f

(Source: Dayton Daily News)

2024 MONTGOMERY COUNTY NATURAL HAZARD MITIGATION PLAN

PREPARED BY:

Burton Planning Services

252 Electric Avenue

Westerville, Ohio 43081

Burton Planning Services

PREPARED FOR:

Montgomery County

760 Vantage Point

Miamisburg, Ohio 45324

Emergency Management

Table of Contents

List of Tables and Figures

1| Introduction

1.1 Overview

With the 2019 Montgomery County Natural Hazard Mitigation Plan set to expire in August 2024, Montgomery County and its constituents are aiming to adopt a new, updated natural hazard mitigation plan. As outlined in the Disaster Mitigation Act of 2000 (DMA2K), any local jurisdiction seeking funding from the Federal Emergency Management Agency (FEMA) must maintain an up-to-date disaster mitigation plan. This Plan meets the criteria as set forth by FEMA in the DMA2K and provides the County and its participating jurisdictions with a comprehensive guide for future mitigation efforts to combat the hazards that affect their communities.

Natural, geological, and human-caused hazards pose a variety of risks to the lives, businesses, and properties within Montgomery County. As such, a Core Planning Committee within Montgomery County has been established with the goal of developing and implementing the 2024 Montgomery County Natural Hazard Mitigation Plan. Through cooperative efforts between local, county, state, and federal government agencies, this Plan is designed to minimize the adverse effects of hazardous events on the lives and properties of residents of Montgomery County.

This 2024 Montgomery County Natural Hazard Mitigation Plan is a multi-jurisdictional plan which considers the impacts of hazards on incorporated cities, villages and unincorporated townships. Montgomery County's jurisdictions are listed below in **Tables 1.1.1 and 1.1.2**. These areas are also displayed in **Figure 1.1.3** on the following page. The Plan is designed for a five-year implementation period and describes the methods and procedures utilized in its development, provides the results of community involvement activities such as survey collection, identifies the mitigation activities determined to the be most important to the County and its jurisdictions, and establishes a timeline for the implementation of the actions.

Table 1.1.1: Montgomery County Jurisdictions

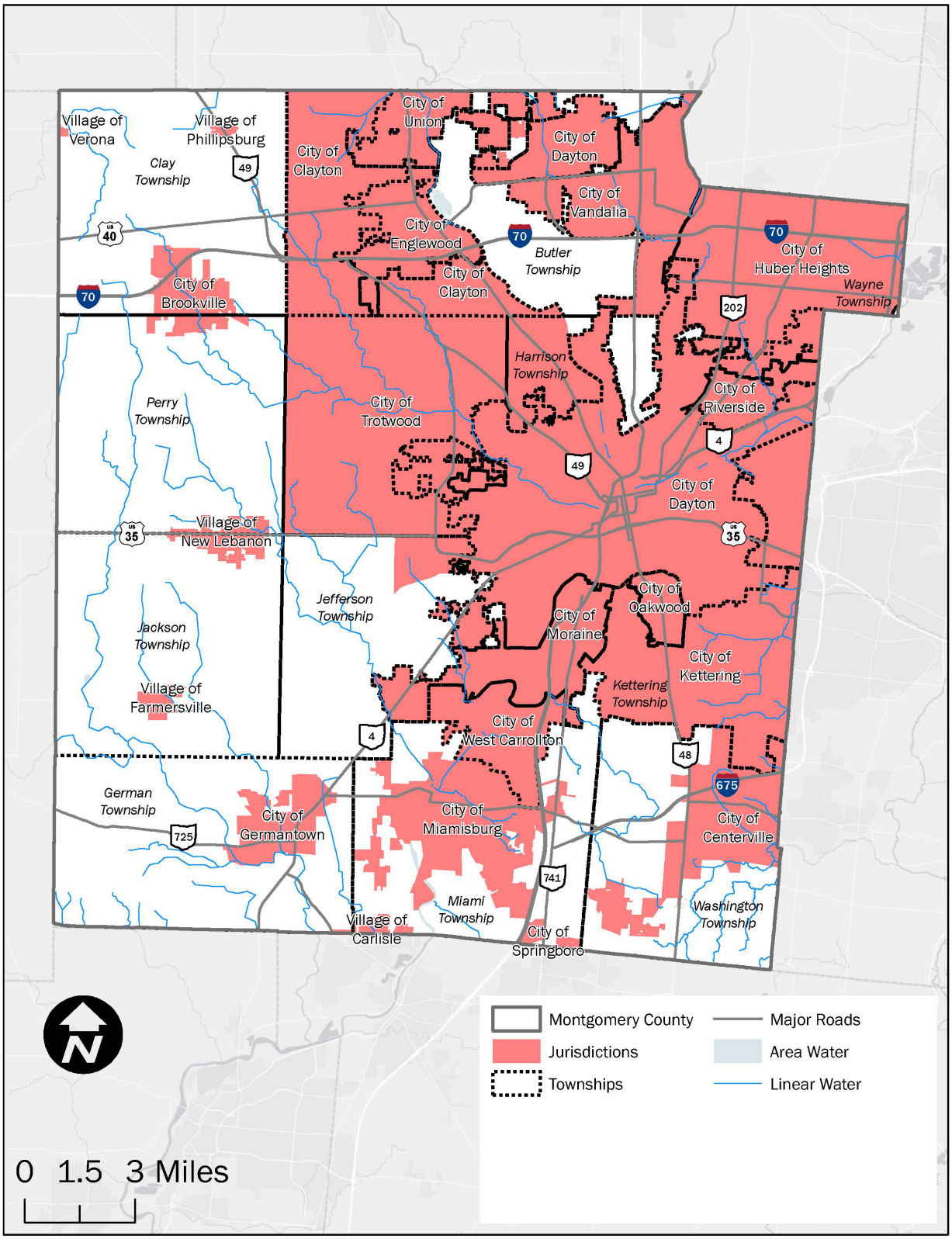
Jurisdictions	
City of Brookville	City of Oakwood
*City of Carlisle	City of Riverside
City of Centerville	*City of Springboro
City of Clayton	City of Trotwood
City of Dayton	City of Union
City of Englewood	City of Vandalia
City of Germantown	City of West Carrollton
City of Huber Heights	Village of Farmersville
City of Kettering	Village of New Lebanon
City of Miamisburg	Village of Phillipsburg
City of Moraine	*Village of Verona

**The majority of these jurisdictions fall outside of Montgomery County and are covered in the plans of adjacent counties.*

Table 1.1.2: Montgomery County Townships

Townships	
Butler Township	Jefferson Township
Clay Township	Miami Township
German Township	Perry Township
Harrison Township	Washington Township
Jackson Township	

Figure 1.1.3: Montgomery County Jurisdictions Map



This Plan is comprised of six chapters, which detail the methods, analysis, and discussion surrounding the various hazards that threaten Montgomery County and its jurisdictions. These chapters are as follows:

- This **Introduction** (Chapter 1) provides a discussion about the general purpose and goals that Montgomery County wishes to achieve throughout the development and implementation of this Plan. This section also includes a summary of the Plan's contents.
- Chapter 2, **History and Demographics**, includes a description of Montgomery County and each participating jurisdiction, including their history, population, and other general information.
- Chapter 3, **Planning Process**, details the process for the development of this Plan. This section includes details about the process used to develop this Plan, including a description of who participated, how the community was involved, which hazards were included in the Plan and why, as well as how the Plan was developed through public meetings, reviews, and evaluations. This section also details the review and incorporation of existing plans, studies, reports, and technical information.
- Chapter 4 contains the **Hazard Identification and Risk Assessment (HIRA)**. This section provides detailed descriptions and a corresponding analysis for each hazard that could potentially affect Montgomery County. The nature, location, extent, historical impact, vulnerability, and likelihood of occurrence for each hazard are provided for each hazard. These analyses include the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas; an estimate of the potential dollar losses to vulnerable structures; and a general description of land uses and development trends within the community.
- Chapter 5, **Hazard Mitigation**, outlines the goals, strategies, and actions for the County. The proposed actions are presented in tables, categorized by the associated hazard and community, and then ranked from highest to lowest priority based on feedback received from County officials and participating jurisdictions and stakeholders. Excluded hazards are also documented in this section, along with the rationale for exclusion from the Plan.
- The final chapter (Chapter 6) of this Plan, **Schedule and Maintenance**, provides a summary of the proposed Plan adoption, integration, and maintenance schedule. This section describes how the County will review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five years to continue to be eligible for mitigation project grant funding.

The resulting 2024 Montgomery County Natural Hazard Mitigation Plan will be submitted to the Ohio Emergency Management Agency (Ohio EMA) and subsequently FEMA for their review. Following the agency review, the jurisdictions will then review the Plan for adoption. This hazard mitigation plan serves as a helpful tool for citizens, policymakers, local businesses, and other local stakeholders who all share a public interest in keeping Montgomery County as safe and resilient as possible. As such, this Plan aims to:

- Minimize property damage, economic loss, injury, and loss of human life – to achieve the Plan's main goal of reducing the impact of natural and manmade hazards on the County's economy and the well-being of its citizens.
- Enhance public awareness and education – to widen the public's understanding of natural and manmade hazards and how they might affect public health and safety, the environment, the local economy, and basic day-to-day operations.

- Coordinate inter-jurisdictional preparedness measures – to encourage and ensure multi-jurisdictional cooperation in County-wide mitigation actions and programs so that they may be implemented efficiently and effectively.
- Provide decision-making tools for interested stakeholders – to formulate a comprehensive, updated analysis of Montgomery County's vulnerability to hazards so that decision-makers can better prepare for natural and manmade disasters.
- Achieve regulatory compliance – to ensure that the County and its political subdivisions meet state and federal mitigation planning requirements so that they may be eligible to participate in and receive funding from grant programs, policies, and regulations.

1.2 Setting

Montgomery County is in the southwestern region of Ohio and has a total area of approximately 461 square miles of which 458 is land and approximately 3.0 square miles is water. The County contains 19 cities, three villages, and nine townships (**Tables 1.1.1 and 1.1.2**). The cities of Carlisle and Springboro, along with the Village of Verona, lie mainly in adjacent counties and these jurisdictions are covered in the hazard mitigation plans of Preble and Warren Counties. The City of Dayton serves as the County seat. Montgomery County is bounded by seven Ohio counties: Miami County to the north, Clark County to the northeast, Greene County to the east, Warren County to the south, Butler County to the southeast, Preble County to the west, and Darke County to the northwest.

Land use patterns in Montgomery County are shown in **Figure 1.2.1**. Land use types include agriculture, commercial, industrial, institutional, and residential. Land cover in Montgomery County is shown in **Figure 1.2.2**. Land cover types include barren land, cultivated crops, developed, forest, hay/pasture, herbaceous/shrub, open water, and wetland.

Figure 1.2.1: Montgomery County Land Use Map

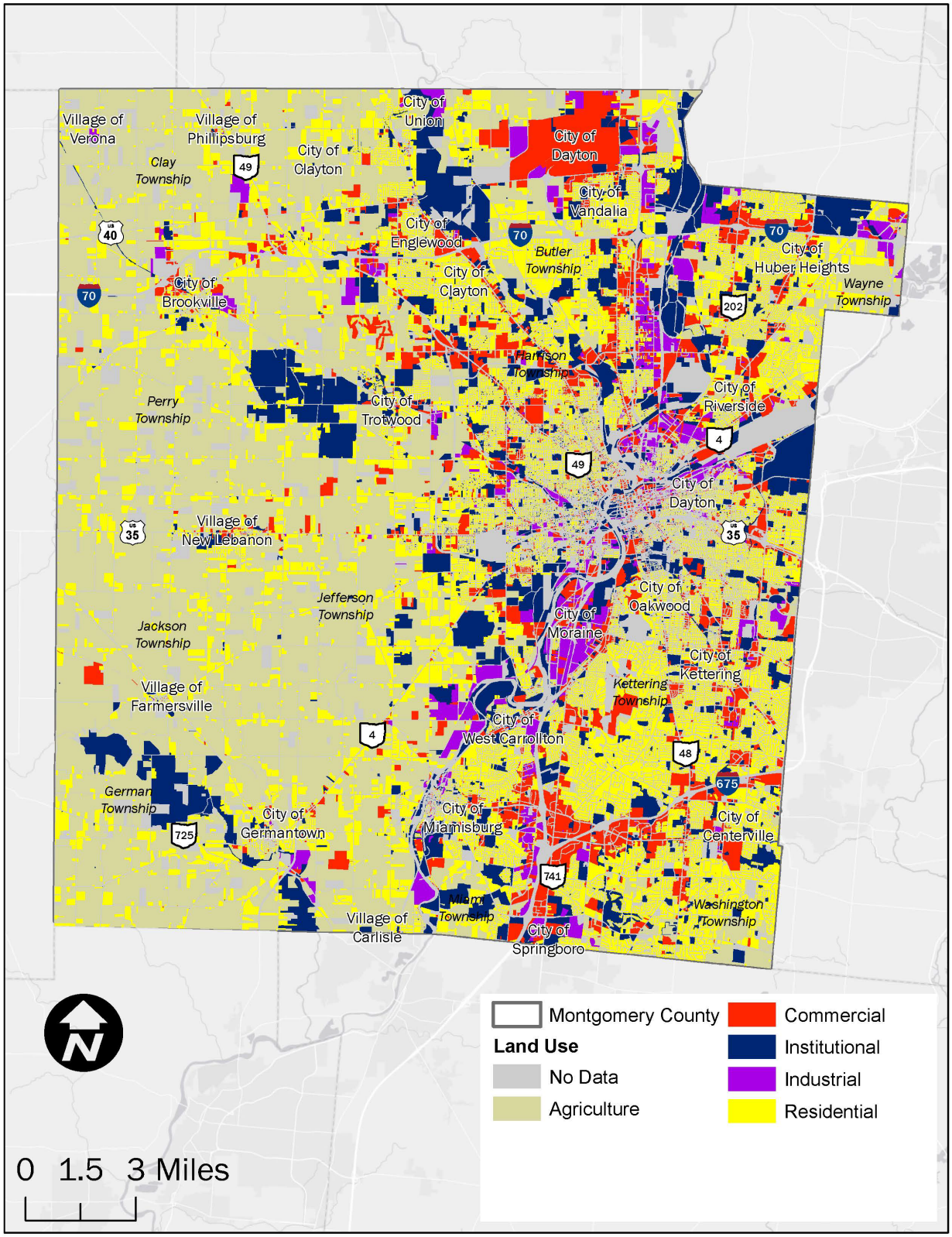
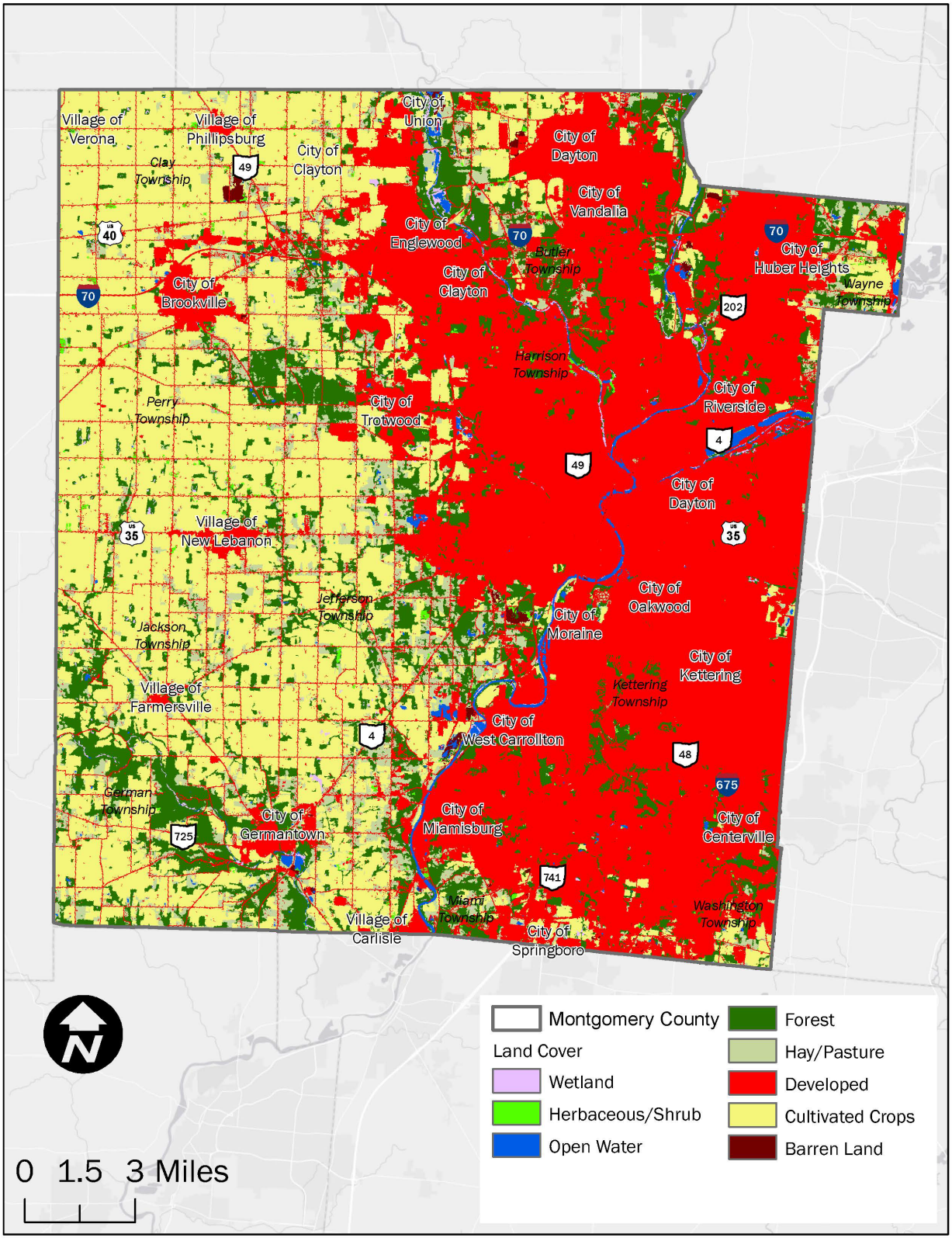


Figure 1.2.2: Montgomery County Land Cover Map



1.3 Region Features

Transportation

Montgomery County contains several major roadways, including several State Routes (SR), two U.S. Highways (US), and three Interstates (I). Major roadways in Montgomery County include SR-49, SR-48, SR-725, SR-123, SR-741, SR-235, SR-4, SR-835, US-35, US-40, I-70, I-75, and I-675.

Montgomery County is home to the Wright Brothers and as such, has several airports; the Dayton-Wright Brothers Airport located in the City of Dayton and the Phillipsburg Airport located in the City of Englewood, are both open to the public. In addition, Moraine Airpark, a privately-owned airport for public use, is in the City of Dayton. Montgomery County is also home to the Dayton International Airport, located nine miles north of the City of Dayton in the City of Vandalia.

Both the CSX Corporation and Norfolk Southern Railway have multiple lines in Montgomery County. The CSX lines run north through the City of Miamisburg, through the City of Dayton to Miami County; northwest out of the City of Dayton towards the City of Trotwood; and north out of Warren County into the City of Germantown. Norfolk Southern Railway runs north through the City of Miamisburg to the City of Dayton, from the City of Dayton to the City of Springfield, and from the City of Dayton towards the City of Kettering.

Natural Features

Table 1.3.1, below, lists Montgomery County parks and nature areas.

Table 1.3.1: Parks & Nature Areas in Montgomery County, Ohio

Parks & Nature Areas	
Art Van Atta Park	Huffman
Arthur O. Fisher	Island
Aullwood Garden	Madison Lakes
Beech Ridge Trail	Meadowlark Trail
Carriage Hill	Possum Creek
Cox Arboretum	RiverScape
Deeds Point	Sugarcreek
Eastwood	Sunrise
Englewood	Sycamore State Park
Germantown	Taylorsville
Ghost Hedge Nature Trail	Twin Creek
Heron Run Trail	Wegerzyn Gardens
Hills & Dales	Wesleyan

Montgomery County also has several streams and water bodies which are listed in **Table 1.3.2** below.

Table 1.3.2: Montgomery County Streams and Water Bodies

Water Bodies	
Asher Lake	Moss Creek
Bear Creek	Mud Creek
Crains Run	North Branch Wolf Creek
Diehl Run	Ohnoname 19 Reservoir
Dry Run	Opossum Creek
Drylick Run	Pigeye Creek
Elk Creek Lake	Poplar Creek
Englewood Recreation Reservoir	Poplar Run
Englewood Reservoir	Razor Run
Garber Run	Sims Pond (historical)
Germantown Reservoir	Spring lake
Guffey Lake	Spring Run
Holes Creek	Stillwater River
Island Park Reservoir	Sunfish Pond
Lake Marinole	Swinging Bridge Lake
Lick Run	Sycamore Creek
Little Bear Creek	Tait Station Reservoir
Little Twin Creek	Taylorsville Reservoir
Mad River	Toms Run
Middle Run	Wolf Creek
Mill Creek	Wysong Run
Mill Run	

2 | History & Demographics

2.1 History

Montgomery County ranks as the 37th largest county in the state in terms of square mileage. The county was established on March 24, 1803, by the Ohio Government when they divided Hamilton and Ross counties. Montgomery County was named after General Richard Montgomery, an American Revolution hero. The largest city is the City of Dayton, where 26 percent of the county's population resides.

Montgomery County has submitted 50 places to the National Register of Historic Places. Of these 50 places, three are of national significance and four are of statewide significance. Two notable properties, Dayton Daily News Building and Dayton Women's Club, were submitted to the National Register of Historic Places by The Montgomery County Historical Society. The Dayton Daily News Building was built in 1910 with an addition added in 1922. The Dayton Daily News Building has been recognized as the most endangered historic site in 2017 and 2019 by Preservation Ohio. The Dayton Women's Club was built between 1845 and 1850 by Robert Steele, a Dayton Board of Education member. In 1865 the building was purchased and refurbished by Napoleon Bonapart Darst to the empire-style Victorian that stands today. The Dayton Daily News Building was added to the National Register of Historic Places in 1978, and Dayton Women's club was added in 1975.

Figure 2.1.1: Dayton Daily News Building (Top right and left) and Dayton Women's Club (Lower right and left)

Sources: National Archives Catalog (top and bottom left)

2.2 Communication Outlets

Montgomery County's primary communication outlets including websites, television, and social media are listed in **Table 2.2.1**, below:

Table 2.2.1: Communication Outlets and Social Media

Communication Type	Source
Website	Montgomery County: https://www.mcohio.org/ Montgomery County Office of Emergency Management: https://www.mcohio.org/201/Emergency-Management Public Health – Dayton and Montgomery County: https://www.phdmc.org/ Montgomery County Sheriff's Office: https://www.mcohiosheriff.org/ Montgomery County Board of Elections: https://www.montgomery.boe.ohio.gov/ The American Red Cross Miami Valley Chapter: https://www.redcross.org/local/ohio/central-and-southern-ohio/about-us/locations/miami-valley-chapter.html
Social media	Montgomery County: https://www.facebook.com/MontgomeryCounty/ Dayton Convention & Visitors Bureau: https://www.facebook.com/daytoncvb/ Montgomery County Chamber of Commerce: https://www.facebook.com/MontgomeryOhioChamber/ Montgomery County Sheriff: https://www.facebook.com/MontgomeryCountySheriff/
News/Newspaper	Dayton Daily News: https://www.daytondailynews.com/ Consolidated Computer-Aided Dispatch System: https://www.mcohiosheriff.org/support_services/dispatch/regional_dispatch.php Local Radio Stations: 97.5 WTGR; 106.5 WDRK; 89.9 EDPG

2.3 Demographics Overview

This section provides select demographic information to help identify strategies to better serve the county residents during emergency hazard events. The information can be used to understand potential vulnerabilities in subgroups of the population. For example, knowing the number of senior citizens that live alone and that may require additional assistance during an emergency can help assistance organizations anticipate where their services may be needed.

Table 2.3.1, below, provides a summary of the total population changes that have occurred in Montgomery County between the 2010 U.S. Census and the 2022 5-Year American Community Survey (ACS) Estimates based on census data. According to the U.S. Census, Montgomery County's population decreased by 2,340 people (0.43 percent) between 2010 and 2022. For comparison, the US population grew 9.04 percent and Ohio's population grew 2.49 percent during that period. Five townships experienced population growth: Butler, Clay, German, Miami, and Washington townships. Of the townships experiencing population decline, Jefferson Township experienced the greatest percentage of population decline with a decrease of 1,131 people (16.13 percent).

A more detailed description of population, housing, and income demographics for Montgomery County and each city and village jurisdiction is provided on the following pages.

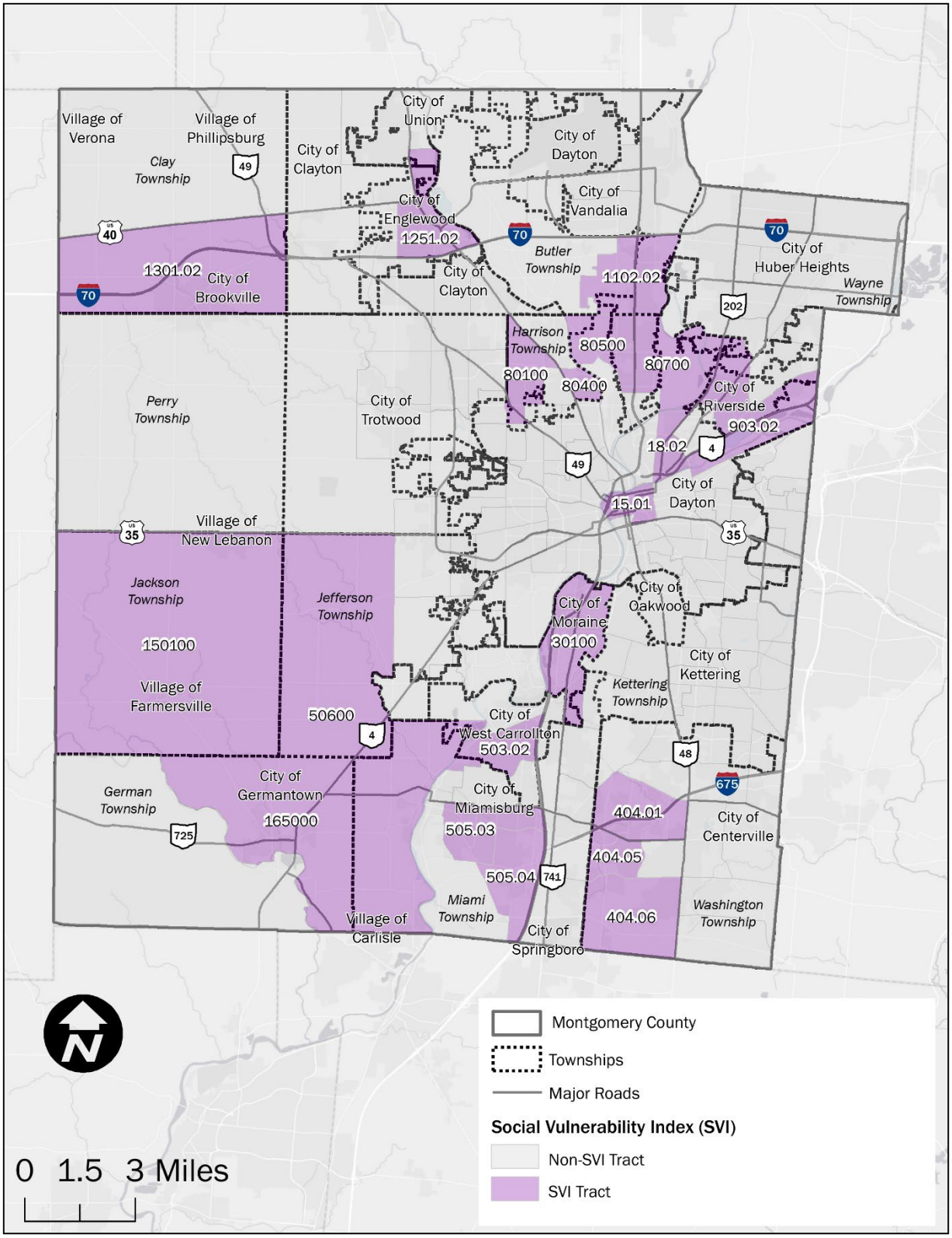
Table 2.3.1: County And Township Population Growth Estimates Between 2010 Census and 2022 5-Year ACS Estimates

County/Township	Total Population 2010 Census	Total Population 2022 Estimate	2010-2022	
			Population Change	Percent Change
Montgomery County	538,461	536,121	-2,340	-0.43%
Butler Township	7,946	8,227	281	3.54%
Clay Township	8,776	8,851	75	0.85%
German Township	8,313	8,731	418	5.03%
Harrison Township	22,717	21,836	-881	-3.88%
Jackson Township	6,333	6,070	-263	-4.15%
Jefferson Township	7,011	5,880	-1,131	-16.13%
Miami Township	49,737	51,966	2,229	4.48%
Perry Township	6,026	5,850	-176	-2.92%
Washington Township	55,847	61,598	5,751	10.30%

Social Vulnerability Tracts

Montgomery County has 156 census tracts total. Out of the 156 census tracts, FEMA uses the top 20 census tracts to estimate structure and vulnerability for social vulnerability. The top 20 census tracts for Montgomery County are shown in **Figure 2.3.1.**

Figure 2.3.1 Social Vulnerability Tracts



Social Vulnerability Index Score

The Social Vulnerability Index Score is a component of the Center for Disease Control and Prevention (CDC) and Agency for Toxic Substances and Disease Registry (ATSDR) Social Vulnerability Index (SVI) that measures the susceptibility (risk) of social groups to the adverse impacts of natural hazards that may result in disproportionate deaths, injury, loss, or disruption of livelihood. As FEMA explains, the "Social Vulnerability score considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards. The score and rating represent the relative level of a community's social vulnerability compared to all other communities at the same level (e.g., county level). A community's Social Vulnerability score is proportional to a community's risk. A higher Social Vulnerability score results in a higher Risk Index score."

According to the Center for Disease Control and Prevention (CDC) and Agency for Toxic Substances and Disease Registry (ATSDR) Social Vulnerability Index (SVI), Montgomery County has a calculated Social Vulnerability Index of 0.98 (on scale of 0 to 1) on a state level, which is considered a high susceptibility to the adverse impacts of natural hazards when compared to the rest of the U.S. For comparison, Ohio's average Social Vulnerability Index is 0.50 on a state level. Table 2.3.3 reports the SVI scores for Socioeconomic status, housing type and transportation, race and ethnic minority status, and household characteristics for Montgomery County and Ohio State at both the state and nation levels.

The score is calculated using U.S. Census data for 16 social factors, which research literature suggests contributes to the reduction in a community's ability to prepare for, respond to, and recover from hazards. Thus, making the community more vulnerable. Each county is subdivided into census tracts and each census track is ranked on the 16 social factors. The 16 social factors are organized into four themes. Each census track is ranked separately for each theme and receives an overall ranking. The four themes and social factors are described below according to the CDC/ATSDR Social Vulnerability Index:

1. **Socioeconomic Status**: this theme covers socioeconomic status, such as households with income below the 150-percentile poverty level, employment status, housing cost burden, high school diploma status, and if the household has health insurance.
2. **Housing Type and Transportation:** this theme covers multi-unit structures, mobile homes, crowding within households, households without a vehicle, and group quarters.
3. **Race and Ethnic Minority Status:** this theme covers the percentage of Hispanic or Latino (of any race); Black and African American (not Hispanic or Latino); American Indian and Alaska Native (not Hispanic or Latino); Native Hawaiian and Other Pacific Islander (not Hispanic or Latino); Two or More Races (not Hispanic or Latino); and Other Races (not Hispanic or Latino).
4. **Household Characteristics:** this theme covers the elderly population (65 and older), children under 17 years of age, civilians with a disability, single-parent households, and the household's English language proficiency.

Table 2.3.3 Social Vulnerability Score per Theme for Montgomery County and Ohio

Theme	Montgomery County (Statewide)	Ohio (Statewide)	Montgomery County (Nationwide)	Ohio (Nationwide)
Socioeconomic Status	0.75	0.50	0.58	0.37
Housing Type and Transportation	0.86	0.50	0.69	0.42
Race and Ethnic Minority Status	0.95	0.50	0.67	0.28
Household Characteristics	0.91	0.50	0.69	0.40

2.4 Community Profiles

Montgomery County

Montgomery County is in southwest Ohio, and it is part of the Dayton-Springfield-Sidney Combined Statistical Area. As of the 2022 5-Year ACS Estimates (census), the population was 536,121 making it the 5th most populated county in Ohio. The City of Dayton is the largest city and serves as the county seat.

Tables 2.4.1 to 2.4.6 summarize Montgomery County, Ohio's population, housing statistics, and income statistics. There are 228,062 households of which 24.16 percent have at least one member under 18 years of age, and 31.30 percent have members 65 years and over. The largest percentage of households (17.50 percent) had an income between $50,000 to $74,999; approximately 5.60 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the Montgomery County, Ohio, was the White (non-Hispanic) group, which makes up 69.26 percent of the population. Black or African American is the second largest race (20.36 percent). Approximately 2.23 percent of the city's population speak Spanish at home. In addition, 1.44 percent speak another Indo-European language, 1.60 percent speak an Asian and Pacific Island language, and 1.11 percent speak another language.

Table 2.4.1: Montgomery County Population by Age Statistics 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	536,121	100%
Under 18 Years	118,071	22.02%
18 to 24 Years	50,039	9.33%
25 to 34 Years	73,548	13.72%
35 to 44 Years	63,142	11.78%
45 to 54 Years	62,596	11.68%
55 to 64 Years	71,127	13.27%
65 Years and Over	97,598	18.20%

Table 2.4.2: Montgomery County Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	252,061	100%
Occupied Housing Units	228,062	90.48%
Housing Units - Mobile Homes	2,542	1.11%
Vacant Housing Units	23,999	9.52%

Table 2.4.3: Montgomery County Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	228,062	
Average Household Size	2.27	
Households with People Under 18 Years	55,093	24.16%
Households with People 65+ Years	71,383	31.30%
Householder Living Alone 65+ Years	33,069	14.50%
No Vehicle Available	20,507	8.99%
With a Broadband Internet Subscription	201,541	88.37%

Table 2.4.4: Montgomery County Population by Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	536,121	100%
White	371,335	69.26%
Black or African American	109,166	20.36%
American Indian and Alaska Native	509	0.09%
Asian	11,915	2.22%
Native Hawaiian and Other Pacific Islander	90	0.02%
Some Other Race	1,823	0.34%
Two or More Races	22,941	4.28%
Hispanic or Latino (of any race)	18,342	3.42%

Table 2.4.5: Montgomery County Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	504,221	100%
English only	472,092	93.63%
Spanish	11,224	2.23%
Other Indo-European languages	7,255	1.44%
Asian and Pacific Island languages	8,076	1.60%
Other languages	5,574	1.11%

Table 2.4.6: Montgomery County Household Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Number of Households
Less than $10,000	5.60%
$10,000 to $14,999	5.30%
$15,000 to $24,999	8.60%
$25,000 to $34,999	8.60%
$35,000 to $49,999	13.10%
$50,000 to $74,999	17.50%
$75,000 to $99,999	13.60%
$100,000 to $149,999	15.20%
$150,000 to $199,999	6.50%
$200,000 or more	6.10%
Median Household Income	$61,942
Mean Household Income	$82,621

City of Brookville

Tables 2.4.7 to 2.4.12 summarize the City of Brookville's population, housing statistics, and income statistics. There are 2,582 households of which 21.57 percent have at least one member under 18 years of age, and 43.80 percent have members 65 years and over. The largest percentage of households (24.10 percent) had an income between $50,000 to $74,999; approximately 3.30 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Brookville was the White (non-Hispanic) group, which makes up 88.30 percent of the population. Asian is the second largest race (5.80 percent). Approximately 0.17 percent of the city's population speak Spanish at home. In addition, 4.96 percent speak another Indo-European language, 1.11 percent speak an Asian and Pacific Island language, and 0.00 percent speak another language.

Table 2.4.7: City of Brookville Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	6,035	100%
Under 18 Years	1,298	21.51%
18 to 24 Years	209	3.46%
25 to 34 Years	715	11.85%
35 to 44 Years	592	9.81%
45 to 54 Years	640	10.60%
55 to 64 Years	762	12.63%
65 Years and Over	1,819	30.14%

Table 2.4.8: City of Brookville Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	2,737	100%
Occupied Housing Units	2,582	94.34%
Housing Units - Mobile Homes	12	0.46%
Vacant Housing Units	155	5.66%

Table 2.4.9: City of Brookville Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	2,582	-
Average Household Size	2.27	-
Households with People Under 18 Years	557	21.57%
Households with People 65+ Years	1,131	43.80%
Householder Living Alone 65+ Years	568	22.00%
No Vehicle Available	207	8.02%
With a Broadband Internet Subscription	2,160	83.66%

Table 2.4.10: City of Brookville Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	6,035	100%
White	5,329	88.30%
Black or African American	61	1.01%
American Indian and Alaska Native	0	0.00%
Asian	350	5.80%
Native Hawaiian and Other Pacific Islander	0	0.00%
Some Other Race	14	0.23%
Two or More Races	230	3.81%
Hispanic or Latino (of any race)	51	0.85%

Table 2.4.11: City of Brookville Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	5,764	100%
English only	5,404	93.75%
Spanish	10	0.17%
Other Indo-European languages	286	4.96%
Asian and Pacific Island languages	64	1.11%
Other languages	0	0.00%

Table 2.4.12: City of Brookville Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	3.30%
$10,000 to $14,999	4.70%
$15,000 to $24,999	10.30%
$25,000 to $34,999	7.40%
$35,000 to $49,999	12.20%
$50,000 to $74,999	24.10%
$75,000 to $99,999	13.10%
$100,000 to $149,999	14.70%
$150,000 to $199,999	4.80%
$200,000 or more	5.40%
Median Household Income	$59,158
Mean Household Income	$81,896

*City of Carlisle *(This majority of this jurisdiction lies in Warren County)*

Tables 2.4.13 to 2.4.18 summarize the City of Carlisle's population, housing statistics, and income statistics. There are 2,231 households of which 22.81 percent have at least one member under 18 years of age, and 39.10 percent have members 65 years and over. The largest percentage of households (19.00 percent) had an income between $50,000 to $74,999; approximately 5.20 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Carlisle was the White (non-Hispanic) group, which makes up 90.85 percent of the population. Asian is the second largest race (3.24 percent). Approximately 1.94 percent of the city's population speak Spanish at home. In addition, 3.85 percent speak another Indo-European language, 0.00 percent speak an Asian and Pacific Island language, and 0.00 percent speak another language.

Table 2.4.13: City of Carlisle Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	5,488	100%
Under 18 Years	1,050	19.13%
18 to 24 Years	741	13.50%
25 to 34 Years	519	9.46%
35 to 44 Years	616	11.22%
45 to 54 Years	763	13.90%
55 to 64 Years	562	10.24%
65 Years and Over	1,237	22.54%

Table 2.4.14: City of Carlisle Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	2,435	100%
Occupied Housing Units	2,231	91.62%
Housing Units - Mobile Homes	25	1.12%
Vacant Housing Units	204	8.38%

Table 2.4.15: City of Carlisle Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	2,231	-
Average Household Size	2.43	-
Households with People Under 18 Years	509	22.81%
Households with People 65+ Years	872	39.10%
Householder Living Alone 65+ Years	308	13.80%
No Vehicle Available	93	4.17%
With a Broadband Internet Subscription	1,969	88.26%

Table 2.4.16: City of Carlisle Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	5,488	100%
White	4,986	90.85%
Black or African American	17	0.31%
American Indian and Alaska Native	32	0.58%
Asian	178	3.24%
Native Hawaiian and Other Pacific Islander	0	0.00%
Some Other Race	0	0.00%
Two or More Races	142	2.59%
Hispanic or Latino (of any race)	133	2.42%

Table 2.4.17: City of Carlisle Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	5,250	100%
English only	4,946	94.21%
Spanish	102	1.94%
Other Indo-European languages	202	3.85%
Asian and Pacific Island languages	0	0.00%
Other languages	0	0.00%

Table 2.4.18: City of Carlisle Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	5.20%
$10,000 to $14,999	2.90%
$15,000 to $24,999	11.10%
$25,000 to $34,999	7.40%
$35,000 to $49,999	8.50%
$50,000 to $74,999	19.00%
$75,000 to $99,999	17.40%
$100,000 to $149,999	18.60%
$150,000 to $199,999	5.60%
$200,000 or more	4.30%
Median Household Income	$69,513
Mean Household Income	$86,672

City of Centerville

Tables 2.4.19 to 2.4.24 summarize the City of Centerville's population, housing statistics, and income statistics. There are 11,489 households of which 21.47 percent have at least one member under 18 years of age, and 41.70 percent have members 65 years and over. The largest percentage of households (17.50 percent) had an income between $100,000 to $149,999; approximately 2.80 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Centerville was the White (non-Hispanic) group, which makes up 83.37 percent of the population. Black or African American is the second largest race (5.70 percent). Approximately 2.46 percent of the city's population speak Spanish at home. In addition, 3.68 percent speak another Indo-European language, 2.20 percent speak an Asian and Pacific Island language, and 1.81 percent speak another language.

