1 year)	Existing budgets	9
21	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	Drought	Develop a template for use by local fire and public service officials to help identify alternative water sources (i.e., lakes, ponds etc.) that can supplement firefighting efforts during dry and drought conditions	County EMA, City Fire Chiefs, Village Fire Chiefs	$10,000	Long Term (4-5 years)	Existing budgets	5
22	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	Earthquake	Continue to provide all necessary support and equipment for BCTRT and invest in enhanced technologies	County EMA, City Fire Chiefs, Village Fire Chiefs	$25,000	Long Term (4-5 years)	Existing budgets	7

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
23	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	Earthquake	Based on identification of earthquake at-risk critical infrastructure, identify funding to implement earthquake risk reduction practices	County EMA, City Grant Writers, Village Mayors	$5,000	Long Term (4-5 years)	Existing budgets	5
24	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of College Corner, Millville, New Miami, Seven Mile	Earthquake	Regularly assess risks using Commodity Flow Studies	County EMA, City GIS Departments, Village Councils	Staff time and resources	Long Term (4-5 years)	Existing budgets	7
25	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	Extreme Temperatures	Develop a public education program for residents and business owners regarding Heat Emergencies	County EMA, City Public Information Officers, Village Public Information Officers	Staff time and resources	Near Term (0-1 year)	Existing budgets	9
26	Butler County, Cities of Fairfield, Hamilton,	Extreme Temperatures	Link Heat Emergencies with Emergency Operations Plan (EOP)	County EMA, Planning Department, City Planning	Staff time and resources	Near Term (0-1 year)	Existing budgets	10

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
	Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of College Corner, Jacksonburg, Millville, New Miami, Seven Mile			Departments, Village Councils				
27	Butler County, Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of College Corner, Jacksonburg, Millville, New Miami, Seven Mile	Flooding	Acquire, demolish, and/or retrofit all flood-prone properties in the planning area	Butler County EMA, City Mayors, Village Mayors	$300,000 per property	Long Term (4-5 years)	FEMA FMA/HMGP/BRIC, local revenue for match	10
28	Butler County, Cities of Fairfield, Hamilton, Monroe, Oxford, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	All hazards	Public awareness: Update all printed material into electronic format for use on media and social media. Priority focus on severe weather, tornadoes, and flooding	County EMA, IT, City Public Information Officers, Village Public Information Officers	$4,000	Medium Term (2-3 years)	Existing budget	9
29	Butler County, Cities of Fairfield, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Millville, New Miami, Seven Mile	Flooding	Identify and GIS/inventory structures subject to flood damage, including critical facilities and repetitive loss properties	County EMA, City Floodplain Administrators, Village Floodplain Administrators	Staff time and resources	Near Term (0-1 year)	Existing budgets	10

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
30	Butler County, Cities of Fairfield, Middletown, Oxford	Dam/Levee Failure	GIS Class I and II dams and their potential inundation zones	County EMA, City Planning Departments	$5,000	Near Term (0-1 year)	Existing budgets	10
31	Butler County, Cities of Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	All hazards	Build Disaster Recovery Support Network	County EMA, City Mayors, Village Mayors	Staff time and resources	Long Term (4-5 years)	Existing budgets	6
32	Butler County, Cities of Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of College Corner, Millville, New Miami, Seven Mile	Flooding	Link flood/hydraulic modeling monitoring to real-time maps and promote their availability	County EMA and Zoning Department, City Floodplain Managers and Zoning Departments, Village Floodplain Managers	$15,000	Near Term (0-1 year)	FEMA FMA, existing budgets	9
33	Butler County, Cities of Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of College Corner, Millville, New Miami, Seven Mile	Flooding	Investigate new technologies for flood prevention and diversion	County EMA, Engineer, City Public Works Departments, Village Public Works Departments	$15,000	Long Term (4-5 years)	Existing budgets	7
34	Butler County, Cities of Hamilton, Middletown, Monroe, Oxford,	Flooding	Encourage residents to secure available FEMA Flood Insurance	County EMA, City Public Information Officers, Village Public Information Officers	Staff time and resources	Near Term (0-1 year)	Existing budgets	7