Table 2.4.19: City of Centerville Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	24,510	100%
Under 18 Years	4,335	17.69%
18 to 24 Years	1,481	6.04%
25 to 34 Years	3,050	12.44%
35 to 44 Years	2,501	10.20%
45 to 54 Years	2,382	9.72%
55 to 64 Years	3,567	14.55%
65 Years and More	7,194	29.35%

Table 2.4.20: City of Centerville Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	12,001	100%
Occupied Housing Units	11,489	95.73%
Housing Units - Mobile Homes	24	0.21%
Vacant Housing Units	512	4.27%

Table 2.4.21: City of Centerville Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	11,489	-
Average Household Size	2.07	-
Households with People Under 18 Years	2,467	21.47%
Households with People 65+ Years	4,791	41.70%
Householder Living Alone 65+ Years	2,286	19.90%
No Vehicle Available	767	6.68%
With a Broadband Internet Subscription	10,690	93.05%

Table 2.4.22: City of Centerville Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	24,510	100%
White	20,435	83.37%
Black or African American	1,398	5.70%
American Indian or Alaska Native	12	0.05%
Asian	1,094	4.46%
Native Hawaiian or Other Pacific Islander	0	0.00%
Some Other Race (One Race)	71	0.29%
Two or More Races	438	1.79%
Hispanic or Latino (of any race)	1,062	4.33%

Table 2.4.23: City of Centerville Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	23,113	100%
English only	20,766	89.85%
Spanish	569	2.46%
Other Indo-European languages	851	3.68%
Asian and Pacific Island languages	508	2.20%
Other languages	419	1.81%

Table 2.4.24: City of Centerville Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	2.80%
$10,000 to $14,999	3.50%
$15,000 to $24,999	6.80%
$25,000 to $34,999	7.00%
$35,000 to $49,999	12.80%
$50,000 to $74,999	14.60%
$75,000 to $99,999	13.90%
$100,000 to $149,999	17.50%
$150,000 to $199,999	11.40%
$200,000 or more	9.80%
Median Household Income	$79,509
Mean Household Income	$103,868

City of Clayton

Tables 2.4.25 to 2.4.30 summarize the City of Clayton's population, housing statistics, and income statistics. There are 5,453 households of which 24.70 percent have at least one member under 18 years of age, and 38.90 percent have members 65 years and over. The largest percentage of households (20.00 percent) had an income between $100,000 to $149,999; approximately 1.20 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Clayton was the White (non-Hispanic) group, which makes up 61.74 percent of the population. Black or African American is the second largest race (29.39 percent). Approximately 1.57 percent of the city's population speak Spanish at home. In addition, 2.04 percent speak another Indo-European language, 0.23 percent speak an Asian and Pacific Island language, and 0.26 percent speak another language.

Table 2.4.25: City of Clayton Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	13,292	100%
Under 18 Years	2,770	20.84%
18 to 24 Years	735	5.53%
25 to 34 Years	1,674	12.59%
35 to 44 Years	1,257	9.46%
45 to 54 Years	1,664	12.52%
55 to 64 Years	2,028	15.26%
65 Years and More	3,164	23.80%

Table 2.4.26: City of Clayton Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	5,663	100%
Occupied Housing Units	5,453	96.29%
Housing Units - Mobile Homes	0	0.00%
Vacant Housing Units	210	3.71%

Table 2.4.27: City of Clayton Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	5,453	-
Average Household Size	2.42	-
Households with People Under 18 Years	1,347	24.70%
Households with People 65+ Years	2,121	38.90%
Householder Living Alone 65+ Years	654	12.00%
No Vehicle Available	52	0.95%
With a Broadband Internet Subscription	5,189	95.16%

Table 2.4.28: City of Clayton Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	13,292	100%
White	8,206	61.74%
Black or African American	3,907	29.39%
American Indian or Alaska Native	58	0.44%
Asian	201	1.51%
Native Hawaiian or Other Pacific Islander	0	0.00%
Some Other Race (One Race)	41	0.31%
Two or More Races	660	4.97%
Hispanic or Latino (of any race)	219	1.65%

Table 2.4.29: City of Clayton Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	12,395	100%
English only	11,886	95.89%
Spanish	195	1.57%
Other Indo-European languages	253	2.04%
Asian and Pacific Island languages	29	0.23%
Other languages	32	0.26%

Table 2.4.30: City of Clayton Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	1.20%
$10,000 to $14,999	2.90%
$15,000 to $24,999	3.10%
$25,000 to $34,999	6.70%
$35,000 to $49,999	10.50%
$50,000 to $74,999	14.20%
$75,000 to $99,999	19.80%
$100,000 to $149,999	20.00%
$150,000 to $199,999	11.90%
$200,000 or more	9.70%
Median Household Income	$89,282
Mean Household Income	$104,234

City of Dayton

Tables 2.4.31 to 2.4.36 summarize the City of Dayton's population, housing statistics, and income statistics. There are 57,362 households of which 21.54 percent have at least one member under 18 years of age, and 25.50 percent have members 65 years and over. The largest percentage of households (17.10 percent) had an income between $50,000 to $74,999; approximately 10.10 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Dayton was the White (non-Hispanic) group, which makes up 50.29 percent of the population. Black or African American is the second largest race (37.88 percent). Approximately 3.62 percent of the city's population speak Spanish at home. In addition, 1.11 percent speak another Indo-European language, 1.19 percent speak an Asian and Pacific Island language, and 1.23 percent speak another language.

Table 2.4.31: City of Dayton Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	137,305	100%
Under 18 Years	28,707	20.91%
18 to 24 Years	20,723	15.09%
25 to 34 Years	21,171	15.42%
35 to 44 Years	15,845	11.54%
45 to 54 Years	14,959	10.89%
55 to 64 Years	17,486	12.74%
65 Years and More	18,414	13.41%

Table 2.4.32: City of Dayton Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	137,305	100%
Occupied Housing Units	28,707	20.91%
Housing Units - Mobile Homes	20,723	15.09%
Vacant Housing Units	21,171	15.42%

Table 2.4.33: City of Dayton Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	57,362	-
Average Household Size	2.17	-
Households with People Under 18 Years	12,358	21.54%
Households with People 65+ Years	14,627	25.50%
Householder Living Alone 65+ Years	7,801	13.60%
No Vehicle Available	10,036	17.50%
With a Broadband Internet Subscription	47,206	82.29%

Table 2.4.34: City of Dayton Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	137,305	100%
White	69,056	50.29%
Black or African American	52,010	37.88%
American Indian or Alaska Native	257	0.19%
Asian	1,767	1.29%
Native Hawaiian or Other Pacific Islander	26	0.02%
Some Other Race (One Race)	611	0.44%
Two or More Races	6,406	4.67%
Hispanic or Latino (of any race)	7,172	5.22%

Table 2.4.35: City of Dayton Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	128,858	100%
English only	119,637	92.84%
Spanish	4,671	3.62%
Other Indo-European languages	1,429	1.11%
Asian and Pacific Island languages	1,539	1.19%
Other languages	1,582	1.23%

Table 2.4.36: City of Dayton Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	10.10%
$10,000 to $14,999	8.70%
$15,000 to $24,999	13.70%
$25,000 to $34,999	10.80%
$35,000 to $49,999	14.30%
$50,000 to $74,999	17.10%
$75,000 to $99,999	10.20%
$100,000 to $149,999	9.40%
$150,000 to $199,999	3.20%
$200,000 or more	2.40%
Median Household Income	$41,443
Mean Household Income	$57,574

City of Englewood

Tables 2.4.37 to 2.4.42 summarize the City of Englewood's population, housing statistics, and income statistics. There are 5,636 households of which 24.89 percent have at least one member under 18 years of age, and 36.60 percent have members 65 years and over. The largest percentage of households (17.20 percent) had an income between $50,000 to $74,999; approximately 2.40 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Englewood was the White (non-Hispanic) group, which makes up 76.80 percent of the population. Black or African American is the second largest race (15.35 percent). Approximately 1.55 percent of the city's population speak Spanish at home. In addition, 0.28 percent speak another Indo-European language, 1.13 percent speak an Asian and Pacific Island language, and 1.09 percent speak another language.

Table 2.4.37: City of Englewood Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	13,433	100%
Under 18 Years	3,283	24.44%
18 to 24 Years	784	5.84%
25 to 34 Years	1,392	10.36%
35 to 44 Years	1,606	11.96%
45 to 54 Years	1,345	10.01%
55 to 64 Years	2,050	15.26%
65 Years and More	2,973	22.13%

Table 2.4.38: City of Englewood Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	5,938	100%
Occupied Housing Units	5,636	94.91%
Housing Units - Mobile Homes	0	0.00%
Vacant Housing Units	302	5.09%

Table 2.4.39: City of Englewood Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	5,636	-
Average Household Size	2.33	-
Households with People Under 18 Years	1,403	24.89%
Households with People 65+ Years	2,063	36.60%
Householder Living Alone 65+ Years	1,088	19.30%
No Vehicle Available	335	5.94%
With a Broadband Internet Subscription	5,245	93.06%

Table 2.4.40: City of Englewood Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	13,433	100%
White	10,317	76.80%
Black or African American	2,062	15.35%
American Indian or Alaska Native	8	0.06%
Asian	127	0.95%
Native Hawaiian or Other Pacific Islander	5	0.04%
Some Other Race (One Race)	24	0.18%
Two or More Races	761	5.67%
Hispanic or Latino (of any race)	129	0.96%

Table 2.4.41: City of Englewood Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	12,598	100%
English only	12,089	95.96%
Spanish	195	1.55%
Other Indo-European languages	35	0.28%
Asian and Pacific Island languages	142	1.13%
Other languages	137	1.09%

Table 2.4.42: City of Englewood Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	2.40%
$10,000 to $14,999	8.50%
$15,000 to $24,999	4.60%
$25,000 to $34,999	7.80%
$35,000 to $49,999	14.40%
$50,000 to $74,999	17.20%
$75,000 to $99,999	12.30%
$100,000 to $149,999	16.80%
$150,000 to $199,999	10.90%
$200,000 or more	5.00%
Median Household Income	$67,769
Mean Household Income	$85,686

City of Germantown

Tables 2.4.43 to 2.4.48 summarize the City of Germantown's population, housing statistics, and income statistics. There are 2,212 households of which 30.65 percent have at least one member under 18 years of age, and 34.40 percent have members 65 years and over. The largest percentage of households (31.00 percent) had an income between $100,000 to $149,999; approximately 1.40 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Germantown was the White (non-Hispanic) group, which makes up 95.76 percent of the population. Two or More Races is the second largest race (2.46 percent). Approximately 0.00 percent of the city's population speak Spanish at home. In addition, 0.17 percent speak another Indo-European language.

Table 2.4.43: City of Germantown Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	5,784	100%
Under 18 Years	1,425	24.64%
18 to 24 Years	674	11.65%
25 to 34 Years	422	7.30%
35 to 44 Years	447	7.73%
45 to 54 Years	995	17.20%
55 to 64 Years	791	13.68%
65 Years and More	1,030	17.81%

Table 2.4.44: City of Germantown Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	2,351	100%
Occupied Housing Units	2,212	94.09%
Housing Units - Mobile Homes	46	2.08%
Vacant Housing Units	139	5.91%

Table 2.4.45: City of Germantown Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	2,212	-
Average Household Size	2.59	-
Households with People Under 18 Years	678	30.65%
Households with People 65+ Years	761	34.40%
Householder Living Alone 65+ Years	361	16.30%
No Vehicle Available	107	4.84%
With a Broadband Internet Subscription	2,008	90.78%

Table 2.4.46: City of Germantown Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	5,784	100%
White	5,539	95.76%
Black or African American	0	0.00%
American Indian or Alaska Native	0	0.00%
Asian	0	0.00%
Native Hawaiian or Other Pacific Islander	0	0.00%
Some Other Race (One Race)	0	0.00%
Two or More Races	142	2.46%
Hispanic or Latino (of any race)	103	1.78%

Table 2.4.47: City of Germantown Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	5,347	100%
English only	5,338	99.83%
Spanish	0	0.00%
Other Indo-European languages	9	0.17%
Asian and Pacific Island languages	0	0.00%
Other languages	0	0.00%

Table 2.4.48: City of Germantown Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	1.40%
$10,000 to $14,999	4.60%
$15,000 to $24,999	8.00%
$25,000 to $34,999	3.40%
$35,000 to $49,999	11.90%
$50,000 to $74,999	12.20%
$75,000 to $99,999	22.50%
$100,000 to $149,999	31.00%
$150,000 to $199,999	3.00%
$200,000 or more	1.90%
Median Household Income	$86,524
Mean Household Income	$84,449

City of Huber Heights

Tables 2.4.49 to 2.4.54 summarize the City of Huber Heights's population, housing statistics, and income statistics. There are 16,969 households of which 30.18 percent have at least one member under 18 years of age, and 29.90 percent have members 65 years and over. The largest percentage of households (21.40 percent) had an income between $100,000 to $149,999; approximately 3.60 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Huber Heights was the White (non-Hispanic) group, which makes up 74.13 percent of the population. Black or African American is the second largest race (15.72 percent). Approximately 2.13 percent of the city's population speak Spanish at home. In addition, 1.85 percent speak another Indo-European language, 4.98 percent speak an Asian and Pacific Island language, and 1.56 percent speak another language.

Table 2.4.49: City of Huber Heights Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	43,095	100%
Under 18 Years	10,955	25.42%
18 to 24 Years	3,477	8.07%
25 to 34 Years	6,293	14.60%
35 to 44 Years	5,425	12.59%
45 to 54 Years	5,199	12.06%
55 to 64 Years	4,894	11.36%
65 Years and More	6,852	15.90%

Table 2.4.50: City of Huber Heights Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	17,491	100%
Occupied Housing Units	16,969	97.02%
Housing Units - Mobile Homes	119	0.70%
Vacant Housing Units	522	2.98%

Table 2.4.51: City of Huber Heights Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	16,969	-
Average Household Size	2.53	-
Households with People Under 18 Years	5,122	30.18%
Households with People 65+ Years	5,074	29.90%
Householder Living Alone 65+ Years	2,019	11.90%
No Vehicle Available	716	4.22%
With a Broadband Internet Subscription	15,778	92.98%

Table 2.4.52: City of Huber Heights Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	43,095	100%
White	31,947	74.13%
Black or African American	6,773	15.72%
American Indian or Alaska Native	48	0.11%
Asian	1,103	2.56%
Native Hawaiian or Other Pacific Islander	0	0.00%
Some Other Race (One Race)	126	0.29%
Two or More Races	1,864	4.33%
Hispanic or Latino (of any race)	1,234	2.86%

Table 2.4.53: City of Huber Heights Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	40,014	100%
English only	35,800	89.47%
Spanish	853	2.13%
Other Indo-European languages	742	1.85%
Asian and Pacific Island languages	1,993	4.98%
Other languages	626	1.56%

Table 2.4.54: City of Huber Heights Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	3.60%
$10,000 to $14,999	2.60%
$15,000 to $24,999	4.50%
$25,000 to $34,999	7.70%
$35,000 to $49,999	13.30%
$50,000 to $74,999	17.50%
$75,000 to $99,999	16.40%
$100,000 to $149,999	21.40%
$150,000 to $199,999	7.50%
$200,000 or more	5.50%
Median Household Income	$75,903
Mean Household Income	$88,359

City of Kettering

Tables 2.4.55 to 2.4.60 summarize the City of Kettering's population, housing statistics, and income statistics. There are 26,355 households of which 23.96 percent have at least one member under 18 years of age, and 31.00 percent have members 65 years and over. The largest percentage of households (17.90 percent) had an income between $50,000 to $74,999; approximately 4.30 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Kettering was the White (non-Hispanic) group, which makes up 85.95 percent of the population. Black or African American is the second largest race (5.59 percent). Approximately 1.42 percent of the city's population speak Spanish at home. In addition, 1.54 percent speak another Indo-European language, 1.19 percent speak an Asian and Pacific Island language, and 2.25 percent speak another language.

Table 2.4.55: City of Kettering Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	57,707	100%
Under 18 Years	12,123	21.01%
18 to 24 Years	4,324	7.49%
25 to 34 Years	9,118	15.80%
35 to 44 Years	7,082	12.27%
45 to 54 Years	6,175	10.70%
55 to 64 Years	7,790	13.50%
65 Years and More	11,095	19.23%

Table 2.4.56: City of Kettering Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	27,764	100%
Occupied Housing Units	26,355	94.93%
Housing Units - Mobile Homes	111	0.42%
Vacant Housing Units	1,409	5.07%

Table 2.4.57: City of Kettering Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	26,355	-
Average Household Size	2.17	-
Households with People Under 18 Years	6,314	23.96%
Households with People 65+ Years	8,170	31.00%
Householder Living Alone 65+ Years	3,953	15.00%
No Vehicle Available	1,555	5.90%
With a Broadband Internet Subscription	24,308	92.23%

Table 2.4.58: City of Kettering Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	57,707	100%
White	49,600	85.95%
Black or African American	3,224	5.59%
American Indian or Alaska Native	7	0.01%
Asian	1,255	2.17%
Native Hawaiian or Other Pacific Islander	0	0.00%
Some Other Race (One Race)	221	0.38%
Two or More Races	2,083	3.61%
Hispanic or Latino (of any race)	1,317	2.28%

Table 2.4.59: City of Kettering Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	54,431	100%
English only	50,946	93.60%
Spanish	775	1.42%
Other Indo-European languages	837	1.54%
Asian and Pacific Island languages	650	1.19%
Other languages	1,223	2.25%

Table 2.4.60: City of Kettering Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	4.30%
$10,000 to $14,999	3.20%
$15,000 to $24,999	7.50%
$25,000 to $34,999	8.60%
$35,000 to $49,999	12.60%
$50,000 to $74,999	17.90%
$75,000 to $99,999	17.20%
$100,000 to $149,999	17.20%
$150,000 to $199,999	6.30%
$200,000 or more	5.10%
Median Household Income	$69,818
Mean Household Income	$88,436

City of Miamisburg

Tables 2.4.61 to 2.4.66 summarize the City of Miamisburg's population, housing statistics, and income statistics. There are 7,560 households of which 30.29 percent have at least one member under 18 years of age, and 33.50 percent have members 65 years and over. The largest percentage of households (22.90 percent) had an income between $100,000 to $149,999; approximately 2.70 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Miamisburg was the White (non-Hispanic) group, which makes up 91.34 percent of the population. Two or More Races is the second largest race (2.79 percent). Approximately 0.83 percent of the city's population speak Spanish at home. In addition, 0.49 percent speak another Indo-European language, 1.97 percent speak an Asian and Pacific Island language, and 0.08 percent speak another language.

Table 2.4.61: City of Miamisburg Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	19,877	100%
Under 18 Years	4,615	23.22%
18 to 24 Years	1,271	6.39%
25 to 34 Years	2,710	13.63%
35 to 44 Years	2,423	12.19%
45 to 54 Years	2,090	10.51%
55 to 64 Years	3,141	15.80%
65 Years and More	3,627	18.25%

Table 2.4.62: City of Miamisburg Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	7,890	100%
Occupied Housing Units	7,560	95.82%
Housing Units - Mobile Homes	0	0.00%
Vacant Housing Units	330	4.18%

Table 2.4.63: City of Miamisburg Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	7,560	-
Average Household Size	2.59	-
Households with People Under 18 Years	2,290	30.29%
Households with People 65+ Years	2,533	33.50%
Householder Living Alone 65+ Years	1,043	13.80%
No Vehicle Available	404	5.34%
With a Broadband Internet Subscription	6,654	88.02%

Table 2.4.64: City of Miamisburg Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	19,877	100%
White	18,156	91.34%
Black or African American	534	2.69%
American Indian or Alaska Native	57	0.29%
Asian	288	1.45%
Native Hawaiian or Other Pacific Islander	0	0.00%
Some Other Race (One Race)	33	0.17%
Two or More Races	554	2.79%
Hispanic or Latino (of any race)	255	1.28%

Table 2.4.65: City of Miamisburg Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	18,699	100%
English only	18,068	96.63%
Spanish	156	0.83%
Other Indo-European languages	92	0.49%
Asian and Pacific Island languages	368	1.97%
Other languages	15	0.08%

Table 2.4.66: City of Miamisburg Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	2.70%
$10,000 to $14,999	3.70%
$15,000 to $24,999	5.00%
$25,000 to $34,999	7.30%
$35,000 to $49,999	13.00%
$50,000 to $74,999	18.40%
$75,000 to $99,999	10.30%
$100,000 to $149,999	22.90%
$150,000 to $199,999	8.00%
$200,000 or more	8.60%
Median Household Income	$74,711
Mean Household Income	$93,130

City of Moraine

Tables 2.4.67 to 2.4.72 summarize the City of Moraine's population, housing statistics, and income statistics. There are 2,687 households of which 27.43 percent have at least one member under 18 years of age, and 26.20 percent have members 65 years and over. The largest percentage of households (16.40 percent) had an income between $50,000 to $74,999; approximately 8.90 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Moraine was the White (non-Hispanic) group, which makes up 70.64 percent of the population. Black or African American is the second largest race (14.70 percent). Approximately 5.88 percent of the city's population speak Spanish at home. In addition, 0.00 percent speak another Indo-European language, 1.52 percent speak an Asian and Pacific Island language, and 0.31 percent speak another language.

Table 2.4.67: City of Moraine Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	6,484	100%
Under 18 Years	1,881	29.01%
18 to 24 Years	477	7.36%
25 to 34 Years	975	15.04%
35 to 44 Years	855	13.19%
45 to 54 Years	528	8.14%
55 to 64 Years	845	13.03%
65 Years and More	923	14.24%

Table 2.4.68: City of Moraine Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	3,088	100%
Occupied Housing Units	2,687	87.01%
Housing Units - Mobile Homes	96	3.57%
Vacant Housing Units	401	12.99%

Table 2.4.69: City of Moraine Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	2,687	-
Average Household Size	2.37	-
Households with People Under 18 Years	737	27.43%
Households with People 65+ Years	704	26.20%
Householder Living Alone 65+ Years	398	14.80%
No Vehicle Available	234	8.71%
With a Broadband Internet Subscription	2,239	83.33%

Table 2.4.70: City of Moraine Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	6,484	100%
White	4,580	70.64%
Black or African American	953	14.70%
American Indian or Alaska Native	0	0.00%
Asian	129	1.99%
Native Hawaiian or Other Pacific Islander	0	0.00%
Some Other Race (One Race)	0	0.00%
Two or More Races	167	2.58%
Hispanic or Latino (of any race)	655	10.10%

Table 2.4.71: City of Moraine Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	6,174	100%
English only	5,698	92.29%
Spanish	363	5.88%
Other Indo-European languages	0	0.00%
Asian and Pacific Island languages	94	1.52%
Other languages	19	0.31%

Table 2.4.72: City of Moraine Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	8.90%
$10,000 to $14,999	7.50%
$15,000 to $24,999	10.90%
$25,000 to $34,999	16.00%
$35,000 to $49,999	13.20%
$50,000 to $74,999	16.40%
$75,000 to $99,999	10.80%
$100,000 to $149,999	11.70%
$150,000 to $199,999	3.20%
$200,000 or more	1.30%
Median Household Income	$40,793
Mean Household Income	$56,293

City of Oakwood

Tables 2.4.73 to 2.4.78 summarize the City of Oakwood's population, housing statistics, and income statistics. There are 3,610 households of which 40.11 percent have at least one member under 18 years of age, and 23.00 percent have members 65 years and over. The largest percentage of households (29.10 percent) had an income of $200,000 or more; approximately 1.30 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Oakwood was the White (non-Hispanic) group, which makes up 91.53 percent of the population. Two or More Races is the second largest race (3.32 percent). Approximately 0.81 percent of the city's population speak Spanish at home. In addition, 1.52 percent speak another Indo-European language, 2.76 percent speak an Asian and Pacific Island language, and 0.17 percent speak another language.

Table 2.4.73: City of Oakwood Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	9,496	100%
Under 18 Years	2,845	29.96%
18 to 24 Years	422	4.44%
25 to 34 Years	998	10.51%
35 to 44 Years	1,198	12.62%
45 to 54 Years	1,895	19.96%
55 to 64 Years	1,011	10.65%
65 Years and More	1,127	11.87%

Table 2.4.74: City of Oakwood Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	3,864	100%
Occupied Housing Units	3,610	93.43%
Housing Units - Mobile Homes	0	0.00%
Vacant Housing Units	254	6.57%

Table 2.4.75: City of Oakwood Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	3,610	-
Average Household Size	2.63	--
Households with People Under 18 Years	1,448	40.11%
Households with People 65+ Years	830	23.00%
Householder Living Alone 65+ Years	357	9.90%
No Vehicle Available	96	2.66%
With a Broadband Internet Subscription	3,514	97.34%

Table 2.4.76: City of Oakwood Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	9,496	100%
White	8,692	91.53%
Black or African American	38	0.40%
American Indian or Alaska Native	0	0.00%
Asian	291	3.06%
Native Hawaiian or Other Pacific Islander	0	0.00%
Some Other Race (One Race)	0	0.00%
Two or More Races	315	3.32%
Hispanic or Latino (of any race)	160	1.68%

Table 2.4.77: City of Oakwood Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	9,058	100%
English only	8,582	94.74%
Spanish	73	0.81%
Other Indo-European languages	138	1.52%
Asian and Pacific Island languages	250	2.76%
Other languages	15	0.17%

Table 2.4.78: City of Oakwood Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	1.30%
$10,000 to $14,999	4.20%
$15,000 to $24,999	2.70%
$25,000 to $34,999	2.20%
$35,000 to $49,999	5.80%
$50,000 to $74,999	9.20%
$75,000 to $99,999	10.40%
$100,000 to $149,999	16.60%
$150,000 to $199,999	18.40%
$200,000 or more	29.10%
Median Household Income	$132,722
Mean Household Income	$179,717

City of Riverside

Tables 2.4.79 to 2.4.84 summarize the City of Riverside's population, housing statistics, and income statistics. There are 10,820 households of which 21.78 percent have at least one member under 18 years of age, and 26.70 percent have members 65 years and over. The largest percentage of households (20.20 percent) had an income between $50,000 to $74,999; approximately 5.20 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Riverside was the White (non-Hispanic) group, which makes up 80.65 percent of the population. Black or African American is the second largest race (7.05 percent). Approximately 2.34 percent of the city's population speak Spanish at home. In addition, 1.57 percent speak another Indo-European language, 2.28 percent speak an Asian and Pacific Island language, and 0.46 percent speak another language.

Table 2.4.79: City of Riverside Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	24,482	100%
Under 18 Years	5,664	23.14%
18 to 24 Years	2,377	9.71%
25 to 34 Years	4,291	17.53%
35 to 44 Years	2,723	11.12%
45 to 54 Years	2,360	9.64%
55 to 64 Years	3,361	13.73%
65 Years and More	3,706	15.14%

Table 2.4.80: City of Riverside Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	11,821	100%
Occupied Housing Units	10,820	91.53%
Housing Units - Mobile Homes	225	2.08%
Vacant Housing Units	1,001	8.47%

Table 2.4.81: City of Riverside Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	10,820	-
Average Household Size	2.26	-
Households with People Under 18 Years	2,357	21.78%
Households with People 65+ Years	2,889	26.70%
Householder Living Alone 65+ Years	1,169	10.80%
No Vehicle Available	575	5.31%
With a Broadband Internet Subscription	9,717	89.81%

Table 2.4.82: City of Riverside Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	24,482	100%
White	19,744	80.65%
Black or African American	1,726	7.05%
American Indian or Alaska Native	5	0.02%
Asian	696	2.84%
Native Hawaiian or Other Pacific Islander	17	0.07%
Some Other Race (One Race)	152	0.62%
Two or More Races	1,278	5.22%
Hispanic or Latino (of any race)	864	3.53%

Table 2.4.83: City of Riverside Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	22,734	100%
English only	21,221	93.34%
Spanish	533	2.34%
Other Indo-European languages	358	1.57%
Asian and Pacific Island languages	518	2.28%
Other languages	104	0.46%

Table 2.4.84: City of Riverside Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	5.20%
$10,000 to $14,999	4.80%
$15,000 to $24,999	9.30%
$25,000 to $34,999	8.60%
$35,000 to $49,999	14.50%
$50,000 to $74,999	20.20%
$75,000 to $99,999	15.70%
$100,000 to $149,999	14.60%
$150,000 to $199,999	4.00%
$200,000 or more	3.10%
Median Household Income	$56,232
Mean Household Income	$69,614

*City of Springboro *(The majority of this jurisdiction lies in Warren County)*

Tables 2.4.85 to 2.4.90 summarize the City of Springboro's population, housing statistics, and income statistics. There are 6,750 households of which 39.35 percent have at least one member under 18 years of age, and 29.40 percent have members 65 years and over. The largest percentage of households (25.10 percent) had an income between $100,000 to $149,999; approximately 2.90 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Springboro was the White (non-Hispanic) group, which makes up 89.78 percent of the population. Two or More Races is the second largest race (3.35 percent). Approximately 0.66 percent of the city's population speak Spanish at home. In addition, 1.64 percent speak another Indo-European language and 1.09 percent speak an Asian and Pacific Island language.

Table 2.4.85: City of Springboro Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	19,218	100%
Under 18 Years	5,368	27.93%
18 to 24 Years	1,394	7.25%
25 to 34 Years	1,959	10.19%
35 to 44 Years	2,551	13.27%
45 to 54 Years	2,791	14.52%
55 to 64 Years	1,987	10.34%
65 Years and More	3,168	16.48%

Table 2.4.86: City of Springboro Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	7,015	100%
Occupied Housing Units	6,750	96.22%
Housing Units - Mobile Homes	0	0.00%
Vacant Housing Units	265	3.78%

Table 2.4.87: City of Springboro Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	6,750	-
Average Household Size	2.83	-
Households with People Under 18 Years	2,656	39.35%
Households with People 65+ Years	1,985	29.40%
Householder Living Alone 65+ Years	567	8.40%
No Vehicle Available	101	1.50%
With a Broadband Internet Subscription	6,492	96.18%

Table 2.4.88: City of Springboro Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	19,218	100%
White	17,253	89.78%
Black or African American	256	1.33%
American Indian or Alaska Native	5	0.03%
Asian	464	2.41%
Native Hawaiian or Other Pacific Islander	0	0.00%
Some Other Race (One Race)	45	0.23%
Two or More Races	643	3.35%
Hispanic or Latino (of any race)	552	2.87%

Table 2.4.89: City of Springboro Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	17,813	100%
English only	17,208	96.60%
Spanish	118	0.66%
Other Indo-European languages	292	1.64%
Asian and Pacific Island languages	195	1.09%
Other languages	0	0.00%

Table 2.4.90: City of Springboro Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	2.90%
$10,000 to $14,999	0.70%
$15,000 to $24,999	1.80%
$25,000 to $34,999	3.50%
$35,000 to $49,999	5.00%
$50,000 to $74,999	16.80%
$75,000 to $99,999	13.50%
$100,000 to $149,999	25.10%
$150,000 to $199,999	12.80%
$200,000 or more	17.90%
Median Household Income	$113,182
Mean Household Income	$130,569

City of Trotwood

Tables 2.4.91 to 2.4.96 summarize the City of Trotwood's population, housing statistics, and income statistics. There are 10,233 households of which 19.38 percent have at least one member under 18 years of age, and 37.50 percent have members 65 years and over. The largest percentage of households (18.00 percent) had an income between $35,000 to $49,999; approximately 7.60 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Trotwood was the Black or African American (non-Hispanic) group, which makes up 64.89 percent of the population. White is the second largest race (27.94 percent). Approximately 1.08 percent of the city's population speak Spanish at home. In addition, 1.76 percent speak another Indo-European language, 0.13 percent speak an Asian and Pacific Island language, and 1.25 percent speak another language.

Table 2.4.91: City of Trotwood Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	23,125	100%
Under 18 Years	4,756	20.57%
18 to 24 Years	1,891	8.18%
25 to 34 Years	2,263	9.79%
35 to 44 Years	2,878	12.45%
45 to 54 Years	3,020	13.06%
55 to 64 Years	3,210	13.88%
65 Years and More	5,107	22.08%

Table 2.4.92: City of Trotwood Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	11,780	100%
Occupied Housing Units	10,233	86.87%
Housing Units - Mobile Homes	185	1.81%
Vacant Housing Units	1,547	13.13%

Table 2.4.93: City of Trotwood Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	10,233	-
Average Household Size	2.20	-
Households with People Under 18 Years	1,983	19.38%
Households with People 65+ Years	3,837	37.50%
Householder Living Alone 65+ Years	2,128	20.80%
No Vehicle Available	1,202	11.75%
With a Broadband Internet Subscription	8,645	84.48%

Table 2.4.94: City of Trotwood Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	23,125	100%
White	6,462	27.94%
Black or African American	15,006	64.89%
American Indian or Alaska Native	4	0.02%
Asian	35	0.15%
Native Hawaiian or Other Pacific Islander	24	0.10%
Some Other Race (One Race)	46	0.20%
Two or More Races	1,132	4.90%
Hispanic or Latino (of any race)	416	1.80%

Table 2.4.95: City of Trotwood Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	22,096	100%
English only	21,164	95.78%
Spanish	238	1.08%
Other Indo-European languages	388	1.76%
Asian and Pacific Island languages	29	0.13%
Other languages	277	1.25%

Table 2.4.96: City of Trotwood Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	7.60%
$10,000 to $14,999	9.50%
$15,000 to $24,999	8.20%
$25,000 to $34,999	10.80%
$35,000 to $49,999	18.00%
$50,000 to $74,999	17.70%
$75,000 to $99,999	10.50%
$100,000 to $149,999	13.70%
$150,000 to $199,999	2.30%
$200,000 or more	1.70%
Median Household Income	$46,442
Mean Household Income	$59,982

City of Union

Tables 2.4.97 to 2.4.102 summarize the City of Union's population, housing statistics, and income statistics. There are 2,725 households of which 31.71 percent have at least one member under 18 years of age, and 40.10 percent have members 65 years and over. The largest percentage of households (26.10 percent) had an income between $50,000 to $74,999; approximately 1.20 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Union was the White (non-Hispanic) group, which makes up 90.91 percent of the population. Two or More Races is the second largest race (5.08 percent). Approximately 0.58 percent of the city's population speak Spanish at home. In addition, 0.44 percent speak another Indo-European language.

Table 2.4.97: City of Union Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	6,894	100%
Under 18 Years	1,786	25.91%
18 to 24 Years	337	4.89%
25 to 34 Years	846	12.27%
35 to 44 Years	984	14.27%
45 to 54 Years	769	11.15%
55 to 64 Years	698	10.12%
65 Years and More	1,474	21.38%

Table 2.4.98: City of Union Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	2,952	100%
Occupied Housing Units	2,725	92.31%
Housing Units - Mobile Homes	44	1.61%
Vacant Housing Units	227	7.69%

Table 2.4.99: City of Union Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	2,725	
Average Household Size	2.53	
Households with People Under 18 Years	864	31.71%
Households with People 65+ Years	1,093	40.10%
Householder Living Alone 65+ Years	496	18.20%
No Vehicle Available	8	0.29%
With a Broadband Internet Subscription	2,405	88.26%

Table 2.4.100: City of Union Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	6,894	100%
White	6,267	90.91%
Black or African American	223	3.23%
American Indian or Alaska Native	0	0.00%
Asian	0	0.00%
Native Hawaiian or Other Pacific Islander	0	0.00%
Some Other Race (One Race)	0	0.00%
Two or More Races	350	5.08%
Hispanic or Latino (of any race)	54	0.78%

Table 2.4.101: City of Union Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	6,602	100%
English only	6,535	98.99%
Spanish	38	0.58%
Other Indo-European languages	29	0.44%
Asian and Pacific Island languages	0	0.00%
Other languages	0	0.00%

Table 2.4.102: City of Union Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	1.20%
$10,000 to $14,999	3.00%
$15,000 to $24,999	2.70%
$25,000 to $34,999	11.20%
$35,000 to $49,999	11.90%
$50,000 to $74,999	26.10%
$75,000 to $99,999	16.50%
$100,000 to $149,999	18.30%
$150,000 to $199,999	5.30%
$200,000 or more	3.90%
Median Household Income	$68,586
Mean Household Income	$80,480

City of Vandalia

Tables 2.4.103 to 2.4.108 summarize the City of Vandalia's population, housing statistics, and income statistics. There are 6,434 households of which 24.62 percent have at least one member under 18 years of age, and 29.70 percent have members 65 years and over. The largest percentage of households (19.60 percent) had an income between $50,000 to $74,999; approximately 1.90 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of Vandalia was the White (non-Hispanic) group, which makes up 88.33 percent of the population. Black or African American is the second largest race (5.12 percent). Approximately 0.20 percent of the city's population speak Spanish at home. In addition, 0.52 percent speak another Indo-European language, 1.07 percent speak an Asian and Pacific Island language, and 0.32 percent speak another language.

Table 2.4.103: City of Vandalia Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	15,139	100%
Under 18 Years	3,429	22.65%
18 to 24 Years	1,316	8.69%
25 to 34 Years	1,809	11.95%
35 to 44 Years	1,837	12.13%
45 to 54 Years	2,134	14.10%
55 to 64 Years	2,039	13.47%
65 Years and More	2,575	17.01%

Table 2.4.104: City of Vandalia Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	6,640	100%
Occupied Housing Units	6,434	96.90%
Housing Units - Mobile Homes	0	0.00%
Vacant Housing Units	206	3.10%

Table 2.4.105: City of Vandalia Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	6,434	-
Average Household Size	2.33	-
Households with People Under 18 Years	1,584	24.62%
Households with People 65+ Years	1,911	29.70%
Householder Living Alone 65+ Years	856	13.30%
No Vehicle Available	253	3.93%
With a broadband Internet subscription	5,830	90.61%

Table 2.4.106: City of Vandalia Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	15,139	100%
White	13,373	88.33%
Black or African American	775	5.12%
American Indian or Alaska Native	10	0.07%
Asian	185	1.22%
Native Hawaiian or Pacific Islander	0	0.00%
Some Other Race (One Race)	47	0.31%
Two or More Races	550	3.63%
Hispanic or Latino (of any race)	199	1.31%

Table 2.4.107: City of Vandalia Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	14,138	100%
English only	13,841	97.90%
Spanish	28	0.20%
Other Indo-European languages	73	0.52%
Asian and Pacific Island languages	151	1.07%
Other languages	45	0.32%

Table 2.4.108: City of Vandalia Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	1.90%
$10,000 to $14,999	2.00%
$15,000 to $24,999	7.30%
$25,000 to $34,999	8.00%
$35,000 to $49,999	11.70%
$50,000 to $74,999	19.60%
$75,000 to $99,999	17.90%
$100,000 to $149,999	14.10%
$150,000 to $199,999	11.20%
$200,000 or more	6.30%
Median Household Income	$73,171
Mean Household Income	$91,730

City of West Carrollton

Tables 2.4.109 to 2.4.114 summarize the City of West Carrollton's population, housing statistics, and income statistics. There are 6,071 households of which 23.06 percent have at least one member under 18 years of age, and 29.60 percent have members 65 years and over. The largest percentage of households (20.90 percent) had an income between $50,000 to $74,999; approximately 4.70 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the City of West Carrollton was the White (non-Hispanic) group, which makes up 75.89 percent of the population. Black or African American is the second largest race (14.32 percent). Approximately 2.39 percent of the city's population speak Spanish at home. In addition, 0.35 percent speak another Indo-European language, 0.83 percent speak an Asian and Pacific Island language, and 0.30 percent speak another language.

Table 2.4.109: City of West Carrollton Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	13,060	100%
Under 18 Years	2,770	21.21%
18 to 24 Years	1,275	9.76%
25 to 34 Years	1,806	13.83%
35 to 44 Years	2,143	16.41%
45 to 54 Years	1,380	10.57%
55 to 64 Years	1,372	10.51%
65 Years and More	2,314	17.72%

Table 2.4.110: City of West Carrollton Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	6,516	100%
Occupied Housing Units	6,071	93.17%
Housing Units - Mobile Homes	245	4.04%
Vacant Housing Units	445	6.83%

Table 2.4.111: City of West Carrollton Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	6,071	-
Average Household Size	2.13	-
Households with People Under 18 Years	1,400	23.06%
Households with People 65+ Years	1,797	29.60%
Householder Living Alone 65+ Years	947	15.60%
No Vehicle Available	308	5.07%
With a Broadband Internet Subscription	5,385	88.70%

Table 2.4.112: City of West Carrollton Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	13,060	100%
White	9,911	75.89%
Black or African American	1,870	14.32%
American Indian or Alaska Native	6	0.05%
Asian	165	1.26%
Native Hawaiian or Pacific Islander	0	0.00%
Some Other Race (One Race)	0	0.00%
Two or More Races	593	4.54%
Hispanic or Latino (of any race)	515	3.94%

Table 2.4.113: City of West Carrollton Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	12,362	100%
English only	11,885	96.14%
Spanish	295	2.39%
Other Indo-European languages	43	0.35%
Asian and Pacific Island languages	102	0.83%
Other languages	37	0.30%

Table 2.4.114: City of West Carrollton Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	4.70%
$10,000 to $14,999	4.30%
$15,000 to $24,999	11.60%
$25,000 to $34,999	7.80%
$35,000 to $49,999	15.50%
$50,000 to $74,999	20.90%
$75,000 to $99,999	14.50%
$100,000 to $149,999	13.20%
$150,000 to $199,999	2.60%
$200,000 or more	4.90%
Median Household Income	$54,861
Mean Household Income	$69,010

Village of Farmersville

Tables 2.4.115 to 2.4.120 summarize the Village of Farmersville's population, housing statistics, and income statistics. There are 357 households of which 39.22 percent have at least one member under 18 years of age, and 31.90 percent have members 65 years and over. The largest percentage of households (27.50 percent) had an income between $50,000 to $74,999; approximately 2.80 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the Village of Farmersville was the White (non-Hispanic) group, which makes up 99.41 percent of the population. Some Other Race is the second largest race (.29 percent).