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
	Sharonville, Trenton, Villages of College Corner, Millville, New Miami, Seven Mile							
35	Butler County, Cities of Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	Severe Winter Storm	Encourage local entities to include snow Emergency Management removal vehicles and equipment, salt storage facilities etc., in their local Capital Improve Emergency Management Plans (CIPs) and to consider shared use facilities and consumable materials (salt etc.) where appropriate	County EMA, City Public Works Departments and Councils, Village Public Works Departments and Councils	Staff time and resources	Near Term (0-1 year)	Existing budgets	10
36	Butler County, Cities of Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg, Millville, Seven Mile	Drought	Investigate and secure funding for Dry force Fire hydrants in high-risk areas in the county	County EMA, City Fire Chiefs, Village Fire Chiefs	$75,000	Long Term (4-5 years)	FEMA BRIC, existing budgets	6
37	Butler County, Cities of Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Millville, Seven Mile	Drought	Coordinate removal of dead trees and underbrush to reduce the risk of drought-related fires	County EMA, City Councils, Village Councils	$5,000	Near Term (0-1 year)	Existing budgets	10
38	Butler County, Cities of Hamilton,	Severe Thunderstorm	Back-up Generators: Critical Facilities Plan. Develop coordinated back-up generator plan for all critical facilities	County EMA, Engineer, City Fire	$7,500	Long Term (4-5 years)	Existing budgets	7

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
	Monroe, Trenton, Villages of Millville, New Miami, Seven Mile			Chiefs, Village Fire Chiefs				
39	Butler County, City of Sharonville, West Chester Township	Flooding	There is an area along the southern border of the county, along Crescentville Road, that floods. Construct and replace several structures located in the area and create a large retention basin.	Butler County Engineer's Office, City of Sharonville Public Safety Director, West Chester Township Trustees	$10,000,000	Medium Term (2-3 years)	FEMA FMA/BRIC, local match from county general budget	5
40	Butler County, Village of Jacksonburg	Tornado	Continue to review and update existing warning sirens coverage county-wide and investigate needs for additional sirens	County EMA, Village Mayor	$7,500	Near Term (0-1 year)	Existing budgets	6
41	Christ Hospital Liberty Township	Health Related Emergencies	Supply Emergency Department with high-level respirators and hazmat suits for ability to care for patients	Emergency Management Department	$150,000	Near Term (0-1 year)	Hospital budget	6
42	Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of College Corner, Jacksonburg, Millville, New Miami, Seven Mile	All hazards	Mitigation activity funding: Apply for funding to implement top priority mitigation projects	City councils, village councils	Staff time and resources	Long Term (4-5 years)	FEMA BRIC/HMGP, CDBG	10
43	Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	All hazards	Maintain NWS "Severe Weather Ready" County status	City Administrators, Village Administrators	Staff time and resources	Near Term (0-1 year)	Existing budgets	6

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
44	Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	Severe Thunderstorm	Tree Maintenance: Continue to coordinate with utility companies	City Public Works Departments, Village Councils	Staff time and resources	Near Term (0-1 year)	Existing budgets	10
45	Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	Severe Thunderstorm	Enhance public awareness and preparation for severe weather: Update written info into media and social media platforms and include straight-line winds and lightning	City Public Information Officers, Village Public Information Officers	$15,000 per generator	Long Term (4-5 years)	FEMA HMGP, existing budgets	8
46	Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Millville, New Miami, Seven Mile	Severe Winter Storm	Ongoing briefings for public official officials regarding winter storm preparedness	City Councils, Village Councils	Staff time and resources	Near Term (0-1 year)	Existing budgets	9
47	Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg,	Severe Winter Storm	Work with local jurisdiction warming centers to assure all can be operational during winter storm events and extreme cold conditions (power outages, heating issues etc.)	City Fire Chiefs, Village Fire Chiefs	Staff time and resources	Near Term (0-1 year)	Existing budgets	10

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
	Millville, New Miami, Seven Mile							
48	Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	Earthquake	Update potential earthquake impact information (HAZUS) and disseminate it to the public and implement a public awareness campaign to educate the public on earthquake preparedness	City Public Information Officers, Village Public Information Officers	$3,000	Near Term (0-1 year)	Existing budgets	9
49	Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	Earthquake	Sustain capabilities of Butler County Tech Rescue Team (BCTRT) for incidences dealing with building collapse	City Fire Chiefs, Village Fire Chiefs	$10,000	Long Term (4-5 years)	Existing budgets	6
50	Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Millville, Seven Mile	Earthquake	Provide First Response and firefighter training for HazMat, rail, storage area and pipeline events	City Fire Chiefs, Village Fire Chiefs	Staff time and resources	Medium Term (2-3 years)	Existing budgets	5
51	Cities of Fairfield, Hamilton, Middletown, Monroe, Oxford, Sharonville,	Extreme Temperatures	Plan for and support cooling stations to serve high at-risk populations	City Councils, Village Councils	Staff time and resources	Near Term (0-1 year)	Existing budgets	10

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
	Trenton, Villages of Millville, New Miami, Seven Mile							
52	Cities of Fairfield, Hamilton, Middletown, Monroe, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	All hazards	IPAWS Web app Implementation: Apply for funding and implement this program	City Administrators, Village Administrators	Staff time and resources	Near Term (0-1 year)	Existing budgets	6
53	Cities of Fairfield, Hamilton, Middletown, Monroe, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	All hazards	Update list of Emergency shelters	City Administrators, Village Administrators	Staff time and resources	Near Term (0-1 year)	Existing budgets	10
54	Cities of Fairfield, Hamilton, Middletown, Monroe, Sharonville, Villages of Jacksonburg, Millville, New Miami, Seven Mile	All hazards	Coordinate fuel for hazard mobilization efforts	City Public Works Departments, Village Public Works Departments	Staff time and resources	Near Term (0-1 year)	Existing budget	9
55	Cities of Fairfield, Middletown, Monroe, Sharonville, Trenton, Villages of Millville, New Miami, Seven Mile	Tornado	Deliver National Weather Service weather spotter course	City and Village Administrators	$5,000	Near Term (0-1 year)	NWS, existing budgets	9

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
56	Cities of Fairfield, Middletown, Oxford	Dam/Levee Failure	Develop and exercise emergency action plans, including evacuation plans, in the event of a dam/levee failure	City Planning Departments	$10,000 per plan	Near Term (0-1 year)	ODNR, existing budgets	10
57	Cities of Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Millville, New Miami, Seven Mile	Drought	Develop an educational campaign for public and business awareness/ preparation for drought conditions, including the increased risk of wildfires	City Fire Chiefs, Village Fire Chiefs	Staff time and resources	Medium Term (2-3 years)	Existing budgets	7
58	Cities of Hamilton, Middletown, Monroe, Oxford, Sharonville, Trenton, Villages of Jacksonburg, Millville, New Miami, Seven Mile	Drought	Coordination of tanker transportation of public potable water during droughts	City Fire Chiefs, Village Fire Chiefs	Staff time and resources	Medium Term (2-3 years)	Existing budgets	7
59	City of Fairfield	Flooding	Remove homes that are located in flood-prone and flood zones.	City of Fairfield Public Works Director	$250,000 per house	Medium Term (2-3 years)	FEMA FMA/HMGP/BRIC, local match from general fund	9
60	City of Fairfield	Tornado	Construct safe rooms in mobile homes parks located in the city and municipal parks.	City of Fairfield Fire Chief	$100,000 per safe room	Long Term (4-5 years)	FEMA HMGP/BRIC, local match from general fund	9
61	City of Fairfield	Dam/Levee Failure	Add flood protection to structures and natural areas in inundation zones of the two HHPDs owned by the city – berms, floodwalls and/or floodproofing are all options to be explored and implemented to minimize the city's vulnerability to and from HHPDs.	Mayor, Public Service Director	$5,000,000	Long Term (4-5 years)	FEMA HHPD, local revenue for match	10
62	City of Fairfield, Villages of Millville and New Miami	Flooding	Develop Mitigation Projects to mitigate FEMA identified repetitive loss susceptible structures	City Floodplain Manager, Village Floodplain Managers	$50,000	Long Term (4-5 years)	FEMA BRIC/FMA, existing budgets	7
63	City of Hamilton	Tornado	Improve the public notification systems in place to alert of impending tornado event, especially in highly populated areas such as school buildings.	City of Hamilton Safety Director	$100,000	Medium Term (2-3 years)	FEMA BRIC, local match from general fund	7