Table 2.4.115: Village of Farmersville Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	1,022	100%
Under 18 Years	314	30.72%
18 to 24 Years	69	6.75%
25 to 34 Years	143	13.99%
35 to 44 Years	104	10.18%
45 to 54 Years	126	12.33%
55 to 64 Years	99	9.69%
65 Years and More	167	16.34%

Table 2.4.116: Village of Farmersville Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	366	100%
Occupied Housing Units	357	97.54%
Housing Units - Mobile Homes	0	0.00%
Vacant Housing Units	9	2.46%

Table 2.4.117: Village of Farmersville Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	357	-
Average Household Size	2.86	-
Households with People Under 18 Years	140	39.22%
Households with People 65+ Years	114	31.90%
Householder Living Alone 65+ Years	26	7.30%
No Vehicle Available	4	1.12%
With a Broadband Internet Subscription	344	96.36%

Table 2.4.118: Village of Farmersville Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	1,022	100%
White	1,016	99.41%
Black or African American	0	0.00%
American Indian or Alaska Native	0	0.00%
Asian	0	0.00%
Native Hawaiian or Other Pacific Islander	0	0.00%
Some Other Race (One Race)	3	0.29%
Two or More Races	3	0.29%
Hispanic or Latino (of any race)	0	0.00%

Table 2.4.119: Village of Farmersville Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics		
Total Population (over 5 years old)	974	99.80%
English only	0	0.00%
Spanish	0	0.00%
Other Indo-European languages	2	0.20%
Asian and Pacific Island languages	0	0.00%
Other languages	976	100%

Table 2.4.120: Village of Farmersville Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	2.80%
$10,000 to $14,999	2.00%
$15,000 to $24,999	2.50%
$25,000 to $34,999	3.60%
$35,000 to $49,999	14.00%
$50,000 to $74,999	27.50%
$75,000 to $99,999	22.40%
$100,000 to $149,999	19.30%
$150,000 to $199,999	3.10%
$200,000 or more	2.80%
Median Household Income	$71,979
Mean Household Income	$84,758

Village of New Lebanon

Tables 2.4.121 to 2.4.126 summarize the Village of New Lebanon's population, housing statistics, and income statistics. There are 1,504 households of which 29.59 percent have at least one member under 18 years of age, and 36.80 percent have members 65 years and over. The largest percentage of households (23.10 percent) had an income between $50,000 to $74,999; approximately 0.70 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the Village of New Lebanon was the White (non-Hispanic) group, which makes up 94.24 percent of the population. Two or more races is the second largest race (3.51 percent). Approximately 0.55 percent of the village's population speak Spanish at home. In addition, 0.50 percent speak an Asian and Pacific Island language.

Table 2.4.121: Village of New Lebanon Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	4.131	100%
Under 18 Years	1,201	29.07%
18 to 24 Years	486	11.76%
25 to 34 Years	463	11.21%
35 to 44 Years	411	9.95%
45 to 54 Years	413	10.00%
55 to 64 Years	282	6.83%
65 Years and More	875	21.18%

Table 2.4.122: Village of New Lebanon Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	1,563	100%
Occupied Housing Units	1,504	96.23%
Housing Units - Mobile Homes	21	1.40%
Vacant Housing Units	59	3.77%

Table 2.4.123: Village of New Lebanon Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	1,504	-
Average Household Size	2.68	-
Households with People Under 18 Years	445	29.59%
Households with People 65+ Years	553	36.80%
Householder Living Alone 65+ Years	224	14.90%
No Vehicle Available	90	5.98%
With a Broadband Internet Subscription	1,376	91.49%

Table 2.4.124: Village of New Lebanon Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	4,131	100%
White	3,893	94.24%
Black or African American	54	1.31%
American Indian or Alaska Native	0	0.00%
Asian	39	0.94%
Native Hawaiian or Other Pacific Islander	0	0.00%
Some Other Race (One Race)	0	0.00%
Two or More Races	145	3.51%
Hispanic or Latino (of any race)	0	0.00%

Table 2.4.125: Village of New Lebanon Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	3,806	100%
English only	3,766	98.95%
Spanish	21	0.55%
Other Indo-European languages	0	0.00%
Asian and Pacific Island languages	19	0.50%
Other languages	0	0.00%

Table 2.4.126: Village of New Lebanon Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	0.70%
$10,000 to $14,999	7.60%
$15,000 to $24,999	13.0%
$25,000 to $34,999	10.20%
$35,000 to $49,999	8.50%
$50,000 to $74,999	23.10%
$75,000 to $99,999	21.30%
$100,000 to $149,999	9.20%
$150,000 to $199,999	6.40%
$200,000 or more	0%
Median Household Income	$59,365
Mean Household Income	$64,646

Village of Phillipsburg

Tables 2.4.127 to 2.4.132 summarize the Village of Phillipsburg's population, housing statistics, and income statistics. There are 178 households of which 31.46 percent have at least one member under 18 years of age, and 23.60 percent have members 65 years and over. The largest percentage of households (23.60 percent) had an income between $75,000 to $99,999; approximately 8.40 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the Village of Phillipsburg was the White (non-Hispanic) group, which makes up 94.97 percent of the population. Hispanic or Latino (of any race) is the second largest race (4.77 percent). Approximately 1.92 percent of the city's population speak Spanish at home.

Table 2.4.127: Village of Phillipsburg Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	398	100%
Under 18 Years	109	27.39%
18 to 24 Years	27	6.78%
25 to 34 Years	66	16.58%
35 to 44 Years	48	12.06%
45 to 54 Years	45	11.31%
55 to 64 Years	45	11.31%
65 Years and More	58	14.57%

Table 2.4.128: Village of Phillipsburg Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	238	100%
Occupied Housing Units	178	74.79%
Housing Units - Mobile Homes	0	0.00%
Vacant Housing Units	60	25.21%

Table 2.4.129: Village of Phillipsburg Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	178	-
Average Household Size	2.24	-
Households with People Under 18 Years	56	31.46%
Households with People 65+ Years	42	23.60%
Householder Living Alone 65+ Years	21	11.80%
No Vehicle Available	11	6.18%
With a Broadband Internet Subscription	160	89.89%

Table 2.4.130: Village of Phillipsburg Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	398	100%
White	378	94.97%
Black or African American	0	0.00%
American Indian or Alaska Native	0	0.00%
Asian	0	0.00%
Native Hawaiian or Other Pacific Islander	0	0.00%
Some Other Race (One Race)	0	0.00%
Two or More Races	1	0.25%
Hispanic or Latino (of any race)	19	4.77%

Table 2.4.131: Village of Phillipsburg Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	364	100%
English only	357	98.08%
Spanish	7	1.92%
Other Indo-European languages	0	0.00%
Asian and Pacific Island languages	0	0.00%
Other languages	0	0.00%

Table 2.4.132: Village of Phillipsburg Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	8.40%
$10,000 to $14,999	3.40%
$15,000 to $24,999	7.30%
$25,000 to $34,999	15.70%
$35,000 to $49,999	14.00%
$50,000 to $74,999	11.80%
$75,000 to $99,999	23.60%
$100,000 to $149,999	11.80%
$150,000 to $199,999	2.80%
$200,000 or more	1.10%
Median Household Income	$56,250
Mean Household Income	$62,525

*Village of Verona *(The majority of this jurisdiction lies in Preble County)*

Tables 2.4.133 to 2.4.138 summarize the Village of Verona's population, housing statistics, and income statistics. There are 240 households of which 16.67 percent have at least one member under 18 years of age, and 23.80 percent have members 65 years and over. The largest percentage of households (29.60 percent) had an income between $50,000 to $74,999; approximately 1.70 percent of households had an annual income of less than $10,000. In 2022, the largest racial group in the Village of Verona was the White (non-Hispanic) group, which makes up 96.67 percent of the population. Two or More Races is the second largest race (1.74 percent).

Table 2.4.133: Village of Verona Population by Age 2022 ACS 5-Year Estimates

Age	Number	Percentage
Total Population	631	100%
Under 18 Years	114	18.07%
18 to 24 Years	76	12.04%
25 to 34 Years	101	16.01%
35 to 44 Years	63	9.98%
45 to 54 Years	73	11.57%
55 to 64 Years	117	18.54%
65 Years and More	87	13.79%

Table 2.4.134: Village of Verona Housing Statistics 2022 ACS 5-Year Estimates

Housing Statistics	Number	Percentage
Total Housing Units	263	100%
Occupied Housing Units	240	91.25%
Housing Units - Mobile Homes	2	0.83%
Vacant Housing Units	23	8.75%

Table 2.4.135: Village of Verona Household Statistics 2022 ACS 5-Year Estimates

Household Statistics	Number	Percentage
Total Households	240	-
Average Household Size	2.63	-
Households with People Under 18 Years	40	16.67%
Households with People 65+ Years	57	23.80%
Householder Living Alone 65+ Years	14	5.80%
No Vehicle Available	5	2.08%
With a Broadband Internet Subscription	228	95.00%

Table 2.4.136: Village of Verona Race and Ethnicity Statistics 2022 ACS 5-Year Estimates

Race and Ethnicity	Number	Percentage
Total Population	631	100%
White	610	96.67%
Black or African American	0	0.00%
American Indian or Alaska Native	1	0.16%
Asian	0	0.00%
Native Hawaiian or Pacific Islander	0	0.00%
Some Other Race (One Race)	0	0.00%
Two or More Races	11	1.74%
Hispanic or Latino (of any race)	9	1.43%

Table 2.4.137: Village of Verona Language Spoken at Home Statistics 2022 ACS 5-Year Estimates

Language Statistics	Number	Percentage
Total Population (over 5 years old)	609	100%
English only	609	100.00%
Spanish	0	0.00%
Other Indo-European languages	0	0.00%
Asian and Pacific Island languages	0	0.00%
Other languages	0	0.00%

Table 2.4.138: Village of Verona Income Statistics 2022 ACS 5-Year Estimates

Household Income Statistics	Percentage of Households
Less than $10,000	1.70%
$10,000 to $14,999	0.80%
$15,000 to $24,999	5.40%
$25,000 to $34,999	5.00%
$35,000 to $49,999	18.30%
$50,000 to $74,999	29.60%
$75,000 to $99,999	10.00%
$100,000 to $149,999	27.90%
$150,000 to $199,999	1.30%
$200,000 or more	0.00%
Median Household Income	$59,813
Mean Household Income	$73,357

3 | Planning Process

3.1 Methodology

The Planning Process chapter describes the steps involved in the development of the 2024 Montgomery County Natural Hazard Mitigation Plan, including details about who participated, how community involvement was organized and promoted throughout the community, what hazards were included in the Plan and why, as well as how stakeholder involvement played a critical role in the planning process. This chapter also explains how the Core Planning Committee was formed and how member feedback contributed to the updating of the County's Hazard Mitigation Plan.

3.2 Existing Plans & Regulations

Montgomery County and the State of Ohio maintain several plans and tools that were pertinent to reference in the development of the 2024 Montgomery County Natural Hazard Mitigation Plan, including:

- 2019 Montgomery County Natural Hazard Mitigation Plan
- 2024 State of Ohio Hazard Mitigation Plan (SOHMP)
- Montgomery County Subdivision Regulations
- Zoning Regulations for all Townships

3.3 Montgomery County Authority to Adopt Plan

The Montgomery County Board of County Commissioners are elected at large for four-year terms. The board members are the budgeting, appropriating, taxing, and purchasing authority. The Montgomery County Planning Commission was established by the Montgomery County Board of County Commissioners in conformance with Section 713.21 of the Ohio Revised Code. The authority to adopt plans comes from statutory law and from Chapter 307 of the Ohio Revised Code. **Table 3.3.1** lists the existing authorities and regulations in place in Montgomery County and its municipalities. The County and all jurisdictions have the staff and authority to implement the mitigation actions found in this plan. The County and all jurisdictions have the capabilities to grow their capacities in completing/implementing the mitigations actions in **Table 5.2.1**.

Every Village in Montgomery County has a planning commission or a zoning board that deals with development and growth issues in their jurisdiction, referencing regulations, development plans, and mitigation strategies as they make decisions. These jurisdictions are small and have limited full-time staff, so the County as an organization provides strong leadership and oversight of economic development, community development, and land use planning. Smaller jurisdictions, such as Villages, while maintaining an extent of a public-works budget, may be more financially and/or administratively limited than larger jurisdictions.

Table 3.3.1: Existing Authorities and Regulations in Montgomery County's Municipalities

Community	Planning Commission	Comprehensive Plan	Floodplain Regulation	Building Codes*	Zoning Codes	Capital Budget	Public Works Budget
Montgomery County	Yes	Yes	Yes	Yes	Yes	Yes	Limited in-kind wages only

Community	Planning Commission	Comprehensive Plan	Floodplain Regulation	Building Codes*	Zoning Codes	Capital Budget	Public Works Budget
City of Brookville	Yes	Yes	Yes	Yes	Yes	Yes	Limited in-kind wages only
City of Centerville	Yes	Yes	Yes	Yes	Yes	Yes	Limited in-kind wages only
City of Clayton	Yes	Yes	Yes	Yes	Yes	Yes	Limited in-kind wages only
City of Dayton	Yes	Yes	Yes	Yes	Yes	Yes	Limited in-kind wages only
City of Englewood	Yes	Yes	Yes	Yes	Yes	Yes	Limited in-kind wages only
City of Germantown	Yes	No	Yes	Yes	Yes	Yes	Limited in-kind wages only
City of Huber Heights	Yes	Yes	Yes	Yes	Yes	Yes	Limited in-kind wages only
City of Kettering	Yes	Yes	Yes	Yes	Yes	Yes	Limited in-kind wages only
City of Miamisburg	Yes	No	Yes	Yes	Yes	Yes	Limited in-kind wages only
City of Moraine	Yes	Yes	Yes	Yes	Yes	Yes	Limited in-kind wages only

Community	Planning Commission	Comprehensive Plan	Floodplain Regulation	Building Codes*	Zoning Codes	Capital Budget	Public Works Budget
City of Oakwood	Yes	Yes	Yes	Yes	Yes	Yes	Limited in-kind wages only
City of Riverside	Yes	Yes	Yes	Yes	Yes	Yes	Limited in-kind wages only
City of Trotwood	Yes	Yes	Yes	Yes	Yes	Yes	Limited in-kind wages only
City of Union	Yes	Yes	Yes	Yes	Yes	Yes	Limited in-kind wages only
City of Vandalia	Yes	Yes	Yes	Yes	Yes	Yes	Limited in-kind wages only
City of West Carrollton	Yes	Yes	Yes	Yes	Yes	Yes	Limited in-kind wages only
Village of Farmersville	Yes	No	Yes	Yes	Yes	Yes	Limited in-kind wages only
Village of New Lebanon	Yes	No	Yes	Yes	Yes	Yes	Limited in-kind wages only
Village of Phillipsburg	No	No	Yes	Yes	Yes	Yes	Limited in-kind wages only
Washington Township	Yes	Yes	No	Yes	Yes	Yes	Limited in-kind wages only

Community	Planning Commission	Comprehensive Plan	Floodplain Regulation	Building Codes*	Zoning Codes	Capital Budget	Public Works Budget
Miami Conservancy District	Yes	No	Yes	No	No	Yes	Limited in-kind wages only

* All jurisdictions within the state now follow the State Building Code (Ohio Administrative Code 4101:1)

3.4 Notification Process

Core Planning Committee members were invited to participate at the beginning of the planning process through a Kickoff Meeting announcement. Prior to each additional meeting, members of the Core Planning Committee were invited to participate via email notification. Representatives from the following entities were invited to participate in the planning process. Additionally, **Table 3.4.1** lists the participating jurisdictions and representatives and how they participated.

Montgomery County

- Montgomery County Auditor
- Montgomery County OEM
- Montgomery County Business Services - Building Regulation
- Montgomery County Engineer's Office
- Montgomery County Facilities Management
- Montgomery County Sheriff's Office
- Montgomery Soil & Water Conservation District

City and Village Members

- City of Brookville
- City of Centerville
- City of Clayton
- City of Dayton
- City of Englewood
- City of Germantown
- City of Huber Heights
- City of Kettering
- City of Miamisburg
- City of Moraine
- City of Oakwood
- City of Riverside
- City of Trotwood
- City of Union
- City of Vandalia
- City of West Carrollton
- Village of Farmersville
- Village of New Lebanon
- Village of Phillipsburg

Township Members

- Butler Township
- Clay Township
- German Township
- Harrison Township
- Jackson Township
- Jefferson Township
- Miami Township
- Perry Township
- Washington Township

Local Schools and Universities

- Sinclair Community College
- University of Dayton

Other Organizations

- AES Ohio
- Alcohol, Addiction, and Mental Health Services (ADAHMS)
- Area Agency on Aging
- CenterPoint Energy
- Downtown Dayton Partnership
- Five Rivers Metro Parks
- Greater Dayton Area Hospital Association (GDAHA)
- Miami Valley Conservancy District
- Miami Valley Regional Planning Committee (MVRPC)
- Spectrum

Table 3.4.1: Participating Jurisdictions

Community/Organization	Surveys Completed			Meetings Attended			Representatives
	Goals & Hazard Priorities	Previous Mitigation Actions	New Mitigation Actions	1	2	Other	
County							
Montgomery County Building Official	√						Anthony Wenzler, Building Official
Montgomery County OEM	√	√	√	√	√	√	Nedra Havens, EMA Deputy Director;
Montgomery County Engineer's Office	√	√		√			Paul Gruner, Montgomery County Engineer
Montgomery County Facilities Management	√						Mike Gorman, Assistant Director
Public Health Dayton and Montgomery County	√	√	√	√	√	√	Larry Clark, EPM
Jurisdictions							
City of Brookville	√	√	√		√	√	Jack Kuntz, City Manager
City of Centerville	√	√	√	√	√	√	Brandon Barnett, Miami Valley Fire District
City of Clayton	√	√	√			√	Brian Garner, Clayton Fire Department
City of Dayton	√	√	√			√	Nick Hosford, Dayton Fire Department

Community/Organization	Surveys Completed			Meetings Attended			Representatives
	Goals & Hazard Priorities	Previous Mitigation Actions	New Mitigation Actions	1	2	Other	
City of Englewood	√	√	√		√	√	Anthony Terrace, Englewood Fire Department
City of Germantown	√	√	√			√	Chip Wirrig, Germantown Service Manager
City of Huber Heights	√	√	√	√		√	Keith Kinsley, Huber Heights Fire Department
City of Kettering	√	√	√		√	√	Mitch Robbins, Kettering Fire Department
City of Miamisburg	√	√	√		√	√	Brandon Barnett, Miami Valley Fire District
City of Moraine	√	√	√			√	Traci Kuzminski, Moraine Fire Department
City of Oakwood	√	√	√	√			Allen Hill, Oakwood Public Safety
City of Riverside	√	√	√	√	√		Marker Miller, Riverside Fire Department
City of Trotwood	√	√	√		√	√	Rick Haacke, Trotwood Fire Department

Community/Organization	Surveys Completed			Meetings Attended			Representatives
	Goals & Hazard Priorities	Previous Mitigation Actions	New Mitigation Actions	1	2	Other	
City of Union	√	√	√			√	John Applegate, City Manager
City of Vandalia		√	√			√	Chad Follick, Vandalia Fire Department
City of West Carrollton	√	√	√			√	Chris Barnett, West Carrolton Fire Department
Village of Farmersville	√	√	√			√	Jeff Erisman, Farmersville Fire Department
Village of New Lebanon	√	√	√			√	J.C. Keyser, New Lebanon Fire Department
Village of Phillipsburg	√	√	√			√	Justin Saunders, Phillipsburg Fire Department
Other							
Butler Township	√		√			√	Steve Stein, Butler Township Fire Department
Clay Township	√	√	√			√	Jack Kuntz, City Manager
German Township	√	√	√			√	Chip Wirrig, Germantown Service Manager

Community/Organization	Surveys Completed			Meetings Attended			Representatives
	Goals & Hazard Priorities	Previous Mitigation Actions	New Mitigation Actions	1	2	Other	
Jackson Township	√	√	√			√	Jeff Erisman, Farmersville Fire Department
Jefferson Township					√		Oscar Young, Township Trustee
Miami Township		√	√	√		√	Brandon Barnett, Miami Valley Fire District
Perry Township			√				J.C. Keyser, New Lebanon Fire Department
Washington Township		√				√	Nicholas Bergman, Washington Township Fire Department
Miami Conservancy District	√	√	√		√	√	Barry Puskas, Chief, Technical and Engineering Services; Jess Moyer, Engineering Associate
Sinclair Community College	√					√	Maria Ryan, Transfer Specialist

*If representatives were unable to attend the virtual Core Planning Committee meetings, they participated via "Other" formats, including online surveys, as documented in **Appendix G**.

3.5 Meetings

The following section details the meetings that took place during the planning process. Documentation of each meeting, including newspaper postings, email announcements and attachments, meeting materials, and completed surveys, can be found in **Appendix G**.

Core Planning Committee Kick-off

A Kickoff Announcement was emailed to stakeholders on February 26, 2024, inviting them to participate in the 2019 Montgomery County Natural Hazard Mitigation Plan update process as part of the Core Planning Committee. All kickoff materials were made available on the project's website (http://www.burtonplanning.com/Montgomery-hmp).

The Announcement outlined the following details regarding the planning process:

- Goals of the Hazard Mitigation Plan
- A summary of who is involved in the planning process
- Federal requirements of the hazard mitigation planning process
- An overview of the hazard mitigation planning process
- The proposed schedule for the Montgomery County Plan update
- The role of the Core Planning Committee in the update process
- Contact information for both Montgomery County OEM and Burton Planning Services
- Dates, times, and Microsoft Teams links of upcoming Core Planning and Public Meetings

Core Planning and Public Meeting 1

The first meetings were open to both the core planning members and the public. They were held both virtually and in-person on Monday, March 25, 2024, at 1:00 P.M and at 5:00 P.M at the Dayton Metro Library – Southeast Branch (Belmont's) Community Room B. The meetings began with a brief introduction from a Burton Planning Services (BPS) representative. This introduction included a description of the in-person and virtual engagement process, including multiple options for participants to sign into the meeting. Participants that attended virtually were reminded multiple times throughout the course of the meeting to sign in using the online survey, via the chat function, or by sending an email to the County EMA or BPS. Participants that attended in-person used the sign-in sheets for attendance. The introduction also informed attendees that they could ask questions using the chat feature, or by unmuting themselves and asking their questions at any time throughout the meeting.

A BPS representative then guided the attendees through a presentation which detailed the hazard mitigation planning process, including requirements of the planning process, potential hazards that could be addressed, benefits of hazard mitigation planning, and potential types of projects that could be federally funded because of the hazard mitigation plan. BPS also described the role that the Core Planning Committee would serve in developing the updates to the 2019 Montgomery County Natural Hazard Mitigation Plan.

A total of 14 people attended the afternoon meeting, including the Montgomery County OEM Director and Deputy Director, and Emergency Operations Officer. Representatives from the City of Centerville, City of Huber Heights, City of Oakwood, City of Riverside, Miami Township, Montgomery County Engineer's Office, Public Health - Dayton & Montgomery County, and CenterPoint Energy were in attendance. No members of the public attended the meeting.

No one attended the evening meeting. Two representatives from BPS and the Montgomery County OEM Director remained on the meeting link for the duration of the one-hour meeting to ensure anyone who joined would have the opportunity to participate.

Following the completion of the presentation, a BPS representative guided the attendees through three surveys, detailed below. The participants were provided with multiple methods of completing the surveys, including a physical hard copy of the surveys, a fillable PDF that could be completed on their computer, or an online version. Links to survey locations were provided throughout the meeting. Public input was requested using social media.

Goals Survey

The purpose of this survey was to reflect on the goals included in the 2019 Montgomery County Natural Hazard Mitigation Plan to determine if they were still relevant to the 2024 Plan. Each attendee reviewed the previous goals and determined if they were still applicable, provided comments or edits to the goals that needed changed, and generated new goals to potentially be included in the Plan.

Discussion on the Goals Survey centered around the relevance of the goals. Attendees indicated a preference for adding a goal related to water treatment and water delivery systems. Other attendees mentioned the relevance of invasive species to the Plan.

Hazard Priority Survey

The purpose of this survey was to review all hazards that were included in the 2019 Montgomery County Natural Hazard Mitigation Plan and prioritize them. As such, attendees were asked to rate each hazard on a scale of zero to five, with five meaning the hazard poses the greatest possible threat to the County or their community and zero meaning the hazard should not be included in the 2024 Plan. Attendees rated hazards that were included in the 2019 Montgomery County Natural Hazard Mitigation Plan, as well as all potential hazards that could be included in the 2024 Plan.

Following the completion of this survey, BPS guided a discussion on which hazards were deemed to be most important and which hazards attendees did not think needed to be included. As mentioned above, attendees emphasized invasive species during this part of the meeting.

Previous Mitigation Actions Status Survey

The purpose of the Previous Mitigation Actions Status Survey was to have attendees review the mitigation actions that were included in the 2019 Montgomery County Natural Hazard Mitigation Plan, reflect on the status of each action, and determine if that action should be included in the 2024 Hazard Mitigation Plan.

Core Planning and Public Meeting 2

The second set of meetings were open to both the core planning members and the public. They were held both virtually and in-person on Monday, April 29, 2024, at 10:00 A.M and at 5:00 P.M at the Dayton Metro Library – Southeast Branch (Belmont's) Community Room B. The meetings began with a brief introduction from a Burton Planning Services (BPS) representative. This introduction included a description of the in-person and virtual engagement process, including multiple options for participants to sign into the meeting. Participants that attended virtually were reminded multiple times throughout the course of the meeting to sign in using the online survey, via the chat function, or by sending an email to the County EMA or BPS. Participants that attended in-person used the sign-in sheets for attendance. The introduction also informed attendees that they could ask questions using the chat feature, or by unmuting themselves and asking their questions at any time throughout the meeting.

A BPS representative then guided the attendees through a presentation which detailed the hazard mitigation planning process, including requirements of the planning process, potential hazards that could be addressed, benefits of hazard mitigation planning, and potential types of projects that could be federally funded because of the hazard mitigation plan. BPS also described the role that the Core Planning Committee would serve in the development of the 2024 Montgomery County Natural Hazard Mitigation Plan.

A total of 17 people attended the morning planning meeting, including the Montgomery County OEM Director and Deputy Director. Representatives of the City of Brookville, City of Centerville, City of Englewood, City of Kettering, City of Miamisburg, City of Riverside, City of Trotwood, Miami Conservancy District, Public Health - Dayton & Montgomery County, and CenterPoint Energy were in attendance. No members of the public attended the meeting.

One representative from Jefferson Township attended the evening public meeting. No members of the public attended the evening public meeting. Two representatives from BPS and the Director of the Montgomery County OEM remained on the meeting link for the duration of the one-hour meeting to ensure anyone who joined would have the opportunity to participate.

Following the completion of the presentation, a BPS representative guided the attendees through three surveys, detailed below. Each participant was provided with multiple methods of completing the survey, including a physical hard copy of the survey, a fillable PDF that could be completed on their computer, or an online version. Links to survey locations were provided throughout the meeting. Public input was requested using social media.

Hazard Mitigation Action Scoring Matrix

The purpose of this survey was to reflect on the hazard mitigation actions included in the 2019 Montgomery County Natural Hazard Mitigation Plan to determine if they were still relevant to the 2024 Plan. New mitigation actions were developed for the 2024 Montgomery County Natural Hazard Mitigation Plan, and these actions were presented to the Core Planning Committee. Participants were asked to score the actions based on their priority for their jurisdiction. Participants were also told that the wording for the mitigation actions may be altered to better align with the needs of their communities. The remainder of the meeting functioned as a working session, where participants were able to ask questions as they completed their surveys. Once complete, the meeting was concluded.

3.6 Public Comment Period

The 2024 Montgomery Natural Hazard Mitigation Plan was made available to the public and Core Planning Committee for review for a 15-day public comment period on September 18, 2024. The public comment period was extended through November 2, 2024. Comments were received prior to the public comment period from the Core Planning Committee. The Natural Hazard Mitigation Plan was made available for review online on the project's website, Montgomery County's website, and a social media post. No comments from the public were received. The comments received from the Core Planning Committee were addressed. Montgomery County's efforts to include the public and core planning members can be found in Appendix G.

4 | Risk Assessments

4.1 Dam/Levee Failure

Description

FEMA defines a dam as ". Any artificial barrier, including appurtenant works, which impounds or diverts water, and which (1) is 25 feet or more in height from the natural bed of the stream or watercourse measured at the downstream toe of the barrier or from the lowest elevation of the outside limit of the barrier if it is not across a stream channel or watercourse, to the maximum water storage elevation or (2) has an impounding capacity at maximum water storage elevation of 50 acre-feet or more." Dam failure occurs when that impounded water is suddenly released in an uncontrollable manner. A dam/levee failure can result in the uncontrolled release of floodwater downstream of a facility, resulting in a flood wave that can cause significant damage to buildings and infrastructure downstream. The unexpected nature of dam collapse also increases the likelihood of loss of life in the impacted area due to reduced warning times.

Dam infrastructure can be affected by natural hazards, such as floods; man-made threats, such as sabotage; and an imbalance between a dams age and number of resources invested towards dam maintenance, such as dam settlement and cracking, or movement of the dam's foundation. Dam failures can be caused by seepage, structural failure, or water overtopping the reservoir. A majority of dams in the U.S. are privately owned but regulated by the State or Federal government.

The National Flood Insurance Program (NFIP) defines a levee as "a man-made structure, usually an earthen embankment, designed and constructed in accordance with the sound engineering practice to contain, control, or divert the flow of water so as to reduce risk from temporary flooding." Levees are built parallel to waterways in order to reduce the risk of flood damage to neighboring infrastructure. Levee failure can occur from improper maintenance, erosion, seepage, subsidence, and when the man-made structure fails.

Common dam-related terms include:

- **Spillway**: A structure that is part of a dam or found beside a dam which allows the controlled release of water from a reservoir.
- **Outlet works:** Used to regulate or release water flow from a dam. An outlet works is a device which consists of one or more pipes or tunnels which move water through the dam.
- **Auxiliary spillway**: Also known as an emergency spillway, the auxiliary spillway is a secondary spillway only designed to operate during periods of increased water inflow or high reservoir levels.
- **Structural failure**: Caused by foundation defects such as settlement and slope instability or earthquakes.
- **Mechanical failure**: Dam failure due to malfunctioning gates, conduits, or valves.
- **Hydraulic failure**: Occurs when water overtops the dam, usually caused by inadequate spillway design, blockages in spillways, or dam crest settlement.
- **Levee System:** A flood protection system which consists of a levee or other structures, such as closure or drainage devices.

Normally, water passes through a dam via the main spillway or outlet works. During periods of increased water inflow or high reservoir levels, water should pass through an auxiliary spillway. Dam failure or partial failures are typically caused by structural, mechanical, or hydraulic failures, rather than during extreme storm events.

According to the U.S. Army Corps of Engineers (USACE), dams can be classified by their hazard potential. The three hazard potential classes are:

- **High Hazard Potential**: During the event of a dam failure loss of life is probable, which is the primary attribute for assigning this designation to a dam. Economic losses, environmental damages, and lifeline impacts are also likely, but are not required for this designation.
- **Significant Hazard Potential**: No loss of life is expected during a dam failure, but economic losses, environmental damages, and lifeline impacts are likely.
- **Low Hazard Potential**: No loss of life is expected during a dam failure and no lifeline impacts are expected. Environmental damages and economic losses are expected to be limited to the dam owner's property.

Location

Dam properties of High to Low hazard potential are listed in **Table 4.1.1.** The status of each dam's Emergency Action Plan as of June 1, 2024, is indicated in the table (Source: USACE). Dam locations can be seen in **Figure 4.1.2**.

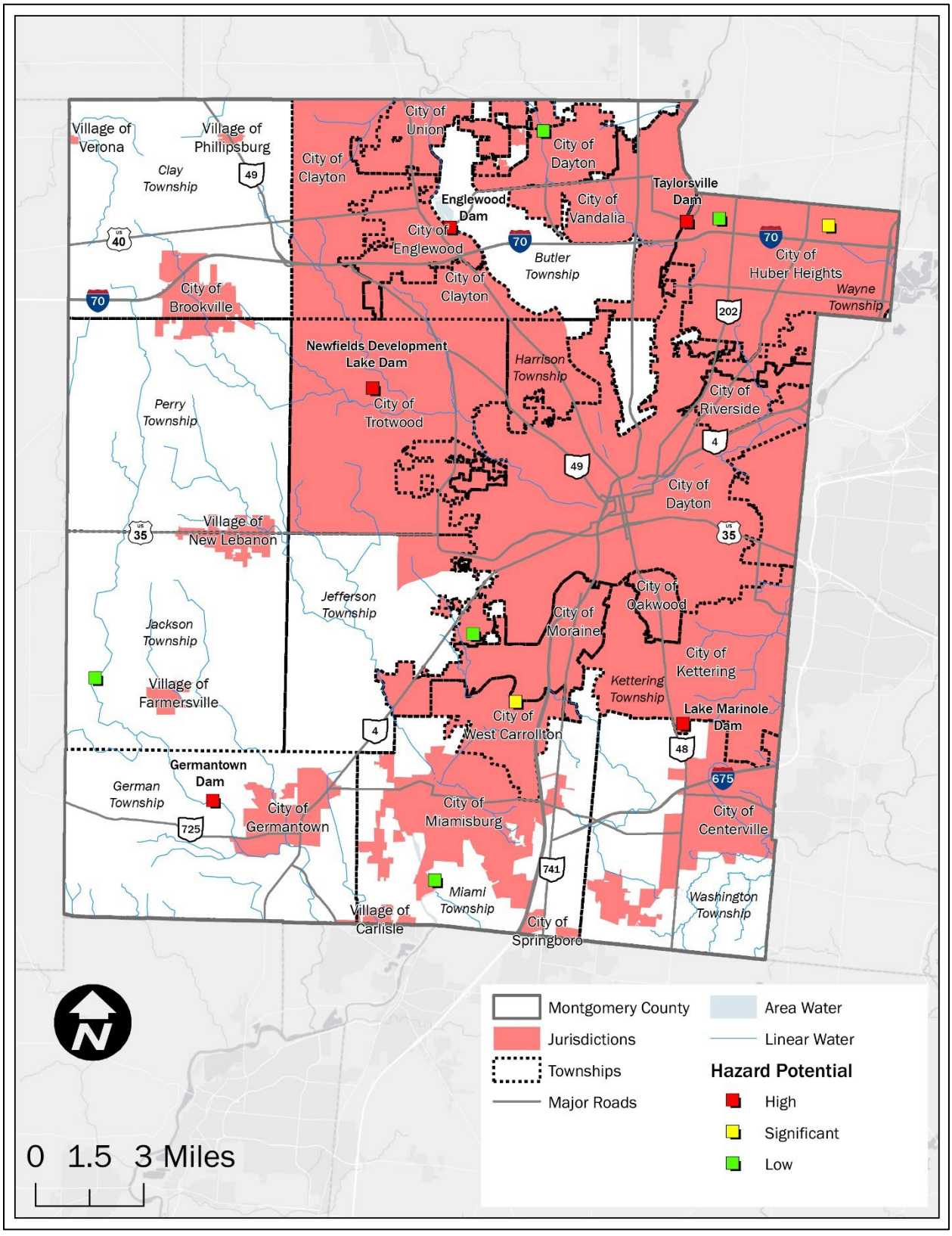
Table 4.1.1: Dam Properties in Montgomery County, Ohio

Hazard Potential Classification	Dam Name	Owner Types	Distance to Nearest City (Miles)	Primary Dam Type	Condition Assessment	EAP Prepared
High	Englewood Dam	Local Government	1.5	Earth	Fair	Yes
High	Germantown Dam	Local Government	1.8	Earth	Fair	Yes
High	Taylorsville Dam	Local Government	0.6	Earth	Fair	Yes
High	Newfields Development Lake Dam	Local Government	1.3	Earth	Fair	Yes
High	Lake Marinole Dam	Private	1.3	Earth	Satisfactory	Yes
Significant	South Montgomery County Low Dam	Local Government	1.3	Concrete	Satisfactory	Yes
Significant	Carriage Hill Reserve Lake Dam	Local Government	7.8	Earth	Satisfactory	Yes
Low	Lake of The Woods Dam	Private	6.3	Earth	Unknown	No
Low	Hutchings Station Dam	Public Utility	0.8	Concrete	Satisfactory	Yes
Low	Possum Creek Reserve Lake Dam	Local Government	2.7	Earth	Satisfactory	Yes
Low	Northpark Center Retention Dam	Local Government	3.5	Concrete	Fair	Yes

Hazard Potential Classification	Dam Name	Owner Types	Distance to Nearest City (Miles)	Primary Dam Type	Condition Assessment	EAP Prepared
Low	Dayton Airport Detention Pond Dam	Local Government	2.4	Earth	Satisfactory	No

Source: U.S. Army Corps of Engineers

Figure 4.1.2: Dam Locations in Montgomery County, Ohio



Extent

The Hazard Priority dam classification system considers the effects of dam failure or mismanagement during both normal and flood flow conditions, as well as worst-case-scenario situations. Dam classification may decrease with physical modifications to the dam or by eliminating downstream infrastructure. The classifications are justifiable, reasonable, and consistent with the federal guidelines for dam safety. The hazard potential classification may change depending on anticipated consequences of a dam failure, such as new development below a dam or within the dam breach floodplain. Hazard potential classification may decrease with physical modifications to the dam or by eliminating downstream infrastructure.

Sudden failure of High Hazard dams could result in one of the following outcomes, depending on environmental conditions.

- Loss of human life.
- All items listed below for failure of Significant Hazard potential dams.

Sudden failures of Significant Hazard dams could result in at least one of the following conditions:

- Disruption of a public water supply or wastewater treatment facility, release of health hazardous industrial or commercial waste, 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 correction facilities as determined by the chief.
- Damage or disruption to railroads or public utilities.
- Damage to downstream dams or levees. Damage to dams or levees can include, but is not limited to, overtopping of the structure. At the request of the dam owner, the chief may exempt dams from the criterion of this paragraph if the dam owner owns the potential affected property.
- Damage or disruption to local roads including, but not limited to, roads not otherwise listed as major roads.
- Damage to agricultural crops and livestock.

Sudden failures of Low Hazard dams could result in property losses restricted mainly to the dam and rural lands, and the loss of human life is not probable.

History

None of the dams listed in **Table 4.1.1** have experienced any known failure or near-failure.

Probability

Dam failures are unlikely but not impossible. All dams, especially High and Significant hazard potential dams, should have an Emergency Action Plan (EAP) in place. In addition, aging dam infrastructure coupled with climate change could result in more frequent dam failures. The Climate Change section in Future Trends discusses climate change further.

Dam conditions can provide insight into how likely it is that a dam will fail. The U.S. Army Corps of Engineers defines dam conditions as follows:

Satisfactory

No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions (static, hydrologic, seismic) in accordance with the minimum applicable state or federal regulatory criteria or tolerable risk guidelines.

- No existing deficiencies or potentially unsafe conditions are recognized, with the exception of minor operational and maintenance items that require attention.
- Safe performance is expected under all loading conditions including the design earthquake and design flood.
- Permanent risk reduction measures (reservoir restrictions, spillway modifications, operating procedures, etc.) have been implemented to eliminate identified deficiencies.

Fair

No existing dam safety deficiencies are recognized for normal operating conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action. Note: Rare or extreme events are defined by the regulatory agency based on their minimum applicable state of federal criteria.

- Lack of maintenance requires attention to prevent developing safety concerns.
- Maintenance conditions may exist that require remedial action greater than routine work and/or secondary studies or investigations.
- Interim or permanent risk reduction measures may be under consideration.

Poor

A dam safety deficiency is recognized for normal operating conditions which may realistically occur. Remedial action is necessary. 'Poor' may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency. Investigations and studies are necessary.

- Dam has multiple deficiencies or a significant deficiency that requires remedial work.
- Lack of maintenance (erosion, sinkholes, settlement, cracking, unwanted vegetation, animal burrows, inoperable outlet gates) has affected the integrity or the operation of the dam under normal operational conditions and requires remedial action to resolve.
- Critical design information is needed to evaluate the potential performance of the dam. For example, a field observation or a review of the dam's performance history has identified a question that can only be answered by review of the design and construction history for the dam. Uncertainty arises when there is no design and/or construction documentation available for review and additional analysis is needed to better understand the risk associated with operation under normal operational conditions.
- Interim or permanent risk reduction measures may be under consideration.

Unsatisfactory

A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.

- A critical component of the dam has deteriorated to unacceptable condition or failed.
- A safety inspection indicates major structural distress (excessive uncontrolled seepage, cracks, slides, sinkholes, severe deterioration, etc.), advanced deterioration, or operational deficiencies which could lead to failure of the dam or its appurtenant structures under normal operating conditions.

- Reservoir restrictions or other interim risk reduction measures are required.
- A partial or complete reservoir drawdown may be mandated by the state or federal regulatory agency.

Englewood Dam

Englewood Dam is located about 1.5 miles from the City of Englewood. Its current condition is assessed as Fair and there is a prepared EAP. According to the Miami Conservancy District, Englewood Dam was completed in 1921. The City of Englewood's wastewater treatment facility is located downstream from the dam.

Germantown Dam

Germantown Dam is located about 1.8 miles from the City of Germantown. Its current condition is assessed as Fair and there is a prepared EAP. The dam was completed in 1920, along with four other dams, for the purpose of flood control. Germantown Dam's inundation area covers 3,520 acres. The inundation area follows Twin Creek for 14 miles and would impact parts of neighboring Preble County.

Taylorsville Dam

Taylorsville dam is located about 0.6 miles from the City of Dayton. Its current condition is assessed as Fair and there is a prepared EAP. The dam was completed in 1921.The dam inundation area covers 11,000 acres and would cover 14 miles towards the City of Troy in Miami County.

Newfields Development Lake Dam

Newfields Development Lake Dam was completed in 1973 for recreational purposes. Its current condition is assessed as Fair and there is a prepared EAP.

Lake Marinole Dam

Lake Marinole Dam was completed in 1966 for recreational purposes. Its current condition is assessed as Fair and there is a prepared EAP.

Vulnerability Assessment

Infrastructure Impact

Failures of High and Significant hazard potential dams could flood roadways, including major routes and local roads. Utility infrastructure (wastewater, drinking water, and commercial and industrial waste lines) may be disrupted or destroyed.

Population Impact

The local population could be impacted by loss of utilities, including the local water supply. Health hazards may also be released into the flood waters during a dam failure which may cause indirect harm to the local population. The local population could be impacted economically as well.

For social vulnerability, in the National Risk Index, "riverine flooding" had a score of 20.42 ("Relatively High"). People that are most vulnerable to flooding are those who live within the 100-year floodplain in structures that are not elevated about the base flood elevation. The index indicates an expected annual loss of $7.3 million due to flood events with 1.5 events occurring per year.

Property Damage

At least one residential or commercial property is likely to face structural collapse during a High or Significant hazard potential dam failure. Dam failure has the potential to damage high value properties. Residential, commercial, industrial, and/or high value properties may be damaged by a significant hazard potential dam failure, as well as publicly owned properties. Properties that are owned by the dam owner may be exempt from the property damage calculation.