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
64	City of Middletown	Tornado	Incorporate tornado shelters into new fire houses.	City Fire Chief	$200,000	Medium Term (2-3 years)	Levy passed by voters	7
65	City of Middletown	Flooding	Conduct system wide evaluation of stormwater infrastructure to identity projects that will reduce flooding in residential neighborhoods and City-owned right-of-way.	Public Works Department	$100,000	Long Term (4-5 years)	FEMA BRIC/HMGP/FMA, local annual budget for match	10
66	City of Monroe	Tornado, Severe Thunderstorm, Flooding, Extreme Temperatures, Severe Winter Storm, Earthquakes, Hazardous Materials Incident	Increase the use of social media to warn residents and visitors of extreme weather and man-made events.	City Manager's Office	$5,000	Near Term (0-1 year)	City budget through tax collection	10
67	City of Monroe	Tornado, Severe Thunderstorm, Flooding, Extreme Temperatures, Severe Winter Storm, Earthquake	Procure portable generators that can be used in extreme weather events for critical infrastructure not protected.	Public Works	$300,000	Medium Term (2-3 years)	FEMA HMGP, local annual budget	7
68	City of Monroe	Severe Winter Storms	Enhance existing snow removal equipment and supplies	Public Works	$200,000	Medium Term (2-3 years)	Revenue through local taxes	7
69	City of Monroe, Village of Seven Mile	Flooding	Develop Mitigation Projects to mitigate structures and critical facilities in designated floodplain areas	City Floodplain Manager, Village Floodplain Manager	$25,000	Long Term (4-5 years)	FEMA FMA, existing budget	7
70	City of Oxford	Hazardous Materials Incidents	The only fire station in the city is located next to railroad tracks, creating a high hazardous materials risk for the critical facility. Relocate the fire station a safe distance from the railroad tracks and any other hazard-prone area to protect the facility.	City of Oxford Fire/EMS Chief	$5,000,000	Medium Term (2-3 years)	FEMA HMGP, local match from general fund	9

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
71	City of Oxford	Tornado	There is a large mobile home park located on College Corner Pike, and there is no shelter or sturdy buildings in the general area for residents of the mobile home park to go to. Create a storm shelter near the mobile home park – possibly at Merry Day Park.	City of Oxford Service Director	$1,000,000	Near Term (0-1 year)	FEMA HMGP, local match from general fund	8
72	City of Sharonville	Severe Thunderstorms, Flooding	Minimize the amount of infrastructure exposed to flood hazard by creating/revising existing plans and maps for the community.	City Council	$350,000	Medium Term (2-3 years)	FEMA FMA, city budget	9
73	City of Trenton	Hazardous Materials Incidents	There is a railroad that cuts the city in half, constantly hauling hazardous materials freight. To prepare for a derailment, the fire department will need to obtain gear and resources.	City of Trenton Fire Chief	$250,000	Near Term (0-1 year)	Firefighter Exposure to Environmental Elements Grants Program, FEMA FP&S	10
74	City of Trenton, Village of College Corner	Severe Thunderstorm	Back-up Generators: Funding. Seek funding for backup generators for all critical facilities in the county	City Administrator, Village Fire Chief	Staff time and resources	Long Term (4-5 years)	FEMA HMGP, OEMA, CDBG, OPWC	7
75	Fairfield Township	Flooding	Current focus is to mitigate the flooding of five homes in the township. Prepare grant applications to seek financial support to relocate, retrofit, or remove homes vulnerable to flooding.	Township Administration, Zoning Department	$500,000	Medium Term (2-3 years)	FEMA FMA, CDBG, township funds	10
76	Liberty Township	Flooding	Conduct a flood assessment study along Gregory Creek at Kyle's Station Road and Hamilton-Mason Road	Township Trustees	$15,000	Near Term (0-1 year)	Township special purpose taxes revenue, general fund	9
77	Reily Township	Tornado	Construct tornado sirens in the township in areas that are not currently covered by sirens.	Township Trustees	$50,000	Medium Term (2-3 years)	FEMA HMGP, local match from general fund	6
78	Reily Township	Flooding	Indian Creek flooding impacts the township. Conduct a flooding study in the area to identify potential solutions to the flooding problem.	Township Trustees	$20,000	Long Term (4-5 years)	Operating budget	7
79	Shared Harvest Foodbank	Severe Thunderstorms, Tornadoes, Flooding, Extreme Temperatures, Severe Winter Storms, Earthquake,	Displaced people following a severe hazard event will need prepared meals and/or immediate access to food and personal care supplies. Distribute food and personal care supplies to those in need following a disaster. Specifically, disperse prepared meals by a mobile kitchen or a refrigerated truck.	Executive Director of Shared Harvest Foodbank	$200,000	Near Term (0-1 year)	Annual operating budget, donations, staff time and resources	10

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
		Dam/Levee Failure						
80	St. Clair Township, Butler County	Hazardous Materials Incident	Build what's being called the "Cedar Grove Connector," a simple project proposed by the Butler County Engineer. The Cedar Grove neighborhood, consisting of 215 homes, is routinely blocked from ingress/egress at its three grade crossings of the Norfolk Southern mainline. In need of Fire/EMS, or in need of evacuation due to derailment and release of hazardous materials, the neighborhood could be completely cut off. The risk of a mass-casualty event is unnecessarily high. The "Connector" would run from West Taylor School Road to West Elkton road and eliminate the need to cross tracks getting into-out of Cedar Grove.	Township Trustees, Butler County Engineer	$3,000,000	Near Term (0-1 year)	County Commissioner Allocation	9
81	Talawanda School District	Hazardous Materials Incident	Talawanda School District has train tracks directly behind the school. There is a potential risk with hazardous chemicals if there were to be a train derailment. Develop a continuity of operations plan that guides the work from the time of the incident through return to normal operations.	School Board, Butler County EMA Director	$25,000	Near Term (0-1 year)	Butler County, School funds	8
82	The Christ Hospital – Liberty	Health Related Emergencies	Cache of supplies and transportation of residents as needed to other facilities during a health related emergency	The Christ Hospital – Liberty EMS Coordinator, The Health Collaborative	$1,000,000	Medium Term (2-3 years)	Ohio Department of Health Healthcare, Hospital revenue	6
83	The Christ Hospital – Liberty	Hazardous Materials Incidents	Prepare the Emergency Department to provide decontamination to large number of patients after exposure to various possible hazardous materials in a decontamination tent.	The Christ Hospital – Liberty Emergency Department, The Health Collaborative	$100,000	Near Term (0-1 year)	The Health Collaborative and Hospital funds	6
84	UC West Chester Hospital	Health Related Emergencies	Build up, inventory, and allocate a supply cache for the county and hospitals in the region.	UC West Chester Hospital EMS Program Manager, The Health Collaborative	$1,000,000	Medium Term (2-3 years)	ASPR, Hospital revenue	6
85	Village of College Corner	Tornado	Tornado safe room at the fire station	Village Fire Chief	$15,000	Medium Term (2-3 years)	FEMA BRIC, local annual budget	7
86	Village of College Corner	Severe Thunderstorm	Generator connection for the fire station	Village Fire Chief	$1,000	Medium Term (2-3 years)	Local general funds	10

Mit. Action #	Community	Hazard(s) Addressed	Action	Responsible Party	Cost	Timeframe	Potential Funding Sources	Priority
87	Village of College Corner	Flooding	Improve stormwater drainage in the village.	Village Fire Chief	$40,000	Long Term (4-5 years)	FEMA BRIC, local annual budget	10
88	Village of Jacksonburg	Tornado	Construct a tornado siren for the village and surrounding area.	Jacksonburg Village Council	$50,000	Medium Term (2-3 years)	FEMA HMGP, local match from general fund	10
89	Village of Millville	Flooding	Smaller creeks have been more prone to flooding. Develop a flood committee that meets regularly to discuss the flooding issues within the village and identify solutions.	Millville Mayor	Staff time and resources	Medium Term (2-3 years)	Village annual operating fund	6
90	Village of New Miami	Flooding	Reinforce Seven Mile Avenue along Four Mile Creek with concrete structures to reduce the vulnerability of the road to streambank erosion.	Streets Commissioner & Village Council	$500,000	Near Term (0-1 year)	FEMA FMA/HMGP/BRIC, local annual budget for match	10
91	Village of New Miami	Tornado	Alert the public that the Town Hall has a basement that can be used as a tornado shelter.	Village Social Media Operator	Staff time and resources	Near Term (0-1 year)	Local annual operating budget	10
92	Village of New Miami	Extreme Temperatures	Alert the public that the Town Hall has heating and air conditioning. The Town Hall can be used as a heating or cooling center for residents in need during an extreme temperature event.	Village Social Media Operator	Staff time and resources	Near Term (0-1 year)	Annual village operating budget	10
93	Village of Seven Mile	Flooding	Get waterways opened up on the north end of the village. Add new stormwater sewer on East Ritter headed west towards the creek. Clean out ditches on the south end of town to keep Jumper and Mill Streets from flooding. Open up waterways on the east side of the village so the houses on East Ritter won't flood annually.	Village Council	$3,000,000	Near Term (0-1 year)	FEMA BRIC/HMGP/FMA, local funds for match	10
94	West Chester Township	Flooding	Increase the structure of Mill Creek to ensure the water remains in the creek during flooding events.	Butler County EMA Director, Township Trustees	$10,000,000	Medium Term (2-3 years)	FEMA FMA	3