Loss of Life

Loss of life is likely during a high hazard potential dam failure. Loss of life during a Significant or Low hazard potential dam failure is not expected.

Economic Losses

Economic losses can include damage from flooding crops, flooding livestock, damaged goods, and the flooding of vital roadways.

Emergency Action Plans (EAPs) have been completed for all High hazard potential dams in the County (**Table 4.1.1**); however, the data is subjected to agreements where it cannot be published publicly. The Ohio Department of Natural Resources (ODNR) holds a record of these EAPs.

Future Trends

Land Use and Development Trends

Development that has occurred in areas that will flood after a dam failure should be prepared for rapid flooding. Land use plans can limit development in these areas to prevent the increase of dam hazard potential. To better understand where development should be limited, dam failure inundation maps should be completed for as many dams as possible. If new residential construction units are within the inundation/breach areas of dams, it would increase property and population vulnerabilities despite county-wide population loss.

The current total value of taxable real estate in Montgomery County is $10,386,064,700. In 2022, Montgomery County authorized 1,343 new residential units at a total value of $268,164,000. The population is expected to decrease by 0.006 percent, or 3,417 people by 2030. An additional decrease of 4.7% is expected by 2040.Given these estimates, there are no known changes in risks associated with dam failures.

Climate Change

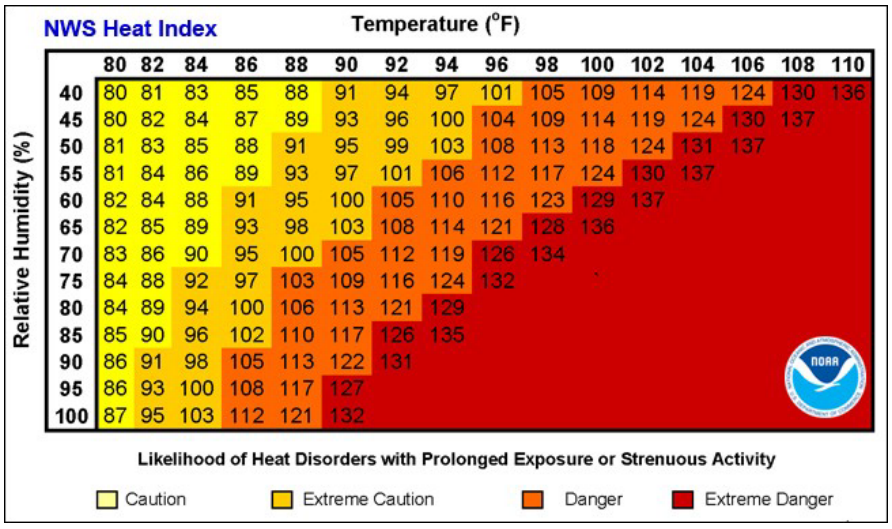
Climate change may increase the frequency and/or the severity of the impacts from a dam failure event. Climate change is having an uneven effect on precipitation (rain and snow) in the U.S. – some areas are experiencing increased precipitation and flooding, while others suffer from drought. If Montgomery County experiences effects of climate change related to heavy rainfall, more frequent and severe flooding could occur, which could lead to or be caused by dam failure. Aging dam infrastructure coupled with climate change could result in more frequent dam failures. According to the 2018 National Climate Assessment, dams and levees can fail after moderate or extreme rainfall. If Montgomery County experiences the effects of climate change related to more frequent droughts, dams and levees can be compromised as a result of the ground cracking due to drying, reduced soil strength, erosion, and subsidence. As drought or precipitation frequency and intensity increase with climate change, the probability and severity of dam failure may increase as well, especially if this infrastructure is not maintained, upgraded, or, if necessary, redesigned.

4.2 Drought and Extreme Heat

Description

According to the Federal Emergency Management Agency (FEMA), extreme heat is a period of high heat and humidity with temperatures above 90 degrees for at least two to three days. In extreme heat the human body works extra hard to maintain a normal temperature, which can lead to death. Extreme heat is responsible for the highest number of annual deaths among all weather-related hazards. Humid conditions, which add to the discomfort of high temperatures, occur when a high-pressure weather system traps hazy, moist air near the ground. Extreme heat may also contribute to the formation of a drought if moisture and precipitation are lacking. The National Weather Service's Heat Index Chart is provided in **Figure 4.2.1**.

Figure 4.2.1: Heat Index Chart



Source: National Weather Service

Extreme heat events are often accompanied by drought conditions when the events are prolonged. A drought is a shortage in precipitation over an extended period of time. Droughts are common throughout all climatic zones and can range in length from a couple of weeks to multiple years or decades in some areas. In 2012, Montgomery County experienced its longest drought, which lasted 34 weeks.

According to the National Oceanic and Atmospheric Administration (NOAA), there are three common types of droughts: Meteorological, Agricultural, and Hydrological. Meteorological drought severity is calculated by the amount of the rainfall deficit (compared to annual averages) and the length of the dry period. Agricultural drought is based on the effects to agriculture by factors such as rainfall and soil water deficits or diminished groundwater/reservoir levels needed for irrigation. Hydrological drought is based on the effects of rainfall shortages on the water supply, such as stream flow, reservoir and lake levels, and groundwater table decline.

Location

Drought is a countywide hazard that can affect all locations and jurisdictions in Montgomery County. More specifically, these hazards typically occur at a regional scale. Droughts most commonly occur in Ohio from spring through autumn; however, they may occur at any time throughout the year.

Extent

Due to the regional nature of droughts and extreme heat events, effects may be noticed throughout the County in both the urbanized and rural areas. All jurisdictions within the County may be affected in a single drought event. In Montgomery County, droughts are often linked to prolonged periods of above average temperatures and little to no precipitation.

Initial effects of drought can be noticed within a short period, as soil may dry out and plants may wither and die. When drought conditions persist over several weeks, months, or years, effects may be more pronounced with reductions in water levels of wells, lakes, reservoirs, streams, and rivers. Water supply issues for agriculture, commercial/industrial activities, and private consumption may arise if drought conditions persist over a long term.

The extent of the drought is determined by the Palmer Drought Severity Index (PDSI), shown below in **Table 4.2.2**. In this way, the Index can be utilized as a tool to help define disaster areas and indicate the availability of irrigation water supplies, reservoir levels, range conditions, amount of stock water, and potential for forest fires. The Palmer Drought Severity Index depicts prolonged (in months or years) abnormal dryness or wetness and is slow to respond, changing little from week to week. It also reflects long-term moisture runoff, recharge, and deep percolation, as well as evapotranspiration.

Table 4.2.2: Palmer Drought Severity Index Classifications and Federal Drought Categories

Palmer Drought Severity Index	Category	Description
-1.0 to -1.9	D0	Abnormally Dry
-2.0 to -2.9	D1	Moderate Drought
-3.0 to -3.9	D2	Severe Drought
-4.0 to -4.9	D3	Extreme Drought
-5.0 or less	D4	Exceptional Drought

The Palmer Drought Severity Index is a standardized index with values typically falling between -4.0 and +4.0, although extreme conditions can be greater in value (includes federal drought categories). Negative values indicate drought conditions while positive values represent wet conditions. Values around zero represent near normal conditions.

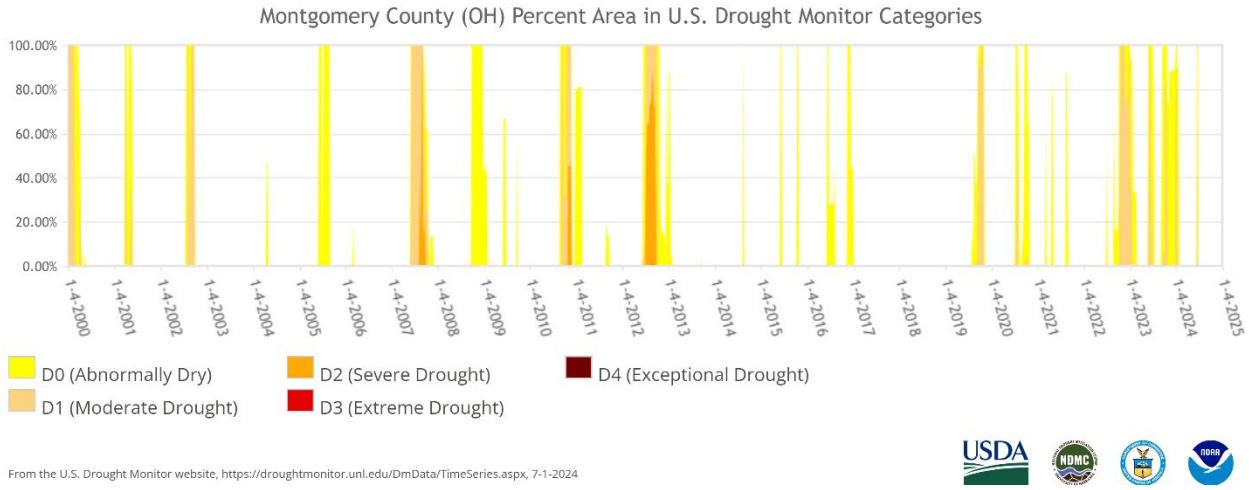
Abnormally dry (D0) and moderate drought (D1) conditions occur frequently and typically do not adversely affect agricultural activities unless conditions are sustained in nature. Severe and extreme drought (D2 and D3, respectively) conditions begin to impact agricultural crops, leading to potential economic losses. These more severe events also may impact drinking water resources, especially if the source is a lake or reservoir. Sustained severe droughts may alter the ability of the soil to absorb water, leading to potential flash flooding when rainfall resumes.

History

Drought

U.S. Drought Monitor (USDM) describes severe drought as a time when crops suffer, the numbers of wildfires are high and the soil is dry, cracked and pulling away from foundations. In an extreme drought, yields are minimal, livestock are stressed, and lawns go dormant. Data shows that Montgomery County has spent 261 weeks in abnormally dry conditions, 98 weeks in moderate drought, 23 weeks in severe drought, and zero weeks in extreme or exceptional drought since 2000. **Figure 4.2.3** depicts the drought monitor history for Montgomery from 2000 through February 2024. The most extensive periods of moderate drought specific to Montgomery County are provided in **Table 4.2.4** (Source: U.S. Drought Monitor).

Figure 4.2.3: Drought in Montgomery County from 2000 to 2024



D0 = Abnormally Dry, D1 = Moderate Drought, D2 = Severe Drought, D3 = Extreme Drought, D4= Exceptional Drought

Source: U.S. Drought Monitor

Table 4.2.4: Periods of Moderate Drought in Montgomery County, Ohio, 2000-2023

Start Date	End Date	# of Consecutive Weeks
9/26/2023	10/24/2023	5
6/6/2023	6/13/2023	2
10/18/2022	1/17/2023	14
10/6/2020	10/13/2020	2
7/21/2020	7/28/2020	2
9/10/2019	10/29/2019	8
6/19/2012	10/2/2012	16
9/14/2010	11/23/2010	11
6/5/2007	10/16/2007	20
8/6/2002	9/24/2002	8
5/8/2001	5/15/2001	2
1/4/2000	2/22/2000	8

Source: U.S. Drought Monitor

Severe Drought

There have been three severe drought events in Montgomery County since January 1, 2020.

- **Severe Drought (D2), July 2012 – September 2012:**
- Starting in June 2012, 100 percent of Montgomery County was experiencing abnormally dry conditions with small parts of the county in moderate drought. Beginning in July 2012, 49 percent of the county entered severe drought, which increased to 89 percent by late August. Severe drought conditions continued until early October 2012.
- **Severe Drought (D2), November 2010:**
- In September 2010, 100% of Montgomery County experienced abnormally dry conditions with fluctuating moderate drought throughout September and October. In early November 2010, 45 percent of the county entered a severe drought that persisted through the end of November.
- **Severe Drought (D2), August 2007– September 2007:**
- Starting in June 2007, 100 percent of Montgomery County was experiencing abnormally dry and moderate drought conditions. In mid-August, conditions worsened, and 40 percent of Montgomery County entered a severe drought. Conditions lessened slightly the following week, but then persisted until early September when 100% of the county entered a severe drought. By the end of September, only 22% of the county remained in severe drought. A moderate drought and abnormally dry conditions persisted through October 2007.

Extreme Heat

There have been three heat events and three excessive heat events in Montgomery County since January 1, 1995. All events are listed individually in Appendix A.

- **Excessive Heat Event, July 19 through 21, 2019:**
- High temperatures in the 90's across Montgomery County and the Dayton metropolitan area combined with high relative humidity created heat index values in excess of 100 degrees for a third day in a row.
- **Heat Event, July 1 through July 7, 2012:**
- Ongoing daily heat continued into early July across southwestern Ohio. Although heat indices were not as high as late June, heat indices in the area generally ranged from 90 to 100 degrees Fahrenheit each day through July 7.
- **Heat Event, June 28 through June 30, 2012:**
- Many locations across southwestern Ohio experienced heat indices over 100 degrees Fahrenheit on June 28 and 29. On June 30, heat indices generally rose to 90 to 95 degrees, which was compounded by widespread power outages in the area.
- **Excessive Heat Event, August 23 and 24, 2007:**
- Oppressively hot and humid conditions with heat indices near 105 degrees impacted the Cincinnati and Dayton metro areas August 22 through August 24.
- **Excessive Heat Event, August 6 through 10, 2007:**
- Oppressively hot and humid conditions with heat indices near 105 degrees impacted southern Ohio August 7 through August 10.

- **Heat Event, July 20 through July 31, 1999:**
- The last part of July was very hot and humid across the state with temperatures reaching the 90's on most days and above 100 for a few days. The dewpoints and overnight lows were in the 70's through much of the period. The excessive heat contributed to ten deaths in the Cincinnati metro area and three in the Dayton metro area.

Probability

Montgomery County has experienced droughts in the past, and the potential exists for the County to experience droughts in the future. Montgomery County has had 15 drought events since 2000. Montgomery County has a 98 percent chance of having a drought and/or experiencing abnormally dry conditions each year based on historical data. Montgomery County had six heat events between 1995 and 2023. Montgomery County has a 21 percent chance of having a heat event each year based on historical data.

Seasons of drought and extreme heat have the potential to occur during any particular year when necessary, conditions are met, and according to the Midwest Chapter of the Fourth National Climate Assessment, the frequency of major heat waves in the Midwest has increased over the last six decades. In addition, it is predicted that as the climate gets warmer, there will be an associated increase in the number and severity of summer droughts and extreme heat events. The Climate Change section in Future Trends discusses climate change further.

Vulnerability Assessment

Drought projections suggest that some regions of the U.S. will become drier and that most will have more extreme variations in precipitation. Even if current drought patterns remain unchanged, warmer temperatures will amplify drought effects. Drought and warmer temperatures may increase risks of large-scale insect outbreaks and wildfires, in addition to accelerating tree and shrub death and changing habitats and ecosystems in favor of drought-tolerant species. Forest and rangeland managers can mitigate some of these impacts and build resiliency in forests through appropriate management actions.

Infrastructure Impact

Drought does not have a significant impact on infrastructure or structures. The greatest impacts of drought are on agricultural interests, as crops may fail, and livestock may not have sufficient water resources.

Population Impact

Extreme heat can have an impact on the population of the entire County. Groups who live in areas with minimal tree cover or urban areas may experience higher temperatures relative to outlying areas due to the urban heat island effects. Groups that are particularly vulnerable to extreme heat, such as older adults and people with chronic health conditions may experience illness or injury, such as heat cramps, heat exhaustion, and heat stroke.

For social vulnerability, the FEMA National Risk Index does not have a rating for drought, but it does have a rating for "Heat Wave" for a score of 87.5 ("relatively moderate"). The index indicates an expected annual loss of $816,000 due to heat wave events with 2.6 events occurring per year.

Property Damage

During extreme heat events, utility failure may occur due to overuse of electricity for cooling. Property damage is a possibility due to extreme heat. Vehicles are at risk of breaking down from excessive heat, as heat can reduce battery life and reduce the efficiency of the cooling system resulting in overheated engines. Extreme heat can also cause a home to dry out and prematurely age. Excessive heat in combination with lack of rainfall (drought) can cause soil to shrink and crack, which puts stress on a

home's foundation that can be costly to fix. Drought and warmer temperatures may increase risks of large-scale insect outbreaks and wildfires. Drought and warmer temperatures may also accelerate tree and shrub death, changing habitats and ecosystems in favor of drought-tolerant species. FEMA's National Risk Index identifies the potential economic loss, specifically expected annual loss for buildings, and expected annual loss (EALP) for population equivalence, associated with Montgomery County for a Heat Wave event, as recorded in **Table 4.2.5** below.

Table 4.2.5: Structure and Population Vulnerability from Heat Wave

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
040406	$58	$168	$11,828	$12,054
150100	$2,057	$104	$8,988	$11,149
010200	$0	$103	$10,878	$10,981
140100	$2,158	$100	$8,651	$10,908
165000	$577	$98	$10,048	$10,723
130102	$744	$112	$9,710	$10,566
020400	$0	$94	$10,079	$10,174
050504	$30	$100	$9,735	$9,865
090304	$12	$76	$9,753	$9,841
125000	$148	$60	$9,574	$9,782
100101	$68	$91	$9,452	$9,611
050503	$5	$109	$9,443	$9,557
090302	$12	$97	$9,372	$9,482
050600	$1,441	$93	$7,929	$9,463
125102	$16	$89	$9,344	$9,449
040405	$0	$93	$9,356	$9,449
080500	$0	$73	$9,226	$9,300
050106	$48	$87	$9,051	$9,186
100102	$1	$86	$8,732	$8,819
080100	$0	$88	$8,674	$8,762
Total	**$7,374**	**$1,922**	**$189,824**	**$199,120**

Source: FEMA National Risk Index

Loss of Life

Loss of life is possible during drought and extreme heat events, especially for young children, the elderly, and individuals with respiratory conditions.

Economic Losses

Economic losses are a threat from extreme heat and droughts to Montgomery County. Crops and livestock may be compromised during prolonged extreme heat events. Human productivity can also be affected when working conditions become too hot. According to the 2022 Census of Agriculture developed by the U.S. Department of Agriculture (USDA), top crop items based on acreage for Montgomery County include soybeans for beans, corn for grain, wheat for grain, forage-land used for all hay and haylage, and corn for silage/greenchop (animal feed). Based on data from the U.S. Department of Agriculture, Montgomery County's crop yields were not impacted from previous drought events. However, census data was collected for 2017 and 2022 which are two years with zero to minimal drought events for Montgomery County. Acreage farmed for Corn, Hay & Haylage, and Soybeans increased, while acreage for Wheat decreased between 2017 and 2022. Yield per acre increased in 2022 versus 2017 with an average of about four bushels per acre for Corn, Soybeans, and Wheat. Yield per acre decreased for Hay & Haylage by two percent **(Figure 4.2.6**). Agricultural land use can be seen on the land use map in Chapter 1 (**Figure 1.2.1).**

Table 4.2.6: Montgomery County Crop Yields 2017 - 2022

Commodity	2017		2022	
	Acres	Crop Yield	Acres	Crop Yield
Corn, Grain	35,568	5,915,748 bushes	39,369	6,796,369 bushels
Hay & Haylage	4,181	9,804 tons	6,418	14,950 tons
Soybeans	44,635	2,246,008 bushels	49,994	2,608,479 bushels
Wheat	1,410	109,670 bushels	2,178	176,544 bushes

Source: United States Department of Agriculture Census

Future Trends

Land Use and Development Trends

Drought and extreme heat are most likely to impact agriculture land uses and land uses that house or serve vulnerable populations, such as schools, daycares, hospitals, and nursing homes. Less people can mean generally less people vulnerable to extreme heat/drought events. However, the increase of people age 65+ from 2017 (9,664) to 2022 (10,326) could mean more vulnerability to Extreme Heat for that population group. Increase of agricultural land use, crop yields, and livestock cash receipts can mean more vulnerability to drought in those areas.

The current total value of taxable real estate in Montgomery County is $10,386,064,700. In 2022, Montgomery County authorized 1,343 new residential units at a total value of $268,164. The population is expected to decrease by 0.006 percent, or 3,417 people by 2030. An additional decrease of 4.7% is expected by 2040. Given these estimates, there are no known changes in risks associated with droughts.

Climate Change

Climate change may increase the frequency and/or the severity of the impacts from drought and extreme heat events. As the climate gets warmer, there will be an associated increase in the number and severity of droughts and extreme heat events. Warmer global temperatures may be associated with a prolonged growing season, but this trend may also increase the risk of crop stress due to excessive heat and crop damage due to increased pests and disease. The longer growing season may help some crops but crops like corn and soybean will be negatively affected by the severe heat in the summer, which will decrease these crops' yields. Additionally, increased frequency and severity may negatively impact infrastructure. For example, dams and levees may be compromised after a

prolonged drought if drying, reduction of soil strength, erosion, subsidence, or ground cracking occurs. Climate change is expected to increase the occurrence and duration of heat waves in the coming decades.

4.3 Earthquakes

Description

Earthquakes are sudden and rapid movements of the Earth's crust and are caused by the abrupt shifting of rocks deep underneath the earth's surface. These movements vary in length and may last from a few seconds to several minutes.

The seismicity, or seismic activity, of an area refers to the frequency, type, and size of earthquakes experienced over time. Earthquakes are measured using observations from seismometers. The Moment Magnitude Scale (MMS), which was developed in the 1970's, is the most common scale on which earthquakes larger than approximately 5.0 in magnitude are reported for the entire world. Earthquakes smaller than magnitude 5.0, which are more numerous, are reported by national seismological observatories and measured most on the local magnitude scale – also referred to as the Richter Scale. These two scales are numerically similar in their range of validity. Earthquakes of magnitude 3.0 or lower are often almost imperceptible or weak, while earthquakes of magnitude 7.0 or greater can potentially cause serious damage over larger areas.

Damage from an earthquake also depends on the earthquake's depth in the Earth's crust. The shallower an earthquake's epicenter, the more damage to structures it will cause. Alternatively, an earthquake can also be measured by its intensity. The Modified Mercalli Intensity Scale (MMI) ranges in value I to XII, in roman numerals (**Table 4.3.1**).

Earthquakes can happen anywhere without warning; they are low-probability, high-consequence events. Most major earthquakes in the U.S. have occurred in California as well as in Alaska, Hawaii, Oregon, Puerto Rico, Washington, and the entire Mississippi River Valley. There have been recorded earthquakes throughout the U.S., and the Ohio River Valley has experienced earthquakes exceeding the 3.0 magnitude within the last 25 years.

Location

Earthquakes are countywide hazards and can affect all areas and jurisdictions within Montgomery County. According to the Ohio Department of Natural Resources (ODNR), Ohio is located on the periphery of the New Madrid Seismic Zone, an area in and around Missouri that was the site of the largest earthquake sequence to occur in the country in the 1800s. Additionally, seismic activity is concentrated in the western Ohio region known as the *western Ohio seismic zone* (also referred to as the *Fort Wayne (Anna) seismogenic zone*), where more than 40 earthquakes have been felt since 1875. Montgomery County does fall in the western Ohio seismic zone.

There is a short fault line that runs north/south in southeast Montgomery County and north Warren County. (**Figure 4.3.2**).

Extent

Earthquakes pose a risk to life and property depending on the severity. To monitor earthquakes, the State of Ohio and the ODNR Division of Geological Survey coordinates a 29-station network (**Figure 4.3.3**) of seismograph stations throughout the state to continuously record earthquake activity. The Ohio Seismic Network (OhioSeis) stations are distributed across the state but are concentrated in the most seismically active areas or in areas that provide optimal conditions for detecting earthquakes. While the seismic network cannot predict earthquakes or provide an alert prior to an event, it can provide insight into earthquake risks in the state so that intelligent decisions about building and facility design and construction, insurance coverage, and other planning decisions can be made by individuals, business and industry, and governmental agencies.

According to the ODNR, there six Ohio Seismic Network monitoring stations in Montgomery County, and three in Montgomery's neighboring Ohio counties: Miami, Greene, and Butler. This sentence is unclear. Please fix the wording.

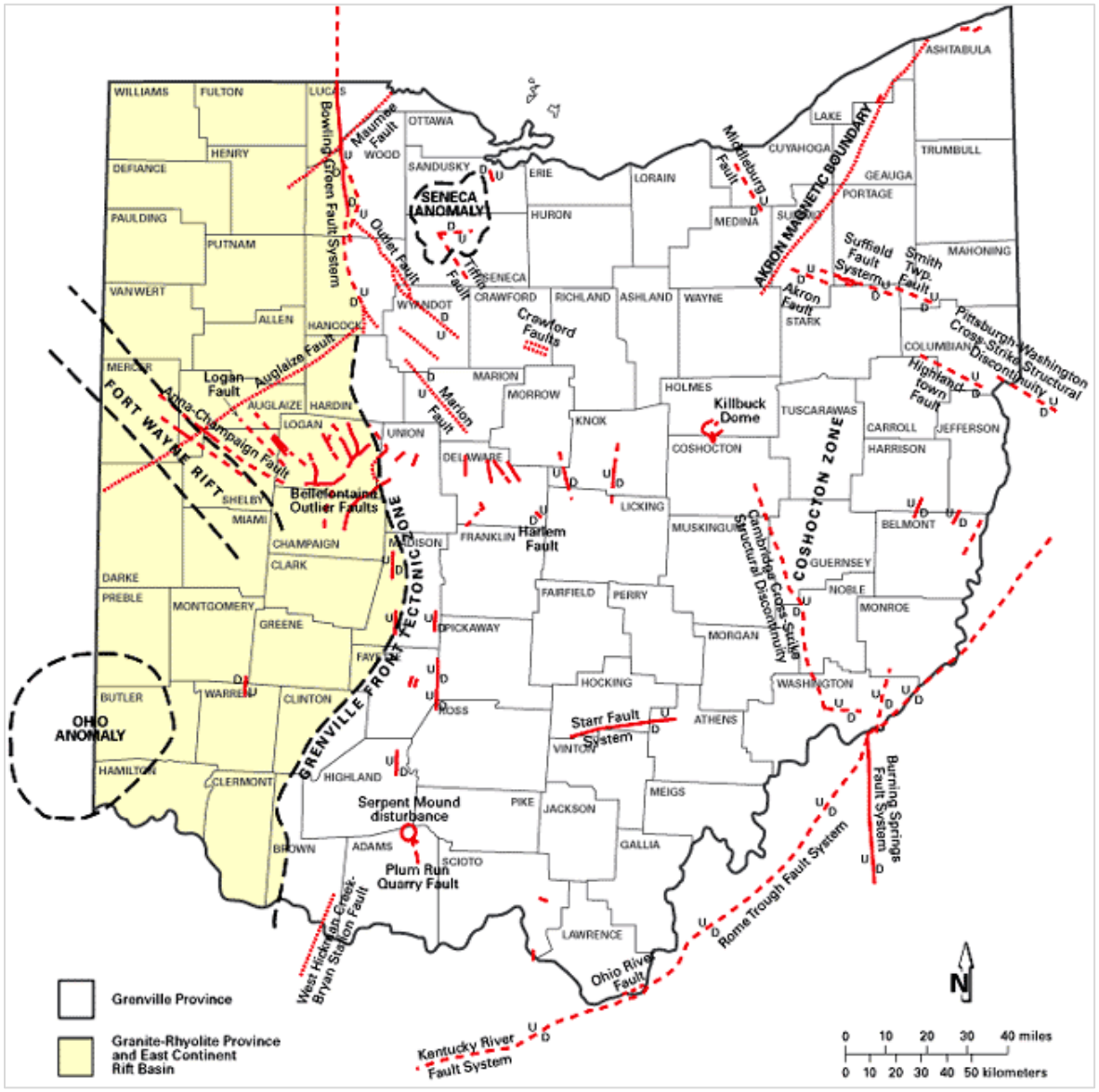
Earthquakes can yield a variety of different outcomes. With the ground shaking associated with earthquake events, buildings have a high potential to be impacted. If soil liquefaction, or the mixing of sand and soil with groundwater occurs, buildings can sink into the ground. Earthquakes also have the potential to rupture dams or levees along a river, resulting in flooding and even tsunamis (see Dam Failure section). Earthquakes can cause landslides or avalanches in high-risk areas and can cause mines to subside. Furthermore, earthquakes that break gas and power lines can result in fires.

Table 4.3.1: Modified Mercalli Intensity Scale

Modified Mercalli Intensity Scale		Magnitude
I	Detected only by sensitive instruments.	1.5
II	Felt by few persons at rest, especially on upper floors; delicately suspended objects may swing.	2
III	Felt noticeably indoors, but not always recognized as earthquake; standing autos rock slightly, vibrations like passing truck.	2.5
IV	Felt indoors by many, outdoors by few, at night some awaken; dishes, windows, doors disturbed; standing autos rock noticeably.	3
V	Felt by most people; some breakage of dishes, windows, and plaster; disturbance of tall objects.	3.5
VI	Felt by all, many frightened and run outdoors; falling plaster and chimneys, damage small.	4
VII	Everybody runs outdoors; damage to buildings varies depending on quality of construction; noticed by drivers of autos.	4.5
VIII	Panel walls thrown out of frames; walls, monuments, chimneys fall; sand and mud ejected; drivers of autos disturbed.	5
IX	Buildings shifted off foundations, cracked, thrown out of plumb; ground cracked; underground pipes broken.	5.5
X	Most masonry and frame structures destroyed; ground cracked, rails bent, landslides.	6
XI	Few structures remain standing; bridges destroyed, fissures in ground, pipes broken, landslides, rails bent.	6.5
XII	Damage total; waves seen on ground surface, lines of sight and level distorted, objects thrown up into air.	7 7.5 8

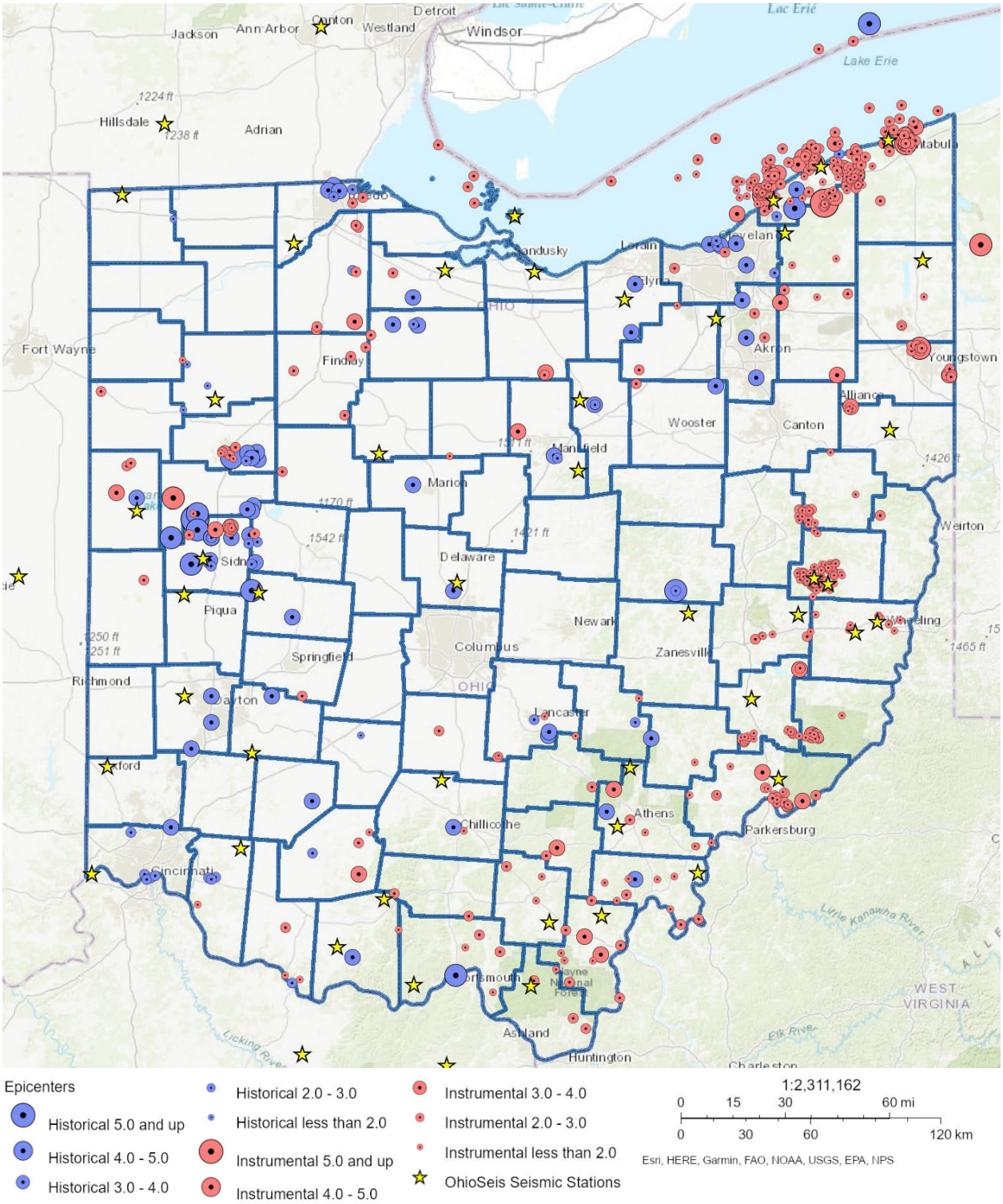
Source: ODNR

Figure 4.3.2: Ohio Faults and Seismic Zones



Source: ODNR

Figure 4.3.3: Earthquake Epicenters and Seismic Monitoring Stations in Ohio



Source: ODNR

History

More than 300 earthquakes of 2.0 magnitude or greater with epicenters in Ohio have occurred since 1776. Most of these events have been small, in the 2.0 to 3.0 magnitude range, while 15 earthquakes

have caused minor-to-moderate damage and no recorded deaths. Montgomery has had three earthquakes, one in 1834 with a 3.5 magnitude, one in 1873 with a 3.0 magnitude, and the last in 1950 with a 3.1 magnitude. There is no known damage.

Figure 4.3.4, below, displays epicenters of all historical earthquakes with a magnitude greater than 1.0. Locations and magnitudes of non-instrumental earthquakes correspond to felt area or maximum epicentral Modified Mercalli Intensities and may be in error by a considerable distance.

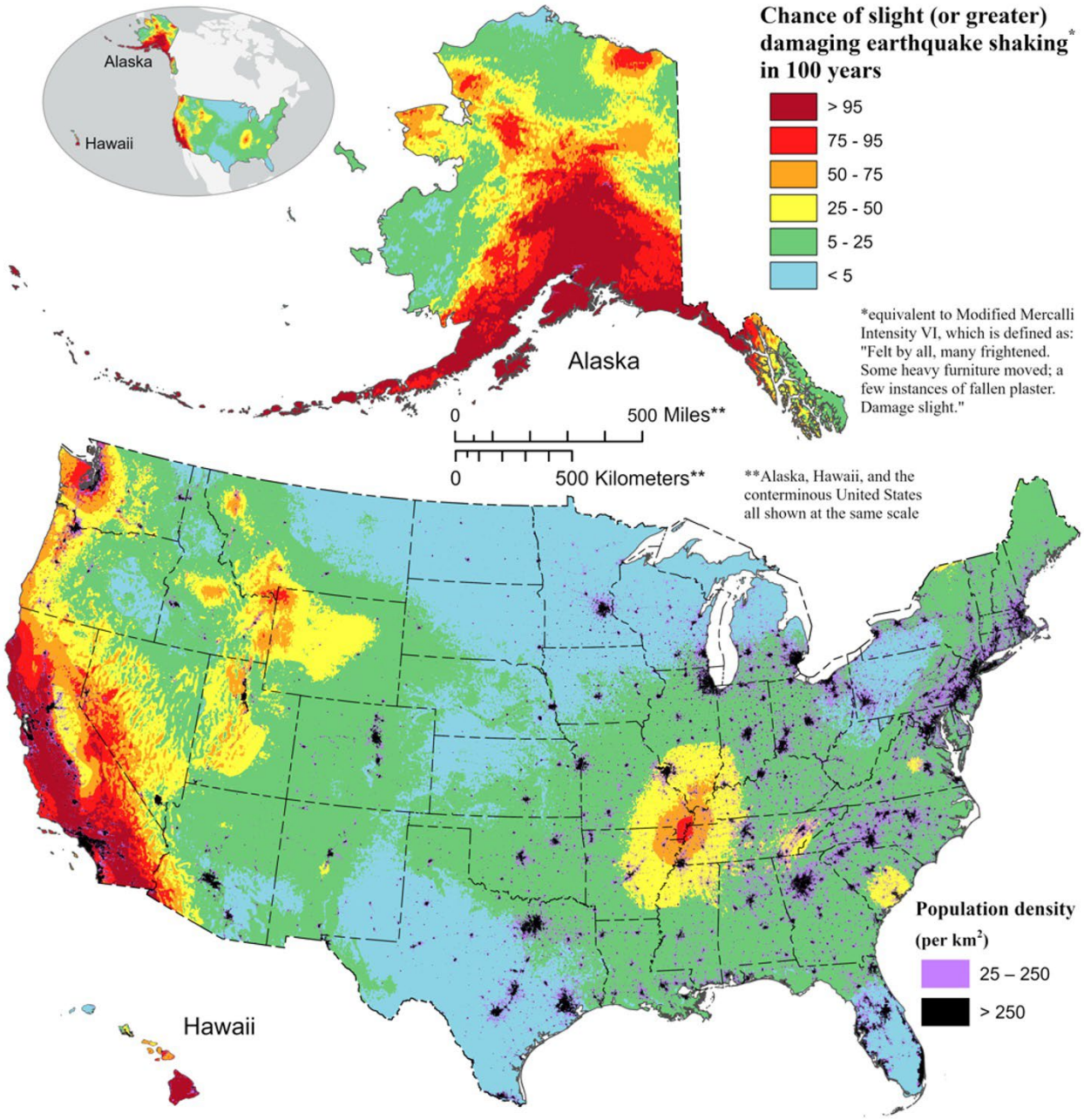
Probability

The USGS has both long-term and short-term probabilistic seismic hazard forecasts. In the 2024 one-hundred-year probabilistic seismic hazard forecast, the United States Geological Survey estimated that there is a 5 to 25 percent chance of potentially minor-damage ground shaking for Montgomery County (**Figure 4.3.4**).

The USGS also prepared national seismic hazard maps (NSHMP) for the United States. These time-independent maps are shown for two percent and ten percent probability of earthquake ground-shaking exceedance levels at specified probabilities over a 50-year period at several hundred thousand sites across the United States. The map (**Figure 4.3.6)** identifies that Montgomery County has an eight percent to 20 percent peak ground acceleration for two percent probability of exceedance in 50 years.

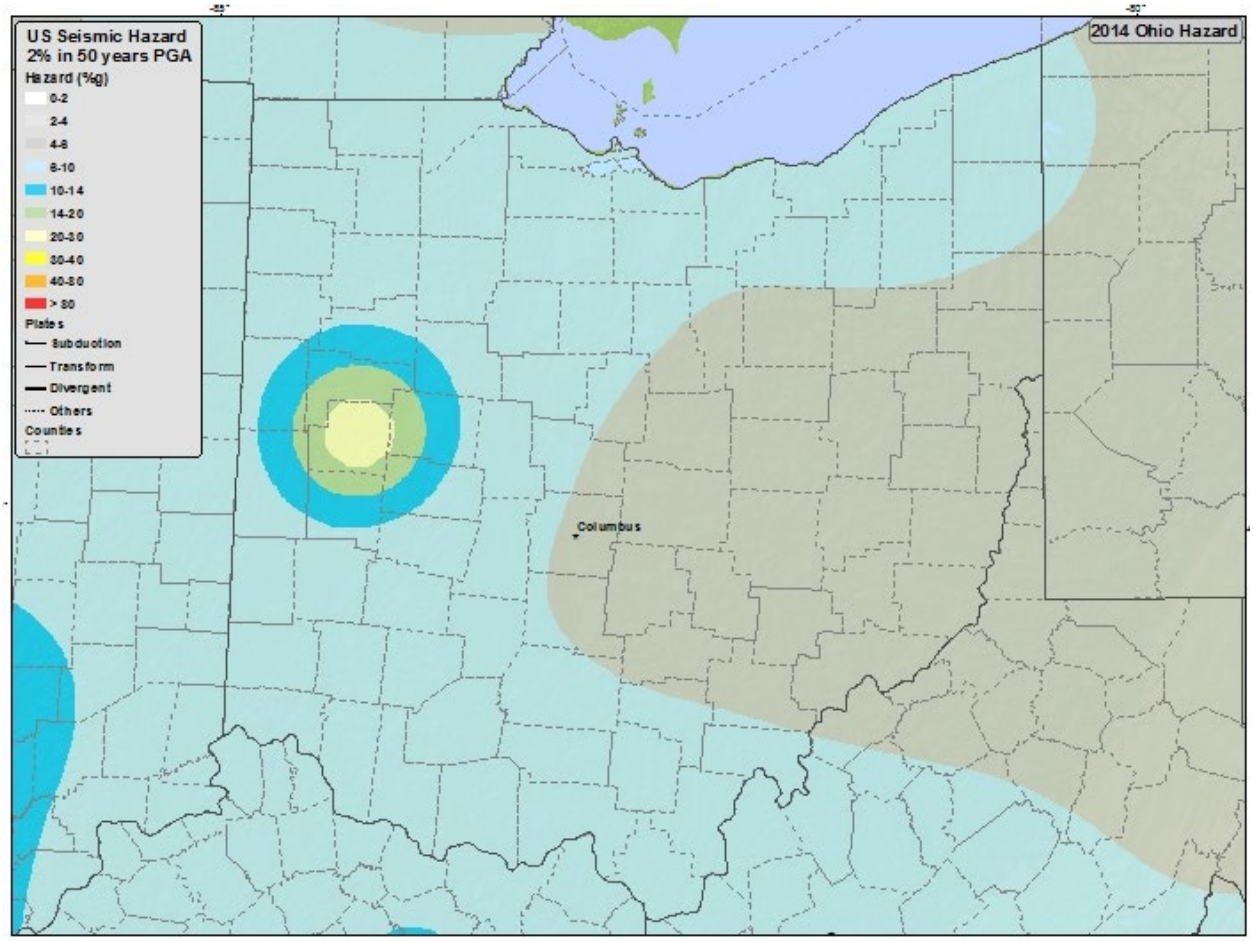
Furthermore, the ODNR indicates that the brief historic record of Ohio earthquakes suggests a risk of moderately damaging earthquakes in the western, northeastern, and southeastern parts of the State.