SECTION 6. PLAN IMPLEMENTATION AND MAINTENANCE

As a living document, it is important that this plan becomes a tool for county resources to ensure possible damage from a hazard event is reduced. This section discusses plan adoption, implementation, monitoring, evaluating, and updating the HMP. Plan implementation and maintenance procedures will ensure that the HMP remains relevant and continues to address the changing environment in Butler County. This section describes the incorporation of the HMP into existing planning mechanisms, and how the planning committee will continue to engage the public.

1. PLAN ADOPTION

Butler County adopted the 2023 Butler County Hazard Mitigation Plan on MONTH DAY, YEAR.

TABLE 6-1 DATES OF 2023 BUTLER COUNTY HMP ADOPTION

Jurisdiction	Adoption Date
Butler County	
Fairfield	
Hamilton	
Middletown	
Monroe	
Oxford	
Sharonville	
Trenton	
College Corner	
Jacksonburg	
Millville	
New Miami	
Seven Mile	

The 2023 Butler County HMP expires on MONTH DAY, YEAR.

2. EVALUATION, MONITORING AND UPDATING

Monitoring, evaluating, and updating this plan is critical to maintaining its value and success in completing identified mitigation efforts. The effective implementation of mitigation activities paves the way for continued momentum in the planning process and gives direction for the future. This section explains who will be responsible for maintenance activities and what those responsibilities entail. It also provides a methodology and schedule for maintenance activities and describes how the public will be involved on a continued basis.

The Butler County Hazard Mitigation Planning Committee (HMPC) established for this 2023 plan is designated to lead the plan maintenance processes of monitoring, evaluation and updating, with

support and representation from all participating municipalities. The HMPC will coordinate maintenance efforts, but the input needed for effective periodic evaluations will come from county-wide representatives and other important stakeholders as well as the general public.

The HMPC will oversee the progress made on the identified action items and will modify actions, as needed, to reflect changing conditions. The HMPC will meet annually to evaluate the plan and discuss specific coordination efforts that may be needed.

The annual evaluation of the 2023 Plan will include not only an investigation of whether mitigation actions were completed, but also an assessment of how effective those actions were in mitigating losses. A review of the qualitative and quantitative benefits (or avoided losses) of mitigation activities will support this assessment. Results of the evaluation will then be compared to the goals and objectives established in the plan; The committee will lead decisions on whether to discontinue or modify actions in any way, in light of new developments. The Hazard Mitigation Planning Committee will document progress for use in the next Hazard Mitigation Plan update. Finally, the Mitigation Planning Committee will monitor and integrate elements of this plan into other planning mechanisms.

This plan will be updated by the FEMA-approved 5-year anniversary date, as required by the Disaster Mitigation Act of 2000, or following a disaster event. Future plan updates will account for any new hazard vulnerabilities, special circumstances, or new information that becomes available. During the 5-year review process, the following questions will be considered as criteria for assessing the effectiveness of the HMP.

- Has the nature or magnitude of hazards affecting the county changed?
- Are there new hazards that have the potential to impact the county?
- Do the identified goals and actions address current and expected conditions?
- Have mitigation actions been implemented or completed?
- Has the implementation of identified mitigation actions resulted in expected outcomes?
- Are current resources adequate to implement the plan?
- Should additional resources be committed to address identified hazards?

Issues that arise during monitoring and evaluation which require changes to the local hazard, risk and vulnerability summary, mitigation strategy, and other components of the plan will be incorporated during future updates.

Update process for plan prior to 5-year update: Anyone interested in updating this plan sooner than the 5-year update will submit a request to the HMPC for consideration. The request should be accompanied by a detailed rationale. The request will be evaluated, and the committee will determine whether or not to act on the update request. If the decision is to act, an individual will be assigned to author the update. A draft of the updated section, along with a detailed rationale, will be

submitted to the Mitigation Planning Committee. The committee will circulate the draft updated section for comment, and after an appropriate period of time, the committee will decide whether to update the plan, at least partially based on the feedback received.

3. PLAN UPDATE AND MAINTENANCE

This section describes the schedule and process for monitoring, evaluating, and updating the 2023 HMP.

6.3.1 SCHEDULE

Monitoring the progress of the mitigation actions and evaluating the effectiveness of the plan will be ongoing throughout the 5-year period between the adoption of the HMP and the next update process. The HMPC will meet annually to monitor the status of the mitigation actions and to develop updates as necessary.

The HMP will be updated every 5 years, as required by DMA 2000. The update process will begin at least 1 year before the HMP expires. However, the HMPC will reconvene within 30 days of any significant disaster that affects the county, to review and update the HMP as appropriate.

6.3.2 PROCESS

The HMPC will coordinate with the responsible agencies/organizations identified for each mitigation action. These agencies/organizations will monitor and evaluate the progress made on the mitigation actions for which they are responsible and report to the HMPC annually. Working with the HMPC, these responsible agencies/organizations will be asked to assess the effectiveness of the mitigation actions and modify the mitigation actions as appropriate.

The next plan update will be initiated by the Butler County EMA Director and will be overseen by the HMPC. Future updates to the HMP will account for any new hazard vulnerabilities, special circumstances, or new information that become available. Issues that arise while monitoring and evaluating the HMP, which require changes to the risk assessment, mitigation strategy and other components of the HMP, will be incorporated into the next update of the HMP. The questions identified above would remain valid while the update is prepared.

Public Involvement

At all stages of the plan maintenance process, the public of Butler County will be invited to participate. Before the HMP's annual review and after major disaster events, when the HMP is revisited, the public will be invited through *Hamilton Journal-News*, posts on social media, and flyers posted at the Butler County Court House.

Any comments received will be logged and then addressed within the main document of the plan. A new version of the plan will be created and saved for each round of major edits.

6.3.3 INCORPORATION INTO EXISTING PLANNING MECHANISMS

An important implementation mechanism is to incorporate the recommendation and underlying principles of the HMP into planning and development such as capital improvement budgeting,

general plans and comprehensive plans. Mitigation is most successful when it is incorporated within the day-to-day functions and priorities of the entity attempting to implement risk-reducing actions. The integration of a variety of departments and agencies on the HMPC provides an opportunity for constant and pervasive efforts to network, identify, and highlight mitigation activities and opportunities. This collaborative effort is also important to monitor funding opportunities that can be leveraged for the mitigation actions.

Past Integration

- **Butler County Subdivision Regulations:** Revised March 12, 2018, the regulations integrated several hazard-related definitions, considerations to minimize flooding impacts, and the involvement of stakeholders who may have zoning or other regulations where a preliminary plat is proposed.

- **Butler County Rural Zoning Resolution:** Revised on November 21, 2022, the regulations for land use and development in Butler County integrated the previous plan's themes of protecting property and people from hazard impacts through zoning ordinance.

- **City of Fairfield Comprehensive Plan:** Fairfield Forward, adopted in December 2019, provides a critical, strategic framework for future growth and community resources to ensure a high quality of life can be sustained for years to come. The future land use goals of the city ensure the mapped floodplains of the city are not targeted for development and integrates the previous HMPs flood zones as well as involves the city's floodplain administrator.

- **City of Fairfield Connectivity Master Plan:** Fairfield Connects, finalized in 2020, was developed as a response to the public input during the city's comprehensive plan's planning process. The Fairfield Connects Plan focused on macrolevel routing strategies that would develop stronger linkages between neighborhoods, schools, and other community destinations such as the Town Center, parks, and commercial destinations. As part of this effort, the project team conducted an analysis of existing conditions within the community, explored best practices and common facility types that could help to improve active transportation connectivity, and determined which corridors and connections would make desirable routes linking key areas within Fairfield. The plan integrated the mapped floodplain on where to continue to develop and add connectivity for scenic views that would also minimize impacts should a flood or flash flood event occur.

- **City of Hamilton Comprehensive Plan:** Plan Hamilton, approved by City Council in 2019, has identified key policy topics important to the community; set goals for each policy; and identified the actions needed to work toward those goals. This plan attempts to balance quality of life and livability, economic health and prosperity, private property needs, and public fiscal responsibility through a consensus building process that allowed the public to determine the future direction of Hamilton. The hazard areas identified in the previous HMP as well as actions to reduce vulnerabilities were integrated into applicable sections of Plan Hamilton.