Figure 4.3.4: Earthquake Shaking and Seismic Design Categories



Source: USGS

Figure 4.3.5: 2014 Seismic Hazard Map of the State of Ohio



Source: USGS

Vulnerability Assessment

Infrastructure Impact

There have been three earthquakes with a 3.0 magnitude or higher in Montgomery County since 1834. The first earthquake recorded was in 1834 with a 3.5 magnitude, the second in 1873 with a 3.0 magnitude, and the final in 1950 with a 3.1 magnitude. This was the first known earthquake to happen in Montgomery County. Magnitudes under three are not generally noticed by people and cause little, if any damage. Buildings, roadways, and gas and power lines have the potential to be affected. Since the probability of an earthquake occurring in Montgomery County is less than one percent, there is a low risk of impact to infrastructure as a result.

Population Impact

There is a relatively low risk of earthquakes occurring in Montgomery County. Accordingly, there is low risk of impact to the population. If an earthquake would occur within Montgomery, the population could be impacted by loss of homes, loss of utilities, as well as potential reduction of air quality.

For social vulnerability, the National Risk Index indicates that the population in Montgomery County has a score of 90.2 ("relatively low") for earthquakes. Earthquakes are unlikely to occur in Montgomery County; therefore, the population is unlikely to be affected by earthquakes. Socially vulnerable populations may be more affected by earthquakes if they live in older housing units or apartment complexes that do not have adequate earthquake-resilient infrastructure. The index indicates an

expected annual loss of $3 million due to earthquakes with a less than 0.048 percent chance of an event occurring per year.

Property Damage

With any earthquake event, there is potential for property damage to occur, as ground shaking can lead to damaged buildings. Due to the non-site-specific nature of this hazard, **Table 4.13** lists the 14 census tracts in Montgomery County with the highest vulnerability.

Loss of Life

Montgomery County has no recorded earthquake events that have resulted in loss of life; however, in the event that an earthquake occurs, there is potential for loss of life. If there are more people and structures in an earthquake prone location, there is likely to be more of an impact. Loss of life can be mitigated by educating the public on proper protection in the event of an earthquake. For example, the USGS resources on preparing for an Earthquake hazard (USGS Resources for Earthquake Preparedness) as well as the Ready Campaign (Ready.gov) are national public service campaigns designed to educate and empower the American people to prepare for, respond to, and mitigate disasters.

Economic Losses

Earthquakes have the potential to damage infrastructure, resulting in the economic burden of clean up and repairs. Potential economic losses and damage associated with Montgomery County for earthquakes according to FEMA's National Risk Index are recorded in **Table 4.3.6** below. This table summarizes the population from 2020, building value, expected annual loss (EAL) for buildings, and expected annual loss (EALP) for population equivalence in Montgomery County. Compared with other hazards, earthquakes are relatively unlikely to occur in Montgomery County, meaning there is low risk of economic loss as a result of an earthquake.

Table 4.3.6: Structure and Population Vulnerability from Earthquakes

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
001501	$0	$162,081	$78,375	$240,456
003404	$0	$67,715	$11,399	$79,114
080700	$0	$59,334	$9,450	$68,784
140100	$0	$42,869	$20,999	$63,867
001700	$0	$52,046	$10,409	$62,455
130102	$0	$49,970	$12,394	$62,365
003500	$0	$49,295	$8,692	$57,987
150100	$0	$39,199	$14,746	$53,945
050107	$0	$44,465	$8,109	$52,574
030100	$0	$42,908	$6,482	$49,390
040406	$0	$40,307	$8,864	$49,171
001802	$0	$40,325	$8,215	$48,540
040401	$0	$39,423	$8,890	$48,314

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
115011	$0	$34,100	$11,919	$46,020
125104	$0	$37,056	$6,932	$43,987
120101	$0	$32,940	$10,044	$42,983
040302	$0	$32,532	$10,415	$42,948
100400	$0	$34,665	$7,626	$42,291
110100	$0	$39,160	$3,074	$42,235
110202	$0	$32,266	$6,847	$39,113
Total	**$0**	**$972,655**	**$263,883**	**$1,236,538**

Source: FEMA National Risk Index

Future Trends

Land Use and Development Trends

While incidence and likelihood of earthquakes is low in Montgomery County, all communities are at low risk. By planning for and managing land use to accomplish social, ecological, and economic sustainability, communities can reduce the negative impacts caused by earthquakes. This can be accomplished through comprehensive land-use plans and supportive federal and state policies. As such, enforcement of stricter building codes that ensure that all new developments are built up to code can reduce risk. Infrastructure (constructed facilities and lifelines) should be designed and constructed to resist earthquake shaking following the current state-of-the-art engineering and technology practices.

More buildings but less people can mean more property loss but less population vulnerability. Similar median structure year built but older relative to today could mean more vulnerability to properties and inhabitants. The current total value of taxable real estate in Montgomery County is $10,386,064,700. In 2022, Montgomery County authorized 1,343 new residential units at a total value of $268,164. The population is expected to decrease by 0.006 percent, or 3,417 people by 2030. An additional decrease of 4.7% is expected by 2040. If new residential buildings are built to code, there are no known changes in the risk associated with earthquakes.

Climate Change

Climate change has no known effect on the probability or extent of earthquakes.

4.4 Flood

Description

FEMA describes a flood as "a general and temporary condition of partial or complete inundation of normally dry land areas from the overflow of inland or tidal waters [and] the unusual and rapid accumulation or runoff of surface waters from any source." Floods are typically riverine, coastal, or shallow. Flash floods are floods that occur quickly, even occurring without visible signs of precipitation.

Urban flooding is a type of flood that can occur in areas of development that have a high level of impervious surfaces such as concrete. The level of development and the level of stormwater management practices impact the severity of urban flooding.

Common flood-related terms include:

- **100-Year Flood:** A flood that has a one percent chance of occurring each year. The 100-year floodplain can be seen in **Figure 4.4.1: Flood Hazard Map**. The elevation of the water from the 100-year flood is called the Base Flood. Mitigation strategies should be based on the base flood elevation.
- **Floodplain:** An area that has the potential to flood from any source.
- **Floodway:** Sometimes referred to as a regulatory floodway. FEMA defines a floodway as "the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the Base Flood without cumulatively increasing the water surface elevation more than a designated height."
- **Flash flood:** Flash floods are typically caused by heavy rainfall over a short period of time. These floods are particularly dangerous because they can occur in minutes and can sometimes occur even without rainfall such as when an ice jam breaks or dissolves. Areas impacted by wildfires are particularly susceptible to flash floods. Flash floods can occur just about anywhere with enough rainfall and are not restricted to the 100-year floodplain. Development/restriction to drainage or increased impervious surfaces can contribute to flash flood frequency.

Location

Flooding can occur throughout Montgomery County. Flash flooding is more likely to occur in developed areas or along lakes and rivers. **Figure 4.4.1** shows the location of the 100-year floodplain. Floods can and do occur outside the FEMA defined 100-year flood zone. Sometimes very small watersheds are not included in the FEMA analyses, but floods can occur in these smaller watersheds as well.

Extent

Montgomery County currently has 116 flood insurance maps (see **Appendix F**). The most recent update is from October 2022.

Montgomery County and 17 communities within the County, including the Cities of Brookville, Carlisle, Centerville, Clayton, Dayton, Englewood, Huber Heights, Kettering, Miamisburg, Moraine, Riverside, Trotwood, Union, Vandalia and West Carrollton participate in the National Flood Insurance Program (NFIP) **(Table 4.4.2)**. The Village of Germantown also participates in the NFIP. The Villages of Farmersville and New Lebanon do not participate in the NFIP. Centerville and Kettering are in both Montgomery County and Greene County. Huber Heights and Union are in both Montgomery County and Miami County. Carlisle is in both Montgomery County and Warren County.

Figure 4.4.1: Flood Hazard Map of Montgomery County, Ohio

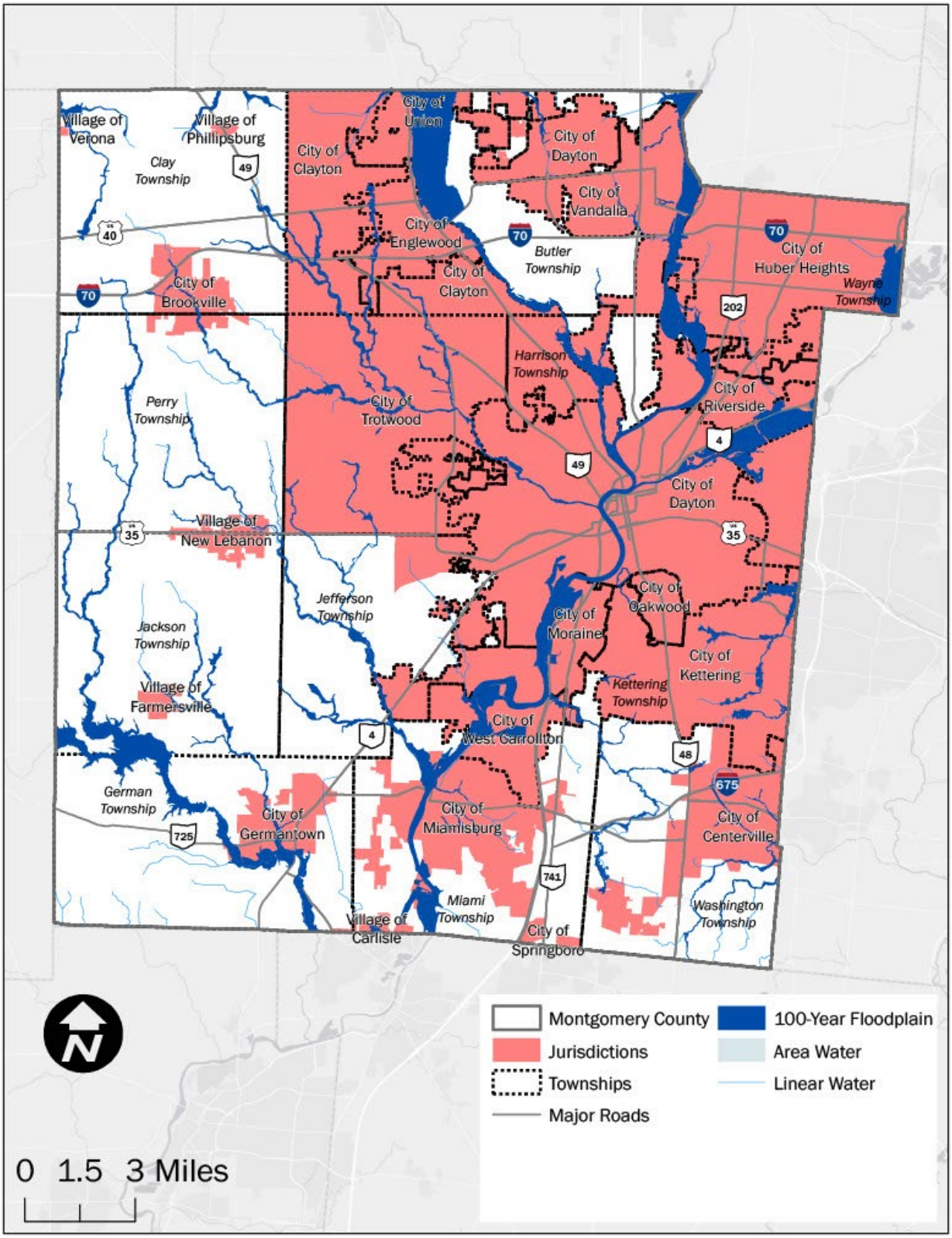


Table 4.4.2: National Flood Insurance Program Participation for Montgomery County, Ohio

Community Name	County	NFIP Coordinator	Init FHBM Identified	Init FIRM Identified	Effective Map Date	Reg-Emer Date	Participating in NFIP
Montgomery County*	Montgomery County	Steve Scott	06/02/78	12/15/81	10/27/22	12/15/81	Yes
City of Brookville	Montgomery County	Sonja Keaton	02/15/74	10/15/81	01/06/05	10/15/81	Yes
City of Centerville	Montgomery County Greene County	Jim Brinegar	05/17/74	11/18/81	10/27/22	11/18/81	Yes
City of Clayton	Montgomery County	Jack Kuntz	11/10/78	01/06/05	01/06/05	11/10/05	Yes
City of Dayton	Montgomery County	Scott Adams	03/15/74	12/04/79	10/27/22	12/04/79	Yes
City of Englewood	Montgomery County	Eric Smith	05/24/74	01/06/05	01/06/05	01/06/05	Yes
City of Huber Heights	Montgomery County/Miami County	Russel Bergman		12/11/84	08/02/11	12/11/84	Yes
City of Kettering	Montgomery County Greene County	Steve Bergstresser	05/31/74	10/15/80	10/27/22	10/15/80	Yes
City of Miamisburg	Montgomery County	Chris Fine	03/01/74	06/15/81	01/06/05	06/15/81	Yes
City of Moraine	Montgomery County	Tony Wenzler	03/01/74	10/15/81	01/06/05	10/15/81	Yes
City of Oakwood	Montgomery County	William Duncan		01/06/05	01/06/05	01/06/06	No
City of Riverside	Montgomery County	Nia Holt	02/15/74	12/15/81	10/27/22	12/15/81	Yes
City of Trotwood	Montgomery County	Johnny McCluskey	02/15/74	12/18/79	01/06/05	12/18/79	Yes
City of Union	Montgomery County Miami County	John Applegate	02/14/75	01/06/05	08/02/11	08/24/81	Yes
City of Vandalia	Montgomery County	Rob Cron	06/07/74	11/04/81	01/06/05	11/04/81	Yes
City of West Carrollton	Montgomery County	John Vance	02/08/74	10/15/81	01/06/05	10/15/81	Yes
Village of Farmersville	Montgomery County	Derek Shell		01/06/05	01/06/05	01/06/06	No
Village of Germantown	Montgomery County	Kelly Novak	06/28/74	07/02/81	01/06/05	07/02/81	Yes
Village of New Lebanon	Montgomery County	Raymond Arriola		01/06/05	01/06/05	01/06/06	No

Source: NFIP Community Status Book

Repetitive Loss

There are 17 repetitive loss *FEMA Community Status Book Report* and two severe repetitive loss properties in or near Montgomery County, Ohio, detailed in **Table 4.4.3**. FEMA defines a repetitive loss property as an insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period since 1978. FEMA defines a severe repetitive loss property as a single family property that is covered under flood insurance by the NFIP and has incurred flood-related damage for which four or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding $5,000 and with cumulative amount of such claims payments exceeding $20,000; or for which at

least two separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

Table 4.4.3: Repetitive Loss Properties in Montgomery County, Ohio

Jurisdiction Occupancy	Total RL/SRL Structures	RL Structures	SRL Structures	Total Losses	Total Paid
MONTGOMERY COUNTY (UNINCORPORATED)	11	11	0	26	$348,316
Single Family Residential	11	11	0	26	$348,316
DAYTON, CITY OF	2	1	1	6	$104,984
Single Family Residential	2	1	1	6	$104,984
CLAYTON, CITY OF	1	0	1	4	$34,411
Single Family Residential	1	0	1	4	$34,411
KETTERING, CITY OF	2	2	0	5	$24,289
Single Family Residential	2	2	0	5	$24,289
HUBER HEIGHTS, CITY OF	1	1	0	3	$21,764
Single Family Residential	1	1	0	3	$21,764
TROTWOOD, CITY OF	1	1	0	2	$7,371
Single Family Residential	1	1	0	2	$7,371
BROOKVILLE, CITY OF	1	1	0	2	$4,707
Single Family Residential	1	1	0	2	$4,707
Countywide Total	**19**	**17**	**2**	**48**	**$545,842**

Source: Ohio EMA

History

There have been 114 floods or flash floods in Montgomery County between January 1996 and August 2022. These events have caused $673,500 in property damage. There has been one major disaster declaration related to flooding covering Montgomery County since 1996. There have been six flood events that caused property damage since the 2019 Montgomery County Natural Hazard Mitigation Plan, five of which were on March 20, 2020, and one on August 26, 2021. The major disaster declaration flooding, floods that have caused the greatest amount of damage and those that have caused damage since the 2019 Montgomery County Natural Hazard Mitigation Plan are described below:

Flooding in the City of Dayton on August 26, 2021:

Showers and thunderstorms developed during the afternoon hours in a warm and humid airmass in place across the Ohio Valley. A few motorists were stranded in high water near downtown Dayton. Montgomery County reported $10,000 in property damage. There were no deaths or injuries reported.

Flooding in Montgomery County on March 20, 2020:

Showers and thunderstorms developed through the early morning hours as a low-pressure system moved through the Ohio Valley. Some of the storms produced locally heavy rainfall amounts of 2 to 3 inches. Vehicles were stuck in high water near the intersection of Shoup Mill Road and Riverside Drive, at Stop 8 Road and Webster Street, and near the intersection of Ark Avenue and Klepinger Road. There was a high-water rescue on Dayton Farmersville Road near Liberty Ellerton Road. Several rescues were made in waist high water on North Snyder Road. There was minor damage, equaling $38,000. There were no deaths or injuries reported.

Flooding in Montgomery County on June 20, 2014:

Slow moving thunderstorms developed in a very unstable airmass during the peak heating of the day. These storms produced damaging winds, heavy rainfall, flooding, and flash flooding. Multiple water rescues from vehicles were reported in the Washington Park area near Mc Ewen Road, Congress Park, and Paragon Road due to heavy rainfall. Montgomery County reported $300,000 in property damage. No deaths or injuries were reported.

Major Disaster Declaration for Severe Winter Storms, Flooding, and Mudslides, February 15, 2005:

A widespread area of showers and thunderstorms ahead of a warm front affected much of central and western Ohio. One to three inches of rain fell across the region, exacerbating existing flooding from previous rains and snowmelt. The heaviest rainfall occurred from west central Ohio southeast through the Columbus area. Numerous roads and low-lying areas were flooded, and several creeks and streams rose out of their banks. A Major Disaster Declaration (DR-1580-OH) was issued on February 15, 2005. Flooding affected Montgomery County from about January 5 through January 11 and the county reported $30,000 in property damage. No deaths or injuries were reported. Public Assistance was offered to 59 counties, including Montgomery County, and totaled $97,938,844.86.

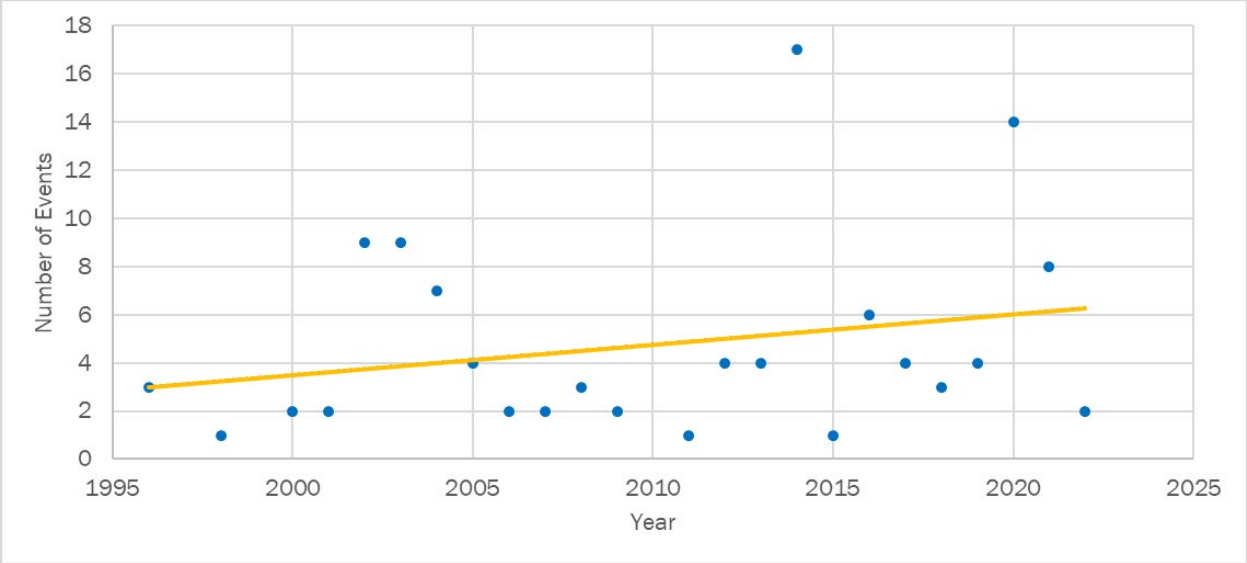
Flooding in Montgomery County on June 16, 2003:

Thunderstorms producing heavy rain moved across portions of the Miami Valley and southwest Ohio throughout the morning. Some locations saw two to four inches of rain, and combined with rainfall over the previous few days, flooding problems developed. Numerous roads were flooded and closed across the region. Up to 50 homes and one business sustained flood damage in the Dayton suburb of Riverside, and a few homes had flooded basements in western Greene County. Montgomery County reported $100,000 in property damage. No deaths or injuries were reported.

Probability

Figure 4.4.5 Between 1995 and 2022, Montgomery County experienced 114 flooding events, including both floods and flash floods. Annually, this amounts to approximately four floods or flash floods per year. The yellow trendline of flood occurrences per year is increasing, which may suggest that Montgomery County can expect a similar frequency of flood events each year or more. In addition, according to the State of Ohio Hazard Mitigation Plan (SOHMP), increased precipitation and variability by climate change will also increase the likelihood and intensity of flood events. The Climate Change section in Future Trends discusses climate change further.

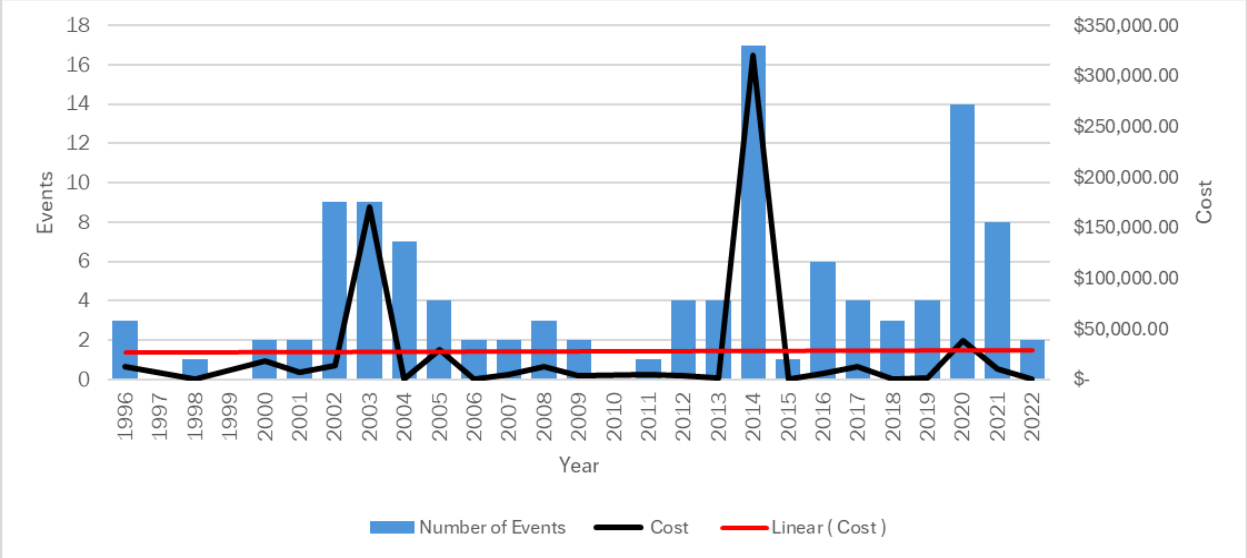
Figure 4.4.4: Probability of Flooding



Data Source: NOAA

Figure 4.4.5 shows both the trend of flood events and affiliated cost over time since January 1995. Between 1995 and 2022, floods or flash flood events have resulted in $673,500 in property damages (Source: NCEI). Annually, this amounts to approximately $25,903 in property damages. The trendline (show in red) indicates a relatively steady cost in property damages.

Figure 4.4.5: Probability and Cost of Flooding



Data Source: NOAA

Vulnerability Assessment

Infrastructure Impact

Floods can impact roadways, including interstates and state routes, by blocking them due to high water, filling them with debris or washing away the road altogether.

Population Impact

Floods and flash floods have caused damage to occupied homes and businesses in the past. During flood events, shelter and temporary housing may need to be provided to those impacted by flooding.

For social vulnerability, in the National Risk Index, "riverine flooding" had a score of 20.42 ("Relatively High"). People that are most vulnerable to flooding are those who live within the 100-year floodplain in structures that are not elevated about the base flood elevation. The index indicates an expected annual loss of $7.3 million due to flood events with 1.5 events occurring per year.

Property Damage

Floods have the potential to damage infrastructure, resulting in the economic burden of clean up and repairs. Potential economic losses and damage associated with Montgomery County for riverine flooding according to FEMA's National Risk Index are recorded in **Table 4.4.6** below. This table summarizes the population from 2020, building value, expected annual loss (EAL) for buildings, and expected annual loss (EALP) for population equivalence in Montgomery County. Compared with other hazards, riverine flooding has an average rating of relatively moderate for the top 20 census tracts, meaning there is moderate risk of economic loss because of a flood in Montgomery County.

Table 4.4.6: Structure and Population Vulnerability from Flooding

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
050302	$0	$2,949	$225,004	$227,953
030100	$568	$8,008	$138,696	$147,271
165000	$3,834	$1,660	$130,751	$136,244
090600	$0	$1,621	$124,390	$126,011
050600	$13,938	$1,891	$95,251	$111,080
021400	$0	$1,010	$99,804	$100,814
080400	$0	$786	$99,542	$100,328
021000	$0	$907	$97,002	$97,908
021700	$0	$1,103	$85,238	$86,341
021301	$1,549	$1,117	$75,547	$78,213
130102	$1,283	$928	$63,383	$65,593
080500	$9	$680	$64,882	$65,570
050301	$3,131	$543	$61,355	$65,029
080200	$0	$589	$63,649	$64,237
040306	$1	$821	$48,820	$49,642
090302	$634	$1,059	$43,882	$45,575
070500	$236	$560	$43,392	$44,188
050503	$0	$428	$42,379	$42,807
150100	$18,882	$435	$19,405	$38,722

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
021602	$0	$486	$37,787	$38,273
Total	**$44,064**	**$27,579**	**$1,660,157**	**$1,731,800**

Source: FEMA National Risk Index

Loss of Life

There are no reported deaths from flood events in Montgomery County between January 1996 through August 2022. Loss of life is possible in future floods or flash floods.

Economic Losses

Floods can halt economic activity, block roadways, and destroy agricultural crops. Businesses may need to shut down their operations due to flood water damage or road closures. Crop losses are also possible during floods or flashfloods.

Future Trends

Land Use and Development Trends

Any development that occurs in flood zones will be at risk. Development in these areas should be limited. Flash flooding is more likely to occur in areas with a high percentage of impervious surfaces. Future land use practices should limit the percentage of impervious surfaces. Chapter 5 contains mitigation actions that address these issues.

More buildings but less people can mean more property loss but less population vulnerability. Similarly, older structures could mean more vulnerability to properties and inhabitants. The current total value of taxable real estate in Montgomery County is $10,386,064,700. In 2022, Montgomery County authorized 1,343 new residential units at a total value of $268,164,000. The population is expected to decrease by 0.006 percent, or 3,417 people by 2030. An additional decrease of 4.7% is expected by 2040. If construction practices, including the location of the new housing units, follow best practices for floodplain management, there are no known changes in the risks associated with riverine flooding.

Communities that are participating in the National Flood Insurance Program (NFIP) are required to adopt and enforce regulations and codes that apply to new developments in Special Flood Hazard Areas (SFHAs). These local floodplain management regulations must contain, at a minimum, NFIP requirements and standards that apply not only to new structures, but also to existing structures which are Substantially Improved (SI), or Substantially Damaged (SD) from any cause, whether natural or human-induced hazards.

According to 44 CFR 59.1, substantial improvement means any reconstruction, rehabilitation, addition or other improvement to a structure, the total cost of which equals or exceeds 50 percent of the market value of the structure before the start of construction of the improvement. Likewise, substantial damage means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred. SI/SD requirements are also triggered when any combination of costs to repair and improvements to a structure in an SFHA equals or exceeds 50 percent of the structure's market value (excluding land value).

$$\frac{(Cost\ to\ Repair) + (Cost\ of\ Improvements)}{Market\ Value\ of\ Structure} \geq 50\ Percent$$

Enforcing the SI/SD requirements is a very important part of a community's floodplain management responsibilities. The purpose of the SI/SD requirements is to protect the property owner's investment and safety, and, over time, to reduce the total number of buildings that are exposed to flood damage, thus reducing the burden on taxpayers through the payment of disaster assistance. SD/SI requirements are enforced by the local floodplain administrator and monitored by the Ohio Department of Natural Resources (ODNR) Floodplain Management Program during Community Assistance Visits. If a local floodplain administrator is overwhelmed by the number of SD/SI inspections after a large event, ODNR has developed a network of building code officials that are trained in conducting SD/SI field determinations. Help with SD/SI inspections can be requested through the county emergency management agency director.

For more information regarding Substantial Improvement and Substantial Damage, please refer to FEMA's Substantial Improvement/ Substantial Damage Desk Reference, P-758 or contact the ODNR Floodplain Management Program.

Climate Change

According to the International Panel on Climate Change, climate change has impacted human and natural systems. For example, infrastructure and stormwater systems in the Midwest are threatened by increased precipitation frequency and intensity induced by climate change (NCA 2018). According to the SOHMP, increased precipitation and variability by climate change will also increase the likelihood and intensity of flood events, which will mostly occur during the summer and fall months. These events will mainly occur from late summer to early winter, increasing the likelihood of cool season flood events in the late autumn and early winter. Additionally, heavy precipitation events and precipitation are projected to increase during winter and spring, causing flooding, sewer overflow, inundated roadways, delayed growing season and crop damage, and infrastructure damage. Emergency action plans, green infrastructure, and anticipating extreme events are important steps to prepare for climate change.

4.5 Invasive Species

Description

Invasive species are non-native and have potential negative impacts on the environment and economy of Montgomery County. The National Oceanic and Atmospheric Administration (NOAA) defines an invasive species as "an organism that causes ecological or economic harm in a new environment and is not native." Harmful species are species that are native to a region, but that also cause significant ecological, public health, or economic harm. Their growth is often encouraged through human activity.

Invasive species can be terrestrial (land dwelling) or aquatic (water dwelling). Terrestrial species include plants, trees, shrubs, animals, birds, and insects, as well as fungi, bacteria, molds, and viruses. Aquatic species include aquatic plants and algae, fish, mollusks, amphibians, and insects, as well as fungi, bacteria, molds, and viruses.

Location

Invasive species have the potential to impact any location within the County. The most invasive of terrestrial species degrade the State's woodlands, wetlands, and prairies. Aquatic Invasive Species use rivers to spread. Ohio has over 66,000 miles of streams, 312 miles of Great Lakes shoreline, nearly 2,000 inland lakes and reservoirs, and shares major watersheds with other states and Canada. Montgomery County lies in the Mississippi River basin, which is an ecologically diverse river system, and is susceptible to invasions through the Ohio River and its tributaries.

Extent

Once invasive species become widely established, controlling their spread is both technically difficult and expensive, making eradication nearly impossible. Invasive species can usually overtake native species and alter the natural wildlife habitat.

The Ohio Department of Agriculture (ODA) has issued a quarantine for six counties in Ohio (Butler, Clermont, Hamilton, Greene, Montgomery, and Warren counties) beginning April 11, 2024, to prevent the spread of the box tree moth **(Figure 4.5.1)**. Plants should not be transported outside of the quarantine zone.

Figure 4.5.1: Box Tree Moth

The **Emerald Ash Borer (EAB) (Figure 4.5.2)** is a common invasive species in Montgomery County. It is an exotic beetle that feeds on ash trees inhibiting its ability to transport water and nutrients. This insect was first found in Ohio in 2002 and has since been found in every county in the State. The EAB was first discovered in Montgomery County in 2007. Since the EAB has been found in every county, there are no quarantines in effect within Ohio's borders. Ohio is still listed in the Federal quarantine boundary.

Figure 4.5.2: Emerald Ash Borer and Feeding Tunnels

Source: David Cappaert (Left) and National Park Services (Right)

Approximately 2,300 plant species occur in the wild in Ohio. Of these, about 78 percent are native, that is, they were found in the region before the times of European settlement. Of the remaining 22 percent, fewer than 100 have been identified to be problems in natural areas. According to the Ohio Invasive Plants Council, there are 38 invasive plant species in Ohio that have been banned and more under consideration (**Table 4.5.3**). These plants cannot be sold, distributed, or imported.

Studies conducted by Ohio Department of Natural Resources, Ohio Sea Grant, and the Ohio State University have identified over 70 invasive aquatic species in Ohio (**Table 4.5.4**). With the exception of White Perch, it is unlawful to possess, import, or sell these species live.

Table 4.5.3: Plant Invasive Species in Ohio as of January 7, 2018

Scientific Name	Common Name
Ailanthus altissima	Tree-of-heaven
Alliaria petiolate	Garlic mustard
Berberis vulgaris	Common barberry
Butomus umbellatus	Flowering rush
Celastrus orbiculatus	Oriental bittersweet
Centaurea stoebe ssp. Micranthos	Spotted knapweed
Dipsacus fullonum	Common teasel
Dipsacus laciniatus	Cutleaf teasel
Egeria densa	Brazilian elodea
Elaegnus angustifolia	Russian olive
Elaegnus umbellate	Autumn olive
Epilobium hirsutum	Hairy willow herb

Scientific Name	Common Name
Frangula alnus	Glossy buckthorn
Heracleum mantegazzianum	Giant hogweed
Hesperis matronlis	Dame's rocket
Hydrilla verticillata	Hydrilla
Hydrocharis morsus-ranae	European frog-bit
Lonicera japonica	Japanese honeysuckle
Lonicera maackii	Amur honeysuckle
Lonicera morrowii	Morrow's honeysuckle
Lonicera tatarica	Tatarian honeysuckle
Lythrum salicaria	Purple loosestrife
Lythrum virgatum (effective January 7, 2019)	European wand loosestrife
Microstegium vimineum	Japanese stiltgrass
Myriophyllum aquaticum	Parrotfeather
Myriophyllum spicatum	Eurasian water-milfoil
Nymphoides peltata	Yellow floating heart
Phragmites australis	Common reed
Potamogeton crispus	Curley-leaved pondweed
Pueraria montana var. lobate	Kudzu
Pyrus calleryana (effective January 7, 2023)	Callery pear
Ranunculus ficaria	Fig buttercup, lesser celandine
Rhamnus cathartica	Common Buckthorn
Rosa multiflora	Multiflora rose
Trapa natans	Water chestnut
Typha angustifolia	Narrow-leaved cattail
Typha x glauca	Hybrid cattail
Vincetoxicum nigrum	Black Swallow-Wort

Table 4.5.4: Aquatic Invasive Species in Ohio

Type	Scientific Name	Common Name
Fish	*Alosa pseudoharengus*	Alewife
Fish	*Carassius auratus*	Goldfish
Fish	*Carassius carassius*	Crucian Carp
Fish	*Carassius gibelio*	Prussian Carp

Type	Scientific Name	Common Name
Fish	*Channa app. and Parachanna app.*	Snakeheads
Fish	*Claris batrachus*	Walking Catfish
Fish	*Ctenopharyngodon idella*	Diploid Grass Carp - White Amur
Fish	*Ctenopharyngodon Idella*	Grass Carp
Fish	*Cyprinus carpio*	Common Carp
Fish	*Fundulus catenatus*	Northern Studfish
Fish	*Fundulus diaphanus*	Eastern Banded Killifish
Fish	*Gambusia holbrooki and Gambusia affinis*	Eastern & Western Mosquitofish
Fish	*Gasterosteus aculeatus*	Three Spine Stickleback
Fish	*Gymnocephalus cernuus*	Ruffe
Fish	*Hypophthalmichthys harmandi*	Large-scale Silver Carp
Fish	*Hypophthalmichthys molitrix*	Silver Carp
Fish	*Hypophthalmichthys nobilis*	Bighead Carp
Fish	*Lates niloticus*	Nile Perch
Fish	*Leuciscus idus*	Ide
Fish	*Morone americana*	White Perch
Fish	*Mylopharyngodon piceus*	Black Carp
Fish	*Neogobius melanostomus*	Round Goby
Fish	*Osmerus mordax*	Rainbow Smelt
Fish	*Perca fluviatilis*	European Perch
Fish	*Perccottus glenii*	Amur Sleeper
Fish	*Petromyzon marinus*	Sea Lamprey
Fish	*Phoxinus phoxims*	Eurasian Minnow
Fish	*Proterorhinus marmoratus*	Tubenose Goby
Fish	*Pseudorasbora parva*	Stone Moroko
Fish	*Rhodeus sericeus*	Bitterling
Fish	*Rutilus sericeous*	Roach
Fish	*Sander lucioperca*	Zander
Fish	*Scardinius erythrophthalmus*	European Rudd
Fish	*Scardinius erythrophthalmus*	Rudd
Fish	*Silurus glanis*	Wels Catfish
Fish	*Tinca tinea*	Tench
Mollusks	*Bellamya (Cipangopaludina)*	Mystery Snails

Type	Scientific Name	Common Name
Mollusks	*Bithynia tentaculata*	Faucet Snail
Mollusks	*Corbicula fluminea*	Asian Clam
Mollusks	*Dreissena bugensis*	Quagga Mussel
Mollusks	*Dreissena polymorpha*	Zebra Mussel
Mollusks	*Limnoperna fortune*	Golden Mussel
Mollusks	*Potamopyrgus antipodarum*	New Zealand Mudsnail
Crustaceans	*Bythotrephes longimanus*	Spiny Waterflea
Crustaceans	*Cercopagis pengoi*	Fishhook Waterflea
Crustaceans	*Cherax destructor*	Yabby
Crustaceans	*Cherax tenuimanus*	Marron
Crustaceans	*Dikerogammarus villosus*	Killer Shrimp
Crustaceans	*Eriocheir sinensis*	Chinese Mitten Crab
Crustaceans	*Faxonius virilis*	Virile Crayfish
Crustaceans	*Hemimysis anomala*	Bloody-red Shrimp
Crustaceans	*Procambarus clarki*	Red Swamp Crayfish
Plant	*Butomus umbellatus*	Flowering-rush
Plant	*Egeria densa*	Brazilian Waterweed
Plant	*Hydrilla verticillata*	Hydrilla
Plant	*Hydrocharis morsus-ranae*	European Frog-bit
Plant	*Iris pseudacorus*	Yellow Iris
Plant	*Ludwigia peploides*	Creeping Water-primrose
Plant	*Lysimachia nummularia*	Moneywort
Plant	*Lythrum salicaria*	Purple Loosestrife
Plant	*Marsilea quadrifolia*	European Water Clover
Plant	*Myriophyllum aquaticum*	Parrotfeather
Plant	*Myriophyllum spicatum*	Eurasian Watermilfoil
Plant	*Najas minor*	Brittle Naiad
Plant	*Nelumbo nucifera*	Pink Lotus
Plant	*Nitellopsis obtusa*	Starry Stonewort
Plant	*Nymphoides peltata*	Yellow Floating Heart
Plant	*Phalaris arundinacea*	Reed Canary Grass
Plant	*Phragmites australis*	Common Reed (Phragmites)
Plant	*Pistia stratiotes*	Water Lettuce

Type	Scientific Name	Common Name
Plant	*Potamogeton crispus*	Curly-Leaf Pondweed
Plant	*Trapa natans*	Water Chestnut
Plant	*Typha angustifolia, Typha x glauc*	Narrowleaf and Hybrid Cattails

Other invasive species that have the potential to impact to Montgomery County and the surrounding counties in Ohio include:

Asian Long-Horned Beetles are wood-boring beetles native to Asia that were unintentionally introduced to North America, likely in wood packing material. Clermont County experienced an infestation in 2011. They pose a significant threat to forested land. There are no known Asian Long-Horned Beetle infestations in Montgomery County.

Mute Swans are invasive species found on public lakes across Ohio, originally known as winter visitors with the first published record in the United States in 1936 and Ohio in 1987. During the breeding season, March through May, adult mute swans become highly territorial and will fight to push native birds out of their nesting area. Mute swans have attacked humans and pets during this time as well. Mute swans can consume submerged aquatic vegetation and usually uproot the whole plant leaving nothing behind. This takes away natural habitat from fish and leaves little food source for native waterfowl. The removal of aquatic vegetation can also cause water quality issues and erosion problems.

History

Montgomery County has been impacted by the Emerald Ash Borer, with infestations starting as early 2007. The extent of this damage is unknown. Box Tree Moths have been found in Montgomery County, and most of the county is part of a quarantine zone. Additionally, it is possible that any of the other species listed above have at one point affected the County and its residents.

Probability

Since there are many invasive species throughout Ohio, it is probable that Montgomery County will experience some of the invasive species listed above (**Tables 4.5.1 and 4.5.2**).

Vulnerability Assessment

Infrastructure Impact

There are no likely impacts to public roadways or utilities. Public trees may be destroyed or impacted by various invasive species. Aquatic invasive species could destroy water quality, make poor habitat for fish, and clog water intake pipes. Some species also increase fire potential and can be problematic to levees, dams, and irrigation systems.

Population Impact

There are no likely impacts on the local population. Recreational activities such as boating and fishing may be mildly impacted.

Property Damage

Property damage, in the form of reduced values from impacts on landscaping, is likely.

Loss of Life

Loss of life because of invasive species is very unlikely. Some of these species consumed as food could lead to diseases and other health impacts in humans.

Economic Losses

Economic impacts can vary greatly depending on the target and the invasive species and their impacts on those targets. Agricultural and horticultural revenue losses may be experienced if crops and plants are affected by an invasive species. Also, there may be indirect economic losses with degradation of forested lands and tree canopies. Examples include reduction in viable lumber for construction, increased heating and cooling costs, and reduced property value.

Climate Change

According to the Fourth National Climate Assessment, warming temperatures caused by climate change are aiding in the spread of invasive species. Climate change can favor non-native invading species over native ones due to the tolerance of invasive species to warmer climate zones and native communities' decreased resistance to the new extreme weather in their environment.

Land Use and Development Trends

There could be slight impacts on development and land use due to invasive species. Some invasive species can be particularly damaging to crops, agricultural land, and wetlands. Future development may involve site investigation to identify any potential invasive species on the property.

4.6 Landslide, Mine Subsidence, and Erosion

Description

The Ohio Department of Natural Resources (ODNR) defines a landslide as "a variety of downslope movements of earth materials. Some slides are rapid, occurring in seconds, whereas others may take hours, weeks, or even longer to develop." Landslides are commonly triggered by human-induced vibrations, over-steepened slopes, increased weight on a slope, and removal of vegetation on areas with landslide-prone slopes. Landslides can also be caused by heavy precipitation.

Similarly, erosion is the process of the wearing-away or removal of soil by large storms, flooding, strong wave action, sea level rise, fluvial (riverine) currents, and human activities. Erosion can lead to downstream sedimentation, causing water quality impacts (USEPA 2024). Erosion can occur at the bottom of a streambed or riverbed, deepening the body of water. It can also occur outward, wearing away at the banks of the stream or river and causing damage to nearby structures. Wind erosion is an additional concern for farmland and rangeland.

Subsidence is the motion of the earth's surface as it shifts downward relative to a benchmark (often sea level) of the surrounding terrain. In Ohio, the two primary causes are abandoned underground mines (AUMs) and karst. Karst is a topographic feature formed when carbonate rock, such as limestone, dolomite, and gypsum, is eroded by water draining or moving from these areas. Karsts are commonly represented as caves. For the purposes of this Plan, there are no known karsts in Montgomery County, so karst subsidence will not be assessed further.

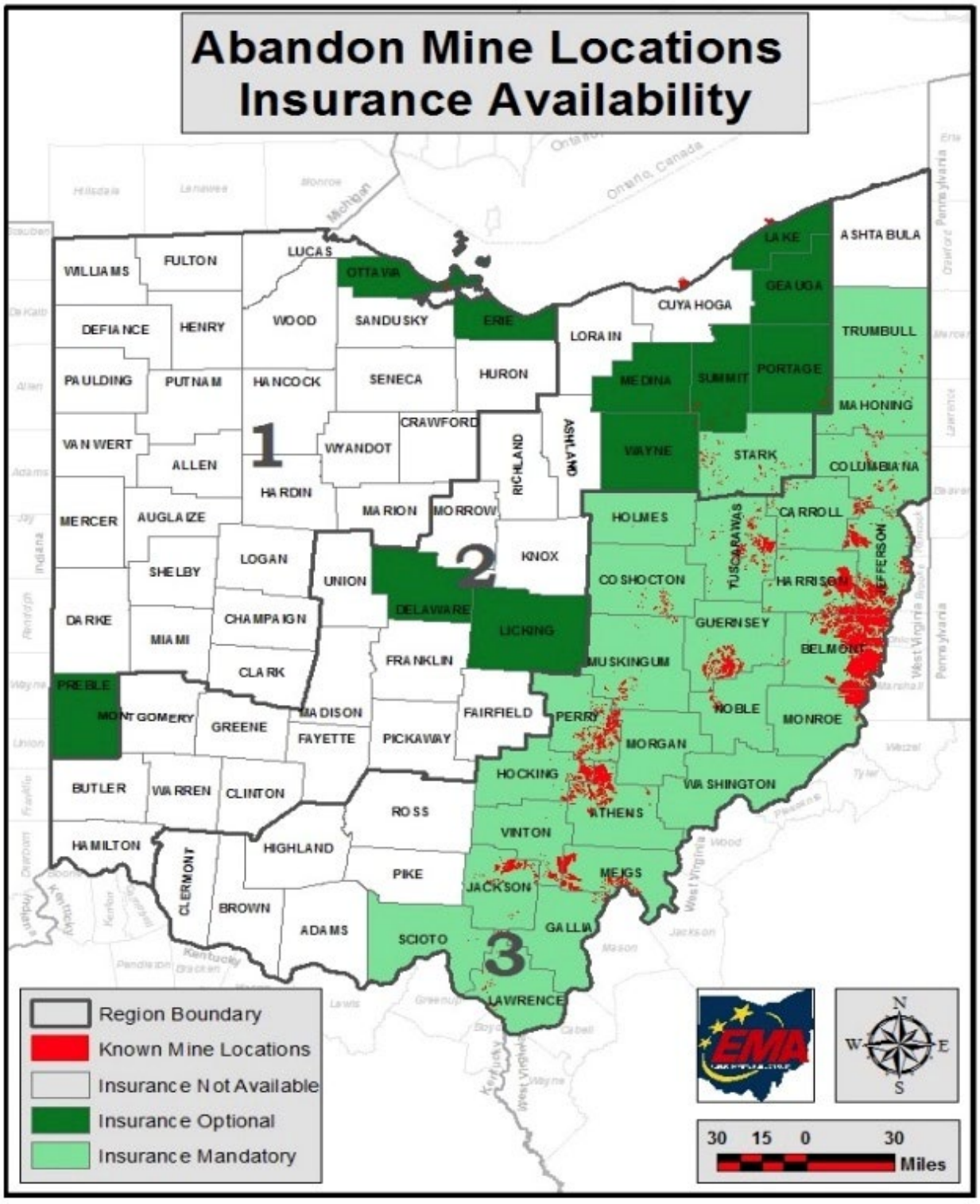
According to the Ohio Administrative Code 3901-1-48, mine subsidence is loss caused by the collapse or lateral or vertical movement of structures resulting from the caving in of underground mines including coal mines, clay mines, limestone mines, and salt mines. Mine subsidence does not include loss caused by earthquakes, landslides, volcanic eruptions, or collapse of strip mines, storm and sewer drains, or rapid transit tunnels. Several factors determine the potential for mines to collapse including depth, mining technique used, types of rock and/or soils, and the development on the ground surface. Additionally, abandoned underground coal mines in Ohio have the potential to discharge acidic water which, if discharged into creeks or streams, can alter the chemical composition of the water habitat and cause considerable harm to sensitive aquatic life.

Location

Figure 4.6.1 shows the location of abandoned underground mines in Ohio and which counties have the option or are required to obtain mine subsidence insurance. The majority of abandoned underground mines can be found in region 3 or in nearby counties. Figure 4.6.2 shows the location of areas at risk for landslides. Montgomery County is in region 2 and has low incidence of landslides, however nine counties in region 2 have the option of mine subsidence insurance.

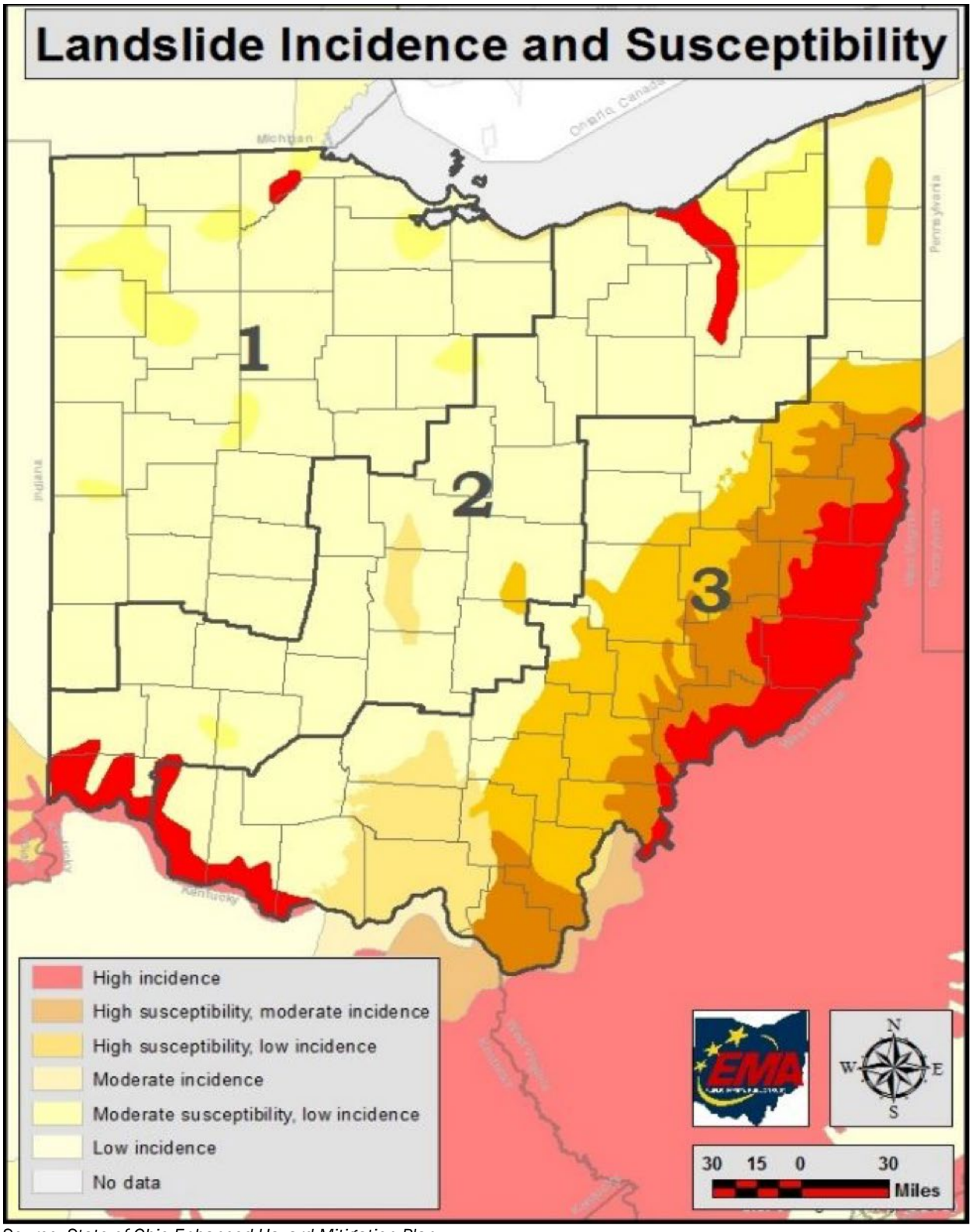
Erosion can occur throughout Montgomery County, particularly along major bodies of water such as the Great Miami River, Mad River, and Stillwater River. Additional tributaries subject to erosion include Holes Creek, Lesley Run, Sugar Creek, Toms Run, Twin Creek, and Wolf Creek. The Miami Conservancy District, an organization dedicated to water resource management in the Great Miami River Watershed, notes that destructive erosion is becoming more common, especially as offshore development continues to remove critical forestland. Similar erosion across the country has led to water quality concerns with sedimentation being the top pollutant in rivers and streams (USEPA 2024).

Figure. 4.6.1: Abandon Mine Locations and Insurance Availability



Source: State of Ohio Enhanced Hazard Mitigation Plan

Figure 4.6.2: Landslide Incidence and Susceptibility Map



Source: State of Ohio Enhanced Hazard Mitigation Plan

Extent

According to ODNR Division of Geologic Survey, Montgomery County is home to 12 bedrock formations: the Lockport Dolomite, Arnheim Formation, Drakes Formation, Whitewater Formation, Liberty Formation Undivided, Sub-Lockport Undifferentiated, Miamitown Shale-Fairview Formation Undivided, Ordovician Undivided, Cedarville Dolomite, Springfield Dolomite, Euphemia Dolomite Undivided, and the Waynesville formation. These formations include a mix of dolomite, shale, limestone, and chert.

There are three major types of landslides:

1. Rotational slump, or a mass of weak rock or sediment moving as a block unit along a slope. These are the largest types of landslides found in Ohio.
2. Earthflow, or a mass of rock or sediment flowing downslope. These are the most common landslides in Ohio.
3. Rock fall, or a rapid downslope movement of large blocks of bedrock. Most rockfalls in Ohio involve sandstone or limestone that have been weakened by surface water.

According to the Ohio Mine Subsidence Insurance Underwriting Association, mine subsidence is caused by the collapse of underground mines causing damage or movement to a property and/or structure located above. Mine Subsidence insurance is required for 26 counties and optional for 11 counties in Ohio State. Insurance for the mandatory counties has an annual premium of $1.00 and $5.00 for optional counties. Montgomery County residents do have the option of enrolling in Mine Subsidence Insurance. According to the ODNR there aren't any abandoned underground mines in Montgomery County. The most common mines in Montgomery County are gravel pits. There are 120 mines in Montgomery County, 76 of which are gravel pits according to the USGS.

It is difficult to directly measure erosion and the risk of erosion. There are other properties, however, that can be used to measure erosion: soil surface stability, aggregate stability, infiltration, compaction, and content of organic matter. Measuring these properties can help with understanding the susceptibility of erosion at a specific location. Comparing visual observations along with quantitative measurements can help provide information about soul surface stability, sedimentation, and soil loss.

Table 4.6.3 provides a summary of the fragile soil index for Montgomery County with the number of acres and percentage area within the county classified across different soil susceptibility categories. Fragile soils are those that are most vulnerable to degradation and tend to be highly susceptible to erosion and can have a low capacity to recover after degradation has occurred (low resilience). Fragile soils are generally characterized by a low content of organic matter, low aggregate stability, and weak soil structure. They are generally located on sloping ground, have sparse plant cover, and tend to be in arid or semiarid regions. The index can be used for conservation and watershed planning to assist in identifying soils and areas highly vulnerable to degradation.

Table 4.6.3 Fragile Soil Index for Montgomery County

Rating	Acres	Percent of County
Fragile	4,903.00	1.60%
Moderately fragile	201,928.70	67.90%
Slightly fragile	12,032.80	4.00%
Null or Not Rated	78,434.00	26.40%
Total	297,298.50	100.00%

Source: USDA Natural Resources Conservation Service, Web Soil Survey)

History

According to the Ohio Department of Transportation (ODOT) there have been 10 landslides and in Montgomery with six happening along I-70 near the City of Vandalia and City of Huber Heights, two on I-75 south of the City of Vandalia, one on South Main Street in the City of Englewood, and one on US-40 north of the City of Huber Heights. Additionally, there have been three rockslide events in Montgomery County, two on I-70 near the City of Huber Heights and one on I-70 near the City of Englewood. All 10 landslides and three rockslides are rated Tier 1. Tier 1 ratings do not require a detailed rating and have a low probability of additional movement and a low probability of significant impact to an ODOT asset or adjacent property.

Table 4.6.4 shows the most up to date probability of occurrences of landslides and rockslides in Montgomery County. "Tier" refers to the probability of an event occurring at a given site, with Tier 1 being low probability and Tier 4 being very high probability.

Since incidents of landslides and rockslides often go unreported, individual sites are an accurate way to discuss both past problem areas and future probability of events. The most common tier in the County is Tier 1, with 13 Tier 1 sites.

Table 4.6.4: Landslide and Rockfall Sites

Tier	Landslides	Rockslides	Total
Tier 1	10	3	13
Tier 2	0	0	0
Tier 3	0	0	0
Tier 4	0	0	0
Total	**10**	**3**	**13**

Source: Ohio Department of Transportation Geohazards Dashboard

Figures 4.6.5 and 4.6.6 show that Montgomery County has low occurrences of landslides and rock falls as compared to other counties within Ohio with nine total landslides as of June 18, 2019. Since 2019 there has been one additional landslide. These events are only reported on roadways, and do not constitute a countywide assessment on their own.

Figure 4.6.5: State of Ohio Total Geohazards Landslide Inventory

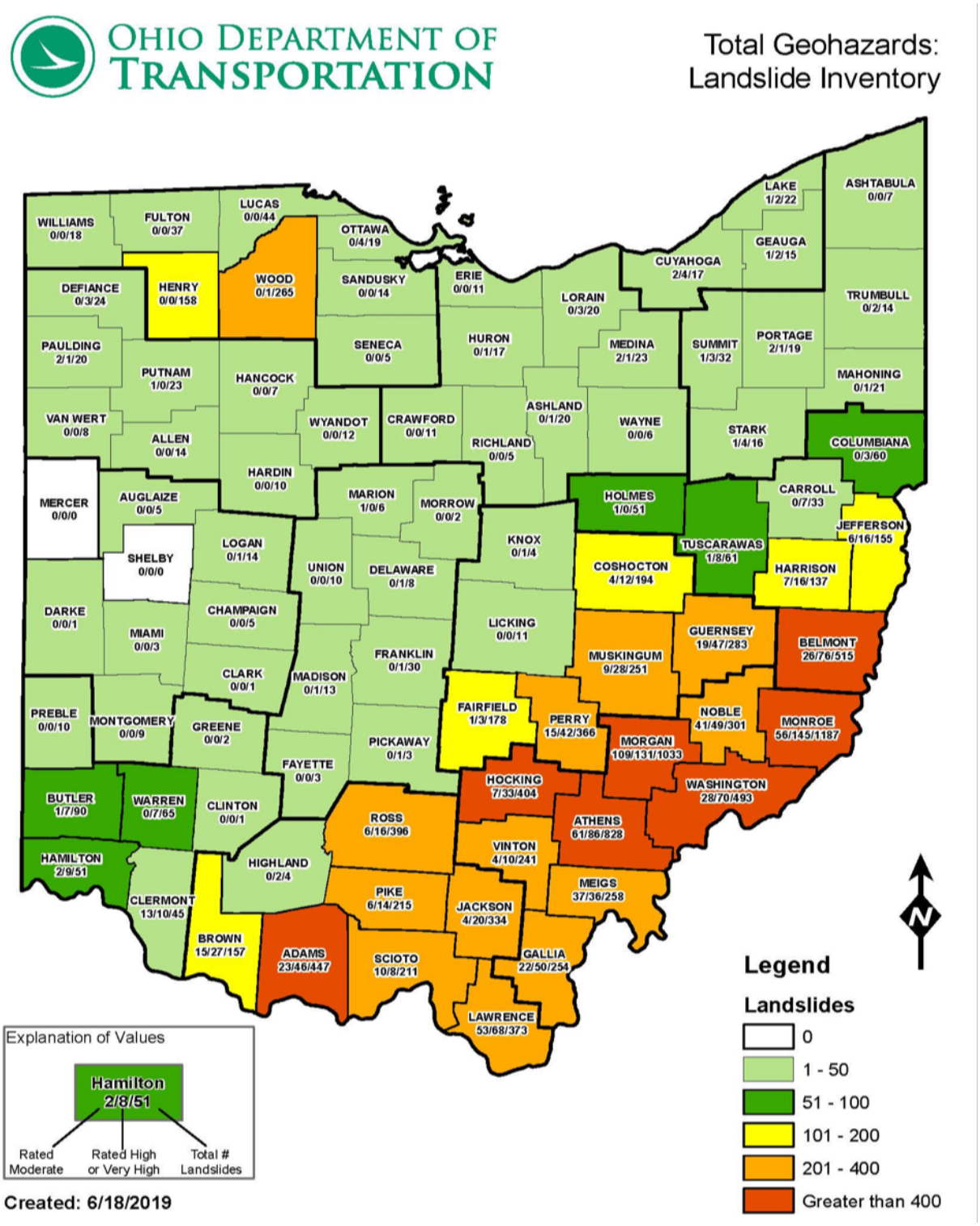
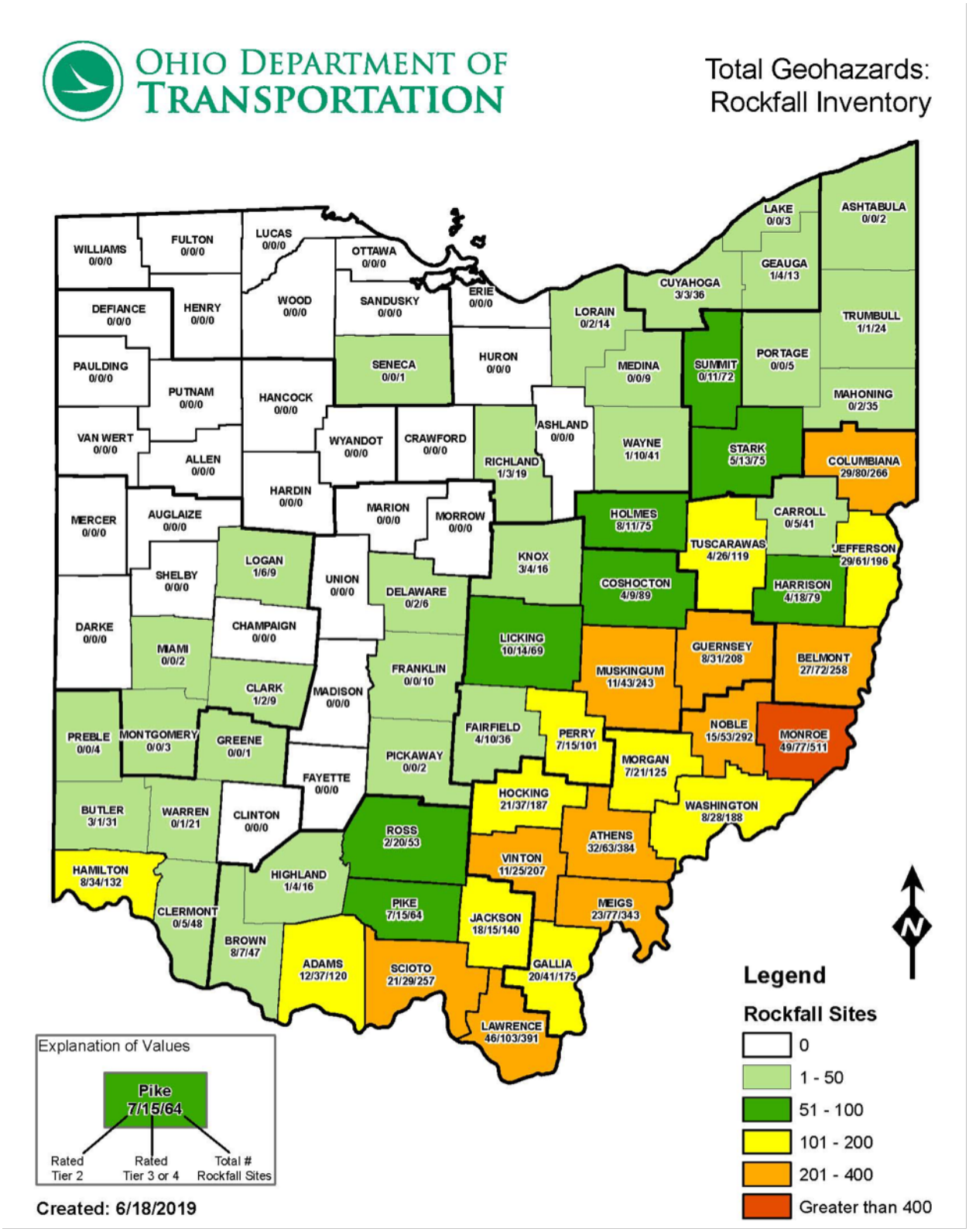


Figure 4.6.6: State of Ohio Total Geohazards Rockfall Inventory



Probability

According to the ODNR, Montgomery County falls within an area of low risk for slope failure. Landslides should be considered a likely event. The 1870 Ohio Mine Law required a mine be registered if it had more than ten employees and mined more than 200,000 tons of coal. This leaves an undocumented number of smaller mines that closed prior to 1870. There are a known 6,000 underground mines in Ohio. On February 08, 2022, the federal government granted the State of Ohio $46.4 million to reclaim abandoned coal mines. There areno documented mine collapses in Montgomery County and mine subsidence should be considered an unlikely event.

Vulnerability Risk Assessment

Infrastructure Impact

Landslides can block or damage roadways, and damage existing utility infrastructure. Mine subsidence can occur under existing roadways or utility infrastructure causing anything from minor damage to complete destruction.

Population Impact

Landslides and mine subsidence can cause injury or death if a person is struck by or trapped under falling earthen material. Mine subsidence can cause sinkholes under occupied structures which could lead to injuries.

For social vulnerability, mine subsidence is not listed in the National Risk Index, but landslide is listed with a score of.85.6 (“relatively moderate”). In general, the Montgomery County population is more exposed to these hazards because they live in hilly areas that are more susceptible to landslides. The index indicates an expected annual loss of $122,000 due to landslides with zero events occurring per year.

Property Damage

Properties caught in the path of a landslide can be destroyed or severely damaged. Properties, including their structures, can be destroyed by mine subsidence.

Additionally, there are currently 67 state-owned and state-leased critical facilities located within Montgomery County, as determined by ODNR. All 67 of these facilities are located within a low landslide risk area or an area that has not been evaluated and have a value of approximately $76,369,896. Potential economic losses and damage associated with Montgomery County for Landslides according to FEMA’s National Risk Index are recorded in **Table 4.6.7** below. This table shows the top 20 census tracts, summarizing the population from 2020, building value, expected annual loss (EAL) for buildings, and expected annual loss (EALP) for population equivalence in Montgomery County.

Table 4.6.7: Structure and Population Vulnerability from Landslides

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
100101	$0	$5,948	$1,045	$6,993
165000	$0	$5,571	$860	$6,431
050302	$0	$4,266	$854	$5,120
020200	$0	$4,448	$540	$4,988
020400	$0	$4,275	$582	$4,857
001100	$0	$3,436	$975	$4,411

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
040102	$0	$3,828	$363	$4,191
003404	$0	$3,559	$348	$3,907
080500	$0	$3,111	$558	$3,669
000801	$0	$2,768	$753	$3,521
003300	$0	$2,734	$781	$3,514
050600	$0	$2,970	$534	$3,504
040103	$0	$2,871	$413	$3,284
020100	$0	$2,486	$498	$2,984
001600	$0	$2,545	$377	$2,922
050301	$0	$2,518	$392	$2,911
040401	$0	$2,557	$298	$2,855
030100	$0	$2,523	$77	$2,601
040204	$0	$2,154	$316	$2,470
000500	$0	$1,938	$350	$2,288
Total	**$0**	**$66,506**	**$10,915**	**$77,421**

Source: FEMA National Risk Index

Loss of Life

Loss of life is possible during sudden mine subsidence or landslides. However, there are no known fatalities in Montgomery County due to mine subsidence or landslides.

Economic Losses

Landslides and mine subsidence can block or destroy sections of roadways vital to shipping. Stores, storage facilities, and other structures that are important to economic activity can also be severely damaged or destroyed. It can also be quite expensive to repair sinkholes when they occur.

Future Trends

Land Use and Development Trends

Uses that serve vulnerable populations, such as schools and hospitals, should not be placed in areas that are in high-risk zones for landslides. Development should be limited to areas with minimal slope to reduce potential losses during landslides. Development should also consider low-impact techniques to reduce the likelihood of runoff from precipitation and therefore reduce the risk of landslides. If new residential construction units are within areas with steep slopes, it would increase property and population vulnerabilities in those areas.

More buildings but less people can mean more property loss but less population vulnerability. Similar median structure year built but older relative to today could mean more vulnerability to properties and inhabitants. The current total value of taxable real estate in Montgomery County is $10,386,064,700. In 2022, Montgomery County authorized 1,343 new residential units at a total value of $268,164,000. The population is expected to decrease by 0.006 percent, or 3,417 people by 2030. An additional

decrease of 4.7% is expected by 2040. Given these estimates, there are no known changes in risks associated with wildfires.

Climate Change

According to the Midwest chapter of the Fourth National Climate Assessment, the likelihood of precipitation has increased nine percent, and the amount of rain falling during heavy precipitation events has increased by 30 percent on average between 1901 to 1960. Extreme precipitation could increase the likelihood of landslides in areas with steep slopes. Flooding caused by heavy precipitation could also increase the rate of runoff for acid mine drainage along rivers and streams. More frequent and intense rain events can also increase erosion rates and lead to greater amounts of sediment runoff into rivers, lakes, and streams (U.S. Environmental Protection Agency 2023).

4.7 Severe Summer Weather

Description

Severe summer weather events may include severe thunderstorms and thunderstorm winds, hail, and lightning. High winds, tornadoes, and flooding may also be related to severe summer storms, and due to the potential threat of these events, they are each discussed in separate risk assessments. While tropical storms and hurricanes are also forms of severe storms, Montgomery County does not have any record of such events affecting the County; therefore, the County has not deemed tropical storms and hurricanes to be a threat, and these specific types of weather will not be addressed further.

According to the National Weather Service (NWS), a severe thunderstorm is a thunderstorm that produces a tornado, has winds of at least 58 MPH, and/or hail at least one inch in diameter. A Severe Thunderstorm Watch is issued by the NWS if conditions are favorable for the development of severe thunderstorms. A watch is usually in place for four to eight hours, during which time people should be prepared to move to a safe place if threatening weather approaches.

A Severe Thunderstorm Warning is issued if either the WSR-88D radar indicates a severe thunderstorm or if a spotter reports a storm producing hail or winds meeting the criteria outlined in the description above. The WSR-88D radar is an advanced Weather Surveillance Doppler Radar utilized by the NWS to generate a radar image. The NWS recommends that people in the affected area seek safe shelter immediately, as severe thunderstorms have the potential to produce tornadoes with little-to-no advance warning. Lightning frequency is not a criterion for issuing a severe thunderstorm warning. The warnings are usually issued for one hour and can be issued without a Severe Thunderstorm Watch already in effect. The National Weather Service Forecast Office in Wilmington, Ohio is responsible for issuing Severe Thunderstorm Watches and Warnings for Montgomery County.

Lightning is caused by a rapid discharge of electrical energy that has built up in the atmosphere between clouds, the air, or the ground. Lightning strikes can be either direct or indirect. A direct strike is when lightning strikes a building or a specific zone, which can result in fusion points melting holes of varying sizes at the point of impact of materials with high resistivity. An indirect lightning strike is when lightning causes power surges that disrupt electrical equipment.

Severe summer weather can also create strong winds – often called “straight-line” winds – to differentiate thunderstorm winds from tornadic winds. These winds, which have the potential to cause damage, are caused by an outflow generated by a thunderstorm downdraft.

Hail is a type of frozen precipitation that occurs when thunderstorm updrafts carry raindrops upward into extremely cold atmospheric zones where they freeze before falling to the ground. The resulting hailstones can fall at speeds greater than 100 MPH and range in size from smaller than 0.50 inches (the size of a pea) to 4.5 inches (the size of a softball) (Source: National Weather Service).

The NWS can issue various types of wind advisories and warnings. A **wind advisory** is issued when sustained winds of 31 to 39 MPH are reached for an hour or more and/or if there are wind gusts of 46 to 57 MPH for any duration. A **High Wind Watch** indicates that sustained, strong winds are possible and outdoor items should be secured. People should modify plans, so they are not caught outside. Additionally, a **High Wind Warning** indicates that sustained, strong winds (40 MPH or greater) with even stronger gusts (greater than 58 MPH) are happening. People should seek shelter, and those driving should keep both hands on the wheel and slow down. An **extreme wind warning** is issued for surface winds of 115 MPH or greater associated with non-convective, downslope, derecho (not associated with a tornado), or sustained hurricane winds that are expected to occur within one hour.

Location

Severe summer weather is a countywide hazard, and all of Montgomery County is susceptible to severe summer weather.

Extent

Severe summer weather events have the potential to create large-scale damage in Montgomery County. Specifically, lightning is responsible for approximately 20 deaths annually across the United States, as well as hundreds of injuries (Source: NOAA). Winds associated with severe summer storms have the potential to cause damage by bringing down tree limbs and generating widespread power outages. Additionally, hail can result in property damage. Severe summer storms can lead to flooding, downed trees and power lines, and other dangerous conditions.

History

According to the National Centers for Environmental Information (NCEI), there have been 552 high-, strong-, or thunderstorm wind events, five heavy rain events, eight heat, or excessive heat events, three lightning events, and 172 hail events recorded in Montgomery County from January 1995 to December 2023. These events resulted in $136 million in property damage and $16,100 in crop damage. There were two deaths and seventeen injuries caused by severe summer weather events in Montgomery County. One death was caused by thunderstorm wind on April 29, 1996, in Montgomery County, one death was caused by a high wind event on November 15, 2020, when a tree struck a woman in her head and trapping her underneath, and one death caused by a high wind event on April 09, 2002, when wind gusts caused a semi tractor to overturn killing the driver. There were three injuries due to high wind on March 9, 2002; nine injuries due to lightning on June 30,2002; two injuries due to hail on May 25,2011; one injury due to lightning on April 8, 2015; and two injuries due to thunderstorm wind on June 8, 2015. All severe storm events from 1995 to 2023 are summarized in **Table 4.7.1**, below:

Table 4.7.1: Thunderstorm-Related Events in Montgomery County since 1995

Severe Storm Event Type	Number of Events	Injuries	Deaths	Property Damage	Crop Damages
Excessive Heat	5	0	0	$0	$0
Hail	172	2	0	$70,103,000	$16,000
Heat	3	0	0	$0	$0
Heavy Rain	5	0	0	$1,000	$0
High Wind	18	3	2	$63,896,500	$0
Lightning	3	10	0	$100,000	$0
Strong Wind	1	0	0	$10,000	$0
Thunderstorm Wind	345	2	1	$1,959,450	$100
Total:	**552**	**17**	**3**	**$136,069,950**	**$16,100**

Source: NOAA Storm Events Database

Montgomery County has not had any disaster declarations for severe storms since the previous hazard mitigation plan. However, the County has been subject to one Major Disaster Declarations (DR) and two emergency declarations (EM) for severe storms and hurricanes (Hurricane Katrina Evacuation and Hurricane Ike Remnants) since January 1995. Several of the most damaging events and/or events that resulted in deaths and/or injuries are described in more detail below.

High Wind Event throughout Montgomery County, November 15, 2020:

A low-pressure system, moved northeast towards Canada as a cold front moved across the region. The two systems led to a convective line with damaging thunderstorms. Wind gusts were measured at 66

MPH at the Dayton airport. Wind gusts caused numerous trees to fall. In the City of Dayton, a tree stuck a woman in the head and trapping her. She died of her injuries. No other deaths or injuries were reported. Montgomery County reported $50,000 in property damage.

Thunderstorm Wind Event throughout Montgomery County, June 8, 2015:

Scattered thunderstorms moved through the area with wind gusts up to 52 MPH. The wind caused a large tree to fall on a house, injuring two people. There were no deaths or other injuries reported. Montgomery County reported $7,500 in property damage.

Lightning Event in the City of Dayton, April 8, 2015:

Thunderstorms with lightning developed across the region on April 8, 2015. While running across a parking lot at the University of Dayton, a student was struck by lightning. The student was hospitalized with a broken jaw and serious burns. There were no deaths or other injuries reported. No property damage was reported in Montgomery County.

Emergency Declaration for Severe Storms, June 30, 2012:

An unstable airmass and northwesterly flow interacted to produce a derecho throughout northern Illinois. The derecho moved east over western Ohio, producing straight line wind damage. The derecho and thunderstorm downed numerous trees, tree limbs, and power poles. Wind gusts up to 71 MPH were reported. Power outages were widespread and large hail was also spotted within stronger portions of the storm. On June 30, 2012, an Emergency Declaration (EM-3346-OH) was declared for every county in Ohio. There were no deaths or injuries reported in Montgomery County. Montgomery County did not have any property damage reported.

Hail Event in the Village of Miamisburg, May 25, 2011:

A low-pressure system moved east over the Ohio Valley developing widespread severe thunderstorms, with large hail and damaging wind. In the Village of Miamisburg hail up to three inches in diameter was reported. While running for shelter, one adult and one child were struck by large hail sustaining injuries. No deaths or other injuries were reported. Montgomery County reported $10,000 in property damage.

Major Disaster Declaration for Windstorm Associated with Tropical Depression Ike, October 24, 2008:

A frontal boundary over the Ohio Valley combined with the remnants of Hurricane Ike on September 14, 2008. Wind gusts of 69 MPH were recorded at Dayton airport. Significant damage throughout the county was reported to structures and crops. Wind gusts downed numerous powerlines causing widespread power outages. Montgomery County reported $63.7 million in property damage. Wind gusts download numerous trees and powerlines. A Major Disaster Declaration (DR-1805-OH) was declared on October 24, 2008, for 33 counties in Ohio. Public assistance was offered for each county, including Montgomery County. Approximately $38 million was approved for public assistance. There were no deaths or injuries reported in Montgomery County.

High Wind Event throughout Montgomery County, March 9, 2002:

High winds with gusts up to 84 MPH caused extensive damage across Montgomery County. Many trees and power poles were blown down. Approximately 100,000 people were without power at one point. The high winds caused car accidents, which resulted in three individuals sustaining injuries. One man was killed with his semi tractor overturned. A tree fell on a mobile home, trapping two people briefly. No other deaths or injuries were reported. Montgomery County reported $85,000 in property damage.

Lightning Event in the Village of Kettering, June 30, 2002:

Lightning struck a tree of an outdoor party, causing nine people who were standing near the tree to be injured. The injured parted reported burned feet, and one person was held overnight for observation,

but was released the next day. There were no deaths or other injuries reported. No property damage was reported in Montgomery County.

Hail Event in the Village of Huber Heights, April 9, 2001:

Golf ball size hail caused extensive structural damage across the eastern part of Montgomery County. No deaths or other injuries were reported. Montgomery County reported $70 million in property damage.

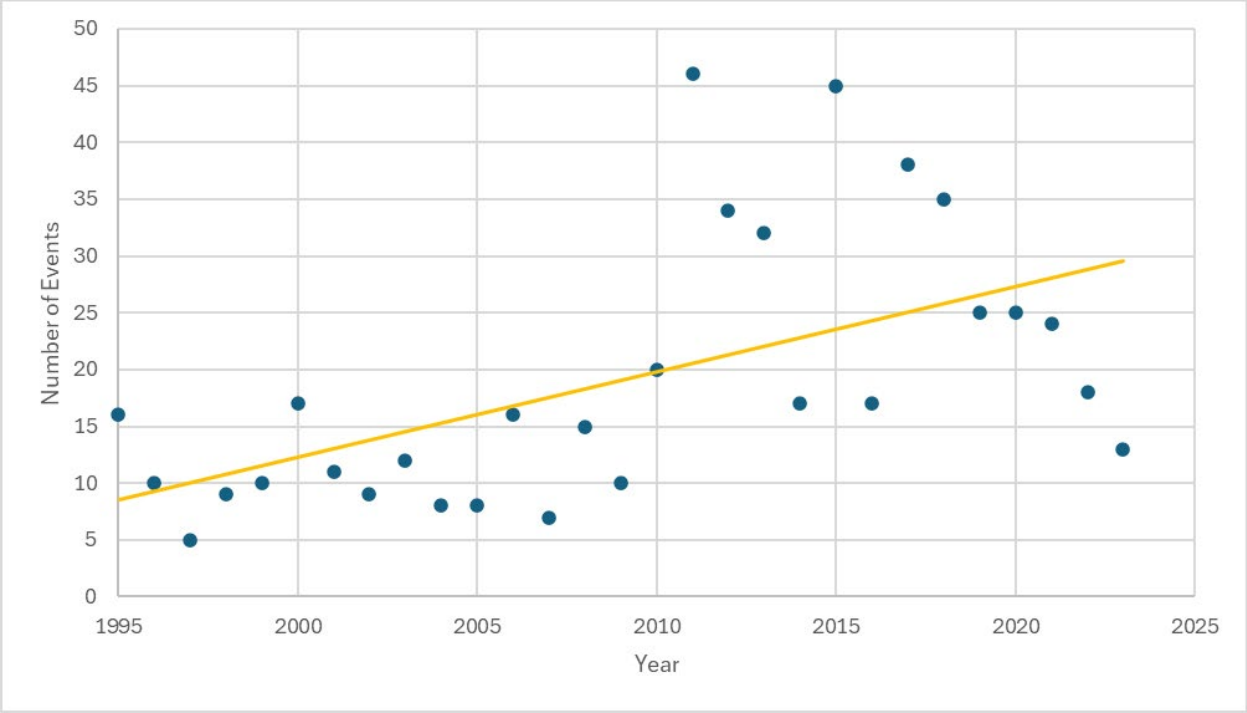
Thunderstorm Wind Event throughout Montgomery County, April 29, 1996:

A thunderstorm moved through the region on April 29, 1996, bringing wind gusts up to 100 MPH and 0.88-inch diameter inch hail. The high winds downed over 100 trees and the church steeple to be destroyed. Over 25,000 people were without power. There was one death reported, but no details were found on the death. No other deaths or injuries were reported. Montgomery County reported $300,000 in property damage.

Probability

According to the NCEI, there have been 552 severe summer storm events reported in Montgomery County from January 1995 to December 2023 with total losses reaching at least $136 million in property damage and $16,100 in crop damage. This amounts to around 19 severe summer storm events annually with average annual damages of approximately $4.9 million. **Figure 4.7.2** below shows the trend in number of severe summer weather events per year since 1995. The yellow trend line has a positive slope, which indicates that the number of severe summer storms has increased over the last 28 years. The year 2011 had 46 severe summer weather events, the highest out of the last 29 years. In 2015, there were 45 severe summer weather events recorded. Since 2009 there hasn't been a year with 10 or less severe summer weather events reported. Preliminary research suggests that the frequency and intensity of severe thunderstorms could increase as the climate changes, according to the National Climate Assessment. The Climate Change section in Future Trends discusses climate change further.

Figure 4.7.2: Severe Summer Storm Probability



Source: NOAA

Vulnerability Assessment

Infrastructure Impact

Above-ground infrastructure is at risk for storm damage by wind and falling debris. For infrastructure, high winds and hail are the most damaging part of a severe storm. Thunderstorm winds can strip bark from trees and detach limbs. If large branches fall, they can damage buildings and supporting above-ground infrastructure. In the most severe storms with high winds, large trees can be uprooted and have the potential to fall on buildings including houses, which can cause harm or death.