- **City of Hamilton Zoning Ordinance:** Revised on July 14, 2023, the City of Hamilton's Zoning Ordinance includes general ordinance provisions, zoning map and land uses, development standards, zoning districts, and planned development regulations. The city referenced the previous HMP to identify actions focused on development in the floodplain and how to approach zoning regulations to ensure future development does not increase the city's vulnerability.
- **City of Middletown Comprehensive Plan:** Destination Middletown, approved April 19, 2022, represents an aspirational vision for the community as a whole that is grounded in reality and framed by past planning efforts. It is a statement of goals and intent. It should be used as a guide for making development decisions and as a basis for establishing priorities and yearly work plans. The plan pulled content, ideas, themes, and actions from several of the city's existing plans, including the previous HMP for Butler County.
- **City of Middletown Development Code:** Effective November 4, 2022, the updated code includes general provisions, zoning districts and use regulations, development standards, and open space protections. The previous HMPs identified high hazard areas were integrated into the code's update to protect development and people alike from impacts.
- **City of Monroe Comprehensive Plan:** Adopted on September 21, 2021, Advance Monroe articulates the long-term vision of Monroe residents, businesses, and institutions. The plan provides policies that reinforce this collective vision by directing future development to strengthen the city and create exceptional places for its people. Hazard mitigation was integrated into the zoning classification transition development, mapped floodplains in the city and deterrent of development, and how to develop without increasing the city's vulnerability.
- **City of Oxford Comprehensive Plan:** Oxford Tomorrow, adopted by City Council on January 17, 2023, is defined as the broad policy guide for the City of Oxford and its community partners in successfully guiding future decision-making. It is also the blueprint for the City Council, boards and commissions, and staff as they evaluate land use, development, redevelopment, annexation, and infrastructure decisions as well as the character, location, and extent of public investments and private development proposals in the city. The previous HMP was integrated as one of the Guiding Pillars of the plan: Environmental Sustainability – embodying environmental stewardship and shaping a more resilient future. Several elements of the previous HMP were then included Oxford Tomorrow to further define how the city will increase its resiliency.
- **City of Sharonville Comprehensive Plan:** Sharonville 2030, adopted September 8, 2020, has several elements of both Butler and Hamilton counties' previous HMPs integrated into its content. The first theme of the plan, Pursue Responsible Community Development, ensures that the city will continue to enforce zoning and codes of the city to regulate and protect development as well as mitigate runoff and flooding issues that can help spur investment

and reduce insurance costs for property owners. Furthermore, flood mitigation is integrated into implementation strategies of the plan.

- **City of Sharonville Planning and Zoning Code:** Effective June 9, 2022, the updated code includes general provisions, zoning districts, land uses, PUDs, development standards, as well as a zoning map. The updated code references the two HMPs that the city is located in and establishes regulations around the various profiled hazards to minimize impacts on new construction, structures, and infrastructure.

There have not been any other planning mechanisms developed by the previous plan's participants during the previous plan's lifespan.

Future Integration

- **Capital Improvement Plans:** Plans that involve the upgrade of existing infrastructure provide an excellent opportunity for the county and communities that have or develop these plans in the next five years to build in hazard mitigation. This may include roadways, stream embankments, riverfront upgrades, or public walkways, but is not limited to these.

- **City of Trenton Comprehensive Plan:** Currently still in the draft phase, the comprehensive plan for the city is being created to plan for future development and redevelopment within Trenton. Prior to its completion, the comprehensive plan could include the updated maps, data, goals, and actions relevant to Trenton to further intertwine the two planning efforts to communicate one consistent message for development and land use in the city.

- **Local Plans and Polices**: The HMP will provide information that can be incorporated into local master plans during the next plan development or update. Specific risk and vulnerability information from the HMP will help identify areas where development may be at risk to potential hazards.

- **Historic Building Inventory**: The HMP includes information on historic buildings that can help guide decisions on what actions to take with historic buildings.

- **Subdivision Regulations:** The HMP will provide important information regarding flooding, NFIP information and data, and best practices regarding a resilient built environment. The last update for the regulations was approved on March 12, 2018.

- **Butler County Flood Damage Prevention Regulations:** Adopted in 2010, the county's floodplain regulations outline the administration of floodplain regulation enforcement and use and development standards to reduce flood hazard risk. In the next revision of the Butler County Flood Damage Prevention Regulations, updated flood locations, extent, impact, and vulnerability information from the 2023 HMP will be integrated. Additionally, flood mitigation actions pertaining to regulatory enforcement will be reviewed during the update.

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