Utilities are at risk for damage by severe summer storms, as well. Electrical lines are spread throughout the County connecting homes, businesses, and other facilities. Severe storms are likely to down tree limbs and generate other debris that can affect above-ground electrical lines causing power outages. Downed power lines that are still live are extremely hazardous and can cause death by electrocution.

Population Impact

Summer storms are random in nature and affect the entire area of the County. Everyone within the County should be prepared during a storm event. Populations residing in mobile home parks are particularly vulnerable and should seek shelter.

For social vulnerability, according to the National Risk Index, hail, lightning, and strong wind had scores of 99.0 (“relatively high”), 88.3 (“relative moderate”), 96.4 (“relatively high”) for Montgomery County. This information indicates that severe summer storms are exposing the population of Montgomery County to some risk from storm events. The index indicates an expected annual loss of $7.9 million due to hail events, $514,000 due to lightning events, and $3.0 million due to strong wind events, with 3.8, 69.4, and 2.6 events occurring per year, respectively.

Property Damage

As described above, these events have caused an average of $136 million in property damage and $16,100 in crop damage annually. Due to the non-site-specific nature of this hazard, **Table 4.29** lists all structures within Montgomery County as having potential impacts from severe storms.

Loss of Life

There have been three deaths and 17 injuries in Montgomery County because of severe summer weather. There is always potential for injuries and fatalities during severe summer weather.

Economic Losses

Severe summer weather has the potential to damage infrastructure, resulting in the economic burden of clean up and repairs. Potential economic losses and damage associated with Montgomery County for hail, strong wind events, and lightning are recorded in **Tables 4.7.3 to 4.75** below. This table summarizes the population from 2020, building value, expected annual loss (EAL) for buildings, and expected annual loss (EALP) for population equivalence in Montgomery County. The top 20 most vulnerable census tracts according to FEMA's National Risk Index are used for the calculations. EAL for buildings and population combine the totals from hail, strong wind events, and lightning. Compared with other hazards, severe summer weather has a rating of relatively low index rating, meaning that economic loss due to severe summer weather is relatively low for Montgomery County.

Table 4.7.3: Structure and Population Vulnerability from Hail

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
001501	$0	$207,714	$120	$207,834
030100	$11	$202,320	$135	$202,467
040406	$46	$154,661	$223	$154,930
040401	$0	$141,044	$149	$141,192
130102	$650	$111,037	$198	$111,885
080700	$3	$111,466	$59	$111,528
150100	$1,741	$100,313	$176	$102,230
140100	$1,874	$98,606	$174	$100,654
050503	$4	$100,371	$178	$100,552
050107	$2	$100,135	$94	$100,231
010200	$0	$97,703	$212	$97,915
110202	$16	$95,970	$96	$96,082
040306	$13	$93,758	$159	$93,930
100400	$174	$93,381	$152	$93,707
120101	$446	$93,110	$149	$93,705
090302	$10	$92,687	$182	$92,879
050504	$24	$92,252	$184	$92,459

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
165000	$460	$90,750	$189	$91,400
020400	$0	$89,830	$196	$90,027
040302	$1	$88,284	$156	$88,441
Total	**$5,475**	**$2,225,390**	**$3,183**	**$2,264,048**

Table 4.7.4: Structure and Population Vulnerability from Lightning

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
040406	$0	$200	$7,870	$8,070
010200	$0	$123	$7,234	$7,357
090304	$0	$98	$6,966	$7,064
090302	$0	$123	$6,574	$6,697
165000	$0	$114	$6,506	$6,620
050504	$0	$117	$6,338	$6,455
130102	$0	$129	$6,230	$6,359
020400	$0	$105	$6,234	$6,339
002600	$0	$66	$5,999	$6,065
100101	$0	$102	$5,951	$6,054
050503	$0	$119	$5,841	$5,960
100102	$0	$102	$5,801	$5,904
050106	$0	$100	$5,770	$5,870
040405	$0	$101	$5,692	$5,793
040306	$0	$121	$5,602	$5,724
002500	$0	$52	$5,642	$5,693
140100	$0	$114	$5,542	$5,657
080500	$0	$79	$5,486	$5,565
080100	$0	$98	$5,412	$5,510
150100	$0	$112	$5,343	$5,456
Total	**$0**	**$2,177**	**$122,034**	**$124,211**

Source: FEMA National Risk Index

Table 4.7.5: Structure and Population Vulnerability from Strong Winds

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
001501	$0	$69,284	$2,877	$72,162
030100	$0	$67,485	$3,239	$70,724
040406	$0	$46,158	$4,769	$50,927
040401	$0	$42,094	$3,177	$45,271
130102	$0	$40,026	$5,182	$45,209
140100	$0	$35,384	$4,412	$39,796
080700	$0	$37,180	$1,412	$38,592
150100	$0	$34,092	$4,248	$38,341
010200	$0	$32,589	$5,063	$37,653
090302	$0	$30,916	$4,362	$35,279
100400	$0	$31,148	$3,627	$34,775
020400	$0	$29,963	$4,692	$34,655
120101	$0	$31,057	$3,571	$34,629
110202	$0	$32,011	$2,296	$34,308
050503	$0	$29,955	$3,808	$33,763
100101	$0	$28,831	$4,400	$33,230
125102	$0	$28,192	$4,349	$32,541
080100	$0	$27,973	$4,037	$32,010
050107	$0	$29,885	$2,018	$31,903
050504	$0	$27,532	$3,925	$31,458
Total	**$0**	**$731,755**	**$75,464**	**$807,226**

Source: FEMA National Risk Index

Future Trends

Land Use and Development Trends

Severe summer storms can occur anywhere. Any development that has occurred since the previous plan, and any future development, has the potential to be impacted by severe summer storms.

More buildings but less people can mean more property loss but less general population vulnerability. Similar median structure year built but older relative to today could mean more vulnerability to properties and inhabitants. Increase of people age 65+ from 2016 to 2022 could mean more vulnerability to summer storms. The current total value of taxable real estate in Montgomery County is $10,386,064,700. In 2022, Montgomery County authorized 1,343 new residential units at a total value of $268,164. The population is expected to decrease by 0.006 percent, or 3,417 people by

2030. An additional decrease of 4.7% is expected by 2040. Given these estimates, there are no known changes in risks associated with wildfires.

Climate Change

Preliminary research suggests that the frequency and intensity of severe thunderstorms could increase as the climate changes, according to the National Climate Assessment. A warming climate may also increase the number of days with conditions conducive to a severe thunderstorm. Future modeling techniques could reveal additional information about the correlation between atmospheric changes and severe thunderstorm formation and intensity.

4.8 Severe Winter Weather and Extreme Cold

Description

Severe winter weather includes winter storms, heavy snow, and extreme cold. Winter storms including blizzards are events that have heavy snow, sleet, ice, freezing rain, or high winds as their primary type of precipitation. While the precipitation itself is typically not dangerous, frozen roads and exposure to cold can cause death and injury.

A winter storm forms under the correct combination of three causes:

1. Below freezing temperatures in the clouds and near the ground, which are necessary to make snow and ice.
2. Lift, which raises the moist air from the clouds and causes precipitation. Warm air colliding with cold air and being forced to rise over the cold is an example of lift.
3. Moisture is needed to form clouds and precipitation. Air blowing across a body of water is a common source of moisture.

Winter storms are categorized by their type: blizzards, ice storms, lake effect storms, and snow squalls. Extreme cold events often accompany winter storms, bringing low temperatures and higher risks of frostbite and hypothermia.

- **Blizzards** are winter storms that are a combination of blowing snow and wind which lead to very low visibility. Heavy snowfalls and severe cold often accompany blizzards, but this is not required. Ground blizzards occur when strong winds pick up snow that has already fallen.
- **Ice Storms** occur when at least a quarter inch of ice accumulates on exposed surfaces. Roads and sidewalks can become dangerously slick, and trees and powerlines can easily break under the weight of accumulated ice.
- **Lake Effect Storms** are cold, dry air masses that move over the Great Lakes regions and drop the moisture as snow in the northeastern portion of Ohio near the Great Lakes area.
- **Snow Squalls** are brief, intense snow showers accompanied by strong winds. Impacts may be significant.
- **Extreme Cold Events** occur when temperatures drop below normal for the given area and they generally coincide with winter storms or are the lasting effect of a winter storm.

Location

Winter storms are typically large events that impact large areas at once. Winter storms will impact the entire County and have the potential to impact multiple counties.

Extent

The State of Ohio Hazard Mitigation Plan 2024 lists winter storms as one of the three highest threat hazards in Ohio. The average annual snowfall in Montgomery County is 12 to 24 inches according to NOAA, similar to the state average of about 27 inches. Snowfall typically occurs between November and April with January being the coldest month on average.

History

There have been at least 28 winter storm events, and another 124 winter weather events including heavy snow, extreme cold, wind chill, ice storm, and frost/freeze, in Montgomery County since January 1995, for a total of 152 severe winter weather events. These events caused $626,000 in property damage and $540,000 in crop damage according to The National Centers for Environmental Information (NCEI). A winter storm on January 6, 1996, caused two deaths, one in Montgomery County

and one in Maimi County due to exposure. All severe winter weather and extreme cold events from 1995 to 2023 are summarized in **Table 4.8.1**, below:

Table 4.8.1: Severe Winter Related Events in Montgomery County since 1995

Severe Storm Event Type	Number of Events	Deaths	Injuries	Property Damage	Crop Damages
Blizzard	1	0	0	$0	$0
Cold/Wind Chill	1	0	0	$100,000	$0
Extreme Cold	2	0	0	$0	$0
Frost/Freeze	1	0	0	$0	$540,000
Heavy Snow	14	0	0	$1,000	$0
Ice Storm	5	0	0	$0	$0
Winter Storm	28	1	0	$525,000	$0
Winter Weather	100	0	0	$0	$0
Total:	**152**	**1**	**0**	**$626,000**	**$540,000**

Montgomery County has not had any disaster declarations for winter storms since the previous hazard mitigation plan. However, the County has been subject to one Emergency Declaration (ER) for snowfall since January 1995. Several of the most damaging events and/or events that resulted in deaths and/or injuries are described in more detail below.

Emergency Declaration for Winter Storm throughout Montgomery County on December 22, 2004:

A surface and upper-level low pressure center tracked Northeast across the Ohio Valley on December 22, 2004, and exited the region on December 23, 2004. A swath of heavy snow cut through Miami Valley. 24-hour storm totals in this narrow band exceeded two feet in Preble and Darke counties. Snowfall totals of 20 inches or more were found along a line generally running from the City of Eaton to the cities of Greenville, Piqua, Sidney, and Bellefontaine. Along and west of the I-71 corridor between the City of Cincinnati and the City of Columbus, over eight inches of snow fell. East of this line, warm air infiltrated the lower layers of the atmosphere and brought periods of freezing rain and sleet during the evening and overnight hours. Several communities in south central and central Ohio were crippled by power outages. Up to 236,000 electric customers were without power for several hours, some lasting up to a week before it was restored. An Emergency Declaration (EM-3198-OH) was issued on January 11, 2005, for 26 counties, including Montgomery County. Throughout Ohio, this event caused a reported $25,000,000 in property damage. There are no reported property or crop damages in Montgomery County.

Extreme Cold throughout Montgomery County on February 1, 1996:

Arctic high pressure brought the coldest air of the season to the Ohio Valley in February 1996. The extreme cold was entrenched for five days, freezing, and bursting numerous water pipes. Throughout the Ohio Valley, there were at least two housefires indirectly related to the cold weather, as space heaters, which were thawing frozen water lines, caught on fire. Electricity outages were reported throughout Ohio AAA motor club had an extremely high number of calls during this cold wave when cars would not start. This event caused a reported $100,000 in property damage.

Winter Storm throughout Montgomery County, January 6, 1996:

A blizzard developed near the Gulf Coast and moved up the East Coast in early 1996, brining freezing temperatures and snowfall to most of Ohio. The additional snowfall resulted in $500,000 in property

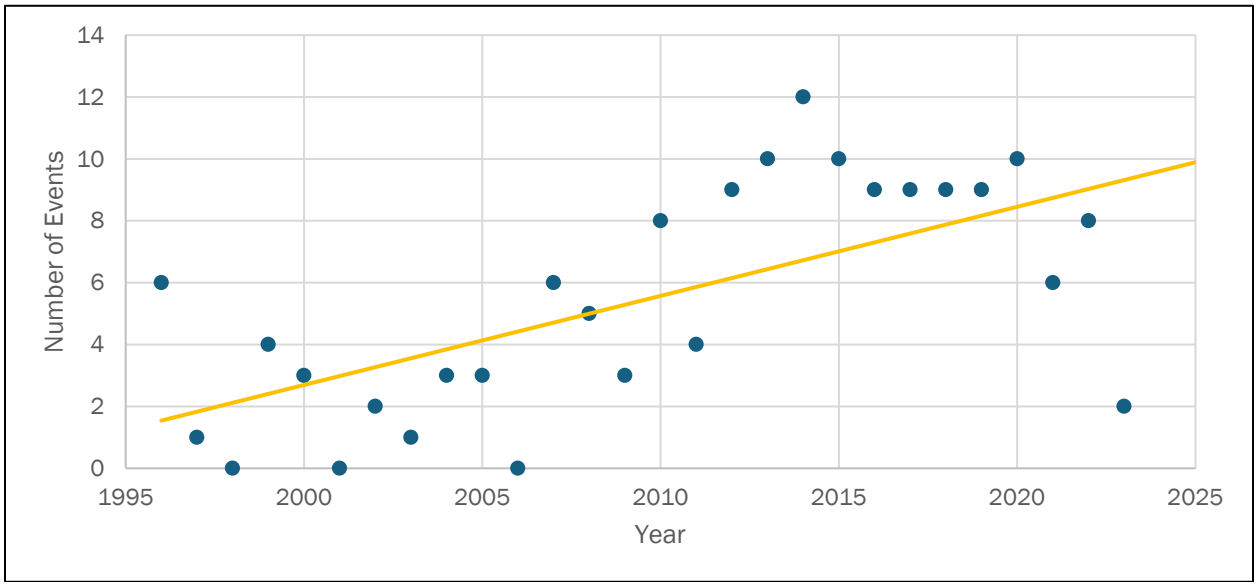
damage throughout Ohio, including in Montgomery County. Many businesses and homes had their roof collapse due to the weight of the new snow. A 76-year-old man died of exposure on his front porch in Montgomery County.

Probability

According to the NCEI, there have been a total of 152 winter storms and winter weather events reported in Montgomery County from January of 1995 to December 2023, with total losses amounting to $626,000 in property damage and $540,000 in crop damage. This amounts to approximately five winter storm events annually with average annual damages of $41,642. In addition, according to the Fifth National Climate Assessment, due to the warming climate, extreme winter weather will be less severe and less frequent in Ohio, and heavy snowfall will manifest as heavy rainfall in future years. The Climate Change section in Future Trends discusses climate change further.

Figure 4.8.2 shows the trend of severe winter weather events over time between January 1995 and December 2025. The trend line slightly increases over the 28 years, illustrating a slight increase of winter weather activity in Montgomery County.

Figure 4.8.2: Severe Winter Weather Probability



Source: NOAA

Vulnerability Assessment

Infrastructure Impact

Winter storms can cause damage to overhead utilities. Wires can collapse under the weight of accumulated snow and ice leading to disruption in communication and power supply for days. Debris can block roadways or damage property as tree limbs can also collapse under the weight of accumulated snow and ice. Water pipes can be frozen under extreme low temperatures that may accompany severe winter storms. Roads and sidewalks can be blocked by the accumulation of snow, as well as being iced over. Bridges and overpasses are particularly dangerous because they freeze before other surfaces. Heavy snow fall and accumulation can cause business and private homes to have partial or full roof collapses.

Population Impact

All residents of Montgomery County are expected to be impacted by severe winter storms. Infants, older adults, sick people, and pets are more vulnerable to injuries and health conditions related to exposure to heavy snow, ice, and lasting extreme cold temperatures. It is advisable to equip vulnerable populations with indoor easy-to-read thermometers and heating devices in locations where they are highly visible.

For social vulnerability, according to the National Risk Index, cold wave, ice storm, and winter weather had scores of 60.2 (“relatively moderate”), 85.8 (“relatively high”), 92.2 (“relatively high”) for Montgomery County. This information indicates that severe winter weather events are exposing the population of Montgomery County to moderately high risk from winter storm events. The index indicates an expected annual loss of $122,000 due to cold wave events, $403,000 due to ice storm events, and $465,000 due to winter weather events, with 0.7, 1.1, and 2.9 events occurring per year, respectively.

Property Damage

Property can be damaged by accumulated snow and ice, debris, and falling trees and utility poles. Extreme low temperatures can also freeze the water in pipes which could cause them to explode. All buildings in the County are exposed and vulnerable to winter storms. The State of Ohio Hazard

Mitigation Plan 2024 estimates annual potential losses due to damage caused by winter storms in Montgomery County to be $1,271752.

Property owners should weatherproof their homes and buildings and conduct regular inspections to eliminate impacts from extreme weather conditions. The Federal Emergency Management Agency (FEMA) suggests that individuals with damaged property should contact their insurance company and take photos of any damage. If individuals are uninsured or underinsured, they should seek assistance by visiting www.DisasterAssistance.gov.

Loss of Life

There was one reported death during the Blizard of 1996 due to exposure in Montgomery. Likely causes of death are from iced-over and dangerous roads which lead to vehicular accidents, frostbite or hypothermia from prolonged exposure to cold, heart attacks from heavy snow shoveling, and carbon monoxide poisoning due to toxic fumes from heating sources.

A few ways to prepare and protect from extreme winter weather conditions include, but are not limited to, staying indoors and dressing warmly, staying off roads, avoid driving if already in a vehicle, equipping vehicles with an emergency supply kit, preparing for power outages and using heating devices intended for indoor use only, staying updated about emergency information and alerts, seeking medical assistance on signs of hypothermia or frostbite, and checking on neighbors.

Economic Losses

Economic losses can occur from businesses shutting down for potentially long periods of time. Economic activity can be completely halted during winter storms including transportation of goods and people. Electricity outages may lead to spoiled goods. Since winter storms occur during the winter season, damage to crops is unlikely but possible. Damaged buildings and pipes, fallen trees and power lines, and costs to repair damages and remove snow further impact the economy of cities and towns. Table 4.8.3 to Table 4.8.5 shows the potential economic impacts if all structures within Montgomery County were damaged.

These tables summarize the expected annual losses (EAL) for agriculture, building value, and population equivalence, and the total expected loss in Montgomery County. The top 20 most vulnerable census tracts according to FEMA's National Risk Index are used for the calculations.

Table 4.8.3: Structure and Population Vulnerability from Cold Wave

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
140100	$7,086	$175	$705	$7,967
150100	$6,754	$183	$733	$7,670
050600	$4,731	$164	$647	$5,541
130101	$4,896	$77	$282	$5,255
160100	$3,336	$74	$235	$3,645
130102	$2,444	$197	$792	$3,433
070101	$2,422	$94	$443	$2,959
165000	$1,893	$173	$819	$2,886
120101	$1,779	$172	$626	$2,577
110100	$1,300	$135	$190	$1,625

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
100400	$693	$172	$635	$1,501
040406	$190	$295	$965	$1,449
125000	$485	$106	$781	$1,372
100101	$222	$160	$771	$1,152
010200	$0	$180	$887	$1,068
050504	$98	$176	$794	$1,068
050106	$156	$154	$738	$1,048
115012	$210	$136	$644	$990
020400	$1	$166	$822	$989
030100	$44	$374	$567	$985
Total	**$38,741**	**$3,363**	**$13,076**	**$55,180**

Table 4.8.4: Structure and Population Vulnerability from Ice Storm

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
040406	$0	$1,596	$4,948	$6,544
010200	$0	$952	$4,437	$5,389
165000	$0	$936	$4,203	$5,140
050504	$0	$952	$4,072	$5,024
020400	$0	$875	$4,111	$4,986
050503	$0	$1,036	$3,950	$4,986
030100	$0	$1,971	$2,838	$4,809
040405	$0	$881	$3,914	$4,795
040401	$0	$1,455	$3,296	$4,752
130102	$0	$991	$3,741	$4,732
090302	$0	$903	$3,823	$4,726
100101	$0	$842	$3,855	$4,697
090304	$0	$709	$3,978	$4,687
125102	$0	$823	$3,811	$4,635
050106	$0	$831	$3,786	$4,617
150100	$0	$951	$3,633	$4,585
001501	$0	$2,023	$2,521	$4,545

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
040306	$0	$967	$3,533	$4,500
125000	$0	$557	$3,905	$4,462
080500	$0	$681	$3,763	$4,444
Total	**$0**	**$20,932**	**$176,120**	**$97,052**

Source: FEMA National Risk Index

Table 4.8.5: Structure and Population Vulnerability from Winter Weather

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
040406	$998	$6,181	$1	$7,180
010200	$611	$5,684	$0	$6,295
165000	$586	$5,251	$14	$5,850
020400	$561	$5,267	$0	$5,828
130102	$667	$5,074	$17	$5,758
050504	$595	$5,087	$1	$5,683
050503	$648	$4,935	$0	$5,582
090304	$455	$5,096	$0	$5,551
100101	$540	$4,939	$2	$5,481
090302	$579	$4,897	$0	$5,477
040405	$551	$4,889	$0	$5,440
125102	$528	$4,883	$0	$5,411
150100	$620	$4,696	$48	$5,365
125000	$357	$5,003	$3	$5,363
080500	$437	$4,821	$0	$5,258
050106	$520	$4,730	$1	$5,250
140100	$594	$4,520	$51	$5,165
100102	$512	$4,563	$0	$5,075
080100	$524	$4,533	$0	$5,057
040401	$910	$4,117	$0	$5,028
Total	**$11,795**	**$99,164**	**$139**	**$111,098**

Source: FEMA National Risk Index

Future Trend

Land Use and Development Trends

Winter storms can occur anywhere bringing an entire community or region to a standstill, including commuter and emergency transportation and medical services. Any development that has occurred since the adoption of the previous plan, and any future development, has the potential to be impacted by winter storms. All land uses are equally impacted by severe winter weather.

Building design and construction is also impacted by the amount of snowfall. Areas that receive high snowfall should have buildings designed to withstand the weight of the snow to avoid sagging, cracking, and collapsing roofs. On the other hand, snow is a natural insulator, and snow accumulated on rooftops helps hold heat in buildings and, consequently, reduces heating costs.

It is important to maintain consistency between emergency planning, financial plans and budgets, and development planning. Zoning codes should ensure that there is adequate greenspace in existing and new developments to foster drainage and offers space to pile cleared snow. Locating emergency facilities, and partnering with emergency organizations during the planning process, will help develop improved contingency responses in cases where emergency transportation and services are cut off during an extreme weather event.

The current total value of taxable real estate in Montgomery County is $10,386,064,700. In 2022, Montgomery County authorized 1,343 new residential units at a total value of $268,164,000. The population is expected to decrease by 0.006 percent, or 3,417 people by 2030. An additional decrease of 4.7% is expected by 2040. Given these estimates, there are no known changes in risks associated with severe winter weather.

Climate Change

According to the Midwest chapter of the Fourth National Climate Assessment, the average Midwest air temperature increased by more than 1.5 degrees Fahrenheit between 1900 and 2010. In recent years, however, warming has increased three times as quickly between 1980 and 2010. By the end of 2030, Ohio's climate may trend towards the climate of Southern Illinois. By 2100, Ohio might feel like Arkansas or Texas. As a result, the warming climate suggests that extreme winter weather will be less severe and less frequent in Ohio, and heavy snowfall will manifest as heavy rainfall in future years.

4.9 Tornadoes

Description

FEMA defines a tornado as "a violently rotating column of air extending from a thunderstorm to the ground." Tornadoes can generate wind speeds greater than 250 miles per hour. Tornado paths can be as large as one mile wide and 50 miles long. Nationally, there is an average of 800 tornadoes reported annually across all 50 states.

In general, the midsection of the United States experiences a higher rate of tornadoes than other parts of the country because of the recurrent collision of moist, warm air moving north from the Gulf of Mexico with colder fronts moving east from the Rocky Mountains. Supercells, which form from rotating thunderstorms, are the most destructive type of tornado.

Tornado Warnings are issued by the Wilmington, OH Forecast Office when a tornado is indicated by the WSR-88D radar or sighted in person by spotters. The WSR-88D radar is an advanced Weather Surveillance Doppler Radar utilized by the NWS to generate a radar image. Once a warning has been issued, people in the warning area should seek shelter immediately. Warnings will include the location of the tornado, as well as what communities will be in its path. A tornado warning can be issued without a tornado watch, and they are typically issued for 30 minutes at a time. If the thunderstorm responsible for the formation of the tornado is also producing large volumes of rain, the tornado warning may be combined with a Flash Flood Warning. The NWS Office will follow up any Tornado Warnings with Severe Weather Statements to provide up-to-date information on the tornado and inform the public when the warning is no longer in effect (Source: NWS).

Location

Tornadoes can occur anywhere in Montgomery County. All areas and jurisdictions should be considered at risk for a tornado.

Extent

Tornadoes are measured by damage scale for their winds with greater damage equating greater wind speed. The original Fujita Tornado Damage Scale (F-scale) was developed in 1971 without much consideration to a structure's integrity or condition as it relates to the wind speed required to damage it. The Enhanced Fujita-scale (EF-Scale) took effect on February 1, 2007. This scale starts with the original F-scale's F0 through F5 ratings and classifies tornado damage across 28 different types of damage indicators. These indicators mostly involve building/structure type and are assessed at eight damage levels from 1 through 8. Therefore, construction types and their relative strengths and weaknesses are incorporated into the EF classification given to a particular tornado. The most intense damage within the tornado path will generally determine the EF scale given the tornado. **Table 4.9.1** lists the classifications under the EF- and F-scale. It should be noted that the wind speeds listed in this table are estimates based on damage rather than measurements.

There are no plans by the National Oceanic Atmospheric Administration (NOAA) or the National Weather Service to re-evaluate the historical tornado data using the enhanced scale. Therefore, this Plan and subsequent plans will reference both scales until a complete switchover is deemed necessary.

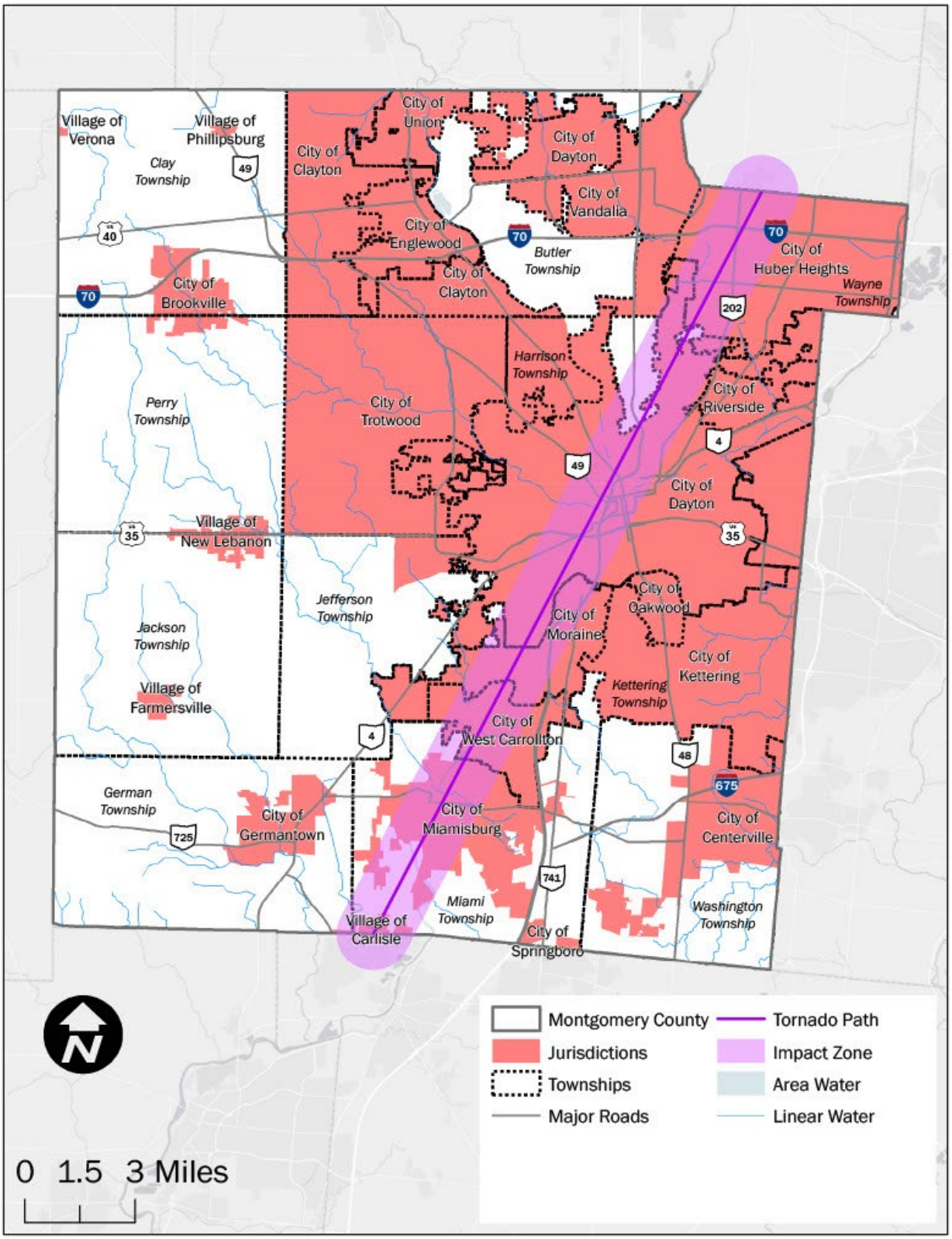
Figure 4.9.2 simulates an extremely destructive, worst-case scenario EF5 tornado and its impacts on Montgomery County assets and infrastructure. The worst-case scenario is simulated by running the EF5 tornado on a straight path through the most populated areas of the County. This theoretical scenario is performed to determine maximum potential damage within the County. The damages associated with this theoretical scenario are used to identify the County's potential vulnerability to tornadoes (**Table 4.9.3**).

Table 4.9.1: Fujita and Enhanced Fujita Scale Classifications

Fujita Scale 3-Second Wind Gust (MPH)		Damage Levels	Enhanced Fujita Scale 3-Second Wind Gust (MPH)	
F0	45-78	Light Damage: Tree branches down.	EF-0	65-85
F1	79-117	Moderate damage: Roof damage.	EF-1	86-110
F2	118-161	Considerable damage: Houses damaged.	EF-2	111-135
F3	162-209	Severe damage: Buildings damaged.	EF-3	136-165
F4	210-261	Devastating damage: Structures leveled.	EF-4	166-200
F5	262-317	Incredible damage: Whole towns destroyed.	EF-5	Over 200

Source: SOHMP

Figure 4.9.2: Worst Case Tornado Scenario



History

There have been 13 tornado events in Montgomery County between March 1995 and July 2023 resulting in a total of $504,485,000 in property damages. There was one indirect death caused during these events, with 174 overall injuries reported. Eight injuries occurred in the October 31, 2013, tornado and 166 occurred in the May 27, 2019, tornado. Average annual damages from 1995 to 2023 are approximately $18,017,321 in property damages. The two tornado events in Montgomery County from 1995 to 2023 that caused the most damages and involved injuries are listed and described below. There has been one disaster declaration in Montgomery County in 2019.

A Major Disaster Declaration for Tornadoes in Montogomery County, May 27, 2019

An EF4 Tornado hit Montogomery County on Monday, May 27, 2019. The tornado initially touched down just west of Brookville and areas on the south side of Brookville sustained heavy damage, consistent with high-end EF2 wind speeds. Numerous homes suffered significant roof damage and removal, including exterior wall collapse and complete garage destruction. The tornado then carved a path east through Trotwood where damage consistent with EF2 wind speeds was widespread and some homes sustained damage consistent with EF3 wind speeds. Structures here again featured roof removal and exterior wall collapse. Areas near Riverside Drive and the Stillwater River exhibited damage consistent with wind speeds of 170 mph, or lower-end EF4 damage. This damage included well-built apartment buildings that sustained complete roof and exterior wall removal. In addition, significant tree devastation was found along the Stillwater River, east of Riverside Drive, that included numerous trees that were debarked and nubbed down to the trunk. The tornado continued southeast through Dayton and Northridge and crossed I-75 into the Old North Dayton Area, where heavy damage continued to homes and businesses. As the tornado entered Riverside, damage began to lessen in intensity, but plenty of damage consistent with EF1 wind speeds was noted. The tornado continued further to the southeast, causing damage in a subdivision north of Burkhardt Road. An 86-year-old woman died (indirect) on September 1st, 2019, in part due to injuries suffered when she was trapped in her home during the tornado. A Major Disaster Declaration (DR-4447-OH) was issued on June 18, 2019, for 12 counties, including Montgomery County. Overall, the tornado caused $500,000,000 in property damage for Montgomery County and 166 injuries were reported.

An EF1 Tornado in the City of Vandalia, October 31, 2013:

An EF1 tornado hit the City of Vandalia on Thursday, October 31, 2013. The tornado touched down just northeast of Interstate 75 at Highway 40, exit number 63 in Vandalia. Initial damage consisted of the collapse of a cinderblock drive through store, and significant destruction of the roof and some of the cinderblocks on an uninhabited commercial building. The tornado continued on to a restaurant, in which the windows were blown in and significant façade and roof damage occurred. Eight people inside the restaurant sustained minor injuries from the glass. The tornado continued into a residential subdivision, where at least three homes sustained damage which rendered them uninhabitable. There were additional homes with partial wall collapses, and more than half the roof was removed. Based on the damage surveyed, the maximum wind speed of this tornado was estimated to be between 100 and 110 miles per hour. Overall, the tornado caused $2,000,000 in property damage for Montgomery County and eight injuries were reported.

Probability

There have been 13 tornado events in Montgomery County between March 1995 and July 2023 resulting in a total of $504,485,000 in property damages. Average annual damages amount to about $18,017,321.

There were no recorded tornadoes between 1995 and 2006. Between 2006 and 2021, the annual rate for tornadoes in Montgomery County has been about one tornado every two years. However, when conditions are right, there may be multiple tornadoes in one year or one storm.

Although it is difficult to predict future tornado activity, a study completed in 2018 on spatial trends of tornadoes saw an eastward shift in tornado frequency. Two other studies (2015 and 2016) showed an increase in tornado frequency in the eastern United States and a decrease in tornado activity in central United States. The study published in 2016 on spatial redistribution of tornado activity stated that there is a documented increase in hazardous conductive weather (HCW) in the lower Ohio valley regions. The studies do note that the number of tornadoes produced from a single storm are increasing. For instance, in 2020 there were 20 documented tornadoes in Ohio, seven from one storm and five from another.

Vulnerability Assessment

Infrastructure Impact

Above-ground infrastructure can be damaged by tornadoes. Debris caught in tornadoes as well as fallen trees can cause damage to buildings and infrastructure. Debris can lead to closure. Above ground utility infrastructure can be damaged or destroyed, which can cause service outages.

Population Impact

Tornadoes are random in nature and have the potential to occur anywhere in the County. Everyone within the County should be prepared for a tornado. Residents in mobile home parks are particularly vulnerable and should have a plan in place.

For social vulnerability, according to the National Risk Index, tornadoes and strong winds have a score of 81.8 (“relatively moderate”) and 92.0 (“relatively moderate”) in Montgomery County. Tornadoes that have occurred in Montgomery County are typically weaker tornadoes, rated EF-2 or lower. The index indicates an expected annual loss of $2.9 million due to strong wind and $7.5 million due to tornadoes, with 2.6 and 0.3 events occurring per year, respectively.

Property Damage

Tornadoes can cause significant damage to buildings and properties. In the last 28 years the property damage in Montgomery County is related to major structural damage to businesses and homes, roof damage, siding damage, and extensive tree damage. The average amount of property damage is $471,250 per tornado (excluding the May 2019 tornado that caused $500,000,000 in damages alone). Eight of the tornadoes that hit Montgomery County resulted in over $100,000 in property damage.

Loss of Life

There has been one indirect reported death and 174 injuries because of tornadoes in Montgomery County since 1995. Loss of life and injuries are always possible during tornadoes. Falling debris is the main the cause of death in a tornado, along with becoming airborne.

Economic Losses

Tornadoes can cause major damage to structures and roads. Higher severity tornadoes have the potential to destroy structures. Debris also has the potential to cause damage to structures by breaking windows, damaging walls, or falling directly onto buildings and above-ground infrastructure. Potential economic losses and damage associated with Montgomery County for tornadoes are recorded in **Table 4.9.3** below.

This table summarizes the population from 2020, building value, expected annual losses (EAL) for buildings, and expected annual loss (EALP) for population equivalence in Montgomery County. The top 20 most vulnerable census tracts according to FEMA’s National Risk Index are used for the calculations. Compared with other hazards, tornadoes have a relatively moderate index rating, meaning that economic and population loss due to tornadoes is moderate for Montgomery County.

Damage to utilities and roadways may also cause economic damage due to business closures, destruction of goods that require electricity, and the halt of economic activity.

Table 4.9.3: Structure and Population Vulnerability from Tornado

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
040406	$69,094	$64,803	$3	$133,900
030100	$78,801	$37,474	$1	$116,276
01501	$80,902	$33,291	$0	$114,193
130102	$49,619	$62,518	$46	$112,182
40401	$63,011	$43,172	$0	$106,183
010200	$38,054	$58,585	$0	$96,639
050503	$44,840	$51,739	$0	$96,579
140100	$43,719	$52,530	$131	$96,381
165000	$40,542	$55,053	$34	$95,630
050504	$41,213	$53,335	$2	$94,550
150100	$42,627	$50,613	$123	$93,363
040405	$38,135	$51,260	$0	$89,396
020400	$34,988	$54,283	$0	$89,271
040306	$41,889	$46,269	$1	$88,160
090302	$36,113	$50,475	$1	$86,588
050106	$35,962	$49,591	$3	$85,556
040302	$39,544	$45,367	$0	$84,911
100101	$33,665	$50,905	$5	$84,575
125102	$32,919	$50,323	$1	$83,243
040303	$36,595	$44,786	$0	$81,381
Total	**$922,234**	**$1,006,372**	**$351**	**$1,928,957**

Source: FEMA National Risk Index

Future Trends

Land Use and Development Trends

Tornadoes can occur anywhere. Any development that has occurred since that previous plan and any future development has the potential to be impacted by tornadoes. While the location of development will not be impacted by tornadoes, shelters should be installed in high occupancy buildings, parks, fairs and festivals, mobile home parks, and similar developments.

More buildings but less people can mean more properties potentially exposed in a tornado event but generally less population vulnerability. Similar median structure year built but older relative to today could mean more vulnerability to properties and inhabitants. The current total value of taxable real

estate in Montgomery County is $10,386,064,700. In 2022, Montgomery County authorized 1,343 new residential units at a total value of $268,164,000. The population is expected to decrease by 0.006 percent, or 3,417 people by 2030. An additional decrease of 4.7% is expected by 2040. Given these estimates, there are no known changes in risks associated with tornadoes.

Climate Change

While rainfall, heat, and drought have clear links to climate change, the link between climate change and tornadoes is not yet fully understood. Tornado records in the United States are often only available starting during the 1950s. This limited data set makes it difficult to compare trends over long periods of time. Additionally, tornado reporting was not fully standardized until 2007, when the Enhanced Fujita Scale was released.

However, some short trends have been identified, although not yet linked directly to climate change. The number of days with tornadoes in the United States has fallen, but tornado outbreaks, or the number of tornadoes in one day, have increased. The density and strength of tornadoes has also increased. Finally, tornado distribution has shifted eastwards, which includes a move towards Ohio (Center for Climate and Energy Solutions).

According to the Fifth National Climate Assessment, severe storms are brief and cover small areas, thus the effects of climate change are difficult to measure. It is known that tornado activity has become more variable, with a decrease in the number of days per year with tornados but an increase in the number of tornadoes that occur on these days. In general, there is some indication that the frequency and intensity of thunderstorms will increase in a warmer climate. However, the effect on tornadoes is unclear.

4.10 Wildfire

Description

A wildfire is an uncontrolled fire that burns in a natural area of combustible vegetation such as a forest, grassland, or prairie, and typically occurs in rural areas. Non-wilderness fires are uncontrolled burning in residential or commercial development that are out of the scope of this plan, however, it is important to note that non-wilderness fires often accidentally cause wildfires. They can happen at any time or place and more than half of the wildfires recorded have been started due to human activity. While wildfires can be caused by human activity or a natural phenomenon such as lightning, it is often the weather conditions that determine how much a wildfire grows.

Location

According to the State of Ohio Hazard Mitigation Plan (SOHMP), Montgomery County is not within the ODNR Division of Forestry's Expanded Forest Fire Protection Area. Counties within this region tend to have abundant forested lands and grasslands and, as such, represent the area of highest wildfire risk and hazard in Ohio. Montgomery County is within region 2. The Ohio Wildfire Hazard Level is included in **Figure 4.10.1**. This assessment identifies wildfire risk level by township and classifies all townships in Montgomery County as low risk for wildfires or has not been assessed.

Extent

Several factors can contribute to the escalation of risk of wildfires, including the prevalence of forests and agricultural lands and their proximity to homes, residences, and structures, as well as the distance between fire and emergency management services. In these cases, the presence of fire near structures causes fire departments to shift focus away from fire suppression and towards structure protection.

According to the SOHMP, 99.9 percent of wildfires in Ohio are caused by human action or accident. As such, many wildfires in Ohio burn in proximity to homes and structures. From 1997 to 2017, the main causes of wildfires in Ohio included debris burning, incendiary (arson), equipment, smoking, campfires, children (playing with matches), lightning, and railroad.

History

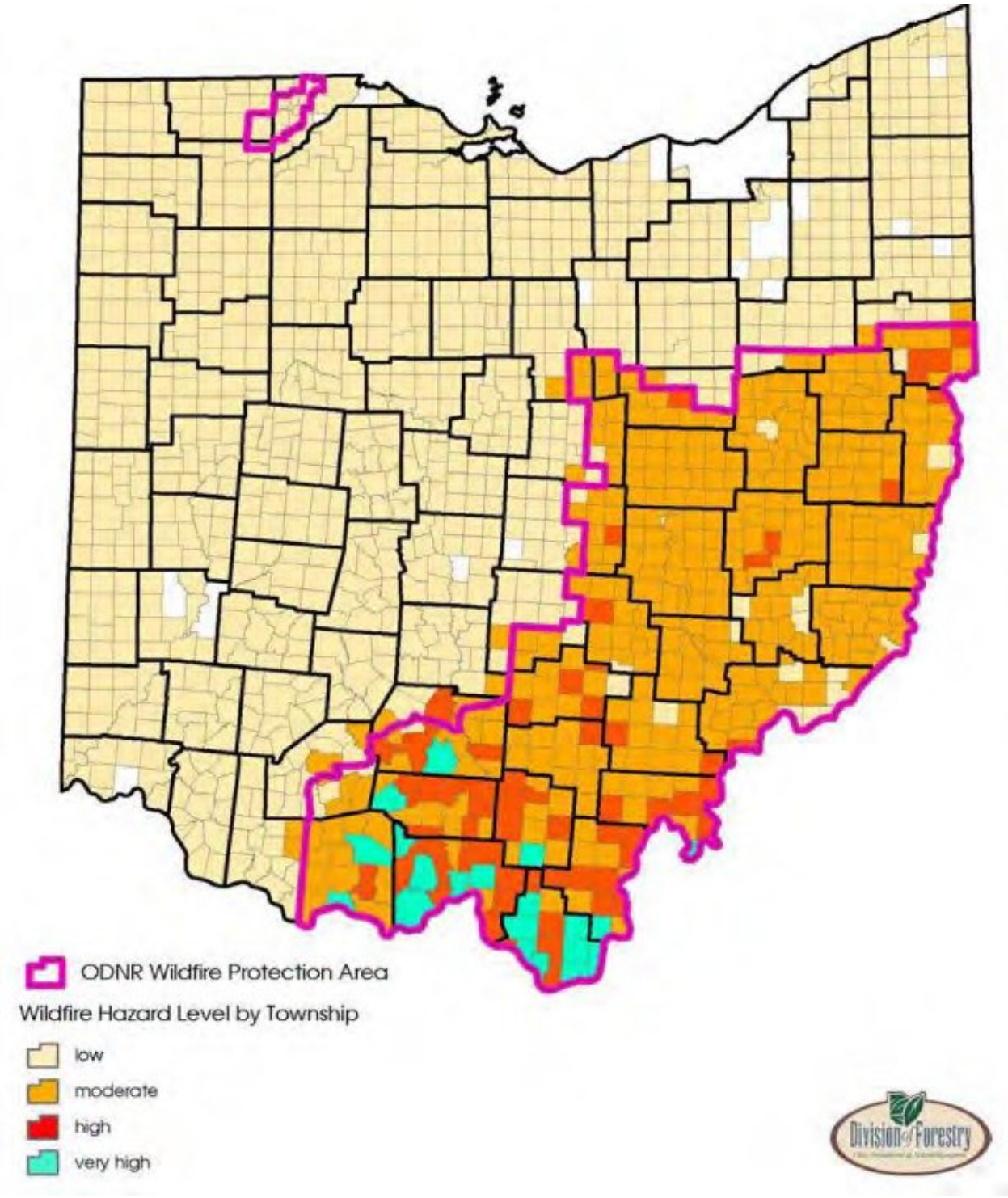
The SOHMP identifies 26 total fire events from January 1, 2018, to December 31, 2022, which averages 5.4 events annually. These events burned a total of 24 acres with an average of 0.94 acres per event.

Estimating the monetary losses associated with wildfires is difficult because most of these events occur on open land or fields with monetary losses often not being recorded. This lack of data may result in inconsistencies if an analysis was done based on reported monetary loss. As such, acres burned per fire event is a more consistent method of analysis for this hazard.

Probability

According to the State of Ohio Hazard Mitigation Plan, there is a 100 percent probability that a wildfire will occur within any county in any given year. Since 26 fire events occurred in Montgomery County from January 1, 2018, to December 31, 2022, an average of 5.2 fire events are estimated to occur annually in the County. In addition, according to the U.S. EPA, the average total area burned by wildfires has increased since the 1980s, and the record-breaking fires tend to occur during record-breaking warm years. The Climate Change section in Future Trends discusses climate change further.

Figure 4.10.1: Ohio Wildfire Hazard Level



Source: ODNR Ohio Division of Forestry

Vulnerability Assessment

Infrastructure Impact

There is a low risk that wildfires in Montgomery County will impact infrastructure. Wildfires will most likely impact the County through minor property and crop damage. Additionally, there are currently 67 state-owned and state-leased critical facilities located within Montgomery County, as determined by ODNR. All 67 of these facilities are located within a low wildfire risk area or an area that has not been evaluated and have a value of approximately $184,208,998.

Population Impact

Figure 4.10.1 shows the Ohio Wildfire Hazard Level, which indicates wildfire hazard level by township. On average, there is a low risk of wildfires occurring in Montgomery County. Accordingly, there is a low risk of impact on the population. If a wildfire would occur within the County, the population could be impacted by loss of homes and crops.

For social vulnerability, according to the National Risk Index, wildfires have a score of 62.6 ("very low") in Montgomery County. The wildfires that have occurred in Montgomery County have only had some impacts on properties and crops. The index indicates an expected annual loss of $93,000 due to wildfires with a less than 0.001 percent change of wildfire event occurring per year.

Property Damage

There were 26 recorded wildfire events between 2018 and 2022 in Montgomery County. It is assumed that the County has experienced some property and crop damage because of wildfires. Occasionally, in the event of a wildfire, fire engines belonging to local fire departments can be damaged while suppressing wildfires, although there are no reports of this in Montgomery County.

Potential economic losses and damage associated with Montgomery County for Wildfire according to FEMA's National Risk Index are recorded in Table 4.10.2 below.

Table 4.10.2: Structure and Population Vulnerability from Wildfire

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
040406	$3,906	$265	$0	$4,172
050600	$2,304	$200	$1	$2,504
100400	$2,236	$133	$0	$2,369
110201	$2,032	$162	$0	$2,194
040303	$1,998	$184	$0	$2,182
110100	$2,049	$88	$0	$2,137
120101	$1,987	$136	$0	$2,123
040306	$1,838	$139	$0	$1,977
150100	$1,840	$135	$0	$1,976
130102	$1,797	$149	$0	$1,946
140100	$1,767	$162	$0	$1,930
165000	$1,751	$163	$0	$1,915
100101	$1,672	$165	$0	$1,837

Census Tract	Expected Annual Loss (Agriculture)	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Total)
125104	$1,742	$83	$0	$1,824
110202	$1,648	$97	$0	$1,745
090302	$1,603	$141	$0	$1,745
115012	$1,556	$139	$0	$1,695
040401	$1,561	$102	$0	$1,663
040305	$1,531	$115	$0	$1,646
050504	$1,483	$127	$0	$1,610
Total	**$38,302**	**$2,886**	**$2**	**$41,190**

Source: FEMA National Risk Index

Loss of Life

Montgomery County has no recorded wildfire events resulting in loss of life, so it is unlikely that loss of life will result from wildfires. However, with any wildfire event, there is potential for loss of life. Advanced evacuation warnings can reduce the likelihood of death because of wildfires.

Economic Losses

Wildfires have the potential to damage agricultural crops and tree plantations, which can result in economic losses. Refer to **Figure 1.2.2** (Land Cover map) in Chapter 1 to see the distribution of forests, hay/pasture, and cultivated crops which are at risk to wildfires.

Future Trends

Land Use and Development Trends

Communities should monitor areas that are especially susceptible to wildfires and avoid development in such areas. New developments in these areas should implement fire protective measures. Slight increase in forested and pasture/hay areas can mean slightly more vulnerability to wildfire. If newer structures are built closer to the Wildland Urban Interface, it could result in increased vulnerability to the structures and inhabitants.

The current total value of taxable real estate in Montgomery County is $10,386,064,700. In 2022, Montgomery County authorized 1,343 new residential units at a total value of $268,164. The population is expected to decrease by 0.006 percent, or 3,417 people by 2030. An additional decrease of 4.7% is expected by 2040. Given these estimates, there are no known changes in risks associated with wildfires.

Climate Change

According to the U.S. EPA and National Climate Assessment, the national average total area burned by wildfires has increased since the 1980s, and the record-breaking fires tend to occur during record-breaking warm years. Combustion from wildfires also releases carbon dioxide into the atmosphere, contributing to climate change and negatively impacting human health. If climate change increases the frequency and intensity of drought in the region, then the risk of wildfire can also increase.

5 | Hazard Mitigation Strategy

5.1 Hazard Mitigation Strategy

Hazard Priorities

Potential hazards, including natural, geological, and human-caused hazards, were rated by members of the Core Planning Committee, which included representatives from each jurisdiction in Montgomery County. Each potential hazard was rated on a scale of zero to five, with zero indicating the hazard should not be studied and five indicating the most significant threat to the representative's jurisdiction. A priority score was developed for each hazard by averaging the representatives' ratings. The hazards were then ranked by their priority score, where the highest priority score was given a hazard rank of one. The resulting hazard rank and associated priority score for each hazard are shown in **Table 5.1.1**.

Table 5.1.1: Hazard Priorities

Hazard	Priority Score	Hazard Rank
Multiple Hazards (Included more than one listed hazard event)	5.00	1
Tornadoes	4.28	2
Flooding	3.32	3
Severe Summer Weather	3.12	4
Severe Winter Weather	3.08	5
Epidemic	2.64	6
Dam/Levee Failure	2.56	7
Extreme Temperatures	2.48	8
Invasive Species	1.96	9
Drought	1.80	10
Earthquakes	1.32	11
Landslides and Land Subsidence	1.28	12
Wildfires	1.00	13

Hazards Not Assessed

Below is a discussion covering hazards that were not included in this Plan update, as compared to the hazards included in the SOHMP and in Montgomery County's previous 2019 HMP.

Coastal Erosion

Coastal erosion is a hazard that is not applicable to Montgomery County due to the County's inland location, so it was not assessed.

Hurricanes/Tropical Storms

Hurricanes/tropical storms are hazards that are not directly applicable to Montgomery County due to the County's inland location, so they were not assessed. However, if remnants of hurricanes or tropical storms were experienced as thunderstorms, thunderstorm winds, or high/severe winds, those events were included in the severe summer storms and/or tornado assessments.

Seiche/Coastal Flooding

Seiche/coastal flooding is a hazard that is not applicable to Montgomery County due to the County's inland location, so it was not assessed.

5.2 Hazard Mitigation Goals

Developing achievable goals forms the foundation for all mitigation actions and activities that will aid Montgomery County in attaining the overall mission of the Core Planning Committee. As such, the Core Planning Committee and participating jurisdictions assessed the goals of the 2019 Hazard Mitigation Plan and updated them for this Plan update. Goals were established and reviewed based upon their relationship to the hazard priorities and potential adverse impact of those hazards upon the community. The goals, as well as the hazards assessed for this Plan, informed the development of actions that the County and participating jurisdictions can take to mitigate the impacts of the hazards. The goals of the Montgomery County Hazard Mitigation Plan are as follows:

- Goal 1: Educate the public on problem areas, encouraging communities to recognize the identified hazards for future planning.
- Goal 2: Encouraging both public and private groups to mitigate prior to disasters and encouraging mitigation after disasters to prevent re-occurrence.
- Goal 3: Identifying practical mitigation solutions for identified hazards.
- Goal 4: Identifying possible prevention and reduction projects.
- Goal 5: Requesting project ideas from the communities as well as plans which address mitigation issues.

Hazard Mitigation Actions & Priorities

Members of the Core Planning Committee completed a Previous Mitigation Action Status survey, which indicated the status of mitigation actions included in the 2019 Hazard Mitigation Plan. This survey asked representatives to indicate whether the mitigation actions from the previous plan were completed, deleted, deferred, unchanged, or ongoing. It also asked the representative if the mitigation action should be included in this Plan update. The final results are included in **Appendix B**. In addition, new mitigation actions were developed and considered for inclusion in this Plan update that address gaps in the previous plan or new issues that have arisen since the 2019 Plan.

All new and old mitigation actions were reviewed and rated by members of the Core Planning Committee and local jurisdictions based on five criteria: cost-effectiveness, technical feasibility, environmentally soundness, immediate need, and total risk reduction. For each action, each of the five criteria were rated on a scale of one to five (low to high). All the surveys were collected and the individual criteria for each mitigation action were averaged and then added together to develop a single raw score for each individual mitigation action. The raw score for each action was used in combination with the rankings of the associated hazard, as determined by the Hazard Priority Survey (**Table 5.1.1**), to develop a score for each mitigation action. The action scores were then ranked to indicate the priority of each specific action. The action with the highest action score was given an action priority of one, indicating that action was the highest priority. Hazard Mitigation Action priorities are organized by hazard in **Table 5.2.1**. The information used to develop the priorities from the jurisdictions surveys and comments can be found in **Appendix G**, along with all completed surveys that were used to prioritize the hazards and develop the goals.

Mitigation projects will only be implemented if the benefits outweigh the associated cost of the proposed project. The Core Planning Committee, in coordination with the Montgomery County EMA, performed a general assessment of each action that would require FEMA funding as part of the

planning process. A detailed cost-benefit analysis of each mitigation action will be required during the project planning phase in order to determine the economic feasibility of each action. Projects will also be evaluated for social and environmental impact-related feasibility, as well as technical feasibility and any other criteria that evaluate project effectiveness. This evaluation of each project will be performed during the pre-application phase of a grant request. Project implementation will be subject to the availability of FEMA grants and other funding sources, as well as local resources.

Projects that are determined to be infeasible during this review process will be re-evaluated by members of the Core Planning Committee for re-scheduling or deletion.

Table 5.2.1: Mitigation Actions Priority Table by Hazard

#	Mitigation action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
Dam and Levee Failure								
1	Ensure all eligible jurisdictions are participating in the NFIP.	City of Englewood, City of Miamisburg, City of Trotwood	1	9	Mayors of Jurisdictions	Existing Budget, FEMA HHPD	11/2024 - 11/2029	New
2	Ensure all high-hazard potential dams have updated Emergency Action Plans (EAPs) in place.	City of Englewood, City of Miamisburg, City of Trotwood	7	67	Mayor of Jurisdictions	(USACE) Flood Control Program, FEMA HHPD	11/2024 - 11/2029	New
3	Identified the need to construct a water retention basin for the Chardonnay housing development to alleviate flooding problems in this neighborhood.	City of Centerville	7	79	Mayor of Centerville	(USACE) Flood Control Program, FEMA HHPD	11/2024 - 11/2029	Previous
4	Obtain or create inundation maps for all dams.	City of Englewood, City of Miamisburg, City of Trotwood	7	77	Mayors of Jurisdictions	Existing Budget, FEMA HHPD	11/2024 - 11/2029	New
5	Perform engineering analysis, engineering design, system monitoring, and construction activities for existing dam and levee structures to reduce potential risk of failure. As of now, three dams have been identified for funding, these are Germantown, Englewood, and Taylorsville dams located in Montgomery County, Ohio.	Miami Conservancy District	7	71	Miami Conservancy District	(USACE) Flood Control Program, FEMA HHPD	11/2024 - 11/2029	Previous
Drought								
6	Commission a study to determine the best course of action to accomplish a drought resilience wellfield project.	City of Dayton	10	72	Mayor of Dayton	Existing Budget	11/2024 - 11/2029	Previous

#	Mitigation action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
Flooding								
7	31 storm drainage ditches and water ways have been identified as at-risk structures in need of maintenance due to local flooding	Montgomery County	3	37	Montgomery County Soil & Water Conservation District Technician	(FMA) Grant Program	11/2024 - 11/2029	Previous
8	Allen Plat – The Allen Plat area is outside of the levee that was built to protect West Carrollton following the 1913 flood of the Great Miami River. The area consists of approximately 122 houses and some businesses. This area is subject to flooding from the Great Miami River and needs a levee system to protect it from flooding. The properties in this area are within the one-hundred-year flood plain and owners are currently paying flood insurance. The City of West Carrollton has been in contact with the U.S. Army Corps of Engineers concerning this matter and the Corps is in the proposing to conduct a feasibility study for constructing flood protection for Allen Plat.	City of West Carrollton, Miami Township, City of Moraine, Miami Conservancy District	3	41	West Carrollton Mayor, Miami Township Trustees, Moraine Mayor, Miami Conservancy District	(FMA) Grant Program	11/2024 - 11/2029	Previous
9	Channel clearing near bridge abutments (Big and Little Twin).	City of Germantown	3	38	Germantown Administration and German Township Board of Trustees	Existing Budget	11/2024 - 11/2029	Previous
10	Develop a floodplain management plan to reduce the loss of life and property damage; plan for evacuation and flood fighting; and create public risk awareness of potential flooding in protected areas of dams and levees including possible failure areas.	Miami Conservancy District	3	39	Miami Conservancy District	(FMA) Grant Program	11/2024 - 11/2029	Previous
11	Develop Flood Alert Emergency System (e.g. Flood warning text messages).	Miami Conservancy District	3	81	Miami Conservancy District	Existing budget	11/2024 - 11/2029	New
12	Eliminate and address stream bank erosion through planning and infrastructure development	City of Germantown	3	42	Mayor of Germantown	Existing Budget	11/2024 - 11/2029	Previous

#	Mitigation action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
13	Holes Creek – This project is already underway by the U.S. Army Corps of Engineers and should be completed within the next year or two. This project involves the flood protection along Holes Creek. The area south of the creek has already been protected; however, the Corps of Engineers is seeking additional congressional funding to complete protection for the area on the north side of the creek. Senator Mike DeWine indicated that it appears the funding is progressing smoothly through Congress for this project.	Montgomery County	3	43	Mayor of West Carrollton, Mayor of Moraine, Miami Township Trustees	Existing Budget	11/2024 - 11/2029	Previous
14	Identified need for storm water drainage in Brant Pike area. Scope of project to be completed in conjunction with the City of Riverside and the Miami Conservancy District.	City of Dayton, City of Riverside	3	44	Dayton Mayor	Existing Budget	11/2024 - 11/2029	Previous
15	Identified need for the construction of an elevated well in the well head area which is located within the 100-year flood plan	City of Germantown	3	45	Germantown Administration and German Township Board of Trustees	(FMA) Grant Program	11/2024 - 11/2029	Previous
16	Identified the need for a drainage project to alleviate some flooding problems in the area of Rahn Road and Grantland Drive.	Washington Township	3	46	Washington Township Trustees	Existing Budget	11/2024 - 11/2029	Previous
17	Identified the need for storm water drainage in the following areas: Webster Street south of Needmore Rd., Eldorado Plat (Edgewater and Earlwood Area), Shiloh Dr. and Blue Ridge, Keats St. and Keenan St., Walbrook Ave. and Notingham Rd.	Harrison Township	3	47	Harrison Township Trustees	(FMA) Grant Program	11/2024 - 11/2029	Previous
18	Identified the need to construct a storm drainage sewer system.	City of Clayton	3	48	Clayton Mayor	Existing Budget	11/2024 - 11/2029	Previous
19	Identified the need to purchase a water pump for the lift station at Hemple Road. Installation of a monitoring system for the water tower	Village of Farmersville	3	49	Mayor of Farmersville	(FMA) Grant Program	11/2024 - 11/2029	Previous
20	Identify properties along Wolfcreek that are flood hazards.	City of Brookville	3	83	City of Brookville City Manager	(FMA) Grant Program	11/2024 - 11/2029	New
21	Identify locations prone to flooding such as creeks and drainage areas located in the City of Englewood. Clear debris and obstructions along these areas to reduce flooding and improve water flow.	City of Miamisburg	3	63	Mayor of Miamisburg	Existing Budget	11/2024 - 11/2029	New

#	Mitigation action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
22	Improve storm drainage systems in the Hillside neighborhood	City of Trotwood	3	50	Mayor of Trotwood	(FMA) Grant Program	11/2024 - 11/2029	Previous
23	Installation of a storm drainage system to be built in the area bordered by: New Lebanon Municipal Limits on the south, Diamond Mill Road on the east, Little Richmond Rd. on the north, and Johnsville-Brookville Pike on the west.	Perry Township	3	40	Perry Township Trustees	(FMA) Grant Program	11/2024 - 11/2029	Previous
24	Main St. Flood Mitigation Project	City of Moraine	3	51	Moraine Fire Chief	(FMA) Grant Program	11/2024 - 11/2029	Previous
25	Multiple properties have been identified as repetitive flood insurance loss properties. This project would enable Harrison Township to purchase all properties in Eldorado plat and demolish them due to chronic river flooding.	Harrison Township	3	52	Harrison Township Trustees	(FMA) Grant Program	11/2024 - 11/2029	Previous
26	One property has been identified as a repetitive flood insurance loss property in Butler Township near the intersection of Kinmont Road and Frederick Pike.	Butler Township	3	53	Butler Township Trustees	(FMA) Grant Program	11/2024 - 11/2029	Previous
27	One property has been identified as a repetitive flood insurance loss property in Harrison Township near the intersection of Cypress Drive and N. Birch Drive.	Harrison Township	3	54	Harrison Township Trustees	(FMA) Grant Program	11/2024 - 11/2029	Previous
28	One property has been identified as a repetitive flood insurance loss property in Perry Township near the intersection of Thornapple Road and US 35.	Perry Township	3	55	Perry Township Trustees	(FMA) Grant Program	11/2024 - 11/2029	Previous
29	One property has been identified as a repetitive flood insurance loss property in Washington Township near the intersection of Yankee and Mad River Rd.	Washington Township	3	56	Washington Township	(FMA) Grant Program	11/2024 - 11/2029	Previous

#	Mitigation action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
30	Owl Creek Watershed – The Owl Creek watershed is a 4.7 sq. mile area that includes a portion of West Carrollton/Miami Township and a portion of the city of Miamisburg. This area runs from the Great Miami River upward toward the Dayton Mall. The City of West Carrollton and Miami Township have recently entered into an agreement with the Miami Conservancy District for a hydrological and hydraulic study of the watershed to determine what measures can be taken to reduce flooding within the watershed. Columbus, DLZ Engineering, has been selected for that work, and the contract has been entered into with the firm to complete this work. The cost of the study is approximately $40,000. The study is to be completed in December of this year. Once this study is completed, the city will have a better understanding of what level of flood protection can be completed, the associated costs, and in essence what is feasible to do within this watershed to reduce the risk of flooding. The goal is to remove people from the one-hundred-year flood plain who are currently paying the FEMA flood insurance rates, which are very high and detract from property values. There are approximately 410 houses subject to flooding from Owl Creek within our city.	City of West Carrollton, Miami Township, City of Miamisburg, Miami Conservancy District	3	64	Mayor of West Carrollton, Miami Township Trustees, Mayor of Miamisburg; Miami Conservancy District	(FMA) Grant Program	11/2024 - 11/2029	Previous
31	Provide educational programs promoting storm water management best practices for the homeowner to the public.	Harrison Township	3	57	Harrison Township Trustees Township	Existing Budget	11/2024 - 11/2029	Previous
32	Replace gate system and install flood warning sign on Rip Rap Road	City of Huber Heights	3	58	Huber Heights Fire Department	Existing Budget	11/2024 - 11/2029	Previous
33	Several properties have been identified as a repetitive flood insurance loss property in Montgomery County.	Montgomery County	3	59	MCOEM, Jurisdictional Representatives	(FMA) Grant Program	11/2024 - 11/2029	Previous
34	Several properties have been identified as a repetitive flood insurance loss property in the City of Brookville which are the apartment units 306-312 Wolf Creek, Brookville.	City of Brookville	3	78	Mayor of Brookville	(FMA) Grant Program	11/2024 - 11/2029	Previous

#	Mitigation action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
35	Several properties have been identified as repetitive flood insurance loss property in the Village of Phillipsburg. The property addresses are 31, 33, 35, 37 East Main Street and 12, 20 and 38 East Poplar St. in Phillipsburg.	Village of Phillipsburg	3	60	Mayor of Phillipsburg	(FMA) Grant Program	11/2024 - 11/2029	Previous
36	There are 110 properties located in either the floodway or floodplain areas designated within the Wiles Creek neighborhood. Of the 110 properties, 45 are located within the floodway of the South Blvd creek, and 8 are located within the floodway of the Middle Branch of the Little Beaver Creek. Several of the homes have experienced years of flood damage approximately once every 10-15 year. Within the past 5 years, the city has purchased multiple homes in the floodway area adjacent to the Middle Branch Creek from willing sellers. The homes have been demolished and the area will remain open space. The 8 remaining homes along the floodway of the Middle Branch of the Little Beaver Creek remain the City's top priority for acquisition and demolition. The eventual goal is to have all structures removed from the floodways of both creeks within the Wiles Creek neighborhood in order to restore both creek channels to their natural state. Property acquisition will depend on the availability of funds and the willingness of property owners to sell their property to the City. The estimated cost of acquisition and demolition of the 8 properties along the Middle Branch floodway is $800,000. The estimated cost of acquisition and demolition of the 45 properties along the South Blvd floodway is $4,500,000. Update 2018- Purchase one of two properties left in the Lower Branch of the Little Beaver Creek Flood Way, demolish the property, and dedicate as permanent open space.	City of Kettering	3	61	Mayor of Kettering	(FMA) Grant Program	11/2024 - 11/2029	Previous
37	To improve storm drainage systems in the Rio Grande neighborhood.	City of Trotwood	3	62	Mayor of Trotwood	(FMA) Grant Program	11/2024 - 11/2029	Previous
38	The New Lebanon storm drainage system was identified as in need of repairs.	City of Union	3	27	New Lebanon Municipal Manager	(FMA) Grant Program	11/2024 - 11/2029	Previous

#	Mitigation action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
Hazardous Materials								
39	Create hazard backup plan for wastewater facility that can be implemented.	City of Brookville	14	75	Mayor of Brookville	Existing Budget	11/2024 - 11/2029	New
40	Mitigate hazardous spills due to chemicals being transported or runoff into the soil.	Jefferson Township	14	73	Township Administration	(MWCD) Grant Program	11/2024 - 11/2029	New
Multiple Hazards								
41	Acquire generators for critical facilities in Montgomery County.	Montgomery County	1	6	County EMA	(BRIC) Grant Program	11/2024 - 11/2029	Previous
42	Acquire generators for critical facilities in the City of Dayton.	City of Dayton	1	7	Mayor of Dayton	(BRIC) Grant Program	11/2024 - 11/2029	Previous
43	Acquire generators for critical facilities.	City of Brookville	1	82	Mayor of Brookville	(BRIC) Grant Program	11/2024 - 11/2029	New
44	Complete an Environmental impact study due to Solar Farm companies wanting to do business withing Jefferson Township.	Jefferson Township	1	10	Mayor of Township	(EMPG) Special Project Grants	11/2024 - 11/2029	New
45	Contingency plans for checking-in on the shut-in and frail elderly neighbors. Educate the public to encourage the public to create contingency plans.	Montgomery County	1	12	MCOEM, Mitigation Planning Team	Existing Budget	11/2024 - 11/2029	Previous
46	Develop and distribute information about risks associated with the identified natural disasters affecting the County.	Montgomery County	1	13	MCOEM	Existing Budget	11/2024 - 11/2029	Previous
47	Develop and distribute informational brochures on the types of homeowner's hazard insurance, e.g. flood, fire, earthquake, etc. Explaining what is required and what is not but should be.	Montgomery County	1	14	MCOEM	(EMPG) Special Project Grants	11/2024 - 11/2029	Previous
48	Educational campaign promoting the usage of tone-activated weather radios.	Harrison Township	1	15	Harrison Township Trustees	Existing Budget	11/2024 - 11/2029	Previous
49	Emergency generators for all City buildings	City of Trotwood	1	2	Mayor of Trotwood	Existing Budget, Urban Canopy Restoration Grant	11/2024 - 11/2029	New
50	Encourage local jurisdictions to acquire electric generators	Montgomery County	1	17	MCOEM, Jurisdictional Representatives	(EMPG) Special Project Grants	11/2024 - 11/2029	Previous

#	Mitigation action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
51	Encourage utility companies to hire tree trimming contractors who are capable of a more citizen friendly trimming service	Montgomery County	1	24	MCOEM, Mitigation Planning Team	(EMPG) Special Project Grants	11/2024 - 11/2029	Previous
52	Ensure that city's critical facilities are equipped with the capability to be connected to one of the city's portable emergency generators via a transfer switch (Public Works facility, Parks Maintenance Facility, and Vandalia Seniors Center facility). His is the last phase of a multi-year project that in recent years has been deferred. This project would be considered as "in the planning stage".	City of Vandalia	1	26	Vandalia City Council	(BRIC) Grant Program	11/2024 - 11/2029	Previous
53	Identified a need for updating the siren alert system for severe weather in the City of Kettering.	City of Kettering	1	8	Mayor of Kettering	Existing Budget	11/2024 - 11/2029	Previous
54	Identified need for the comprehensive Severe Weather Package and Fire Safety House. As a result, the city is in the planning process to obtain funding to acquire a mobile educational trailer.	City of Englewood	1	18	Mayor of Englewood	(BRIC) Grant Program	11/2024 - 11/2029	Previous
55	Identified the need to purchase and install power generators and power hookups for the severe weather shelters located in the public schools.	City of Englewood	1	3	Mayor of Englewood	(EMPG) Special Project Grants	11/2024 - 11/2029	Previous
56	Improvements at Emergency Operations Center to serve as second site for data connections and business continuity.	City of Miamisburg	1	22	Mayor of Miamisburg	Existing Budget	11/2024 - 11/2029	New
57	Increase Preparedness for Personnel Deployment	City of Centerville	1	11	Christine Smart, Centerville Police Department	(BRIC) Grant Program	11/2024 - 11/2029	Previous
58	Electric generator.	Jefferson Township	1	16	Jefferson Township Fire Department	(EMPG) Special Project Grants	11/2024 - 11/2029	Previous
59	Install Generators at two Township office buildings	Harrison Township	1	4	Harrison Township Trustees Township	Existing Budget	11/2024 - 11/2029	Previous
60	Installation of electronic storm window shutters for the Emergency Operations Center.	City of Centerville	1	28	Mayor of Centerville	(EMPG) Special Project Grants	11/2024 - 11/2029	Previous
61	Installation of electronic storm window shutters for EOC.	City of Brookville	1	31	Mayor of Brookville	Existing Budget	11/2024 - 11/2029	New

#	Mitigation action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
62	Launch educational campaigns through public/government cable channels and newsletters, websites, street festivals, libraries, school functions, etc.	Montgomery County	1	23	MCOEM	Existing Budget	11/2024 - 11/2029	Previous
63	Make the County Natural Hazard Mitigation Plan available to the public by publishing the plan on public website(s).	Montgomery County	1	19	MCOEM, Local Jurisdictions Mayors/Managers/Trustees, and Mitigation Planning Team	Staff Time	11/2024 - 11/2029	Previous
64	Public information campaign conducted by Montgomery County, in coordination with the jurisdictions, to inform and educate the citizens of Montgomery County of the 13 identified hazards and the risks affecting the jurisdictions in Montgomery County.	City of Brookville, City of Centerville, City of Clayton, City of Dayton, City of Englewood, City of Germantown, City of Huber Heights, City of Kettering, City of Miamisburg, City of Moraine, City of Oakwood, City of Riverside, City of Trotwood, City of Union, City of Vandalia, City of West Carrolton, Village of Farmersville, Village of New Lebanon, Village of Phillipsburg, Butler TWP, Clay TWP, German TWP, Jackson TWP, Miami TWP, Perry TWP	1	1	MCOEM, Jurisdictional Mayors, Managers and Trustees, Oakwood Fire Department	Existing Budget	11/2024 - 11/2029	New
65	Safe room reinforcement for the Emergency Operations Center.	City of Centerville	1	30	Mayor of Centerville	(BRIC) Grant Program	11/2024 - 11/2029	Previous

#	Mitigation action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
66	School window blast guards.	City of Centerville	1	29	Mayor of Centerville	(BRIC) Grant Program	11/2024 - 11/2029	Previous
67	Select locations, conduct site surveys, and implement city cameras to provide additional monitoring of weather conditions along the western boundary of the city. This will allow for earlier warning to the community of approaching storms and their locations.	City of Englewood	1	5	Mayor of Englewood	Existing Budget	11/2024 - 11/2029	New
68	Technological improvements at Emergency Operations Centers to improve connectivity with first responders.	City of Englewood	1	21	Mayor of Englewood	Existing Budget	11/2024 - 11/2029	New
69	Work with all jurisdictions on filling in gaps and strengthening capabilities in enacting mitigation strategies.	City of Englewood, City of Miamisburg, City of Trotwood	1	20	Mayors of Jurisdictions	Existing Budget	11/2024 - 11/2029	Previous
70	Identified the need to purchase and install power stations for the City's severe weather shelters. The city also identified the need to acquire power hookups for the following potential severe weather shelters: Union School and Two City owned buildings at 216 Shaw Rd.	City of Union	1	70	Mayor of Union	Existing Budget	11/2024 - 11/2029	Previous
71	Montgomery County EMA, and the Core Planning Committee, consisting of leadership from participating jurisdictions, will work with the top-elected officials and authorities within their jurisdictions to integrate the hazard mitigation plan into the relevant existing and future planning mechanisms and capabilities as listed in Table 3.3.1 of the plan.	Montgomery County	1	25	County EMA	Existing Budget	11/2024 - 11/2029	Previous
Severe Summer Weather								
72	Distribute NOAA Weather Radio featuring SAME technology to Very Low Income and Extremely Low-Income Households.	Montgomery County	4	65	MCOEM	(EMPG) Special Project Grants	11/2024 - 11/2029	Previous
73	Identified a need for replacing the severe weather alerting and siren system	City of Kettering	4	80	Mayor of Kettering	Existing Budget	11/2024 - 11/2029	New

#	Mitigation action	Community	Hazard Priority	Action Priority	Lead Agency	Funding Source	Start/End	Status
74	Identified a need to educate the public about the dangers when driving a vehicle in the snow or fog and intend to develop and launch an educational campaign for the public.	Butler Township	5	68	Butler Township Trustees	Existing Budget	11/2024 - 11/2029	Previous
75	Identified the need to purchase and install tire chains for all emergency response vehicles.	Butler Township	5	69	Butler Township Trustees	(EMPG) Special Project Grants	11/2024 - 11/2029	Previous
Severe Winter Weather								
76	Public Information Campaign about winter storm preparedness.	City of Trotwood	5	76	Mayor of Trotwood	Staff Time	11/2024 - 11/2029	Previous
77	Snow Emergency Route Information and Public Education Campaign	Jefferson Township	5	66	Jefferson Township Trustees	Staff Time	11/2024 - 11/2029	Previous
Tornadoes								
78	Identified the need for tornado shelters within their community and in partnership with Jackson Township are planning a tornado shelter on E. Walnut Street.	Village of Farmersville, Jackson Township	2	32	Farmersville Mayor / Jackson Township Trustees	HMGP Grant	11/2024 - 11/2029	Previous
79	Identified the need for tornado shelters within their community.	Clay Township	2	33	Clay Township Trustees	Staff Time	11/2024 - 11/2029	Previous
80	Seek funding to construct tornado safe rooms in public areas and neighborhoods without basements	Montgomery County	2	74	MCOEM	Staff Time	11/2024 - 11/2029	Previous
81	Seek funding to construct tornado safe rooms in public areas and neighborhoods without basements for City of Germantown.	City of Germantown	2	34	Germantown Administration and German Township Board of Trustees	HMGP Grant	11/2024 - 11/2029	Previous
82	Seek funding to construct tornado safe rooms in public areas and neighborhoods without basements in Montgomery County	Montgomery County	2	35	MCOEM, Jurisdictional Representatives	Staff Time	11/2024 - 11/2029	Previous
83	Vandalia has identified the need for an additional tornado siren. This project is currently in the planning process.	Cit of Vandalia	2	36	Vandalia City Council	Staff Time	11/2024 - 11/2029	Previous

6 | Schedule & Maintenance

6.1 Participation Overview

The Montgomery County Hazard Mitigation Plan will be adopted by all jurisdictions in Montgomery County, except the City of Carlisle, City of Springboro, and the Village of Verona. These jurisdictions are covered under other County's' Hazard Mitigation Plans. After the jurisdictions have adopted the plan, their signed resolutions or ordinances will be added to the plan in **Appendix G**.

In addition, Montgomery County EMA, and the Core Planning Committee, consisting of leadership from participating jurisdictions, will work with the top-elected officials and authorities within their jurisdictions to integrate the hazard mitigation plan into the relevant existing and future planning mechanisms and capabilities as listed in **Table 3.1.1** of the plan.

6.2 Plan Maintenance and Continued Public Involvement

The public will continue to provide feedback on the Plan, as the Plan will be available through the Montgomery County Emergency Management Agency and Ohio Emergency Management Agency websites. Montgomery County will provide access to the Plan to all county, municipal, and township offices, and will make the Plan available in hardcopy and electronic format to the public as appropriate. The Montgomery County EMA Director will post notices of any meetings for updating and evaluating the Plan, using the usual methods for posting meeting announcements in the county to invite the public to participate. All meetings will be open to the public.

An annual review process will be hosted by the Montgomery County EMA at least once a year. The annual review will include providing updates on mitigation actions, determining which mitigation actions to implement, updates on changes in hazard risks, suggestions for new mitigation actions, suggestions on how to improve the effectiveness of the Plan and the planning process, and any other information the county, municipal, or township representatives decide to share.

6.3 Previous Integration Efforts

Local governments play a major role in enforcing and implementing mitigation strategies because their daily operations guide the development of the communities in Montgomery County. Every Village in Montgomery County has a planning commission or a zoning board that deals with development and growth issues in their jurisdiction, referencing regulations, development plans, and mitigation strategies as they make decisions. These jurisdictions are small and have limited full-time staff, so the County as an organization provides strong leadership and oversight of economic development, community development, and land use planning. Many local officials wear numerous hats as they guide, direct, and facilitate local growth and development through regulation. Mitigation efforts are considered simultaneously with building code enforcement, zoning regulations, and land use rules at the county level. There is significant overlap between county officials when it comes to growth and development, including plan approval, issuance of permits, and occupancy approval responsibilities.

Montgomery County also has a Floodplain Manager who works with the Montgomery County Engineer to help plan, approve, modify, and regulate new facilities, subdivisions, and neighborhoods not only in the context of building codes, but also with consideration for flood risk. They also collaborate to be sure that new structures are not placed within flood risk zones without taking compensatory measures, like elevation, as early as the site development stage of construction. The Montgomery County Engineer works with the Montgomery County Auditor to manage the floodplain mapping and parcel identification and documentation by developing and maintaining GIS mapping. The Montgomery County Engineer also ensures that mitigation actions, like elevation, are properly included in the submitted building and occupancy permits during the approval process. The Montgomery County Engineer is also responsible for county ditch maintenance, which ties the County Engineer's office to the Montgomery County Surface Water Management District, as well as the Farm Service Agency

director, as agricultural drainage concerns are shared and resolved. These officials work with the Floodplain Manager to check and evaluate the floodplain maps as introduced by FEMA to ensure accuracy through the map adoption process.

6.4 Future Integration Efforts

Because local government plays a key role in the execution and implementation of mitigation strategies, each community will be responsible for understanding which items they are accountable for implementing. Annually, jurisdictions and responsible agencies should provide a status update for each mitigation action that is under their purview. This meeting with be where the jurisdictions and responsible parties assess the implementation and effectiveness of the hazard mitigation plan. This meeting should coincide with the budget process so that future funding sources can be determined and set aside for actions slated for that particular year. This meeting will also be available to the public. Additionally, each jurisdiction and the County will review the Hazard Mitigation Plan during other planning processes, such as development of comprehensive plans or capital improvement plans and incorporate appropriate goals and mitigation actions into such documents.

Additionally, the County and its participating jurisdictions will make a concerted effort to integrate the Hazard Mitigation Plan and its mitigation actions into existing plans and regulations, such as comprehensive plans, capital improvement plans, zoning codes and subdivision regulations, parks and open space plans, active shooter plans, and emergency operations plans.

Specifically, Montgomery County should have an Emergency Operations Plan. The EOP should facilitate integration of mitigation into response and recovery activities where appropriate, so key staff responsible for administering and updating the EOP should coordinate with the Core Planning Committee to identify integration areas and perform them. For the jurisdictions with floodplain regulations (Montgomery County and all jurisdictions), this Plan includes an action to “develop a floodplain management plan and update it regularly” so as floodplain regulations are reviewed and updated, the local floodplain coordinator(s) should continue to participate in the National Flood Insurance Program and should keep their maps updated. The Core Planning Committee should also engage the local floodplain coordinators and include them in their annual meetings for coordination, support, and to ensure this action is being met. For the zoning and land use regulations, this plan can be integrated in several ways. When zoning and/or land use regulations are reviewed and updated, related to flooding and dam failure, potential impact areas should be designated for limited to no development; and for landslides and land subsidence, land bordering waterways should either be left free of development or be reinforced to resist erosion. The Core Planning Committee should also engage the staff involved in administering and updating zoning codes and land use regulations and include them in their annual meetings for coordination, support, and assistance in integrating these recommendations from the plan.

The County and all jurisdictions have the staff and authority to implement the mitigation actions found in this plan. The County and all jurisdictions have the capabilities to grow their capacities in completing/implementing the mitigations actions in Table 5.2.1.

6.5 Updating the Plan

The Hazard Mitigation Plan must be updated within five years and re-adopted by the County and all participating jurisdictions to maintain compliance with federal regulations and ensure eligibility for certain federal mitigation grant funds. Montgomery County will defer meeting HHPD requirements for their 2024 Hazard Mitigation Plan and will amend them when/where necessary. Montgomery County will identify any necessary modifications to the Plan, including changes to mitigation goals and actions that should be incorporated into the next update. The Montgomery County EMA Director and the County Commissioners will initiate the process of updating the Plan two years before the expiration of

this Plan, plus one year for the grant application process in accordance with federal guidelines to meet state and federal deadlines.